DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

MAR 18 2014

Honorable John A. Boehner
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

Dear Mr. Speaker:

The Secretary of the Army recommends modifying the cost of the Illinois Shoreline Erosion, Interim III, Wilmette, Illinois, to the Illinois-Indiana State Line (Chicago Shoreline) project that was authorized by Section 101(a)(12) of the Water Resources Development Act (WRDA) of 1996, as amended. The recommended cost increases are necessary because the respective current estimated project first cost exceeds the maximum project cost allowed by Section 902 of the WRDA of 1986, as amended. The enclosed report of the Director of Civil Works, Army Corps of Engineers, dated September 10, 2013, explains and supports the cost increases and includes other pertinent documents. The enclosed documents demonstrate that this storm damage risk reduction project remains economically justified and environmentally acceptable.

Section 101(a)(12) authorized the construction of a locally preferred plan that consisted of approximately nine miles of hurricane and storm damage reduction features, including eight miles of new revetment, and reconstruction of an offshore breakwater at a total first cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. Section 318 of the WRDA of 1990 modified the authorization to provide credit or reimbursement for the Federal share of project costs for additional project work undertaken by the non-Federal interests, including certain work that occurred before the signing of the project cooperation agreement.

The maximum authorized cost, adjusted for modifications up to 20 percent and cost index changes in accordance with Section 902, as amended, is $327,350,000 for the project (October 2013 price levels). The revised estimated total project first cost is $540,546,000. The increases are attributed to design changes necessary to address public safety, regulatory concerns, public acceptability, and hazardous waste investigations. In accordance with Section 101(a)(12), the Federal cost share would be about $185,441,000 (34.3 percent) and the non-Federal share would be about $355,105,000 (65.7 percent). The City of Chicago and the Chicago Park District are the non-Federal cost sharing sponsors and will be responsible for the operation, maintenance, repair, replacement, and rehabilitation, currently estimated at $507,000.

At a 3.5 percent discount rate, which is the new rate starting in October, 2013, and a 50-year period of economic analysis, the estimated total equivalent annual cost of the project is about $31,543,000 and the equivalent average annual benefit is about $229,300,000. The equivalent annual net benefits are $197,757,000 and the benefit-to-cost ratio is 7.3-to-1.

A Finding of No Significant Impact was signed for the project on July 2, 1993, based on an Environmental Assessment (EA). Since then, there have been nine supplemental EAs for the project. These National Environmental Policy Act documents adequately address the environmental impacts of the project. The project does not require any compensatory mitigation. The project continues to be environmentally acceptable.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress and concludes that the report recommendation is consistent with the policy and programs of the President. OMB also advises that should Congress increase the project authorization for construction, the project would need to compete with other proposed investments in future budgets. A copy of OMB's letter, dated February 28, 2014, is enclosed. I am providing a copy of this transmittal and the OMB letter to the Subcommittee on Transportation and Infrastructure of the Senate Committee on Environment and Public Works, and the Subcommittee on Energy and Water Development of the Senate Committee on Appropriations. I am providing an identical letter to the Speaker of the House of Representatives.

Very truly yours,

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Enclosures

3 Enclosures

1. Report of the Director of Civil Works, September 19, 2013
2. OMB Clearance Letter, February 28, 2014
3. Post Authorization Change Report, August 2013

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, D.C. 20314-1000

CECW-LRD

SEP 19 2013

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Illinois Shoreline Erosion, Interim III, Wilmette, Illinois, to the Illinois-Indiana State Line (Chicago Shoreline) Post-Authorization Change Report (August 2013)

1. Purpose. Request your review and approval of the Illinois Shoreline Erosion, Interim III, Wilmette, Illinois, to the Illinois-Indiana State Line (Chicago Shoreline) Post Authorization Change Report (enclosure 1). The report documents the need to increase the authorized project cost from $204,000,000 (October 1996 price level) to $536,013,000 (October 2012 price level).

2. Project Location. The authorized project is located along the south western shore of Lake Michigan, entirely within the City of Chicago, Cook County, Illinois, extending from Montrose Avenue south to 75th Street. The project spans the congressional districts of United States Representatives Bobby Rush (D-IL-1), Robin Kelly (D-IL-2), Mike Quigley (D-IL-5), Danny Davis (D-IL-7), and Jan Schakowsky (D-IL-9).

3. National Economic Development (NED) Plan and Locally Preferred Plan (LPP).

a. The Chicago District developed the NED plan to provide storm damage protection to infrastructure located adjacent to the Lake Michigan shoreline and, in particular, to Lake Shore Drive, a major transportation artery in the City of Chicago. The NED plan was determined to be a combination of storm damage reduction measures, featuring approximately eight (8) miles of rubble mound revetment along about nine (9) miles of Chicago's Lake Michigan shoreline, and reconstruction of a failed offshore breakwater near the City of Chicago's South Water Filtration Plant.

b. The non-federal project sponsors, the City of Chicago and the Chicago Park District, did not find the NED plan acceptable, primarily due to concerns regarding aesthetics and restricted public accessibility to the Lake Michigan shoreline and requested that a LPP be recommended for authorization. The LPP provides for approximately nine miles of storm damage reduction features, including eight (8) miles of new revetment. The LPP also includes reconstruction of an offshore breakwater near the South Water Filtration Plant as a separable project feature. The revetment structure includes a vertical sheet pile wall and a concrete promenade lake-ward of a concrete stepped revetment and wave deflector. The configurations of the steps and the wave deflector above the top step are designed to not only provide structural stability to the Lake Michigan shoreline, but also reduce the wave overtopping during high lake levels and/or high wave conditions. Backshore drainage is also incorporated into the LPP design in the form of swales or berms to convey storm water from high storm-driven waves that exceed the elevation of the wave deflector crest. The LPP incorporates features such as the promenade and steps to

allow public access to the Lake Michigan shoreline and beach nourishment and new beach construction lake-ward of the revetment, promenade, and steps to allow associated recreational benefits.

4. Project Authorizations. Section 101(a)(12) of the Water Resources Development Act (WRDA) of 1996 (Public Law 104-303) authorized *"the project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000"* (October 1996 price level). The authorized project is the LPP as generally described in the April 14, 1994 Report of the Chief of Engineers. Section 318 of the WRDA of 1999 modified the authorized project to provide for work-in-kind credit for construction of project features performed independently by the non-federal project sponsors. The WRDA 1999 project modification did not add new project features or modify the total project cost.

5. Post Authorization Change. The Post-Authorization Change Report (PACR) does not include any new plan formulation and there are no changes in the Chicago Shoreline project location, purpose, or scope. The project is about 78-percent physically complete but only about 54-percent complete fiscally. The current estimated total project cost exceeds the maximum cost legislated by Section 902 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), as amended. The total authorized cost of the Chicago Shoreline project is $324,069,000 stated at the October 2012 price level. The section 902 limit for the Chicago Shoreline Project for fiscal year 2013, is $327,834,000. The currently estimated total cost for the Chicago Shoreline project, including $292,147,000 in sunk costs through September 30, 2012, is $536,013,000 (October 2012 price level). The new fully funded cost estimate is $546,148,000. The total cost of the authorized project has increased primarily due to changes in the design of the LPP across several of the project segments.

6. Status of Project Construction. The project is separated into five reaches for analysis (each reach may contain multiple project construction segments) with project segments being constructed by either the Corps or the non-federal sponsors. The project is approximately 78-percent physically complete, with eighteen of twenty-three project segments fully constructed, one segment currently under construction, and four segments remaining to be constructed. Based upon the current cost estimate of $536,013,000 and considering $292,147,000 in total expenditures (sunk costs) through September 30, 2012, the project is approximately 54-percent fiscally complete. The four remaining unconstructed project segments are Montrose to Irving Park Road; Fullerton/Theater on the Lake; 45th to 51st Street; and 54th to 56th Street, Promontory Point. The current estimated cost for these uncompleted project segments is $243,866,000 (October 2012 price level). Design and construction activities for three of the four uncompleted project segments are being funded by the non-federal sponsors, the City of Chicago and the Chicago Park District. Three executed project cooperation agreements with the non-federal sponsors allow work-in-kind credit. The non-federal sponsors will construct three of the

four uncompleted project segments with local funds and seek credit towards the non-federal share of total project costs.

7. Economic Evaluation. The authorized project remains economically justified under the increased total project cost estimate. The PACR provides separate economic evaluations for the authorized revetment and offshore breakwater separable features. Benefits for the revetment feature include storm damage reduction and incidental and separable recreation. At the October 2012 price level, and based on a 3.75 percent discount rate and 50-year period of economic evaluation, the revetment feature has equivalent annual benefits, including storm damage reduction and incidental and separable recreation, of $209,373,000 and equivalent annual costs of $30,226,000. Equivalent annual net benefits are $179,147,000 and the indicated ratio of benefits-to-costs is 7.0-to-1. Only storm damage reduction benefits are claimed for the breakwater separable feature. At the October 2012 price level, and based on a 3.75 percent discount rate and 50-year period of economic evaluation, the offshore breakwater feature has equivalent annual benefits of $19,927,000 and equivalent annual costs of $557,000. Equivalent annual net benefits are $19,369,000 and the indicated ratio of benefits-to-costs is 36.2-to-1. At the October 2012 price level, and based on a 3.75 percent discount rate and 50-year period of economic evaluation, the overall project, including both separable elements, has equivalent annual benefits of $229,300,000 and equivalent annual costs of $30,783,000. Equivalent annual net benefits are $198,516,000 and the indicated ratio of benefits-to-costs is 7.4-to-1.

8. Cost Apportionment. The NED plan was formulated to address the storm damage reduction project purpose at the lowest cost. The LPP also addresses this high priority project purpose but also includes measures designed to provide for additional recreational values. The total cost of the LPP is significantly greater than the total cost of the NED plan; however, the LPP does not provide greater high priority storm damage reduction benefits compared to the NED plan. Cost sharing for the authorized LPP is consistent with section 103(c)(5) of the WRDA of 1986. Specifically, the federal share is based on the 65-percent federal/35-percent non-federal cost sharing formula applicable to the NED plan. The non-federal project sponsors must pay 100-percent of the additional costs of the authorized project that exceed the federal share (65-percent) of the NED plan costs. The current estimate of the cost to implement the NED plan is $290,975,000 at the October 2012 price level. The total cost of the NED plan has increased since authorization of the Chicago Shoreline project due to more precise estimates of stone quantities that would be required to implement the NED plan. Based on the current total project cost estimate ($536,013,000), the federal share of the total project cost would be $189,134,000 and the non-federal share of the total project cost would be $346,879,000. Under the current project cost estimate, the Federal government has approximately $8,000,000 in expenditures remaining. The non-federal sponsors' remaining costs are estimated as about 235,866,000. The non-federal sponsors must perform all operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) of the completed project. Total OMRR&R is currently estimated as $507,000 annually.

9. Environmental Considerations. There are no unresolved environmental considerations associated with the authorized project. The first National Environmental Policy Act (NEPA) document for the Illinois Shoreline Erosion, Interim III, Wilmette, Illinois, to Illinois-Indiana State Line Project was an Environmental Assessment (EA) with a signed Finding of No Significant Impact from July 1993 that accompanied the April 14, 1994, Report of the Chief of Engineers. Since then, there have been nine supplemental EAs for the project, conducted on an as needed basis for the various Federal and non-Federal construction reaches of the project. The existing NEPA documents for the Chicago Shoreline project have been reviewed and they adequately identify the environmental impacts of the project.

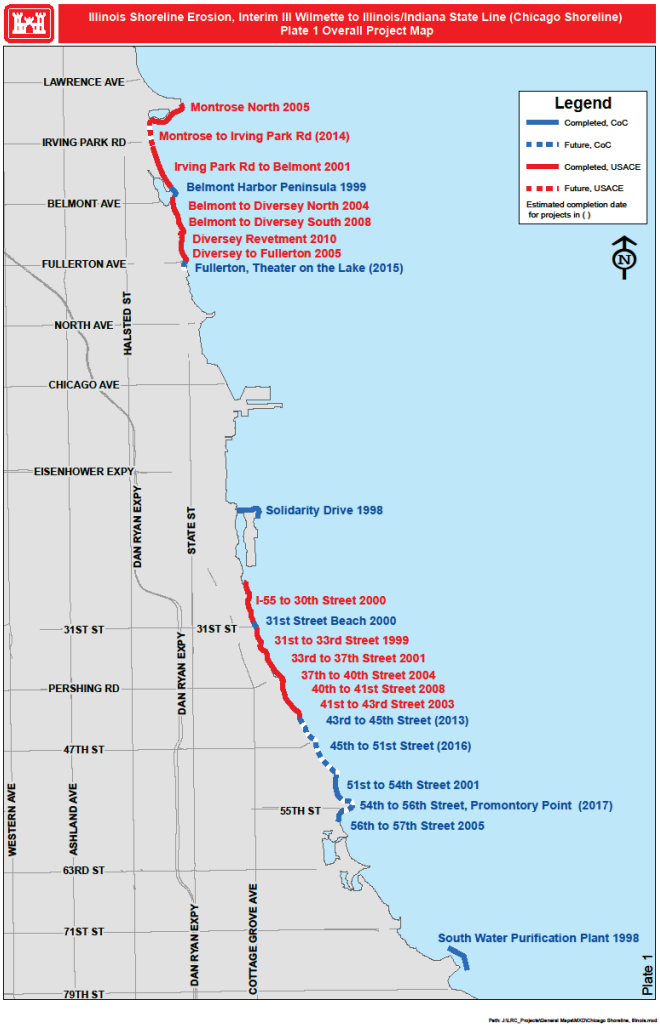
10. Conclusions. The Chicago District prepared the PACR in accordance with ER 1105-2-100, Appendix G, dated, June 30, 2004, to document the increases in the project cost and recommend an increase in the authorized project cost. The National Planning Center of Expertise for Coastal Storm Damage Reduction conducted a Type I Independent External Peer Review (IEPR) for the PACR in accordance with Engineer Circular 1165-2-209, dated January 31, 2010; CECW-CP memorandum, dated March 30, 2007; and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review released December 16, 2004. The Battelle Memorial Institute prepared the final IEPR report, dated April 2, 2013. The final IEPR report contains a total of nine comments from the review panel. All nine of the IEPR panel comments resulted in modifications to the economic analyses or addition of clarifying documentation or text to the PACR. Draft final agency responses to the review panel comments are at enclosure 2. The HQUSACE policy compliance review of the PACR concluded that there are no unresolved policy issues and that the project is technically sound, environmentally acceptable, and economically justified. Documentation of the HQUSACE policy review is at enclosure 3.

11. Recommendation. I recommend that the enclosed PACR be transmitted to Congress as a basis for increasing the authorized project cost of the Illinois Shoreline Erosion, Interim III, Wilmette, Illinois, to the Illinois-Indiana State Line (Chicago Shoreline) project to $536,013,000 (October 2012 price levels). Documents necessary to coordinate this recommendation with the Office of Management and Budget will be developed in coordination with your staff and provided under separate cover.

Encls
as

STEVEN L. STOCKTON, P.E.
Director of Civil Works

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT



U.S. ARMY CORPS OF ENGINEERS
CHICAGO DISTRICT
231 SOUTH LA SALLE, SUITE 1500
CHICAGO, ILLINOIS 60604

August 2013

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

August 2013

EXECUTIVE SUMMARY

This Post Authorization Change Report (PACR) will address the cost increase in the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project. Construction costs are estimated to exceed the maximum authorized project cost according to Section 902 of the Water Resources Development Act of 1986 (WRDA86), as amended. The project was originally authorized by Section 101 of WRDA 1996. This report intends to notify Congress of cost increases and recommends that the project's authorization be modified in order to complete construction of the project.

The project's cost estimate has increased from the 1996 authorized cost of $204,000,000 (which equates to $324,069,000 at October 2012 price levels) to $536,013,000. The increase in estimated project costs at 2012 price levels is $211,944,000. The new fully funded cost estimate is $546,148,000. Project costs increased primarily due to changes in the design of the Locally Preferred Plan across several of the many project segments.

Section 902 of WRDA86 defines the maximum limit authorized project cost. The current fiscal year 2013 902 limit for the Chicago Shoreline Project is $327,834,000.

The project is currently in the construction phase. The project is approximately 78 percent physically complete with eighteen of twenty-three fully constructed, one segment currently under construction, and four segments remaining to be constructed. Based upon the new cost estimate of $536,013,000 outlined in this report and $292,147,000 in total expenditures, the project is approximately 54 percent fiscally complete. Under the new cost estimate, less than $8,000,000 in new Federal funds would be needed to complete the project; the remaining costs are all being borne by the non-Federal Sponsors, the City of Chicago and the Chicago Park District. The three executed Project Cooperation Agreements (PCAs) with the non-Federal Sponsor allow Work-in-Kind credit. The non-Federal Sponsor is planning on constructing the remaining project reaches with local funds and seeking credit towards its cost share. The current estimate of the total project costs exceeds the current authorized 902 limit.

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

August 2013

1.0 PURPOSE

This Post Authorization Change Report (PACR) will address the cost increase in the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project. Construction costs are estimated to exceed the maximum project cost limit according to Section 902 of the Water Resources Development Act of 1998 (WRDA98), as amended. The project was originally authorized by Section 101 of WRDA 1996 and then modified by Section 318 of WRDA 1999. This report intends to notify Congress of cost increases and recommends that the project's authorization be modified to reflect the updated cost estimate.

2.0 AUTHORIZED PROJECT

2.1 LOCATION

The authorized project is located along south western shore of Lake Michigan entirely within the City of Chicago, Cook County, Illinois extending from Montrose Avenue south to 75th Street. The project spans the Congressional Districts of Rep. Bobby Rush (IL-1), Rep. Robin Kelly (IL-2), Rep. Mike Quigley (IL-5), Rep. Danny Davis (IL-7), and Rep. Janice Schakowsky (IL-9). Refer to Plate 1 for a total project map.

2.2 DESCRIPTION

The City of Chicago and the Chicago Park District, in conjunction with the U.S. Army Corps of Engineers (USACE) - Chicago District, have embarked on a multi-year reconstruction of approximately nine miles of Chicago's Lake Michigan shoreline. Chicago's shoreline is largely man-made and constructed on lake fill with an average width of 1,500 feet. This fill is a key-contributing factor to the creation of an extensive series of lakeshore parks that began in the mid to late 1800's and continued through the 1940's. Constructed primarily in the 1920s and 1930s, the Chicago shoreline protects significant infrastructure, parkland and Lake Shore Drive from storm damage and shoreline erosion. The primary objective of the USACE Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Study was to investigate the storm damage, flooding and related erosion problems along the Lake Michigan shoreline. The engineering analysis centered on determining the effectiveness of the shorelines; the structures' ability to reduce storm related flood damages and land erosion; and design analysis for the structural alternatives formulated for the feasibility study. Some of the most significant identified shoreline problems occurred within parkland under the administration of the Chicago Park District that is between U.S. Highway Route 41, Lake Shore Drive and Lake Michigan. Additionally, the non-Federal sponsors' objectives included:

- Maintaining and enhancing the predominately landscaped, spacious, and continuous character of the lakeshore parks
- Preserve the cultural, historical, and recreational heritage of the lakeshore parks
- Increase the diversity of recreational opportunities while emphasizing lake-oriented leisure time activities
- Increase personal safety
- Design all lake edge and lake construction to prevent detrimental shoreline erosion.

The National Economic Development (NED) Plan is determined to be the plan that maximizes the net benefits. For this project, the NED Plan was determined to be a rubble mound structure (refer to Plate 2 for a typical cross section). The Local Sponsor did not find the NED Plan acceptable - their primary concerns with the design being the aesthetics and accessibility of the structure - thus the Local Sponsor requested a Locally Preferred Plan (LPP) that resulted in a greater total project cost and required additional local funding in excess of the NED Plan costs. The LPP does not provide a significant difference in benefits from the NED plan based on shoreline protection. The significant difference in benefits between the LPP and NED plan are due to increased recreation benefits.

The LPP is comprised of a vertical sheet pile wall and a concrete promenade lakeward of a concrete stepped revetment and wave deflector. The configurations of the steps and the wave deflector above the top step were designed to not only provide structural stability to the shoreline, but also reduce the wave overtopping during high lake levels and/or high wave conditions (refer to Plate 3 for a typical LPP cross section). Backshore drainage was also incorporated into the design in the form of swales or berms to convey storm water and lake water from wave events that exceed the elevation of the wave deflector crest. The LPP incorporates project features, such as the promenade and steps, which also allow public access and recreational benefits. Implementation of the project was broken into several reaches, which are being constructed over a number of years by either USACE or the non-Federal Sponsors, and are shown below in Table 1.

Table 1: Shoreline Reconstruction Segments

Reach	Shoreline Segment (North to South)	Year Completed[1]	Length (Feet)	Constructed By
2	Montrose (North)	2005	3,760	USACE
	Montrose to Irving Park Road	*2014*	2,050	USACE
	Irving Park Road to Belmont Ave.	2001	4,000	USACE
	Belmont to Diversey North	2004	1,700	USACE
	Belmont to Diversey South	2008	1,100	USACE
	Belmont Harbor Peninsula	1999	1,000	City of Chicago
	Diversey Revetment	2010	800	USACE
	Diversey to Fullerton	2005	2,300	USACE
	Fullerton/Theater on the Lake	*2015*	1,200	City of Chicago
3	Solidarity Drive	1998	2,800	City of Chicago
4	I-55 to 30th Street	2000	3,400	USACE
	31st Street Beach	2000	800	City of Chicago
	31st to 33rd Street	1999	1,400	USACE
	33rd to 37th Street	2001	2,050	USACE
	37th to 40th Street	2004	3,200	USACE
	40th to 41st Street	2008	1,500	USACE
	41st to 43rd Street	2003	1,350	USACE
	43rd to 45th Street	*2013*	2,040	City of Chicago
	45th to 51st Street	*2016*	4,460	City of Chicago
	51st to 54th Street	2001	1,600	City of Chicago
	54th to 56th Street, Promontory Point	*2017*	4,200	City of Chicago
	56th to 57th Street	2005	800	City of Chicago
5	South Water Purification Plant	1998	800	City of Chicago

[1] Estimated completion date for projects currently under design or being constructed are noted in italics

2.3 LOCAL COOPERATION

The following items of local cooperation were identified in the Chief of Engineer's Report dated 14 April 1994:

6. Accordingly, I recommend that hurricane and storm damage reduction measures for the Lake Michigan shore of the city of Chicago, Illinois be authorized for implementation in accordance with the reporting officers' recommended (locally preferred) plan. My recommendation is subject to cost-sharing, financing, and other applicable requirements of Public Law 99-662 for this kind of project. Also, this recommendation is subject to the non-Federal sponsor, prior to construction, agreeing to comply with applicable Federal laws and policies, including the following requirements:

a. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations

determined by the Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;

b. Provide or pay to the Government the cost of providing all retaining dikes, waste weirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;

c. Provide 35 percent of the estimated costs of construction of the NED plan. Where the value of lands, easements, rights-of-way, relocations and disposal areas is less than 35 percent of total project costs of the NED plan, the sponsor is required to provide, during project construction, a cash contribution of the amount necessary to make its total contribution equal to 35 percent of the total cost of the NED plan;

d. Provide 100 percent of the costs of construction of the recommended (locally preferred) plan that are in excess of the estimated costs of construction of the NED plan during the construction of the project;

e. Hold and save the Government free from all damage arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project related betterments, except for damages due to the fault or negligence of the Government or the Government's contractor;

f. Operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and state laws and specific directions prescribed by the Government;

g. Operate, maintain, repair, replace, and rehabilitate the existing South water Filtration Plant cofferdam, at no cost to the Government, such that the structural integrity and crest of the cofferdam is preserved in a manner consistent with protection provided by the proposed breakwater;

h. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

i. Maintain public ownership and public use of the shorelands upon which the amount of Federal participation is based for so long as the project remains authorized;

j. Provide and maintain necessary roads, parking area, and other public use facilities open and available to all on equal terms;

k. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs;

1. Perform or cause to be performed such investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. 9601-9675, on all lands necessary for project construction, operation, maintenance, repair, replacement, and rehabilitation:

m. To the maximum extent practicable, operate, maintain, repair, replace and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

n. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located on any lands necessary for the construction, operation, or maintenance of the project;

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

p. Comply with all applicable Federal and state laws and regulations, including section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;

q. Publicize flood plain information in the area concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to-ensure compatibility with protection levels provided by the project;

r. At least annually, notify affected interests of the limitations of the protection afforded by the project;

s. Participate in and comply with applicable Federal flood plain management and flood insurance programs; and

t. Prevent future encroachments which might interfere with proper functioning of the project.

The City of Chicago and the Chicago Park District, collectively the non-Federal Sponsors, and the Department of Army, acting by and through the Assistant Secretary of the Army for Civil Works, entered into the following Project Cooperation Agreements (PCAs), as required by Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, for this project:

- PCA #1 executed April 23rd, 1997
- PCA #2 executed August 7th, 1998
- PCA #3 executed May 17th, 1999
- An amendment to PCA #3 was signed on the December 22nd, 2009

The authorized plan for the Project is a Locally Preferred Plan. As such, the cost share agreement is outlined in the items of local cooperation (c) & (d) cited above. The PCA's are included in Appendix B, Project Cooperation Agreements to this report.

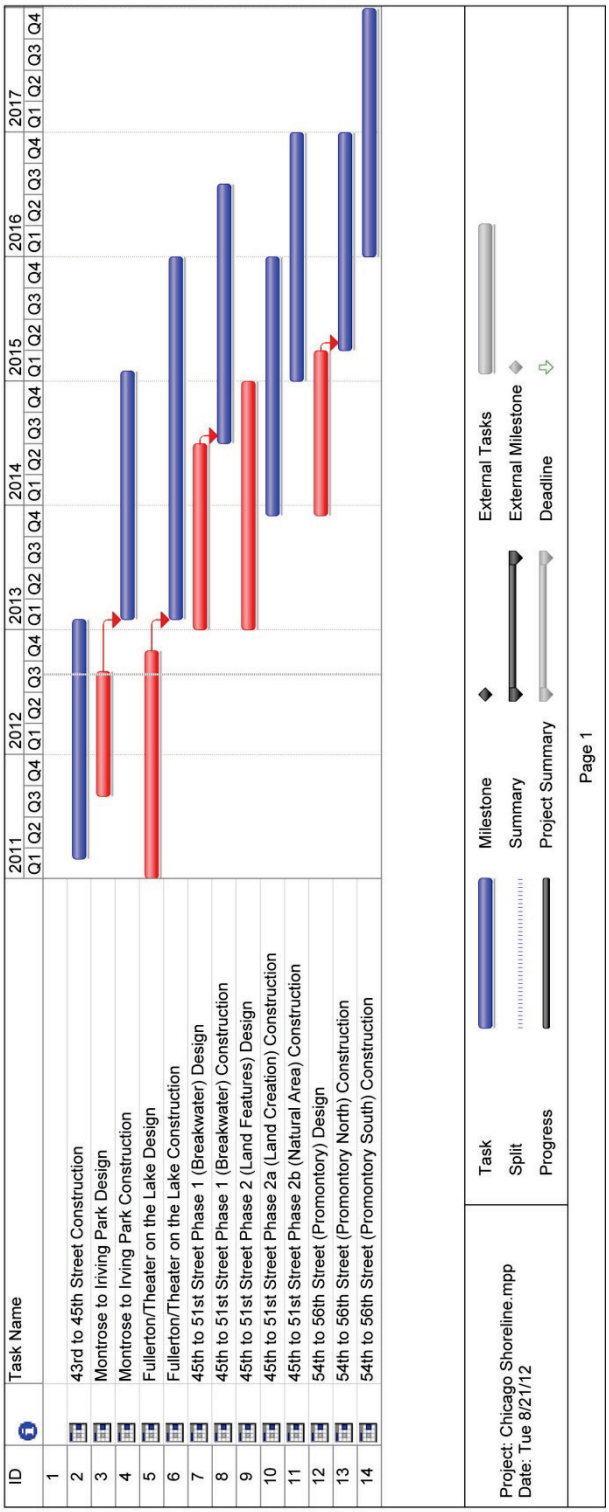
2.4 CURRENT STATUS

The project is currently in the construction phase. The project is approximately 78 percent physically complete with eighteen of twenty-three fully constructed, one segment currently under construction, and four segments remaining to be constructed. Based upon the new cost estimate of $536,013,000 outlined in this report and $292,147,000 in total expenditures, the project is approximately 54 percent fiscally complete. Under the current project cost estimate, the Federal government has approximately $8,000,000 in expenditures remaining, with a need for $5,000,000 new Federal funds allocated by Congress. The remaining design and construction activities are being funded by the non-Federal Sponsor and subject to Work-In-Kind credit. The four remaining project segments are Montrose to Irving Park Road; Fullerton/Theater on the Lake; 45th to 51st Street; and 54th to 56th Street, Promontory Point. Design work is near complete for the remaining segments with the exception of 54th to 56th Street, Promontory Point. WRDA 2007 included authorization for a third party review of the Promontory Point design. No funding has been received to conduct the third party review.

3.0 REMAINING PROJECT SCHEDULE

The project is currently scheduled for completion in December 2017 as shown in Figure 1.

Figure 1. Remaining Project Schedule



4.0 AUTHORIZATION

Congress authorized the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project in Section 101of the Water Resources Development Act of 1996, Public Law 104-303, which reads as follows:

> TITLE I – WATER RESOURCE PROJECTS
> SEC. 101. PROJECT AUTHORIZATIONS
>
> *(a) PROJECTS WITH CHIEF'S REPORTS.—Except as provided in this subsection, the following projects for water resources development and conservation and other purposes are authorized to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, described in the respective reports designated in this subsection:*
>
> *(12) LAKE MICHIGAN, ILLINOIS.—The project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. The project shall include the breakwater near the South Water Filtration Plant described in the report as a separate element of the project, at a total cost of $11,470,000, with an estimated Federal cost of $7,460,000 and an estimated non-Federal cost of $4,010,000. The Secretary shall reimburse the non-Federal interest for the Federal share of any costs incurred by the non-Federal interest—*
>
> *(A) in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the project; and*
>
> *(B) in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois.*

Section 318 of the Water Resources Development Act of 1999, Public Law 106-53, modified the project as follows:

> *SEC. 318. LAKE MICHIGAN, ILLINOIS.*
>
> *(a) IN GENERAL.—The project for storm damage reduction and shore protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), is modified to provide for reimbursement for additional project work undertaken by the non-Federal interest.*
>
> *(b) CREDIT OR REIMBURSEMENT.—The Secretary shall credit or reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the*

non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000.
(c) REIMBURSEMENT.—The Secretary shall reimburse the non- Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.

The project modification as stated in WDRA 1999 did not add new project features and only affected project financing in terms of work-in-kind credit by the non-Federal Sponsors.

Section 5072 of the Water Resources Development Act of 2007, Public Law 106-53, directed a third-party review of the project as follows:

SEC. 5072. PROMONTORY POINT THIRD-PARTY REVIEW, CHICAGO SHORELINE, CHICAGO, ILLINOIS.
(a) REVIEW.—
(1) IN GENERAL.—The Secretary shall conduct a third-party review of the Promontory Point feature of the project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), at a cost not to exceed $450,000.
(2) JOINT REVIEW.—The Buffalo and Seattle Districts of the Corps of Engineers shall jointly conduct the review under paragraph (1).
(3) STANDARDS.—The review under paragraph (1) shall be based on the standards under part 68 of title 36, Code of Federal Regulations (or any successor regulation).
(b) CONTRIBUTIONS.—The Secretary may accept funds from a State or political subdivision of a State to conduct the review under paragraph (1).
(c) TREATMENT.—The review under paragraph (1) shall not be considered to be an element of the project referred to in paragraph (1).
(d) EFFECT OF SECTION.—Nothing in this section shall be construed to affect the authorization for the project referred to in paragraph (1).

The current FY13 902 limit for the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project is $327,834,000. The 902 limit was calculated using the Section 902 Limit Tool that was certified by HQUSACE in November 2010. See Appendix E, Computation of FY13 902 Limit for further 902 Limit computation details.

5.0 FUNDING SINCE AUTHORIZATION

Table 2 below summarizes the history of federal funding of this project, by fiscal year, since the project began.

Table 2. Funding History

Fiscal Year	Appropriations Category	Fiscal Year Allocation	Cumulative Allocation
1993	General Investigations	$750,000	$750,000
1994	General Investigations	$291,000	$1,041,000
1995	General Investigations	$612,000	$1,653,000
1996	General Investigations	$300,000	$1,953,000
1997	Construction General	$8,000,000	$9,953,000
1998	Construction General	$7,392,000	$17,345,000
1999	Construction General	$14,382,800	$31,727,800
2000	Construction General	$16,539,000	$48,266,800
2001	Construction General	$20,193,000	$68,459,800
2002	Construction General	$25,626,000	$94,085,800
2003	Construction General	$20,404,000	$114,489,800
2004	Construction General	$19,812,000	$134,301,800
2005	Construction General	$11,551,000	$145,852,800
2006	Construction General	$18,301,950	$164,154,750
2007	Construction General	$10,136,000	$174,290,750
2008	Construction General	$8,856,000	$183,146,750
2009	Construction General	$4,000,000	$187,146,750
2010	Construction General	$0	$187,146,750
2011	Construction General	-$1,370,000	$185,776,750
2012	Construction General	$0	$185,776,750

6.0 CHANGES FROM AUTHORIZED PROJECT

6.1 PROJECT SCOPE

There have been no changes to the project scope since the original authorization.

6.2 PROJECT PURPOSES

There has been no change in project purpose since authorization. The authorized project purposes of the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project remain storm damage reduction and shoreline erosion protection.

6.3 LOCAL COOPERATION

There have been no significant changes in the required items of local cooperation which have affected the total cost of the project.

6.4 LOCATION

There have been no changes to the project location.

6.5 DESIGN CHANGES

There have been changes in the design of the Locally Preferred Plan across several of the project segments.

6.6 COST CHANGES

The project's current cost estimate has increased to $536,013,000. The current authorized cost of $204,000,000, which is referenced to October 1995 price levels, equates to $324,069,000 in October 2012 price levels. Table 3 provides a comparison of the original and re-authorized project costs updated to current price levels, the cost of the project last presented to Congress, and the current recommended cost estimate. The change in costs referenced to constant 2012 price levels is $211,944,000. The reasons for the cost changes, other than price level changes, are itemized in the following paragraphs.

The cost estimate for the remaining work was developed using MII and was based on the latest anticipated scope for each project. Historical cost information from previous Chicago Shoreline contracts was used when applicable. Contingencies were developed through a formal Cost Schedule Risk Analysis completed by the Cost Engineering Directory of Expertise (Cost-DX). Contingencies for the current Authorized Cost are identified in Appendix B of the 1993 Feasibility Report. Since the original authorization the development of project contingencies have become standardized.

The majority of the cost increases to the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project are a result of the changes to the LPP. The projected NED cost (which is the basis for the cost sharing agreement with the local sponsor) has not seen significant cost changes since the start of the project. The NED plan for all project reaches was clearly defined in the original authorizing document and the design has tracked with inflation throughout the life of the project. The NED plan cost estimate has remained relatively unchanged since project authorization. The cost of the NED plan from 1996 Price Levels is not readily broken out by project features, but is displayed as a total number. Escalated to 2012 Price Levels the NED plan cost estimate from 1992 is $262,419,000; this number is relatively close to the current NED estimate of $290,975,000. The difference in the two can be explained by precise estimates of the stone quantities used in the more recent NED plan cost estimate and the comparison in escalating the original authorized cost. Due to several design changes to the LPP on a reach by reach basis, the estimated total project cost has risen.

Table 3 shows the change in cost from the current Authorized Cost Estimate to the current Recommended Cost Estimate.

Table 3. Changes in Total Project First Costs

Column	A	B	C	C - B	D
Project Feature	Current Authorized Project Cost (Oct-96 PL)	Authorized Project Cost[1] (Oct-12 PL)	Recommended Estimated Total Project Cost (Oct-12 PL)	Cost Change (Oct-12 PL)	Recommended Estimated Total Project Cost (Fully Funded)
Lands and Damages	$308,000	$489,000	$124,000	-$365,000	$124,000
Breakwaters and Seawalls	$178,022,000	$282,800,000	$411,340,000[2]	$128,540,000	$424,228,000
Levees and Floodwalls	$0	$0	$507,000	$507,000	$507,000
Beach Replenishment	$2,108,000	$3,349,000	$5,084,000[2]	$1,735,000	$0
PED	$11,321,000	$17,984,000	$80,097,000	$62,113,000	$80,534,000
CM	$12,242,000	$19,447,000	$38,659,000	$19,212,000	$40,556,000
HTRW	$0	$0	$199,000	$199,000	$199,000
Total	$204,000,000	$324,069,000	$536,013,000	$211,944,000	$546,148,000

[1]Costs were developed using the Civil Works Construction Cost Index System and the Planning, Engineering & Design; and Construction Management Costs were indexed using the Consumer Price Index. See *Appendix C, Cost Estimating* for additional details.

[2]31st Street Beach was included as a sunk cost in the current cost estimate under the project feature Breakwaters and Seawalls found in Appendix C. For the purposes of cost comparison, the 31st Street Beach construction costs were included as a Beach Nourishment feature in this table.

Lands and Damages (-$365,000)

The project is being constructed upon land owned by one of the non-Federal Sponsors, the Chicago Park District. The project area is not eligible for LERRD credit because the land is subject to navigational servitude. Only NED plan costs for temporary staging and storage are eligible. The estimated real estate requirements for NED plan temporary staging and storage have decreased since the 1996 cost estimate was created. The Lands and Damages estimate reflects the current working estimate based on consultation with Real Estate Division appraisal staff.

Breakwaters and Seawalls ($128,540,000)

There was at least a cost increase of $19,000,000 to the construction contracts for the reaches of this project. This total number is likely higher, but there are gaps in the construction contract data from contracts that were completed before the RMS system was implemented and from lack of detailed record keeping by the non-Federal Sponsor. The largest portion of the $128,540,000 is found in the four remaining construction segments.

The main causes for increases to total project costs during the construction periods were increases in materials costs, execution of contract options, costs associated with delays to the

contract and unanticipated relocations caused by project construction. The majority of these deviations were associated with the LPP. For a detailed description of cost changes on a per reach basis please refer to Appendix D.

Additionally, the most significant reason for the increase to this project feature has been the redesign of several local project segments. For example, on Belmont to Diversey – South, the original design did not include incorporating existing art stones into the reconstruction of the revetment. There was local opposition to the removal of the art stones and thus, there was a significant redesign efforts required to include the art stones in the project. There have been several segments where similar issues have been raised.

Levees and Floodwalls ($507,000)

For a few project segments the design of backshore swales or berms were included to allow overtopping waves to drain back into the lake. These were not included in the original design.

Beach Replenishment ($1,735,000)

The original cost estimate called for beach nourishment on two of the original project reaches; Reach 2 (Fullerton) and Reach 4a. The Local Sponsors elected to complete the Beach Nourishment for Reach 2 (Fullerton) on their own, outside of the Chicago Shoreline Project. The corresponding construction segment within Reach 4a is 31st Street Beach. 31st Street Beach was constructed for a Total Cost of $6,150,772.35, of which $5,084,087.33 was spent on construction of the beach, with the difference spent on PED, CM and PM. A difference of +$1,735,087.33 is the change in the authorized cost of the beach nourishment project feature versus the current estimate. 31st Street Beach was included as a sunk cost in the current cost estimate under the project feature Breakwaters and Seawalls found in Appendix C.

Planning, Engineering and Design (PED) ($62,113,000)

Planning, Engineering and Design costs have increased in conjunction with the design and redesign of the remaining project segments. Of the $62,113,000 cost change, $37,652,000 of that cost is in the four remaining project segments that have yet to be constructed, leaving an increase of $24,461,000 in sunk costs from the original authorized cost. The $24,641,000 in sunk PED costs is mainly due to several construction segments that have required substantial design changes from the original decision document to comply with changed conditions, unforeseen regulatory compliance requirements, and local opposition.

Construction Management (CM) ($19,212,000)

Construction Management costs have increased in conjunction with the design and redesign of the remaining project segments. Of the four remaining project segments there is a CM cost of $22,098,000. Without the four remaining project segments there would a decrease of $2,886,000 in CM costs, with the four remaining project segments there is an increase of $19,212,000 in the CM cost for the total project.

Hazardous, Toxic and Radioactive Waste (HTRW) Investigation ($199,000)

The original cost estimate did not include an HTRW investigation, which had to be performed over the life of the project post authorization.

6.7 PROJECT BENEFITS

The scope of the economic reevaluation associated with this report was limited to an evaluation of project benefits as a result of changes in depreciated replacement value of facilities and infrastructure, increases in annual average daily traffic and value of time saved, and an increase in the unit day value of recreation.

Both the NED plan and LPP included the reconstruction of a failed offshore breakwater protecting the South Water Filtration Plant. The breakwater element and the revetment element are considered separable elements, therefore the costs and benefits were reported separately.

Recreation benefits of the project were considered incidental to the justification of the project. Since the NED plan was foregone for the LPP, recreational benefits above and beyond the NED plan are identified as separable.

Table 4. Benefits of Authorized Plan by Separable Element (3.75% FDR, 50 years, Oct 2012 PL)

Benefit Category	Revetment	Breakwater
Transportation Road Loss Prevention	$114,802,000	
Facilities and Infrastructure Protection	$30,374,000	$19,927,000
Transportation and Flood Damage Reduction	$530,000	
Incidental Recreation	$36,881,000	
Separable Recreation	$5,521,000	
Maintenance Costs Avoided	$1,050,000	
Accumulated Benefits During Construction	$20,215,000	
Total Benefits	$209,373,000	$19,927,000

As a result of the protracted implementation period various reaches of the project accumulated benefits prior to the start of the period of analysis (2018). Additional project benefits were garnered as a result of this project implementation schedule. Table 4 shows the annual benefits per reach (see Appendix A, Economic Reevaluation for more detailed development), the year in which the last project in each reach is expected to be complete, present worth of accumulated benefits, and the benefits annualized over a period of 50 years. Reach 5, South Water Filtration Plant breakwater project, is a separable element of the overall project. As such, Reach 5 does not accumulate any benefits prior to its baseline since the revetment and breakwater do not use the same baseline year.

Table 5. Accumulated Project Benefits Prior to Baseline (3.75% FDR, Oct 2012 PL)

Reach	Annual Benefits	Year Reach was Completed	Years of accumulated Benefits	Present Worth of Accumulated Benefits (2018)	Annualized Benefits
2	$65,783,938	2016	2	$139,061,078	$6,198,539
3	$11,223,120	1999	19	$314,442,491	$14,016,028
4	$87,390,402	2018	0	$-	$0

6.8 PROJECT COSTS

The total project cost is the cost of all work associated with preconstruction engineering and design (PED) and construction, including real estate and appropriate credit provisions of Section 104 of the WRDA of 1986 and Section 215 of Public Law 90-483. The development of the total project costs used in the economic analysis are detailed in Appendix C, Cost Estimating. Table 6 provides information on price level adjustments for the total project costs. Prior to project authorization, PED costs of $1,953,000 were expended between FY1992 and FY1996. These sunk costs expended prior to project authorization were removed from the economic evaluations. The total for the completed projects (1998 through 2012) is $290,194,000. The total for future construction projects is $243,867,000. The estimated total project cost taking into account actual costs for PED and completed segments is $536,013,000 (The sum of $1,953,000, $290,194,000 and $243,867,000). The overall project cost used for the economic evaluation, which removes sunk PED costs and adjusting all completed project costs to constant October 2012 price levels using CWCCIS WBS 10, results in an overall project cost of $616,727,000.

Table 6. Price Level Adjustment (value in $1,000)

Reach	Segment	Year Complete	Construction Cost ($1,000)	Index (CWCCIS)	Construction Cost ($1,000) 2012PL
5	South Water Filtration Plant	1998	$9,586	1.48	$14,158
2	Belmont Harbor	1999	$5,507	1.45	$8,013
4	31st Street Beach	1999	$6,999	1.45	$10,184
4	31st - 33rd Street	1999	$7,830	1.45	$11,393
3	Solidarity Drive	1999	$12,059	1.45	$17,546
4	I-55 to 30th Street	2000	$17,535	1.43	$25,023
2	Irving to Belmont	2002	$19,700	1.39	$27,402
4	33rd to 37th Street	2002	$15,930	1.39	$22,158
4	56th to 57th Street	2002	$9,161	1.39	$12,743
4	41st to 43rd Street	2003	$8,357	1.34	$11,196
4	51st to 54th Street	2003	$10,628	1.34	$14,239
2	Belmont to Diversey North	2004	$15,096	1.31	$19,796
4	37th to 40th Street	2004	$27,885	1.31	$36,568
2	Montrose North	2005	$36,382	1.24	$45,276
2	Diversey to Fullerton	2005	$20,685	1.24	$25,742
4	40th to 41st Street	2008	$19,692	1.12	$21,992
2	Belmont to Diversey South	2008	$13,954	1.12	$15,584
2	Diversey Revetment	2010	$12,635	1.05	$13,277
4	43rd to 45th Street	2012	$16,696	1.00	$16,696
2	Montrose to Irving	2015	$26,440	1.00	$26,440
2	Fullerton/Theater on the Lake	2016	$35,059	1.00	$35,059
4	45th to 51st Street	2017	$129,413	1.00	$129,413
4	54th to 56th Street	2018	$56,618	1.00	$56,618
NA	PACR	2013	$212	1.00	$212
	Total PED 1992 through 1996		$1,953		-[1]
	Total for completed projects through 2012		$290,194		$369,198
	Total for future projects 2013 through 2018		$243,867		$247,530
	Total for Entire Project		$536,013		$616,727

[1]Preconstruction Engineering and Design (PED) costs incurred prior to authorization are considered sunk and not included in the economic evaluation of the project.

The opportunity cost associated with projects in construction was calculated in Table 7. Interest During Construction (IDC) is an additional project cost that a project must account for until the project generates benefits. Once each project segment was completed, IDC for that project is complete.

The duration of the overall projection construction period is from 1998 to 2018. The period of construction for each segment is significantly less. Each of the four project reaches (Reach 2, Reach 3, Reach 4, and Reach 5) can have a number of project segments. Reach 5 (Water Filtration Plant) was a separable element and was completed in only a couple of years. Reach 2 was started in 1999 and is expected to be completed in 2016. Reach 3 was completed 1999. Reach 4 was started in 1999 and is expected to be completed in 2018. To capture the time value of the IDC during the construction phase to the start of the period of analysis (2018), IDC for each project segment was compounded based on the number of years since the completion of the reach. All project segments in Reach 2 are expected to be completed in 2016, 2018 for Reach 4, 1999 for Reach 3, and 1998 for Reach 5.

The premise for this method is the compromise between capturing IDC and the time value of IDC for projects that span long periods of time. The integrity of the coastal revetment as a system of individual project segments is addressed in this method. Unlike a levee system, the coastal revetment system is not particularly prone to flanking by floodwaters when the system is not complete. The construction of the new revetment was typically tied into the old revetment. This provides protection during the interim period of project construction by segments. The termination of the IDC at the completion of the segment construction acknowledges that the new revetment segment is providing a benefit from the federal and non-federal investment. Since each project reach is comprised of one or more segments, the time value of the entire reach IDC was computed based on the number of years between the completion of the reach and the start of the period of analysis.

Table 7. Interest During Construction (Oct 2012 PL, 3.75% FDR, values in $1,000)

Reach	Project Segment	Construction Cost	Months (Segment start to Reach Complete)	IDC	Present Worth (2018)
NA	PED	$1,953	NA	NA	NA
5	Water Filtration Plant	$9,586	12	$242	NA
2	Belmont Harbor	$5,507	219	$3,394	$3,653
4	31st Street Beach	$6,999	244	$4,948	$4,948
4	31st - 33rd Street	$7,830	244	$5,535	$5,535
3	Solidarity Drive	$12,059	12	$300	$603
4	I-55 to 30th Street	$17,535	231	$11,336	$11,336
2	Irving to Belmont	$19,700	207	$10,818	$11,644
4	33rd to 37th Street	$15,930	231	$10,038	$10,038
4	56th to 57th Street	$9,161	207	$5,031	$5,031
4	41st to 43rd Street	$8,357	207	$4,420	$4,420
4	51st to 54th Street	$10,628	195	$5,222	$5,222
2	Belmont to Diversey North	$15,096	170	$6,150	$6,620
4	37th to 40th Street	$27,885	195	$13,412	$13,412
2	Montrose North	$36,382	195	$16,605	$17,874
2	Diversey to Fullerton	$20,685	170	$7,997	$8,608
4	40th to 41st Street	$19,692	158	$6,263	$6,263
2	Belmont to Diversey South	$13,954	122	$3,288	$3,539
2	Diversey Revetment	$12,635	97	$2,163	$2,328
4	43rd to 45th Street	$16,696	85	$2,350	$2,350
2	Montrose to Irving	$26,440	61	$2,591	$2,789
2	Fullerton/Theater on the Lake	$35,059	73	$4,176	$4,495
4	45th to 51st Street	$129,413	73	$15,414	$15,414
4	54th to 56th Street	$56,618	61	$5,549	$5,549
NA	PACR	$212	NA	NA	NA
	Total	$536,013		$146,999	$151,671

6.9 BENEFIT-COST RATIO

A summary of benefit-cost ratios (BCRs) for this project as reported in previously approved decision documents and reports is summarized in Table 8 below. A current economic summary of the authorized plan is shown in Table 9.

Table 8. Summary of Reported Benefit-Cost Ratio Computations

Decision Document	Price Level	FDR	BCR
Feasibility Report	October 1993	8%	5.1
Post Authorization Change Report	October 2012	3.75%	7.4

Table 9. Economic Summary of Authorized Plan (3.75% FDR, 50 years, Oct 2012 PL)

Cost	Revetment	Breakwater
Total First Cost	$602,570,000	$14,158,000
Interest During Construction	$151,671,000	$242,000
Sunk PED Costs	-$87,342,000	-$2,053,000
Total NED Investment Cost	$666,899,000	$12,347,000
Amortization	$29,727,000	$550,000
OMRR&R	$500,000	$7,000
Total Annual Costs	$30,226,000	$557,000
Benefit to Cost Ratio	7.04	36.21
Net NED Benefits	$179,147,000	$19,369,000

6.10 REMAINING BENEFITS REMAINING COST RATIO

The remaining benefit-remaining cost ratio of the project was calculated based on the latest Program Development Guidance for the FY2014 budget development (EC-11-2-202) as shown in Table 10.

Table 10. Remaining Benefits and Remaining Costs Calculations (3.75% FDR, Oct 2012 PL)

Remaining Project Cost without IDC	$243,867,000
Remaining IDC	$30,826,000
Annualized Remaining Project Cost w/ IDC	$12,244,000
Annualized OMRR&R Cost	$700,000
Total Annual Remaining Project Cost	$12,944,000
Sunk Annual Remaining Benefit (Reach 3, Breakwater)	$46,192,000
Total Annual Remaining Benefit	$186,714,000
RBRCR Calculation	14.4
Remaining Average Annual Net Benefit	$173,769,000

6.11 COST ALLOCATION

There have been no changes in cost allocation since project authorization. The current project purpose is still coastal storm damage reduction.

6.12 COST APPORTIONMENT

A comparison of the apportionment of costs between Federal and non-Federal interests for the authorized project and the recommended project, both at current October 2012 price levels, is summarized in Table 11. As mentioned previously, the authorized project is a LPP. Apportionment of costs is 65 percent Federal and 35 percent non-Federal based on the NED plan; any remaining costs over the NED plan are a 100 percent non-Federal responsibility per the Project Cooperation Agreements. The NED plan is calculated mandatorily for each segment and

then totaled. What follows is a table containing the NED plan estimate for each segment of the project, and then a cost apportionment table for the total project costs.

Table 11. Cost Apportionment for the Authorized and the Recommended Project (Oct 2012 PL)

	Federal	Non-Federal	Total
Authorized Project	65%	35%	100%
NED Plan (65/35)	$170,572,000	$91,847,000	$262,419,000
LPP (Cost in excess of NED, 0/100)	$0	$61,650,000	$61,650,000
TOTAL Authorized Project	$170,572,000	$153,497,000	$324,069,000
Recommended Project	65%	35%	100%
NED Plan (65/35)	$189,134,000	$101,841,000	$290,975,000
LPP (Cost in excess of NED, 0/100)	$0	$245,038,000	$245,038,000
TOTAL Recommended Project	$189,134,000	$346,879,000	$536,013,000

7.0 ENVIRONMENTAL CONSIDERATIONS

There are no environmental considerations surrounding this PACR. The first National Environmental Policy Act (NEPA) documents for the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project was an Environmental Assessment (EA) with a signed Finding of No Significant Impact from July 1993 that accompanied the April 14, 1994 Chief's Report. Since then, there have been nine supplemental EAs for the project, conducted on an as needed basis for the various Federal and non-Federal construction reaches of the project (refer to Appendix F for a list of these documents). The existing NEPA documents for the Chicago Shoreline project have been reviewed and they adequately identify the environmental impacts of the project.

8.0 PUBLIC INVOLVEMENT

Environmental Assessment for segments were conducted as needed prior to construction. The public is allowed to comment on the proposed plans at this time. Additionally, per the WRDA 2007 Authorization, there will be a third-party review of the 54th to 56th Street, Promontory Point Reach to facilitate an acceptable design between the non-Federal Sponsor and the surrounding communities that pursued the legislation. There was no public involvement in the development of this PACR.

9.0 HISTORY

A brief history of the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project, subsequent to authorization, is given in Table 12.

Table 12. Brief Project History Since Authorization

Item/Event	Completion
Study Authorization	December 1971
Design Authorization	April 1974
Chief of Engineers Report	April 1994
Project Authorization	October 1996
PCA #1 Executed	April 1997
PCA #2 Executed	August 1998
PCA #3 Executed	May 1999
Amendment to PCA #3 Signed	December 2009

10.0 RECOMMENDATION

The Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project remains economically justified and the authorization for a modified total project cost from $324,069,000 to $536,013,000 at October 2012 price level with a Federal Share of $189,134,000 would allow USACE and its non-Federal Sponsors to complete this critical project for the City of Chicago. I recommend that this Post Authorization Change Report be approved and the authorized project cost estimate be modified as described herein.

08/28/13

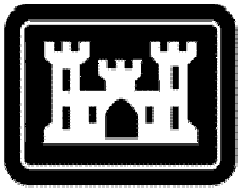
Frederic A. Drummond Jr. Date
Colonel, U.S. Army
District Engineer

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Plates

Prepared By:

U.S. Army Corps of Engineers
Chicago District



January 2013

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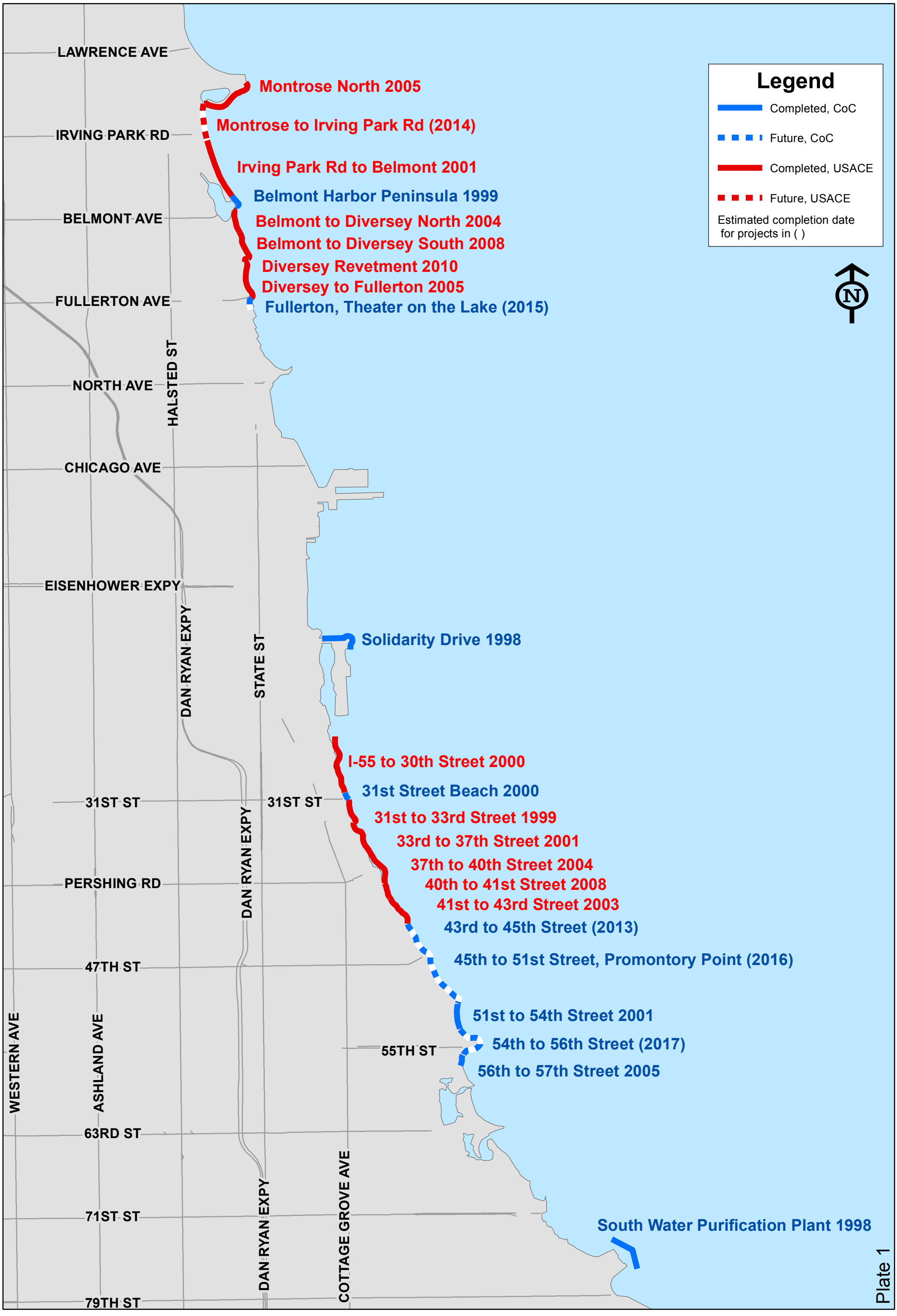
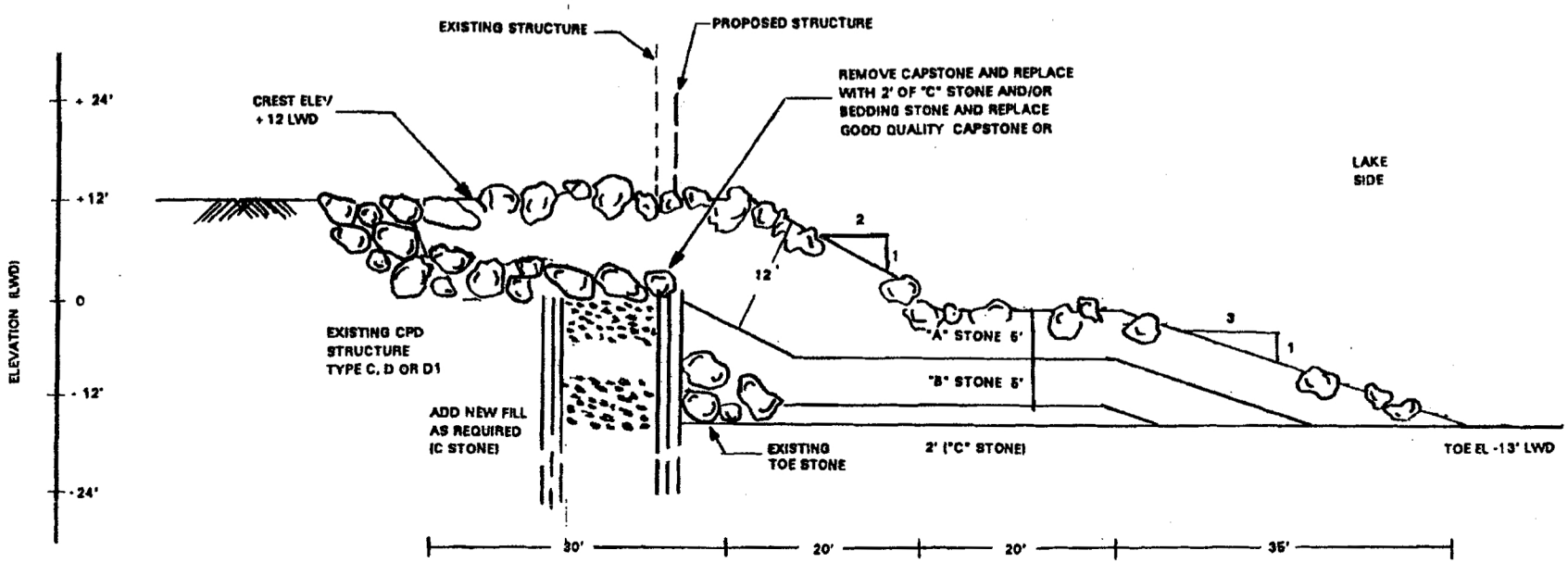
Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line (Chicago Shoreline)
Plate 1 Overall Project Map



Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line (Chicago Shoreline)
Plate 2 Typical NED Plan Cross Section



NOTE:

-APPLICATION WHERE EXISTING STRUCTURE IS DETERIORATED

-EXISTING CPD STRUCTURE TYPE C, D OR D1

STONE SIZES

"A" 7,000 lbs (3.5 t) - 16,000 lbs (8.01 t)
"B" 700 lbs - 1,600 lbs
"C" 1 lb - 50 lbs

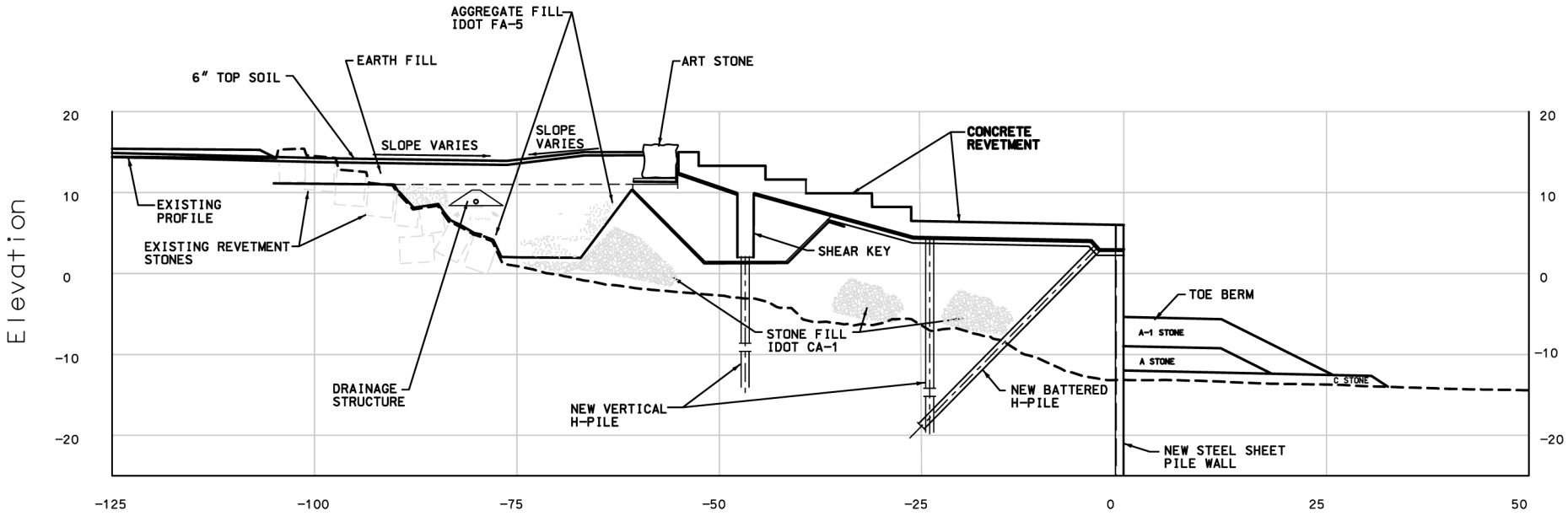
ILLINOIS SHORELINE
INTERIM III
FEASIBILITY REPORT
OPTIMIZED DESIGN
TYPICAL CROSS SECTION
LOW BERM REVETMENT

CHICAGO DISTRICT CORPS OF ENGINEERS

JANUARY 1988

Plate 2

Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line (Chicago Shoreline)
Plate 3 Typical LPP Cross Section



TYPICAL CONCRETE REVETMENT SECTION

10 5 0 10 20

1 INCH = 10 FEET

Plate 3

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix A

Economic Reevaluation

Prepared By:

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Chicago District

April 2013

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
POST AUTHORIZATION CHANGE REPORT
(CHICAGO SHORELINE)
APPENDIX A – ECONOMIC REEVALUATION

EXECUTIVE SUMMARY

The purpose of this appendix is to detail the post authorization changes in project benefits since the project was originally authorized, which was based upon the March 1994 Supplement to Final Feasibility Report and the Final Feasibility Report dated July 1993, herein collectively referred to as the Feasibility Report. The scope of the economic reevaluation contained in this appendix will cover the changes to three key benefit categories: savings related to the prevention of delays associated with road loss due to erosion, valuation of facilities and infrastructure, and the loss of recreation opportunities. Two minor benefit categories, traffic delays associated with road flooding and maintenance cost avoidance, will be addressed in a cursory manner.

The authorized project detailed in the Feasibility Report was a plan preferred by the non-Federal sponsor. Per USACE regulations, a Locally Preferred Plan (LPP) must have outputs similar in-kind, and equal to or greater than the outputs of the Federal plan. The incremental benefits and cost of the locally preferred plan, beyond the Federal plan, must be analyzed and documented in feasibility reports. The Federal plan, a rubble mound revetment, was chosen as the National Economic Development (NED) plan, because it reasonably maximized the net economic benefits consistent with protecting the Nation's environment. Cost estimates for the authorized plan were developed and detailed in the Cost Appendix of the Feasibility Report. The total estimated first cost for the authorized plan was reported as $192,251,000 at October 1993 price levels. The current fully funded cost estimate of the authorized plan is $546,148,000 at October 2012 price levels. Through this limited economic reevaluation, it is shown that the benefits of this project are robust enough to support a locally preferred plan that is almost twice the cost and with outputs that are similar in-kind to the Federal plan.

The table below provides a summary comparison of the authorized plan economics as reported in the Feasibility Report with that of this current Limited Revaluation Report.

Executive Summary Table – Economic Summary Comparison

ECONOMIC SUMMARY, AUTHORIZED PLAN, BY SEPARABLE ELEMENT ($1,000, 50 years)				
	1994 Supplement to Feasibility Report (October 1993 PL; 8% FDR)		2013 Limited Reevaluation Report (October 2012 PL; 3.75% FDR)	
Benefits	Revetment	Breakwater	Revetment	Breakwater
Transportation Road Loss Prevention	$28,081		$114,802	
Facilities and Infrastructure Protection	$4,146	$9,466	$30,374	$19,927
Transportation and Flood Damage Reduction	$4,617		$530	
Incidental Recreation	$14,749		$36,881	
Separable Recreation	$7,249		$5,521	
Maintenance Costs Avoided	547		$1,050	
Accumulated Benefits During Construction			$20,215	
Total Benefits	$59,389	$9,466	$209,373	$19,927
Cost				
Total First Cost	$184,082	$8,169	$602,570	$14,158
Interest During Construction	$31,299	$836	$151,671	$242
Sunk PED			($87,342)	($2,053)
Total NED Investment Cost	$215,831	$9,005	$666,899	$12,347
Amortization	$11,882	$736	$29,727	$550
OMRR&R	$420	$7	$500	$7
Total Annual Costs	$12,302	$743	$30,226	$557
Benefit to Cost Ratio	4.5	12.7	7.04	36.21
NET NED BENEFITS	$47,087	$8,723	$179,147	$19,369

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List of Acronyms

AADT – Annual Average Daily Traffic
BLS – Bureau of Labor Statistics
CPD – Chicago Park District
CPI – Consumer Price Index
CWCCIS – Civil Works Construction Cost Index System (EM1110-2-1304)
FDR – Federal Discount Rate
FY – Fiscal Year
HCM – Highway Capacity Model
IDOT – Illinois Department Of Transportation
LSD – Lake Shore Drive
MFR – Memorandum for Record
NED – National Economic Development
RBRCR – Remaining Benefit Remaining Cost Ratio
SMSA – Standard Metropolitan Statistical Area
UDV – Unit Day Value
USACE – United States Army Corps of Engineers
WLRC – Washington Level Review Committee
WRDA – Water Resources Development Act

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
POST AUTHORIZATION CHANGE REPORT
APPENDIX A – ECONOMIC REEVALUATION

1. SCOPE OF ECONOMIC REEVALUATION

The scope of the economic reevaluation contained in this appendix will cover the updates to three key benefit categories: savings related to the prevention of road loss and its associated traffic detours/delays, valuation of facilities and infrastructure, and the loss of recreation opportunities. Two minor benefit categories, traffic delays associated with road flooding and maintenance cost avoidance, will be addressed in a cursory manner.

In 1994 the project was authorized for construction; since that time, the field of transportation modeling has matured. The original feasibility study utilizes the procedures of the 1985 Highway Capacity Model (HCM) and various other transportation publications to analyze transportation delay benefits. For its time the methods employed for the Feasibility Report were contemporary and appropriate. A drawback to this method is the HCM's inability to account for the ripple effect in transportation delays that would occur on secondary and tertiary roads adjacent to the detour routes. This limitation was noted during the Washington Level Review (WLR) of the Feasibility Report. At that time the WLR indicated that the limitation was a conservative assumption to the model's output.

A limitation to this reanalysis is access to the original transportation model created for this study. During the late 1980's the use of personal computers was not common. Most computations were either done by hand or analyzed with the help of a mainframe computer. Review of project documentations from this period indicates that a mainframe program was created to construct the traffic delay results. What survives from the original computation runs are the incremental time delays, reported in the Feasibility Report, and the detour traffic counts. The procedures in the HCM allowed for the determination of: the increase travel times as a result of detour of Lake Shore Drive to secondary feeder roads, the increase travel times on the secondary feeder roads as a result of the diversion of Lake Shore Drive to those roads, and the capacity of the secondary roads.

Lake Shore Drive is an eight lane highway with limited egress and ingress points. The source of the original Annual Average Daily Traffic (AADT) counts was from an Illinois Department of Transportation (IDOT) map from 1979. Notably, the volume of traffic has increased while the capacity of road has remained constant. The capacity of the secondary road system adjacent to Lake Shore Drive has not been enhanced since the early 1990s. This limited reevaluation assumes that the computed increase travel times determined in the original report are sufficiently conservative. An update of the annual average daily traffic counts and the computed value of time saved are sufficient to understand the benefits associated with this economic update.

This limited economic reevaluation provides a clear picture of the current and potential future damages to shoreline structures and surrounding infrastructure. The list of structures used in the original study was analyzed to find those structures that have provided, collectively, approximately 97 percent of the reported structure and infrastructure damages. A replacement value less depreciation analysis was performed on this truncated list. The remaining 3 percent of the structures were indexed using the Bureau of Labor Statistics' Consumer Price Index.

Recreation loss, as a result of not implementing the project, was a substantial component of the original study. The original analysis and point assignment for the Unit Day Value (UDV) computations were used without any change. Economic Guidance Memorandum (EGM) 13-03 was used to update the conversion of point values to dollar value for this analysis.

The method used to calculate the benefits resulting from the prevention of flood related delays were taken from the Feasibility Report. Key input parameters such as the frequency of flooding, flooding delay times, and value of time were available from the Feasibility Report, however; the formula for these calculations were not provided in the Feasibility Report. The calculations in this limited reevaluation report, using the Feasibility Report parameters, showed that the updated methods yield about half the value report in the Feasibility Report.

Estimated maintenance cost avoided of $650,000 was developed based on the City of Chicago's allocated budget per year for emergency repairs and the likelihood of the repair occurring. In early FY12 a portion of the shoreline failed near Montrose Harbor. The cost of the repair was approximately one million dollars. Updating the Feasibility Report value for estimated maintenance cost avoided to October 2012 Price levels (CWCCIS CWBS Code 10) would raise the value to $1,050,000. This estimate is in line with the value paid during the 2012 emergency repair.

2. ECONOMIC PROFILE

Since the early 1990's the economic profile of the City of Chicago, Cook County, and the collar counties (Lake, DuPage, Kane, McHenry, and Will Counties) have shown the recent effects of the housing market. The region is becoming more diverse as shown by the decreasing percentage of white population since the 1990's and an increase of approximately 2.5 million in the overall population. Median household incomes are down from twenty years ago; but this parallels the dramatic increase in unemployment. The following is a detailed review of the demographic changes since the Feasibility Report.

2.1 Study Area

The study area for this Interim III report is defined as extending from Wilmette Harbor to the Indiana State line and includes the entire shorelines of Evanston and Chicago, and the southern section of Wilmette. For the purpose of delineation of human resources, it is recognized that this area is a functional border of the Chicago Standard Metropolitan Statistical Area (prior to the 2000) or the Chicago Metropolitan Statistical Area. For the purpose of a qualitative assessment of economic profile of the region it is assumed herein that the old Chicago Standard Metropolitan Statistical Area and the newer definition of the Chicago Metropolitan Statistical Area are similar and will be referred to hereon as the Chicago Region. The Chicago Region is comprised of six Illinois counties: Cook, DuPage, Kane, Lake, McHenry, and Will. The concentration of population in this area has traditionally been a function of geographical advantage defined by highly developed transportation links (e.g. water, rail, road, and air) connecting this capital city of the Midwest with other regions of the nation.

2.2 Human Resources

The neighborhoods surrounding the shorelines within the study area are, for the most part, urban, densely populated areas, with predominantly multiple unit dwellings. The benefits related to shore land use within the study area extend inland a considerable distance from the shoreline. For this study, the impact area of these benefits has been determined to be the Chicago Region.

Population

The most recent population data for the study area municipalities and counties comprising the impact area are shown in Table 2-1. The population growth rate in the Chicago Region since 1990 is on average 2 percent per year. The Chicago Region has increased in population since the 1990 study by 30 percent. The surrounding suburban collar counties have experienced marked growth over the last 20 years. The projection of population growth in the Chicago Region is only 0.5 percent per year based on the *2040 Forecast of Population, Households and Employment* study by Chicago Metropolitan Agency for Planning; this a slight increase from the 1985 Bureau of Economic Analysis Regional Projections reported in the Feasibility Report.

Households and Housing

Within the Chicago Region, DuPage County is first of the six counties in the measure of housing value at $297,700, as shown in Table 2-2. Will County is the fastest growing county of the Chicago Region, reflecting a 93 percent increase in housing units during the last two decades. All the collar counties of the Chicago Region experienced significant growth of housing stock and population in comparison to Cook County, which had been effectively built-up in earlier decades.

Housing values in Cook County have kept pace with those in the other counties which have more recent housing stock. Cook County is also distinguished from the collar counties by the percentage of housing units that are owner occupied. Approximately 42 percent of the units in Cook County are rental, whereas in the collar counties 25 to 30 percent are rental units. Although in the areas of housing, household and population growth are predominately outside Cook County. Cook County's share of the housing stock remains dominant at 57 percent of the Chicago Region total. The City of Chicago, located entirely within Cook County, contained 40 percent of the total Chicago Region housing units. The growth trends prevalent in the past two decade, if continued, may eventually produce a more evenly geographically distributed population base within the Chicago Region.

Income and Education

Within the Chicago Region, Lake County is first in highest income level at $77,598 closely followed by McHenry County with median household income of $75,014. DuPage County has the highest educational attainment, as measured by the percentage of county population over 25 years old having graduated high school or with 4 years of college, as shown in Table 2-3. The data also indicates that just over 20 percent of the Chicago Region adult populations are high school graduates.

A comparison of income between 1989 and 2010, when adjusted for inflation, shows a 30 percent decrease in median household income in Chicago Region.

Employment

Employment figures for the Chicago Region are provided in Table 2-4. The Chicago Region, the state, and the Midwest region in general have experienced higher unemployment rates than the national average during the late 1980s. However, within the SMSA the unemployment rate ranged from a low of 3.6 percent in DuPage County to a high of 6.4 percent in Will County in 1990. Between 1980 and 1989 total employment in the Chicago area increased from 3,650,300 to 4,225,395 for a net change of 575,095 jobs. Most of this growth came in the trade and service sectors of the economy. The manufacturing sector, on the other hand, lost over 139,800 jobs (17 percent) during the same period.

The effects to the market as a result of the 2008 housing market downturn have affected the unemployment rate for the Chicago Region. Cook County and the Chicago Region are still experiencing higher employment rates than the national average. The collar counties have

generally experienced the same percentage of unemployment (9 percent), except for DuPage County which is a percentage point less than its neighbors.

Table 2-1 Population Statistics

Area	Population, 2010	Population, 1990	Percent Change	Percent White, 2010	Percent White, 1990
Chicago Region	9,461,105	7,261,176	30%	65.4	70.5
Cook County, Illinois	5,194,675	5,105,067	2%	55.4	62.8
DuPage County, Illinois	916,924	781,666	17%	77.9	91.5
Kane County, Illinois	515,269	317,471	62%	74.6	84.9
Lake County, Illinois	703,462	516,418	36%	75.1	87.3
McHenry County, Illinois	308,760	183,241	68%	90.1	97.6
Will County, Illinois	677,560	357,313	90%	76	84.9

Table 2-2 Income and Housing Statistics

Area	Median Gross Rent, 2010 ($2010)	Median Gross Rent, 1990 ($2010)	Percent Change	Value of Owner Occupied Housing, 2010 ($2010)	Value of Owner Occupied Housing, 1990 ($2010)	Percent Change
Chicago Region	$ 913	NA	NA	$ 236,000	NA	NA
Cook County, Illinois	$ 917	$ 779	18%	$ 244,400	$ 193,495	26%
DuPage County, Illinois	$ 997	$ 1,076	-7%	$ 297,700	$ 259,825	15%
Kane County, Illinois	$ 939	$ 832	13%	$ 235,100	$ 194,253	21%
Lake County, Illinois	$ 957	$ 923	4%	$ 268,000	$ 259,067	3%
McHenry County, Illinois	$ 1,010	$ 874	16%	$ 231,700	$ 210,362	10%
Will County, Illinois	$ 957	$ 714	34%	$ 227,200	$ 168,668	35%

Table 2-3 Housing statistics

Area	Housing Units, 2010	Housing Units, 1990	Percent Change	Persons Per Household, 2010	Persons Per Household, 1990	Percent Owner Occupied, 2010	Percent Owner Occupied, 1990
Chicago Region	3,797,247	2,798,004	36%	2.8	2.8	66.0	57.0
Cook County, Illinois	2,180,359	2,021,833	8%	2.7	2.7	58.2	55.5
DuPage County, Illinois	356,179	292,537	22%	2.8	2.8	74.7	74.4
Kane County, Illinois	182,047	111,496	63%	3.0	2.9	76.6	69.5
Lake County, Illinois	260,310	183,283	42%	2.9	2.9	76.6	74.2
McHenry County, Illinois	116,040	65,985	76%	2.9	2.9	83.1	79.9
Will County, Illinois	237,501	122,870	93%	3.0	3.0	83.2	77.4

Table 2-4 Economic Characteristics of Region

	Updated Estimates					Original Feasbility Data				
Area	Median Household Income 2010	Per Capita Income	Percent Person Below Poverty Line	Percent Graduated High School	Percent with a 4 year College Degree	Median Household Income 1989 (2010 PL)	Per Capita Income	Percent Person Below Poverty Line (1979)	Percent Graduated High School (1980)	Percent with a 4 year College Degree (1980)
Chicago Region	$ 59,707	$ 29,963	12.7	86.1	20.9	$ 77,029	$ 38,656	-	67.6	18.7
Cook County	$ 53,080	$ 28,982	12.2	83.6	20.4	$ 68,480	$ 37,390	13.6	64.3	17.1
DuPage County	$ 75,014	$ 37,038	4.3	91.8	28.1	$ 96,777	$ 47,784	3	83	29
Kane County	$ 66,562	$ 28,845	7.8	83	20.7	$ 85,873	$ 37,214	6.1	70.6	16.7
Lake County	$ 77,598	$ 37,148	5.4	88.6	24.9	$ 100,111	$ 47,925	5.3	77.6	28.1
McHenry County	$ 75,569	$ 31,315	5.5	92.3	22.2	$ 97,493	$ 40,400	4.2	74.9	17.1
Will County	$ 74,670	$ 29,215	5.7	90.2	20.4	$ 96,333	$ 37,691	6.4	70.2	16.5

1. 2010 Data derived from American Community Survey 2010 to 2008 unless otherwise noted

	Updated Estimates					Original Feasbility Data				
Area	Unemployment[1]	Total Employment	Manufacturing	Wholesale/Retail Trade	Services	Unemployment Rate (1990)	Total Employment	Manufacturing	Wholesale/ Retail Trade	Services
Chicago Region	10%	5,460,538	703,489	1,121,949	1,853,848	5.8%	4,225,395	670,556	983,951	1,254,476
Cook County	11%	3,321,602	399,657	630,666	1,195,600	6.3%	3,084,276	483,918	712,281	925,900
DuPage County	8%	696,727	83,003	178,158	233,380	3.6%	493,321	64,702	123,355	165,274
Kane County	9%	239,977	41,723	46,565	81,515	5.9%	162,855	34,465	37,056	44,839
Lake County	9%	415,337	58,432	91,159	123,266	3.9%	286,102	47,335	68,579	63,795
McHenry County	9%	110,994	23,127	24,740	26,435	5.3%	79,712	21,877	15,369	18,076
Will County	9%	184,447	20,521	40,584	53,131	6.4%	119,129	18,260	25,311	30,592

Updated data derived from BEA data SIC codes for 2000 unless otherwise noted

Table 2-5 Economic Characteristics of Region

	Percent Change in				
Area	Median Household	Per Capita Income	Percent Person Below Poverty Line	Percent Graduated High School	Percent with a 4 year College Degree
Chicago Region	29%	29%		-21%	-11%
Cook County	29%	29%	11%	-23%	-16%
DuPage County	29%	29%	-30%	-10%	3%
Kane County	29%	29%	-22%	-15%	-19%
Lake County	29%	29%	-2%	-12%	13%
McHenry County	29%	29%	-24%	-19%	-23%
Will County	29%	29%	12%	-22%	-19%

1. 2010 Data derived from American Community Survey 2010 to 2008 unless otherwise noted

	Percent Change in				
Area	Unemployment1	Total Employment	Manufacturing	Wholesale/Retail Trade	Services
Chicago Region	43%	23%	5%	12%	32%
Cook County	43%	7%	-21%	-13%	23%
DuPage County	57%	29%	22%	31%	29%
Kane County	34%	32%	17%	20%	45%
Lake County	55%	31%	19%	25%	48%
McHenry County	41%	28%	5%	38%	32%
Will County	30%	35%	11%	38%	42%

Updated data derived from BEA data SIC codes for 2000 unless otherwise noted

3. DAMAGE REACHES

The original economic analysis as documented in the Feasibility Report broke up the study area into five main reaches. Certain reaches were subdivided into smaller segments for formulating and evaluating shore protection plans. These reach designations were maintained for this economic reevaluation to provide consistency. The Feasibility Report detailed, by study reach, the total potential shoreline property and land improvement replacement values. Replacement values (bolded) reported herein were calculated from a facilities and infrastructure database collected for the feasibility study. Updates to the facilities and infrastructure replacement values are based on values provided by the Chicago Park District (CPD). Section 4 of this report provides more detail on the development of the facility and infrastructure replacement value. The following reach descriptions were pulled from the Feasibility Report to provide a context for the damages the project was envisioned to protect.

3.1 Reach 1

Reach 1 extends from Juneway (7800 N.) to Lane (5934 N.). It contains $**242,377,339** worth of facilities, beaches, and parks, including four historic buildings at Berger Park. There are 16.44 acres of parks and beaches. Reach 1 extends from shore mile 593.000 to 589.685. The evaluations in this study consider no part of this area to be subject to damages.

3.2 Reach 2

The first shoreline area included in the economic evaluations for Interim III is Reach 2. Reach 2 is a large portion of the Lincoln Park shoreline extending from 4300 north to 2800 north (Diversey Ave.). In previous studies this reach has been segmented at the Belmont Harbor entrance (3200 north) into 2N and 2S. Reach 2 contains $**4,782,561,214** worth of facilities, beaches, and parks.

A principal feature of Reach 2 is comprised of Lincoln Park, which was established in 1865 shortly after the death of Abraham Lincoln. At that time its northern border was roughly what is now North Ave. (1600 N.). As the city grew the amount of free open public land was extended north along the shore. City ordinances were passed prohibiting any further development of the land for any commercial or residential use, permanently setting aside 1,212 acres for public use.

Lake Shore Drive (LSD) in Lincoln Park was started and partially completed between 1869 and 1870. From 1880 to 1894 LSD progressed north along the shore and had gone as far north as Fullerton Ave. (2400 N.). The north side of Chicago was quickly becoming a residential area. The construction of Lincoln Park and LSD were significant influential factors in this development. Originally the Drive was considered to be a recreational facility of Lincoln Park; but as heavier traffic developed; it became an essential way of moving traffic in the city. LSD serves a similar function both north and south of the city center. However, unlike the southern

shoreline, the area north of the Chicago loop does not support any rail lines parallel to the shore. This permits greater access to the shore in the area north of the Chicago Loop.

Reach 2 is a heavily developed and intensely used area. The study site features Montrose and Belmont Harbors, world famous (no entrance fee) Lincoln Park Zoo, conservatory, Chicago Historical society and Academy of Science buildings, a continuous path that some individuals use to travel to work while many use it for biking, jogging and walking, many service yards and garages, Marovitz golf course (a nine hole lake side Park district operated golf course), fishing, scuba diving, tennis courts, baseball fields, metered parking spaces and ideal sites for relaxing watching listening to the lake.

3.3 Reach 3

Reach 3 extends from Pearson to 31st St. (shoremile 580.899 to 574.9(0). The most valuable area of this study site in terms of facilities replacement value per shoremile, Reach 3 includes $**4,475,758,437** worth of lands, facilities, and infrastructure and 217.24 acres of beach and park.

Reach 3 contains, Grant Park, the cultural mecca of Chicago, as well as valuable facilities which serve the city. Reach 3 is subject to damages in three areas. LSD flooding occurs from North Ave. to just south of Division (S.M. 582.0 - 581.15). Shore destruction and land loss damages are foreseen in portions of the Northerly Island connecting peninsula between the Shedd Aquarium and the Adler Planetarium; and for the shoreline from North of 26th St. to the south end of the reach. (S.M. 575.8 -574.9)

Included in Reach 3 are facilities and structures necessary for city services, such as the water Jardin filtration plant and the Ninth St. service yard.

Prominent in this reach are cultural facilities including the Art Institute, Petrillo Music Pavilion, Millennium Park (Lurie Garden, Pritzker Pavilion, and monuments), and the Field Museum of Natural History at Grant Park. Adler Planetarium and Shedd Aquarium, Soldier Field stadium and central Park District offices are located here as well as one of the most popular views of the city from Northerly Island. Major convention centers, McCormick Place and Navy Pier with immense parking facilities for conventioneers, draw large crowds to this reach which produces revenues that surpass any other single location.

3.4 Reach 4

Reach 4 extends from 31st St. to 56th St. (shoremile 574.899 - 570.450). Reach 4 contains $**1,819,365,232** worth of land and facilities and including 478 acres of public lands. Reach 4 is subject to damage throughout the entire area.

Reach 4 is a long narrow park land, Burnham Park, featuring one relatively small beach at 31st street. The site is used principally for bicycling, walking and running. Good running and bicycling paths exist throughout the park reach, and mile markers for roughly a 14 mile round trip are posted. The running/bicycling paths are set back in the park, not up against the

lakeshore. It is clear from aerial photos that at one time a wide concrete pathway existed all along the shoreline, right at the shoreline. Today these pathways have deteriorated for most of the length due primarily to the wash-out by storm waves of the earth material underlying the walkways. At some reaches the pathway is no longer recognizable, in most areas it appears as rubble.

The landscaping of the park is negligible within 50-100 feet of the shoreline. This condition is primarily due to wave washout where the existing shore protection is not high enough or has deteriorated over time. Steel posts have been driven in the lake at various locations to hold deteriorating step stone revetment in place. This same problem is not apparent in Reach 2 (Lincoln Park) previously profiled. Massive sodding would be useful in many areas throughout the park, but it would be difficult to maintain without rehabilitation of existing shore protection. In the past two years, however, 800 trees have been planted in the area.

Given the length of the park, it has very few parking facilities. South of 39th street and again south of 31st street there is nicely designed parking for 100 autos at each site. During storm conditions parking east of the drive is covered with water. The park offers beautiful views of the central city skyline, McCormick Place, the Hyde Park skyline and the entire Lake Michigan southern shore. A drive on the southern segment of Lake Shore Drive would provide similar views since the Drive virtually defines the western portion of Burnham Park. LSD would be immediately threatened at 46th and 48th streets if the shore protection were to fail.

Burnham Park serves as a lakeshore park and open space link nearly connecting Jackson Park to the south (nearly) with Grant Park to the north. Interfering with a continuous lake park shore link between south Grant Park and north Burnham Park is the McCormick Place edifice and Meigs airfield. The two parks near both the northern and southern extremes of Burnham Park are past sites of World's Fairs. The northern section hosted the Century of Progress exhibit in 1933-34; and to the south, in 1893, Jackson Park was the site of the World's Columbian Exhibition.

Two major arteries to the City exist in this area; LSD and the Illinois Central (IC) railroad. Since the early 1920' s the railroad served an indispensable role of moving freight and people from the south and east into the growing city of Chicago. With the growth of auto traffic LSD was overlaid onto this area.

At 41st street roughly 700 feet from the lake shore, the IC rail lines are situated. At this point and at 37th street are the two areas where a severe shore destruction scenario would first jeopardize these rail lines. The IC railroad presently handles freight trains as well as a heavy traffic of commuter passengers. Easterly lines are used by diesel engine driven trains. Amtrak is a user of these lines for the "City of New Orleans" run and service down-state. The freight traffic line is mostly diverted at 16th street where a switch to/from the St. Charles Rail line is executed. Four westerly lines are for overhead electric train and south usage. IC commuter servicing areas include Joliet, the south suburbs, and south Chicago. Northern Indiana is served by Chicago South Shore (CSS) railroad company which leases IC rails in Illinois. In 1985 the IC recorded 9,000,000 passenger trips, the CSS roughly 3,000,000.

Burnham Park is land between the lakeshore and LSD. Access to the Burnham Park public land, LSD being a substantial barrier to access, is available every one-half mile through pedestrian overpasses at 35th St., 43rd St., 47th St., 51st St., and 57th St. Pedestrian crossings on sidewalks are located at 31st and 39th streets and an underpass at 55th street aids access. At 49th street, west of LSD and directly south of a multipurpose play field is a residential condominium high rise known as the Newport. The Newport consists of a north and south tower connected by the main entrance, offices, and common recreation facilities. This structure marks the northern lake side boundary of the Hyde Park neighborhood. It also has the distinction in this study of being the residential development most threatened by loss should the shore protection fail and the shore line erode. The north tower is approximately 320 feet from the existing shoreline, separated primarily by all eight lanes of LSD. The Newport consists of 728 units: 516 in the north tower, 312 in the south.

3.5 Reach 5

Reach 5 extends from 56th St. to 79th St. (shoremile 570.449 to 566.300). It contains $**3,775,464,318** worth of land and facilities including 605.24 acres of beach and park. Reach 5 is subject to damages at the breakwater off 76th fronting the City's water filtration plant (shoremile 567.200 to 566.650), and at the point just south of 56th St. (Shoremile 570.449 - 570.300). Over $**961,398,937** worth of facilities and public lands lie in damage prone areas. Reach 5 contains valuable cultural and service facilities along with two nine hole golf courses (e.g. South shore and Jackson Park), eight launching ramps in Jackson Park boat harbor, tennis courts and athletic fields. Cultural facilities include the Rose and Japanese gardens at Jackson Park, the Museum of Science and Industry, and the South Shore Cultural Center and band shell. Valuable service buildings include: the coast guard house and La Rabida Sanitarium at Jackson Park; the water filtration plant, service building, and pumping station at 76th street.

3.6 Reach 6

Reach 6 extends from Avenue G to the Indiana state line (Shoremile 566.299 - 562.000). It contains $ $**704,664,980** worth of lands and facilities including 194 acres of public lands and beaches. Reach 6 is subject to damages in two places, the 95th St. point (Shoremile 563.400-563.250) and the 98th St. point (Shoremile 562.800 - 562.600).

This reach contains a variety of important city facilities such as a powerhouse, Coast Guard Station, and a Department of Conservation building as well as recreation facilities like archery ranges, volleyball courts a beach house and launch ramps.

Figure 3-1 Chicago Shoreline Map

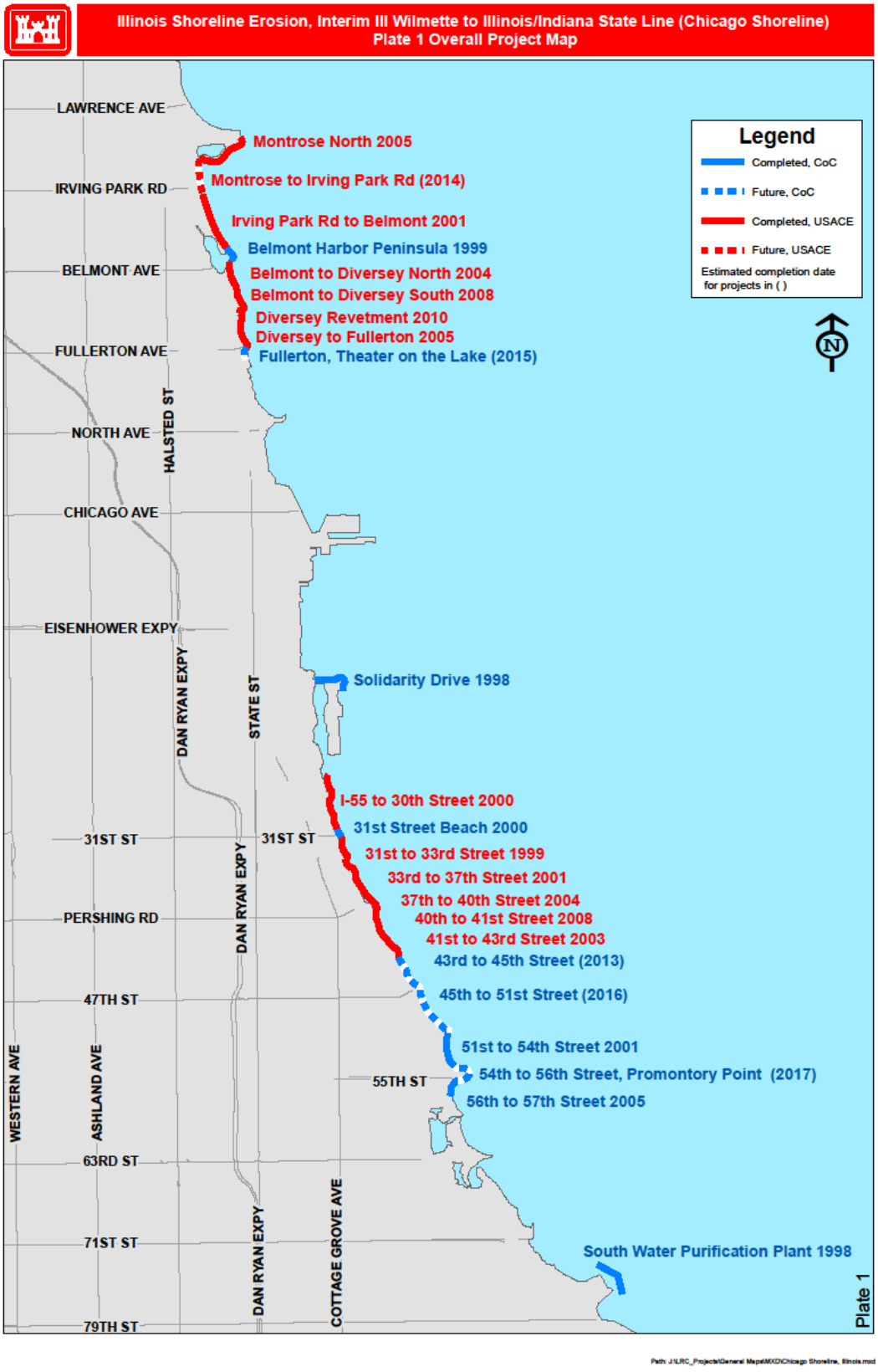
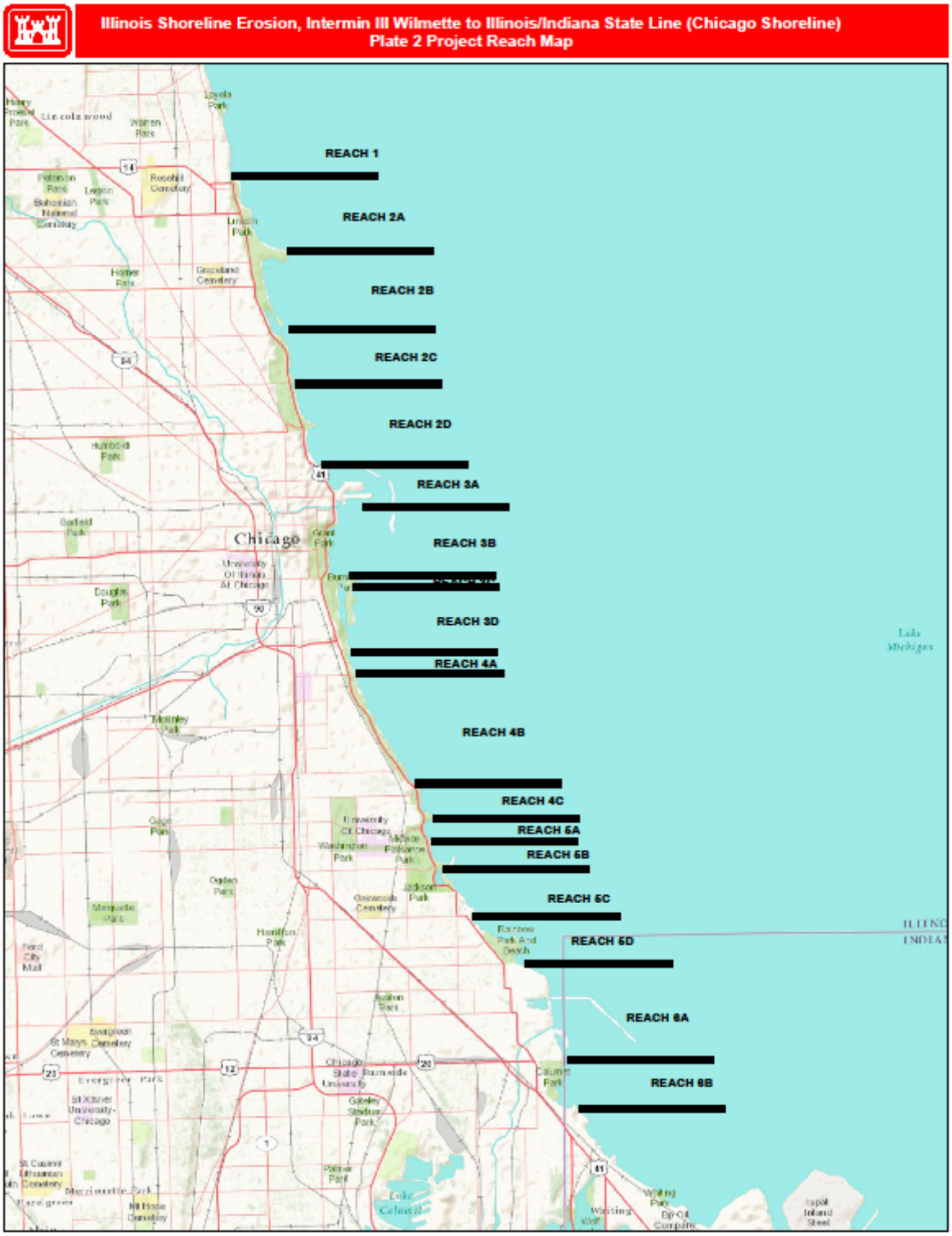


Figure 3-2 Chicago Shoreline Reach Map



4. ECONOMIC ASSUMPTIONS, PARAMETERS, AND METHODS

The major economic categories are Prevention of Transportation Road Loss, Facilities and Infrastructure, and Incidental Recreation. These three categories account for more than 90 percent of the potential damage reduction gained by the National Economic Development (NED) plan and Locally Preferred Plan (LPP). This section will review the underpinning assumptions from the original Feasibility Report and critique their validity for this limited reevaluation analysis.

4.1 Risk associated with shoreline failure

Two critical economic assumptions for this study are the coastal engineering recession rate and the probability of the onset of failure. The coastal engineering recession rate that was performed used a combination of the 10 year deep wave and the 20 year lake level or vice versa, but one important distinction is the lake level used is a design water level rather than a still water level. The design water level includes wind setup, which raises lake levels two to three feet during coastal storms. Deep water waves on the southern end of Lake Michigan can grow to nearly 20 feet and are a significant source of shoreline erosion and backshore flooding potential.

Low lake levels continue to expose timber on the existing shoreline, further contributing to degradation of the cribs and loss of the stone fill. Loss of this stone fill, coupled with wave attack, causes failure of the existing stone structure.

The lake level document referenced in the 1993 Feasibility Study is "Revised Report on Great Lakes Open-Coast Flood Levels" (Detroit District, April 1988). Subsequent design reaches utilized lake levels from "Design Water Level on the Great Lakes (Detroit, September 1993). This was the latest published document with lake levels for these frequencies in this location.

The second critical economic assumption was the shoreline recession rate. The Feasibility Report used a value of 20 ft/year. This is the long-term average rate of shoreline recession along the Chicago Lake Michigan shoreline in the absence of any shore protection structures. The difference in the design water levels in the 10 yr and 20 yr frequency range is small (less than 0.5 feet). A recent analysis (not published) performed by ERDC in February 2013 for the southern end of Lake Michigan also showed little difference in the 10 yr and 20 yr frequency. When considering the long period of record (starting in 1903), a comparison of these three frequency analyzes shows only small changes. While the latest forecast and projections shows that lake levels will remain below average in the near term, it is still expected that lake levels will continue to fluctuate in the future.

In the Feasibility Report a lower recession rate was used in the economic analysis. The assumption is based on the idea that a limited amount of funds would be used per year for the purpose of emergency protection measures along limited sections of the shoreline. The “fix as fails” emergency protection measure will slow the overall rate of erosion. The value calculated in the Feasibility Report was 19.3 ft/year (see Attachment 2, page 13). Table D-15 of the Feasibility Report shows that project justification was insensitive relative to the range of erosion

rates. Probability of the onset of failure within a reach of the project requires a more details explanation.

The probability of functional failure of the existing shore protection was developed to factor in the uncertainty of the timing of the failure. Total functional failure of Reach 2 was expected in 2008, however, the failure could have happened as early as 2003 or as late as 2017. Reach 3 was expected to fail in 1998; however the failure has a low probability of starting in as early as 1995 or as late as 2003. Reach 4 and Reach 5 were expected to fail in 2003 with a low probability of failure in 1995 and 2007. Triangular distributions were created from the expected year of failure (mode), lower, and upper limit of failure for each reach. Table 4-5 shows the probability distribution function (PDF) and the cumulative distribution function (CDF). This distribution was used to calculate the risk or *weighted annual damage* based on the yearly damage reported. Two methods of calculation are presented (Feasibility Method and the Limited Reevaluation Method). Method 1 (Feasibility Method) will provide information on how the original method was calculated. Method 2 (Limited Reevaluation Method) will provide a new method in addition to a rational for its use over the old method.

Method 1(Feasibility Method)

Common to both methods is the development of the annualized value of damages over the period of analysis. Figure 4-1 depicts how the yearly damage is spread out over a period of fifty years. The procedure would take the yearly value and discount it back to the start of the period of analysis. Table 4-1 depicts what is graphical displayed in Figure 4-1. The example shown in Table 4-1 assumes the yearly damage for each reach is $100. However, as Figure 4-1 shows Reach 2, 4, and 5 do not start eroding until 11 and 6 years, respectively, from the start of the period of analysis. The delay in damages in Reach 2, 4, and 5 shrinks the overall present worth of damages for the 50 year period of analysis for those reaches. The annuity or annual value is value of the present worth value broken up into 50 yearly payments at a particular discount rate.

Figure 4-1Reach failure over Period of Analysis

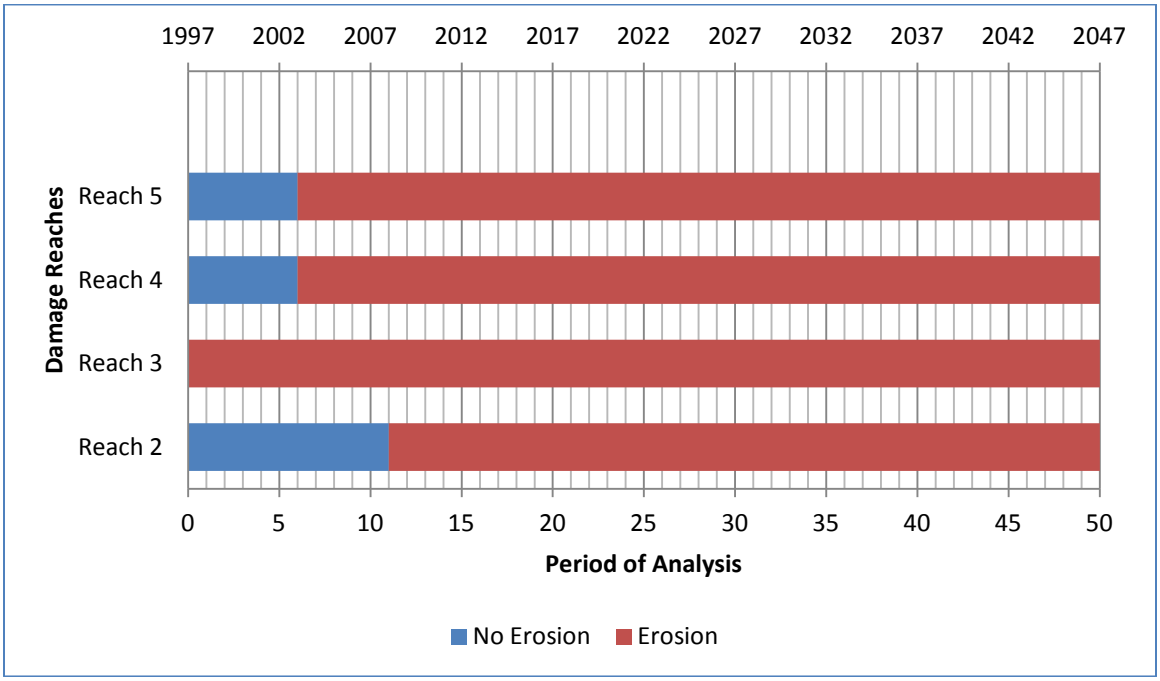


Table 4-1 Present Worth Example

Year	Reach 2	Reach 3	Reach 4	Reach 5
1		96.38554		
2		92.90173		
3		89.54383		
4		86.30731		
5		83.18777		
6		80.18098	80.18098	80.18098
7		77.28287	77.28287	77.28287
8		74.48952	74.48952	74.48952
9		71.79712	71.79712	71.79712
10		69.20205	69.20205	69.20205
11	66.70077	66.70077	66.70077	66.70077
12	64.2899	64.2899	64.2899	64.2899
13	61.96617	61.96617	61.96617	61.96617
14	59.72643	59.72643	59.72643	59.72643
15	57.56764	57.56764	57.56764	57.56764
16-44	…	…	…	…
45	19.07811	19.07811	19.07811	19.07811
46	18.38854	18.38854	18.38854	18.38854
47	17.72389	17.72389	17.72389	17.72389
48	17.08327	17.08327	17.08327	17.08327
49	16.4658	16.4658	16.4658	16.4658
50	15.87065	15.87065	15.87065	15.87065
Total PW	1422.171	2243.449	1795.123	1795.123
Annual Value[1]	$63.39	$100.00	$80.02	$80.02

Method 1 applied the annual value calculated per reach to the probability of shoreline failure. Table 4-2 provides an example of the calculations involved. The annual value for Reach 2 in Table 4-1 is $63.39. The risk of shoreline failure for Reach 2 is $61.03. In order to calculate this value, Method 1 assumes that the $63.39, in annual damages for Reach 2, is the point of reference in a second period of analysis calculation. The probability distribution is centered on the mode of the triangular distribution. It is the supposition of Method 1 that the time value of money is related back to the year 2008, in the case of Reach 2. Table 4-2 calculates the present worth relative to 2008 using the Present Worth factor, see Equation 4.1.

Equation 4.1 – Present worth (*P*)

$P = \frac{F_m}{(1+i)^l}$, where l = (modal year – year of distribution)

[1] Annuitized value based on total present worth value, discount rate of 3.75 percent, and payments over 50 years

Table 4-2 Method 1 example of Reach 2 risk of failure

Reach 2					
	A	B	C	D	E
Year	Annual Value	Present Worth Factor (Equation 4-1)	Present Worth (AxB)	PDF[2]	Damage per year (CxD)
1998					
1999					
2000					
2001					
2002					
2003	$ 63.39	1.22	77.13	0.01	$ 1.08
2004	$ 63.39	1.17	74.16	0.05	$ 3.53
2005	$ 63.39	1.12	71.31	0.07	$ 4.82
2006	$ 63.39	1.08	68.56	0.09	$ 6.46
2007	$ 63.39	1.04	65.93	0.11	$ 7.44
2008	**$ 63.39**	**1.00**	**63.39**	**0.12**	**$ 7.81**
2009	$ 63.39	0.96	60.95	0.11	$ 6.78
2010	$ 63.39	0.92	58.61	0.10	$ 5.85
2011	$ 63.39	0.89	56.36	0.08	$ 4.69
2012	$ 63.39	0.85	54.19	0.07	$ 3.99
2013	$ 63.39	0.82	52.10	0.06	$ 3.23
2014	$ 63.39	0.79	50.10	0.05	$ 2.43
2015	$ 63.39	0.76	48.17	0.03	$ 1.59
2016	$ 63.39	0.73	46.32	0.02	$ 0.95
2017	$ 63.39	0.70	44.54	0.01	$ 0.38
SUM (Column E)					$ 61.03

The downside of this method is the assumption that the present worth calculation is static relative to Figure 4-1. Method 2 assumes that, in the particular case of Reach 2, if the probability of failure is 11% in 2007 then the annual value in Table 4-2 should reflect a present worth calculation from 2007 through 2047 rather than 2008 to 2047 which Method 1 assumes for its calculation. The value, $65.93, used to determine the annual value in Table 4-2 for 2007 is the result of a second present worth calculation on the $63.39.

Method 2(Limited Reevaluation Method)

Probability at which failure initiates is over a range of time. This range for the initiation of failure has a particular set of consequences for each reach in this study. Figure 4-2 depicts damage, over the period of analysis, as a probability of failure. Reach 2 has a period of no erosion from year 1 until year 8. The probability of failure increases from year 8 until year 14 at which point the probability decreases. The portion of the graph is purple indicates that regardless of the point in time erosion is initiated this period of time erosion is occurring.

[2] Probability Distribution Function

Figure 4-2 Probability of Failure over Period of Analysis

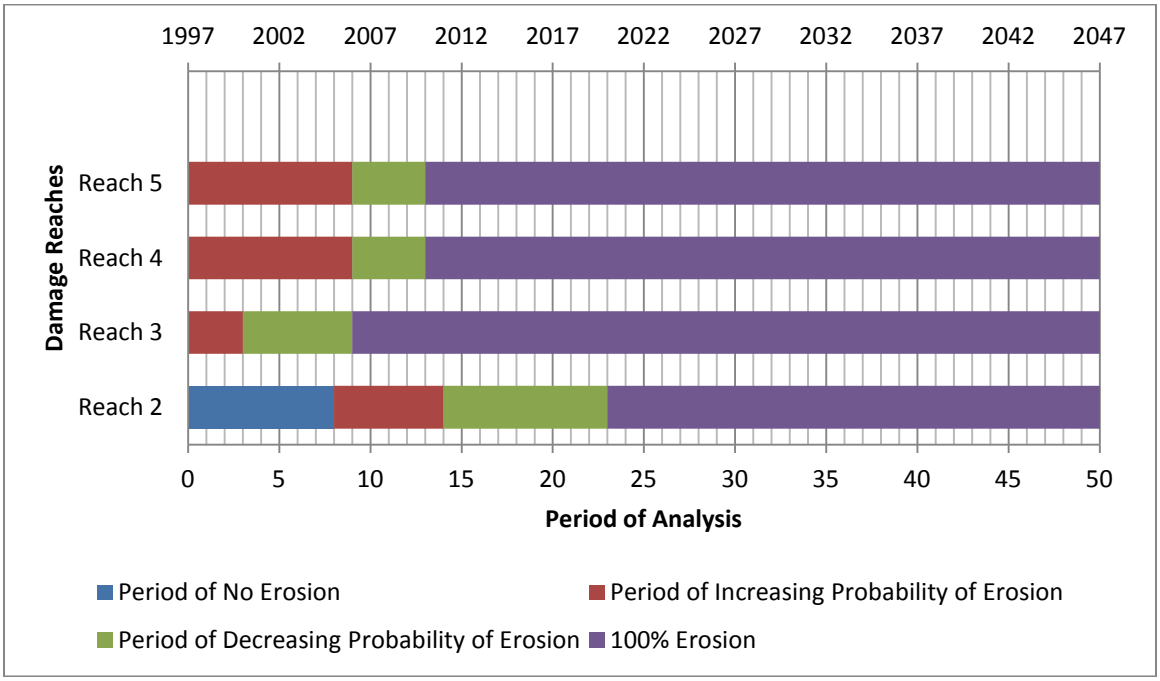


Table 4-3 presents in a tabular format what is shown in Figure 4-2. The probability that Reach 2 would fail in 2003 is 1%. The potential damage from a reach failure in 2003 for Reach 2 would be $80, Table 4-3. The potential damage from a reach failure in 2008 would be $63, Table 4-3.

Table 4-3 Method 2 Calculation of consequence of failure per probability period

Year	POA	PW From 2003 to 2047	PW From 2004 to 2047	PW From 2005 to 2047	PW From 2006 to 2047	PW From 2007 to 2047	PW From 2008 to 2047	PW From 2009 to 2047	PW From 2010 to 2047	PW From 2011 to 2047	PW From 2012 to 2047	PW From 2013 to 2047	PW From 2014 to 2047	PW From 2015 to 2047	PW From 2016 to 2047	PW From 2017 to 2047
1998	1															
1999	2															
2000	3															
2001	4															
2002	5															
2003	6	$80														
2004	7	$77	$77													
2005	8	$74	$74	$74												
2006	9	$72	$72	$72	$72											
2007	10	$69	$69	$69	$69	$69										
2008	11	$67	$67	$67	$67	$67	$67									
2009	12	$64	$64	$64	$64	$64	$64	$64								
2010	13	$62	$62	$62	$62	$62	$62	$62	$62							
2011	14	$60	$60	$60	$60	$60	$60	$60	$60	$60						
2012	15	$58	$58	$58	$58	$58	$58	$58	$58	$58	$58					
2013	16	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55	$55				
2014	17	$53	$53	$53	$53	$53	$53	$53	$53	$53	$53	$53	$53			
2015	18	$52	$52	$52	$52	$52	$52	$52	$52	$52	$52	$52	$52	$52		
2016	19	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	
2017	20	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48
2018	21	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46	$46
…	…															
2046	49	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16
2047	50	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16	$16
Total PW		$1,795	$1,715	$1,638	$1,563	$1,491	$1,422	$1,355	$1,291	$1,229	$1,169	$1,112	$1,056	$1,003	$951	$902
Annual Value		$80	$76	$73	$70	$66	$63	$60	$58	$55	$52	$50	$47	$45	$42	$40

Table 4-4 presents the risk calculation. Probability of increase failure, shown in red on Figure 4-2, is represented in Table 4-4 under the PDF or probability distribution function from years 2003 to 2008. Probability of increase failure, shown in red on Figure 4-2, is represented in Table 4-4 under the PDF or probability distribution function from years 2008 to 2017.

Table 4-4 Risk calculation for the probability of the onset of failure

Year	Annual Value	PDF	Damage per year
1998			
1999			
2000			
2001			
2002			
2003	$80	0.01	$ 1.12
2004	$76	0.05	$ 3.64
2005	$73	0.07	$ 4.93
2006	$70	0.09	$ 6.56
2007	$66	0.11	$ 7.50
2008	$63	0.12	$ 7.81
2009	$60	0.11	$ 6.72
2010	$58	0.10	$ 5.74
2011	$55	0.08	$ 4.56
2012	$52	0.07	$ 3.84
2013	$50	0.06	$ 3.07
2014	$47	0.05	$ 2.29
2015	$45	0.03	$ 1.48
2016	$42	0.02	$ 0.87
2017	$40	0.01	$ 0.35
Sum of Damage per Year			**$ 60.48**

The difference between the results of Method 1 and Method 2 are slight. Table 4-2, Method 1, reports a value of $61.03 and Table 4-3, Method 2, reports a value of $60.48. The results of Method 2 use only a single present worth calculation to obtain the consequence of increasing the period over which failure would likely occur. By this method each reach result is still relatable to the start of the period of analysis and consistent time value of money. Again, Method 1 assumes that damages occur over a static period of time. For Reach 2 that period of damage initiates in 2008 and occurs through 2047. The 40 years of damages are annualized over a 50 year period. The consequence value in Method 1 is computed from this single annualized value, $63.39 in the example above. A new time value of money, relative to the mode of the probability distribution, is created using the present worth function. Table 4-5 provides a breakdown of these probability and present worth functions.

Reach 3, 4, and 5 have probabilities that extend past the Feasibility Reports Period of Analysis. While this isn't an issue for Method 1 it presents an issue for Method 2. The conservative solution for Method 2 in this case was to assume the values from 1995 through 1997 are the same as 1998.

Table 4-5 Probability of Functional Failure

	Reach 2			Reach 3			Reach 4			Reach 5			Reach 6		
Year	**EQ 4.1**	**PDF**	**CDF**	**EQ 4.1**	**PDF**	**CDF**	**EQ 4.1**	**PDF**	**CDF**	**EQ 4.1**	**PDF**	**CDF**	**EQ 4.1**	**PDF**	**CDF**
1995				1.12	0.04	0.04	1.37	0.01	0.01	1.37	0.01	0.01	1.37	0.01	0.01
1996				1.08	0.11	0.14	1.32	0.03	0.04	1.32	0.03	0.04	1.32	0.03	0.04
1997				1.04	0.16	0.31	1.27	0.05	0.09	1.27	0.05	0.09	1.27	0.05	0.09
1998				**1.00**	**0.20**	**0.51**	1.22	0.07	0.16	1.22	0.07	0.16	1.22	0.07	0.16
1999				0.96	0.17	0.69	1.17	0.09	0.25	1.17	0.09	0.25	1.17	0.09	0.25
2000				0.92	0.14	0.82	1.12	0.10	0.34	1.12	0.10	0.34	1.12	0.10	0.34
2001				0.89	0.10	0.92	1.08	0.13	0.47	1.08	0.13	0.47	1.08	0.13	0.47
2002				0.85	0.06	0.98	1.04	0.14	0.61	1.04	0.14	0.61	1.04	0.14	0.61
2003	1.22	0.01	0.01	0.82	0.02	1.00	**1.00**	**0.14**	**0.75**	**1.00**	**0.14**	**0.75**	**1.00**	**0.14**	**0.75**
2004	1.17	0.05	0.06				0.96	0.11	0.86	0.96	0.11	0.86	0.96	0.11	0.86
2005	1.12	0.07	0.13				0.92	0.07	0.93	0.92	0.07	0.93	0.92	0.07	0.93
2006	1.08	0.09	0.22				0.89	0.05	0.98	0.89	0.05	0.98	0.89	0.05	0.98
2007	1.04	0.11	0.34				0.85	0.02	1.00	0.85	0.02	1.00	0.85	0.02	1.00
2008	**1.00**	**0.12**	**0.46**												
2009	0.96	0.11	0.57												
2010	0.92	0.10	0.67												
2011	0.89	0.08	0.75												
2012	0.85	0.07	0.83												
2013	0.82	0.06	0.89												
2014	0.79	0.05	0.94												
2015	0.76	0.03	0.97												
2016	0.73	0.02	0.99												
2017	0.70	0.01	1.00												

EQ 4.1 – Equation 4-1 where $F_m = 1$
PDF – Probability Distribution Function
CDF – Cumulative Distribution Function
BOLD Values are the mode values of the triangular distribution

4.2 Transportation Road Loss Methodology (Traffic Delay loss as a result of erosion of shoreline)

The Feasibility Report provided copious detail on the methodology used to create the transportation damages and delay costs associated with road loss due to erosion. A detailed explanation of this method is provided in Attachment 2, pages 16-28.

The conservative assumption for this limited reevaluation is to only update the AADT estimates and the value of time saved. The delay time per vehicle was original calculated based on the annual average daily traffic estimates from 1979. The 2009 estimate of the AADT counts have increased by 1.5 times that of the 1979 value.

4.3 Transportation Flooding Methodology (Traffic Delay loss as a result of flood induced closures)

The assumptions laid out in the Feasibility Report were used to generate the transportation delays as a result of a partial closure of South Shore Drive and Lake Shore Drive. The original Feasibility Report did not provide enough information to reproduce the results from that report. The following method is based on deduction of a reason based method from the data available in the Feasibility Report.

Flooding damages are limited to transportation delays caused by partial closure of South Shore Drive and Lake Shore Drive. The flood-prone areas include 2200 ft. of shoreline between Oak Street and North Avenue (Reach 2) and the intersection of 67th St and South Shore Drive (Reach 5). The transportation delay methodology used to evaluate the impacts of the loss of use of LSD is used to estimate the impacts of flooding induced road closure increasing travel time, with one critical exception: because flooding would occur without warning, a traffic management plan incorporating operational or signal modifications was not assumed. Although it may be argued that if erosion closed Lake Shore Drive in areas adjacent to the flood-prone sections, that a traffic management plan would have probably already been implemented for the assumed detour route, it was the attempt of this analysis to determine the feasibility of each section separately. In that respect, traffic delay as result of erosion and flooding induced closures are considered independently.

The assumptions related to flooding along Lake Shore Drive appear to be moderately conservative. The total increased travel times on the detour routes would be approximately an hour in Reach 2 and 7 minutes in Reach 5. Applying similar simplifying assumptions of only correcting for the increase in the AADT and the value of time saved this study will be able to provide a cursory update of the damages.

Determining the value of time saved between the Feasibility Report and the current data available requires some data manipulation. The Feasibility Report reports the value of time between work trips, average trips, and weekend trips. A single weighted time value is needed for this analysis. Equation 4-5 establishes the probability between flooding occurring during the week or weekend. This is necessary since the value of time is differentiated as work trips or weekend trips. The probability that this event would occur during a typical work week is approximately (260 total work days per year[3]/365 day per year) 71 percent chance. Next there needs to be a differentiation between the peak work trips and the average trips during the week. The peak traffic during a typical work week was assumed to be 17 percent of a total day. Equation 4-6 shows how the peak weekday trips, non-peak, and weekend trips were weighted relative to probability of occurrence. The actual monetary value of those periods could be "low, medium, or high time savings". The total increase in delay for Reach 2 was greater than 15 minutes so the high time savings values were used in the equation. The weighted value of time per hour from the Feasibility Report would be $11.51 per hour ($1.04+$6.43+$4.04).

Equation 4-5 – Probability that flooding would occur during a work day

$$P(W|A) = {52\ weeks * year^{-1} * 5\ days * week^{-1}} \Big/ {365\ days * year^{-1}}$$

Equation 4-6 – Weighted value of Time [4]

$$\text{Peak Hours} - \$8.58 * 0.71 * 0.17 = \$1.04$$

[3] 52 work weeks per year * 5 days per work week

[4] Value per hour was taken from Value Per Hour table in Appendix D of the Feasibility Report for High Time Savings (>15 min)

$$\text{NonPeak Hours} - \$10.97 * 0.71 * [1 - 0.17] = \$6.43$$
$$\text{Weekend} - \$13.93 * [1 - 0.71] = \$4.04$$

The values in Table 5-3 are broken down by time increments and purpose. This is slightly different than the values reported in the Feasibility Report –time increments and periods of the week. Equation 4-5 and Equation 4-6 were created to establish a single time increment (0-5, 5-15, >15) that sufficiently accounted for the apportionment of the monetary value for the week and weekend trips. Table 5-3, in a similar manner, adjusts the apportionment of the trip purposes to the time increments ($17.61*85%+$17.22*13%+$18.51*2% = $17.57).

The assumption in Reach 2 is that all eight lanes of Lake Shore Drive would be closed for a period of one day. An annual exceedance probability for this event is a 1/15 chance of meeting or exceeding these conditions. AADT for this section of Lake Shore Drive is 150,000 vehicles. Total closure would be two days long with additional day being used to clean and inspect the roadway. Using the AADT from 1979 and the value of time saved from the Feasibility Report the total annual cost associated with road flood prevention would be $221,462[5]. The updated total annual cost is $495,155 shown in Table 4-6. The value reported in the Feasibility Report for Reach 2 was $577,580.

Table 4-6 Transportation Flooding Calculations for Reach 2

Categories	**Value (1979 AADT, 1992 Weighted Value of Time)**	**Value (2012 AADT, 2012 Weighted Value of Time)**
Incremental Time Delay (sec) [1.333hrs*60*60]	4,799	4,799
Number of Vehicles (vph) [AADT/24]	4,271	6,250
Hours of Delay in a year	48	48
Value of Time per hour	$11.5	$17.57
Hours to Seconds Conversion (hour/second)	0.00027	0.00027
Annual Exceedance Probability	0.07133	0.07133
Expected Annual Damage	$221,462	$495,155

The assumptions concerning the wave induced flooding along Reach 5 is not well defined in the Feasibility Report. The implied assumption is that all eight lanes of South Shore Drive would be closed from 67th Street to approximately 71st Street. The average daily traffic in this area of concern was reported to be 23,000 vehicles near 71st and South Shore Drive, and 10,400 vehicles south of 71st Street. The current AADT from IDOT for 67th to 71st Street is 27,000 vehicles and the AADT value just south of 71st Street is 15,900 vehicles. An annual exceedance probability for this event is a 1/7 to 1/8 chance of meeting or exceeding these conditions. The closure duration was assumed to be 36 hours include clean-up and inspection of road. Traffic heading south on South Shore Drive are assumed to detour at 67th or 71st Street, while traffic heading north will detour at 75th Street. The normal travel time on South Shore Drive is approximately

[5] Section 5.1 Transportation Road Loss Prevention provides the formula to calculate the average annual flood related damages prevented.

9.8 minutes. Under a flood scenario the congestion on South Shore Drive is expected to elevate the travel time to 15 minutes. The increased travel delay would be approximately 5 minutes. The associated average annual delay would be $18,061. The updated total average annual delay would be $35,141 shown in Table 4-7. The value reported in the Feasibility Report was $17,037.

Table 4-7 Transportation Flooding Calculations for Reach 5

Categories	Value (1979 AADT, 1992 Weighted Value of Time)	Value (2012 AADT, 2012 Weighted Value of Time)
Incremental Time Delay (sec) [5 min*60sec)	900	900
Number of Vehicles (vph) [AADT/24]	1404	1788
Hours of Delay in a year	36	36
Value of Time per hour	11.5	17.57
Hours to Seconds Conversion (hour/second)	0.00027	0.00027
Annual Exceedance Probability	0.12787	0.12787
Expected Annual Damage	$18,061	$35,141

The Feasibility Report presented transportation flood prevention benefits that were much larger for Reach 2, $577,580 at 1992 price levels and 1979 AADT values. The current method using the parameters from the Feasibility Study would produce a value of $221,462 which is less than half the original value of $577,580. The current method is reasonable, conservative relative to the original estimate, and provides an idea of the magnitude of transportation flood damage relative to current input parameters.

4.4 Damage to Facilities and Infrastructure

Under the without project condition existing physical structures and facilities on Park District property would be lost, including buildings, gardens, and roads. Revenue producing facilities such as parking lots, boat handling facilities, and concessions stands would be lost. Use of park lands and facilities would also be lost.

The list of structures and impacted park facilities is extensive. At the time of the original study it was not known which structures and impacted park facilities would be affected in this study. Applying hindsight to the reevaluation the list of vulnerable structures can be ranked based the sensitivity of the impact to the NED calculation. A list of those structures that comprised 97 percent of the total facilities and infrastructure monetary damages was reviewed and updated. The replacement value of these structures was obtained from the City of Chicago. Structure replacement value was used for many of the tourist attractions. USACE policy (ER1105-2-100, E-19) requires the use of replacement value less depreciation. Many of the high value structures are critical pieces of the city's infrastructure, historical landmarks, or generate substantially revenue for the city. The original rationalization for the use of replacement value over depreciated replacement value was that these public facilities are constantly maintained and renovated which establishes a relatively low effective age for the facilities and infrastructure; therefore, the structures depreciated replacement value is very close to the replacement value. The remaining 3 percent of total monetary damages to the facilities and infrastructure represents

a list of approximately 400 facility and infrastructure locations represent a low potential of the impacts to the magnitude of the value of this category.

Upon the recommendation of the Independent External Peer Review panel the replacement values obtained from the City of Chicago needed additional documentation to support the dramatic increase in value. Obtaining this supporting documentation is not likely to occur at this time. USACE policy ER1105-2-100, Appendix D, D-4,b(3) stipulates that indexing of the overall benefits is not an acceptable procedure. The values obtained by the City of Chicago were far higher than those used in the original project justification. The uses of index benefits for this portion of the project benefits should be viewed as conservative. The Engineering News Record's Construction Cost Index was substituted for the usual Consumer Price Index for Rent of Primary Residence as the indices for the prices level update. To address the additional concern of depreciation of the structure value, RS Mean's commercial/industrial/institutional adjustment for depreciation was used for all structures. Eight percent deprecation was used for an observed age of 10 years for all facilities.

The following is a list, Table 4-8, of the facilities that were updated for this study. Replacement value for these structures was determined by the local sponsor.

Table 4-8 List of updated facilities

Facility	***1993 Replacement Value***	***2012 Depreciated Replacement Value***
South Shore Filtration Plant	$173,000,000	$290,129,850
South Shore Low Lift Pumping	$34,819,200	$58,393,580
South Shore Service Building	$33,480,000	$56,147,673
South Shore New Chlorine Building	NA	NA
South Shore Guardhouse Improvements	NA	NA
South Shore Site Improvements	NA	NA
Adler Planetarium	$25,000,000	$41,926,000
Lincoln Park Zoo	$81,700,000	$137,015,079
Belmont Harbor Facilities	$4,506,700	$7,557,966
Lincoln Park Conservatory	$13,000,000	$21,801,665

The replacement value of public land along the Chicago lakefront reflected 1989 bids taken for landfill and park development contemplated by Loyola University. The estimate was reviewed by the Chicago Park District (CPD) and USACE at the time and it was concluded that the value of $624,000 per acre was an accurate estimate of the land and required infrastructure. The infrastructure accounted for $240,000 of the $624,000 per acre estimate or 38.5 percent of the total. CPD estimates that the current value of the Chicago Shoreline infrastructure is $3,583,112.

4.5 Loss of Recreation Opportunities

The Feasibility Study employed the unit day value methodology to measure the value of lost recreational opportunities stemming from the destruction of recreation sites at and along the

shore. Working closely with the City of Chicago and the Chicago Park District numerous user point schedules were developed for the diverse nature of recreation activities which take place along the Chicago shoreline.

The Unit Day Value method presented a challenge for this study. The standard UDV method examines the recreational activates of an entire facility rather than the individual recreational activates within that facility. The premise of this method is that an individual is choosing a particular recreational facility over others for its collective activities rather than a single individual activity offered by the recreation facility. UDV examines the collective recreational experience rather than the recreational experience of a single activity. The method applied in the Feasibility Report deviated from this method.

Recreational activities along the Chicago Shoreline can be accessed freely over the extensive 9 miles of shoreline. Shore erosion occurs at variable rates across the 6 reaches of this study. The method used in the Feasibility Report examined the recreational activities individually rather than collectively.

During a Washington Level Review in 1993 issues regarding the Chicago District's application of loss recreation opportunities were discussed over a two day working session on the 15 & 16 of April 1993. Attachment 1 is a memorandum from this two day discussion between the Washington Level Review Committee and the Chicago District. Over the two day working session the reviewers examined the assumptions of the methods applied and concluded that the results are reasonable. The current analysis only updates the EGM point to value relationship and holds the user days to the values provided in the Feasibility Report.

4.6 Federal Discount Rate and Price Levels

A significant change in the Federal Discount Rate (FDR) could determine the viability of a project. Since fiscal year 1994, the FDR has been reduced from 8 percent to the current rate of 3.75 percent. The implications of the rate change when compared to the Feasibility Report can be substantial. Discounting is a means to account for the time value of money. The monetary equivalent value today of a million dollars fifty years from now (at a constant discount rate of 4 percent) would be approximately $141,000. The same million dollars would be worth approximately $21,000 if the constant discount rate was at 8 percent. Viewed from the context of today, an individual would have a million dollars in fifty years if that individual yielded a 4 percent return on their initial investment of $141,000.

Throughout this reevaluation report there will be similar cases where the lower discount rate of 3.75 percent will yields higher benefit than the 8 percent would have in the Feasibility Report. The project cost stream will also be examined in a comparative manner.

The price levels in this report are noted as October 2012 price levels or FY1994 price levels. In this document the designation of a price level will be the first month of the corresponding fiscal year, e.g. October 2012 for fiscal year 2013 and October 1993 for fiscal year 1994.

4.7 Emergency Maintenance and Repair

Maintenance cost avoided of $650,000 was developed based on the City of Chicago's allocated budget per year for emergency repairs and the likelihood of the repair occurring. In 2012 a portion of the shoreline failed near Montrose Harbor. The cost of the repair was approximately one million dollars. Updating the Feasibility Report value to October 2012 Price levels (CWCCIS CWBS Code 10) would raise value to $1,050,000. This estimate is in line with the value paid during the 2012 emergency repair.

The total functional failure for shore protection along Reach 2 was expected to occur by the year 2008. Reach 4 failure was expected to reach functional failure by 2003. The assumption that the City would exhaust its fix or fail budget of $650,000 ($1,050,000 in FY2012 Price levels) is a conservative assumption.

5. NATIONAL ECONOMIC DEVELOPMENT ASSESSMENT CATEGORIES

Evaluation of the National Economic Development account used five categories to aid in the selection of the project alternatives. These categories are Transportation Road Loss Prevention, Transportation Flooding Prevention, Facility and Infrastructure Protection, Recreation, and Maintenance Cost Avoidance. Each category will be examined in turn to provide some background on the purpose and methodology of the category in addition to changes resulting from the economic reevaluation.

5.1 Transportation Road Loss Prevention

One of the largest measurements of project benefits for the Illinois Shoreline Project is the successful avoidance of traffic delays. The simplest assessment would be the comparison of the travel time on Lake Shore Drive under ordinary circumstances to the travel time on alternate or detour routes assuming that sections of LSD were closed due to erosion or flooding. The difference between the two travel times could be considered the apparent transportation delay. However, the actual overlay of LSD traffic on the alternate routes seriously complicates any calculations and makes any exercise in simple subtraction quite inadequate. Lake Shore Drive is a limited access roadway with underpasses approximately every half-mile for entering and exiting traffic; the alternate routes are gridded streets with traffic signals at every major intersection and unrestricted cross vehicle access at every block. Without adjustments or compensations, the alternate routes would easily be overwhelmed since it is not possible to empirically test this scenario, we must select a methodology which relates volume, capacity and speed in a simulated traffic flow. The methodology developed by the National Transportation Research Board in the HCM provides assistance is determining our parameters. An HCM analysis consists of three parts: 1) determination of road capacity (vehicles per hour [vph]); 2) estimation of traffic volume; and 3) evaluation of level of service (LOS) and operating speed.

The HCM produced three key components that this reevalution study will utilize, with modification, for its analysis: the increase travel times as a result of detour of Lake Shore Drive to second feeder roads, the increase travel times on the secondary feeder roads as a result of the diversion of Lake Shore Drive to those roads, and the capacity of the secondary roads as a result of the detoured traffic. The primary component of the transportation delay loss is the determination of the incremental time delay. The Feasibility Report, Appendix D, detailed these incremental delays which have been reproduced in Tables 5-1 & 5-2. The incremental delay in Tables 5-1 & 5-2 were used to update the total value of transportation delay as a result of the original increased time delay computed by the original HCM analysis. New data traffic counts were provided by IDOT[6]. Traffic counts are reported as AADT. Only specific reaches of Lake Shore Drive were needed to update this study. Table 5-3 is an update of the "Value of Time per hour" on page 23 of Appendix D of the Feasibility Report.

Table 5-3 contains the major components of Table D-4 from ER 1105-2-100, Appendix D. Per guidance the hour value was adjusted for the occupancy of the vehicle for work trips only, ex.

[6] The year for which the AADT was computed is reported as 2009. The data was obtained from IDOT as a GIS product. The prior data was taken from an IDOT traffic map created in 1979.

1.14. The occupancy adjustment was established from the 2001 National Household Travel Survey published by NHTS. The "weight categories" were determined by the Chicago Metropolitan Agency for Planning. The values represent the daily trip purposes as a percentage. The weighting allows for a single adjusted rate per category for each time grouping. For the "0-5" minute grouping the $1.83 values is the sum of the following: (2.09*.85+0.37*.13+0.03*0.02). The other two groupings follow the same formula.

Tables 5-4 thru 5-9 provide the reach specific information under "Number of Vehicles per hour (vph)". This value is derived from the AADT and the percentage of home to work travel taken from Table 34 of the National Cooperative Highway Research Program Report 187 (1978). The original study assumed two peak hour times during the work week, 0700 to 0900 hours in the morning and 1600 to 1800 hours in the evening time.

Again the three key components of the HCM discussed in the above paragraph were not changed for this analysis. At the time of approval, the Washington Level Review team indicated that the analysis was "a conservative and responsible estimate of potential damages and benefits."[7] The only modifications to the road geometry, signaling, and detour assumptions of Lake Shore Drive, since the early 1979 AADT traffic counts were taken, was the reconstruction of the famous S-curve just south of where Lake Shore Drive crosses the Chicago River in 1987 and the realignment of north bound lanes of Lake Shore Drive near the Museum Campus area in 1996.

Figure 5-1 Photos of S-Curve (circa 1963) and Museum Campus (circa 1990s)

Charles Cushman, Indiana University Archives, 1963.

Matthew Kaplan

Transportation delays were computed using a simple arithmetic equation. The physical location of each study reach of the project does not directly correspond to the traffic analysis. The assignment of transportation delay calculation per study reach is as follows:

Reach 2 – Fullerton to Montrose,
Reach 3 – The segment of traffic between 23rd Street and 31st Street[8],
Reach 4 – The segment of traffic between 31st Street and 47th Street, and
Reach 5 – The segment from 47th Street to Marquette Avenue and 79th Street.

[7] Illinois Shoreline Erosion, Interim III, Storm Damage Reduction, Project Guidance Memorandum Number 2, June 1992

[8] This was calculated as the difference between Marquette to 23rd Street and Marquette to 31st Street.

Reach 2 is located entirely in the Fullerton to Irving Park segment. This is only a portion of the total transportation delays for Reach 2. Since the original data HCM was not available the current method was compared to the results published in the Feasibility Report. Truncating the transportation damages to only that portion between Fullerton and Irving Park matched the original data within 5 percent. This provides a conservative assumption of the potential damages in Reach 2.

Reach 3 thru 5 are noted as being "interrelated" in the Feasibility Report. Reach 3 is about 90 percent of the delays allocated between 23rd and 31st Street since Reach 3 ends north of 31st Street. Reach 4 is a composition of the segment of traffic between the intersection of Marquette Avenue /79th Street and 23rd Street. The remaining 10 percent of the traffic between 23rd and 31st Street is allocated to Reach 4, 100 percent of the traffic between 31st and 47th Street, and about 13 percent of the traffic between 47th and Marquette Avenue /79th Street. The remaining 87 percent of the traffic allocated to segment between 47th and Marquette Avenue /79th Street is assigned to Reach 5.

The following are the computations shown in Tables 5-4 thru 5-9. The AADT values were derived from IDOT in 2009.

Parameter 1:
Incremental Time Delay (sec) – Derived from the HCM method, See Table 5-1 and 5-2.

Parameter 2:
Number of Vehicles per hour (vph) – [AADT based on the most recent IDOT] * [56 percent or 35 percent (the percentage of Home to Work travelers moving into or out of the central business district respectively)] * 8 percent of the Average Daily Traffic **OR** the value was taken directly from the HCM method.

Parameter 3:
Number of Peak Hours per year[9]:

$$\text{Peak Hours} = 2\frac{hrs}{days} * 5\frac{days}{week} * 52.14\frac{weeks}{year} = 521.4$$

$$\text{Non-Peak Hours} = 22\frac{hours}{days} * 5\frac{days}{week} * 52.14\frac{weeks}{year} = 5735.4$$

$$\text{Weekend} = 24\frac{hrs}{days} * 2\frac{days}{week} * 52.14\frac{weeks}{year} = 2502.72$$

Parameter 4:
Value of Time per Hour – Data is derived from Table 5-3

Equation:

[9] Peak and Non-Peak hours are calculated for both the north and south bound traffic lanes.

Peak hour delay per year ($1,000) - Incremental Time Delay (sec) * Number of Vehicles per hour (vph) * Number of Peak Hours per year * Value of Time per Hour /(3600 sec per hour*1000)

The results produced in tables 5-4 through 5-9 are reported in table 5-10. The total per transportation reach (e.g. Marquette to 47th) are summed and presented in the column marked "Transportation Reach Value". Since the transportation reaches overlap the data is parsed into "Study Reach Value" columns. This was done to prevent double counting. Finally, the transportation reaches do not correspond to the study reaches. A percentage of each transportation reach is assigned to a study reach in the last four columns of Table 5-10.

Table 5-11 uses the yearly damage values calculated in Table 5-10. The original study indicated that the current revetment along Reach 3 was expected to fail in 1998. This year marked the common point of analysis for the remaining reaches. The revetment along Reach 2 would fail 10 years later. The revetment in Reach 4 and Reach 5 would fail 5 years after Reach 3. The present worth calculation in Table 5-11 computes the present worth of annual damages over fifty years for the staggered failure period.

Table 5-12 utilizes the annual damages that were assessed per reach in Table 5-11. The original report assumed failure for Reach 3 in 1998. Each reach has a specific functional failure as discussed in Section 4 and shown in figure 4-1. The overall weighted damage for the Transportation Loss category is approximately 3 times more than the original study ($114 Million versus $28 Million). Section 6 of this report reviews the sensitivity of the results to the increases in both the AADT value and the Value of Time Saved.

Table 5-1 Reach 2 Incremental Travel Time

Reach 2 Incremental Travel Time (minutes)

Lake Shore Drive	Peak Hour	Non-Peak Hour	Weekend
Irving Park to Fullerton			
Northbound	32.5	3.8	3.9
Southbound	22.7	4.2	4.3
Montrose to Fullerton			
Northbound	40.7	4.7	4.8
Southbound	28.6	5.4	5.4
Regular Detour Route Traffic	Peak Hour	Non-Peak Hour	Weekend
Irving Park to Fullerton			
Northbound	11.7	-1.9	-2.0
Southbound	13.3	-0.7	-0.7
Montrose to Fullerton			
Northbound	13.3	-2.1	-2.3
Southbound	17.2	-0.8	-0.8

Table 5-2 Reach 3/4/5 Incremental Travel Time

Reach 3/4/5 Incremental Travel Time (minutes)			
Lake Shore Drive	Peak Hour	Non-Peak Hour	Weekend
Marquette to 47st			
Northbound	21.24	3.63	3.94
Southbound	25.11	3.96	4.32
Marquette to 31st			
Northbound	41.28	6.26	6.64
Southbound	45.07	6.54	6.97
Marquette to 23rd			
Northbound	43.55	7.25	9.36
Southbound	50.20	7.60	8.00
Regular Detour Route Traffic	Peak Hour	Non-Peak Hour	Weekend
Marquette to 47st			
Northbound	16.37	-0.93	-0.64
Southbound	20.04	-0.60	-0.27
Marquette to 31st			
Northbound	32.96	-1.53	-1.18
Southbound	36.62	-1.19	-0.81
Marquette to 23rd			
Northbound	33.45	-2.07	-1.72
Southbound	40.32	-1.49	-1.09

Again, Table 5-3 contains the major components of Table D-4 from ER 1105-2-100, Appendix D. Per guidance the hour value was adjusted for the occupancy of the vehicle for work trips only, ex. 1.14. The "$/Hour" column is developed from the multiplication of the "% of Hrly. Family Income" and the Hourly Rate $29. The occupancy adjustment was established from the 2001 National Household Travel Survey published by NHTS. The fourth column "Value of Time Saved Adjusted to Hourly and Occupancy" is the multiplication of the column one "$/Hour" and the column three "Occupancy rate. The "Weight categories" were determined by the Chicago Metropolitan Agency for Planning. The values represent the daily trip purposes as a percentage. The weighting allows for a single adjusted rate per category for each time grouping. For the "0-5" minute grouping the $1.83 values is the sum of the following: (2.09*.85+0.37*.13+0.03*0.02). The other two groupings follow the same formula.

Table 5-3 Value of Time Saved by Trip Length and Purpose

Value of Time Saved (Oct. 2012 Price Level)

2010 Median Household Income…… **$59,707**
Hourly Rate (2080 Hours per annum) …….. **$29**

Table D-4 from ER 1105-2-100, Appendix D: Value of Time Saved

	Value of Time Saved Adjusted to Hourly Basis	Value of Time Saved Adjusted to Hourly Basis	Occupancy Rate	Value of Time Saved Adjusted to Hourly and Occupancy
				Value per
	$/Hour	% of Hrly. Family Income		Vehicle per Hour
Low Time Savings				
0-5 minutes				
Work trips	1.84	6.40%	**1.14**	2.09
Social/Rec Trips	0.37	1.30%	**1.00**	0.37
Other Trips	0.03	0.10%	**1.00**	0.03
Medium				
6-15 minutes				
Work trips	9.24	32.20%	1.14	10.54
Social/Rec Trips	6.63	23.10%	1.00	6.63
Other Trips	4.16	14.50%	1.00	4.16
High Time Savings				
Over 15 minutes				
Work trips	15.44	53.80%	1.14	17.61
Social/Rec Trips	17.22	60.00%	1.00	17.22
Other Trips	18.51	64.50%	1.00	18.51
Vacation				
All Time Savings	21.56	75.10%	1.00	21.56

Weight Categories	Values
Work	**0.85**
Social/Rec	**0.13**
Other	**0.02**

Adjusted Rate per Category per Time Grouping

0-5 minutes	1.83
6-15 Minutes	9.90
>15 minutes	17.57

Note: American Community Survey Estimate for 2011 shows a value of $59,482 for median household income, +/-$277

Table 5-4 Lake Shore Drive to Detour Route with Traffic Management (Reach 2)

Reach 2		Reach 2		Reach 2		Reach 2	
Irving Park to Fullerton (SB)		***Montrose to Fullerton (SB)***		***Irving Park to Fullerton (NB)***		***Montrose to Fullerton (NB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	1,361.70	Incremental Time Delay (sec)	1717.7	Incremental Time Delay (sec)	1,950.00	Incremental Time Delay (sec)	2442
Number of Vehicles per hour (vph)	6,720.00	Number of Vehicles per hour (vph)	6,720.00	Number of Vehicles per hour (vph)	4,200.00	Number of Vehicles per hour (vph)	4,200.00
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 23,291.10	Peak hour delay per year ($1,000)	29,380.28	Peak hour delay per year ($1,000)	$ 20,846.03	Peak hour delay per year ($1,000)	26,105.64
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	254.4	Incremental Time Delay (sec)	321.4	Incremental Time Delay (sec)	228	Incremental Time Delay (sec)	282
Number of Vehicles per hour (vph)	2798	Number of Vehicles per hour (vph)	2798	Number of Vehicles per hour (vph)	3027	Number of Vehicles per hour (vph)	3027
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83
Peak hour delay per year ($1,000)	$ 2,074.59	Peak hour delay per year ($1,000)	$ 14,187.26	Peak hour delay per year ($1,000)	$ 2,011.53	Peak hour delay per year ($1,000)	$ 2,487.94
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	258.5	Incremental Time Delay (sec)	326.5	Incremental Time Delay (sec)	234	Incremental Time Delay (sec)	288
Number of Vehicles per hour (vph)	3125	Number of Vehicles per hour (vph)	3125	Number of Vehicles per hour (vph)	3125	Number of Vehicles per hour (vph)	3125
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	0.37	Value of Time per Hour	$ 6.63	Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37
Peak hour delay per year ($1,000)	$ 207.79	Peak hour delay per year ($1,000)	$ 4,702.80	Peak hour delay per year ($1,000)	$ 188.10	Peak hour delay per year ($1,000)	$ 231.50
Total	$ 25,573.49	Total	$ 48,270.34	Total	$ 23,045.65	Total	$ 28,825.08

Table 5-5 Lake Shore Drive to Detour Route with Traffic Management (Reach 3/4/5)

Reach 3/4/5		Reach 3/4/5		Reach 3/4/5	
Marquette to 47st (NB)		***Marquette to 31st (NB)***		***Marquette to 23rd (NB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	1,274.60	Incremental Time Delay (sec)	2476.5	Incremental Time Delay (sec)	2613.2
Number of Vehicles per hour (vph)	4,570	Number of Vehicles per hour (vph)	4,570	Number of Vehicles per hour (vph)	4,570
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 14,824.89	Peak hour delay per year ($1,000)	$ 28,804.20	Peak hour delay per year ($1,000)	$ 30,394.16
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	217.6	Incremental Time Delay (sec)	375.8	Incremental Time Delay (sec)	435.1
Number of Vehicles per hour (vph)	1,902.76	Number of Vehicles per hour (vph)	1,902.76	Number of Vehicles per hour (vph)	1,902.76
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 9.90
Peak hour delay per year ($1,000)	$ 1,206.66	Peak hour delay per year ($1,000)	$ 11,280.24	Peak hour delay per year ($1,000)	$ 13,060.23
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	236.1	Incremental Time Delay (sec)	398.5	Incremental Time Delay (sec)	561.8
Number of Vehicles per hour (vph)	2,125.00	Number of Vehicles per hour (vph)	2,125.00	Number of Vehicles per hour (vph)	2,125.00
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 6.63	Value of Time per Hour	$ 6.63
Peak hour delay per year ($1,000)	$ 129.05	Peak hour delay per year ($1,000)	$ 3,903.11	Peak hour delay per year ($1,000)	$ 5,502.55
Total	$ 16,160.60	Total	$ 43,987.55	Total	$ 48,956.94

Table 5-6 Lake Shore Drive to Detour Route with Traffic Management (Reach 3/4/5)

Reach 3/4/5		Reach 3/4/5		Reach 3/4/5	
Marquette to 47st (SB)		***Marquette to 31st (SB)***		***Marquette to 23rd (SB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	1,506.30	Incremental Time Delay (sec)	2704.1	Incremental Time Delay (sec)	3012.1
Number of Vehicles per hour (vph)	2,856.00	Number of Vehicles per hour (vph)	2,856.00	Number of Vehicles per hour (vph)	2,856.00
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 10,949.87	Peak hour delay per year ($1,000)	$ 19,657.14	Peak hour delay per year ($1,000)	$ 21,896.11
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	237.8	Incremental Time Delay (sec)	392.5	Incremental Time Delay (sec)	454.6
Number of Vehicles per hour (vph)	2,058.55	Number of Vehicles per hour (vph)	2,058.55	Number of Vehicles per hour (vph)	2,058.55
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 9.90
Peak hour delay per year ($1,000)	$ 1,426.63	Peak hour delay per year ($1,000)	$ 12,746.09	Peak hour delay per year ($1,000)	$ 14,762.73
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	258.9	Incremental Time Delay (sec)	417.9	Incremental Time Delay (sec)	481.25
Number of Vehicles per hour (vph)	2,125.00	Number of Vehicles per hour (vph)	2,125.00	Number of Vehicles per hour (vph)	2,125.00
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 6.63	Value of Time per Hour	$ 6.63
Peak hour delay per year ($1,000)	$ 141.51	Peak hour delay per year ($1,000)	$ 4,093.12	Peak hour delay per year ($1,000)	$ 4,713.60
Total	$ 12,518.02	Total	$ 36,496.35	Total	$ 41,372.44

Table 5-7 Detour Route - Regular Volumes/Geometries versus Detour volume and Traffic Management (Reach 2)

Reach 2		Reach 2		Reach 2		Reach 2	
Irving Park to Fullerton (NB)		***Montrose to Fullerton (NB)***		***Irving Park to Fullerton (SB)***		***Montrose to Fullerton (SB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	702.10	Incremental Time Delay (sec)	799	Incremental Time Delay (sec)	797.40	Incremental Time Delay (sec)	1030.4
Number of Vehicles per hour (vph)	666.00	Number of Vehicles per hour (vph)	718	Number of Vehicles per hour (vph)	779.00	Number of Vehicles per hour (vph)	789
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 9.90	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 670.59	Peak hour delay per year ($1,000)	$ 822.73	Peak hour delay per year ($1,000)	$ 890.84	Peak hour delay per year ($1,000)	$ 2,069.29
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	-112	Incremental Time Delay (sec)	-128.1	Incremental Time Delay (sec)	-43.1	Incremental Time Delay (sec)	-48.7
Number of Vehicles per hour (vph)	227	Number of Vehicles per hour (vph)	245	Number of Vehicles per hour (vph)	281	Number of Vehicles per hour (vph)	285
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83
Peak hour delay per year ($1,000)	$ (74.09)	Peak hour delay per year ($1,000)	$ (91.47)	Peak hour delay per year ($1,000)	$ (35.30)	Peak hour delay per year ($1,000)	$ (40.45)
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	-122.3	Incremental Time Delay (sec)	-139	Incremental Time Delay (sec)	-41.8	Incremental Time Delay (sec)	-47.2
Number of Vehicles per hour (vph)	264	Number of Vehicles per hour (vph)	284	Number of Vehicles per hour (vph)	323	Number of Vehicles per hour (vph)	327
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37
Peak hour delay per year ($1,000)	$ (8.31)	Peak hour delay per year ($1,000)	$ (10.15)	Peak hour delay per year ($1,000)	$ (3.47)	Peak hour delay per year ($1,000)	$ (3.97)
	$ 588.19	Total	$ 721.11	Total	$ 852.07	Total	$ 2,024.87

Table 5-8 Detour Route - Regular Volumes/Geometries versus Detour volume and Traffic Management (Reach 3/4/5)

Reach 3/4/5		**Reach 3/4/5**		**Reach 3/4/5**	
Marquette to 47st (NB)		***Marquette to 31st (NB)***		***Marquette to 23rd (NB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	982.10	Incremental Time Delay (sec)	1977.4	Incremental Time Delay (sec)	2006.7
Number of Vehicles per hour (vph)	$ 550.00	Number of Vehicles per hour (vph)	621	Number of Vehicles per hour (vph)	658
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 1,374.86	Peak hour delay per year ($1,000)	$ 3,125.54	Peak hour delay per year ($1,000)	$ 3,360.84
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	-55.8	Incremental Time Delay (sec)	-91.5	Incremental Time Delay (sec)	-124.1
Number of Vehicles per hour (vph)	206	Number of Vehicles per hour (vph)	229	Number of Vehicles per hour (vph)	241
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83	Value of Time per Hour	1.83
Peak hour delay per year ($1,000)	$ (33.50)	Peak hour delay per year ($1,000)	$ (61.07)	Peak hour delay per year ($1,000)	$ (87.16)
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	-38.4	Incremental Time Delay (sec)	-70.8	Incremental Time Delay (sec)	-103
Number of Vehicles per hour (vph)	235	Number of Vehicles per hour (vph)	261	Number of Vehicles per hour (vph)	276
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37
Peak hour delay per year ($1,000)	$ (2.32)	Peak hour delay per year ($1,000)	$ (4.75)	Peak hour delay per year ($1,000)	$ (7.31)
Total	$ 1,339.04	Total	$ 3,059.72	Total	$ 3,266.36

Table 5-9 Detour Route - Regular Volumes/Geometries versus Detour volume and Traffic Management (Reach 3/4/5)

Reach 3/4/5		**Reach 3/4/5**		**Reach 3/4/5**	
Marquette to 47st (SB)		***Marquette to 31st (SB)***		***Marquette to 23rd (SB)***	
Peak Hour Analysis		***Peak Hour Analysis***		***Peak Hour Analysis***	
Incremental Time Delay (sec)	1,202.40	Incremental Time Delay (sec)	2196.9	Incremental Time Delay (sec)	2419.2
Number of Vehicles per hour (vph)	568.00	Number of Vehicles per hour (vph)	646	Number of Vehicles per hour (vph)	686
Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40	Number of Peak Hours per year	521.40
Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57	Value of Time per Hour	$ 17.57
Peak hour delay per year ($1,000)	$ 1,738.35	Peak hour delay per year ($1,000)	$ 3,612.29	Peak hour delay per year ($1,000)	$ 4,224.11
Non-peak Analysis		***Non-peak Analysis***		***Non-peak Analysis***	
Incremental Time Delay (sec)	-35.9	Incremental Time Delay (sec)	-71.6	Incremental Time Delay (sec)	-89.3
Number of Vehicles per hour (vph)	205	Number of Vehicles per hour (vph)	226	Number of Vehicles per hour (vph)	239
Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4	Number of Peak Hours per year	5735.4
Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83	Value of Time per Hour	$ 1.83
Peak hour delay per year ($1,000)	$ (21.45)	Peak hour delay per year ($1,000)	$ (47.16)	Peak hour delay per year ($1,000)	$ (62.20)
Weekend (average) Analysis		***Weekend (average) Analysis***		***Weekend (average) Analysis***	
Incremental Time Delay (sec)	-16.4	Incremental Time Delay (sec)	-48.7	Incremental Time Delay (sec)	-65.6
Number of Vehicles per hour (vph)	235	Number of Vehicles per hour (vph)	261	Number of Vehicles per hour (vph)	276
Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72	Number of Peak Hours per year	2502.72
Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37	Value of Time per Hour	$ 0.37
Peak hour delay per year ($1,000)	$ (0.99)	Peak hour delay per year ($1,000)	$ (3.27)	Peak hour delay per year ($1,000)	$ (4.66)
Total	$ 1,715.91	Total	$ 3,561.86	Total	$ 4,157.25

Table 5-10 Distribution of Transportation delays per Reach (October 2012, 3.75 percent FDR, $1,000)

Transportation Reaches	Transportation Reach Value	Study Reaches	Study Reach Value	Percentage of Reach 2	Percentage of Reach 3	Percentage of Reach 4	Percentage of Reach 5
Fullerton to Irving Park	$51,574.30	Fullerton to Irving Park	$51,574	100%	0%	0%	0%
Fullerton to Montrose	$83,019.52	Fullerton to Montrose	$83,019	0%	0%	0%	0%
Marquette to 47st	$32,787.61	Marquette to 47st	$32,787	0%	0%	13%	87%
Marquette to 31st	$91,019.89	31st to 47th	$58,232	0%	0%	100%	0%
Marquette to 23rd	$102,747.35	23rd to 31st	$11,727	0%	90%	10%	0%
Yearly Damage Per Reach				**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**
				$51,574	**$10,555**	**$63,667**	**$28,525**

Table 5-11 Present worth calculations per Reach (October 2012, 3.75 percent FDR, $1,000)

Year	Reach 2	Reach 3	Reach 4	Reach 5
1		$10,173		
2		$9,806		
3		$9,451		
4		$9,109		
5		$8,780		
6		$8,463	$51,049	$22,872
7		$8,157	$49,204	$22,045
8		$7,862	$47,426	$21,248
9		$7,578	$45,711	$20,480
10		$7,304	$44,059	$19,740
11	$34,400	$7,040	$42,467	$19,027
12	$33,157	$6,786	$40,932	$18,339
13	$31,959	$6,540	$39,452	$17,676
14	$30,803	$6,304	$38,026	$17,037
15	$29,690	$6,076	$36,652	$16,421
16	$28,617	$5,856	$35,327	$15,828
17	$27,583	$5,645	$34,050	$15,256
18	$26,586	$5,441	$32,819	$14,704
19	$25,625	$5,244	$31,633	$14,173
20	$24,699	$5,055	$30,490	$13,661
21	$23,806	$4,872	$29,388	$13,167
22	$22,945	$4,696	$28,326	$12,691
23	$22,116	$4,526	$27,302	$12,232
24	$21,317	$4,362	$26,315	$11,790
25	$20,546	$4,205	$25,364	$11,364
26	$19,804	$4,053	$24,447	$10,953
27	$19,088	$3,906	$23,563	$10,557
28	$18,398	$3,765	$22,712	$10,176
29	$17,733	$3,629	$21,891	$9,808
30	$17,092	$3,498	$21,100	$9,453
31	$16,474	$3,371	$20,337	$9,112
32	$15,879	$3,250	$19,602	$8,782
33	$15,305	$3,132	$18,893	$8,465
34	$14,752	$3,019	$18,210	$8,159
35	$14,218	$2,910	$17,552	$7,864
36	$13,704	$2,805	$16,918	$7,580
37	$13,209	$2,703	$16,306	$7,306
38	$12,732	$2,606	$15,717	$7,042
39	$12,271	$2,511	$15,149	$6,787
40	$11,828	$2,421	$14,601	$6,542
41	$11,400	$2,333	$14,074	$6,305
42	$10,988	$2,249	$13,565	$6,078
43	$10,591	$2,167	$13,075	$5,858
44	$10,208	$2,089	$12,602	$5,646
45	$9,839	$2,014	$12,147	$5,442
46	$9,484	$1,941	$11,708	$5,245
47	$9,141	$1,871	$11,284	$5,056
48	$8,811	$1,803	$10,876	$4,873
49	$8,492	$1,738	$10,483	$4,697
50	$8,185	$1,675	$10,104	$4,527
Present Worth	$733,475	$236,790	$1,142,909	$512,063
Annual Value	$32,694	$10,555	$50,944	$22,825

Table 5-12 Weighted Average Annual Transportation Damages (October 2012, 3.75 percent FDR, $1,000)

FDR	Reach 2			Reach 3			Reach 4			Reach 5		
Year	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages
1995				$9,583	0.04	$371	$60,562	0.01	$739	$27,608	0.01	$337
1996				$9,583	0.11	$1,006	$60,562	0.03	$1,659	$27,608	0.03	$756
1997				$9,583	0.16	$1,576	$60,562	0.05	$3,137	$27,608	0.05	$1,430
1998				$9,583	0.20	$1,960	$60,562	0.07	$3,961	$27,608	0.07	$1,806
1999				$9,171	0.17	$1,591	$57,960	0.09	$5,251	$26,422	0.09	$2,394
2000				$8,774	0.14	$1,215	$55,452	0.10	$5,323	$25,279	0.10	$2,427
2001				$8,392	0.10	$839	$53,035	0.13	$6,682	$24,177	0.13	$3,046
2002				$8,023	0.06	$444	$50,705	0.14	$6,997	$23,115	0.14	$3,190
2003	$40,056	0.01	$561	$7,668	0.02	$153	$48,459	0.14	$6,852	$22,091	0.14	$3,124
2004	$38,267	0.05	$1,821				$46,295	0.11	$5,157	$21,104	0.11	$2,351
2005	$36,542	0.07	$2,470				$44,209	0.07	$3,271	$20,153	0.07	$1,491
2006	$34,880	0.09	$3,286				$42,198	0.05	$1,958	$19,237	0.05	$893
2007	$33,278	0.11	$3,754				$40,260	0.02	$781	$18,353	0.02	$356
2008	$31,734	0.12	$3,910									
2009	$30,245	0.11	$3,363									
2010	$28,811	0.10	$2,875									
2011	$27,428	0.08	$2,282									
2012	$26,095	0.07	$1,921									
2013	$24,811	0.06	$1,538									
2014	$23,573	0.05	$1,146									
2015	$22,379	0.03	$739									
2016	$21,229	0.02	$437									
2017	$20,121	0.01	$173									
2018												
2019												
2020												
Weighted			$ 30,276			$ 9,156			$ 51,770			$ 23,600
Total	$ 114,802											

5.2 Transportation Flooding

The assumptions laid out in the Feasibility Report were used to generate the transportation delays as a result of a partial closure of South Shore Drive and Lake Shore Drive. Section 4.3 of this report detailed the assumptions of the revised methodology used in this update. Review of the computed damages in the Feasibility Report in relation to the updated value indicates a discrepancy between the original methodology and that applied herein.

Table 5-13 Summary of Transportation Flooding Damages

Impacted Reach	Annual Damages (Oct. 1992, 8.25 percent FDR)	Annual Damages (Oct. 2012 PL, 3.75 percent FDR)
Reach 2	$577,580	$485,155
Reach 5	$6,105	$35,141

The lack of specificity in the Feasibility Report on how these values were computed required the new method to be developed from deductive reasoning, as described in Section 4.3. Two factors that could contribute to the number being lower than the 1994 Report value: the additional Time Saving associated with the increased travel time on the secondary detour routes and the value used to compute the monetary value of time saved. The value of time per hour used in the 1994 report for delays greater than 15 minutes was $8.58 for work trips, $10.97 for an average trip, and $13.93 for weekend trips. It is not known if the original calculation used a weighting of the value of time per hour.

The computations provided for the Transportation Flooding are conservative. As a result of lack of information in the original report, this analysis used deductive reason with the data available to establish a conservative estimate of the potential delay savings as a result of flooding to roads. Table 5-13 provides a side-by-side comparison of the results from the original study and this current analysis.

5.3 Facilities and Infrastructure

The Feasibility Report detailed the separable elements of the project. The breakwater project for the South District Water Purification Plant, Reach 5, was identified as a separable element from the overall revetment project. Table 3 of the Feasibility Report showed a viable project with net benefits of $8.7 million dollars. The current analysis shows a net benefit of $19,927,000 with a benefit-to-cost ratio of 36.2. The prior working estimate of the replacement value for the South District Water Treatment Facility was $961,398,977.[10] Due to the lack of support documentation the estimate of the South District Water Treatment

[10] Personal Communication with Michael Sturtevant, Deputy Commissioner, Chicago Department of Water Management, the values were calculated using Engineering News Record Construction Cost Index on the 1989 values using the 1994 Chief's Report. The values correlate with insured replacement cost.

Facility value was indexed from the original 1992 price level with a discount of 8 percent to account for depreciation.

Adler Planetarium is protected by the 1998 Solidarity Drive project. The original replacement cost of the planetarium in the Feasibility Report was approximately $50 million. Development of a replacement cost of this historic structure and its contents presents a challenge since designing and build such a structure is a niche field. In 1987 the Adler Planetarium was elevated to the status of a National Landmark[11]. In order to acquire a reasonable estimate of the replacement value of this unique structure, the International Planetarium Society was consulted on this issue. The Society consulted its members to provide a reasonable range based on their expertise and knowledge of recent planning and design costs for similar structures. An estimate of $150 to $200 million for the Adler Planetarium was provided to USACE from the Society. This estimate considered three parts: 1) shell of the building, 2) the digital projection technology and theaters, and 3) the built-in exhibits and galleries.[12] As a result of a comment from the IEPR panel the replacement cost of $150 million was not used in this report. The original replacement cost for the facility was index from 1992 price levels with a discount of 8 percent to account for depreciation. Removal of the City of Chicago and Chicago Park District's facility replacement values for the current estimates did not affect the overall BCR. The change in the weighted annual damage value for the revetment project was about four million dollars. The change was more significant for the breakwater project where the weighted annual damage value was lowered by approximately fifteen million dollars. The change in the BCR was about 0.3 points.

To create the weighted annual values the probability distribution per reach used method 2 from Section 4.1. The weighted annual value per reach is the sum of the reach damage column in Table 5-14.

[11] The Adler Planetarium, which opened in 1930, was the first planetarium in the Western Hemisphere. It was given to the people of Chicago by Max Adler to enable everyone to "observe the heavenly bodies as heretofore only astronomers could do." The planetarium was an attraction at the great Chicago exposition, "A Century of Progress" (1933-1934). National Register Number: 87000819.

[12] Personal communication with Shawn Laatsch, IPS Treasure, International Planetarium Society, Hilo, HI

Table 5-14 Weighted Average Annual Facilities & Infrastructure Damages (October 2012, 3.75% FDR)

3.75%	Reach 2			Reach 3			Reach 4			Reach 5			Reach 5 Sepearable Elements		
Year	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages
1995	$25,325,646			$38,769	0.04	$1,500	$15,314,501	0.01	$186,837	$22,824,506	0.01	$278,459	$22,632,943	0.01	$276,122
1996	$25,302,866			$41,386	0.11	$4,346	$15,305,703	0.03	$419,376	$22,487,155	0.03	$616,148	$22,302,282	0.03	$611,083
1997	$25,360,475			$43,909	0.16	$7,223	$15,297,873	0.05	$792,430	$22,163,315	0.05	$1,148,060	$21,983,572	0.05	$1,138,749
1998	$26,234,071			$46,341	0.20	$9,477	$15,290,075	0.07	$999,971	$21,849,862	0.07	$1,428,981	$21,676,381	0.07	$1,417,635
1999	$25,097,695			$48,685	0.17	$8,447	$15,281,784	0.09	$1,384,530	$21,547,739	0.09	$1,952,225	$21,380,295	0.09	$1,937,055
2000	$24,025,771			$46,925	0.14	$6,499	$15,272,716	0.10	$1,466,181	$21,507,150	0.10	$2,064,686	$21,094,910	0.10	$2,025,111
2001	$22,992,591			$45,229	0.10	$4,523	$14,608,869	0.13	$1,840,717	$21,312,809	0.13	$2,685,414	$20,819,840	0.13	$2,623,300
2002	$21,996,424			$43,594	0.06	$2,411	$13,969,016	0.14	$1,927,724	$20,437,472	0.14	$2,820,371	$19,962,320	0.14	$2,754,800
2003	$21,034,807	0.01	$294,487	$42,019	0.02	$840	$13,352,290	0.14	$1,888,014	$19,593,773	0.14	$2,770,560	$19,135,796	0.14	$2,705,802
2004	$20,109,403	0.05	$957,208	$40,500			$12,757,856	0.11	$1,421,225	$18,780,330	0.11	$2,092,129	$18,339,146	0.11	$2,042,981
2005	$19,217,745	0.07	$1,299,120	$39,036			$12,184,907	0.07	$901,683	$17,996,288	0.07	$1,331,725	$17,571,290	0.07	$1,300,275
2006	$18,358,316	0.09	$1,729,353	$37,625			$11,632,667	0.05	$539,756	$17,240,585	0.05	$799,963	$16,831,189	0.05	$780,967
2007	$17,529,951	0.11	$1,977,378	$36,265			$11,100,388	0.02	$215,348	$16,512,196	0.02	$320,337	$16,117,838	0.02	$312,686
2008	$16,728,826	0.12	$2,060,991	$34,954			$10,587,347			$15,810,135			$15,430,270		
2009	$15,959,583	0.11	$1,774,706	$33,691			$10,092,850			$15,133,449			$14,767,555		
2010	$15,205,307	0.10	$1,517,490	$32,473			$9,613,270			$14,481,191			$14,128,793		
2011	$14,486,463	0.08	$1,205,274	$31,300			$9,153,981			$13,852,507			$13,513,119		
2012	$13,793,602	0.07	$1,015,209	$30,168			$8,711,293			$13,246,506			$12,919,698		
2013	$13,125,783	0.06	$813,799	$29,078			$8,284,605			$12,662,409			$12,347,726		
2014	$12,482,103	0.05	$606,630	$28,027			$7,873,340			$12,099,423			$11,796,428		
2015	$11,861,688	0.03	$391,436	$27,014			$7,476,642			$11,556,786			$11,265,056		
2016	$11,107,931	0.02	$228,823	$26,037			$7,094,469			$11,025,262			$10,752,891		
2017	$10,537,182	0.01	$90,620	$25,096			$6,725,659			$10,521,451			$10,259,237		
2018	$9,987,062			$24,189			$6,370,741			$10,035,849			$9,783,427		
2019	$9,454,488			$23,315			$6,028,652			$9,567,799			$9,324,814		
2020	$8,943,502			$22,472			$5,698,927			$9,115,852			$8,882,778		
Weighted AAD			$15,962,523			$45,266			$13,983,791			$20,309,058			$19,926,566
Total Value		$50,300,638													

5.4 Incidental Recreation

USACE's approach of the Unit Day Value (UDV) methodology is documented in the National Economic Development Procedures Manual – Recreation (IWR Report 86-R-5). Generally speaking, UDV is determined through an estimate of the annual use of the recreation facility and the corresponding value of day of recreational use for the recreation facility. However, the method used in the Feasibility Report estimated individual UDV for specific activities within the study area. Unit Day method is an attempt to measure the willingness to pay of recreationists for a day of recreation activity. Most UDV analyzes examine the willingness of a specific recreation location or activity, e.g. a USACE park or lake. All the activities provided at the recreation facility; whether they are swimming, boating, or sports; are not analyzed individually but collectively. The reason for the collective analysis of willingness-to-pay for a day of recreation activity is the result of handling the potential for double counting or under counting.

Again, the conventional approach would ask, "What is an individual's willingness-to-pay for a day of recreation activity at this location?" The general default assumption of the UDV method is that when an individual decides to go to the Illinois Shoreline area it is a result of the total recreational opportunity rather than a single purpose trip. Additionally, it is typically very hard to parse out of the daily user counts how many individuals only used certain recreational features, e.g. ball fields, portion of hiking trails, etc. The assumption in the Illinois Shoreline recreation analysis is that the development of user counts by reach for these daily activities effectively deals with double counting. Individuals recreating at the shoreline cannot possibly utilize the 9 plus miles of recreational activities. The assumption that multiple recreational actives will occur in each reach of the project was not applied.

Prior to approval of the recreation analysis, a Washington Level Review Committee (WLRC) held a working session with District personnel in the spring of 1993. The spreadsheet model used at the time required WLRC to exercise the model prior to approval of its use. The reviewers at the time determined that "the model produces accurate number-crunching results."[13] The spreadsheet model that has survived from the early 1990's was exercised in an attempt to reproduced the results and identify any software issues.

The formulas of the original spreadsheet model were recast in a format more suitable for review. The complexity of the method used in the original study still requires additional documentation beyond what is available in the Feasibility Report. Results of recasting the data and formulas into a new version revealed that the difference between the incidental recreation reported in the Feasibility Report and new spreadsheet model increased from the original value reported by 2 percent. Analysis of the separable recreation, see Section 5.5 for more information, shows that the new spreadsheet model reported a value that decreased from the original report by 63 percent. Per ER 1105-2-100(b)(7), budget policy generally precludes using Civil Works resources to implement recreation orientated projects. An exception is allowed where the project is formulated for other primary purposes and the average annual recreation benefits are less than 50 percent of the annual benefits required for justification. The primary purpose of this project is coastal protection of US Route 41, Lake Shore Drive, and facilities and infrastructure located

[13] Memorandum for CECW-P from WRSC-WLR-M dated 16 April 1993

near the shore of Lake Michigan. The annual benefits of project attributed to the primary purpose are $189,454,000 (Transportation Road Loss Prevention, Facilities and Infrastructure Protection, Transportation Flood Protection, and Maintenance Costs Avoided). The project cost for the Recommended Plan in this case is $602,570,000. The annual cost is $30,367,000. The entire project cost is justified by the primary purpose of the project. The benefits derived from any recreation would be considered incidental to the justification of this project. Since the separable recreation is above and beyond the NED plan further investigation as to the discrepancy was terminated. The potential lower separable recreation benefits are assumed to be a very conservative estimate.

The concern was raised by the IEPR panel that the UDV method was not used in a policy complainant manner. The original feasibility study faced a similar issue during its vertical review. Project Guidance Memorandum (PGM) Number 2 Dated 4 June 1992 provides the Washington Level Review response on this issue: "Paragraph 6-90d of ER 1105-2-100, Guidance for Conducting Civil Works Planning Studies, indicates that UDV is not the proper evaluation procedure where annual visitation is greater than 750,000. Use of the UDV method is acceptable in this case because it only supports the locally preferred plan." (Section 8, Subsection d, paragraph [1])

5.5 Separable Recreation

The Chicago Park District and the City of Chicago determined that a stone step design was a preferred solution to the NED plan proposed by USACE. Recreational benefits are considered an incidental output to the overall project output[14]. The LPP creates additional recreational benefits above and beyond the incidental recreation output by the NED plan, as such, they are considered separable. The separable recreation is simple the difference between the LPP and NED recreational output as shown in Table 5-15.

Table 5-15 Calculation of Separable Recreation

	Reach 2	Reach 3	Reach 4	Reach 5	Total
Rubble Mound (Incidental)	$14,459,510	$1,091,873	$16,072,616	$5,257,051	$36,881,050
Stone Step (Separable)	$16,529,672	$1,092,173	$18,982,134	$5,797,961	$42,401,940
Difference or Separable	$2,070,162	$300	$2,909,518	$540,911	$5,520,890

Table 5-16 and Table 5-17 show the annual values per year and the probability distribution used by method 2 in Section 4.1. The results per reach were added to Table 5-15 to illustrate the separable recreation.

[14] ER1105-2-100,3-4(b)4 Formulation and Establishing Corps Participation.

Table 5-16 Weighted Average Annual Recreation (Stone Step Design) Damages (October 2012, 3.75 percent FDR)

Stone Step @ 3.7	Reach 2			Reach 3			Reach 4			Reach 5		
Year	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages
1995	$ 33,140,469			$ 1,254,809	0.0387	$ 48,561	$ 25,900,601	0.0122	$ 315,987	$ 7,743,421	0.0122	$ 94,470
1996	$ 32,134,416			$ 1,213,725	0.105	$ 127,441	$ 24,830,851	0.0274	$ 680,365	$ 7,475,561	0.0274	$ 204,830
1997	$ 31,114,171			$ 1,169,397	0.1645	$ 192,366	$ 23,718,237	0.0518	$ 1,228,605	$ 7,208,080	0.0518	$ 373,379
1998	$ 29,715,118			$ 1,121,941	0.2045	$ 229,437	$ 22,591,633	0.0654	$ 1,477,493	$ 6,940,964	0.0654	$ 453,939
1999	$ 28,255,410			$ 1,071,470	0.1735	$ 185,900	$ 21,467,176	0.0906	$ 1,944,926	$ 6,591,265	0.0906	$ 597,169
2000	$ 26,852,192			$ 1,022,823	0.1385	$ 141,661	$ 20,387,318	0.096	$ 1,957,183	$ 6,254,226	0.096	$ 600,406
2001	$ 25,503,422			$ 975,934	0.1	$ 97,593	$ 19,350,447	0.126	$ 2,438,156	$ 5,929,391	0.126	$ 747,103
2002	$ 24,207,293			$ 930,740	0.0553	$ 51,470	$ 18,355,008	0.138	$ 2,532,991	$ 5,616,317	0.138	$ 775,052
2003	$ 22,961,742	0.014	$ 321,464	$ 887,180	0.02	$ 17,744	$ 17,399,505	0.1414	$ 2,460,290	$ 5,314,580	0.1414	$ 751,482
2004	$ 21,764,940	0.0476	$ 1,036,011	$ 845,194			$ 16,482,493	0.1114	$ 1,836,150	$ 5,023,770	0.1114	$ 559,648
2005	$ 20,615,286	0.0676	$ 1,393,593	$ 804,726			$ 15,602,582	0.074	$ 1,154,591	$ 4,743,492	0.074	$ 351,018
2006	$ 19,510,915	0.0942	$ 1,837,928	$ 765,720			$ 14,758,431	0.0464	$ 684,791	$ 4,474,893	0.0464	$ 207,635
2007	$ 18,450,191	0.1128	$ 2,081,182	$ 728,125			$ 13,948,746	0.0194	$ 270,606	$ 4,218,101	0.0194	$ 81,831
2008	$ 17,431,536	0.1232	$ 2,147,565	$ 691,888			$ 13,172,283			$ 3,972,243		
2009	$ 16,453,430	0.1112	$ 1,829,621	$ 656,961			$ 12,427,840			$ 3,736,925		
2010	$ 15,542,778	0.0998	$ 1,551,169	$ 623,296			$ 11,714,921			$ 3,511,765		
2011	$ 14,668,833	0.0832	$ 1,220,447	$ 590,848			$ 11,031,744			$ 3,296,441		
2012	$ 13,830,267	0.0736	$ 1,017,908	$ 559,573			$ 10,377,234			$ 3,090,598		
2013	$ 13,025,802	0.062	$ 807,600	$ 529,429			$ 9,750,355			$ 2,894,193		
2014	$ 12,254,206	0.0486	$ 595,554	$ 500,374			$ 9,150,108			$ 2,706,586		
2015	$ 11,514,289	0.033	$ 379,972	$ 472,369			$ 8,575,690			$ 2,527,457		
2016	$ 10,804,909	0.0206	$ 222,581	$ 445,376			$ 8,026,008			$ 2,356,501		
2017	$ 10,125,119	0.0086	$ 87,076	$ 419,359			$ 7,500,168			$ 2,194,996		
2018	$ 9,473,698			$ 394,282			$ 6,998,210			$ 2,042,380		
2019	$ 8,849,620			$ 370,112			$ 6,518,369			$ 1,896,961		
2020	$ 8,251,897			$ 346,816			$ 6,059,845			$ 1,758,478		
Weighted			$16,529,672			$1,092,173			$18,982,134			$5,797,961
Total	$42,401,940											

Table 5-17 Weighted Average Annual Recreation (Rubble Mound Design) Damages (October 2012, 3.75 percent FDR)

Rubble @ 3.75%	Reach 2			Reach 3			Reach 4			Reach 5		
Year	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages	Annual Damage	Probability	Damages
1995	$ 29,068,541			$ 1,254,455	0.0387	$ 48,547	$ 22,000,173	0.0122	$ 268,402	$ 7,055,753	0.0122	$ 86,080
1996	$ 28,168,947			$ 1,213,388	0.105	$ 127,406	$ 21,078,886	0.0274	$ 577,561	$ 6,803,142	0.0274	$ 186,406
1997	$ 27,257,111			$ 1,169,075	0.1645	$ 192,313	$ 20,124,056	0.0518	$ 1,042,426	$ 6,551,016	0.0518	$ 339,343
1998	$ 26,038,404			$ 1,121,633	0.2045	$ 229,374	$ 19,158,998	0.0654	$ 1,252,998	$ 6,299,357	0.0654	$ 411,978
1999	$ 24,755,976			$ 1,071,177	0.1735	$ 185,849	$ 18,196,725	0.0906	$ 1,648,623	$ 5,980,117	0.0906	$ 541,799
2000	$ 23,523,311			$ 1,022,544	0.1385	$ 141,622	$ 17,272,915	0.096	$ 1,658,200	$ 5,672,436	0.096	$ 544,554
2001	$ 22,338,609			$ 975,668	0.1	$ 97,567	$ 16,386,179	0.126	$ 2,064,659	$ 5,375,896	0.126	$ 677,363
2002	$ 21,200,294			$ 930,488	0.0553	$ 51,456	$ 15,535,175	0.138	$ 2,143,854	$ 5,090,095	0.138	$ 702,433
2003	$ 20,106,533	0.014	$ 281,491	$ 886,940	0.02	$ 17,739	$ 14,718,613	0.1414	$ 2,081,212	$ 4,814,645	0.1414	$ 680,791
2004	$ 19,055,715	0.0476	$ 907,052	$ 844,966			$ 13,935,247	0.1114	$ 1,552,387	$ 4,549,171	0.1114	$ 506,778
2005	$ 18,046,448	0.0676	$ 1,219,940	$ 804,509			$ 13,183,878	0.074	$ 975,607	$ 4,293,312	0.074	$ 317,705
2006	$ 17,077,070	0.0942	$ 1,608,660	$ 765,515			$ 12,463,349	0.0464	$ 578,299	$ 4,048,145	0.0464	$ 187,834
2007	$ 16,146,139	0.1128	$ 1,821,285	$ 727,930			$ 11,772,546	0.0194	$ 228,387	$ 3,813,822	0.0194	$ 73,988
2008	$ 15,252,266	0.1232	$ 1,879,079	$ 691,703			$ 11,110,394			$ 3,589,514		
2009	$ 14,394,112	0.1112	$ 1,600,625	$ 656,786			$ 10,475,857			$ 3,374,860		
2010	$ 13,593,580	0.0998	$ 1,356,639	$ 623,131			$ 9,868,585			$ 3,169,510		
2011	$ 12,825,456	0.0832	$ 1,067,078	$ 590,693			$ 9,286,959			$ 2,973,173		
2012	$ 12,088,569	0.0736	$ 889,719	$ 559,426			$ 8,730,053			$ 2,785,524		
2013	$ 11,381,789	0.062	$ 705,671	$ 529,290			$ 8,196,973			$ 2,606,543		
2014	$ 10,704,027	0.0486	$ 520,216	$ 500,244			$ 7,686,857			$ 2,435,621		
2015	$ 10,054,237	0.033	$ 331,790	$ 472,247			$ 7,199,037			$ 2,272,469		
2016	$ 9,431,405	0.0206	$ 194,287	$ 445,262			$ 6,732,545			$ 2,116,804		
2017	$ 8,834,718	0.0086	$ 75,979	$ 419,252			$ 6,286,611			$ 1,969,902		
2018	$ 8,263,076			$ 394,183			$ 5,861,394			$ 1,831,226		
2019	$ 7,715,574			$ 370,019			$ 5,455,243			$ 1,699,137		
2020	$ 7,191,338			$ 346,730			$ 5,067,469			$ 1,573,396		
Weighted			$14,459,510			$1,091,873			$16,072,616			$5,257,051
Total	$36,881,050											

5.6 Results of Update of Damages Prevented

The scope of this limited economic update was to analyze the increase in project benefits as a result of changes in depreciated replacement value of facilities and infrastructure, increases in annual average daily traffic and value of time saved, and an increase in the unit day value of recreation.

In FY 1994 the Recommended Plan had $68,855,000 in benefits at a Federal discount rate of 8 percent. Update this value to accounting for the new Federal discount rate of 3.75 percent and price levels change, the FY 1994 Recommended Plan would be approximately $58,573,00[15] at discount rate of 3.75 percent at the October 2012 price levels. Through the process of updating the assumptions and calculations the new annualized project benefits are $188,108,272 at October 2012 price levels and a federal discount rate of 3.75 percent. Project benefits increased by almost a factor of three since 1994. The primary contributor to this increase is the Transportation Road Loss Prevention category. Of the $188,108,272 the Transportation Road Loss Prevention category represents about 39 percent of the total benefits or $114,801,000. Comparing the updated 1994 value (accounting for price level and discount rate) for Transportation Road Loss Prevention to the updated value there is almost six-fold increases in this category's benefit. Section 6, Sensitivity Analysis, provides sufficient evidence that the fourfold increase is based on the increases in annual average daily traffic counts and an increase in the value of time saved.

Recreation benefits doubled as a result of the application of the new Economic Guidance Memorandum (EGM) 13-03. The 1994 study used EGM 93-1 to allocate monetary values to the point system developed per policy. The increase monetary value per point is about 1.6 times the values used in EGM 93-1.

The overall economic efficiency of the project is on par with the Feasibility Report. The benefit-to-cost ratio derived for this study indicates that for every dollar spent on the project the completed project yields eight dollars in benefits. In contrast, the Feasibility Report showed this relationship to be 9 dollars of benefits to each dollar of project construction. The increase in value of the project is likely due to better knowledge of the construction costs and better estimates on facility and infrastructure replacement costs.

Table 5-18 was developed form the July 1993 Feasibility Report (1992 Price Level at 8.25 percent discount rate), while the $68,855,000 is from the September 1994 Supplement Report (October 1993 Price Level at 8 percent discount rate). The July 1993 report provides more detailed economic data and allows for more direct comparison of results. Table 5-19 is a compilation of the new data presented in the July 1993 report format for comparative purposes.

[15] Index was 1.56 based on BEA's GDP in chained 2005 dollars

Table 5-18 Feasibility Report[16] Weighted Average of Benefits of the Locally Preferred Plan

Storm Damage Reduction	Reach 2	Reach 3	Reach 4	Reach 5	Total
Transportation Road Loss Prevention	$7,197,502	$2,687,082	$10,761,376	$5,978,542	$26,624,502
Transportation Flooding Protection	$577,580	$ -	$ -	$7,037	$584,617
Facilities and Infrastructure Protection	$1,313,042	$50,594	$1,984,911	$9,346,861	$12,695,408
Incidental Recreation	$4,749,641	$1,286,931	$6,189,190	$1,757,846	$13,983,608
Separable Recreation	$2,879,879	$106,967	$3,299,331	$586,401	$6,872,578
Total	$16,717,644	$4,131,574	$22,234,808	$17,676,687	$60,760,713
Emergency Maintenance Cost Avoided					$509,967
Annual Storm Damage Reduction					$61,270,680
Oct 1992 Price Levels and FDR of 8.25 percent					

Table 5-19 Limited Reevaluation Report Weighted Average of Benefits of the Locally Preferred Plan

Storm Damage Reduction	Reach 2	Reach 3	Reach 4	Reach 5	Total
Transportation Road Loss Prevention	$30,275,587	$9,155,700	$51,770,322	$23,600,353	$114,801,963
Transportation Flooding Protection	$495,155			$35,141	$530,296
Facilities and Infrastructure Protection	$15,962,523	$45,266	$13,983,791	$382,492	$30,374,072
Incidental Recreation	$14,459,510	$1,091,873	$16,072,616	$5,257,051	$36,881,050
Separable Recreation	$2,070,162	$300	$2,909,518	$540,911	$5,520,891
Total	$63,262,937	$10,293,139	$84,736,248	$29,815,948	$188,108,272
Emergency Maintenance Cost Avoided					$1,050,000
Annual Storm Damage Reduction					$189,158,272
Oct 2012 Price Levels and FDR of 3.75 percent					

Overall, the study cost and benefits of the Feasibility Report have increased substantially since the start of this project. The Feasibility Report estimated the first cost to be $192,251,000 (October 1993 Price Levels) and the FY1997 authorized cost was $204,000,000 (October 1995 Price Levels). Inflating the current sunk cost to October 2012 price levels would raise the cost estimate to $281,558,000[17]. Inflating the $204,000,000 authorized cost to October 2012 price levels would be $324,067,613, while inflating the estimated first cost of the Feasibility Report would be $323,700,652. The current non-inflated cost estimate to complete this project is $602,570,000 at 2012 price levels. What these numbers show is that inflationary factors are not

[16] Data take from the July 1993 Feasibility Report

[17] Based on CWCCIS CWBS Code 10 FY96 thru FY13 Yearly indices and year sunk cost taken from the 902 Worksheet Tool.

the reason for increase in project costs. The increase in project cost from the $324,067,613 to the $602,570,000 is approximately 46 percent. A discussion in the increase in cost is located in the main report.

Table 5-20 provides a comparison of the Feasibility Report estimate of project benefits ($68,855,000) when inflated to today's prices and adjust for the discount rate ($58,573,000)[18]. The original project benefits are approximately 85 percent of the current estimate of project benefits. The increase project benefits between the original study and today is a result of increased utilization of Lake Shore Drive, updated value of facilities and infrastructure, and the value of recreation benefits. The increase in cost between the original estimate and today is likely a result of more site specific engineering cost estimating for projects going to construction and the incorporation of risked based on cost contingency analysis for those in design.

Table 5-20 Ratio of Feasibility Report benefits to PACR

	Feasibility Report (October 1993, FDR 8.00 percent[19]	**Feasibility Report (October 2012, FDR 3.75 percent**	**Limited Reevaluation Report (October 2012, FDR 3.75 percent**	**Ratio of Limited Reevaluation Report to Feasibility Report**
Total Benefits	$68,855,000	$58,573,000	$188,108,272	3.21:1
Transportation Road Loss Prevention	$28,081,000	$23,888,000	$114,801,963	4.82:1
Recreation	$21,998,000	$18,713,000	$42,401,940	2.27:1

[18] Index was 1.56 based on BEA's GDP in chained 2005 dollars

[19] The March1994 Supplemental to Final Feasibility Report did not update the individual Reach values to Oct 1993 Price Levels and 8% Federal Discount Rate

6. SENSITIVITY ANALYSIS

The change in project benefits, from the Feasibility Report to this economic reevaluation, has increased four-fold since the reported value of $68,855,000. Two benefit categories, Transportation Road Loss and Recreation, account for approximately 70 percent of the project benefits in this reevaluation analysis. The Facilities and Infrastructure benefit category accounts for approximately 29 percent of the project benefits in this reevaluation. Transportation Road Loss Prevention increased from $27 million to $114.8 million, a change of 325 percent. Incidental recreation increased from $13.9 million to $35.9 million, a change of 158 percent. The benefits resulting from the update procedures for the two aforementioned categories are unlike the replacement value of facilities and infrastructure. The benefits derived from the facilities and infrastructure category is directly related to the update value. Benefits for the Transportation Road Loss Prevention and Recreation are a function of the update of parameters to functions. As such, the benefits resulting from a one-to-one increase in a single or a combination of parameters may not result in a one-to-one increase in the benefits. This section will help show that the change in value is consistent with changes in the Federal discount rate and increase in value of time for transportation and increase in UDV.

6.1 Transportation Road Loss NED Category

The weighted equivalent annual damage for the transportation road loss for all reaches in the Feasibility Report is approximately $27 million (1992 Price Levels, FDR 8.25 percent). This value represents an equivalent yearly cost of delays associated with the Transportation Road Loss calculations using the data available in the Feasibility Report. Again, the weighting factor is used to account for the uncertainty of the onsite of the erosion. Updating the calculations for the new AADT, Value of Time Delay, and the federal discount rate, the economic reevaluation calculations for this category would raise that value to $117 million. The new weighted equivalent annual damage of $120 million is an increase of 356 percent.

The percent change in AADT from the Feasibility Report to today is approximately 50 percent for North Lake Shore Drive and 90 percent for South Lake Shore Drive. The percent change in the Time Value of Delay is approximately 140 percent more in the value of the time delay. Figure 6-1 shows how the transportation road loss formula (Section 5.1 ***Peak hour delay per year***) responds to the incremental increase in the two key parameters (AADT and Value of Time Delay) and the federal discount rate.

An analysis of the results shows that the Value of Time Delay accounts for about 61 percent of the total change in damages while AADT is only 39 percent. This is also depicted in Figure 6-1; the graph shows that Value of Time Delay affects the results well after the AADT results remain constant.

6.2 Incidental and Separable Recreation Opportunity Loss

The incidental recreation opportunity loss calculations increase from $13.9 million in the Feasibility Report to $35.9 million in this economic reevaluation. The marked change is the relationship between the Unit Day Value point value and the dollar value increase about 60

percent from 1998 to 2012. Lowering the discount rate from 8.25 percent to 3.75 percent resulted in a 28 percent increase in the annual benefits. As you can see from Figure 6-2, the combination of the Federal discount rate and the increase in UDV dollar value will account for the increase from $14 million to $35 million for the incidental recreation.

Figure 6-1 Direct Annual Damage of Transportation Loss

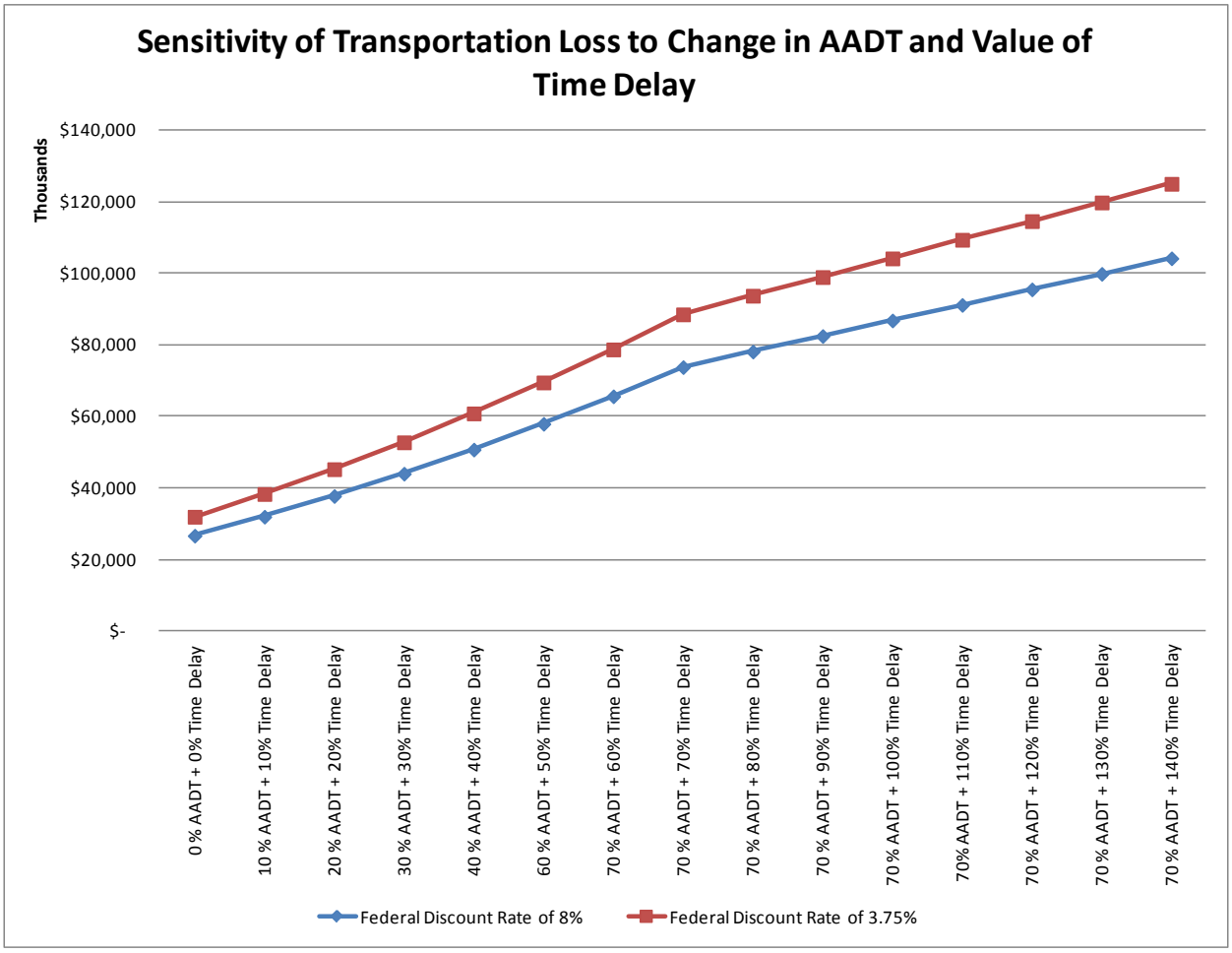
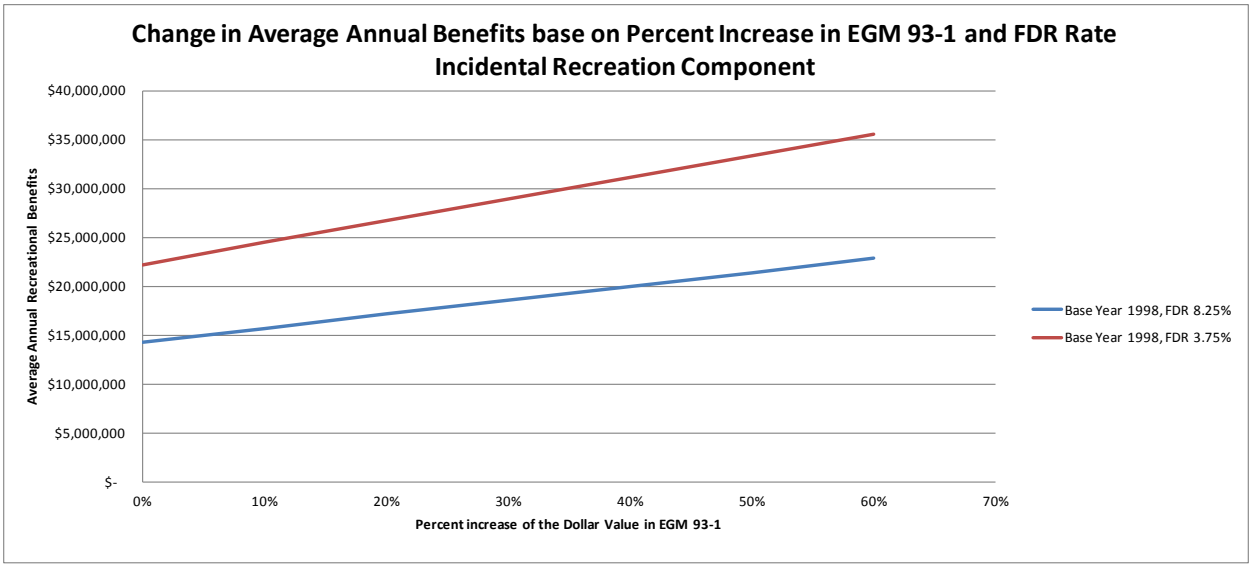


Figure 6-2 Sensitivity of Average Annual Benefits for Incidental Recreation



6.3 Summary

The results in this section show that the increase in the two major NED categories (Transportation Road Loss Prevention and Recreation) is based on reasonable changes to the input parameters and discount rates between the original Feasibility Report and the current economic reevaluation. The recreational Unit Day Values and Federal discount rate are provided as an Economic Guidance Memorandums and are used systematically throughout the USACE organization. The opportunity cost of time is a prescribed method with the USACE ER1105-2-100. The takeaway from this is that the majority of the input is regulated by policy and procedures. What has been shown in this sensitivity analysis is how the outputs change progressively from the Feasibility Report to the current economic reevaluation and that these changes are reasonable.

7. ACCRUED BENEFITS DURING CONSTRUCTION, NED, AND LPP ANALYSIS

Per USACE policy, (all project purposes with the except ecosystem restoration) the selected alternative plan must be the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation's environment. The LPP is a deviation from the NED or National Ecosystem Restoration (NER) plan as requested by the non-Federal sponsor. The LPP must have greater net benefits than smaller scale plans. If the sponsor prefers a plan that is more costly than the NED plan or the increased scope of the plan is not sufficient to warrant full Federal participation, Assistant Secretary of the Army for Civil Works may grant an exception as long as the sponsor pays the difference in cost between the NED plan and the LPP.

During the development of the Feasibility Study, the non-Federal sponsor expressed a preference for a LPP. The NED and the LPP designs deliver the same degree of high priority storm damage reduction benefits. The NED design was to construct a rubble mound revetment and the LPP design is a stone-step revetment. Each design included a separable design element, the reconstruction of an offshore breakwater to protect the South Water Filtration Plant.

7.1 National Economic Development Plan

A rubble mound revetment was chosen as the alternative that reasonably maximizes the net economic benefits consistent with protecting the Nation's environment. The cost estimate for this plan was developed and detailed in the Cost Appendix of this report.

The reported Feasibility Report NED cost for this design was $154,193,000 at 1992 price levels. The current cost of this design is $262,419,000 in October 2012 dollars.

7.2 Recommended Plan (Locally Preferred Plan)

The LPP plan was a compromise of the NED plan, the Chicago Shoreline Protection Commission Plan, and the Chicago Park District Plan. The final project left the shore at the water's edge essentially as it was before the severe deterioration of the existing structure become common. In place of the existing structure steel sheet-pile and step stone revetment was constructed.

The total cost for this design was $192,251,000 at 1993 price levels. At 2012 price levels this design would be $319,414,000. The current cost of this design is $602,570,000 in October 2012 dollars.

7.3 Separable Elements Analysis

The NED plan and the Recommended Plan both included the reconstruction of a failed offshore breakwater protecting the South Water Filtration Plant. The breakwater element and the

revetment element are considered separable elements. A separable element is any part of a project which has separately assigned benefits and costs, and which can be implemented as a separate action (at a later date as a separate project). Separable elements so considered are similar to the planning concept of last added increments, with the added idea of separation or detachment of the increment from the whole. The Corps has used a separable element concept for many decades; the term itself was coined in the WRDA of 1986 to assist in the transition to new cost sharing formulas. The WRDA definition was more complex, yet more ambiguous than that above. Separable elements usually must be incrementally justified.

Table 7-1 and Table 7-2 are the economic summary of the recommended plan by separable element. The values presented in Table 7-2 are from the September 1994 Supplement Report. The Breakwater element has dramatically increased in benefits as a result of capital improvements to the water filtration plant. The cost of construction has almost doubled in cost over the last twenty years. The benefits of the shoreline project have keep pace with the increased costs and in certain cases exceeded the cost growth. This is evident in the increased AADT and capital investment in shoreline structures and facilities.

Table 7-1 Economic Summary, Recommended Plan

ECONOMIC SUMMARY, RECOMMENED PLAN, BY SEPARABLE ELEMENT ($1,000, 50 years, October 2012 prices, 3.75 percent)		
Benefits	Revetment	Breakwater
Transportation Road Loss Prevention	$114,802	
Facilities and Infrastructure Protection	$30,374	$19,927
Transportation Flooding Protection	$530	
Incidental Recreation	$36,881	
Separable Recreation	$5,521	
Maintenance Costs Avoided	$1,050	
Accumulated Benefits During Construction	$20,215	
Total Benefits	$209,373	$19,927
Cost		
Total First Cost (update with 2012 price levels)	$602,570	$14,158
Interest During Construction	$151,671	$242
Sunk PED (PGN, Appendix D…)	($87,342)	($2,053)
Total NED Investment Cost	$666,899	$12,347
Amortization	$29,727	$550
OMRR&R	$500	$7
Total Annual Costs	$30,226	$557
Benefit to Cost Ratio	7.04	36.21
NET NED BENEFITS	$179,147	$19,369

Table 7-2 Economic Summary, Recommended Plan from the 1994 Supplement to Final Feasibility Study

ECONOMIC SUMMARY, RECOMMENED PLAN, BY SEPARABLE ELEMENT ($1,000, 50 years, October 1993 prices, 8 percent)		
Benefits	Revetment	Breakwater
Transportation Road Loss Prevention	$28,081	
Facilities and Infrastructure Protection	$4,146	$9,466
Transportation and Flood Damage Reduction	$4,617	
Incidental Recreation	$14,749	
Separable Recreation	$7,249	
Maintenance Costs Avoided	$547	
Total Benefits	$59,389	$9,466
Cost		
Total First Cost	$184,082	$8,169
Interest During Construction	$31,299	$836
Amortization	$11,882	$736
OMRR&R	$420	$7
Total Annual Costs	$12.302	$743
Benefit to Cost Ratio	4.5	12.7
NET NED BENEFITS	$47,087	$8,723

7.4 Accumulated Benefits During Construction, Interest During Construction, and Betterments

Per ER 1105-2-100 Appendix D-4c, benefits that accumulated during construction should be documented and included in the benefit analysis. The Chicago Shoreline project was started in 1997 and has a projected completion year of 2018. Over this 21 year period various projects have been constructed and are providing shoreline project. Construction schedules for each project were not designed to complete whole reaches but individual projects. As such, an entire reach may take decades to complete. Computation of the accumulated benefits in this report will assumes that an entire reach must be complete in order to qualify as shore protection. This assumption will ensure that a contiguous reach is not undermined as a result of pre-project site conditions.

Table 7-3 provides information on how each project reach's accumulated benefits were calculated. Table 7-4 provides information on the general start and end date of construction. Various projects in Reach 2 have completed for 18 to 19 years. Overall the entire reach will only have been completed for 2 years by the completion date of the entire project in 2018. Reach 3 was a single project. This project was completed in 1999 and has been accumulating benefits for 19 years.

Reach 5's breakwater construction is a separable element. The treatment of the water filtration plant's accumulated benefits was considered independent of the revetment project. The project was completed in approximately one year. The project would not accumulate any benefits during as the period of analysis would commence upon the completion of the breakwater.

Interest during construction represents the opportunity cost of capital incurred during the construction period. The cost of a project to be amortized is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial cost plus interest during construction. Cost incurred during the construction period should be increased by adding compound interest at the applicable project discount rate from the date the expenditures are incurred to the beginning of the period of analysis. Interest during construction was be computed in accordance with accounting practices (ER 37-2-10) which provide for interest from the middle of the month in which expenditures are made to the in-service date of the function or separable unit thereof. The in-service date is the first of the month following availability for service.

Table 7-4 provides a summary of the per project interest during construction. Termination of IDC was assumed to occur at the completion of the reach in which the project was assigned. Reach 2 is projected to be complete in 2016. Reach 3 was completed in 1999. Reach 4 is projected to be completed in 2018. The present worth of IDC for Reach 2 and Reach 3 were compounded to 2018 or the start of the period of analysis. Reach 5, as a separable element, appears to originally estimate the period of IDC for a period of construction of about two and half years. The actual construction was substantially less and was completed in a year. Applying the current FDR of 3.75 percent over the period of construction the IDC for Reach 5 is $242,000.

ER 1105-2-100, Appendix D-3e(11)a. allows for PED costs to be considered sunk when performing economic updates and not included in the benefit-cost ratio. Table 7-5 calculated the engineering and design during the pre-contract award or preconstruction period.

Table 7-3 Accumulated Benefits during Construction

Reach	Annual Benefits	Year Reach was Completed	Years of accumulated Benefits	Present Worth of Accumulated Benefits (2018)	Annualized Benefits
2	$65,783,938	2016	2	$139,061,078	$6,198,539
3	$11,223,120	1999	19	$314,442,491	$14,016,028
4	$87,390,402	2018	0	$-	$0

Project Betterments

The total betterment for the Chicago Shoreline project is $10,360,451. This represents the sunk cost for three projects over a period of time. Table 7-4 depicts the distribution of betterments and the price level change. The 2012 Price level for the betterments is $13,011,000.

Table 7-4 Interest During Construction (FDR 3.75%, October 2012 PL, $1,000)

Projects	Reach	Date Started	Date Completed	Date Reach Completed	Months (Segment start to Reach Complete)	Construction Cost ($1,000)	Betterment Cost ($1,000)	Index (CWCCIS)	Construction Cost ($1,000) 2012PL	Betterment Cost ($1,000) 2012 PL	IDC 2012PL	Present Worth (2018)
Water Filtration Plant	5	1/1/1997	1/1/1998	1/1/1998	12	$9,586	$0	1.48	$14,158	$0	$242	NA
Belmont Harbor	2	1/1/1998	1/1/1999	1/1/2016	219	$5,507	$562	1.45	$8,013	$818	$3,394	$3,653
31st Street Beach	4	1/1/1998	1/1/1999	1/1/2018	244	$6,999	$562	1.45	$10,184	$818	$4,948	$4,948
31st - 33rd Street	4	1/1/1998	1/1/1999	1/1/2018	244	$7,830	$562	1.45	$11,393	$818	$5,535	$5,535
Solidarity Drive	3	1/1/1998	1/1/1999	1/1/1999	12	$12,059	$562	1.45	$17,546	$818	$300	$603
I-55 to 30th Street	4	1/1/1999	1/1/2000	1/1/2018	231	$17,535	$562	1.43	$25,023	$803	$11,336	$11,336
Irving to Belmont	2	1/1/1999	1/1/2002	1/1/2016	207	$19,700	$305	1.39	$27,402	$424	$10,818	$11,644
33rd to 37th Street	4	1/1/1999	1/1/2002	1/1/2018	231	$15,930	$305	1.39	$22,158	$424	$10,038	$10,038
56th to 57th Street	4	1/1/2001	1/1/2002	1/1/2018	207	$9,161	$305	1.39	$12,743	$424	$5,031	$5,031
41st to 43rd Street	4	1/1/2001	1/1/2003	1/1/2018	207	$8,357	$305	1.34	$11,196	$408	$4,420	$4,420
51st to 54th Street	4	1/1/2002	1/1/2003	1/1/2018	195	$10,628	$305	1.34	$14,239	$408	$5,222	$5,222
Belmont to Diversey North	2	1/1/2002	1/1/2004	1/1/2016	170	$15,096	$305	1.31	$19,796	$399	$6,150	$6,620
37th to 40th Street	4	1/1/2002	1/1/2004	1/1/2018	195	$27,885	$305	1.31	$36,568	$399	$13,412	$13,412
Montrose North	2	1/1/2000	1/1/2005	1/1/2016	195	$36,382	$0	1.24	$45,276	$0	$16,605	$17,874
Diversey to Fullerton	2	1/1/2002	1/1/2005	1/1/2016	170	$20,685	$0	1.24	$25,742	$0	$7,997	$8,608
40th to 41st Street	4	1/1/2005	1/1/2008	1/1/2018	158	$19,692	$5,416	1.12	$21,992	$6,049	$6,263	$6,263
Belmont to Diversey South	2	1/1/2006	1/1/2008	1/1/2016	122	$13,954	$0	1.12	$15,584	$0	$3,288	$3,539
Diversey Revetment	2	1/1/2008	1/1/2010	1/1/2016	97	$12,635	$0	1.05	$13,277	$0	$2,163	$2,328
43rd to 45th Street	4	1/1/2011	1/1/2013	1/1/2018	85	$16,696	$0	1.00	$16,696	$0	$2,350	$2,350
Montrose to Irving	2	1/1/2011	1/1/2015	1/1/2016	61	$26,440	$0	1.00	$26,440	$0	$2,591	$2,789
Fullerton/Theater on the Lake	2	1/1/2010	1/1/2016	1/1/2016	73	$35,059	$0	1.00	$35,059	$0	$4,176	$4,495
45th to 51st Street	4	1/1/2012	1/1/2017	1/1/2018	73	$129,413	$0	1.00	$129,413	$0	$15,414	$15,414
54th to 56th Street	4	1/1/2013	1/1/2018	1/1/2018	61	$56,618	$0	1.00	$56,618	$0	$5,549	$5,549
PACR	NA	1/1/2010	3/1/2013	NA	NA	$212	$0	1.00	$212	NA	NA	NA
Total For Revetment						$524,474	$10,360		$602,570	$13,011	$146,999	$151,671
Total For Breakwater						$9,586	$0		$14,158	$0	$242	$0

Table 7-5 Preconstruction, Engineering and Design (October 2012 PL, $1,000)

Projects	Reach	Date Started	Date Completed	Date Reach Completed	PED ($1,000)	Index CWBS 10 (CWCCIS)	PED ($1,000) 2012 PL
Water Filtration Plant	5	1/1/1997	1/1/1998	1/1/1998	$1,390	1.48	$2,053
Belmont Harbor	2	1/1/1998	1/1/1999	1/1/2016	$799	1.45	$1,162
31st Street Beach	4	1/1/1998	1/1/1999	1/1/2018	$1,015	1.45	$1,477
31st - 33rd Street	4	1/1/1998	1/1/1999	1/1/2018	$1,135	1.45	$1,652
Solidarity Drive	3	1/1/1998	1/1/1999	1/1/1999	$1,749	1.45	$2,544
I-55 to 30th Street	4	1/1/1999	1/1/2000	1/1/2018	$2,543	1.43	$3,628
Irving to Belmont	2	1/1/1999	1/1/2002	1/1/2016	$2,857	1.39	$3,973
33rd to 37th Street	4	1/1/1999	1/1/2002	1/1/2018	$2,310	1.39	$3,213
56th to 57th Street	4	1/1/2001	1/1/2002	1/1/2018	$1,328	1.39	$1,848
41st to 43rd Street	4	1/1/2001	1/1/2003	1/1/2018	$1,212	1.34	$1,623
51st to 54th Street	4	1/1/2002	1/1/2003	1/1/2018	$1,541	1.34	$2,065
Belmont to Diversey North	2	1/1/2002	1/1/2004	1/1/2016	$2,189	1.31	$2,870
37th to 40th Street	4	1/1/2002	1/1/2004	1/1/2018	$4,043	1.31	$5,302
Montrose North	2	1/1/2000	1/1/2005	1/1/2016	$5,275	1.24	$6,565
Diversey to Fullerton	2	1/1/2002	1/1/2005	1/1/2016	$2,999	1.24	$3,733
40th to 41st Street	4	1/1/2005	1/1/2008	1/1/2018	$2,855	1.12	$3,189
Belmont to Diversey South	2	1/1/2006	1/1/2008	1/1/2016	$2,023	1.12	$2,260
Diversey Revetment	2	1/1/2008	1/1/2010	1/1/2016	$1,832	1.05	$1,925
43rd to 45th Street	4	1/1/2011	1/1/2013	1/1/2018	$2,421	1.00	$2,421
Montrose to Irving	2	1/1/2011	1/1/2015	1/1/2016	$3,834	1.00	$3,834
Fullerton/Theater on the Lake	2	1/1/2010	1/1/2016	1/1/2016	$5,084	1.00	$5,084
45th to 51st Street	4	1/1/2012	1/1/2017	1/1/2018	$18,765	1.00	$18,765
54th to 56th Street	4	1/1/2013	1/1/2018	1/1/2018	$8,210	1.00	$8,210
PACR	NA	1/1/2010	3/1/2013	NA		1.00	NA
Total For Revetment					$76,018		$87,342
Total For Breakwater					$1,390		$2,053

8. REMAINING BENEFIT-TO-REMAINING COST RATIO

Per Engineering Circular 11-2-202, the Remaining Benefit to Remaining Cost Ratio (RBRCR) economic update method "will consist of the district preparing an economic update of total and remaining project benefits on current price levels in accordance with an approved Economic Update Plan. The price level prevailing during PY-2 will be used to update the benefits. Remaining cost will be calculated using the steps outlined in paragraph 1 above. RBRCRs calculations using this method will then be adjusted by the deflation method outlined above. The Economic Update Method should be used for projects wherein the last approved economic analysis is old and/or otherwise no longer reflective of current and anticipated future conditions. This would be especially useful for projects that have prolonged and periodic construction activities such as levee lifts (ie. MR&T) and additions to training river control works over extended periods of time. In performing economic updates current and future development, traffic levels, fleet characteristics, residual risks, operating practices, and other relevant factors should be factored in to the analysis as appropriate to derive a reasonably accurate estimate of project benefits."

There are a total of four remaining reaches in the revetment portion of the study. Reaches to be completed are Reaches 2 and 4. The total remaining cost of the project is $243,867,000 with computed interest during construction of $30,825,702. While there are only 4 projects remaining those remaining projects are integral to the entire reach. The benefits for Reach 3 were sunk since the project was completed in 1999. The separable breakwater project was completed in 1999. The total benefits for Reach 3 are approximately 5 percent of the total benefits for the revetment project.

The RBRCR for the project is 14.4 at a discount rate of 3.75 percent.

Table 8-1 RBRCR at FDR 3.75 percent

EC 11-2-202
31-Mar-12

Remaining Benefits -Remaining Costs (FY12 on) Ratio Calculation

Chicago Shoreline

Current Price Level (Fiscal Year)	**2012**	
Total Fully Funded Project Cost	**$502.0**	**million**
Remaining Fully Funded Project Cost	**$260.0**	**million**
Discount Rate	**3.750%**	
Period of analysis (years)	**50**	
Remaining years of Construction	**5.0**	FY17
Number of years project has been under construction	**7.0**	Thru FY12

Step		Factor	First Costs	Annual Costs	Annual Benefits	BCR
1	Remaining Base Costs without IDC at Current Price Level (2012)		$ 243,867,000			
2	Remaining interest during construction at Current Price Level (2012)		$ 30,825,702			
3	Total remaining costs including IDC at current price level (2012)		$ 274,692,702			
4	Remaining costs deflated to price level of the approved report (2012)	1.0000	$ 274,692,702			
5	Annualized Remaining Project Costs at 3.75% discount rate (2012)	0.0446		$ 12,244,213		
6	Total Project Annual O&M at price level of the approved report (2012)			$ 700,000		
7	Sunk Annual O&M cost at price level of the approved report (2012)	0.0%				
8	**Total Annual Remaining Costs**			**$12,944,213**		
9	Annual Project Benefits from approved report at 3.75% discount rate (2012)				$ 232,905,628	
10	Sunk Expected Annual Benefits	19.8%			$ 46,192,120	
11	**Total Annual Remaining Benefits**				**$186,713,508**	
12	**RBRCR Calculation**					**14.4**
13	**Remaining Average Annual Net Benefits**				**$173,769,295**	
14	Please provide an explanation of how sunk O&M costs were derived:					
15	Please provide an explanation of how sunk benefits were derived:	The total miles of shoreline to be protected in 9.47 miles. Currently, the total miles completed is 6.98. Reach 3 is complete. Reach 2 and Reach 4, 95% of the benefits, are not yet complete. Breakwater is complete				

ATTACHMENT 1

Memorandum for Record, Summary of the 15-16th April 1993 Washington Level Review Center (WRLC) and Chicago District (CENCC) discussions held at Fort Belvoir.

U.S. ARMY CORPS OF ENGINEERS
CHICAGO DISTRICT

PLANNING DIVISION

FAX HEADER SHEET

Date: 19 April 1993

From: Kim M. Bloomquist

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Number of Pages (Including Header Sheet): 9

SUBJECT
Chuck, This is Chicago District's MFR concerning the working session between WLRC and Chicago District on the Illinois Shoreline Interim 3 project held during 15-16 April 1993. This memo contains information on Number of affected users requested by Jim Smyth. Kim Bloomquist

WRSC-WLR-M 16 April 1993

MEMORANDUM FOR: CECW-P, ATTN: Deputy for Planning

SUBJECT: Interim III Wilmette to Illinois State Line, Illinois Shoreline Erosion, Lake Michigan, Storm Damage Reduction

1. INTRODUCTION. WLRC has completed an interim review of the recreation analysis for the subject study. We have tentatively determined that the economic analysis results as displayed in the draft final report significantly understate the incremental NED recreation benefits of the Plan IV step stone revetment plan versus the Plan I rubble revetment plan.

2. BACKGROUND. For a detailed discussion of the events and circumstances leading to this analysis see CEWRC-WLR-M memo of 9 April 1993 for CECW-PC ATTN: Chuck Moeslein SUBJECT: Review of Recreation Benefits for Illinois Shoreline Erosion Study (Chicago Shoreline) which is attached.

3. PROBLEM STATEMENT. During previous review WLRC identified problems with the recreation analysis summarized as follows:

a. There was an unexplained change in NED recreation benefits between the October 1992 Response to PGM comments and the December 1992 draft report.

b. The point-counts used to estimate the user-day value of a recreation experience with the rubble revetment versus the step stone revetment were inconsistent between the two reports.

c. WLRC reviewers were unable to understand and review the method used to calculate recreation benefits.

d. Recreation impacts were shown in reaches of the project not affected by the construction of a rubble revetment, namely reaches 3, 5, and 6.

e. Information was needed regarding the technique that was used to allocate area-wide recreation use rates to reaches 2 and 4, the affected project reaches.

f. Usage of the lake front for some activities exceeds the estimated frequency of use for the entire Chicago area. Also, if the activity level of active recreationists is too high, passive recreation use would also be too high due to the method used to estimate passive use, namely, passive use is set to be equal to active use.

g. Recreation impacts were shown for user groups which are seemingly not impacted by the presence or absence of a user-friendly revetment design, such as volleyball players, softball and baseball players, etc.

4. REVIEW PROCESS. Each of the problems summarized above were addressed during a meeting on 14 April at HQUSACE followed by a working session on 15 and 16 April at WLRC.

a. The change in NED recreation benefits between the October 1992 Response to PGM comments and the December 1992 draft final report was due to a change in the engineering design of the of rubble revetment. This change led to a more efficient section producing optimum storm damage reduction benefits but also worsened the negative impact on recreation use of the lake shore. Thus the difference in recreation benefits between the rubble and the step stone revetment widened from about $1 million to about $4 million per year.

b. WLRC reviewers (with the assistance of Forester Einarsen) completely revamped the Chicago Districts' method of assigning points to value recreation experience from an activity-based to the more conventional site-based analysis outlined in the P&G and Corps regulation. All participants reached agreement on the points to be assigned to each of the five user-day value categories. The associated FY 1993 UDV values were calculated and Chicago District's recreation computer model was run using the new values. The results were practically indistinguishable from previous runs using the Chicago District point counts.

c. WLRC reviewers were unable to understand and review the method used to calculate recreation benefits. The calculation of user-days times value equals benefits is straightforward but a large number of calculations are needed for the Chicago Shoreline project because a large number of recreation activities are defined, each activity has its own set of impact values and all future impacts need to be discounted and averaged. District personnel brought a copy of the Lotus-based spread sheet model to the work session and familiarized WLRC personnel with its functions. By exercising the model, and also by checking model results using benefit estimation procedures, WLRC reviewers are now reasonably certain that the model produces accurate number-crunching results. Work will proceed to become more familiar with the internal working of the District's benefit calculation model.

d. Recreation impacts were shown in reaches of the project not affected by the construction of a rubble revetment, namely reaches 3, 5, and 6. This deletion affects the total recreation analysis but will not affect the incremental analysis of benefits and costs for reaches 2 and 4 - the affected reaches.

e. Information was obtained regarding the technique that was used to allocate area-wide recreation use rates various reaches of the project. WLRC agrees with the method employed by the District.

f. Usage of the lake front for some activities appeared to exceed the estimated frequency of use for the entire Chicago area. This was caused by misstatements in the draft final report. WLRC

has confirmed the recreation use estimates, which were provided by the local sponsor, are specific to the lake front planning area.

g. Recreation impacts were shown for user groups which are seemingly not impacted by the presence or absence of a user-friendly revetment design such as volleyball players, softball and baseball players, etc. No adjustment was made to assess the impact of excluding these users during the working session since the number of such users is small compared to major use categories such as joggers, bikers, special events, and passive use. Thus deletion would not cause a significant change in benefit measurements.

5. The above review concerns were resolved to the extent that District personnel could accomplish work and WLRC reviewers could assimilate results during the work session. Resolution of the above concerns resulted in only small changes in the positive net benefits associated with the step stone revetment. More significant was a test of a change in discounting procedures whereby both the benefits and costs associated with project alternatives are discounted to the same base year. In the report, future benefits are discounted 11 and 16 years for reaches 4 and 2 respectively and compared to annual costs. This method compares highly-discounted benefits against undiscounted costs and results in a relatively low (although still positive) BCR. If both benefits and costs are compared at the time of construction completion, the approximate same base year, incremental benefits of the step stone plan increase to about $3 million for reach 4 and over $6 million for reach 2 and corresponding BCR's increase to about 2.3 for reach 4 and about 8.7 for reach 2.

6. CONCLUSIONS. The NED recreation assessment in the December 1992 draft final report concludes that the additional cost of Plan IV, the step stone revetment plan, is incrementally justified based on positive net recreation benefits. The results of the review team's work over the past three days indicates that the margin of incremental justification, as measured by positive net benefits and a positive incremental BCR, is at least as great as stated in the report and could be much greater i.e. on the order of 5 times greater, than reported. The likelyhood that the justification conclusion would be reversed during review of the final report during the Washington-level decision-making process is remote.

CENCC-PD-E

April 16, 1993

MEMORANDUM FOR RECORD

SUBJECT: Recreation Benefits of Interim III Wilmette to Illinois State Line, Illinois Shoreline Erosion, Lake Michigan

1. The purpose of this memorandum is to summarize discussions held between members of CENCC and WLRC on 15 April 1993 at Fort Belvoir on the subject topic. Key points discussed were the following: 1) conventional versus current application of the UDV methodology in the subject study, 2) Plan I versus Plan IV impact on recreation experience using the conventional UDV approach, 3) validation of the spreadsheet model used by Chicago District to calculate without project recreation losses and with project recreation benefits, 4) runner, jogger, and biker user days and 5) number of users affected by the design differences in the proposed plans.

2. Conventional Versus Current Application. The subject study estimates individual UDVs for specific activities within the study area. This approach was adopted for reasons of interest to the local sponsor which devoted substantial time and money collecting data on the many activities along the Chicago Lake Michigan shoreline. The more conventional approach using the UDV methodology is to estimate a single UDV for an entire site.

The meeting participants agreed that the point scores and dollar values shown in the table below are reasonable measures of the impact of the two plans on visitors of the Chicago lakefront. Scores were based on Table VIII-3-2 Guidelines for Assigning Points For General Recreation from Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studiesl, 1983.

	Plan I Random Rubble	Plan IV Step-Stone
Recreation Experience	14	20
Availability of Opportunity	11	16
Carrying Capacity	7	10
Accessibility	11	16
Environmental Quality	8	13
TOTAL	51	75
UDV	$4.98	$5.93

An explanation of the point scores is as follows:

Recreation Experience

Plan I (14 points). Characterized by several general activities; one high quality value activity. Access to shoreline for fishing and passive recreation severely restricted or eliminated.

Plan IV (20 points). Several general activities; more than one high quality high activity. No restrictions to lakefront for fishing and passive activities.

Availability of Opportunity

Plan I (11 points). No similar facilities within one hour travel time.

Plan IV (16 points). No similar facilities within two hour travel time.

Carrying Capacity

Plan I (7 points). Adequate facilities to conduct without deterioration of the resource or activity experience.

Plan IV (10 points). Optimum facilities to conduct activity at site potential.

Accessibility

Plan I (11 points). Good access, good roads to site; fair access within site (restricted access to and along shoreline), good roads within site.

Plan IV (16 points). Good access, high standard road to site, good access within site.

Environmental Quality

Plan I (8 points). Above average aesthetic quality; any limiting factors can be reasonably rectified.

Plan IV (13 points). High aesthetic quality; no factors exist that lower quality. (N.B. the point scores for Plan I (Random Rubble) explicitly assume that the crest of the structure does not extend above ground level. These scores do assume the presence of a cable fence, or similar barrier, located between the shore and the crest of the structure.)

3. Plan I Versus Plan IV Impact Using Conventional UDV Approach. There are approximately 37.4 million annual recreation user days in Reaches 2 and 4 (28.7 million in Reach 2 and 8.7 million in Reach 4). Therefore, the estimated difference in annual recreation value between the Plans I and IV is 37.4 million user days X $0.95 (difference in UDV between Plan I and Plan IV) = $35.5 million.

It was agreed by the meeting participants that a reasonable estimate of the annual difference in recreational value between the Plans I and IV using the conventional approach is achieved by applying the difference in UDV value times the annual number of recreation user days in the affected reaches.

4. Validation of the Spreadsheet Model. A computer diskette and hardcopy version of the spreadsheet model was provided to WLRC. The model was loaded on a PC and demonstrated to WLRC staff. WLRC staff recommended the following changes to the model's assumptions:

a) Eliminate all recreation losses previously claimed for Reaches 1, 3, 5, and 6 (i.e., only estimate recreation losses for Reach 2 and Reach 4).

b) Replace the activity-specific UDVs with site-specific UDVs agreed to by WLRC and CENCC.

c) Compute recreation benefits using the same base year as project costs. Therefore, the base year for Reach 2 benefits is 2008 and year 2003 for Reach 4. These dates correspond with the year construction is scheduled to be completed.

The model was rerun with the above changes resulting in the following output:

Incidental Recreation Benefits
($Millions)

Reach	Plan IV	Plan I	Difference
2	$20.7	$12.0	$8.7
4	15.0	8.6	6.4
TOTAL	$35.7	$20.6	$15.1

Therefore, total incremental annual recreation benefits of Plan IV versus Plan I using the model with the above changes are $15.1 million compared to incremental costs of $3 million - a benefit to cost ratio of over 5 to 1 and net benefits of $12.1 million.

It is the opinion of WLRC staff that Chicago District's spreadsheet model is reasonable and independently verifiable. The analysis using Chicago District's UDVs yields results that appear to be about the same as the more conventional application of UDV. The conventional approach indicates an annual difference in recreation benefits of $35.5 million between Plans I and IV whereas the model

shows a difference of only $15.1 million, using the assumptions described above.

5. Runner, Jogger, Biker User Days. There was considerable discussion concerning the appropriate number of runners, joggers, and bikers that currently use the lakefront paths. The draft Feasibility Report did not make clear that the 9.2 million runner and jogger user days and 4.5 million biker user days assumed in the spreadsheet model referred only to those individuals that conducted their activities within the lakefront park system and not elsewhere throughout the Chicago Metropolitan Area. Confirmation of this data was provided via a telephone conversation between a WLRC staff representative (Mr. Tom Odle) and the recreation consultant for the City of Chicago and Chicago Park District (Ms. Marcia Jimenez).

Based on this confirmation and further discussion, it was decided that the estimated number of user days for runners, joggers, and bikers contained in the model was acceptable.

6. Users assumed to be impacted by the spreadsheet model. During the meeting held on 14 April 1993 at HQUSACE Mr. Jim Smyth of ASA(CW) and others expressed interest in knowing exactly how many of the total number of annual user days contained in the spreadsheet model were assumed to be impacted by the design differences embodied by the two plans. The answer is provided in the attached Figures and printout from the model. Figure 1 shows for both Reach 2 and Reach 4 the total number of visitor days in the model, the "Core" use category (i.e., all but the imputed user categories for team sports and playgrounds), and the number of impacted users. For Reach 2 10.2 million out of 32.5 million visitor days are impacted (31.4 percent), while in Reach 4 6.6 million out of 8.8 million visitor days are affected (75 percent). Figure 2 provides the same information only with the assumption that the number of bikers, runners, and joggers is reduced by 50 percent (similarly the number of passive users is reduced by a like amount). Finally, Table 1 shows by activity and sub-reach (where appropriate) the number of impacted users for Reaches 2 and 4. The second column of Table 1 shows the total number of visitor days, the third column contains a 0 if no impact else the value in column 2 if an impact is felt. The subsequent columns identify the number of impacted users by specific activity.

The meeting participants agree that the number of impacted visitor days is contained in the spreadsheet model and appears to be both consistent and reasonable.

7. Two additional sensitivity analyses were also performed at the request of WLRC staff. Both analyses started with the original estimate of recreation benefits contained in the draft Feasibility Report. The first sensitivity test examined the difference in benefits between Plans I and IV when the recreation benefits in Reaches 2 and 4 were set to the same base year as construction

costs (i.e., 2008 for Reach 2 and 2003 for Reach 4). The second sensitivity test examined the impact of substituting the above agreed upon UDV values for all study area reaches. The results of these investigations were provided to WLRC to their satisfaction. The WLRC staff had no further outstanding information requests of CENCC staff at the time this memo was prepared.

Meeting Participants:

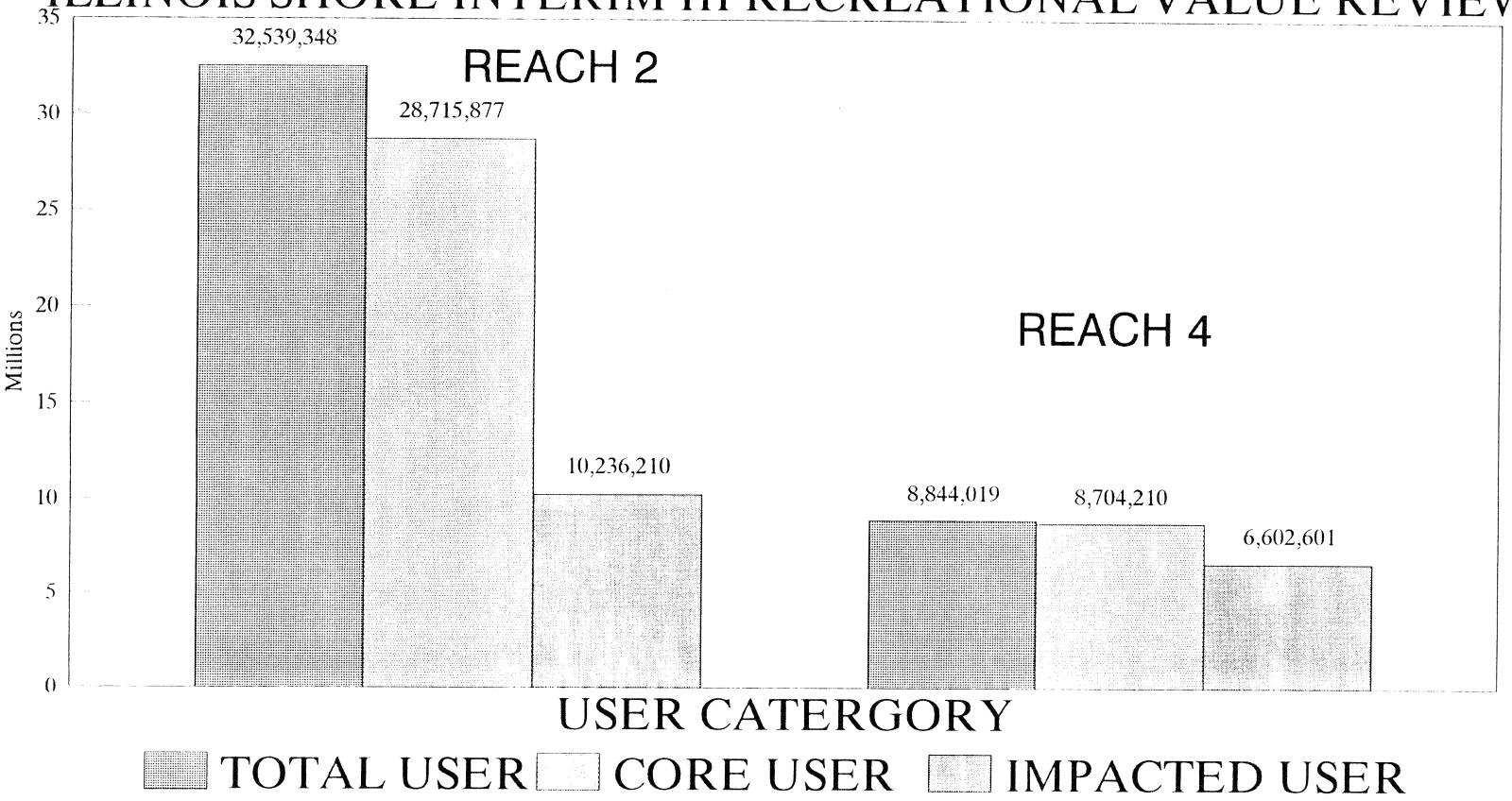
Forester Einarsen, CEWRC-WLR
Dick MacDonald, CEWRC-WLR
Art Klingerman, CEWRC-WLR
Tom Odle, CEWRC-WLR
Kim Bloomquist, CENCC-PD-E
Dennis Giba, CENCC-PD-E

Encls.
1. Figure 1
2. Figure 2
3. Table 1

cf: Meeting Participants

KIM M. BLOOMQUIST
Chief, CENCC-PD-E

DELINEATION OF USERS IMPACTED FROM FAILURE
ILLINOIS SHORE INTERIM III RECREATIONAL VALUE REVIEW



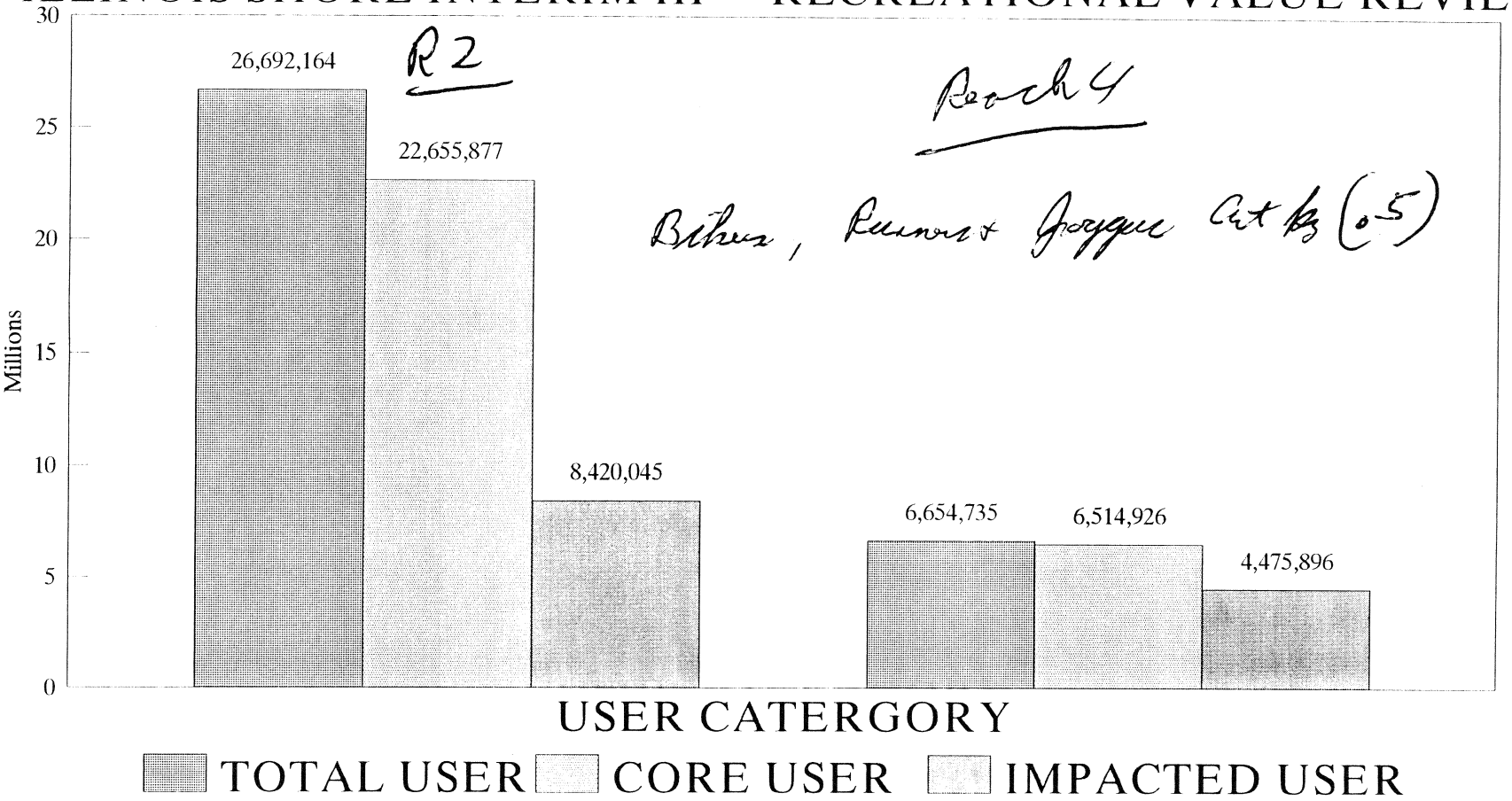
WLRC– 15 APRIL 1993
CENCC–PE–E: D. GIBA FROM ILS3WLRC.WK3

Figure 1

DELINEATION OF USERS IMPACTED FROM FAILURE

ILLINOIS SHORE INTERIM III – RECREATIONAL VALUE REVIEW

ANNUAL USERS REACH 2 & REACH 4



R2

Reach 4

Bikers, Runners & Joggers Act by (0.5)

WLRC– 15 APRIL 1993
CENCC–PE–E; D. GIBA FROM ILS3WLRC.WK3

Figure

Table 1

	USE TOTAL	USE CORE R2		USE IMPACTED							
	41,383,367	37,420,087		16,838,811							
	TOTAL USERS ASSIGNED										
		USE IN CORE USE	non core	USE IMPACTED							
R2	32,539,348	28,715,877	3823471	10,236,210							
R4	8,844,019	8,704,210	139809	6,602,601							
105											
105											
1			1	1							
2N	32546506	0	2N	2N							
207	498	0	2N Lk Sh Drive	207	498 MARATHON RUNNERS						
207	1913	0	2N Lk Sh Drive	207	1913 MARATHON RUNNERS						
207	2143	2143	2N Lk Sh Drive	207	2143 MARATHON RUNNERS						
207	1941	1941	2N Lk Sh Drive	207	1941 MARATHON RUNNERS						
207	4012	0	2N Lk Sh Drive	207	4012 MARATHON RUNNERS						
207	2143	2143	2N Lk Sh Drive	207	2143 MARATHON RUNNERS						
207	2862	0	2N Lk Sh Drive	207	2862 MARATHON RUNNERS						
207	492	0	2N N. Sher. Rd.	207	492 MARATHON RUNNERS						
207	498	0	2N N. Sh rd	207	498 MARATHON RUNNERS						
2N	0	0	2N	2N							
201	935405	0	2N Beach	201	935405 SWIMMERS AND BEACH PERMITS						
201	1405582	0	2N Beach	201	1405582 SWIMMERS AND BEACH PERMITS						
201	538828	0	2N Beach	201	538828 SWIMMERS AND BEACH PERMITS						
2N	0	0	2N	2N							
214	4000	0	2N Tennis Court (5)	214	4000 Tennis Court (5)						
214	1600	0	2N 2 Tennis Cts	214	1600 2 Tennis Cts						
214	5187	0	2N Volleyball Cts (1)	214	5187 Volleyball Cts (1)						
214	35200	35200	2N soccer fields(4)	214	35200 soccer fields(4)						
214	17600	0	2N Soccer field (2)	214	17600 Soccer field (2)						
214	14400	0	2N Baseball Jr (2)	214	14400 Baseball Jr (2)						
214	7200	0	2N baseball Sr (1)	214	7200 baseball Sr (1)						
214	14400	14400	2N Softball	214	14400 Softball						
214	21600	21600	2N Softball (3)	214	21600 Softball (3)						
214	14400	14400	2N Baseball Jr (2)	214	14400 Baseball Jr (2)						
214	14400	0	2N Baseball Sr (2)	214	14400 Baseball Sr (2)						
214	16000	16000	2N Basketball Stnd (4)	214	16000 Basketball Stnd (4)						
213	3200	0	2N archery range	213	3200 archery range						
213	2552	2552	2N playground	213	2552 playground						
214	2552	2552	2N playground	214	2552 playground						
213	2552	2552	2N playground	213	2552 playground						
214	2552	0	2N playground	214	2552 playground						
214	2552	2552	2N Playground (1)	214	2552 Playground (1)						
214	2552	0	2N playground	214	2552 playground						
214	2552	0	2N Playground (1)	214	2552 Playground (1)						
214	217	0	2N Playslabs (1)	214	217 Playslabs (1)						
2N	0	0	2N	2N							
203	736826	736826	2N Park	203	9297 FISHING	204	41276 AIR WATER SHC	249	686253 PASSIVE		
203	829840	0	2N Park	203	10471 FISHING	204	46486 AIR WATER SHC	249	772883 PASSIVE		
203	110102	0	2N Park	203	1389 FISHING	204	6168 AIR WATER SHC	249	102545 PASSIVE		
203	854349	0	2N Park	203	10780 FISHING	204	47859 AIR WATER SHC	249	795710 PASSIVE		
203	686608	686608	2N Park	203	8664 FISHING	204	38462 AIR WATER SHC	249	639482 PASSIVE		
203	1051999	0	2N Park	203	13274 FISHING	204	58931 AIR WATER SHC	249	979793 PASSIVE		
203	1978267	0	2N Park	203	24962 FISHING	204	110819 AIR WATER SHC	249	1842486 PASSIVE		
2N	0	0	2N	2N							
209	94719	94719	2N Hbr Facil	209	94719 LARGE CRAFT BOATERS						
209	31526	0	2N Hbr facil	209	31526 LARGE CRAFT BOATERS						
208	13500	0	2N Launch Ramp	208	13500 SMALL CRAFT BOATERS						
2N	0	0	2N	2N							
2N	0	0	2N	2N							
205	173583	0	2N Path 2525'	205	173583 RUNNERS,JOGGERS,BIKERS						
205	375845	375845	2N path 1	205	375845 RUNNERS,JOGGERS,BIKERS						
205	702885	702885	2N Path 9,525'	205	702885 RUNNERS,JOGGERS,BIKERS						
205	340625	0	2N Path 8000'	205	340625 RUNNERS,JOGGERS,BIKERS						
205	335594	0	2N path 18,075'	205	335594 RUNNERS,JOGGERS,BIKERS						
205	375845	375845	2N path 11,550'	205	375845 RUNNERS,JOGGERS,BIKERS						
205	500623	0	2N path 6,655'	205	500623 RUNNERS,JOGGERS,BIKERS						
2S	0	0	2S	2S							
258	3426	0	2S L.Sh. Drive	258	3426 MARATHON RUNNERS						
258	3496	3496	2S Lk Sh Drive	258	3496 MARATHON RUNNERS						
258	5832	0	2S Lakeshore Dr.	258	5832 MARATHON RUNNERS						
258	3496	0	2S Lk Sh Drive	258	3496 MARATHON RUNNERS						
2S	0	0	2S	2S							
251	90917	0	2S Beach 4	251	90907 SWIMMER	253	10 SCUBA				
251	256266	0	2S Beach 2	251	256237 SWIMMER	253	29 SCUBA				
251	242446	0	2S Beach 6	251	242419 SWIMMER	253	27 SCUBA				
251	246083	0	2S Beach 5	251	246056 SWIMMER	253	27 SCUBA				
251	3333638	0	2S Beach	251	3333267 SWIMMER	253	371 SCUBA				
251	121223	0	2S Beach 1	251	121210 SWIMMER	253	13 SCUBA				
251	204059	0	2S Beach 3	251	204036 SWIMMER	253	23 SCUBA				
2S	0	0	2S	2S							
265	6400	0	2S Tennis court (8)	265	6400 Tennis court (8)						
265	3200	0	2S 4 Tennis cts	265	3200 4 Tennis cts						
264	8062	0	2S 10 Vollyball Ct.	264	8062 10 Vollyball Ct.						
265	21502	21502	2S Soccer/foot	265	21502 Soccer/foot						
265	10751	0	2S Soccer/Foot	265	10751 Soccer/Foot						
265	16127	0	2S Softball	265	16127 Softball						
265	16127	16127	2S Baseball Sr (2)	265	16127 Baseball Sr (2)						
265	8063	0	2S Baseball Jr (1)	265	8063 Baseball Jr (1)						
265	28800	0	2S Basketball Stnd (4)	264	28800 Basketball Stnd (4)						
265	4000	0	2S Shuffleboard (5)	265	4000 Shuffleboard (5)						
265	22400	0	2S Horseoe (28)	265	22400 Horseoe (28)						
265	4000	4000	2S Oval Asphalt Running Ri	265	4000 Oval Asphalt Running Ring						
265	2552	2552	2S playground	265	2552 playground						
264	2552	2552	2S Playground	264	2552 Playground						
264	2552	0	2S playground	264	2552 playground						
265	2552	0	2S playground	265	2552 playground						
265	217	0	2S Playslabs (1)	264	217 Playslabs (1)						
265	1600	0	2S Bocci (2)	265	1600 Bocci (2)						
2S	0	0	2S	2S							
254	2377585	2377585	2S Park	254	21586 FISHING	255	191659 AIR WATER SHC	299	2164340 PASSIVE		
254	816202	0	2S Park	254	7410 FISHING	255	65795 AIR WATER SHC	299	742997 PASSIVE		
254	2369412	0	2S Park	254	21512 FISHING	255	191001 AIR WATER SHC	299	2156900 PASSIVE		

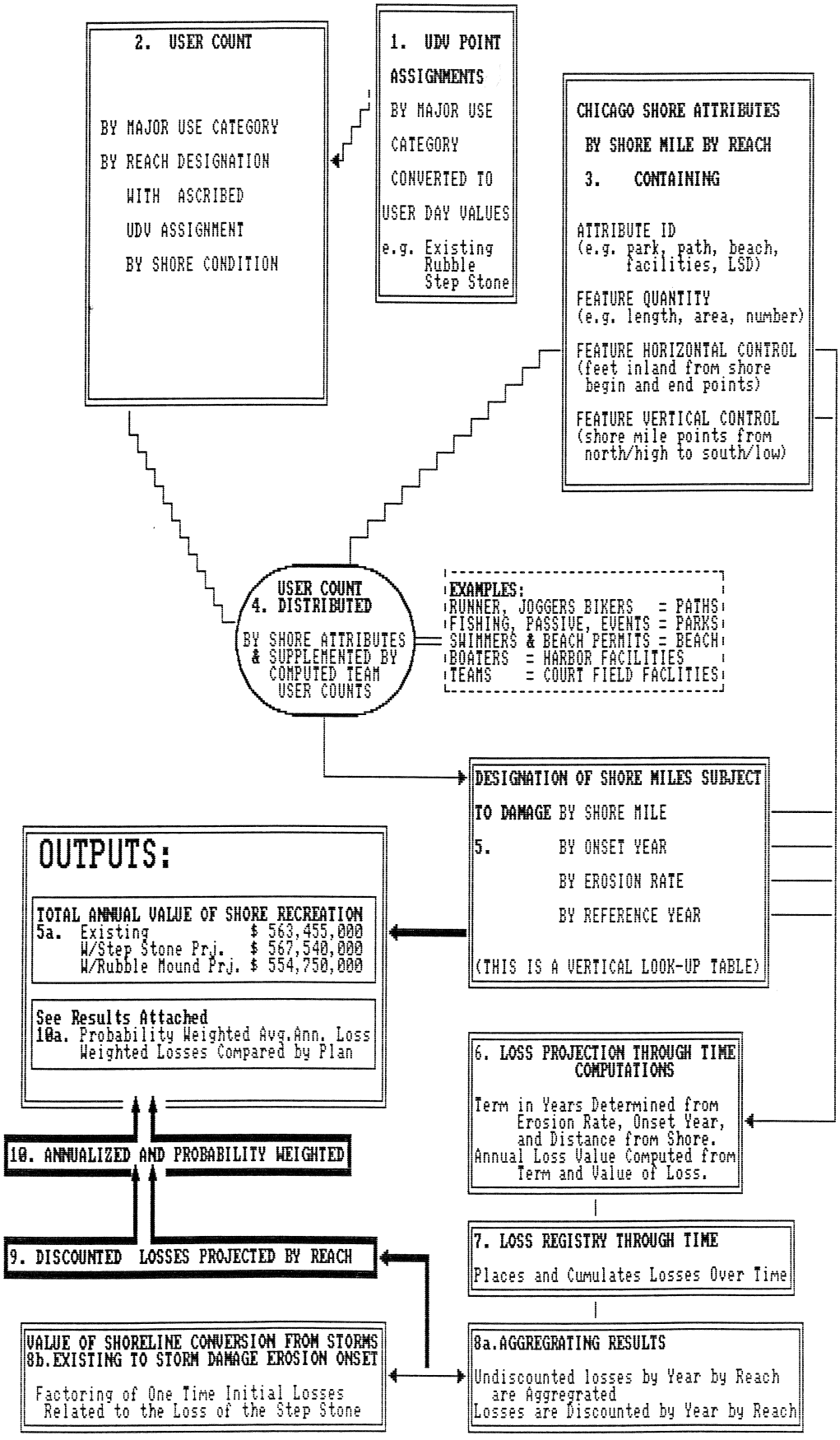
Table 1 continued

254	3120485	0	2S Park	254	28330	FISHING	255	251545	AIR WATER SHC	299	2840609 PASSIVE
2S	0	0	2S	2S							
265	4000000	4000000	2S Zoo	265	4000000	ZOO					
260	70136	70136	2S Harbor Facility	260	70136	LARGE CRAFT BOATERS					
259	7500	0	2S Launch Ramp	259	7500	SMALL CRAFT BOATERS					
2S	0	0	2S	2S							
256	435557	0	2S path East	256	435557	RUNNERS,JOGGERS,BIKERS					
256	431470	0	2S path	256	431470	RUNNERS,JOGGERS,BIKERS					
256	226536	226536	2S Path West	256	226536	RUNNERS,JOGGERS,BIKERS					
256	420961	420961	2S path West	256	420961	RUNNERS,JOGGERS,BIKERS					
256	639907	0	2S path	256	639907	RUNNERS,JOGGERS,BIKERS					
256	290177	0	2S Path East	256	290177	RUNNERS,JOGGERS,BIKERS					
256	384761	0	2S Path West	256	384761	RUNNERS,JOGGERS,BIKERS					
2S	0	0	2S	2S							
TOTAL USE R4		0	USE CORE R4								
	8,844,019	6,602,601	8704210								
4	8846020	8846020	4	4							
406	5478	5478	4 lsd	406	5478	MARATHON RUNNERS					
406	5118	5118	4 lsd	406	5118	MARATHON RUNNERS					
406	532	532	4 lsd	406	532	MARATHON RUNNERS					
406	5122	0	4 sl shd	406	5122	MARATHON RUNNERS					
4	0	0	4	4							
401	2050561	0	4 beach	401	2050561	SWIMMERS & BEACH PERMITS					
4	0	0	4	4							
403	1502988	1502988	4 Park	403	31976	FISHING	499	1471011	PASSIVE		
403	1538562	1538562	4 Park	403	32733	FISHING	499	1505828	PASSIVE		
403	1298439	1298439	4 park	403	27625	FISHING	499	1270815	PASSIVE		
403	106721	0	4 park	403	2271	FISHING	499	104451	PASSIVE		
4	0	0	4	4							
409	2552	2552	4 playground	409	2552	playground					
410	2552	2552	4 playground	410	2552	playground					
410	2552	2552	4 playground	410	2552	playground					
410	2552	2552	4 playground	410	2552	playground					
409	2552	2552	4 playground	409	2552	playground					
410	2552	2552	4 playground	410	2552	playground					
410	3500	3500	4 model yacht basin	410	3500	model yacht basin					
410	16000	16000	4 Basketball (4)	410	16000	Basketball (4)					
409	32000	32000	4 Basketball Cts (8)	409	32000	Basketball Cts (8)					
410	8000	8000	4 Basketball (2)	410	8000	Basketball (2)					
410	7200	7200	4 Softball (Jr.)	410	7200	Softball (Jr.)					
410	7200	7200	4 Baseball Sr	410	7200	Baseball Sr					
410	7200	7200	4 Baseball	410	7200	Baseball					
410	28800	28800	4 Softball (4)	410	28800	Softball (4)					
410	4800	4800	4 athletic field	410	4800	athletic field					
410	4800	4800	4 athletic field	410	4800	athletic field					
409	6400	0	4 Tennis court (8)	409	6400	Tennis court (8)					
4	0	0	4	4							
404	737006	737006	4 Path	404	737006	RUNNERS,JOGGERS,BIKERS					
404	689585	689585	4 path	404	689585	RUNNERS,JOGGERS,BIKERS					
404	690079	690079	4 9188' path #5 *	404	690079	RUNNERS,JOGGERS,BIKERS					
404	72614	0	4 path (6)	404	72614	RUNNERS,JOGGERS,BIKERS					
5	5	0	5		5						
6	0	0	6	6							

COLUMN SUMS:

ILLINOIS SHORELINE INTERIM III FEASIBILITY REPORT

RECREATIONAL VALUE OF THE CHICAGO SHORELINE AND LOSS COMPUTATION MODEL FLOW CHART 4/14/93



ATTACHMENT 2

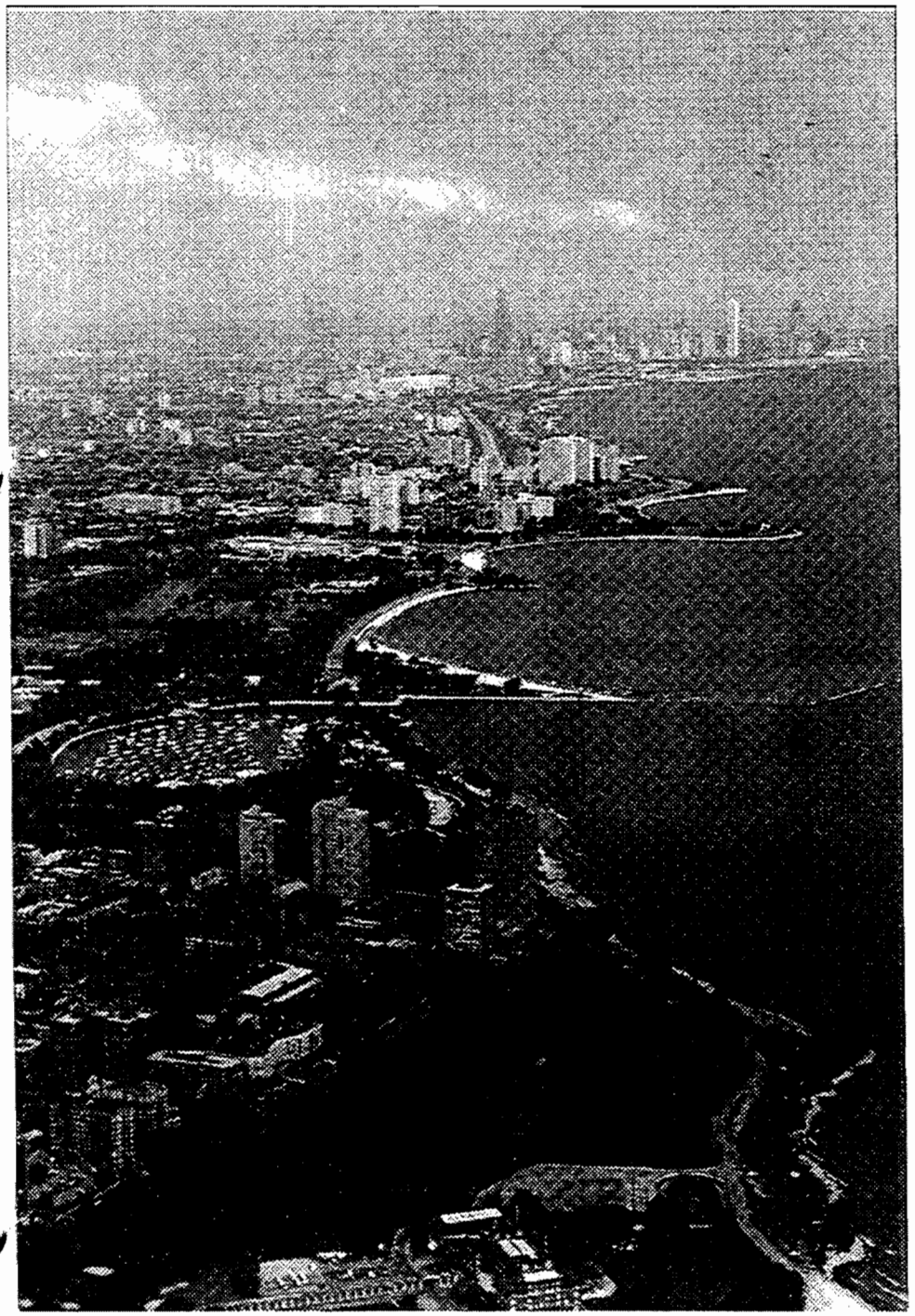
Illinois Shoreline Erosion Technical Volume II, Interim III Feasibility Report, Appendix D – Economic Analysis, July 1993, GPO Number 748-291/292-93

Illinois Shoreline Erosion

Interim III

Wilmette to Illinois/Indiana State Line

Storm Damage Reduction



Volume II

Appendix D Economic Analysis

Appendix E Plan Formulation

Appendix F Local Sponsor Plan Formulation

Appendix G Correspondence

Appendix H Real Estate

U.S. Army Corps of Engineers
Chicago District
North Central Division

July 1993

★ U.S. G.P.O. 748-291/292-93

ILLINOIS SHORELINE EROSION TECHNICAL VOLUME II

INTERIM III
Feasibility Report

Appendix D

ECONOMIC ANALYSIS

ILLINOIS SHORELINE EROSION
INTERIM III
ECONOMIC APPENDIX

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ILLINOIS SHORE BEACH EROSION
INTERIM III
CHICAGO AND EVANSTON

INTRODUCTION

This appendix presents economic evaluations on proposed structural remedies to the threat of shore destruction resulting from storm damages and erosion. A discussion of the human resources of the stusy area and the particular economic and social profiles of each reach jeopardized by destruction precedes the presentation of the economic methodology and evaluation results. The analysis principally revolves around the present value of transportation delays, structural damage, and lost recreation opportunities resulting from of the projected failure of the existing shoreline protection, and as compared to the similar analysis under differing project conditions. The appendix concludes with the comparison of costs and benefits for the various project proposals.

ECONOMIC PROFILE

DESCRIPTION OF THE STUDY AREA

The study area for this Interim III report has been previously defined as extending from Wilmette Harbor to the Indiana State line and includes the entire shorelands of Evanston and Chicago, and the southern section of Wilmette. For the purpose of delineation of human resources it is recognized that this area is a functional border of the Chicago Standard Metropolitan Statistical Area (SMSA). The Chicago SMSA is comprised of six Illinois counties: Cook, Du Page, Kane, Lake, Mchenry, and Will. The concentration of population in this area has traditionally been a function of geographical advantage defined by highly developed transportation links (e.g. water, rail, road, and air) connecting this capital city of the Midwest with other regions of the nation.

HUMAN RESOURCES

The neighborhoods surrounding the shorelands within the study area are, for the most part, urban, densely populated areas, with predominantly multiple unit dwellings. The benefits related to shoreland use within the study area extend inland a considerable distance from the shoreline. For this study, the impact area of these benefits has been determined to be the Chicago Standard Metropolitan Statistical Area (SMSA). The Chicago SMSA, the third largest in the nation, is comprised of six Illinois counties: Cook, DuPage, Kane, Lake, McHenry, and Will.

Population

The most recent population data for the study area municipalities and counties comprising the impact area are shown in Table D-1. The population growth rate in the SMSA since 1960 is on average 0.5 percent per year. Chicago has gradually lost approximately 840,000 in population since the city's population peaked at 3.62 million in 1950, whereas surrounding suburban collar counties have experienced steady growth. The projection of population growth in the Chicago SMSA to 2035 is only 0.2 percent per year based on 1985 Bureau of Economic Analysis Regional Projections.

Households and Housing

Within the Chicago SMSA, DuPage County is first of the six SMSA counties in the measure of housing value at $137,100, as shown in Table D-2. McHenry County is the fastest growing county of the SMSA, reflecting a 28.2 percent increase in housing units during the last decade. All the collar counties of the SMSA experienced significant growth of housing stock and population in comparison to Cook County, which had been effectively built-up in earlier decades. Significantly, and probably due to central city attributes, housing values in Cook County have kept pace with those in the other counties which have more recent housing stock. Cook County is also distinguished from the collar counties by the percentage of housing units owner occupied. Approximately 45 percent of the units in Cook County are rental, whereas in the collar counties 25 to 30 percent are rental units. Although the areas of housing, household and population growth are outside Cook County, Cook County's share of the housing stock remains dominant at 72 percent of the Chicago SMSA total. The City of Chicago, located entirely within Cook County, contained 40 percent of the total SMSA housing units. The growth trends prevalent in the past decade, if continued, may eventually produce a more evenly geographically distributed population base within the SMSA.

Table D-1 Population of Chicago Area and Selected Study Area Communities

Area	Population, 1990	Population Per Square Mile	Percent White	Births per 1,000 1988	Deaths per 1,000 1987
Chicago SMSA (IL)	7,261,176	527	70.5	-	-
Cook County	5,105,067	1,206	62.8	17.3	9.1
Du Page County	781,666	895	91.5	16.8	5.6
Kane County	317,471	234	84.9	18.3	7.3
Lake County	516,418	146	87.3	17.6	6.1
McHenry County	183,241	116	97.6	16.6	7.1
Will County	357,313	162	84.9	16.3	6.2

Source: U.S. Bureau of the Census

Table D-2 Households and Housing - Selected Characteristics

Area	Housing Units	Percent Change, '80-'90	Persons per Household	Percent Owner Occupied	Median Gross Rent ($1990)	Median Value of Owner-Occupied Non-Condominium Unit ($1990)
Chicago SMSA (IL)	2,798,004	5.8	2.77	57.0	-	$ -
Cook County	2,021,833	0.0	2.67	55.5	411	102,100
DuPage County	292,537	25.8	2.76	74.4	568	137,100
Kane County	111,496	14.3	2.90	69.5	439	102,500
Lake County	183,283	24.5	2.85	74.2	487	136,700
McHenry County	65,985	28.2	2.89	79.9	461	111,000
Will County	122,870	13.4	2.98	77.4	377	89,000

Source: U.S. Bureau of the Census

Income and Education

Within the Chicago SMSA, Lake County is first in highest income level at $54,229 closely followed by DuPage County with median household income of $51,189. DuPage County has the highest educational attainment, as measured by the percentage of county population over 25 years old having graduated high school or with 4 years of college, as shown in Table D-3. The data also indicates that just over two thirds of the SMSA adult population are high school graduates.

Employment

Employment figures for the Chicago SMSA are provided in Table D-4. The SMSA, the state, and the midwest region in general have experienced higher unemployment rates than the national average for the past several years. However, within the SMSA the unemployment rate ranged from a low of 3.6 percent in Du Page County to a high of 6.4 percent in Will County in 1990. Between 1980 and 1989 total employment in the Chicago area increased from 3,650,300 to 4,225,395 for a net change of 575,095 jobs. Most of this growth came in the trade and service sectors of the economy. The manufacturing sector, on the other hand, lost over 139,800 jobs (17%) during the same period.

SHORELINE AREA PROFILES

INTRODUCTION

The study includes Lake Michigan shoreline from Wilmette Harbor to the Illinois/Indiana state line. However, no serious erosion damage or flooding impacts were encountered in Wilmette or Evanston. Serious damage was found in 6 of 7 areas along the Chicago shoreline which, for study purposes, have been delineated into Reaches as follows:

Reach 1	North City Limits to Ardmore
Reach 2N	Ardmore to Belmont Ave.
Reach 2S	Belmont Ave. to Pearson (at Oak Street Beach)
Reach 3	Cermak to 31st Street
Reach 4	31st Street to 56th Street
Reach 5	56th Street to 79th Street
Reach 6	79th Street to the Illinois/Indiana State Line

To facilitate economic analysis (e.g. structure and facility inventory, demarcation of erosion prone areas) shoremile numbers (S.M.) have been assigned the various reaches based on the shore mile reference utilized in the 1975 Great Lakes Basin Framework Study sponsored by the USACE, North Central Division, as follows:

	North Point	South Point
Reach 1	593.000	589.686
Reach 2N	589.685	585.000
Reach 2S	584.999	580.900
Reach 3	580.899	574.900
Reach 4	574.899	570.450
Reach 5	570.449	566.300
Reach 6	566.299	562.599

Table D-3 Income and Education, Chicago SMSA

	Median 1/ Household Income 1989	Per 1/ Capita Income (1989)	Percent Persons Below Poverty Level (1979)	Percent 2/ Graduated High School (1980)	Percent 2/ with 4 Years College (1980)
Chicago SMSA (IL)	38,882	14,451	-	67.6	18.7
Cook County	35,844	13,622	13.6	64.3	17.1
DuPage County	51,189	18,529	3.0	83.0	29.0
Kane County	38,999	13,970	6.1	70.6	16.7
Lake County	54,229	18,391	5.3	77.6	28.1
McHenry County	42,161	14,757	4.2	74.9	17.1
Will County	37,445	12,650	6.4	70.2	16.5

1/ Based on 1989 estimates from CERL's Economic Impact Forecast System (EIFS).

2/ Education data applicable to population over 25 years of age.

Table D-4 Employment - Selected Characteristics in 1989 1/

Area	Unemployment Rate 2/ (1990)	Total Employment	Manufacturing	Wholesale/Retail Trade	Services
Chicago SMSA (IL)	5.8	4,225,395	670,556	983,951	1,254,476
Cook County	6.3	3,084,276	483,918	712,281	925,900
DuPage County	3.6	493,321	64,702	123,355	165,274
Kane County	5.9	162,855	34,465	37,056	44,839
Lake County	3.9	286,102	47,334	68,579	69,795
McHenry County	5.3	79,712	21,877	15,369	18,076
Will County	6.4	119,129	18,260	25,311	30,592

1/ Unless otherwise noted data are from the Regional Economic Information System, Bureau of Economic Analysis.

2/ Bureau of Labor Statistics.

The study area consists of public parks, beaches, infrastructure such as roads, electrical, telephone, and sewer lines, water filtration plants, ball diamonds, tennis courts, playgrounds, harbor facilities, concessions, airports, museums, zoos, piers, beach houses and parking lots. The categorical components of Chicago shore property and improvements measured via replacement value and registered as input into the evaluations are depicted in pie chart form in figure D-1. The distribution of shoreland property and improvements as measured via replacement value is depicted in bar chart form in figure D-2. Figure D-2 also displays the replacements value by reach boundaries, running North to South, Reach 1 to Reach 6, by shoremile.

Reach 1

Reach 1 extends from Juneway (7800 N.) to Lane (5934 N.). It contains $74,485,692 worth of facilities, beaches, and parks, including four historic buildings at Berger Park. There are 16.44 acres of parks and beaches. Reach 1 extends from shoremile 593.000 to 589.685. The evaluations in this study consider no part of this area to be subject to damages.

Reach 2

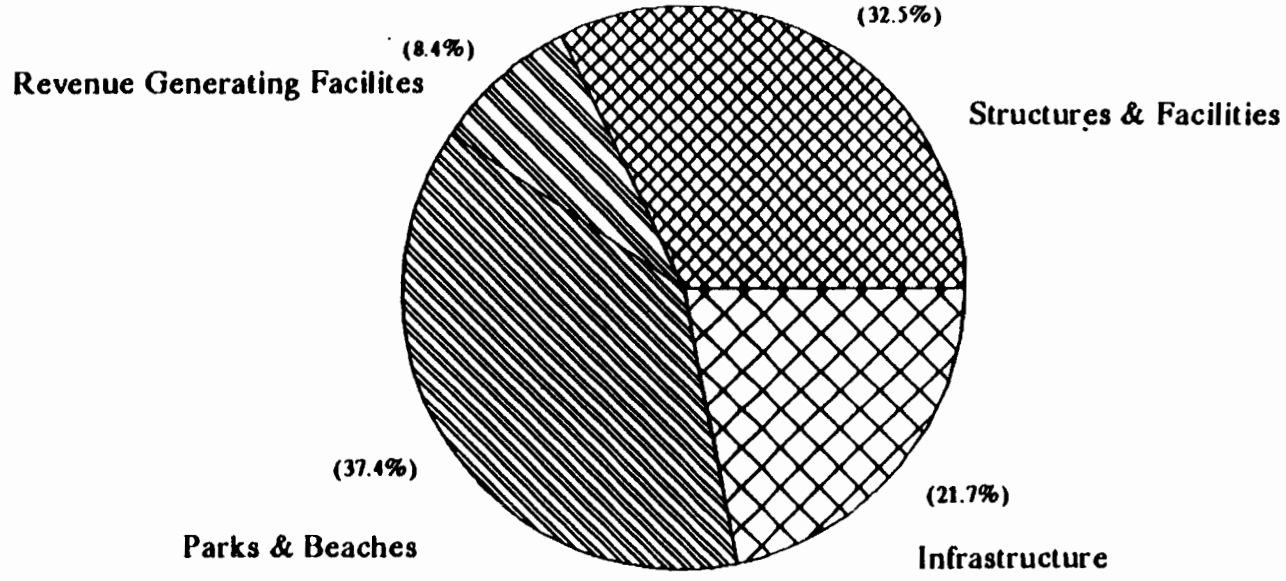
The first shoreline area included in the economic evaluations for Interim III is Reach 2. Reach 2 is a large portion of the Lincoln Park shoreline extending from 4300 north to 2800 north (Diversey Ave.). In previous studies this reach has been segmented at the Belmont Harbor entrance (3200 north) into 2N and 2S. Reach 2 contains $1,063,468,042 worth of facilities, beaches, and parks.

A principal feature of Reach 2 is comprised of Lincoln Park, which was established in 1865 shortly after the death of Abraham Lincoln. At that time its northern border was roughly what is now North Ave. (1600 N.). As the city grew the amount of free open public land was extended north along the shore. City ordinances were passed prohibiting any further development of the land for any commercial or residential use permanently setting aside 1212 acres for public use.

Lake Shore Drive (LSD) in Lincoln Park was started and partially completed during 1869 and 1870. From 1880 to 1894 LSD progressed north along the shore and had gone as far north as Fullerton Ave.(2400 N.). The north side of Chicago was quickly becoming a residential area. The construction of Lincoln Park and LSD were significant influential factors in this development. Originally the Drive was considered to be a recreational facility of Lincoln Park; but as heavier traffic developed, it became an essential way of moving traffic in the city.

LSD serves a similar function both north and south of the city center. However, unlike the southern shoreline, the area north of the Chicago loop does not support any rail lines parallel to the shore. This permits greater access to the shore in the area north of the Chicago Loop.

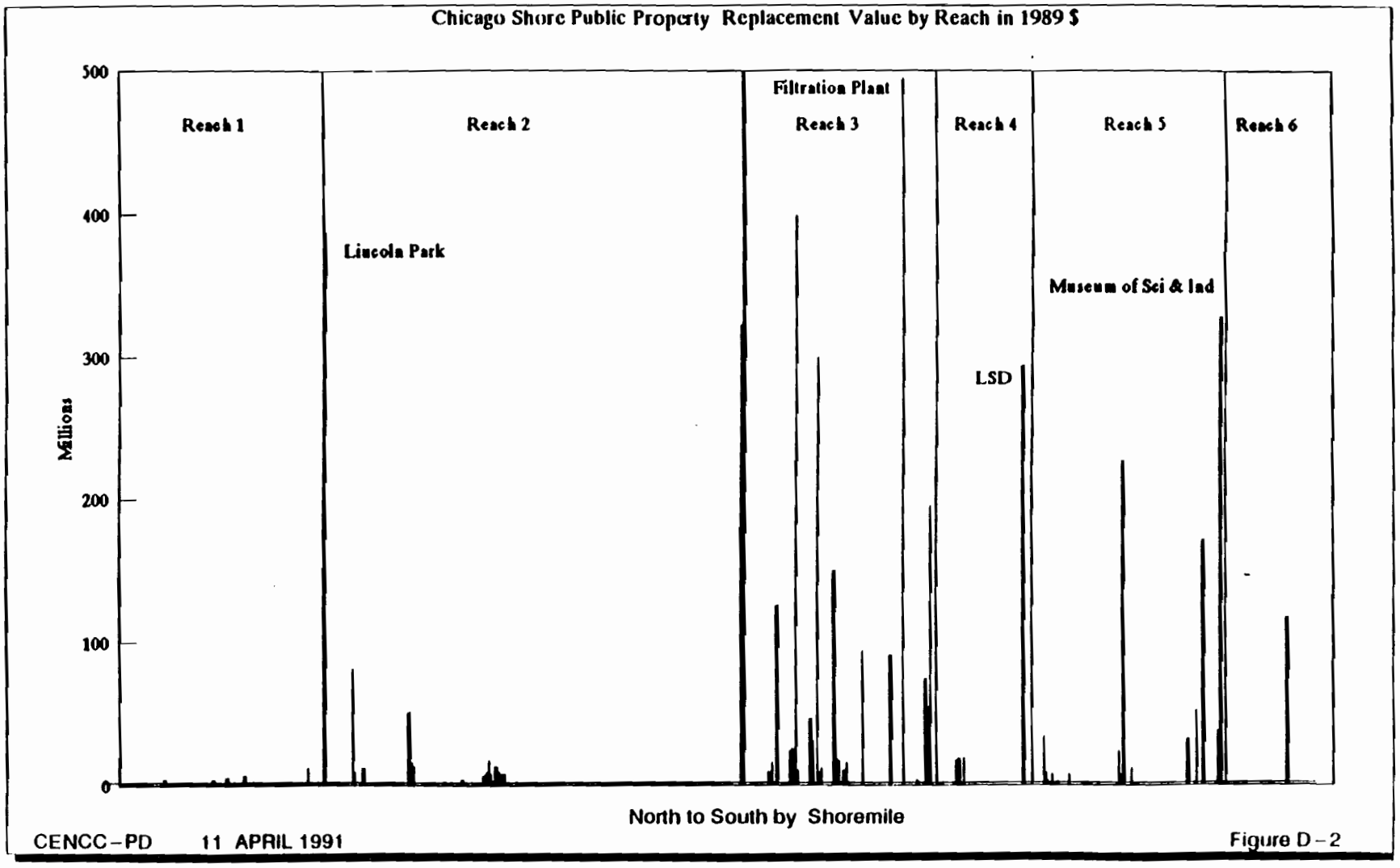
Components of Chicago Shore Public Property Value



Total Replacement Value = 5,062,978,948 (1989 $)

CENCC-PD 11 APRIL 1991

Figure D-1


Chicago Shore Public Property Replacement Value by Reach in 1989 $
500
400
300
200
100
0
Millions
Reach 1
Reach 2
Filtration Plant
Reach 3
Reach 4
Reach 5
Reach 6
Lincoln Park
Museum of Sci & Ind
LSD
North to South by Shoremile
CENCC-PD 11 APRIL 1991
Figure D-2

Reach 2 is a heavily developed and intensely used area. The study site features Montrose and Belmont Harbors, world famous (no entrance fee) Lincoln Park Zoo, conservatory, Chicago Historical society and Academy of Science buildings, a continuous path that some individuals use to travel to work while many use it for biking, jogging and walking, many service yards and garages, Marovitz golf course (a nine hole lake side Park district operated golf course), fishing, scuba diving, tennis courts, baseball fields, metered and non-metered parking spaces and ideal sites for relaxing watching listening to the lake.

Reach 3

Reach 3 extends from Pearson to 31st St. (shoremile 580.899 to 574.900). The most valuable area of this study site in terms of facilities replacement value per shoremile, Reach 3 includes $2,429,653,128 worth of lands, facilities, and infrastructure and 217.24 acres of beach and park.

Reach 3 contains, Grant Park, the cultural mecca of Chicago, as well as valuable facilities which serve the city. Reach 3 is subject to damages in three areas. LSD flooding occurs from North Ave. to just south of Division (S.M. 582.0 - 581.15). Shore destruction and land loss damages are foreseen in portions of the Northerly Island connecting peninsula between the Shedd Aquarium and the Adler Planetarium; and for the shoreline from North of 26th St. to the south end of the reach. (S.M. 575.8 -574.9)

Included in Reach 3 are facilities and structures necessary for city services, such as the water filtration plant at Navy Pier, the Ninth St. service yard, and Meigs airfield, a busy small plane airport located on Northerly Island.

Prominent in this reach are cultural facilities including the Art Institute, Petrillo Music Pavilion, and the Field Museum of Natural History at Grant Park. Adler Planetarium and Shedd Aquarium, Soldier Field stadium and central Park District offices are located here as well as one of the most popular views of the city from Northerly Island. Major convention centers, McCormick Place and Navy Pier with immense parking facilities for conventioneers, draw large crowds to this reach which produces revenues that surpass any other single location.

Reach 4

Reach 4 extends from 31st St. to 56th St. (shoremile 574.899 - 570.450). Reach 4 contains $360,590,274 worth of land and facilities and including 478 acres of public lands. Reach 4 is subject to damage throughout the entire area.

Reach 4 is a long narrow park land, Burnham Park, featuring one relatively small beach at 31st street. The site is used principally for bicycling, walking and running. Good running and bicycling paths exist throughout the park reach, and mile markers for roughly a 14 mile round trip are posted. the running/bicycling paths are set back in the park, not up against the

lakeshore. It is clear from aerial photos that at one time a wide concrete pathway existed all along the shoreline, right at the shoreline. Today these pathways have deteriorated for most of the length due primarily to the wash-out by storm waves of the earth material underlying the walkways. At some reaches the pathway is no longer recognizable, in most areas it appears as rubble.

The landscaping of the park is negligible within 50-100 feet of the shoreline. This condition is primarily due to wave wash-out where the existing shore protection is not high enough or has deteriorated over time. Steel posts have been driven in the lake at various locations to hold deteriorating step stone revetment in place. This same problem is not apparent in Reach 2 (Lincoln Park) previously profiled. Massive sodding would be useful in many areas throughout the park, but it would be difficult to maintain without rehabilitation of existing shore protection. In the past two years, however, 800 trees have been planted in the area.

Given the length of the park, it has very few parking facilities. South of 39th street and again south of 31st street there is nicely designed parking for 100 autos at each site. During storm conditions parking east of the drive is covered with water. The park offers beautiful views of the central city skyline, McCormick Place, the Hyde Park skyline and the entire Lake Michigan southern shore. A drive on the southern segment of Lake Shore Drive would provide similar views since the Drive virtually defines the western portion of Burnham Park. LSD would be immediately threatened at 46th and 48th streets if the shore protection were to fail.

Burnham Park serves as a lakeshore park and open space link nearly connecting Jackson Park to the south (nearly) with Grant Park to the north. Interfering with a continuous lake park shore link between south Grant Park and north Burnham Park is the McCormick Place edifice and Meigs airfield. The two parks near both the northern and southern extremes of Burnham Park are past sites of World's Fairs. The northern section hosted the Century of Progress exhibit in 1933-34; and to the south, in 1893, Jackson Park was the site of the World's Columbian Exhibition.

Two major arteries to the City exist in this area; LSD and the Illinois Central (IC) railroad. Since the early 1920's the railroad served an indispensable role of moving freight and people from the south and east into the growing city of Chicago. With the growth of auto traffic LSD was overlaid onto this area.

At 41st street roughly 700 feet from the lake shore, the IC rail lines are situated. At this point and at 37th street are the two areas where a severe shore destruction scenario would first jeopardize these rail lines. The IC railroad presently handles freight trains as well as a heavy traffic of commuter passengers. Easterly lines are used by diesel engine driven trains. Amtrak is a user of these lines for the "City of New Orleans" run and service down-state. The freight traffic line is mostly diverted at 16th street where a switch to/from the St. Charles Rail Line is executed. Four westerly lines are for overhead electric train and south usage. IC commuter

servicing areas include Joliet, the south suburbs, and south Chicago. Northern Indiana is served by Chicago South Shore (CSS) railroad company which leases IC rails in Illinois. In 1985 the IC recorded 9,000,000 passenger trips, the CSS roughly 3,000,000.

Burnham Park is land between the lakeshore and LSD. Access to the Burnham Park public land, LSD being a substantial barrier to access, is available every one-half mile through pedestrian overpasses at 35th St., 43rd St., 47th St., 51st St., and 57th St.. Pedestrian crossings on sidewalks are located at 31st and 39th streets and an underpass at 55th street aids access.

At 49th street, west of LSD and directly south of a multipurpose play field is a residential condominium high rise known as the Newport. The Newport consists of a north and south tower connected by the main entrance, offices, and common recreation facilities. This structure marks the northern lake side boundary of the Hyde Park neighborhood. It also has the distinction in this study of being the residential development most threatened by loss should the shore protection fail and the shore line erode. The north tower is approximately 320 feet from the existing shoreline, separated primarily by all eight lanes of LSD. The Newport consists of 728 units: 516 in the north tower, 312 in the south.

Reach 5

Reach 5 extends from 56th St. to 79th St. (shoremile 570.449 to 566.300). It contains $1,003,656,385 worth of land and facilities including 605.24 acres of beach and park. Reach 5 is subject to damages at the breakwater off 76th fronting the City's water filtration plant (shoremile 567.200 to 566.650), and at the point just south of 56th St. (Shoremile 570.449 - 570.300). Over $250,000,000 worth of facilities and public lands lie in damage prone areas.

Reach 5 contains valuable cultural and service facilities along with two nine hole golf courses (e.g. South shore and Jackson Park), eight launching ramps in Jackson Park boat harbor, tennis courts and athletic fields. Cultural facilities include the Rose and Japanese gardens at Jackson Park, the Museum of Science and Industry, and the South Shore Cultural Center and band shell. Valuable service buildings include: the coast guard house and La Rabida Sanitarium at Jackson Park; the water filtration plant, service building, and pumping station at 76th street.

Reach 6

Reach 6 extends from Avenue G to the Indiana state line (Shoremile 566.299 - 562.000). It contains $130,225,427 worth of lands and facilities including 194 acres of public lands and beaches. Reach 6 is subject to damages in two places, the 95th St. point (Shoremile 563.400-563.250) and the 98th St. point (Shoremile 562.800 - 562.600).

This reach contains a variety of important city facilities such as a powerhouse, Coast Guard Station, and a Department of Conservation building as well as recreation facilities like archery ranges, volleyball courts a beach house and launch ramps.

WITHOUT PROJECT CONDITIONS

The without project condition assumes that emergency maintenance measures only are taken. The future without project condition is defined to be the projected future condition of the problem area in the absence of a federal project. The without project scenario is discussed in the main report in the section entitled "WITHOUT PROJECT CONDITION".

Table D-5 shows the extent of land loss by reach under the future without project conditon. The six reaches shown in Table D-5 are identified by shoremile reference and the extent to which land loss is designated to occur in each reach. Note that reaches 2 and 4 contain over ninety percent of the impact shoremiles.

Table D-5 Linear Extent of Designated Loss by Shoremile by Reach

	Reach North	Reach South	Reach Total	Land Loss Total	Land Loss Ratio
Reach 1	593.000	589.686	3.315	0.000	0.000
Reach 2	589.685	580.900	8.642	5.050	0.584
Reach 3	580.899	574.900	5.999	0.991	0.165
Reach 4	574.899	570.450	4.449	4.449	1.000
Reach 5	570.449	566.300	4.149	1.046	0.252
Reach 6	566.299	562.599	4.299	0.350	0.081
Total	593.000	562.599	30.853	11.886	0.385

Land Loss = the number of miles of shoreline in which the shore protection has either failed or is in danger of failure.

Calculation of Future Without Project Recession Rate

It has been estimated that the long-term average rate of shoreline recession along the Chicago Lake Michigan shoreline would be 20 feet per year in the absence of any shore protection structures. For the future without project condition it is assumed that the City of Chicago and the Chicago Park District (CPD) would carry out some emergency protection measures with the limited budget available for such activities. According to the CPD and the City of Chicago, approximately $650,000 could be made available for emergency shore protection works. It is further assumed that the expected useful life of such emergency measures would not exceed three years according to estimates provided by the Chicago District's Coastal Engineering Team. Finally, the cost for emergency shore protection is estimated at $834 per lineal foot for Reach 2 and $2,078 per lineal foot for Reach 4. The large difference in cost between Reach 2 and 4 is due largely to differences in bathymetric conditions. It should also be noted that these costs

only include the cost of stone used to construct an emergency revetment and excludes any landscaping costs or premium for spot market availability of stone. Based on these costs an unweighted average cost for emergency shore protection is just under $1,500 per lineal foot.

Given a cost of $1,500 per lineal foot for the emergency protection structures and an annual budget ceiling of $650,000, only 433 feet of shoreline could be protected in any one year. If the average useful life of emergency shore protection measures is three years, then in any year only 433 ft X 3 years = 1,299 ft of shoreline per year could be protected. This represents approximately 3.45 percent of the total combined length of Reaches 2 and 4 (37,700 feet). Therefore, 96.55 percent of Reaches 2 and 4 would be unprotected even with emergency action by the local sponsors once existing structures fail. Based on this reasoning, the future without project shoreline recession rate is calculated as

20 ft/yr X (1 - .0345) = 20 ft/yr X 0.9655 = 19.3 ft/yr

Table D-6 below shows how the recession rate varies with different assumptions for the cost of emergency repairs. It is interesting to note from Table D-6 that the recession rate is quite insensitive to large changes in emergency repair cost until costs drop below $500 per lineal foot. For example, even with a 50 percent reduction in cost from the estimated $1,500 per lineal foot to $750 the rate of recession decreases from 19.3 feet per year to only 18.6 feet per year. For the future without project condition a recession rate of 19.0 feet per year is used. This figure is assumed to be a reasonable approximation of the effectiveness of the emergency actions and implies that 1,950 feet (5.2 percent) of Reach 2 and Reach 4 will be protected in any year by the emergency structures.

TABLE D-6

Calculation of Future Without Project Recession Rate

Repair Cost/FT	Annual Shoreline Repaired (Feet)	Average Shoreline Protected (Feet)	Average Percent Recession Shoreline Protected	Average Recession Rate (FT/Year)
$2,000	325	975	2.6%	19.5
$1,750	371	1,114	3.0%	19.4
$1,500	433	1,300	3.4%	19.3
$1,250	520	1,560	4.1%	19.2
$1,000	650	1,950	5.2%	19.0
$750	867	2,600	6.9%	18.6
$500	1,300	3,900	10.3%	17.9
$250	2,600	7,800	20.7%	15.9
$125	5,200	15,600	41.4%	11.7

Source: Calculated by Chicago District, Corps of Engineers

Reasonableness of the Future Without Project Emergency Action

The magnitude of expenditures required of the local sponsors, in this case the Chicago Park District and the City of Chicago, *to maintain the existing shoreline* in the absence of a planned Federal project is key to determining the reasonableness of the without project scenario. If such expenditures greatly exceed the local sponsors' anticipated operating funds then it is assumed that the local sponsors will have to budget for new construction outlays in order to prevent major destruction of existing infrastructure along Chicago's Lake Michigan shoreline.

To determine these expenditures a simulation model was developed which calculates the average annual cost of future emergency shoreline protection measures assuming that such measures are taken immediately following 100 percent functional failure of existing protection structures. The model assumes that 500 foot segments of the existing revetment will fail randomly at different times in the future rather than assuming that the entire shoreline is exposed at the same time. Other assumptions of the model are as follows:

1) The probability of 100 percent functional failure of the existing shore protection structures is derived from the functional response curves developed by the Chicago

District's Coastal Engineering Team for Reaches 2 and 4. Total functional failure for Reach 2 is expected to occur by the year 2008. However failure could occur as early as 2003 or as late as 2017. Similarly for Reach 4, complete functional failure is anticipated by 2003 with a chance that existing structures could be destroyed sometime between 1995 and 2007. For both reaches a triangular probability density function was used to model failure probabilities for each 500 foot segment, of which there were 75 segments in total (Table D-7).

2) Once a segment fails immediate emergency repair is performed. The cost of such repairs is estimated at $834 per lineal foot in Reach 2 and $2,078 per lineal foot in Reach 4.

3) The expected useful life of the emergency measures does not exceed three years. This is based on engineering judgment concerning the capacity of the emergency shore protection measures to withstand storm events of varying intensities. Such temporary structures are expected to fail structurally with storm events associated with a return interval of 1.5 years and longer.

TABLE D-7

Probability of Functional Failure of Existing Protection

	Reach 2		Reach 4	
Year	Prob	Cum	Prob	Cum
1995			0.0122	0.0122
1996			0.0274	0.0396
1997			0.0518	0.0914
1998			0.0654	0.1568
1999			0.0906	0.2474
2000			0.0960	0.3434
2001			0.1260	0.4694
2002			0.1380	0.6074
2003	0.0140	0.0140	0.1414	0.7488
2004	0.0476	0.0616	0.1114	0.8602
2005	0.0676	0.1292	0.0740	0.9342
2006	0.0942	0.2234	0.0464	0.9806
2007	0.1128	0.3362	0.0194	1.0000
2008	0.1232	0.4594		
2009	0.1112	0.5706		
2010	0.0998	0.6704		
2011	0.0832	0.7536		
2012	0.0736	0.8272		
2013	0.0620	0.8892		
2014	0.0486	0.9378		
2015	0.0330	0.9708		
2016	0.0206	0.9914		
2017	0.0086	1.0000		

Source: Chicago District, Corps of Engineers

The simulation model was implemented using the C programming language and developed on a desktop PC (Compudyne 386). The average annual cost of emergency repairs to maintain

the existing shoreline is based on the average cost in future years (base year 1995) for 100 simulations of shoreline failure (Table D-8). The average annual discounted cost using a Federal Discount Rate of 8.25% is $19.2 million dollars.

TABLE D-8

Emergency Expenditures for Shoreline Protection
Results From 100 Simulation Runs
($1,000s)

	1995	2000	2005	2015	2025	2035	2045
Average	561	10,672	27,917	35,414	37,381	36,437	36,949
Maximum	21,175	19,057	36,422	42,592	48,311	45,135	49,475
Minimum	0	4,235	20,541	25,855	28,181	27,763	26,489

Source: Chicago District, Corps of Engineers

TOPICS OF EVALUATION

The overall categories of impacts, those impact categories which can be measured in nearly every reach, associated with these economic evaluations include the following:

Traffic Delays due to Lake Shore Drive Destruction
Traffic Delays due to Lake Shore Drive Flooding
Storm Related Damage to Facilities
Loss of Recreation Opportunity

GENERAL METHODOLOGY

The damage estimations due to impacts from shoreline destruction were calculated for the without project and with project conditions. For traffic delays a externally developed traffic simulation model framework was adopted. Additional support for the methodology used in estimating transportation damages may be found in attachment 1. For the other categories the dominant operating mechanism for computations was in-house custom design spreadsheet construction and execution, using Lotus 1-2-3. In total three worksheet models, designed for particular damage category features, were developed. For all categories projected damages are discounted over a 50-year period at the FY93 interest rate of 8.25%.

TRANSPORTATION DELAYS

Lake Shore Drive is a critically important traffic artery in the City. Loss of this roadway, or any part of it, would result in significant delays for thousands of detoured motorists daily. Closure of Lake Shore Drive not only affects the normal traffic flow on this

road, but also causes delays for traffic that normally travels on the alternate (or detour) routes. There are two components to the transportation benefit methodology - 1) delays in travel time and 2) greater motor vehicle operating costs as a result of the longer travel distance on the detour route.

Value assignments were primarily based on the detailed and comprehensive analysis of traffic detours conducted for the Advance Measures (Autumn 1986) report at 57th and 49th streets and Lake Shore Drive. This Advanced Measures analysis provided a solid value to apply to each particular reach, and a reference value to use (via a traffic load adjustment keyed to the comparative LSD traffic volumes as well as the LSD segment length needed to be closed) in LSD roadway segments removed from the original analysis study area. Reach 1 and 2S are projected to erode LSD only after the segment has been eroded from a neighboring reach. So for these two reaches no traffic delay values were computed. The loss streams for each evaluation reach were discounted, summed to obtain present worth, and factored to determine the annualized value.

The benefit analysis will focus on one aspect of transportation: delays in travel time. Project benefits are measured as the avoidance of travel delays. Travel delay was measured by comparing travel time under normal circumstances (i.e. travel time on Lake Shore Drive) to travel time assuming sections of Lake Shore Drive were closed due to damages (i.e. travel time on detour routes). If traffic flow was generally light, incremental travel time would be relatively easy to determine. One could drive both routes and compute the difference. However, the closure of Lake Shore Drive would likely create severe congestion. The signalized urban streets which would serve as alternate routes do not have the excess capacity to absorb the traffic from the Drive. Determination of travel time under these conditions is not field testable. Therefore, a methodology which relates volume, capacity, and speed must be used to simulate traffic flow. The methodology developed by the National Transportation Research Board in the Highway Capacity Manual (1985), hereafter referred to as HCM, provided excellent assistance in determining these parameters. The HCM analysis consists of three parts: (1) determination of road capacity (vph), (2) estimation of traffic volume, and (3) evaluation of level of service (LOS) and operating speed. The following sections address these analyses.

Road Capacity

The first step in this procedure is to determine the saturation flow rate(s), defined as the maximum flow rate per hour assuming 100% of the time is available for traffic movement. Determination of s depends on geometric conditions (such as number and width of lanes, road gradation, and area type) and traffic conditions (such as parking maneuvers, bus stoppages, percentage of heavy vehicles, and turning movements, to name a few). Some of these factors were not readily observable in the field given the limited time available for such a task, so default values prescribed by HCM were used instead. The ideal saturation flow rate of 1800 vehicles per lane per hour is adjusted based on the considerations listed above to determine the value of s.

Capacity is determined directly from the saturation flow rate (s) by adjusting it to reflect the actual amount of time that traffic movement is permitted. The time during which movement is permitted is controlled by traffic control signals. Movement was assumed to occur only during the green phase of a traffic signal cycle. The proportion of time that a signal is green relative to the cycle length (C) is measured as the green ratio (g/C). The cycle length (C) is defined as the length of time (in seconds) from the onset of green until the following onset of green. Capacity is defined algebraically as $c = s \times g/C$.

Volume of Traffic

Average annual daily traffic volumes were obtained from a 1979 traffic map of Chicago, published jointly by the Departments of Transportation (United States of America and the State of Illinois), Chicago Department of Streets and Sanitation, and the Chicago Department of Public Works. Hourly volume, expressed in vehicles per hour (vph), divided by the capacity (derived above) yields a volume/capacity ratio. This is a measure of saturation. For example, a ratio of 1 means that a road is operating at its capacity.

Level of Service

The level of service (LOS), a method for typing flow characteristics of a road or network of roads, is assessed after computation of the travel speed. In this analysis, LOS and travel speed were determined by segment, by section, and then aggregated for the entire route. Travel speed is calculated in the parts - (1) running time and (2) intersection approach delay. The former is a measure of the time required to cover the length of a segment at free flow speed. Free flow speed is defined as the average speed attained by vehicles at mid-segment (i.e. areas farthest from intersection constriction) during low volume conditions. As the term indicates, running time includes only the time during which a vehicle is moving i.e. no stoppages or delays are included in this measure. HCM provides a table which relates running time per mile to free flow speed, length of segment, and arterial class. (The latter is a method for classifying roads based upon their intended function and design.) Running time is the product of running time per mile and segment length.

Intersection approach delay estimates the delays and stoppages that prevent vehicles from traveling at free flow speed. Its measurement includes such parameters as volume/capacity ratio, cycle length (traffic signal), green ratio, and road capacity. The estimation of intersection approach delay Is reliable for volume/capacity ratio, with values of 1.2 or less. (1.2 was used as the upper limit on the v/c ratio in this study.) A volume/capacity ratio greater than 1.2 indicates a very serious problem. When volume exceeds capacity, the result is a breakdown in service. Traffic flow is very unstable and queues form. The growth and dissipation of queues is an area of transportation research which has not been well documented. No estimation of queuing (or spillover effects to upstream road segments) was made in the Interim 3 analysis and for that reason the delays computed are conservative.

Total travel time is the sum of running time and intersection approach delay. Travel time

is converted into travel speed, which is converted into a LOS rating by using a HCM table which relates the two. Travel of service is interpreted as follows:

LOS Conditions
- A High maneuverability, approx. 90% of free flow speed
- B Slightly restricted maneuverability, 70% free flow spd
- C Stable conditions, approx. 50% free flow speed
- D Potentially unstable conditions, 40% free flow spd
- E Significant intersection delays, spd = 30% or less
- F Extreme congestion, very low operating speeds

Selection of Detour Route

Transfer of traffic from an eight-lane freeway to a network of signalized urban streets necessarily results in congestion and delays. Selection of detour routes was confined to streets close to the lakefront so that the impact on traffic would be localized. A comprehensive detour plan was developed for the Chicago lakefront between 75th St (7500 S) and Hollywood Ave (5700 N), although the entire length would not be affected by either erosion or flooding. When computing the travel delays for a particular reach, only that portion of the transportation route located within the reach boundaries was included. The selection of the most feasible detour route (which may include portions of more than one road) was based on the following considerations: (1) select roads with greatest number of lanes (parking and flow), i.e. avoid side streets with low volume/low capacity and little opportunity to expand capacity, (2) select "through" streets which run for extended distances (3) minimize number of turns (turns are necessary when one detour route involves the use of multiple roads), (4) avoid conflict of major flows at intersection (i"e. cross flows), (5) choose streets roughly parallel to the lakefront to satisfy general origin-destination patterns of motorists nod using Lake Shore Drive.

To facilitate discussion of the detour selection, the area will be divided into 3 sections: northside (Hollywood to Fullerton), central (Fullerton to 23rd), and southside (23rd to 75th). A list of roads by section and brief description follows.

Northside

(1) Clark - heavily commercial between Fuller and Belmont; mixed residential/commercial north of Belmont; 1 lane per direction plus parking on both sides of street; orientation: SE/NW

(2) Ashland -2 lanes per direction plus parking on both sides of street (Hollywood to Montrose); orientation: N/S; Ashland becomes increasingly far from the lakefront as one travels south because of the NW/SE orientation of the shoreline; at Montrose, Ashland is 13 blocks inland

(3) Broadway - runs from Diversey (2800 N) through Hollywood; 1 lane per direction with parking on both sides of street from Diversey to Montrose; north of Montrose, the lanes widen considerably allowing for the passage of 2 cars; orientation: primarily NW/SE, although north of Lawrence 4800 N), runs N/S

(4) Sheridan - 1 lane per direction with parking on both sides of street; runs from Diversey through Hollywood; primarily high-rise residential between Diversey (2800 N) and Sheridan E/W (3900 N); north of 3900 N, land use is a mixture of low-rise residential and commercial

Central

(1) Columbus - runs from junction with Lake Shore Drive at Field Museum (at about 1200 S) to Ontario (600 N); serves as connector to Ontario/Ohio, which carry cars to/from the Kennedy Expressway; 3 lanes per direction; no parking

(2) Michigan - extends northward only as far as Oak St (1000 N) where it connects with Lake Shore Drive; very heavily used by both motorists and pedestrians, especially between Ohio and Oak St; flow is normally quite slow in these congested areas

(3) other N/S streets west of Michigan - run through central business district and are therefore subject to disruptions which impede flow (e.g. turns, pedestrians, parking maneuvers, busses, etc.); it would be more advantageous to choose a detour which would bypass the City's congested downtown

(4) LaSalle - runs through CBD; however, north of Ontario/Ohio (north of CBD), 2 wide lanes per direction plus parking on both sides of street; since neither Columbus nor Michigan run through to Fullerton, LaSalle serves as a good N/S detour street to carry traffic north of Ontario

Southside

(1) Martin Luther King Jr. Drive - 3-4 wide lanes per direction plus parking from 23rd to 35th; narrows to 2 wide lanes per direction from 35th to 5lst; south of 5lst, dwindles to 1 lane per direction and loses its arterial status

(2) Cottage Grove - 2 lanes per direction with parking; runs from 75th to about 35th St; orientation: N/S; because shoreline runs NW/SE, Cottage Grove becomes quite far inland as one progresses south

(3) Stony Island Drive - 4 lanes per direction plus parking; runs from 75th to 67th, where it splits: 2 lanes continue north as Stony Island, 2 lanes become Cornell; Stony Island terminates at 56th St.

(4) Drexel - 3 lanes per direction plus parking; runs between 75th and Oakwood, where it merges with Cottage Grove; however, south of 5lst, it dwindles to a side-street-type road and becomes discontinuous at some intervals

Although there are other streets available, the search for a detour was confined to those streets most qualified to handle heavy flows. Side streets of narrow widths that are often controlled by stop signs may have less traffic, but operating speed would be slow due to considerations other than just volume vs. capacity. Movement away from the congested lakefront area would not necessarily reduce travel time either. In this instance, greater travel distance would be a factor.

The intent of this analysis is to identify a plausible detour route, impose traffic management principles, and determine the incremental travel time (delay) under these conditions. It is assumed that if the City enacts a traffic management plan to improve flow on selected streets, that motorists will favor those streets. Once LSD is permanently closed, it is assumed that all motorists are aware of the situation and select an appropriate detour route.

The selected detour, beginning at the northern end of Lake Shore Drive at Hollywood Ave, is:

Ashland/Broadway from Hollywood (5700 N) to Montrose v 400 N)
Clark/Broadway from Montrose (4400 N) to Belmont (3200 N)
Clark/Sheridan from Belmont (3200 N) to Diversey (2800 N)
Clark/Cannon-Stockton from Diversey (2800 N) to North Ave (1600 N)
LaSalle from North Ave (1600 N) to Ontario/Ohio (628 N/600 N)
Ontario/Ohio from La Salle (150 W) to Columbus (300 E)
Columbus from Ontario/Ohio (628 N/600 N) to Balboa (700 S)
Michigan from Balboa (700 S) to l4th St (1400 S)
Michigan/Indiana from l4th St (1400 S) to Cermak (2200 S)
King Dr. from Cermak (2200 S) to 5lst St (5100 S)
Ellisworth-Russell-Best from 5lst St (5100 S) to Cottage Grove (200 E)
Cottage Grove from Best (5950 S) to Marquette (6600 S)
Marquette from Cottage Grove (200 E) to Stony Island (1600 E)
Stony Island from Marquette (6600 S) to 75th St (7500 S)

Traffic Delay Parameters Considered

Traffic Control

To minimize the friction of diverting normal Lake Shore Drive traffic to the detour routes, the National Cooperative Highway Research Program (NCHR4 Report #194, entitled "Traffic Control in Oversaturated Street Networks", was consulted to determine possible solutions. These solutions apply to the existing network of streets and do not require major

road construction. Two types of control are possible -- signal and non-signal. The traffic management plan described below is purely hypothetical and is not intended to describe what actions the City of Chicago will take nor what actions it should take. The purpose is to suggest a plan which could potentially reduce congestion, and thus provide a conservative estimate of travel delays.

Non-signal Controls

Non-signal controls include regulatory and operational measures. The former may include such options as turning and parking prohibitions and the enforcement of such. Operational measures include the addition of turning bays, major lane arrangement modifications (such conversions to one-way streets or reversible lane flow), and the elimination of disruptions to flow (from pedestrians, bus stops, parking maneuvers, and unrestricted mid-block access). In this analysis, several operational measures were implemented in the detour plan, where applicable. These included conversion of some streets to one-way streets (Ashland, Clark, Michigan south of 14th St to southbound; Broadway, Sheridan, Cannon, Stockton, Indiana to northbound), reduction of bus stops, and elimination of parking on selected detour streets.

Signal Controls

Existing green ratios were adjusted to accommodate flow and avoid queuing whenever possible on the detour route while at the same time acknowledging the traffic in the cross-flow, direction. That is to say, green time was allocated proportionately based on the flow ratios of the two opposite flows meeting at the intersection. The equation used to determine the appropriate green times is: $g1 = (v/s1)(C/Xc)$, where g1 = green time for flow 1 (sec), v/s1 (sec), v/s1 = flow ratio for flow 1, C = cycle length (sec), and Xc = volume-capacity ration for the intersection.

Value of Delay

"A Manual on User Benefit Analyses for Highway and Bus-transit Improvements", written by the American Association of State Highway and Transportation Officials (AASHTO), was used to place a value on the time delays resulting from the closure of Lake Shore Drive. According to AASHTO, the value assigned to time savings is a function of trip type, the amount of time saved, and income. There is a direct relationship between the amount of time saved and the value of time. Value; were assigned to 3 time bands-- 0-5 min, 5-15 min, and over 15 min. "To work" trips are valued most highly. For time savings in excess of 15 minutes, the value of time is the same regardless of trip type.

The AASHTO manual is in January 1975 price levels, but can be updated using recent income figures specific to the area. The estimated 1987 average household income for Cook County is $34,960. This value is divided by the number of work hours per household per year to derive average hourly income. Based on 1980 Census information, there are an average of 1.25 employees per household. Assuming that all workers are full-time, the

average number of work hours per household is 2600 (2080 x 1.25) and the average hourly income is $13.45 ($34,960/yr. / 2600 hrs/Hr/yr.). Value of time is computed as a percentage (which varies by trip purpose) of average hourly income and this adjusted by the average number of adults per vehicle. The number of passengers per car varies according to trip type, with the fewest adults per car for work trips (1.22) and the greatest number for social/recreational trips (1.98). The derived values ($1987) are shown below.

Condition	Value of time per hour
Low time savings (0-5 min)	
work trip -- to	$1.05
-- from	0.46
avg. trip	0.59
weekend	0.75
Medium time savings (5-15 min)	
work trip -- to	$5.28
-- from	3.97
avg. trip	5.08
weekend	6.44
High time savings (>15 min)	
work trip -- to	$ 8.58
-- from	8.58
avg. trip	10.97
weekend	13.93

Travel Delays - Lake Shore Drive Traffic

Travel times were computed for three periods: peak hours (weekday), non-peak hours (weekday), and weekend. Peak hours were defined as the hours when motorists are traveling to work, generally from 0700-0900 hours, and the peak hours for the trip home from work, 1600-1800 hours. The National Cooperative Highway Research Program Report #187, "Quick Response Urban Travel Estimation Techniques and Transferable Parameters User's Guide", was used to distribute the daily traffic total by hourly volume for the two time bands (peak vs. nonpeak) used to analyze the traffic delays. The 24-hr avg. hourly traffic was used for the weekend analysis.

Travel Delays - Normal Detour Route Traffic

Normal traffic on the detour route would also be impacted by the closure of Lake Shore

Drive. These volumes were likewise obtained from the 1979 Chicago Traffic Map. The incremental travel time on the detour route due to the heavier traffic is used to determine the traffic delays to the detour traffic. An analysis was similarly performed for the three time periods described earlier - work (peak) weekday hours, non-peak weekday hours, and weekends. For purposes of this analysis, it is assumed that basic traffic flows have not significantly altered since the previous study.

Additional Comments

It should be noted that in addition to travel delays there are other transportation-related considerations, which are not quantified in this analysis. The first of these issues is safety. Lake Shore Drive is a limited access roadway. Urban streets, on the other hand, introduce conflicts in the traffic flow by permitting unrestricted access. These disruptions include mid-block access (such as driveways at bank drive-thru windows, fast food restaurants, parking lots, high-rise residential buildings), pedestrians, and bus stops. These traffic disruptions combined with a very large traffic volume increases the potential for accidents involving both pedestrians and vehicles. Such traffic volume on an urban street would not be desirable.

The traffic management plan suggested in this analysis calls for the elimination of parking on all detour streets. The loss of parking would affect 3 groups: residents/customers, businesses, and the City of Chicago (revenue collection). The need for parking, especially when car ownership and usage is on the rise, is at a premium. Loss of parking would impact businesses by making deliveries more difficult and reducing the likelihood that patrons will find parking. Most of the streets included as detours pass by residential areas. The use of parking by locals is common. Alternative parking is not readily available.

Incremental mileage was not claimed as a damage category. Nor were delays associated with east/west streets connecting the detour to the Drive included. The benefits are based solely on substituting an alternate north/south detour for the closed portion of Lake Shore Drive. Increased operating costs associated with lower operating speeds (due to congestion on the detour) were not included either. The point here is not to suggest that these categories are trivial. However, assuming large portions of the Drive are closed and that closure extends to areas near the central business district, motorists may choose not to return to Lake Shore Drive if their destination is relatively close to the termination of the detour. Continuing with this line of reasoning, the incremental mileage (Lake Shore Drive versus the north/south detour) would be minor. Operating costs are a legitimate category, but could not be developed within the time frame for study completion.

Traffic Delay Losses

Reach 2

Between Fullerton and Montrose, Lake Shore Drive is 4 lanes per direction. Estimated daily traffic is 102,500 vehicles. Truck traffic is prohibited on the Drive. Therefore, no commercial truck traffic would be affected.

The distance between Lake Shore Drive and the shoreline varies. The minimum distance within a reach determines the year of closure for that reach. There are 4 exit/entrance ramps on Lake Shore Drive in the vicinity: Fullerton, Belmont, Irving Park, and Montrose. These access points control the length of Lake Shore Drive that will effectively be closed when erosion in any given reach has reached the Drive. For example, although an impact section extends from Fullerton to Diversey, the next exit/entrance to the north is at Belmont. Therefore, an area longer than the impacted section boundaries would be unusable. Given the shoreline widths, the sequence of closure schedule is first Fullerton to Irving Park and then Fullerton to Montrose. Travel time on a detour route between these points of closure on the Drive represents the without project condition. Northbound lanes are closed first, southbound lanes, being landward, are assumed to close 1 year later.

The detour route for northbound traffic is Stockton (Fullerton to Diversey) - Sheridan (Diversey to Belmont) - Belmont (Sheridan to Broadway) - Broadway (Belmont to Montrose). Presently, the detour streets operate at a LOS of C as an average over a 24-hr period. Two-way flow on these streets would be converted to one-way (northbound). Parking would be eliminated. With these modification, 4 lanes would be available for northbound traffic movement. Clark St is the southbound detour route. Upon conversion to one-way flow and elimination of parking, Clark would also provide 4 lanes for traffic movement. Average annual daily traffic counts are as follows: Stockton - 1000, Sheridan - 13200, Belmont - 17400, Broadway - 15700, and Clark - 15700.

Normal average travel time on the detour route (Fullerton to Montrose) is 10.5 min northbound on Stockton/Sheridan/Broadway; 9.5 min, southbound on Clark. Travel time on Lake Shore Drive between the same points is 3.3 minutes. These represent travel times under average flow conditions. The traffic delay analysis is in fact based on 3 time periods. The listing below shows the incremental delay (in minutes) per vehicle for these 3 periods.

Reach 2 incremental travel time (min):

Lake Shore Drive:	peak hr	non-peak avg.	weekend
Fullerton-Irving Pk			
Northbound	32.5	3.8	3.9
Southbound	22.7	4.2	4.3
Fullerton-Montrose			
Northbound	40.7	4.7	4.8
Southbound	28.6	5.4	5.4
Regular Detour Route Traffic:			
Fullerton-Irving Pk			
Northbound	11.7	-1.9*	-2.0
Southbound	13.3	-0.7	-0.7
Fullerton-Montrose			
Northbound	13.3	-2.1	-2.3
Southbound	17.2	-0.8	-0.8

*Negative values indicate time saved.

Total annual delay costs (value of time 1992 $) associated with closure of Lake Shore Drive between Fullerton and Irving Park are $25,723,033. Closure of the Drive between Fullerton and Montrose would result in delay costs totaling $40,820,507.

Reach 3/4/5

The losses in Reaches 3, 4, and 5 are interrelated because the southern portion of Lake shore Drive is contained in these reaches. The area of potential impact extends from 55th St. to 23rd St.. The area in Reach 4, from 26th St. to 55th St., is subject to roadway loss throughout the entire reach.

Access points are located at 23rd St., Oakwood (3946 S.), 47th St., and 57th. Although the land loss threat does not extend much farther south than about 55th St., the southern end of LSD is assumed to be virtually useless if closure occurs at 57th St. It would be pointless to enter at any point south of 57th St. only to exit at 57th St. The closure sequence for the northbound lanes of LSD is the following: first, 55th to 47th St.; then 47th to 31st; and the 31st to 23rd. Northbound lanes are closed first, southbound lanes, being landward, are assumed to close 1 year later.

LSD is 3 lanes per direction between 55th and 57th. North of 57th, LSD has 4 lanes per direction. Average daily traffic totals 53,600 vehicles. Travel time form 23rd to the south most impact area is approximately 7.5 minutes, under average flow conditions. The detour route (i.e. the north/south substitute) is Cottage Grove (between Marquette and 60th), Best-Russell-Ellisworth roads (through Washington Park), and Martin Luther King Jr. Drive (51st

to 23rd). Average operation conditions over a 24 hour period are given a LOS rating of B-C. As part of the traffic management plan, parking along the detour route was prohibited. The number of lanes available per direction for traffic movement varies from 2 to 5. Presently, travel time on the detour in the northbound direction is estimated at 16.9 minutes. Southbound, the travel time is 16.7 minutes. These times represent average flow conditions. The incremental travel times used in the economic analysis are shown below:

Reach 3/4/5 incremental travel time (minutes):

Lake Shore Drive:	peak hr	non-peak avg.	weekend
Marquette-47th			
Northbound	21.2	3.6	3.9
Southbound	25.1	4.0	4.3
Marquette-31st			
Northbound	41.3	6.3	6.6
Southbound	45.1	6.5	7.0
Marquette 23st			
Northbound	43.6	7.3	9.6
Southbound	50.2	7.6	8.0
Regular Detour Route Traffic:			
Marquette-47th			
Northbound	16.4	-0.9*	-0.6
Southbound	20.0	-0.6	-0.3
Marquette-31st			
Northbound	33.0	-1.5	-1.2
Southbound	36.6	-1.2	-0.8
Marquette 23st			
Northbound	33.4	-2.1	-1.7
Southbound	40.3	-1.5	-1.1

*Negative values indicate time saved.

Total annual delay costs (value of time 1992 $) associated with closure of Lake Shore Drive between Marquette and 47th are $12,983,075; between Marquette and 31st, $34,889,431; and between Marquette and 23rd, $39,469,744.

Summary of Road Loss Delay Projections

Given the incidence of LSD loss due to storm and storm related land loss the annualized value of this loss of value due to increased travel times is summarized in Table D-9.

Table D-9 Weighted Average Annual Transportation Damages*

	REACH 2			REACH 3			REACH 4			REACH 5		
Year	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages
1995				$3,508,921	0.0399	$140,006	$17,603,008	0.0122	$214,757	$9,779,449	0.0122	$119,309
1996				$3,241,497	0.105	$340,357	$16,261,439	0.0274	$445,563	$9,034,133	0.0274	$247,535
1997				$2,994,455	0.1645	$492,588	$15,022,114	0.0518	$778,146	$8,345,619	0.0518	$432,303
1998				$2,766,240	0.2055	$568,462	$13,877,242	0.0654	$907,572	$7,709,579	0.0654	$504,206
1999				$2,555,418	0.1745	$445,920	$12,819,623	0.0906	$1,161,458	$7,122,013	0.0906	$645,254
2000				$2,360,663	0.1399	$330,257	$11,842,608	0.0960	$1,136,890	$6,579,227	0.0960	$631,606
2001				$2,180,751	0.1001	$218,293	$10,940,053	0.1260	$1,378,447	$6,077,807	0.1260	$765,804
2002				$2,014,551	0.0563	$113,419	$10,106,285	0.1380	$1,394,667	$5,614,603	0.1380	$774,815
2003	$11,372,944	0.0140	$159,221	$1,861,017	0.0203	$37,779	$9,336,060	0.1414	$1,320,119	$5,186,700	0.1414	$733,399
2004	$10,506,183	0.0476	$500,094				$8,624,536	0.1114	$960,773	$4,791,409	0.1114	$533,763
2005	$9,705,481	0.0676	$656,091				$7,967,239	0.0740	$589,576	$4,426,244	0.0740	$327,542
2006	$8,965,802	0.0942	$844,579				$7,360,036	0.0464	$341,506	$4,068,909	0.0464	$189,725
2007	$8,282,497	0.1128	$934,266				$6,799,109	0.0194	$131,903	$3,777,283	0.0194	$73,279
2008	$7,651,267	0.1232	$942,636									
2009	$7,068,145	0.1112	$785,978									
2010	$6,529,464	0.0998	$651,641									
2011	$6,031,838	0.0832	$501,849									
2012	$5,572,136	0.0736	$410,109									
2013	$5,147,470	0.0620	$319,143									
2014	$4,755,169	0.0486	$231,101									
2015	$4,392,766	0.0330	$144,961									
2016	$4,057,982	0.0206	$83,594									
2017	$3,748,713	0.0086	$32,239									
Weighted AAD			$7,197,502			$2,687,062			$10,761,376			$5,978,542

Note: Damages are shown in 1992 $, FDR=0.0825 Base Year = 1998
Revised 5/25/93

FLOODING DAMAGES

Flooding damages are limited to transportation delays caused by partial closure of South Shore Drive and Lake Shore Drive. The flood-prone areas include 2200 ft. of shoreline between Oak St and North Ave (Reach2) and the intersection of 67th St and South Shore Drive (Reach 5). The transportation delay methodology used to evaluate the impacts from the loss of use of LSD was used to estimate the impacts of flooding induced road closure increasing travel time, with one critical exception: because flooding would occur without warning, a traffic management plan incorporating operational or signal modifications was not assumed. Although it may be argued that if erosion closed Lake Shore Drive in areas adjacent to the flood-prone sections, that a traffic management plan would have probably already been implemented for the assumed detour route, it was the attempt of this analysis to determine the feasibility of each section separately. In that respect, these two benefit categories are independent.

Reach 2

The analysis of Reach 2 assumes flooding of all 8 lanes of Lake Shore Drive between North Ave and Oak St.. Because of the limited number of access points to/from the Drive, flooding in this area would close the roadway between North Ave and Monroe St. (At the junction of Michigan Ave/Lake Shore Drive, southbound egress from and northbound ingress to the Drive is possible. However, the reverse movements would be necessary in order for the Michigan Ave junction to function as a detour.). An analysis of the overtopping rates was performed by the Coastal Engineering section as part of the Advance Measures program (1986-88). From that analysis, it was concluded by the coastal engineers that a storm of the severity to flood Lake Shore Drive in this location would occur approximately once every 15 years. Storm duration was assumed to be one day. The clean-up effort was also assumed to require a one day period. Therefore, total closure of Lake Shore Drive was set at 48 hours.

Average daily traffic on Lake Shore Drive in this area is 102,500 vehicles. Travel time between North Ave and Montrose St under average flow conditions is about 4 min. Under normal conditions an the detour route, travel time is approximately 16 min. Because of the temporary and unexpected nature of the problem, the ensuing congestion and confusion would increase travel time an the detour route to about one hour 20 minutes. The total delay cost associated with closure of 48 hours under these conditions is $6,857,400. On an average annual basis, the delay cost is $482,760. Updated, accounting for decline in FDR and an increase in income levels (i.e. value of time) average annual damages equal $577,580 in 1992.

Reach 5

When overtopping occurs at the intersection of 67th St and South Shore Drive, SSD), flood water runs south on SSD and floods the road through about 7lst St, The general area is residential in nature and "good' detour routes are few. It was assumed that northbound

vehicles detour from SSD at 75th St, travel west on 75th to Stony Island Blvd, travel north on Stony Island to Marquette, and, on the final leg of the detour, travel east on Marquette to the junction of Lake Shore Drive/South Shore Drive. (The reverse is true for southbound vehicles.) Travel time an SSD under average flow conditions is about 3.5 miles normal travel time on the detour route is 9.8 min; however, under the congested conditions of an unanticipated flood event, travel that increases to about 15 minutes. Average daily traffic on SSD north of 7lst St is 23,300 vehicles; south of 7lst St, 10,400 vehicles. This location was also studied as part of the Advance Measures program. The frequency of flooding was determined to be about once every 7-8 years. A closure duration of 36 hours per event (including clean-up) was assumed. The cost of the delay associated with one 36-hr closure is $39,900. Average annual delay cost is $5,100. Updated, accounting for decline in interest rate and increase in income levels (i.e. value of time), the estimate is $6,105 average annual projected loss (1992 dollars and 8.25 FDR).

DAMAGE TO FACILITIES AND LOSS OF RECREATIONAL OPPORTUNITIES

Under the without project condition existing physical structures and facilities on Park District property would be lost, including buildings, gardens, and roads. Revenue producing facilities such as parking lots, boat handling facilities, and concessions stands would be lost. Use of park lands and facilities would be lost. A worksheet model was developed and applied to evaluate damages to improvements and facilities at the study area. A similar worksheet model is employed in evaluating the loss of use value at the study area. A similar worksheet model is used to evaluate the direct and immediate user affected impact under the with project conditions.

The following report sections will define the data inputs used in the worksheet models, relate and define how the parameters were applied in the worksheet evaluations, discuss the features which distinguish each of the worksheet models, and present the results from the application of the worksheet models.

Facilities and Structures, and Use Inventories

A thorough listing of public facilities and annual number of visitors by type of activity has been supplied by the City and the Park District for purposes of this evaluation. The listing of facilities and features is referred to as the "Facilities and Structures Core". The inventory of use is known as the "Use Core". Though extensive, for the readers appreciation these compilations are reproduced as attachments 1 and 2 in the attachments accompanying this appendix. These inventories largely contributed by the City and the Chicago Park District to the progress of these evaluations. Further written documented support for the information used in these worksheet model evaluations is included as attachment 3 in the attachments "Narrative in Support of Inventories" accompanying this appendix.

User Day Value Estimations for Recreational Opportunities

To measure the value of lost recreational opportunities stemming from the destruction of recreation sites at and along the shore the user day value methodology was employed. Working closely with the City of Chicago and the Chicago Park District numerous user point schedules were developed for the diverse nature of recreation activities which take place along the Chicago shoreline. The product of the user day method point assignments and the corresponding translation into FY93 user day values are shown as attachments d-3-B and D-4. These use values when applied to the existing rate of usage along the shoreline shown in item D-3-A, result in an estimate of total recreational user value attributable to the use of the Chicago shoreline of $ 563,455,368 annually.

Definitions

Many of the elements of the worksheet models developed to evaluate the categories of impacts are defined and explained below in a series of definitions. The definitions refer to features of the worksheet models. Further explanations of the logic of the models, using the terms and parameters defined, a drawing of the distinctions found among the models, and the presentation of the findings based on these worksheet models concludes this section.

Impact Areas

Those shoreline stretches which have been determined to be subject to the effective loss of protection once provided by their original shoreline protection features.

Land Loss Rate

The rate of land loss measured in feet per year. This land loss is to begin in the future, once the existing shoreline protection looses effectiveness. Portions of the study area shoreline are deemed subject to storm related land loss and erosion at a rate of 19 ft./yr.

Onset Year

The year in the future where the existing shoreline feature looses its effectiveness, allowing land loss to commence. This year can be different by reach. The onset year is recorded as a calendar year (i.e. 1998).

Onset Preview

A feature of the worksheet models used in the risk/probability analysis which allows for the consideration of failure occurring some integer number of years (including negative integers) different from the established onset year. This feature is intended to account for the lack of (storm/engineering) certainty in the determination of the onset year.

Base Year Discounting Reference

The base year of the discount stream. A calendar year (e.g. 1998) is used as the base year of the discount stream in this evaluation. The base year allows for a benchmark reference, in order to facilitate the standardized comparison of impacts between reaches with varying damage onset years. Base year discounting reference is the same for all reaches.

Landward Distances

"Shoreline" refers to the point where the land shore meets the lake water. The impact areas are largely coffer dam developed landfill, and the shoreline does not vary with lake water levels except for the beach shorelines. Distance measurements were taken from 1987 aerial photographs for distance landward from shoreline. The beginning landward distance records in feet the distance from the shoreline to the closest point of the item. The ending landward measures the farthest point from the shoreline of the item. For some facilities, such as buildings, the begining landward and ending landward measurements are equal, as use of the facility would be lost as soon as part of it is damaged. Landward distance is used in the determination of the destruction commencement year and destruction cessation year.

Replacement Value

The 1989 replacement value of facilities, structures, infrastructure, and park land as provided by park district personnel. This is updated to 1992 dollars using ENR indices. See attachments numbers D-1 and D-4 to this appendix for further explanations.

Initial Loss Year

The interval in years between the base year discounting reference and the incidence of storm related damages and land loss impacting the feature. The initial loss year is determined by dividing the landward distance by the land loss rate and adding this value to the difference of base year discounting reference and onset year. The calendar loss year may then be determined by adding the initial loss year to base year discounting reference. Say the base year discounting reference is 1992 and the initial loss year is 17: the calendar year loss year is then 1992+17 or year 2009.

Final Loss Year

The interval in years between the base year discounting reference and the period at which that feature would be entirely consumed due to land loss. Analogous to initial loss year but determined using the end landward distance as opposed to the begin landward distance.

Registry of Loss Value

This is an entire section of the worksheet: It consist of a battery or registry of fifty columns where the appropriate value of loss for each feature (e.g. improvement, revenue, use) is registered. These loss registry columns represent a particular year in the future, all in reference to the base year discounting reference (e.g. 1998). If the column representing a particular year in the future is within the "Initial Loss Year" and "Final Loss Year" range of the feature, then the appropriate loss value is computed and enters the time registry for that feature. If the column representing a particular year in the future is outside the "Initial Loss Year" and "Final Loss Year" range of the activity attribute then the appropriate loss value defaults to 0. Now the "Initial Loss Year" and "Final Loss Year" are directly related to the "Loss of Land Rate" and "Onset Year". The penultimate operation in the worksheet models is to compute the total losses for each year. This merely requires the vertical summation, of all the loss entries in the fifty columns, each column representing a future year.

Reduction, Discounting and Annualization of Loss Value

The worksheet models contain an area where the loss registry is summed resulting in fifty yearly loss totals which comprise the undiscounted stream of losses over fifty years. The stream of losses years 1-50 (e.g. initial loss year through final loss year for each feature), are discounted and the discounted stream of losses is summed. Using the designated federal discount rate (FDR) (e.g. 8.25% for 1993), the model computes the annualized value of loss from the sum of the discounted stream of loss. Each of the worksheet models then has as a final output the annualized value of loss by reach due to:

1. Facilities, structures and infrastructure replacement value loss;
2. The loss value of use (recreational and passive);

Without Project Conditions

The probability weighted average annual damages by reach for facilities and infrastructure loss are shown in Table D-10. Facilities and Infrastructure losses equal $12,695,408 on a probability weighted average annual basis. The probability weighted estimate of loss recreational use due to damaged and lost shoreline is $18,505,231 on an average annual basis in 1992 dollar values. The complete recreational loss profile by reach is shown in table D-11. This loss estimate is the function of three major parameters in the worksheet model: 1) the time/probability of loss schedule; 2) the loss rate; 3) the level and type of activity ongoing at the site. Of these three parameters the level and type of activity has been fully supported it has been provided by the City of Chicago and the Chicago Park District in a hands on working relationship with the Corps Chicago District planners. The loss rate and time of erosion onset were developed by the coastal engineers of the Chicago District. Both the timing and loss rate have been included in the sensitivity analysis.

With Project Conditions

The projects designed to protect the shoreline from increasing storm damage destruction are described in detail in the main body of this report and consist, in general, of:

1. Replacing the existing shoreline revetments via a placement of stone rock in a random fashion (i.e. Plan 1 - Random Rubble) or;
2. Reconstructing the existing shoreline revetments in a fashion more closely resembling the existing step-stone revetments (i.e. Plan 4 - Step Stone).

Both plans, 1 and 4, will prevent the loss of park land, so the facilities in the park and the recreational activities which take place in the park will be preserved. Only in the shoreline configuration component of recreation value will a contrast in residual damages between the plans be apparent. Plan 4 - Step Stone, allows for much greater access to "at water activity" (e.g. fishing, running, biking, ... reference attachment 3); whereas Plan 1 - Random Rubble, severely restricts "at water activity".

There is a difference in recreational value between the two plans. Plan 1 is shown to exhibit residual damages to recreation. These residual damages represent the discounted and annualized diminished value to specific recreational users attributable to a random rubble shoreline. In contrast, under Plan 4, no residual damages to recreation are forecast.

Total average annual recreation opportunity benefits equal $13,983,608 under Plan 1 and $20,856,186 under Plan 4, for an incremental recreational user benefit of $6,872,578 associated with Plan 4. Total average annual benefits weighted by probability of occurrence for Plans 1 and 4 are shown in Table D-12.

Table D–10 Weighted Average Annual Facilities Damages*

	REACH 2			REACH 3			REACH 4			REACH 5		
Year	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages
1995				$62,360	0.0887	$5,531	$3,246,835	0.0122	$39,611	$15,289,204	0.0122	$186,526
1996				$57,607	0.1050	$6,049	$2,999,385	0.0274	$82,183	$14,123,976	0.0274	$386,997
1997				$53,217	0.1645	$8,754	$2,770,795	0.0518	$143,527	$13,047,553	0.0518	$675,863
1998				$49,181	0.2045	$10,053	$2,559,626	0.0654	$167,400	$12,053,166	0.0654	$788,277
1999				$45,414	0.1735	$7,879	$2,364,550	0.0906	$214,228	$11,134,565	0.0906	$1,008,792
2000				$41,953	0.1385	$5,811	$2,184,342	0.0960	$209,697	$10,285,972	0.0960	$987,453
2001				$38,756	0.1000	$3,876	$2,017,868	0.1260	$254,251	$9,502,053	0.1260	$1,197,259
2002				$35,802	0.0553	$1,980	$1,864,081	0.1380	$257,243	$8,777,678	0.1380	$1,211,347
2003	$2,074,768	0.0140	$29,047	$33,074	0.0200	$661	$1,722,015	0.1414	$243,493	$8,108,894	0.1414	$1,146,598
2004	$1,916,645	0.0476	$91,232				$1,590,776	0.1114	$177,212	$7,490,895	0.1114	$834,486
2005	$1,770,573	0.0676	$119,691				$1,469,539	0.0740	$108,746	$6,919,996	0.0740	$512,080
2006	$1,635,633	0.0942	$154,077				$1,357,542	0.0464	$62,990	$6,392,606	0.0464	$296,617
2007	$1,510,977	0.1128	$170,438				$1,254,080	0.0194	$24,329	$5,905,409	0.0194	$114,565
2008	$1,395,822	0.1232	$171,965									
2009	$1,289,443	0.1112	$143,386									
2010	$1,191,171	0.0998	$118,879									
2011	$1,100,389	0.0832	$91,552									
2012	$1,016,526	0.0736	$74,816									
2013	$939,054	0.0620	$58,221									
2014	$867,486	0.0486	$42,160									
2015	$801,373	0.0330	$26,445									
2016	$740,298	0.0206	$15,250									
2017	$683,878	0.0086	$5,881									
Weighted AAD			$1,313,042			$50,594			$1,984,911			$9,346,861

Note: Damages are shown in 1992 $, FDR=0.0825 Base Year = 1998
Revised 5/25/93

TABLE D–11 Recreational Opportunites Lost to Storm Damaged Shore – Probability Weighted Average Annual Damages

	Weighted AAD = REACH 2		$7,629,520	Weighted AAD = REACH 3		$1,393,898	Weighted AAD = REACH 4		$6,949,447	Weighted AAD = REACH 5		$2,344,247	Weighted AAD = REACH 6		$188,118
Year	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages	AAD	Probability	Weighted Damages
1995	($21,060,324)	0.0000	$0	($1,512,831)	0.0387	$58,547	($11,152,140)	0.0122	$136,056	($3,540,025)	0.0122	$43,188	($312,594)	0.0122	$3,814
1996	($20,461,245)	0.0000	$0	($1,512,216)	0.1050	$158,783	($10,500,845)	0.0274	$287,723	($3,413,195)	0.0274	$93,522	($289,938)	0.0274	$7,944
1997	($19,856,095)	0.0000	$0	($1,511,647)	0.1645	$248,666	($9,826,304)	0.0518	$509,003	($3,286,675)	0.0518	$170,250	($269,012)	0.0518	$13,935
1998	($18,818,467)	0.0000	$0	($1,511,122)	0.2045	$309,024	($9,115,665)	0.0654	$596,164	($3,082,952)	0.0654	$201,625	($248,427)	0.0654	$16,247
1999	($17,330,157)	0.0000	$0	($1,393,714)	0.1735	$241,809	($8,385,289)	0.0906	$759,707	($2,837,082)	0.0906	$257,040	($228,049)	0.0906	$20,661
2000	($15,955,721)	0.0000	$0	($1,285,255)	0.1385	$178,008	($7,711,053)	0.0960	$740,261	($2,609,951)	0.0960	$250,555	($209,226)	0.0960	$20,086
2001	($14,686,479)	0.0000	$0	($1,185,061)	0.1000	$118,506	($7,088,678)	0.1260	$893,173	($2,400,129)	0.1260	$302,416	($191,840)	0.1260	$24,172
2002	($13,514,436)	0.0000	$0	($1,092,504)	0.0553	$60,415	($6,514,211)	0.1380	$898,961	($2,206,299)	0.1380	$304,469	($175,782)	0.1380	$24,258
2003	($12,432,163)	0.0140	$174,050	($1,007,000)	0.0200	$20,140	($5,984,001)	0.1414	$846,138	($2,027,241)	0.1414	$286,652	($160,950)	0.1414	$22,758
2004	($11,432,817)	0.0476	$544,202	($928,013)	0.0000	$0	($5,494,676)	0.1114	$612,107	($1,861,830)	0.1114	$207,408	($147,251)	0.1114	$16,404
2005	($10,510,101)	0.0676	$710,483	($855,046)	0.0000	$0	($5,043,119)	0.0740	$373,191	($1,709,025)	0.0740	$126,468	($134,599)	0.0740	$9,960
2006	($9,658,153)	0.0942	$909,798	($787,639)	0.0000	$0	($4,626,452)	0.0464	$214,667	($1,568,049)	0.0464	$72,757	($122,913)	0.0464	$5,703
2007	($8,871,579)	0.1128	$1,000,714	($725,370)	0.0000	$0	($4,242,016)	0.0194	$82,295	($1,438,002)	0.0194	$27,897	($112,180)	0.0194	$2,176
2008	($8,145,397)	0.1232	$1,003,513	($667,847)	0.0000	$0	($3,887,355)	0.0000	$0	($1,318,049)	0.0000	$0	($102,279)	0.0000	$0
2009	($7,475,005)	0.1112	$831,221	($614,708)	0.0000	$0	($3,560,199)	0.0000	$0	($1,207,422)	0.0000	$0	($93,146)	0.0000	$0
2010	($6,859,020)	0.0998	$684,530	($565,618)	0.0000	$0	($3,258,538)	0.0000	$0	($1,105,411)	0.0000	$0	($84,723)	0.0000	$0
2011	($6,290,435)	0.0832	$523,364	($520,270)	0.0000	$0	($2,980,346)	0.0000	$0	($1,011,364)	0.0000	$0	($76,955)	0.0000	$0
2012	($5,765,636)	0.0736	$424,351	($478,378)	0.0000	$0	($2,723,833)	0.0000	$0	($924,674)	0.0000	$0	($69,794)	0.0000	$0
2013	($5,281,288)	0.0620	$327,440	($439,678)	0.0000	$0	($2,487,346)	0.0000	$0	($844,781)	0.0000	$0	($63,251)	0.0000	$0
2014	($4,834,306)	0.0486	$234,947	($403,928)	0.0000	$0	($2,269,361)	0.0000	$0	($771,166)	0.0000	$0	($57,221)	0.0000	$0
2015	($4,421,844)	0.0330	$145,921	($370,903)	0.0000	$0	($2,068,487)	0.0000	$0	($703,352)	0.0000	$0	($51,664)	0.0000	$0
2016	($4,041,271)	0.0206	$83,250	($340,394)	0.0000	$0	($1,883,400)	0.0000	$0	($640,895)	0.0000	$0	($46,544)	0.0000	$0
2017	($3,690,177)	0.0086	$31,736	($312,211)	0.0000	$0	($1,712,897)	0.0000	$0	($583,411)	0.0000	$0	($41,875)	0.0000	$0
2018	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0
2019	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0
2020	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0	–	0.0000	$0

Weighted AAD All Reaches = $16,505,231

Note: Damages are shown in FY 1993 $ user day values; FY 1993 FDR = 0.0825; Base Reference Year of 1998 = Year 1.

Table D–12 Summary of Weighted Average Annual Benefits

Weighted Average Annual Benefits Plan I

Storm Damage Reduction	Reach 2	Reach 3	Reach 4	Reach 5
Transportation Road Loss	$7,197,502	$2,687,082	$10,761,376	$5,978,542
Transportation Flooding*	$577,580	$0	$0	$7,037
Facilities & Infrastructure	$1,313,042	$50,594	$1,984,911	$9,346,861
Incidental Recreation	$4,749,641	$1,286,931	$6,189,190	$1,757,846
Total	$13,837,765	$4,024,607	$18,935,477	$17,090,286
Emergency Maintanance Costs Avoided				$509,967
Sum of all Reaches				**$54,398,102**

Weighted Average Annual Benefits Plan IV

Storm Damage Reduction	Reach 2	Reach 3	Reach 4	Reach 5
Transportation Road Loss	$7,197,502	$2,687,082	$10,761,376	$5,978,542
Transportation Flooding*	$577,580	$0	$0	$7,037
Facilities & Infrastructure	$1,313,042	$50,594	$1,984,911	$9,346,861
Incidental Recreation	$7,629,520	$1,393,898	$9,488,521	$2,344,247
Total	$16,717,644	$4,131,574	$22,234,808	$17,676,687
Emergency Maintanance Costs Avoided				$509,967
Sum of all Reaches				**$61,270,680**

In 1992 dollars and FDR of 0.0825

*Flooding damages in Reach 2 are based on road closure for a 48 hr period with a recurrence interval of 15 years, in Reach 5 road closure is 36 hrs with a recurrance interval of eight years.
Revised 5/28/93 Base Year is 1998.

THE DEVELOPMENT OF NATIONAL ECONOMIC DEVELOPMENT BENEFITS

The main report relates the extent of the plan formulation process and the four plans carried forward for study and comparison of their economic characteristics, among other considerations. These four plans are referred by numeral and title as shown below where CSPC is the Chicago Shoreland Protection Commission; and CPD is the Chicago Park District; and COE is the Corps of Engineers, Chicago District. For details of the nature and design, similarities and difference among these plans the reader is referred to the main report. The critical feature that these plans share in common regarding the economic evaluations is their effectiveness in eliminating the without condition projected land losses.

Plan I Base Plan Low Berm Revetment
Plan II Breakwater (CSPC/COE)
Plan III Breakwater Enhanced (CSPC/CPD)
Plan IV Based Plan Enhanced - Step Stone Revetment

PLAN COSTS

Plans I through Plans IV have been cost estimated as shown in table D-13, "Cost Estimates for Plans I through Plans IV, by Reach". First costs and interest during construction have been computed and annualized. Yearly projected annualized operation and maintenance expenses have been added to arrive at the average annual cost associated with each Plan for each reach as displayed in table D-13. The reader is referred to the "Cost Appendix" of this report for further information concerning the Plan cost estimates.

BENEFIT AND COST COMPARISONS BY PLAN

Based on the annualized benefits developed and presented in Table D-12, and the annualized costs presented in Table D-13, the plans have benefits and cost ratios, by reach, as presented in Table D-14. The plan which provides the greatest net benefits overall is Plan 4, however Plan 1 is the NED plan as the incremental benefits of Plan 4 are entirely recreational.

14-Jul-93

Table D-13 Cost Estimates for all Plans by Reach ($000)

	Plan I	Plan II	Plan III	Plan IV
Reach 2 Total First Cost:	$65,118.9	$137,860.0	$207,217.9	$72,928.6
Interest During Construction	$9,683.0	$19,711.0	$29,628.0	$10,844.3
Total Investment	$74,801.9	$157,571.0	$236,845.9	$83,772.9
Annualized Project Costs:				
Interest & Amortization	$3,018.6	$13,251.7	$19,918.7	$3,380.6
Operation & Maintenance	$95.6	$146.8	$220.7	$41.3
Average Annual Cost	$3,114.2	$13,398.5	$20,139.4	$3,421.9
Reach 3 Total First Cost	$6,672.3	$7,952.9	$11,747.8	$6,672.3
Interest During Construction	$389.5	$1,004.2	$1,483.4	$389.5
Total Investment	$7,061.8	$8,957.1	$13,231.2	$7,061.8
Annualized Project Costs:				
Interest & Amortization	$533.2	$753.3	$1,112.7	$533.2
Operation & Maintenance	$9.8	$8.5	$12.5	$9.8
Average Annual Cost	$543.0	$761.8	$1,125.2	$543.0
Reach 4 Total First Cost	$71,418.4	$191,182.2	$220,108.7	$93,082.2
Interest During Construction	$14,115.4	$36,333.0	$41,830.0	$18,397.2
Total Investment	$85,533.8	$227,515.2	$261,938.7	$111,479.4
Annualized Project Costs:				
Interest & Amortization	$5,352.6	$19,134.0	$22,029.0	$7,038.8
Operation & Maintenance	$164.2	$203.6	$234.4	$13.1
Average Annual Cost	$5,516.8	$19,337.6	$22,263.4	$7,051.9
Reach 5 Total First Cost	$10,983.5	$42,228.2	$31,942.6	$11,819.4
Interest During Construction	$1,122.9	$4,155.0	$3,143.0	$1,209.4
Total Investment	$12,106.4	$46,383.2	$35,085.6	$13,028.8
Annualized Project Costs:				
Interest & Amortization	$880.7	$3,900.8	$2,950.7	$947.8
Operation & Maintenance	$6.5	$45.0	$34.0	$6.6
Average Annual Cost	$887.2	$3,945.8	$2,984.7	$954.4
Total First Costs	$154,193.1	$379,223.2	$471,017.0	$184,502.5
Total IDC	$25,310.8	$61,203.2	$76,084.4	$30,840.4
Annualized O & M	$276.1	$403.9	$501.6	$70.8
Total Average Annual Costs	$10,061.1	$37,443.8	$46,512.8	$11,971.2

Note: Interest during construction is calculated based on the following assumptions: Construction in each segment is dependent on the total construction in the reach. Thus interest during construction is calculated over: a 3.5 year period for Reach 2; a 1.5 year period for Reach 3; a 4.5 year period for reach 4: and a 2.5 year period for Reach 5. Interest and amortization factor over 50yrs = 0.0841 based on FDR of).0825 Real Estate Costs equal $420 on an average annual basis and are not included in the totals.

Table D–14 Cost to Benefit Ratio's for Plans I & IV

Plan	I		IV
Reach 2			
Ned Benefits	$13,838		$16,718
Average Annual Costs	$3,114		$3,422
Benefit Cost Ratio	4.4		4.9
Net Benefits	$10,724		$13,296
Reach 3			
Ned Benefits	$4,025		$4,132
Average Annual Costs	$543		$543
Benefit Cost Ratio	7.4		7.6
Net Benefits	$3,482		$3,589
Reach 4			
Ned Benefits	$18,935		$22,235
Average Annual Costs	$5,517		$7,052
Benefit Cost Ratio	3.4		3.2
Net Benefits	$13,419		$15,183
Reach 5			
Ned Benefits	$17,090		$17,677
Average Annual Costs	$887		$954
Benefit Cost Ratio	19.3		18.5
Net Benefits	$16,203		$16,722
Total			
Ned Benefits*	**$54,398**		**$61,271**
Average Annual Costs	**$10,061**		**$11,971**
Benefit Cost Ratio	5.4		5.1
Net Benefits	$44,337		$49,300

* Includes $509.9 Emergency Costs Avoided.

SENSITIVITY ANALYSIS

Sensitivity analysis was performed with altered values for first costs, erosion rates, and the erosion onset year. The objective was to determine how sensitive project economic feasibility was to changes in key assumptions used in the evaluation.

Sensitivity to Project Costs

The break even point, that where average annual benefits will equal average annual costs, was determined for Plan I. First costs plus interest during construction costs at the break even point equal $646,825,200 for Plan I, over four times the current estimated value.

Sensitivity to Erosion Rate

The previously discussed benefit estimation is based on an erosion rate of 19 ft/yr. Sensitivity with regard to erosion was calculated by estimating the benefits for a range of erosion rates, between 13 ft/yr to 26 ft/yr. The unweighted estimated benefits and benefit to cost ratios are shown in Table 15. Even at 13 ft/yr the project has a benefit-to-cost ratio significantly greater than unity.

Table D-15 Sensitivity Analysis for Plan I - Erosion Rate

Storm Damage Reduction Category	Erosion Rate	
	13/ft/yr*	26 ft/yr*
Transportation Road Loss	$17,287	$30,841
Facilities & Infrastructure	8,243	14,704
Incidental Recreation	10,051	15,077
Total Average Annual Benefits	35,581	60,622
Total Average Annual Costs	10,061	10,061
Benefit to Cost Ratio	3.5	6.0

*Unweighted average annual benefits are shown, FDR=.0825

Sensitivity to Erosion Onset Year

Currently it is assumed that the most likely year erosion will begin is 2003 for Reach 4, 2008 for Reach 2, 1998 for Reach 5, and so forth with a chance that erosion could begin before or after those dates according to the probability schedule shown in the failure scenario developed in the Coastal Engineering Appendix. For the sensitivity analysis, it is important

to know how far in the future erosion could be delayed and still have an economically feasible project; i.e. where the probability weighted average annual benefits (AAB) are equal to the average annual project costs (AAC). A simple method for determining this break even point which eliminates the need to re-calculate project benefits for each future year is to solve the following equation:

$$\frac{AAB}{(1+r)^N} = AAC$$

Where r is the current federal discount rate of 8.25 %. Substituting current values for AAB and AAC in the above equation we have:

$$\frac{\$54,398,000}{1.0825^N} = \$10,061,000$$

$$N \; Log \; 1.0825 = Log \frac{\$54,398,000}{\$10,061,000}$$

$$N = 21 \; Years$$

Therefore the onset of erosion could be delayed 11 years in all reaches and the project would still be feasible.

In addition, there are a number of factors which play large roles in the magnitude of the quantified results presented in this appendix. One factor is a substantial number of secondary losses which are not being reflected in the benefit levels claimed. These losses include but are not limited to:

1. The extension of the traffic disruption analysis into secondary areas as discussed in item 5 of the attachments to this appendix.

2. The impact on the city in terms of tourism and consequent tax revenue and jobs should the deterioration of the lakeshore not be prevented.

3. The impact on near shore private property values and consequent property tax revenues should the deterioration of the lakeshore not be prevented.

Sensitivity to Depreciated Facility and Infrastructure Values

Replacement values for facilities and infrastructure threatened by erosion were used in the analysis of without project and with project damages. This information was provided by the local sponsor for hundreds of facilities and structures in the study area and is contained in Volume II, Appendix D of this report. (Volumes I and II contain technical working papers). Corps guidance, however, calls for the use of depreciated values rather than replacement values when evaluating flooding and erosion damages.

Most if not all of the facilities inventoried for this study (particularly the highly valued structures which represent a large portion of the aggregate facility and infrastructure value) are maintained in a virtual zero depreciation state: they must be replaced in kind or maintained in good working condition indefinitely since they represent or support essential infrastructure or recreation opportunities in high demand. Even if this category of benefits were eliminated entirely the project would remain economically feasible in all reaches (see Tables 25 and 29). However, a sensitivity analysis to account for the depreciated value of near-shore structures was performed. The test assumed that all non-road and non-infrastructure facilities had zero value at the time of erosion onset. Thus, Lincoln Park Zoo and Meigs Field have zero value as do all sports-related facilities such as soccer and tennis courts, playground equipment, concession stands, park maintenance buildings and miscellaneous structures (e.g., statues and monuments). For the remaining roads and infrastructure (e.g., Lake Shore Drive, water filtration plant and pumping station, electric, gas, and water lines) replacement values were reduced by 25 percent at the time of erosion impact. Such assumptions are conservative in the extreme. The results of this sensitivity analysis are shown in Table D-16. As this table shows, even with the restrictive assumptions previously described the project is economically feasible in all reaches for both plans.

Table D-16 Sensitivity Test of Depreciated Facility and Infrastructure Values ($1,000s)

Plan I				
	Reach 2	**Reach 3**	**Reach 4**	**Reach 5**
F&I Benefits[1/]	$1,313.0	$50.6	$1,984.9	$5,978.5
Revised F&I Benefits	552.3	0.0	592.9	5,347.8
Revised Net Benefits	9,881.3	3,362.4	11,979.0	15,570.3
Revised BCR	4.2	7.2	3.2	18.6
Plan IV				
	Reach 2	**Reach 3**	**Reach 4**	**Reach 5**
F&I Benefits [1/]	$1,313.0	$50.6	$1,984.9	$5,978.5
Revised F&I Benefits	552.3	0.0	592.9	5,347.8
Revised Net Benefits	12,472.3	3,459.4	13,820.0	16,086.3
Revised BCR	4.6	7.4	3.0	17.9

1/ Facilities and Infrastructure (F&I) Benefits from Table 25.

ILLINOIS SHORE INTERIM III

LIST OF ATTACHMENTS TO APPENDIX D

Attachment	Topic
D-1	Facilities and Structures Database
D-2	Revenue Database
D-3	Use Database
D-3-a	Major Use by Reach
D-3-b	UDV point assignments
D-4	Narrative in Support of Inventories
D-5	Narrative in Supplement to Traffic Impacts
D-6	Narrative on Tourism
D-7	List of Public Property Values
D-8	Narrative on Regional Econometric Model
D-9	Preliminary Financial Analysis
D-10	Analysis of Staged Implementation (Project Timing)
D-11	Emergency Maintenance Without Project
D-12	Transportation Model
D-13	Plan IV Optimization

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix B

Project Cooperation Agreements

Prepared By:

U.S. Army Corps of Engineers
Chicago District

April 2013

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The following are copies of the signed Project Cooperation Agreements and a subsequent Amendment to the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project.

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Project Cooperation Agreement #1

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PROJECT COOPERATION AGREEMENT

BETWEEN

THE DEPARTMENT OF THE ARMY

AND

THE CITY OF CHICAGO

FOR PARTIAL COST REIMBURSEMENT
FOR CONSTRUCTION OF THE

SOUTH WATER FILTRATION PLANT
OUTER BREAKWATER
LAKE MICHIGAN, ILLINOIS
STORM DAMAGE REDUCTION
AND
SHORELINE EROSION PROTECTION PROJECT

THIS AGREEMENT by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government") acting by and through the Assistant Secretary of the Army (Civil Works), and the City of Chicago (hereinafter the "Non-Federal Sponsor") represented by its Mayor.

WITNESSETH, THAT:

WHEREAS, the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project (hereinafter referred to as the "Authorized Project") along the shoreline of Lake Michigan from Ardmore Avenue south to 79th Street at Chicago, Cook County, was authorized by Section 101(a)(12) of the Water Resources Development Act of 1996, Public Law 104-303 (WRDA 96);

WHEREAS, Section 101(a)(12) of WRDA 96 authorized the construction of a breakwater near the South Water Filtration Plant as a separable element of the Authorized Project;

WHEREAS, Section 101(a)(12) of WRDA 96 provides that the Secretary of the Army shall reimburse the Non-Federal Sponsor for the Federal share of any costs incurred by the Non-Federal Sponsor in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois;

WHEREAS, $8,000,000 (eight million Dollars) to initiate construction of the project was appropriated in Title I of the Energy and Water Development Appropriations Act of 1997 (P.L. 104-206) dated September 30, 1996;

WHEREAS, the Government and the Non-Federal Sponsor desire to enter into a Project Cooperation Agreement for the construction of the South Water Filtration Plant, Outer Breakwater, Lake Michigan, Illinois, (hereinafter the "Project" as defined in Article I.A. of this Agreement);

WHEREAS, the Non-Federal Sponsor proposes to construct the breakwater near the South Water Filtration Plant and apply for such reimbursement, in accordance with this Agreement, as it is entitled to under applicable law;

WHEREAS, Section 103(c)(5) of the Water Resources Development Act of 1986 (Public Law 99-662), as amended, specifies the cost sharing requirements applicable to the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, provide that the Secretary of the Army shall not commence construction of any water resources project, or separable element thereof, until the Non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 902 of Public Law 99-662 establishes the maximum amount of costs for the Project and sets forth procedures for adjusting such maximum amount; and,

WHEREAS, the Government and Non-Federal Sponsor have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the construction of the Project in accordance with the terms of this Agreement.

NOW THEREFORE, the parties hereto agree as follows:

Article I - Definitions and General Provisions

For purposes of this Agreement:

A. The term "Project" shall mean the Non-Federal Sponsor's Locally Preferred Plan (hereinafter the "LPP") for reconstruction of the breakwater at the South Water Filtration Plant, Chicago, Cook County, Illinois, as generally described in the Design Memorandum, Chicago Shoreline Storm Damage Reduction Project, Chicago, Illinois dated May 1995 and approved by the Division Engineer, North Central Division, Department of the Army on July 6, 1995 (hereinafter referred to as "DM 1"), the addition of supplemental stone over the

length of the existing 2,671 linear foot breakwater to an elevation of +10 feet, Low Water Datum with 1.5 : 1 slopes on the landward side and 2.0 : 1 slopes on the Lakeward side of the main sections and 3.0 : 1 slopes on both sides at the head sections. The approximate average structure height is 32 feet to the crest. The LPP (along with associated betterments) is further depicted in the drawings captioned A6-A13 of Exhibit A which is attached hereto and incorporated herein.

B. The term "NED Plan" shall mean a plan as generally described in DM 1 as the NED Plan and as further clarified in the drawings captioned A1-A5 of Exhibit A which generally provides for the reconstruction of the existing Filtration Plant breakwater to an elevation of +8 feet, Low Water Datum with sideslopes as per the LPP above and head sections with 2.5 : 1 slopes. The approximate average height of the structure would be 30 feet at the crest.

C. The term "total project costs" shall mean all costs incurred by the Non-Federal Sponsor and the Government in accordance with the terms of this Agreement directly related to Project construction. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to: preconstruction engineering and design costs incurred by the Government; preconstruction engineering and design costs incurred by the Non-Federal Sponsor subsequent to February 1, 1997 including costs of preparation of plans and specifications; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation investigation in accordance with Article XIX. of this Agreement; additional engineering and design costs during construction; actual construction costs incurred subsequent to the effective date of this Agreement; supervision and administration costs including those incurred by the Non-Federal Sponsor; costs of participation in the Project Coordination Team in accordance with Article VIII of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, and relocations for which the Government affords credit toward the total project costs in accordance with Article VI of this Agreement; and applicable costs of audit in accordance with Article XII of this Agreement. The term does not include any costs for operation, maintenance, repair, rehabilitation, or replacement; any costs due to betterments; or any costs of dispute resolution under Article IX of this Agreement.

D. The term "total NED costs" shall mean the costs, as determined by the Government, that the Government and the Non-Federal Sponsor would have incurred for the Project had the NED Plan been constructed. Such costs shall consist of all costs the Government and the Non-Federal Sponsor would have incurred in construction of the NED Plan features, including but not necessarily limited to: preconstruction engineering and design costs incurred by the Government; preconstruction engineering and design costs incurred by the Non-Federal Sponsor subsequent to February 1, 1997 including costs of preparation of plans and specifications; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation investigation in accordance with Article XIX. of this

Agreement; additional engineering and design costs during construction; total construction costs that would have been incurred subsequent to the effective date of this Agreement; supervision and administration costs including those incurred by the Non-Federal Sponsor; costs of participation in the Project Coordination Team in accordance with Article VIII of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, and relocations for which the Government affords credit toward the total project costs in accordance with Article VI of this Agreement; and applicable costs of audit in accordance with Article XII of this Agreement. The term does not include any costs for operation, maintenance, repair, rehabilitation, or replacement; any costs due to betterments; or any costs of dispute resolution under Article IX of this Agreement. Total NED costs currently are estimated to be $10,132,515. Total NED cost shall include costs of placed stone under the NED Plan as calculated pursuant to Exhibit A.

E. The term "incremental costs" shall mean the difference between total project costs and total NED costs.

F. The term "Federal proportionate share" shall mean the ratio between the Government's total contribution required under Article II.B.1 of this Agreement to total project costs as projected by the Government.

G. The term "Non-Federal Sponsor's proportionate share" shall mean one minus the Federal proportionate share.

H. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

I. The term "period of construction" is the time period from execution of this Agreement until completion of all Project construction work.

J. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

K. The term "betterment" shall mean a change in the design and construction of an element of the Project (the LPP) resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element. For the purposes of this Agreement, the term betterment shall include but not be limited to the following items which exceed the LPP, and which shall be constructed at 100% Non-Federal expense and shall not be included in total Project costs or subject to reimbursement:

1. The Non-Federal Sponsor intends to displace more capstones than required under the NED Plan for the purpose of inspecting for voids within the existing breakwater and filling of detected voids with core stone as the Non-Federal Sponsor determines upon inspection.

2. The Non-Federal Sponsor intends to replace two existing navigation light towers.

L. The term "betterment cost" shall mean the costs associated within the design and construction of betterments as defined in Article I.K.

1. The betterment cost of inspecting for voids and the filling of same shall mean the cost associated with the activities described in items 5 and 6, of the City of Chicago Plans and Specifications.

2. The betterment cost of replacing two existing navigation light towers shall be the costs associated with the activities described in item 11 of the City of Chicago Plans and Specifications.

M. The term "proper invoice" shall mean a request for payment by the Non-Federal Sponsor in which the Non-Federal Sponsor certifies that it has made payments in the amount claimed to its contractors, suppliers or employees for performance of work in accordance with this Agreement and provides evidence of payment made by it as may be reasonably required by the Government.

ARTICLE II - OBLIGATIONS OF THE PARTIES

A. THE NON-FEDERAL SPONSOR'S OBLIGATIONS

1. Using its funds and the funds to be reimbursed by the Government, the Non-Federal Sponsor shall expeditiously construct the Project.

2. The Non-Federal Sponsor shall contribute 35 percent of the total NED costs and 100 percent of incremental and betterment costs.

3. The Non-Federal Sponsor shall prepare and furnish the Government, for review, a proposed Operation, Maintenance, Repair, Rehabilitation and Replacement Manual (hereinafter the."OMRR&R Manual"). The failure of the Non-Federal Sponsor to prepare an acceptable OMRR&R Manual shall not negate the Non-Federal Sponsor's responsibility to provide for the operation, maintenance, repair, rehabilitation and replacement of the completed Project, in accordance with Article X of this Agreement, until and unless the Project is deauthorized by the Congress of the United States.

4. As further specified in Article V of this Agreement, the Non-Federal

Sponsor shall provide all lands, easements, and rights-of-way required for the construction, operation, maintenance, repair, rehabilitation, and replacement of the Project, and shall perform or ensure performance of all relocations that the Non-Federal Sponsor and the Government determine are necessary for the construction, operation, maintenance, repair, rehabilitation, and replacement of the Project.

5. The Government shall be afforded the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Non-Federal Sponsor's issuance of such solicitations. In the event that the Non-Federal Sponsor proposes to do work with its own forces, the Government shall be afforded the opportunity to review and approve the plan of work and materials to be incorporated into the work. No construction shall commence under this Agreement until the designs, detailed plans and specifications, and arrangements for prosecution of the work have been approved in writing by the District Engineer, U.S. Army Corps of Engineers, Chicago District (hereinafter referred to as the "District Engineer") or his representative, all bids received and the proposed provisions of any contract shall be subject to review within five (5) working days of receipt of the complete bid package or contract document by the Government prior to contract award. The District Engineer shall certify in writing that the provisions of Article III.C and D have been met. In addition, all proposed changes in approved designs, plans, and specifications also must be reviewed and approved by the District Engineer or his representative in writing in advance of the related construction where practicable. Such reviews shall be completed not later than five (5) working days from receipt of complete documentation unless the proposed changes are of such volume or complexity as to render the above review period unreasonable as agreed by the parties. To the extent possible, the Non-Federal Sponsor also shall afford the Government the opportunity to review and comment on all contract claims prior to resolution thereof. Such reviews shall be completed not later than five (5) working days from receipt of complete documentation unless the proposed changes are of such volume or complexity as to render the above review period unreasonable as agreed by the parties. The Non-Federal Sponsor shall consider in good faith the comments of the Government made as a result of its review, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project (whether the work is performed under contract or by Non-Federal Sponsor personnel), shall be exclusively within the control of the Non-Federal Sponsor. However, the failure of the Non-Federal Sponsor to comply with direction received from the District Engineer, with respect to the project, may result in the costs associated with such work being determined ineligible for reimbursement.

6. The Non-Federal Sponsor shall not use Federal funds to meet the Non-Federal Sponsor's share of the total NED costs or incremental costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized;

7. The Government recognizes that the Non-Federal Sponsor shall seek

appropriations for the Project on a fiscal year basis. The Non-Federal Sponsor shall include in its budget requests for funds sufficient to meet the obligations and make the payments required under this Agreement, and will use all reasonable and lawful means to secure the funding necessary to make such payments and meet such obligations. The Non-Federal Sponsor reasonably believes that funds in amounts sufficient to allow it to meet in full its payment and performance requirements will be made available. In addition, in the event that the Non-Federal Sponsor does not acquire appropriations in amounts sufficient to meet its performance and payment responsibilities hereunder, the Non-Federal Sponsor shall use its best efforts to satisfy any performance or payment requirements under this Agreement from any source of funds legally available for this purpose. In agreeing to this language the Government reserves any rights it may have to protect its interests should such appropriations not be made available to the Non-Federal Sponsor.

B. OBLIGATIONS OF THE GOVERNMENT

1. Subject to the availability of funds and the limitations on reimbursement contained in this Agreement, the Government shall contribute a total of 65% of total NED costs.

2 The Government shall perform a final accounting in accordance with Article IV.C. of this Agreement to determine the credits afforded to and cash contributions provided by the Non-Federal Sponsor toward the total project costs in accordance with this Article and Articles VI and XV of this Agreement and to determine whether the Non-Federal Sponsor has met its obligations under paragraphs A.1-6 of this Article.

3. The Government may perform periodic inspections to verify progress of construction, and a final inspection to establish the beginning of operation and maintenance by the Non-Federal Sponsor. The Government is authorized to inspect the Project at any and all times. Costs incurred by the Government in furtherance of this paragraph shall be included in the total project costs.

ARTICLE III - MANNER OF PERFORMING THE PROPOSED WORK

A. The Non-Federal Sponsor assumes full and exclusive responsibility for construction of the Project.

B. In the event that the Non-Federal Sponsor elects to construct betterments during the period of construction, the Non-Federal Sponsor shall notify the Government in writing and describe the betterments it intends to construct. The Non-Federal Sponsor shall be solely responsible for all costs due to the requested betterments, including costs associated with obtaining permits and shall pay all such costs directly to its contractor or contractors and without reimbursement by the Government.

C. The Non-Federal Sponsor shall procure all necessary permits and licenses,

comply with all applicable laws, regulations, ordinances and other rules of the United States of America, of the state or political subdivisions thereof wherein the work is done, or of any other duly constituted public authority, including the laws and regulations specified in Article VII of this Agreement.

D. Any contract awarded by the Non-Federal Sponsor for the proposed work under this Agreement shall include provisions consistent with all applicable Federal laws and regulations.

ARTICLE IV - METHOD OF PAYMENT

* A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs and total NED costs. At least quarterly, the Non-Federal Sponsor shall provide the Government with its projections of total project costs. At least quarterly the Government shall provide the Non-Federal Sponsor with a report setting forth all contributions or reimbursements to the Non-Federal Sponsor provided to date and the current projections of NED costs, of the components of these costs, of the maximum total NED costs determined in accordance with Article XX of this Agreement; of each party's share of total project and NED costs, of the Non-Federal Sponsor's proportionate share, of the Federal proportionate share and of the funds the Government projects it shall reimburse the Non-Federal Sponsor for the upcoming fiscal year or the funds required from the Non-Federal Sponsor for its cost-sharing for the upcoming fiscal year, and of the Non-Federal Sponsor's contributions for betterments in accordance with Article III.B. of this Agreement. On the effective date of this Agreement, total NED costs are projected to be $10,132,515, the Non-Federal Sponsor's cash required to meet its total financial obligations for construction is projected to be $4,320,165; the Government's reimbursement under Article II.B.1. is projected to be $6,124,328. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsor.

B. The Government shall provide the reimbursement required under Article II.B.1. of this Agreement in accordance with the provisions of this paragraph.

1. Periodically, but not more frequently than once every thirty (30) days, the Non-Federal Sponsor shall provide the District Engineer, Chicago District, or his representative with a proper invoice, describing the amount of funds it has expended, since the previous invoice for project design and construction (including expenditures under Articles II, VIII, XV.A., and XIX of this Agreement) and the amount thereof that comprises betterment costs. Not later than 30 days thereafter, the Government, subject to review and approval of such invoice, and subject to the availability of funds, shall reimburse the Non-Federal Sponsor an amount equal to the Federal proportionate share of the expended amount excluding betterment costs, reduced by the Non-Federal Sponsor's proportionate share of costs incurred by the Government for the Project since the previous invoice.

2. Periodically, but not more frequently than once every thirty (30) days, the Non-Federal Sponsor shall provide the District Engineer, Chicago District, or his representative with documentation of the values, as determined in accordance with Article VI of this Agreement, of lands easements, rights-of-way, and relocations required for the NED Plan and provided by the Non-Federal Sponsor since the previous documentation. Not later than 30 days thereafter, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsor an amount equal to the Federal proportionate share of the documented values.

C. Upon completion of the project or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting and furnish the Non-Federal Sponsor with the results of the final accounting. The final accounting shall determine total Project costs, total NED costs, incremental costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting shall take no longer than one hundred twenty (120) days from receipt of all required supporting documentation from the Non-Federal Sponsor and its contractor.

1. In the event the final accounting shows that the total reimbursement provided by the Government is less than its required share of total NED costs as set forth in Article II.B.1. of this Agreement, the Government shall, subject to the availability of funds, no later than 90 calendar days after completion of final accounting, make a cash payment to the Non-Federal Sponsor of whatever sum is required to meet the Government's required share of total NED costs. In the event existing funds are not available to make the required cash payment, the Government shall seek such appropriations as are necessary to make the refund.

2. In the event the final accounting shows that the total contribution provided by the Government exceeds its required share of total NED costs as set forth in Article II.B.1. of this Agreement, the Non-Federal Sponsor shall refund the excess to the Government no later than 90 calendar days after written notice by the Government that the final accounting is complete. In the event existing funds are not available to refund the excess to the Government, the Non-Federal Sponsor shall seek such funds as are necessary to make the refund. In the event that such funds are not made available within a reasonable amount of time, the Government may off-set any amounts owed against any other projects with the same Non-Federal Sponsor authorized under Section 101(a)(12) of WRDA 96 and may use any other procedures permitted by law. The Non-Federal Sponsor shall be liable for interest under Article XIV.D. of this Agreement with the interest beginning to accrue after the ninety [90] calendar days lapses.

D. The amount of credit or reimbursement for which the Non-Federal Sponsor may be eligible under this Article shall not be subject to interest charges and shall not be adjusted to reflect changes in price levels between the time that construction of the Project was completed and the time the credit is afforded or reimbursement is made.

ARTICLE V - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Non-Federal Sponsor, in consultation with the Government, shall determine the lands, easements, and rights-of-way required for construction, operation, maintenance, repair, rehabilitation and replacement of the Project, including those required for relocations, borrow materials and dredged or excavated material disposal. The Non-Federal Sponsor shall delineate which of the required lands, easements, and rights-of-way are required for the NED Plan and which are required for the Project but not for the NED Plan. Prior to the issuance of solicitation for each construction contract, the Non-Federal Sponsor shall acquire all such lands, easements, and rights-of-way necessary for that contract. Furthermore, for purposes of inspection, the Non-Federal Sponsor shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Non-Federal Sponsor has provided.

B. The Non-Federal Sponsor, in consultation with the Government, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, maintenance, repair, rehabilitation and replacement of the Project. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Non-Federal Sponsor shall delineate which of the required improvements are required for the NED Plan and which are required for the Project but not for the NED Plan. Prior to the issuance of any solicitation for construction where the proper disposal of dredged or excavated material associated with the construction is anticipated, the Non-Federal Sponsor shall provide the Government with copies of all permits obtained for the disposal of dredged or excavated materials in accordance with Articles III.C. of this Agreement and with plans and specifications of such improvements in detail sufficient for the Government to review and comment in accordance with Article II.A.5 of this Agreement.

C. The Non-Federal Sponsor, in consultation with the Government, shall determine the relocations necessary for the construction, operation, maintenance, repair, replacement and rehabilitation, of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Non-Federal Sponsor shall delineate which of the required relocations are required for the NED Plan and which are required for the Project but not for the NED Plan. The Non-Federal Sponsor shall be responsible for preparing or ensuring the preparation of plans and specifications for all relocations determined necessary.

D. The Non-Federal Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, and shall inform all affected persons of applicable benefits, policies, and

procedures in connection with said Act.

E. The Non-Federal Sponsor in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided during the period of construction pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs and total NED costs, and afford credit, as appropriate, for such value toward the Non-Federal Sponsor's share of total NED costs.

ARTICLE VI - CREDIT FOR THE VALUE OF LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsor shall receive credit toward its share of total NED costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsor must provide pursuant to Article V of this Agreement for the NED Plan, and for the value of the relocations that the Non-Federal Sponsor must perform or for which it must ensure performance pursuant to Article V of this Agreement for the NED Plan. However, the Non-Federal Sponsor shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project. The Non-Federal Sponsor also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the sole purpose of affording credit in accordance with this Agreement, the value of lands, easements, and rights-of-way, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of the real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsor on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsor awards the first construction contract for the Project, or, if the Non-Federal Sponsor performs the construction with its own labor, the date that the Non-Federal Sponsor begins construction of the Project. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsor after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in

accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsor shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsor and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsor's appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's appraisal, the Non-Federal Sponsor may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsor's second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsor's second appraisal, or the Non-Federal Sponsor chooses not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsor. In the event the Non-Federal Sponsor does not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsor, shall consider the Government's and the Non-Federal Sponsor's appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsor for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsor, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsor, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsor, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsor shall, prior to instituting such proceedings, submit to the Government notification in writing of its intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsor shall use the amount set forth in such appraisal

as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsor shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsor agree as to an appropriate amount, then the Non-Federal Sponsor shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsor cannot agree as to an appropriate amount, then the Non-Federal Sponsor may use the amount set forth in its appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the construction, operation, and maintenance of the Project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsor within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article XII.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article V.E. of this Agreement.

C. After consultation with the Non-Federal Sponsor, the Government shall determine the value of relocations in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the

relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article XII.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. The value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article XII.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE VII - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsor and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army".

ARTICLE VIII - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication the Non-Federal Sponsor and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of construction. The Government's Project Manager and a counterpart named by the Non-Federal Sponsor shall co-chair the Project Coordination Team.

B. The Government's Project Manager and the Non-Federal Sponsor's counterpart shall keep the Project Coordination Team informed of the progress of construction and of significant pending issues and actions, and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; contract costs; the Government's cost projections; final inspection of the construction or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of

operation, maintenance, repair, rehabilitation, and replacement of the Project; and other related matters.

D. The Project Coordination Team may make recommendations that it deems warranted to the Non-Federal Sponsor on matters that the Project Coordination Team generally oversees, including suggestions to avoid potential sources of dispute. The Non-Federal Sponsor in good faith shall consider the recommendations of the Project Coordination Team. The Non-Federal Sponsor, having the legal authority and responsibility for construction of the Project, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations. Except as otherwise provided in this Agreement, the Non-Federal Sponsor may not reject or modify the Project Coordination Team's recommendations when the purpose of such recommendations are to ensure that the Project complies with Federal, State, or local laws or regulations.

E. The costs of participation in the Project Coordination Team shall be included in total project costs or total NED costs, and cost shared in accordance with the provisions of this Agreement.

ARTICLE IX - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE X - OPERATION, MAINTENANCE, REPAIR, REHABILITATION AND REPLACEMENT (OMRR&R)

A. Upon completion of construction and final inspection by the Government as provided for by Article II.B.3. of this Agreement, the Non-Federal Sponsor shall operate, maintain, repair, rehabilitate, and replace the entire Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's design, its Operation, Maintenance, Repair, Rehabilitation and Replacement Manual, and in accordance with applicable Federal and State laws as provided in Article VII of this Agreement, until and unless the Project is deauthorized by the Congress of the United States.

B. The Non-Federal Sponsor shall also be required to operate, maintain, repair, replace, and rehabilitate the existing South Water Filtration Plant cofferdam, at no cost to the Government, such that the structural integrity and crest of the cofferdam is preserved in a manner consistent with protection provided by the Government, until and unless the Project

is deauthorized by the Congress of the United States.

C. The Non-Federal Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Non-Federal Sponsor for any reason is failing to perform its obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsor. If, after 30 calendar days from receipt of notice, the Non-Federal Sponsor continues to fail to perform, or diligently undertake reasonable efforts to cure the deficiency, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsor of responsibility to meet the Non-Federal Sponsor's obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE XI - INDEMNIFICATION

The Non-Federal Sponsor shall hold and save the Government free from all damages arising from the design, construction, operation, maintenance, repair, rehabilitation and replacement of the Project, and any Project-related betterments, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE XII - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 45 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsor shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsor shall maintain such books, records, documents, and other evidence pertaining to construction in accordance with these procedures and for a minimum of three years after the period of construction and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsor shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsor is responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-128 and

Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsor and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsor and independent auditors any information necessary to enable an audit of the Non-Federal Sponsor's activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-128, and such costs as are allocated to the Project shall be included in the total project costs or total NED costs and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsor is required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in the total project costs or total NED costs and cost shared in accordance with the provisions of this Agreement.

ARTICLE XIII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement, the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsor fails to fulfill its obligations under Article II.A.1-4., III, IV, or XIX.C. of this Agreement, or take reasonable efforts to cure the deficiency, within 30 calendar days of written notice, the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement, after 30 calendar days of written notice to the Non-Federal Sponsor, unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If the Government fails to receive annual appropriations in amounts sufficient to meet Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsor in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance

under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsor elects to terminate this Agreement.

C. In the event that either party elects to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article IV.D. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of liability for any obligation previously incurred. Any delinquent payment owed by the Non-Federal Sponsor shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the Government, the Non-Federal Sponsor shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsor determines to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Non-Federal Sponsor, in consultation with the Government determines, pursuant to Article V of this Agreement, to be required for the construction, operation, maintenance, repair, rehabilitation, and replacement of the Project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-Federal Sponsor shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsor for such investigations for hazardous substances shall be included in the total project costs or total NED costs and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article XII.C. of this Agreement to determine reasonableness, allowability, and allocability of costs to the Project.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way that the Non-Federal Sponsor and the Government determine, pursuant to Article II.A.4. of this Agreement, to be required for the construction,

operation, and maintenance of the Project, the Non-Federal Sponsor and the Government shall provide prompt written notice to each other, and the Non-Federal Sponsor shall not proceed with the acquisition of the real property interests until both parties agree that the Non-Federal Sponsor should proceed.

C. The Government and the Non-Federal Sponsor shall determine whether to initiate construction of the Project, or, if already in construction, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Non-Federal Sponsor and the Government determine, pursuant to Article II.A.4. of this Agreement, to be required for the construction, operation, maintenance, repair, rehabilitation, and replacement of the Project. Should the Government and the Non-Federal Sponsor determine to initiate construction or continue with construction after considering any liability that may arise under CERCLA, the Non-Federal Sponsor shall be responsible, as between the Government and the Non-Federal Sponsor, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of the total project costs. In the event the Non-Federal Sponsor fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsor's responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project.

D. The Non-Federal Sponsor and the Government shall consult with each other in accordance with Article VIII of this Agreement in an effort to ensure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XVII -NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or by telegram or mailed by first-class, registered, or certified mail, as follows:

If to the City of Chicago:

Commissioner
Department of Environment
30 North LaSalle Street, 25th Floor
Chicago, Illinois 60602

If to the Government:

District Engineer
U. S. Army Corps of Engineers, Chicago District
111 North Canal Street, Suite 600
Chicago, Illinois 60606

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVIII -CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XIX - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs or total NED costs and cost shared in accordance with the provisions of this Agreement.

B. As specified in Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in total project costs or total NED costs, up to the statutory limit of one percent of the total amount authorized to be appropriated for the Project.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs or total NED costs and cost shared between the Non-Federal Sponsor and the Government in accordance with the provisions of this Agreement.

ARTICLE XX -SECTION 902 PROJECT COST LIMITS

The Non-Federal Sponsor has reviewed the provisions set forth in Section 902 of Public Law 99-662, as amended, and understands that Section 902 establishes the maximum amount of total project costs for the South Water Filtration Plant, Outer Breakwater, Lake Michigan, Illinois. Notwithstanding any other provision of this Agreement, the Government shall not make a new Project financial obligation, make a Project expenditure, or afford credit toward total project costs for the value of any contribution provided by the Non-Federal Sponsor, if such obligation, expenditure, or credit would result in total project costs exceeding this maximum amount, unless otherwise authorized by law. On the effective date of this Agreement, this maximum amount is estimated to be $14,392,000, as calculated in accordance with ER 1105-2-100 using October 1, 1996 price levels and allowances for projected future inflation. The Government shall adjust this maximum amount in accordance with Section 902.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the authorized representative of the Department of the Army.

THE DEPARTMENT OF THE ARMY

BY: _____
H. MARTIN LANCASTER
Assistant Secretary of the Army
(Civil Works)

DATE: 28 APR 1997, 1997

THE CITY OF CHICAGO

BY: _____
RICHARD M. DALEY
Mayor

DATE: April 23, 1997

CERTIFICATE OF AUTHORITY

I, Susan Sher, do hereby certify that I am the principal legal officer of the City of Chicago, that the City of Chicago is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Chicago in connection with the South Water Filtration Plant, Outer Breakwater, Lake Michigan, Illinois, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by Section 221 of Public Law 91-611 (42 U.S.C. Section 1962d-5b), and that the persons who have executed this Agreement on behalf of the City of Chicago have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 23rd day of April 1997.

Susan Sher

Susan Sher
Corporation Counsel

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

BY: _____
RICHARD M. DALEY
Mayor

DATE: April 23, 1997

EXHIBIT A

1. Reference the Chicago Shoreline Project, "Design Memorandum One, Reach 5 - South Water Purification Plant", dated May 1995.

2. The Chicago Shoreline Project was authorized in the 1996 Water Resources Development Act. Following the project authorization, the detailed Plans and Specifications, for "Reach 5, South Water Filtration Plant", were completed in preparation for contract procurement and project construction. The Plan and Specification design details underwent the Corps standard BCOE review process and were completed by: 1) overlaying the design presented in DM1 onto detailed hydrographic survey cross sections, 2) making adjustments to the cross sections for variations in breakwater alignment, 3) adjusting structure crest orientation to facilitate constructability, and 4) adjust cross section limits to allow for construction tolerances and neatlines. The representative typical cross sections for the NED plan are attached as Exhibits A-1 through A-5 and representative typical cross sections for the LPP are attached as Exhibits A-6 through A-13.

3. For the initial estimate and calculation of the Federal proportionate share, total project costs shall be computed as follows:

> The contract bid price less any betterments will be used to determine the cost estimate for the construction work, which is based on typical drawings in Exhibit A-6 through A-13. To that amount will be added a contingency of 10%. To that sum will be added 8% for construction management costs. An additional 2% will be added to the resulting sum for engineering design during construction. Computation of the estimated tonnage of stone to be placed by the Non-Federal Sponsor will be based on a factor of 1.6 tons per cubic yard to allow for spacing between stones.

4. For the initial estimate and calculation of the Federal proportionate share, NED costs shall be computed as follows:

> The unit prices for purchase and placement of stone by type as established in the lowest construction bid will be used to determine the cost estimate for the construction work, which is based on typical drawings in Exhibit A-1 through A-5. The quantity estimates to which these unit prices are applied will be determined from the volumes indicated in Exhibits A-6 through A-13 as adjusted to construct the NED plan to the neat lines depicted in Exhibits A-1 through A-5. Computation of the estimated tonnage of stone will be based on a conversion rate of 1.6 tons per cubic yard. To that amount will be added a contingency of 10%. To that sum will be added 8% for construction management costs. An additional 2% will be added to the resulting sum for engineering design during construction.

5. For purposes of the final accounting for the Total Project Costs as defined in this Agreement, the quantity of stone required to construct the Locally Preferred Plan, and the associated costs therewith, shall be computed as follows:

A. Use the actual tonnage of placed stone;

B. Apply the contract unit prices ($/ton) for applicable stone categories to compute the costs.

6. For purposes of the final accounting for the NED Plan Costs as defined in the Agreement, the quantity of stone required to construct the NED Plan, and the associated costs therewith, shall be computed as follows:

A. Use the "after" surveys provided by the selected contractor at 20-ft intervals to determine the crest profile elevation to which the LPP was built in excess of +10 Low Water Datum (LWD). Calculate the area of stone at each section in excess of +10 LWD.

B. Calculate the corresponding volume of excess stone using the average end area method;

C. Convert the resulting volume of excess stone to tonnage on the basis of 1.6 tons per cubic yard;

D. Apply the contract unit prices ($/ton) for applicable stone categories to compute the costs in excess of +10 LWD; and

E. Compute NED Plan stone cost as the difference between the LPP stone costs defined in paragraph 5 above and the stone costs in excess of +10 LWD.

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Project Cooperation Agreement #2

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PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE CITY OF CHICAGO AND
THE CHICAGO PARK DISTRICT
FOR
CONSTRUCTION OF CERTAIN AREAS OF THE
CHICAGO SHORELINE, CHICAGO, ILLINOIS PROJECT

THIS AGREEMENT is entered into this 20th day of August, 1998, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the Assistant Secretary of the Army (Civil Works), and the CITY OF CHICAGO (hereinafter the "City") represented by its Mayor, and the CHICAGO PARK DISTRICT, (hereinafter the "Park District"), represented by its General Superintendent (the City and the Park District hereinafter collectively referred to as the "Non-Federal Sponsors").

WITNESSETH, THAT:

WHEREAS, construction of the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project (hereinafter referred to as the "Authorized Project") along the shoreline of Lake Michigan from Wilson Avenue south to 79th Street at Chicago, Cook County, Illinois was authorized by Section 101(a)(12) of the Water Resources Development Act of 1996 (Public Law 104-303) (hereinafter the "WRDA 96");

WHEREAS, the Government and the Non-Federal Sponsors entered into a previous Project Cooperation Agreement dated April 28, 1997 for the construction of the South Water Filtration Plant Breakwater (which Breakwater is contained within Reach 5 which extends from 57th Street to 79th Street);

WHEREAS, the Government and the Non-Federal Sponsors desire to enter into a Project Cooperation Agreement (hereinafter the "Agreement") for construction of the 31st Street Beach nourishment, a 1,000 ft revetment north of Belmont Harbor entrance between Aldine Street and Roscoe Street, and the revetment between 31st and 33rd Streets (hereinafter the "Project" as defined in Article I.A. of this Agreement);

WHEREAS, Section 103(c)(5) of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as

amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, provide that the Secretary of the Army shall not commence construction of any water resources project, or separable element thereof, until each non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 902 of Public Law 99-662 establishes the maximum amount of costs for the Authorized Project and sets forth procedures for adjusting such maximum amount;

WHEREAS, the City and the Park District and the Government each have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the construction of the Project in accordance with the terms of this Agreement;

WHEREAS, the Non-Federal Sponsors propose to perform certain work, as defined in Article I.N. of this Agreement (hereinafter referred to as the "Section 215 Work"), which falls within the parameters of the Project as defined in Article I.A. of this Agreement;

WHEREAS, Section 215 of the Flood Control Act of 1968, Public Law 90-483, as amended, provides that the Secretary of the Army may enter into an agreement to reimburse (including providing reductions of the contributions of the Non-Federal Sponsors that they would otherwise be required to make) for the costs of certain work accomplished by States or political subdivisions thereof, which later is incorporated by the Government into an authorized project, when it is determined that such reimbursement/reduction is in the public interest;

WHEREAS, the Secretary of the Army has determined that it is in the public interest to reimburse the Non-Federal Sponsors (including reducing the contributions of the Non-Federal Sponsors as described in the preamble above) to the extent authorized by law for the cost of the Section 215 Work, as defined in Article I.N. of this Agreement, up to a statutory maximum amount of $5,000,000 or one percent of the total project costs, whichever is greater ;

WHEREAS, reimbursement (including reductions) may be afforded only after the appropriation of funds and the commencement of construction of the Project by the Government and the Non-Federal Sponsors;

WHEREAS, the Section 215 Work shall meet or exceed the Project standards for similar Federal work;

WHEREAS, the Government and the Non-Federal Sponsors, in connection with this Agreement, desire to foster a "partnering" strategy and a working relationship between the Government and the Non-Federal Sponsors through a mutually developed formal strategy of commitment and communication embodied herein, which creates an environment where trust and team work prevent disputes, foster a cooperative bond between the Government and the Non-

Federal Sponsors, and facilitate the completion of a successful project;

WHEREAS, the Government and the Non-Federal Sponsors formalized the commitment of a partnering strategy and working relationship in the Chicago Shoreline Protection Project Partnering Charter, dated February 18, 1998, (hereinafter the "Partnering Charter").

NOW, THEREFORE, the Government and the Non-Federal Sponsors agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Project" shall mean: the rehabilitation of the shoreline of Lake Michigan consisting of the 31st Street Beach nourishment, a 1,000 ft segment of revetment north of Belmont Harbor entrance between Aldine Street and Roscoe Street, and revetment between 31st and 33rd Streets at Chicago, Cook County, Illinois as generally described in the Illinois Shoreline Erosion, Interim 3, Wilmette to Illinois/Indiana State Line, Storm Damage Reduction, Plan IV, Final Feasibility Study Report and Environmental Assessment (EA) dated July 1993, Revised March 1994, and approved April 14, 1994 by the Chief of Engineers, Department of the Army, as supplemented by the Limited Re-Evaluation Report dated March 1998 and approved on July 9, 1998 by the Assistant Secretary of the Army (Civil Works). The Project includes the Section 215 Work described in paragraph N. of this Article.

B. The term "NED plan" shall mean a combination of measures, featuring rubble mound revetments, which captures the high priority storm damage reduction outputs at lowest cost while preserving as much of the recreation use of the Chicago shoreline as possible as further described as Plan I in the abovementioned Feasibility report.

C. The term "total project costs" shall mean all costs incurred by the Non-Federal Sponsors and the Government in accordance with the terms of this Agreement directly related to construction of the Project. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to: continuing planning and engineering costs incurred after October 1, 1985; advanced engineering and design costs; the Government's preconstruction engineering and design costs; engineering and design costs during construction; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation activities in accordance with Article XVIII.A. and XVIII.C. of this Agreement; actual construction costs, including the costs of alteration, lowering, raising, or replacement and attendant removal of existing railroad bridges and approaches thereto; costs incurred for the Section 215 Work as defined in paragraph N. of this Article, to the extent that they do not duplicate costs otherwise included in this paragraph C. of this Article; supervision

and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas that the Government determines, pursuant to Article III of this Agreement, to be required for the Project but not for the NED Plan; and costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

D. The term "total NED costs" shall mean the costs, as determined by the Government, that the Government and the Non-Federal Sponsors would have incurred for the Project had the NED Plan been constructed. Such costs shall consist of all costs the Government and the Non-Federal Sponsors would have incurred in construction of the NED Plan features, including but not necessarily limited to: preconstruction engineering and design costs incurred by the Government including costs of preparation of plans and specifications; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation investigation in accordance with Article XVIII.A. and XVIII.C. of this Agreement; additional engineering and design costs during construction; total construction costs that would have been incurred subsequent to the effective date of this Agreement including costs incurred for the Section 215 Work as defined in paragraph N. of this Article, for which the Government affords credit in accordance with Articles II.G. and II.P. of this Agreement, to the extent that they do not duplicate costs otherwise included in this paragraph D. of this Article and to the extent that these costs would have been incurred for construction of the NED plan features; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit toward the NED costs in accordance with Article IV of this Agreement; and applicable costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, rehabilitation, or replacement; any costs due to betterments; or any costs of dispute resolution under Article IX of this Agreement. Total NED costs currently are estimated to be $12,687,500. Total NED cost shall be calculated pursuant to Exhibit A.

E. The term "incremental costs" shall mean the difference between total project costs and total NED costs.

F. The term "financial obligation for construction" shall mean a financial obligation of the Government, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or

would result in a cost that is or would be included in total project costs.

G. The term "non-Federal proportionate share" shall mean the ratio of the Non-Federal Sponsors' total cash contribution required in accordance with Articles II.E.2. and II.F.2. of this Agreement to total financial obligations for construction, as projected by the Government.

H. The term "period of construction" shall mean the time from the date the Government first notifies the Non-Federal Sponsors in writing, in accordance with Article VI.B. of this Agreement, of the scheduled date for issuance of the solicitation for the first construction contract to the date that the U.S. Army Engineer for the Chicago District (hereinafter the "District Engineer") notifies the Non-Federal Sponsors in writing of the Government's determination that construction of the Project is complete.

I. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

J. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

K. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

L. The term "functional portion of the Project" shall mean a portion of the Project that is suitable for tender to the Non-Federal Sponsors to operate and maintain in advance of completion of the entire Project. For a portion of the Project to be suitable for tender, the District Engineer must notify the Non-Federal Sponsors in writing of the Government's determination that the portion of the Project is complete and can function independently and for a useful purpose, although the balance of the Project is not complete.

M. The term "betterment" shall mean a change in the design and construction of an element of the Project resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

N. The term "Section 215 Work" shall mean the engineering and design, construction management and construction of a portion of the Project described as the 31st Street Beach

nourishment and a 1,000 foot segment of the Reach 2 shoreline revetment north of the Belmont Harbor entrance between Aldine Street and Roscoe Street commencing after the execution of this Agreement, but does not include the construction of betterments. As total NED costs include the value of lands, easements, rights-of-way, relocations, or suitable borrow and dredged or excavated material disposal areas associated with the Section 215 Work which are required for the NED Plan, such value shall not be included in the Section 215 Work as defined in this paragraph. The Government understands that the Non-Federal Sponsors shall contract for the Section 215 Work to proceed in distinct stages as authorized.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSORS

A. The Government, subject to receiving funds appropriated by the Congress and using those funds and funds provided by the Non-Federal Sponsors shall expeditiously construct the Project (with the exception of the Section 215 Work) , applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the Non-Federal Sponsors opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. The Government shall provide the solicitations, including relevant plans and specifications, to the Non-Federal Sponsors for the opportunity to review and comment at the 50 percent and 95 percent stage of preparation of each solicitation, including relevant plans and specifications. Such reviews shall by completed by the Non-Federal Sponsors within 10 days of receipt of each solicitations package, including relevant plans and specifications. Within 10 days of receipt of the Non-Federal Sponsors' comments on each solicitations package at each such stage of completion, the Government shall document in writing the resolution of each comment including detailed reasons for nonconcurring in a comment. The Government and the Non-Federal Sponsors shall consult in good faith, through the Project Coordination Team in accordance with Article V of this Agreement, to promptly resolve the issues or areas of disagreement that are identified in the Government's resolution of comments. The Government shall not issue the solicitation for the first construction contract until the Non-Federal Sponsors have confirmed in writing their willingness to proceed with the Project. The Government shall afford the Non-Federal Sponsors the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsors with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsors opportunity to review and comment on all contract claims prior to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsors, but the contents of

solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project (with the exception of the Section 215 Work) (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. Throughout the period of construction, the District Engineer shall furnish the Non-Federal Sponsors with written monthly progress reports, by the 15th of the next month, and a copy of the Government's Written Notice of Acceptance of Completed Work for each contract completed during the preceding month, for construction managed by the Government for the Project.

B. For the Section 215 Work, the Government shall be afforded the opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Non-Federal Sponsors' issuance of such solicitations. In the event that the Non-Federal Sponsors propose to do work with their own forces, the Government shall be afforded the opportunity to review and approve the plan of work and materials to be incorporated into the work. The Non-Federal Sponsors shall provide the solicitations, including relevant plans and specifications, or plans of work, including materials to be incorporated into the work, to the Government for the opportunity to review and comment at the 50 percent and 95 percent stage of preparation of each solicitation, including relevant plans and specifications or plans of work. Such reviews shall by completed by the Government within 10 days of receipt of each solicitations package at each such stage of completion, including relevant plans and specifications. Within 10 days of receipt of the Government's comments on each solicitations package, the Non-Federal Sponsors in writing shall document the resolution of each comment including detailed reasons for nonconcurring in a comment. The Government and the Non-Federal Sponsors shall consult in good faith, through the Project Coordination Team in accordance with Article V of this Agreement, to promptly resolve the issues or areas of disagreement that are identified in the Non-Federal Sponsors' resolution of comments. No construction shall commence under this Agreement until the designs, detailed plans and specifications, and arrangements for prosecution of the Section 215 Work have been approved in writing by the District Engineer, or his representative, all bids received and the proposed provisions of any contract shall be subject to review by the Government prior to contract award. In addition, all proposed changes in approved designs, plans, and specifications also must be reviewed and approved by the District Engineer or his representative in writing in advance of the related construction where practicable. To the extent possible, the Non-Federal Sponsors also shall afford the Government the opportunity to review and comment on all contract claims prior to resolution thereof. The Non-Federal Sponsors shall consider in good faith the comments of the Government made as a result of its review, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all Section 215 Work shall be exclusively within the control of the Non-Federal Sponsors. However, the failure of the Non-Federal Sponsors to comply with direction received from the District Engineer, with respect

to the Section 215 Work, may result in the costs associated with such work being determined ineligible for credit towards the Non-Federal Sponsors' share of total project costs. Throughout the period of construction, the Non-Federal Sponsors shall furnish the Government with written monthly progress reports, by the 15th of the next month, and a copy of the Non-Federal Sponsors' Written Notice of Acceptance of Completed Work for each contract completed during the preceding month, for construction managed by the Non-Federal Sponsors for the Project.

C. The Non-Federal Sponsors may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsors in a writing that sets forth any applicable terms and conditions which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsors shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

D. When the District Engineer determines that the entire Project is complete or that a portion of the Project has become a functional portion of the Project, the District Engineer shall so notify the Non-Federal Sponsors in writing and furnish the Non-Federal Sponsors with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") for the Project or functional portion of the Project (except the Section 215 Work) and with copies of all of the Government's Written Notices of Acceptance of Completed Work for all contracts managed by the Government for the Project or the functional portion of the Project that have not been provided previously. Upon such notification, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project in accordance with Article VIII of this Agreement.

E. The Non-Federal Sponsors shall contribute 35 percent of total NED costs in accordance with the provisions of this paragraph. In the event the Park District is unable to contribute their portion of total NED costs the City shall provide such sums as are necessary to meet the Non-Federal Sponsors' share of total NED costs.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsors shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsors must provide for the construction, operation, and maintenance of the NED Plan, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the NED Plan.

2. If the Government projects that the value of the Non-Federal Sponsors' contributions under paragraph E.1. of this Article and Articles V, X, and XV.A. of this

Agreement will be less than 35 percent of total NED costs, the Non-Federal Sponsors shall provide a cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsors' total contribution equal to 35 percent of total NED costs.

3. If the Government determines that the value of the Non-Federal Sponsors' contributions provided under paragraphs E.1. and E.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 35 percent of total NED costs , the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsors for any such value in excess of 35 percent of total NED costs. After such a determination, the Government, in its sole discretion, may provide any remaining NED Plan lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining NED Plan relocations on behalf of the Non-Federal Sponsors.

F. The Non-Federal Sponsors shall contribute 100 percent of incremental costs in accordance with the provisions of this paragraph. In the event the Park District is unable to contribute their portion of the incremental costs the City shall provide such sums as are necessary to meet the Non-Federal Sponsors' share of the incremental costs.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsors shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsors must provide for the construction, operation, and maintenance of the Project that are not otherwise necessary for the NED Plan, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the Project that are not otherwise necessary for the NED Plan.

2. If the Government projects that the value of the Non-Federal Sponsors' contributions under paragraph F.1. of this Article and Articles V, X, and XV.A. of this Agreement will be less than 100 percent of incremental costs, the Non-Federal Sponsors shall provide a cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsors' total contribution equal to 100 percent of incremental costs.

3. If the Government determines that the value of the Non-Federal Sponsors' contributions provided under paragraphs F.1. and F.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 100 percent of incremental costs, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsors for any such value in excess of 100 percent of incremental costs.

G. As authorized by Section 215 of Public Law 90-483, as amended, the Government shall afford reimbursement (including reductions in the contributions of the Non-Federal Sponsors) for the Section 215 Work. Such reimbursement/reduction shall be afforded in

increments as useful increments of the Section 215 Work are completed by the Non-Federal Sponsors or on a quarterly basis, whichever occurs first. The Government, for purposes of calculating the amounts of the reimbursement/reduction for the Section 215 Work, shall first determine the NED costs for the Section 215 work and shall include such amount in total NED costs. The inclusion of such amount in total NED costs shall be subject to a technical review by the Government to verify that the work was accomplished in a satisfactory manner and in accordance with the limitations contained in this Agreement, including but not limited to Article II.P. of this Agreement. The actual amount to be included in total NED costs shall not exceed the Non-Federal Sponsors' actual costs attributable to the Section 215 Work and shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. The NED costs included in the Section 215 Work shall be the credit afforded the Section 215 work as described in Article I.D. of this Agreement. After determination of the NED costs for the Section 215 Work, the Government, to afford the Non-Federal Sponsors the reimbursement/reduction for the Section 215 Work, shall calculate the federal share of the NED costs of the Section 215 Work on a quarterly basis, and, as further specified in Article VI.B. of this Agreement, shall apply the resulting amount of the reimbursement/reduction on a quarterly basis to the cash contributions required by paragraphs E. and F. of this Article. If the actual amount of the reimbursement/reduction payable to the Non-Federal Sponsors exceeds the cash contributions required by paragraphs E. and F. of this Article, the Government shall apply the excess to offset the Non-Federal Sponsors' required contributions in that quarter. As an alternative, and in its sole discretion, the Government shall, subject to the availability of funds, reimburse the Non-Federal Sponsors in an amount equal to such excess credit amount as provided in Article VI.E. of this Agreement. The Non-Federal Sponsors' cash contributions which are required by paragraphs E. and F. of this Article shall be reduced by an amount equivalent to the amount of credit afforded for the Section 215 Work as calculated pursuant to this paragraph.

H. The Non-Federal Sponsors may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the Non-Federal Sponsors. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsors in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsors shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government, the Non-Federal Sponsors shall be responsible, as between the Government and the Non-Federal Sponsors, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

I. The Government shall perform a final accounting in accordance with Article VI.E. of this Agreement to determine the contributions provided by the Non-Federal Sponsors in accordance with paragraphs C., E., F., and H. of this Article and Articles V, X, and XV.A. of this Agreement and to determine whether the Non-Federal Sponsors have met their obligations under paragraphs C., E., F., and H. of this Article.

J. The Non-Federal Sponsors shall not use Federal funds to meet the Non-Federal Sponsors' share of total NED costs or incremental costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

K. The Non-Federal Sponsors agree to participate in and comply with applicable Federal floodplain management and flood insurance programs.

L. Not less than once each year the Non-Federal Sponsors shall inform affected interests of the extent of protection afforded by the Project.

M. The Non-Federal Sponsors shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

N. The Non-Federal Sponsors shall assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the Project.

O. The Non-Federal Sponsors shall, to the extent of their powers, prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

P. In addition to any other limitations contained in this Agreement, the affording and the amount of reimbursement/reduction for the Section 215 Work is subject to the following additional limitations:

1. No crediting of the Section 215 Work in total NED costs shall be given until the District Engineer has certified that the work subject to the credit has been completed and performed in accordance with the terms of this Agreement and is subject to an audit in accordance with Article X of this Agreement to determine reasonableness, allocability, and allowability of costs.

2. This Agreement shall not be construed as committing the Government to assume any responsibilities placed upon the Non-Federal Sponsors or any other non-Federal entity by the conditions of Federal Project authorization or any other applicable statute or regulation.

3. No crediting of the Section 215 Work in total NED costs shall be made for any work which does not, in the judgment of the Government, conform to the Project.

4. The amount of reimbursement/reduction provided by the Government to the Non-Federal Sponsors for the Section 215 Work described herein shall not exceed the statutory limitation of $5,000,000 or 1 percent of total project costs, whichever is greater.

5. The amount of credit or reimbursement for which the Non-Federal Sponsors may be eligible pursuant to this Agreement is neither subject to interest charges nor to adjustment to reflect changes in price levels between the time the Section 215 Work is completed and the time that the credit or reimbursement is afforded, except as authorized by law.

6. No credit for the Section 215 Work shall be afforded for costs incurred before the date of this Agreement.

7. The Non-Federal Sponsors shall obtain all applicable Federal, State and local permits required for the performance of the Section 215 Work and for operation, maintenance, repair, rehabilitation and replacement of the Project.

8. Any contract awarded by the Non-Federal Sponsors for the Section 215 Work awarded after the effective date of this Agreement shall include provisions consistent with all applicable Federal laws and regulations. At such time as the District Engineer is satisfied the Non-Federal Sponsors have complied with this provision he shall so certify in writing to the Non-Federal Sponsors.

9. For the Section 215 Work, the Non-Federal Sponsors shall prepare and furnish the Government, for review, a proposed Operation, Maintenance, Repair, Rehabilitation and Replacement Manual (hereinafter the "OMRR&R Manual"). The failure of the Non-Federal Sponsors to prepare an acceptable OMRR&R Manual shall not negate the Non-Federal Sponsors' responsibility to provide for the operation, maintenance, repair, rehabilitation and replacement of the completed Project, in accordance with Article VIII of this Agreement, until and unless the Project is deauthorized by Congress. The Non-Federal Sponsors shall receive credit for all reasonable, allowable and allocable costs incurred in the preparation of the OMRR&R Manual.

Q. The Non-Federal Sponsors shall provide and maintain necessary roads, parking areas, and other public use facilities open and available to all on equal terms.

ARTICLE III - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, in consultation with the Non-Federal Sponsors, shall determine the lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsors must provide, in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. The Government, in that general written description, shall delineate which of the required lands, easements, and rights-of-way are required for the NED Plan and those which are required for the Project but not for the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the Non-Federal Sponsors shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsors must provide for that contract. For so long as the Project remains authorized, the Non-Federal Sponsors shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project and that were provided by the Non-Federal Sponsors are retained in public ownership for uses compatible with the authorized purposes of the Project.

B. The Government, in consultation with the Non-Federal Sponsors, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the Project. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with construction of such improvements. The Government, in that general written description, shall delineate which of the required improvements are associated with the NED Plan and those which are associated with the Project but not with the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsors shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in

accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsors, shall determine the relocations necessary for the construction, operation, and maintenance of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with such relocations. The Government in that general written description shall delineate which of the necessary relocations are necessary for the NED Plan and which are necessary for the Project but not for the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall perform or ensure the performance of all relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsors shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsors in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs and delineate and allocate such costs to the NED Plan that are attributable to the NED Plan. The Government shall afford credit for such value toward the Non-Federal Sponsors' share of total NED costs and incremental costs.

E. The Non-Federal Sponsors shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR VALUE OF LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsors shall receive credit toward their share of total NED costs

for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsors must provide pursuant to Article III of this Agreement for the NED Plan, and for the value of the relocations that the Non-Federal Sponsors must perform or for which they must ensure performance pursuant to Article III of this Agreement for the NED Plan. However, the Non-Federal Sponsors shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project. The Non-Federal Sponsors also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the purposes of affording credit toward the Non-Federal Sponsors' share of NED costs and inclusion in total NED costs and total project costs, the value of lands, easements, and rights-of-way necessary for the NED Plan, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of such real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph. In addition, for the sole purpose of inclusion in total project costs, the value of lands, easements, and rights-of-way necessary for the Project but not for the NED Plan, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of such real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsors on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsors provide the Government with authorization for entry thereto. However, for lands, easements, or rights-of-way owned by the Non-Federal Sponsors on the effective date of this Agreement that are required for the construction of the Section 215 Work, fair market value shall be the value of such real property interests as of the date the Non-Federal Sponsors award the first construction contract for the Section 215 Work, or, if the Non-Federal Sponsors perform the construction with their own labor, the date that the Non-Federal Sponsors begin construction of the Section 215 Work. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsors after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsors shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsors and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsors' appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsors' appraisal, the Non-Federal Sponsors may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsors' second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsors' second appraisal, or the Non-Federal Sponsors choose not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsors. In the event the Non-Federal Sponsors do not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsors, shall consider the Government's and the Non-Federal Sponsors' appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsors for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsors, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsors, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsors, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsors shall, prior to instituting such proceedings, submit to the Government notification in writing of their intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsors shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal,

including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsors shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsors agree as to an appropriate amount, then the Non-Federal Sponsors shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsors cannot agree as to an appropriate amount, then the Non-Federal Sponsors may use the amount set forth in their appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the construction, operation, and maintenance of the Project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsors within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. For the purposes of affording credit toward the Non-Federal Sponsors' share of total NED costs and inclusion in total NED costs and total project costs, the Government shall determine, after consultation with the Non-Federal Sponsors, the value of relocations necessary for the NED Plan in accordance with the provisions of this paragraph. In addition, for the sole purpose of inclusion in total project costs, the Government shall determine, after consultation with the Non-Federal Sponsors, the value of relocations necessary for the Project but not for the NED Plan, in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard

that the State of Illinois would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. For the purposes of affording credit toward the Non-Federal Sponsors' share of total NED costs and inclusion in total NED costs and total project costs, the value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material associated with the NED Plan, shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. In addition, for the sole purpose of inclusion in total project costs, the value of improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material associated with the Project but not for the NED Plan, shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsors and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of construction. The Project Coordination Team shall generally oversee the Project in accordance with the provisions of this Article and the Partnering Charter. In the event of a conflict between the Partnering Charter and this Agreement, this Agreement shall control. The Government's Project Manager and a counterpart named by the Non-Federal Sponsors shall co-chair the Project Coordination Team. Members of the Project Coordination Team shall include but not be limited to the Project Manager, Chief of Design Branch, Chief of Hydraulics and Hydrology Branch, Chief of Construction Branch, Construction Inspector, Resource Management Accountant, and a

Contracting Officer representative from the Government and the City's Project Manager, Park District's Project Manager, City's Engineering Representative, and Park District's Engineering Representative from the Non-Federal Sponsors.

B. The Government's Project Manager and the Non-Federal Sponsors' counterpart shall keep the Project Coordination Team informed of the progress of construction and of significant pending issues and actions, and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; construction of the Section 215 Work; contract costs; the Government's cost projections; final inspection of the entire Project or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters. This oversight shall be consistent with a project management plan developed by the Government after consultation with the Non-Federal Sponsors in accordance with ER 5-7-1(FR) and ER 5-1-11.

D. The Project Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Coordination Team generally oversees which relate to the portions of the Project to be constructed by the Government, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Coordination Team. The Government, having the legal authority and responsibility for construction of the Project, except for the Section 215 Work, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations. However, the Government's exercise of this discretion shall be subject to paragraphs G. and H. of this Article.

E. The Project Coordination Team may make recommendations that it deems warranted to the Non-Federal Sponsors on matters that the Project Coordination Team generally oversees which relate to the portions of the Project to be constructed by the Non-Federal Sponsors, including suggestions to avoid potential sources of dispute. The Non-Federal Sponsors in good faith shall consider the recommendations of the Project Coordination Team. The Non-Federal Sponsors, having the legal authority and responsibility for construction of the Section 215 Work, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations. However, the Non-Federal Sponsors' exercise of this discretion shall be subject to paragraphs G. and H. of this Article. Notwithstanding any other provision of this Agreement, the Non-Federal Sponsor may not reject or modify the Project Coordination Team's recommendations when the purpose of such recommendations is to ensure that the Project complies with Federal, State, or

local laws and regulations.

F. The costs of participation in the Project Coordination Team shall be included in total project costs and cost shared in accordance with the provisions of this Agreement. The Government shall also delineate which of these costs are attributable to the NED Plan and allocate these costs to total NED costs.

G. If a dispute arises which cannot be resolved by the Project Coordination Team and further negotiation is considered by the Team members to be futile, the Government's Project Manager and counterpart for the Non Federal Sponsors may elect to report the dispute in writing to the District Engineer and the City's Project Manager and Park District's Project Manager. Within 15 days of receipt of notice of such a dispute, the District Engineer and the City's Project Manager and Park District's Project Manager, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the dispute. If the District Engineer and the City's Project Manager and Park District's Project Manager, or their duly appointed representatives, are unable to resolve the dispute, they may elect to report the dispute in writing to the U.S. Army Engineer for the Great Lakes and Ohio River Division (hereinafter the "Division Engineer") and the City's Commissioner for the Department of Environment and Park District's General Superintendent. Within 15 days of receipt of notice of such a dispute, the Division Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the dispute. If the Division Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives, are unable to resolve the dispute, they may elect to report the dispute in writing to the Director of Civil Works and the City's Mayor. Within 15 days of receipt of notice of the dispute, the Director of Civil Works and the City's Mayor, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the dispute.

H. If the monthly progress reports, monthly financial reports, review comments, or any other written notice required by this Agreement are not received by each party in a timely manner, the Government's Project Manager and counterpart for the Non Federal Sponsors may elect to report the lack of compliance in writing to the District Engineer and the City's Project Manager and Park District's Project Manager. Within 15 days of receipt of notice of such a lack of compliance, the District Engineer and the City's Project Manager and Park District's Project Manager, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the lack of compliance. If the District Engineer and the City's Project Manager and Park District's Project Manager, or their duly appointed representatives, are unable to resolve the lack of compliance, they may elect to report the lack of compliance in writing to the Division Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent. Within 15 days of receipt of notice of

such a lack of compliance, the Division Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the lack of compliance. If the Division Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives, are unable to resolve the lack of compliance, they may elect to report the dispute in writing to the Director of Civil Works and the City's Mayor. Within 30 days of receipt of notice of the lack of compliance, the Director of Civil Works and the City's Mayor, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the lack of compliance.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs, total NED costs, incremental costs, and costs due to betterments. By the 15th of each and every month following the effective date of this Agreement, the Government shall provide the Non-Federal Sponsors with a written report setting forth all contributions provided to date and the current projections of total project costs; total NED costs; incremental costs; total costs due to betterments; a breakdown of each of the aforementioned costs into categories including but not limited to PED, E&D during construction, actual construction, construction management, Federal oversight of Section 215 Work, and Government overhead; of the maximum amount of total project costs determined in accordance with Article XIX of this Agreement; of the components of total project costs; of each party's share of total project costs; of the Non-Federal Sponsors' total cash contributions required in accordance with Articles II.C., II.E., II.F., and II.H. of this Agreement; of the non-Federal proportionate share; of the credit afforded the Non-Federal Sponsors in accordance with Articles II.G. and II.P., and of the funds the Government projects to be required from the Non-Federal Sponsors for the upcoming fiscal year by quarters. By the 15th of each and every month following the effective date of this Agreement, the Non-Federal Sponsors shall provide the Government with a written report setting forth estimated and actual (to date) betterment costs; the total project cost estimates for the work performed by the Non-Federal Sponsors by segment; a breakdown of each of the aforementioned costs into categories including but not limited to engineering and design costs, construction management costs, program and project management costs, and any additional costs that fall into other categories not identified herein; and projections (for the current month through the end of the current month) of financial obligations, contractor accruals, and expenditures of work performed by the Non-Federal Sponsors. On the effective date of this Agreement, total project costs are projected to be $21,160,300, total NED costs are projected to be $12,687,500 and incremental costs are projected to be $8,472,800. The Non-Federal Sponsors' cash contributions required under Article II.E. of this Agreement for total NED costs are projected to be $4,440,600, contributions required under Article II.F. for incremental

costs are projected to be $8,472,800, and total Non-Federal Sponsors' contributions are projected to be $12,913,400. The amount of credit for the Section 215 Work to be afforded against the Non-Federal Sponsors' required contribution towards total project costs in accordance with Article II.G. of this Agreement is projected to be $5,000,000. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsors.

B. The Park District, to the extent not prohibited by Illinois law, and the City as Non-Federal Sponsors shall provide the cash contribution required under Articles II.E. and II.F. of this Agreement in accordance with the provisions of this paragraph.

1. Not less than 30 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract by the Government, the Government shall notify the Non-Federal Sponsors in writing of such scheduled date and the funds the Government determines, after offsetting for reimbursements/reductions afforded for Section 215 Work in accordance with Article II.G. of this Agreement, to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction through the first quarter, including the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction and an amount of projected financial obligations necessary for a contingency fund to facilitate ongoing Government construction through the first fiscal quarter of construction. Not later than such scheduled date, the Non-Federal Sponsors shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors. For the remaining quarters of the first fiscal year of construction, the Government, after offsetting for reimbursements/reductions afforded for Section 215 Work in accordance with Article II.G. of this Agreement, shall notify the Non-Federal Sponsors in writing, no later than 60 calendar days prior to the beginning of that fiscal year quarter and the subsequent fiscal year quarters, of the funds the Government determines to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction and the contingency fund for that quarter of the fiscal year. No later than 30 calendar days prior to the beginning of that quarter, the Non-Federal Sponsors shall make the full amount of the required funds for that quarter available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

2. For the second and subsequent fiscal years of construction, the Government, after offsetting for reimbursements/reductions afforded for Section 215 Work in accordance with Article II.G. of this Agreement, shall notify the Non-Federal Sponsors in writing, no later than 60 calendar days prior to the beginning of that fiscal year quarter and the subsequent fiscal year quarters, of the funds the Government determines to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction

and the contingency fund for that quarter of the fiscal year. No later than 30 calendar days prior to the beginning of that quarter, the Non-Federal Sponsors shall make the full amount of the required funds for that quarter available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

3. The Government shall draw from the funds provided by the Non-Federal Sponsors in accordance with paragraphs B.1. and B.2. of this Article such sums as the Government deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction; and (b) the non-Federal proportionate share of financial obligations for construction as they are incurred during the period of construction.

4. If at any time during the period of construction the Government, after offsetting for reimbursements/reductions afforded for Section 215 Work in accordance with Article II.G. of this Agreement, determines that additional funds will be needed from the Non-Federal Sponsors to cover the non-Federal proportionate share of projected financial obligations for construction for the current fiscal year quarter, the Government shall notify the Non-Federal Sponsors in writing of the additional funds required together with an explanation of why additional funds are required, and the Non-Federal Sponsors, no later than 30 calendar days from receipt of such notice, shall make the additional required funds available through the payment mechanism specified in Article VI.B.1. of this Agreement.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.C. or II.H. of this Agreement, the Non-Federal Sponsors shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors. The Government shall draw from the funds provided by the Non-Federal Sponsors such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsors must provide additional funds to meet their cash contribution, the Government shall notify the Non-Federal Sponsors in writing of the additional funds required together with an explanation of why additional funds are required. Within 30 calendar days thereafter, the Non-Federal Sponsors shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors.

D. Each quarter, the Non-Federal Sponsors shall be entitled to reduce the cash contributions required under Article VI.B. of this Agreement by an amount equal to the reimbursement/reduction for the Section 215 Work as calculated pursuant to the quarterly audit provisions in this paragraph. Within fifteen working days after the end of each quarter, the Government, using information received from the Non-Federal Sponsors in accordance with

paragraph A. of this Article, shall (a) conduct an accounting of all costs incurred by the Non-Federal Sponsors with respect to the Section 215 Work completed by the Non-Federal Sponsors in that quarter, and (b) complete an interim audit satisfying the conditions of reimbursement/reduction set forth in Article II.P. of this Agreement for the purposes of determining the amount of the reimbursement/reduction to be afforded the Non-Federal Sponsors for the Section 215 Work for that quarter. If, as a result of the quarterly accounting and audit in (a) and (b) above, the Non-Federal Sponsors have incurred costs for the Section 215 Work that render its total contributions to the Project as of the date of the accounting greater than the Non-Federal share of total project costs incurred to date, a reimbursement/reduction shall be afforded to the Non-Federal Sponsors in the amount of the excess of its actual expenses for the Section 215 work over the Non-Federal share of total project costs incurred to date, and said reimbursement/reduction shall be used to reduce the amount of cash contributions provided to the Government for the work that the Government is performing for the 31st-through 33rd-Street segment of the Project.

E. After completion of each of the following: (a) construction of each segment; (b) the period of construction, or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting of all costs associated with each segment and furnish the Non-Federal Sponsors with the results of that accounting. The accounting shall determine segment costs, NED costs, incremental costs, each party's contribution provided thereto (including any reimbursements/reductions afforded to the Non-Federal Sponsors), and each party's required share thereof associated with that segment of the Project. The accounting also shall determine costs due to betterments and the Non-Federal Sponsors' cash contribution provided pursuant to Article II.C. of this Agreement.

1. In the event the accounting shows that the total contribution (including any reimbursements/reductions afforded to the Non-Federal Sponsors) per segment provided by the Non-Federal Sponsors is less than their required share of required NED costs and incremental costs for the appropriate segment, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement, the Non-Federal Sponsors shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsors' required share of NED costs and incremental costs, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement for the appropriate segment.

2. In the event the final accounting shows that the total contribution (including any reimbursements/reductions afforded to the Non-Federal Sponsors) per segment provided by the Non-Federal Sponsors exceeds their required share of total NED costs and incremental costs for the appropriate segment, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement for the appropriate segment, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsors no later than 90 calendar days

after the final accounting is complete. In the event existing funds are not available to refund the excess to the Non-Federal Sponsors, the Government shall seek such appropriations as are necessary to make the refund. If so desired by the Non-Federal Sponsors, the Government shall not refund the excess to the Non-Federal Sponsors but instead apply the value of the excess toward subsequent required contributions of the Non-Federal Sponsors, so long as the Non-Federal Sponsors provides written notice of its desire to the Government no later than 30 calendar days after completion of the final accounting for the segment.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

A. Upon notification in accordance with Article II.D. of this Agreement and for so long as the Project remains authorized, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XI of this Agreement and specific directions in the OMRR&R Manual and any subsequent amendments thereto.

B. The Non-Federal Sponsors hereby give the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors own or control for access to the Project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Non-Federal Sponsors for any reason are failing to perform their obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsors. If, after 30 calendar days from receipt of notice, the Non-Federal Sponsors continue to fail to perform, or fail to diligently undertake reasonable efforts to cure the deficiency, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors own or control

for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsors of responsibility to meet the Non-Federal Sponsors' obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX - SAVE AND HOLD HARMLESS

The Non-Federal Sponsors shall hold and save the Government free from all damages arising from the design, construction, operation, maintenance, repair, replacement, and rehabilitation of the Project and any Project-related betterments, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 30 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsors shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsors shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of construction and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsors shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsors are responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-133 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsors and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsors and independent auditors any information necessary to enable an audit of the Non-Federal Sponsors' activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-133, and such costs as are allocated to the Project shall be included in total project costs and, as determined by the Government, included in total NED

costs, and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct audits in addition to any audit that the Non-Federal Sponsors are required to conduct under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project costs and, as determined by the Government, included in total NED costs, and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsors and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army", and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans.

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement, the Government and the Non-Federal Sponsors each act in an independent capacity, and no party is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other parties, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsors fail to fulfill their obligations under Article II.C., II.E., II.F., II.H., VI, XVIII.C. or XVIII.D. of this Agreement the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or suspend future performance under this Agreement unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If the Government fails to receive annual appropriations in amounts sufficient to meet its share of scheduled Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsors in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsors elect to terminate this Agreement.

C. In the event that either the Government or the Non-Federal Sponsors elect to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.E. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of liability for any obligation previously incurred. Any delinquent payment by the Non-Federal Sponsors shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsors shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsors determine to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the

Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsors with prior specific written direction, in which case the Non-Federal Sponsors shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsors for such investigations for hazardous substances shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project, the Non-Federal Sponsors and the Government shall provide prompt written notice to the other, and the Non-Federal Sponsors shall not proceed with the acquisition of the real property interests until all parties agree that the Non-Federal Sponsors should proceed.

C. The Government and the Non-Federal Sponsors shall determine whether to initiate construction of the Project, or, if already in construction, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. Should the Government and the Non-Federal Sponsors determine to initiate or continue with construction after considering any liability that may arise under CERCLA, the Non-Federal Sponsors shall be responsible, as between the Government and the Non-Federal Sponsors, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of either total project costs or total NED costs. In the event the Non-Federal Sponsors fail to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsors' responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project.

D. The Non-Federal Sponsors and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under

CERCLA.

E. As between the Government and the Non-Federal Sponsors, the Non-Federal Sponsors shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or by telegram or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsors:

Commissioner
City of Chicago
Department of Environment
30 North LaSalle Street, 25th Floor
Chicago, Illinois 60602

General Superintendent
Chicago Park District
425 East McFetridge Drive
Chicago, Illinois 60605

If to the Government:

District Engineer
U. S. Army Corps of Engineers, Chicago District
111 North Canal Street, Suite 600
Chicago, Illinois 60606

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually

received or seven calendar days after it is mailed.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared in accordance with the provisions of this Agreement.

B. As specified in Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in either total project costs, or total NED costs up to the statutory limit of one percent of the total amount authorized to be appropriated for the Project.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared between the Non-Federal Sponsors and the Government in accordance with the provisions of this Agreement.

D. Notwithstanding the above, the Non-Federal Sponsors shall pay 100 percent of any costs of mitigation and data recovery that are not attributable to the NED Plan.

ARTICLE XIX - SECTION 902 PROJECT COST LIMITS

The Non-Federal Sponsors have reviewed the provisions set forth in Section 902 of Public Law 99-662, as amended, and understand that Section 902 establishes the maximum amount of total project costs for the Authorized Project. Notwithstanding any other provision of this Agreement, the Government shall not make a new Authorized Project financial obligation, make an Authorized Project expenditure, or afford credit toward total project costs for the value of any contribution provided by the Non-Federal Sponsors, if such obligation, expenditure, or credit would result in total project costs exceeding this maximum amount, unless otherwise authorized by law. On the effective date of this Agreement, this maximum amount is estimated to be

$299,316,000 as calculated in accordance with ER 1105-2-100 using October, 1997 price levels and allowances for projected future inflation. The Government shall adjust this maximum amount in accordance with Section 902.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY

BY: _____ Date: August 7 1998

Joseph W. Westphal
Assistant Secretary of the Army
(Civil Works)

THE CITY OF CHICAGO

BY: _____ Date: August 3, 1998

Richard M. Daley
Mayor

ATTEST: _____

Brian Crowe
Corporation Counsel

THE CHICAGO PARK DISTRICT

BY: _____ Date: August 3, 1998

Carolyn Williams Meza
General Superintendent
Chicago Park District

ATTEST: _____

Carol A. Diver
Secretary
Chicago Park District

EXHIBIT A

Paragraphs 1 through 5 of this Exhibit will establish the methodology for purposes of determining total NED costs. These cost estimates will then be compared to actual costs for the Project plan in order to establish incremental costs for the Project.

1. No additional design will be performed with respect to the features identified in the NED Plan defined in Article 1 (B) of this agreement.

2. If, in any construction contract for the Project, the NED Plan is substantially the same as the Project plan, total NED costs relating to that construction contract will be the same as total Project costs and no other adjustments will be made.

3. Other than as provided in paragraph 2. above, the methodology for determining NED construction costs will be as set forth in the following subparagraphs:

(A) As of the date of award of each construction contract, the Government shall have conducted a market survey of stone material prices from Government inspected and approved Category I sources, F.O.B job site. Stone material prices for the NED Plan will be determined based on the average of the two lowest written quotes, F.O.B. job site as of the date of contract award, from those sources capable of providing sufficient quantities of approved stone for the portion of the NED plan relating to that contract. The Government shall elicit at least 4 written quotes from inspected and approved Category 1 quarries with sufficient quantities and quality of stone to fulfill NED requirements. The Government shall make periodic inspections of these quarries to insure that the quantities and quality of stone quoted exist.

(B) Upon completion of each construction contract, the Government estimates of construction items stated in the approved NED Plan other than those described in paragraph 3.(A) above will be adjusted using the appropriate Engineering News-Record Construction Cost Index to the current price levels as of the date of the construction award for each Contract in each construction contract. If a construction contract is scheduled to extend for more than one calendar year, the above construction items will be adjusted, covering the period commencing with the construction award and ending with contract completion, to reflect cost escalation using the appropriate Engineering News-Record Construction cost indices as of the midpoint date of the scheduled work.

(C) At the time of completion of each construction contract, adjustments to material quantities for the applicable construction contract of the NED Plan will be made based on the construction contractor's pre-construction hydrographic survey data. This data will be superimposed upon the most applicable NED design cross-section, adjusting the "neat lines" for the average of the elevations of the upper and lower tolerance levels. The material quantities will be re-computed from the resultant maps.

(D) A revised NED construction cost will be generated from the approved NED plan MCACES (Micro Computer Assisted Cost Estimating System), or its successor, estimates with adjustments to material quantities and prices as described above. An eight percent (8%) contingency will be included in the MCACES estimate of NED construction costs.

4. The estimated costs of Engineering and Design (E&D) and Construction Management (CM) for the NED Plan will be based on the ratio of the estimated E&D and CM costs of the NED Plan to those for the Project plan as contained in the Chicago Shoreline Project Management Plan dated August, 1993. The ratios for Reach 2 are 88% for E&D and 90% for CM. Those for Reach 4 are 78% for E&D and 77% for CM. For all other Reaches, actual E&D and CM costs for the Authorized Plan will be 100% NED. The NED portion of E&D and CM for each construction contract will be determined by multiplying the applicable ratio for that Reach above by the actual CM and E&D costs incurred for the construction segment.

5. The costs computed in paragraph 2. (if applicable) or the sum of the costs computed in paragraphs 3. and 4. above will be the total NED cost for cost sharing purposes.

6. For the sole purposes of estimating budgetary commitment amounts and escrow deposits by the Non-Federal Sponsor, the NED plan shall be revised during the Design Memorandum for each segment, using current stone material prices and construction estimates as described in Paragraphs 3.(A) and 3.(B) above. Quantities will be adjusted based on Design Memorandum level surveys. Thereafter until the final accounting, the NED cost shall be updated annually utilizing the Cost Estimates-Updating Indices which are published annually by the Government's Office of Management and Budget.

CERTIFICATE OF AUTHORITY

I, Joan Fencik, do hereby certify that I am the principal legal officer of the Chicago Park District, that the Chicago Park District is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Chicago Park District in connection with the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by section 221 of Public Law 91-611 (42 U.S.C. section 1962d-5b), and that the persons who have executed this Agreement on behalf of the Chicago Park District have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 4th day of August 1998.

Joan Fencik

Joan Fencik
General Counsel
Chicago Park District

CERTIFICATE OF AUTHORITY

I, Brian Crowe, do hereby certify that I am the principal legal officer of the City of Chicago, that the City of Chicago is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Chicago in connection with the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project , and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by section 221 of Public Law 91-611 (42 U.S.C. section 1962d-5b), and that the persons who have executed this Agreement on behalf of the City of Chicago have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 3rd day of August 1998.

Brian Crowe
Corporation Counsel

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

RICHARD M. DALEY
Mayor
City of Chicago

DATE: August 3, 1998

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

C W Meza

CAROLYN WILLIAMS MEZA
General Superintendent
Chicago Park District

DATE: August 3, 1998

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ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Project Cooperation Agreement #3

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PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE CITY OF CHICAGO AND
THE CHICAGO PARK DISTRICT
FOR
CONSTRUCTION OF THE REMAINDER OF THE
CHICAGO SHORELINE, CHICAGO, ILLINOIS PROJECT

THIS AGREEMENT is entered into this 17 th day of MAY, 1999, by and between the DEPARTMENT OF THE ARMY (hereinafter the "Government"), represented by the Assistant Secretary of the Army (Civil Works), and the CITY OF CHICAGO (hereinafter the "City") represented by its Mayor, and the CHICAGO PARK DISTRICT, (hereinafter the "Park District"), represented by its General Superintendent (the City and the Park District hereinafter collectively referred to as the "Non-Federal Sponsors").

WITNESSETH, THAT:

WHEREAS, construction of the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project (hereinafter referred to as the "Authorized Project") along the shoreline of Lake Michigan from Wilson Avenue south to 79th Street at Chicago, Cook County, Illinois was authorized by Section 101(a)(12) of the Water Resources Development Act of 1996 (Public Law 104-303) (hereinafter the "WRDA 96");

WHEREAS, the Government and the Non-Federal Sponsors desire to delete Reach 2D (North Avenue to Oak Street) from the Authorized Project and exclude any such work that may be accomplished from the reimbursement and credit provisions associated with this Agreement;

WHEREAS, the Government and the Non-Federal Sponsors entered into a previous Project Cooperation Agreement dated April 28, 1997 for the construction of the South Water Filtration Plant Breakwater (which Breakwater is contained within Reach 5 which extends from 57th Street to 79th Street);

WHEREAS, the Government and the Non-Federal Sponsors entered into a subsequent Project Cooperation Agreement dated August 7, 1998 for the construction of additional areas of the Authorized Project, including the rehabilitation of the shoreline of Lake Michigan consisting of beach stabilization, a 1,000 ft segment of revetment north of Belmont Harbor entrance between Aldine Street and Roscoe Street, and a revetment between 31st and 33rd Streets at Chicago, Cook County, Illinois (hereinafter the "Interim Agreement");

WHEREAS, the Government and the Non-Federal Sponsors desire to enter into a Project Cooperation Agreement (hereinafter the "Agreement") for construction of the rehabilitation of the shoreline of Lake Michigan consisting of Reach 2, Segments 1 through 3; Reach 2F; Reach 3M; Reach 3; and Reach 4, Segments 1, 2, 5, 6, 7, 8a, and 8b: as delineated in Exhibit B of this Agreement and as generally described in the Illinois Shoreline Erosion, Interim 3, Wilmette to Illinois/Indiana State Line, Storm Damage Reduction, Plan IV, Final Feasibility Study Report and Environmental Assessment (EA) dated July, 1993, revised March 1994, and approved April 14, 1994 by the Chief of Engineers, Department of the Army, as supplemented by the Limited Re-Evaluation Report dated March, 1998 and approved on July 9, 1998 by the Assistant Secretary of the Army (Civil Works) (hereinafter the "Project" as defined in Article I.A. of this Agreement);

WHEREAS, Section 103(C)(5) of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to the Project;

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, provide that the Secretary of the Army shall not commence construction of any water resources project, or separable element thereof, until each non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

WHEREAS, Section 902 of Public Law 99-662 establishes the maximum amount of costs for the Authorized Project and sets forth procedures for adjusting such maximum amount;

WHEREAS, the City and the Park District and the Government each have the full authority and capability to perform as hereinafter set forth and intend to cooperate in cost-sharing and financing of the construction of the Project in accordance with the terms of this Agreement;

WHEREAS, the Non-Federal Sponsors propose to perform certain work, as defined in Article I.N. of this Agreement (hereinafter referred to as the "Additional Non-Federal Work"), which falls within the parameters of the Project as defined in Article I.A. of this Agreement;

WHEREAS, Section 206(e) of the Water Resources Development Act of 1992, Public Law 102-580, authorizes the Secretary of the Army, subject to the enactment of appropriation Acts, to reimburse a non-Federal interest (including providing reductions of the contributions of the non-federal interest that it would otherwise be required to make) in an amount equal to the estimate of the Federal share, without interest, of the cost of any authorized shoreline protection project or separable element thereof which is constructed under Section 206;

WHEREAS, such reimbursements or reductions under Section 206(e) also require that the Government (a) approve plans for the construction after project authorization and prior to initiation of construction, (b) find the construction to be

economically justified and environmentally acceptable, (c) consider budgetary and programmatic priorities and any other appropriate factors in reviewing plans, (d) regularly monitor and audit any non-federal project construction to ensure that it complies with approved plans and that costs are reasonable, and (e) certify, prior to any reimbursement or reduction, that the work by the non-federal interest has been performed in accordance with applicable permits or approved plans;

WHEREAS, the Secretary of the Army has determined that it is in the public interest to afford credit (that is, as further provided in this Agreement, a reduction in the Non-Federal Sponsors' cash contribution or reimbursement) toward total project costs for the Additional Non-Federal Work, as described in Article I.O of this Agreement, and to reduce the Non-Federal Sponsor's cash contributions by the amount of the credit to the extent authorized by law;

WHEREAS, credit may be afforded only after the appropriation of funds and the commencement of construction of the Project by the Government and the Non-Federal Sponsors;

WHEREAS, Section 101(a)(12) of the Water Resources Development Act of 1996, Public Law 104-303, provides that the Secretary of the Army shall reimburse the Non-Federal Sponsors for the Federal share of any costs incurred by the Non-Federal Sponsors in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the Authorized Project;

WHEREAS, on July 9, 1998, the Government determined that reconstruction of the revetment structures along Solidarity Drive in Chicago, Illinois, is a component of the Authorized Project;

WHEREAS, subject to the terms of this Agreement (including but not limited to Articles I.O, II.G and II.P of this Agreement), work performed by the Non-Federal Sponsors on Solidarity Drive will be included in the Project;

WHEREAS, the Government and the Non-Federal Sponsors, in connection with this Agreement, desire to foster a "partnering" strategy and a working relationship between the Government and the Non-Federal Sponsors through a mutually developed formal strategy of commitment and communication embodied herein, which creates an environment where trust and team work prevent disputes, foster a cooperative bond between the Government and the Non-Federal Sponsors, and facilitate the completion of a successful project;

WHEREAS, the Government and the Non-Federal Sponsors formalized the commitment of a partnering strategy and working relationship in the Chicago Shoreline Protection Project Partnering Charter, dated February 18, 1998, (hereinafter the "Partnering Charter");

WHEREAS, providing the parties have sufficient funding and barring unforeseen construction delays the Government and the Non-Federal Sponsors desire to complete the contracting for the construction of the Project by the end of the federal fiscal year 2005;

NOW, THEREFORE, the Government and the Non-Federal Sponsors agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

A. The term "Project" shall mean: the rehabilitation of the shoreline of Lake Michigan consisting of Reach 2, Segments 1 through 3; Reach 2F; Reach 3M; Reach 3 and Reach 4, Segments 1, 2, 5, 6, 7, 8a and 8b: as delineated in Exhibit B of this Agreement as generally described in the Illinois Shoreline Erosion, Interim 3, Wilmette to Illinois/Indiana State Line, Storm Damage Reduction, Plan IV, Final Feasibility Study Report and Environmental Assessment (EA) dated July 1993, Revised March 1994, and approved April 14, 1994 by the Chief of Engineers, Department of the Army, as supplemented by the Limited Re-Evaluation Report dated March 1998 and approved on July 9, 1998 by the Assistant Secretary of the Army (Civil Works). The Project includes the Additional Non-Federal Work described in paragraph N. of this Article and the Solidarity Drive Work, if any, as described in Article I.O of this Agreement.

B. The term "NED plan" shall mean a combination of measures, featuring rubble mound revetments, which captures the high priority storm damage reduction outputs at lowest cost while preserving as much of the recreation use of the Chicago shoreline as possible as further described as Plan I in the abovementioned Feasibility report.

C. The term "total project costs" shall mean all costs incurred by the Non-Federal Sponsors and the Government in accordance with the terms of this Agreement directly related to construction of the Project. Subject to the provisions of this Agreement, the term shall include, but is not necessarily limited to: continuing planning and engineering costs incurred after October 1, 1985; advanced engineering and design costs; the Government's preconstruction engineering and design costs; engineering and design costs during construction; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation activities in accordance with Article XVIII.A. and XVIII.C. of this Agreement; actual construction costs, including the costs of alteration, lowering, raising, or replacement and attendant removal of existing railroad bridges and approaches thereto; costs eligible for credit for the Additional Non-Federal Work, the Solidarity Drive Work, if any, in accordance with Article II.G. of this Agreement; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit in accordance with Article IV of this Agreement; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas that the Government determines, pursuant to Article III of this Agreement, to be required for the Project but not for the NED Plan; and costs of audit in accordance with Article X of this Agreement. The term does not

include any costs for operation, maintenance, repair, replacement, or rehabilitation; any costs due to betterments; or any costs of dispute resolution under Article VII of this Agreement.

D. The term "total NED costs" shall mean the costs, as determined by the Government, that the Government and the Non-Federal Sponsors would have incurred for the Project had the NED Plan been constructed. Such costs shall consist of all costs the Government and the Non-Federal Sponsors would have incurred in construction of the NED Plan features, including but not necessarily limited to: preconstruction engineering and design costs incurred by the Government including costs of preparation of plans and specifications; the costs of investigations to identify the existence and extent of hazardous substances in accordance with Article XV.A. of this Agreement; costs of historic preservation investigation in accordance with Article XVIII.A. and XVIII.C. of this Agreement; additional engineering and design costs during construction; total construction costs that would have been incurred subsequent to the effective date of this Agreement including costs incurred for the Additional Non-Federal Work as defined in paragraph N. of this Article, for which the Government affords credit in accordance with Articles II.G. and II.P. of this Agreement, to the extent that they do not duplicate costs otherwise included in this paragraph D. of this Article and to the extent that these costs would have been incurred for construction of the NED plan features; costs incurred for Solidarity Drive Work, if any; supervision and administration costs; costs of participation in the Project Coordination Team in accordance with Article V of this Agreement; costs of contract dispute settlements or awards; the value of lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas for which the Government affords credit toward the NED costs in accordance with Article IV of this Agreement; and applicable costs of audit in accordance with Article X of this Agreement. The term does not include any costs for operation, maintenance, repair, rehabilitation, or replacement; any costs due to betterments; or any costs of dispute resolution under Article IX of this Agreement. Total NED costs currently are estimated to be $230,181,000. Total NED cost shall be calculated pursuant to Exhibit A.

E. The term "incremental costs" shall mean the difference between total project costs and total NED costs.

F. The term "financial obligation for construction" shall mean a financial obligation of the Government, other than an obligation pertaining to the provision of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas, that results or would result in a cost that is or would be included in total project costs.

G. The term "non-Federal proportionate share" shall mean the ratio of the Non-Federal Sponsors' total cash contribution required in accordance with Articles II.E.2. and II.F.2. of this Agreement to total financial obligations for construction, as projected by the Government.

H. The term "period of construction" shall mean the time from the date the Government first notifies the Non-Federal Sponsors in writing, in accordance with Article VI.B. of this Agreement, of the scheduled date for issuance of the solicitation for the first construction contract to the date that the U.S. Army Engineer for the Chicago District (hereinafter the "District Engineer") notifies the Non-Federal Sponsors in writing of the Government's determination that construction of the Project is complete.

I. The term "highway" shall mean any public highway, roadway, street, or way, including any bridge thereof.

J. The term "relocation" shall mean providing a functionally equivalent facility to the owner of an existing utility, cemetery, highway or other public facility, or railroad when such action is authorized in accordance with applicable legal principles of just compensation or as otherwise provided in the authorizing legislation for the Project or any report referenced therein. Providing a functionally equivalent facility may take the form of alteration, lowering, raising, or replacement and attendant removal of the affected facility or part thereof.

K. The term "fiscal year" shall mean one fiscal year of the Government. The Government fiscal year begins on October 1 and ends on September 30.

L. The term "functional portion of the Project" shall mean a portion of the Project that is suitable for tender to the Non-Federal Sponsors to operate and maintain in advance of completion of the entire Project. For a portion of the Project to be suitable for tender, the District Engineer must notify the Non-Federal Sponsors in writing of the Government's determination that the portion of the Project is complete and can function independently and for a useful purpose, although the balance of the Project is not complete.

M. The term "betterment" shall mean a change in the design and construction of an element of the Project resulting from the application of standards that the Government determines exceed those that the Government would otherwise apply for accomplishing the design and construction of that element.

N. The term "Additional Non-Federal Work" shall mean the engineering and design, construction management and construction of a portion of the Project described as Reaches 2F; 3M; and 4, Segments 7, 8a, and 8b and further described in Exhibit B. As total NED costs include the value of lands, easements, rights-of-way, relocations, or suitable borrow and dredged or excavated material disposal areas associated with the Additional Non-Federal Work which are required for the NED Plan, such value shall not be included in the Additional Non-Federal Work as defined in this paragraph. The Government understands that the Non-Federal Sponsors shall contract for the Additional Non-Federal Work to proceed in distinct stages as authorized.

O. The term "Solidarity Drive Work" shall mean the portion of Reach 3 -

Solidarity Drive consisting of approximately a 3,000 foot segment of shoreline revetment extending from the isthmus at Shedd Aquarium east to the Adler Planetarium and around to the south side of the Planetarium for which the Congress of the United States (hereinafter the "Congress") enacts legislation having the effect of authorizing the Government to credit or reimburse costs of the Non-Federal Sponsors which were incurred prior to the effective date of this Agreement.

ARTICLE II - OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSORS

A. The Government, subject to receiving funds appropriated by the Congress and using those funds and funds provided by the Non-Federal Sponsors shall expeditiously construct the Project (with the exception of the Additional Non-Federal Work), applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

1. The Government shall afford the Non-Federal Sponsors opportunity to review and comment on the solicitations for all contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations. Prior to the initiation of plans and specifications for a segment of the Project, the Project Coordination Team as defined in Article V of this Agreement shall conduct a project definition meeting which will identify general design parameters of project features including widths, profiles and elevations, identify anomalies requiring special design treatments, and identify project milestones. The Government shall provide the solicitations, including relevant plans and specifications, to the Non-Federal Sponsors for the opportunity to review and comment at the 50 percent and 95 percent stage of preparation of each solicitation, including relevant plans and specifications. Such reviews shall by completed by the Non-Federal Sponsors within 10 days of receipt of each solicitations package, including relevant plans and specifications. Within 10 days of receipt of the Non-Federal Sponsors' comments on each solicitations package at each such stage of completion, the Government shall document in writing the resolution of each comment including detailed reasons for nonconcurring in a comment. The Government and the Non-Federal Sponsors shall consult in good faith, through the Project Coordination Team in accordance with Article V of this Agreement, to promptly resolve the issues or areas of disagreement that are identified in the Government's resolution of comments. The Government shall not issue the solicitation for the first construction contract until the Non-Federal Sponsors have confirmed in writing their willingness to proceed with the Project. The Government shall afford the Non-Federal Sponsors the opportunity to review and comment on all contract modifications, including change orders, prior to the issuance to the contractor of a Notice to Proceed. In any instance where providing the Non-Federal Sponsors with notification of a contract modification or change order is not possible prior to issuance of the Notice to Proceed, the Government shall provide such notification in writing at the earliest date possible. To the extent possible, the Government also shall afford the Non-Federal Sponsors opportunity to review and comment on all contract claims prior

to resolution thereof. The Government shall consider in good faith the comments of the Non-Federal Sponsors, but the contents of solicitations, award of contracts, execution of contract modifications, issuance of change orders, resolution of contract claims, and performance of all work on the Project (with the exception of the Additional Non-Federal Work) (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

2. The Government and the Non-Federal Sponsors shall use their best efforts to engage in a consensus-based process in the review and approval of designs, plans, specifications and modifications before the parties proceed to construction of the Project. Every effort will be made by all parties to the Agreement to coordinate on the decision-making for review and approvals of designs, plans, specifications and modifications while taking into account that the Government has final approval over budget and contracting matters and for ensuring that all economic benefits are achieved and federal design standards are met.

3. Throughout the period of construction, the District Engineer shall furnish the Non-Federal Sponsors with written monthly progress reports, by the 15th of the next month, and a copy of the Government's Written Notice of Acceptance of Completed Work for each contract completed during the preceding month, for construction managed by the Government for the Project. Prior to issuance of the Written Notice of Completed Work, the Government shall conduct a final inspection and shall invite the Non-Federal Sponsor to participate and offer comments.

B. For any segment of the Project that is a portion of Additional Non-Federal Work, the Project Coordination Team as defined in Article V of this Agreement shall conduct a project definition meeting which will identify general design parameters of project features including widths, profiles and elevations, identify anomalies requiring special design treatments, and identify project milestones. Throughout the review process for Additional Federal Work, the Government and Non-Federal Sponsors, acting through the Project Coordination Team shall consult in good faith to promptly resolve issues or areas of disagreement that are identified. Upon resolution of general design parameters, the Non-Federal Sponsors shall provide copies of the solicitations, bids and qualification statements for any design and/or construction agents for that work for the Government's review and approval as to the ability and capability of each proposed agent. Award of any contract for design or construction agents (not including construction contractors) shall be subject to approval by the District Engineer or designee. The criteria to be considered in the approval process will show that the Firm is highly qualified in that particular type of work as demonstrated by the professional qualifications of the individuals to be assigned to that work and the firm's experience in that type of work. The selected design agent will prepare plans and specifications for the Additional Non-Federal Work, including a plan of work and materials to be included in the work, at the 50 percent and 95 percent stages of completion which will be furnished by the Non-Federal Sponsors to the Government for review and approval. The Government shall be afforded 10 business days from receipt to complete its review. Upon completion of the solicitation for the work, the Government shall be afforded 10 days from receipt to review the solicitation, including all final plans and specifications.

No solicitations shall be issued without the written approval of the District Engineer or designee nor without an approved schedule for the construction work. In the event that the Non-Federal Sponsors propose to do work with their own forces, the Government shall be afforded the opportunity to review and approve the plan of work, the proposed materials to be used in the work, and the estimated costs for the work through each fiscal year. The approval process for any contract award for Additional Non-Federal Work shall include a review of the contract, the opportunity for the Government to review bids received prior to award, and a determination by the District Engineer that Federal requirements are met. This determination shall be in writing and shall state that Federal requirements for competition in advertising and awarding of contracts are met; that the value of the contract, when taken together with the value of other Project financial commitments by the Non-Federal Sponsors through the then-current fiscal year does not exceed the non-Federal proportionate share of the value of all Project financial commitments through that fiscal year; and that the total Non-Federal Project financial commitments do not exceed the projected total Non-Federal Sponsors contributions as stated in Article VI.A. of this Agreement unless such excess has been approved in advance by the Energy and Water Development Appropriations Subcommittee of the House and Senate. If, however, after such determination, the Non-Federal Sponsors' Project financial commitments (including any contract modifications) through a fiscal year exceed such limitations, the excess amount shall be applied to the Non-Federal Sponsors' Project financial commitments for the following fiscal year and be eligible for future crediting subject to any other crediting conditions contained in this Agreement. Upon crediting, the amount of the credit shall be used to reduce the Non-Federal Sponsors' contributions under this Agreement. All proposed changes in approved designs, plans, and specifications also must be reviewed and approved by the District Engineer or his representative in writing in advance of the related construction where practicable. The Non-Federal Sponsors also shall afford the Government the opportunity to review and approve all contract claims prior to resolution thereof. Throughout the period of construction, the Non-Federal Sponsors shall furnish the Government with written monthly Statements of progress, by the 15th of the next month, and a copy of the Non-Federal Sponsors' Written Notice of Acceptance of Completed Work for each contract completed during the preceding month, for construction managed by the Non-Federal Sponsors for the Project. Prior to issuance of the Written Notice of Completed Work, the Non-Federal Sponsors shall conduct a final inspection and shall invite the Government to participate and offer comments. The Government shall have the right to enter the work areas for the Additional Non-Federal Work at any time for oversight purposes. If the Additional Non-Federal Work is determined to be in non-conformance with the approved plans and specifications or Federal law, regulation or standards the Government shall use its best efforts to inform the Non-Federal Sponsors of the specific deficiency within 1 (one) working day of the determination of such nonconformance. The Non-Federal Sponsor shall be responsible for taking all necessary steps to correct the non-conforming Additional Non-Federal Work. For the Solidarity Drive Work, if any, the Non-Federal Sponsors shall furnish the Government with complete copies of the bid solicitation package and contract documents for the work accomplished at Reach 3 (Solidarity Drive), design computations, certified copies of as-built drawings, all documentation,

including design computations to support modifications during construction and invoices or similar documentation acceptable to the Government for all reimbursable or creditable costs associated with the work accomplished.

C. The Non-Federal Sponsors may request the Government to accomplish betterments. Such requests shall be in writing and shall describe the betterments requested to be accomplished. If the Government in its sole discretion elects to accomplish the requested betterments or any portion thereof, it shall so notify the Non-Federal Sponsors in a writing that sets forth any applicable terms and conditions which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsors shall be solely responsible for all costs due to the requested betterments and shall pay all such costs in accordance with Article VI.C. of this Agreement.

D. When the District Engineer determines that the entire Project is complete or that a portion of the Project has become a functional portion of the Project, the District Engineer shall so notify the Non-Federal Sponsors in writing and furnish the Non-Federal Sponsors with an Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual (hereinafter the "OMRR&R Manual") for the Project or functional portion of the Project (except the Additional Non-Federal Work) and with copies of all of the Government's Written Notices of Acceptance of Completed Work for all contracts managed by the Government for the Project or the functional portion of the Project that have not been provided previously. Upon such notification, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the entire Project or the functional portion of the Project in accordance with Article VIII of this Agreement.

E. The Non-Federal Sponsors shall contribute 35 percent of total NED costs in accordance with the provisions of this paragraph. In the event the Park District is unable to contribute to total NED costs, the City shall provide such sums as are necessary to meet the Non-Federal Sponsors' share of total NED costs.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsors shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsors must provide for the construction, operation, and maintenance of the NED Plan, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the NED Plan.

2. If the Government projects that the value of the Non-Federal Sponsors' contributions under paragraph E.1., and G of this Article and Articles V, X, and XV.A. of this Agreement will be less than 35 percent of total NED costs, the Non-Federal Sponsors shall provide a cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsors' total contribution equal to 35 percent of total NED costs.

3. If the Government determines that the value of the Non-Federal Sponsors' contributions provided under paragraphs E.1., E.2., and G. of this Article and Articles

V, X, and XV.A. of this Agreement has exceeded 35 percent of total NED costs, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsors for any such value in excess of 35 percent of total NED costs. After such a determination, the Government, in its sole discretion, may provide any remaining NED Plan lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas and perform any remaining NED Plan relocations on behalf of the Non-Federal Sponsors

F. The Non-Federal Sponsors shall contribute 100 percent of incremental costs in accordance with the provisions of this paragraph. In the event the Park District is unable to contribute to incremental costs, the City shall provide such sums as are necessary to pay the full amount of the incremental costs.

1. In accordance with Article III of this Agreement, the Non-Federal Sponsors shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal Sponsors must provide for the construction, operation, and maintenance of the Project that are not otherwise necessary for the NED Plan, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction, operation, and maintenance of the Project that are not otherwise necessary for the NED Plan.

2. If the Government projects that the value of the Non-Federal Sponsors' contributions under paragraph F.1. of this Article and Articles V, X, and XV.A. of this Agreement will be less than 100 percent of incremental costs, the Non-Federal Sponsors shall provide a cash contribution, in accordance with Article VI.B. of this Agreement, in the amount necessary to make the Non-Federal Sponsors' total contribution equal to 100 percent of incremental costs.

3. If the Government determines that the value of the Non-Federal Sponsors' contributions provided under paragraphs F.1. and F.2. of this Article and Articles V, X, and XV.A. of this Agreement has exceeded 100 percent of incremental costs, the Government, subject to the availability of funds, shall reimburse the Non-Federal Sponsors for any such value in excess of 100 percent of incremental costs.

G. As authorized by Section 206(e) of the Water Resources Development Act of 1992, Public Law 102-580, the Government shall afford credit for the Additional Non-Federal Work. The Government shall also afford reductions in the contributions of the Non-Federal Sponsors for any unused credits due the Non Federal Sponsors for any Section 215 work accomplished under the Interim Agreement. Such credit shall be afforded in increments as useful increments of the Additional Non-Federal Work are completed by the Non-Federal Sponsors or on a quarterly basis, whichever occurs first. The Government, for purposes of calculating the amounts of the credit for the Additional Non-Federal Work and Solidarity Drive Work, if any, and the unused Section 215 credits accrued under the Interim Agreement, shall first determine the NED costs for the Additional Non-Federal Work and Solidarity Drive Work, if any, and shall include such amount in total NED costs. The inclusion of such amount in total NED costs shall be subject to a technical review by the Government to verify that the work was accomplished in a satisfactory manner and in accordance with the limitations

contained in this Agreement, including but not limited to Article II.P. of this Agreement. The actual amount to be included in total NED costs shall not exceed the Non-Federal Sponsors' actual costs attributable to the Additional Non-Federal Work and Solidarity Drive Work, if any, and shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. The NED costs included in the Additional Non-Federal Work and Solidarity Drive Work, if any, shall be the credit afforded the Additional Non-Federal Work as described in Article I.D. of this Agreement. After determination of the NED costs for the Additional Non-Federal Work and Solidarity Drive Work, if any, the Government, to afford the Non-Federal Sponsors the credit for the Additional Non-Federal Work, and the unused Section 215 credits accrued under the Interim Agreement, shall calculate the NED costs of the Additional Non-Federal Work and Solidarity Drive Work, if any, and the unused amount of the Section 215 credits under the Interim Agreement on a quarterly basis, and, as further specified in Article VI.B. of this Agreement, shall apply the resulting amount of the credit on a quarterly basis to reduce the cash contributions required by paragraphs E. and F. of this Article. If, after applying the reduction in a quarter, the actual amount of the credit allowable to the Non-Federal Sponsors in that quarter for the Additional Non-Federal Work, and any unused Section 215 credits under the Interim Agreement exceeds the cash contributions required by paragraphs E. and F. of this Article in that quarter, the Government shall apply the excess to offset the Non-Federal Sponsors' required contributions in the next quarter. Any unused credits in any quarter will be carried over to the next quarter(s), to offset the cash contribution for that quarter. Any excess credits not otherwise used will be reimbursed in the final accounting. As an alternative, and in its sole discretion, the Government may, subject to the availability of funds, reimburse the Non-Federal Sponsors in an amount equal to such excess credit amount as provided in Article VI.E. of this Agreement. The Non-Federal Sponsors' cash contributions which are required by paragraphs E. and F. of this Article shall be reduced by an amount equivalent to the amount of credit afforded for the Additional Non-Federal Work and any unused Section 215 credits under the Interim Agreement as calculated pursuant to this paragraph and Solidarity Drive Work as provided below, if any. In addition to the above, the Government shall credit or reimburse the Non-Federal Sponsors for the Solidarity Drive Work, if any, as further provided in this paragraph. At the end of each fiscal year during the period of construction, the Government shall afford credits (that is, a reduction in the Non-Federal Sponsors' cash contribution) for the Solidarity Drive Work, if any, to the extent that the Non-Federal Sponsors' other contributions under this Agreement for that fiscal year are credited in an amount less than the contributions required of the Non-Federal Sponsors for that fiscal year. At the end of the period of construction, the Government shall credit any of the Solidarity Drive Work, if any, which was not previously credited and which is needed for the Non-Federal Sponsors to satisfy their required contributions for the Project. After the final accounting conducted pursuant to Article VI.E. of this Agreement, the Government shall, subject to the availability of funds, refund an amount to the Non-Federal Sponsors equal to the credits earned by the Non-Federal Sponsors for the Solidarity Drive Work, if any, which were not previously used to offset the Non-Federal Sponsor's required contributions for the Project under the prior two sentences. During the final accounting conducted pursuant

to Article VI.E. of this Agreement, the Government shall apply any credit and/or reimburse the Non-Federal Sponsors for the Solidarity Drive Work not previously applied, if any.

H. The Non-Federal Sponsors may request the Government to provide lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or perform relocations on behalf of the Non-Federal Sponsors. Such requests shall be in writing and shall describe the services requested to be performed. If in its sole discretion the Government elects to perform the requested services or any portion thereof, it shall so notify the Non-Federal Sponsors in a writing that sets forth any applicable terms and conditions, which must be consistent with this Agreement. In the event of conflict between such a writing and this Agreement, this Agreement shall control. The Non-Federal Sponsors shall be solely responsible for all costs of the requested services and shall pay all such costs in accordance with Article VI.C. of this Agreement. Notwithstanding the provision of lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas or performance of relocations by the Government, the Non-Federal Sponsors shall be responsible, as between the Government and the Non-Federal Sponsors, for the costs of cleanup and response in accordance with Article XV.C. of this Agreement.

I. The Government shall perform a final accounting in accordance with Article VI.E. of this Agreement to determine the contributions provided by the Non-Federal Sponsors in accordance with paragraphs C., E., F., G and H. of this Article and Articles V, X, and XV.A. of this Agreement and to determine whether the Non-Federal Sponsors have met their obligations under paragraphs C., E., F., G and H. of this Article.

J. The Non-Federal Sponsors shall not use Federal funds to meet the Non-Federal Sponsors' share of total NED costs or incremental costs under this Agreement unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

K. The Non-Federal Sponsors agree to participate in and comply with applicable Federal floodplain management and flood insurance programs.

L. Not less than once each year the Non-Federal Sponsors shall inform affected interests of the extent of protection afforded by the Project.

M. The Non-Federal Sponsors shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

N. The Non-Federal Sponsors shall assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the economic life of the Project.

O. The Non-Federal Sponsors shall, to the extent of their powers, prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would

reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

P. In addition to any other limitations contained in this Agreement, the affording and the amount of credit for the Additional Non-Federal Work and Solidarity Drive Work, if any, is subject to the following additional limitations:

1. No crediting of the Additional Non-Federal Work and Solidarity Drive Work, if any, in total NED costs shall be given until the District Engineer has certified that the work subject to the credit has been completed and performed in accordance with the terms of this Agreement and is subject to an audit in accordance with Article X of this Agreement to determine reasonableness, allocability, and allowability of costs.

2. This Agreement shall not be construed as committing the Government to assume any responsibilities placed upon the Non-Federal Sponsors or any other non-Federal entity by the conditions of Federal Project authorization or any other applicable statute or regulation.

3. No crediting of the Additional Non-Federal Work and Solidarity Drive Work, if any, in total NED costs shall be made for any work which does not, in the judgment of the Government, conform to the Project.

4. The amount of credit or reimbursement for which the Non-Federal Sponsors may be eligible pursuant to this Agreement is neither subject to interest charges nor to adjustment to reflect changes in price levels between the time the Additional Non-Federal Work and Solidarity Drive Work, if any, is completed and the time that the credit or reimbursement is afforded, except as authorized by law.

5. No credit for the Additional Non-Federal Work shall be afforded for costs incurred before the date of this Agreement. Crediting for Section 215 Work shall be afforded according to the provisions of the Interim Agreement.

6. The Non-Federal Sponsors shall obtain all applicable Federal, State and local permits required for the performance of the Additional Non-Federal Work and for operation, maintenance, repair, rehabilitation and replacement of the Project.

7. Any contract awarded by the Non-Federal Sponsors for the Additional Non-Federal Work awarded after the effective date of this Agreement shall include provisions consistent with all applicable Federal laws and regulations. At such time as the District Engineer is satisfied the Non-Federal Sponsors have complied with this provision he shall so certify in writing to the Non-Federal Sponsors.

8. For the Additional Non-Federal Work and Solidarity Drive Work, if any, the Non-Federal Sponsors shall prepare and furnish the Government, for review, a proposed Operation, Maintenance, Repair, Rehabilitation and Replacement Manual (hereinafter the "OMRR&R Manual"). The failure of the Non-Federal Sponsors to prepare an acceptable OMRR&R Manual shall not negate the Non-Federal Sponsors' responsibility to provide for the operation, maintenance, repair, rehabilitation and replacement of the completed Project, in accordance with Article VIII of this Agreement, until and unless the Project is deauthorized by Congress. The Non-Federal Sponsors shall receive credit for all reasonable, allowable and allocable costs incurred

in the preparation of the OMRR&R Manual.

9. Any credit granted to the Non-Federal Sponsors for the Additional Non-Federal Work is conditioned upon completion of the Project or a separable element thereof. The Government reserves the right to require the Non-Federal Sponsors to remit previously received credits if the Non-Federal Sponsors fail to complete the Additional Non-Federal Work and such failure results in an incomplete Project or separable element thereof.

Q. The Non-Federal Sponsors shall provide and maintain necessary roads, parking areas, and other public use facilities open and available to all on equal terms.

R. The Non-Federal Sponsors shall obtain all applicable Federal, State and local permits required for the performance of all Project related work and for operation, maintenance, repair, rehabilitation and replacement of the Project and provide the Government with copies of same.

ARTICLE III - LANDS, RELOCATIONS, DISPOSAL AREAS, AND PUBLIC LAW 91-646 COMPLIANCE

A. The Government, in consultation with the Non-Federal Sponsors, shall determine the lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those required for relocations, borrow materials, and dredged or excavated material disposal. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions, including maps as appropriate, of the lands, easements, and rights-of-way that the Government determines the Non-Federal Sponsors must provide, in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with acquisition of such lands, easements, and rights-of-way. The Government, in that general written description, shall delineate which of the required lands, easements, and rights-of-way are required for the NED Plan and those which are required for the Project but not for the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall acquire all lands, easements, and rights-of-way set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each construction contract, the Non-Federal Sponsors shall provide the Government with authorization for entry to all lands, easements, and rights-of-way the Government determines the Non-Federal Sponsors must provide for that contract. For so long as the Project remains authorized, the Non-Federal Sponsors shall ensure that lands, easements, and rights-of-way that the Government determines to be required for the operation and maintenance of the Project and that were provided by the Non-Federal Sponsors are retained in public ownership for uses compatible with the authorized purposes of the Project.

B. The Government, in consultation with the Non-Federal Sponsors, shall determine the improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the Project. Such improvements may include, but are

not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and de-watering pumps and pipes. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions of such improvements in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with construction of such improvements. The Government, in that general written description, shall delineate which of the required improvements are associated with the NED Plan and those which are associated with the Project but not with the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall provide all improvements set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsors shall prepare plans and specifications for all improvements the Government determines to be required for the proper disposal of dredged or excavated material under that contract, submit such plans and specifications to the Government for approval, and provide such improvements in accordance with the approved plans and specifications.

C. The Government, after consultation with the Non-Federal Sponsors, shall determine the relocations necessary for the construction, operation, and maintenance of the Project, including those necessary to enable the removal of borrow materials and the proper disposal of dredged or excavated material. The Government in a timely manner shall provide the Non-Federal Sponsors with general written descriptions, including maps as appropriate, of such relocations in detail sufficient to enable the Non-Federal Sponsors to fulfill their obligations under this paragraph, and shall provide the Non-Federal Sponsors with a written notice to proceed with such relocations. The Government in that general written description shall delineate which of the necessary relocations are necessary for the NED Plan and which are necessary for the Project but not for the NED Plan. Prior to the end of the period of construction, the Non-Federal Sponsors shall perform or ensure the performance of all relocations as set forth in such descriptions. Furthermore, prior to issuance of the solicitation for each Government construction contract, the Non-Federal Sponsors shall prepare or ensure the preparation of plans and specifications for, and perform or ensure the performance of, all relocations the Government determines to be necessary for that contract.

D. The Non-Federal Sponsors in a timely manner shall provide the Government with such documents as are sufficient to enable the Government to determine the value of any contribution provided pursuant to paragraphs A., B., or C. of this Article. Upon receipt of such documents the Government, in accordance with Article IV of this Agreement and in a timely manner, shall determine the value of such contribution, include such value in total project costs and delineate and allocate such costs to the NED Plan that are attributable to the NED Plan. The Government shall afford credit for such value toward the Non-Federal Sponsors' share of total NED costs and incremental costs.

E. The Non-Federal Sponsors shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform

Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 C.F.R. Part 24, in acquiring lands, easements, and rights-of-way required for the construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - CREDIT FOR VALUE OF LANDS, RELOCATIONS, AND DISPOSAL AREAS

A. The Non-Federal Sponsors shall receive credit toward their share of total NED costs for the value of the lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Non-Federal Sponsors must provide pursuant to Article III of this Agreement for the NED Plan, and for the value of the relocations that the Non-Federal Sponsors must perform or for which they must ensure performance pursuant to Article III of this Agreement for the NED Plan. However, the Non-Federal Sponsors shall not receive credit for the value of any lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas that have been provided previously as an item of cooperation for another Federal project. The Non-Federal Sponsors also shall not receive credit for the value of lands, easements, rights-of-way, relocations, or borrow and dredged or excavated material disposal areas to the extent that such items are provided using Federal funds unless the Federal granting agency verifies in writing that such credit is expressly authorized by statute.

B. For the purposes of affording credit toward the Non-Federal Sponsors' share of NED costs and inclusion in total NED costs and total project costs, the value of lands, easements, and rights-of-way necessary for the NED Plan, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of such real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph. In addition, for the sole purpose of inclusion in total project costs, the value of lands, easements, and rights-of-way necessary for the Project but not for the NED Plan, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, shall be the fair market value of such real property interests, plus certain incidental costs of acquiring those interests, as determined in accordance with the provisions of this paragraph.

1. Date of Valuation. The fair market value of lands, easements, or rights-of-way owned by the Non-Federal Sponsors on the effective date of this Agreement shall be the fair market value of such real property interests as of the date the Non-Federal Sponsors provide the Government with authorization for entry thereto. However, for lands, easements, or rights-of-way owned by the Non-Federal Sponsors on the effective date of this Agreement that are required for the construction of the Additional Non-Federal Work, fair market value shall be the value of such real property interests as of the date the Non-Federal Sponsors award the first construction contract for the

Additional Non-Federal Work, or, if the Non-Federal Sponsors perform the construction with their own labor, the date that the Non-Federal Sponsors begin construction of the Additional Non-Federal Work. The fair market value of lands, easements, or rights-of-way acquired by the Non-Federal Sponsors after the effective date of this Agreement shall be the fair market value of such real property interests at the time the interests are acquired.

2. General Valuation Procedure. Except as provided in paragraph B.3. of this Article, the fair market value of lands, easements, or rights-of-way shall be determined in accordance with paragraph B.2.a. of this Article, unless thereafter a different amount is determined to represent fair market value in accordance with paragraph B.2.b. of this Article.

a. The Non-Federal Sponsors shall obtain, for each real property interest, an appraisal that is prepared by a qualified appraiser who is acceptable to the Non-Federal Sponsors and the Government. The appraisal must be prepared in accordance with the applicable rules of just compensation, as specified by the Government. The fair market value shall be the amount set forth in the Non-Federal Sponsors' appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsors' appraisal, the Non-Federal Sponsors may obtain a second appraisal, and the fair market value shall be the amount set forth in the Non-Federal Sponsors' second appraisal, if such appraisal is approved by the Government. In the event the Government does not approve the Non-Federal Sponsors' second appraisal, or the Non-Federal Sponsors choose not to obtain a second appraisal, the Government shall obtain an appraisal, and the fair market value shall be the amount set forth in the Government's appraisal, if such appraisal is approved by the Non-Federal Sponsors. In the event the Non-Federal Sponsors do not approve the Government's appraisal, the Government, after consultation with the Non-Federal Sponsors, shall consider the Government's and the Non-Federal Sponsors' appraisals and determine an amount based thereon, which shall be deemed to be the fair market value.

b. Where the amount paid or proposed to be paid by the Non-Federal Sponsors for the real property interest exceeds the amount determined pursuant to paragraph B.2.a. of this Article, the Government, at the request of the Non-Federal Sponsors, shall consider all factors relevant to determining fair market value and, in its sole discretion, after consultation with the Non-Federal Sponsors, may approve in writing an amount greater than the amount determined pursuant to paragraph B.2.a. of this Article, but not to exceed the amount actually paid or proposed to be paid. If the Government approves such an amount, the fair market value shall be the lesser of the approved amount or the amount paid by the Non-Federal Sponsors, but no less than the amount determined pursuant to paragraph B.2.a. of this Article.

3. Eminent Domain Valuation Procedure. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted after the effective date of this Agreement, the Non-Federal Sponsors shall, prior to instituting such proceedings, submit to the Government notification in writing of their intent to institute such proceedings and an appraisal of the specific real property interests to be acquired in

such proceedings. The Government shall have 60 days after receipt of such a notice and appraisal within which to review the appraisal, if not previously approved by the Government in writing.

a. If the Government previously has approved the appraisal in writing, or if the Government provides written approval of, or takes no action on, the appraisal within such 60-day period, the Non-Federal Sponsors shall use the amount set forth in such appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

b. If the Government provides written disapproval of the appraisal, including the reasons for disapproval, within such 60-day period, the Government and the Non-Federal Sponsors shall consult in good faith to promptly resolve the issues or areas of disagreement that are identified in the Government's written disapproval. If, after such good faith consultation, the Government and the Non-Federal Sponsors agree as to an appropriate amount, then the Non-Federal Sponsors shall use that amount as the estimate of just compensation for the purpose of instituting the eminent domain proceeding. If, after such good faith consultation, the Government and the Non-Federal Sponsors cannot agree as to an appropriate amount, then the Non-Federal Sponsors may use the amount set forth in their appraisal as the estimate of just compensation for the purpose of instituting the eminent domain proceeding.

c. For lands, easements, or rights-of-way acquired by eminent domain proceedings instituted in accordance with sub-paragraph B.3. of this Article, fair market value shall be either the amount of the court award for the real property interests taken, to the extent the Government determined such interests are required for the construction, operation, and maintenance of the Project, or the amount of any stipulated settlement or portion thereof that the Government approves in writing.

4. Incidental Costs. For lands, easements, or rights-of-way acquired by the Non-Federal Sponsors within a five-year period preceding the effective date of this Agreement, or at any time after the effective date of this Agreement, the value of the interest shall include the documented incidental costs of acquiring the interest, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such incidental costs shall include, but not necessarily be limited to, closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with Article III.E. of this Agreement.

C. For the purposes of affording credit toward the Non-Federal Sponsors' share of total NED costs and inclusion in total NED costs and total project costs, the Government shall determine, after consultation with the Non-Federal Sponsors, the value of relocations necessary for the NED Plan in accordance with the provisions of this paragraph. In addition, for the sole purpose of inclusion in total project costs, the Government shall determine, after consultation with the Non-Federal Sponsors, the value of relocations necessary for the Project but not for the NED Plan, in accordance with the provisions of this paragraph.

1. For a relocation other than a highway, the value shall be only that portion of relocation costs that the Government determines is necessary to provide a functionally equivalent facility, reduced by depreciation, as applicable, and by the salvage value of any removed items.

2. For a relocation of a highway, the value shall be only that portion of relocation costs that would be necessary to accomplish the relocation in accordance with the design standard that the State of Illinois would apply under similar conditions of geography and traffic load, reduced by the salvage value of any removed items.

3. Relocation costs shall include, but not necessarily be limited to, actual costs of performing the relocation; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with performance of the relocation, but shall not include any costs due to betterments, as determined by the Government, nor any additional cost of using new material when suitable used material is available. Relocation costs shall be subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

D. For the purposes of affording credit toward the Non-Federal Sponsors' share of total NED costs and inclusion in total NED costs and total project costs, the value of the improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material associated with the NED Plan, shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. In addition, for the sole purpose of inclusion in total project costs, the value of improvements made to lands, easements, and rights-of-way for the proper disposal of dredged or excavated material associated with the Project but not for the NED Plan, shall be the costs of the improvements, as determined by the Government, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs. Such costs shall include, but not necessarily be limited to, actual costs of providing the improvements; planning, engineering and design costs; supervision and administration costs; and documented incidental costs associated with providing the improvements, but shall not include any costs due to betterments, as determined by the Government.

ARTICLE V - PROJECT COORDINATION TEAM

A. To provide for consistent and effective communication, the Non-Federal Sponsors and the Government, not later than 30 days after the effective date of this Agreement, shall appoint named senior representatives to a Project Coordination Team. Thereafter, the Project Coordination Team shall meet regularly until the end of the period of construction. The Project Coordination Team shall generally oversee the Project in accordance with the provisions of this Article and the Partnering Charter. In the event of a conflict between the Partnering Charter and this Agreement, this Agreement shall control. The Government's Project Manager and a counterpart named

by the Non-Federal Sponsors shall co-chair the Project Coordination Team. Members of the Project Coordination Team shall include but not be limited to the Project Manager, Chief of Design Branch, Chief of Hydraulics and Hydrology Branch, Chief of Construction Branch, Construction Inspector, Resource Management Accountant, and a Contracting Officer representative from the Government and the City's Project Manager, Park District's Project Manager, City's Engineering Representative, and Park District's Engineering Representative from the Non-Federal Sponsors.

B. The Government's Project Manager and the Non-Federal Sponsors' counterpart shall keep the Project Coordination Team informed of the progress of construction and of significant pending issues and actions; and shall seek the views of the Project Coordination Team on matters that the Project Coordination Team generally oversees.

C. Until the end of the period of construction, the Project Coordination Team shall generally oversee the Project, including issues related to design; plans and specifications; scheduling; real property and relocation requirements; real property acquisition; contract awards and modifications; construction of the Additional Non-Federal Work; contract costs; the Government's cost projections; final inspection of the entire Project or functional portions of the Project; preparation of the proposed OMRR&R Manual; anticipated requirements and needed capabilities for performance of operation, maintenance, repair, replacement, and rehabilitation of the Project; and other related matters. This oversight shall be consistent with a project management plan developed by the Government after consultation with the Non-Federal Sponsors in accordance with ER 5-7-1(FR) and ER 5-1-11.

D. The Project Coordination Team may make recommendations that it deems warranted to the District Engineer on matters that the Project Coordination Team generally oversees which relate to the portions of the Project to be constructed by the Government, including suggestions to avoid potential sources of dispute. The Government in good faith shall consider the recommendations of the Project Coordination Team. The Government, having the legal authority and responsibility for construction of the Project, except for the Additional Non-Federal Work, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations. However, the Government's exercise of this discretion shall be subject to paragraphs G. and H. of this Article.

E. The Project Coordination Team may make recommendations that it deems warranted to the Non-Federal Sponsors on matters that the Project Coordination Team generally oversees which relate to the portions of the Project to be constructed by the Non-Federal Sponsors, including suggestions to avoid potential sources of dispute. The Non-Federal Sponsors in good faith shall consider the recommendations of the Project Coordination Team. The Non-Federal Sponsors, having the legal authority and responsibility for construction of the Additional Non-Federal Work, has the discretion to accept, reject, or modify the Project Coordination Team's recommendations. However, the Non-Federal Sponsors' exercise of this discretion shall be subject to

paragraphs G. and H. of this Article. Notwithstanding any other provision of this Agreement, the Non-Federal Sponsors may not reject or modify the Project Coordination Team's recommendations when the purpose of such recommendations is to ensure that the Project complies with Federal, State, or local laws and regulations.

F. The costs of participation in the Project Coordination Team shall be included in total project costs and cost shared in accordance with the provisions of this Agreement. The Government shall also delineate which of these costs are attributable to the NED Plan and allocate these costs to total NED costs.

G. If a dispute arises which cannot be resolved by the Project Coordination Team and further negotiation is considered by the Team members to be futile, the District Engineer, the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the dispute.

H. If the monthly progress reports, monthly financial reports, review comments, or any other written notice required by this Agreement are not received by each party in a timely manner, the Government's Project Manager and counterpart for the Non Federal Sponsors may elect to report the lack of compliance in writing to the District Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent. Within 15 days of receipt of notice of such a lack of compliance, the District Engineer and the City's Commissioner for the Department of Environment and Park District's General Superintendent, or their duly appointed representatives shall meet in person or by teleconference and negotiate in good faith to resolve the lack of compliance.

I. A Project Review Committee consisting of the District Engineer, the City's Commissioner for the Department of Environment and Park District's General Superintendent shall meet on a quarterly basis to review the progress of the project by segment. Subjects shall include, but not be limited to, performance against established milestones status against budgeted expenditures projected costs, unresolved Project Coordination Team issues, and design or construction changes. Briefings shall be delivered by the Project Manager responsible for the execution of the work.

ARTICLE VI - METHOD OF PAYMENT

A. The Government shall maintain current records of contributions provided by the parties and current projections of total project costs, total NED costs, incremental costs, and costs due to betterments. By the 15th of each and every month following the effective date of this Agreement, the Government shall provide the Non-Federal Sponsors with a written report setting forth all contributions provided to date and the current projections of total project costs; total NED costs; incremental costs; total costs due to betterments; a breakdown of each of the aforementioned costs into categories

including but not limited to PED, E&D during construction, actual construction, construction management, Federal oversight of Additional Non-Federal Work, and Government overhead; of the maximum amount of total project costs determined in accordance with Article XIX of this Agreement; of the components of total project costs; of each party's share of total project costs; of the Non-Federal Sponsors' total cash contributions required in accordance with Articles II.C., II.E., II.F., and II.H. of this Agreement; of the non-Federal proportionate share; of the credit afforded the Non-Federal Sponsors in accordance with Articles II.G., and II.P. and of the funds the Government projects to be required from the Non-Federal Sponsors for the upcoming fiscal year by quarters. By the 15th of each and every month following the effective date of this Agreement, the Non-Federal Sponsors shall provide the Government with a written report setting forth estimated and actual (to date) betterment costs; the total project cost estimates for the work performed by the Non-Federal Sponsors by segment; a breakdown of each of the aforementioned costs into categories including but not limited to engineering and design costs, construction management costs, program and project management costs, and any additional costs that fall into other categories not identified herein; and projections (for the current month through the end of the current month) of financial obligations, contractor accruals, and expenditures of work performed by the Non-Federal Sponsors. On the effective date of this Agreement, total project costs are projected to be $ 262,487,000, total NED costs are projected to be $230,181,000, and incremental costs are projected to be $ 32,306,100. The Non-Federal Sponsors' cash contributions required under this Agreement for total project costs are projected to be $10,499,000, and total Non-Federal Sponsors' contributions are projected to be $ 112,869,000. The amount of credit for the Additional Non-Federal Work to be afforded against the Non-Federal Sponsors' required contribution towards total project costs in accordance with Article II.G. of this Agreement is projected to be $102,370,000. Such amounts are estimates subject to adjustment by the Government and are not to be construed as the total financial responsibilities of the Government and the Non-Federal Sponsors.

B. The Park District, to the extent not prohibited by Illinois law, and the City as Non-Federal Sponsors shall provide the cash contribution required under Articles II.E. and II.F. of this Agreement in accordance with the provisions of this paragraph.

1. Not less than 30 calendar days prior to the scheduled date for issuance of the solicitation for the first construction contract by the Government, the Government shall notify the Non-Federal Sponsors in writing of such scheduled date and the funds the Government determines, after offsetting for credit afforded for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement, to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction through the first quarter, including the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction and an amount of projected financial obligations necessary for a contingency fund to facilitate ongoing Government construction through the first fiscal quarter of construction. Not later than such scheduled date, the Non-Federal Sponsors

shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors. For the remaining quarters of the first fiscal year of construction, the Government, after offsetting for credit afforded for Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement in accordance with Article II.G. of this Agreement, shall notify the Non-Federal Sponsors in writing, no later than 60 calendar days prior to the beginning of that fiscal year quarter and the subsequent fiscal year quarters, of the funds the Government determines to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction and the contingency fund for that quarter of the fiscal year. No later than 30 calendar days prior to the beginning of that quarter, the Non-Federal Sponsors shall make the full amount of the required funds for that quarter available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

2. For the second and subsequent fiscal years of construction, the Government, after offsetting for credit afforded for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement, shall notify the Non-Federal Sponsors in writing, no later than 60 calendar days prior to the beginning of that fiscal year quarter and the subsequent fiscal year quarters, of the funds the Government determines to be required from the Non-Federal Sponsors to meet the non-Federal proportionate share of projected financial obligations for construction and the contingency fund for that quarter of the fiscal year. No later than 30 calendar days prior to the beginning of that quarter, the Non-Federal Sponsors shall make the full amount of the required funds for that quarter available to the Government through the funding mechanism specified in Article VI.B.1. of this Agreement.

3. The Government shall draw from the funds provided by the Non-Federal Sponsors in accordance with paragraphs B.1. and B.2. of this Article such sums as the Government deems necessary to cover: (a) the non-Federal proportionate share of financial obligations for construction incurred prior to the commencement of the period of construction; and (b) the non-Federal proportionate share of financial obligations for construction as they are incurred during the period of construction.

4. If at any time during the period of construction the Government, after offsetting for credit afforded for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement, determines that additional funds will be needed from the Non-Federal Sponsors to cover the non-Federal proportionate share of projected financial obligations for construction for the current fiscal year quarter, the Government shall notify the Non-Federal Sponsors in writing of the additional funds required together with an explanation of why additional funds are required, and the Non-Federal Sponsors, no later than 30 calendar days from receipt of such notice, shall make the additional required funds

available through the payment mechanism specified in Article VI.B.1. of this Agreement.

C. In advance of the Government incurring any financial obligation associated with additional work under Article II.C. or II.H. of this Agreement, the Non-Federal Sponsors shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors. The Government shall draw from the funds provided by the Non-Federal Sponsors such sums as the Government deems necessary to cover the Government's financial obligations for such additional work as they are incurred. In the event the Government determines that the Non-Federal Sponsors must provide additional funds to meet their cash contribution, the Government shall notify the Non-Federal Sponsors in writing of the additional funds required together with an explanation of why additional funds are required. Within 30 calendar days thereafter, the Non-Federal Sponsors shall verify to the satisfaction of the Government that the Non-Federal Sponsors have deposited the required funds in an escrow or other account acceptable to the Government, with interest accruing to the Non-Federal Sponsors.

D. Each quarter, the Non-Federal Sponsors shall be entitled to reduce the cash contributions required under Article VI.B. of this Agreement by an amount equal to the credit for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement. The Government shall calculate the credits for the Additional Non-Federal Work and the Solidarity Drive Work, if any, pursuant to the quarterly audit provisions of this paragraph. Within fifteen working days after the end of each quarter, the Government, using information received from the Non-Federal Sponsors in accordance with paragraph A. of this Article, shall (a) conduct an accounting of all costs incurred by the Non-Federal Sponsors with respect to the Additional Non-Federal Work completed by the Non-Federal Sponsors in that quarter, and (b) complete an interim audit satisfying the conditions of credit set forth in Article II.G. of this Agreement for the purposes of determining the amount of the credit to be afforded the Non-Federal Sponsors for the Additional Non-Federal Work for that quarter, the Solidarity Drive Work, if any, and unused Section 215 credits as accrued under the Interim Agreement. The Government has received documentation of certain section 215 Work which, subject to accounting and audit, as provided for above, will be applied to offset the Non-Federal Sponsor's required contributions toward the Interim Agreement, and any excess credits under the Interim Agreement will be used to reduce the Non-Federal Sponsors' required contributions under this Agreement. If, as a result of the quarterly accounting and audit in (a) and (b) above, the Non-Federal Sponsors have incurred costs for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and the unused credits for the Section 215 Work that render its total contributions to the Project as of the date of the accounting greater than the Non-Federal share of total project costs incurred to date, a "carryover" credit shall be afforded to the Non-Federal Sponsors for the quarter in which the accounting and audit was conducted in the amount of the excess of its actual

expenses for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and unused Section 215 credits accrued under the Interim Agreement over the Non-Federal share of total project costs incurred to date, and said "carryover" credit shall be used in that quarter to reduce the amount of cash contributions provided to the Government for the work that the Government is performing in that quarter. If, in any quarter the carryover credit exceeds the amount of cash contributions required to be provided to the Government in that quarter, the excess (...provided in Section II.G) will be carried over to the next quarter(s) to offset the cash contributions required to be provided to the Government. The interim audit and accounting for each quarter, shall be completed within 15 working days after the end of that quarter. Claims for credits received more than 30 days in advance of the end of each fiscal quarter will be included in the interim audit for that quarter.

E. After completion of each of the following: the period of construction, or termination of this Agreement, and upon resolution of all relevant claims and appeals, the Government shall conduct a final accounting of all costs associated with each segment and furnish the Non-Federal Sponsors with the results of that accounting. The accounting shall determine segment costs, NED costs, incremental costs, each party's contribution provided thereto (including the value of any credits afforded to the Non-Federal Sponsors for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and the Section 215 Work), and each party's required share thereof associated with that segment of the Project. The accounting also shall determine costs due to betterments and the Non-Federal Sponsors' cash contribution provided pursuant to Article II.C. of this Agreement.

1. In the event the accounting shows that the total contribution (including the value of any credits afforded to the Non-Federal Sponsors for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and the Section 215 Work) per segment provided by the Non-Federal Sponsors is less than their required share of required NED costs and incremental costs for the appropriate segment, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement, the Non-Federal Sponsors shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet the Non-Federal Sponsors' required share of NED costs and incremental costs, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement for the appropriate segment.

2. In the event the final accounting shows that the total contribution (including the value of any credits afforded to the Non-Federal Sponsors for the Additional Non-Federal Work, the Solidarity Drive Work, if any, and the Section 215 Work) per segment provided by the Non-Federal Sponsors exceeds their required share of total NED costs and incremental costs for the appropriate segment, plus costs due to any betterments provided in accordance with Article II.C. of this Agreement for the appropriate segment, the Government shall, subject to the availability of funds, refund the excess to the Non-Federal Sponsors no later than 90 calendar days after the final

accounting is complete. In the event existing funds are not available to refund the excess to the Non-Federal Sponsors, the Government shall seek such appropriations as are necessary to make the refund. If so desired by the Non-Federal Sponsors, the Government shall not refund the excess to the Non-Federal Sponsors but instead apply the value of the excess toward subsequent required contributions of the Non-Federal Sponsors, so long as the Non-Federal Sponsors provides written notice of its desire to the Government no later than 30 calendar days after completion of the final accounting for the segment.

ARTICLE VII - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to both parties. The parties shall each pay 50 percent of any costs for the services provided by such a third party as such costs are incurred. The existence of a dispute shall not excuse the parties from performance pursuant to this Agreement.

ARTICLE VIII - OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R)

A. Upon notification in accordance with Article II.D. of this Agreement and for so long as the Project remains authorized, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the Project or the functional portion of the Project, at no cost to the Government, in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws as provided in Article XI of this Agreement and specific directions in the OMRR&R Manual and any subsequent amendments thereto.

B. The Non-Federal Sponsors hereby give the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors own or control for access to the Project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Non-Federal Sponsors for any reason are failing to perform their obligations under this Agreement, the Government shall send a written notice describing the non-performance to the Non-Federal Sponsors. If, after 30 calendar days from receipt of notice, the Non-Federal Sponsors continue to fail to perform, or fail to diligently undertake reasonable efforts to cure the deficiency, then the Government shall have the right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsors own or control for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation,

maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Non-Federal Sponsors of responsibility to meet the Non-Federal Sponsors' obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance pursuant to this Agreement.

ARTICLE IX - SAVE AND HOLD HARMLESS

The Non-Federal Sponsors shall hold and save the Government free from all damages arising from the design, construction, operation, maintenance, repair, replacement, and rehabilitation of the Project and any Project-related betterments, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS AND AUDIT

A. Not later than 30 calendar days after the effective date of this Agreement, the Government and the Non-Federal Sponsors shall develop procedures for keeping books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement. These procedures shall incorporate, and apply as appropriate, the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 C.F.R. Section 33.20. The Government and the Non-Federal Sponsors shall maintain such books, records, documents, and other evidence in accordance with these procedures and for a minimum of three years after the period of construction and resolution of all relevant claims arising therefrom. To the extent permitted under applicable Federal laws and regulations, the Government and the Non-Federal Sponsors shall each allow the other to inspect such books, documents, records, and other evidence.

B. Pursuant to 32 C.F.R. Section 33.26, the Non-Federal Sponsors are responsible for complying with the Single Audit Act of 1984, 31 U.S.C. Sections 7501-7507, as implemented by Office of Management and Budget (OMB) Circular No. A-133 and Department of Defense Directive 7600.10. Upon request of the Non-Federal Sponsors and to the extent permitted under applicable Federal laws and regulations, the Government shall provide to the Non-Federal Sponsors and independent auditors any information necessary to enable an audit of the Non-Federal Sponsors' activities under this Agreement. The costs of any non-Federal audits performed in accordance with this paragraph shall be allocated in accordance with the provisions of OMB Circulars A-87 and A-133, and such costs as are allocated to the Project shall be included in total project costs and, as determined by the Government, included in total NED costs, and cost shared in accordance with the provisions of this Agreement.

C. In accordance with 31 U.S.C. Section 7503, the Government may conduct auditsin addition to any audit that the Non-Federal Sponsors are required to conduct

under the Single Audit Act. Any such Government audits shall be conducted in accordance with Government Auditing Standards and the cost principles in OMB Circular No. A-87 and other applicable cost principles and regulations. The costs of Government audits performed in accordance with this paragraph shall be included in total project costs and, as determined by the Government, included in total NED costs, and cost shared in accordance with the provisions of this Agreement.

ARTICLE XI - FEDERAL AND STATE LAWS

In the exercise of their respective rights and obligations under this Agreement, the Non-Federal Sponsors and the Government agree to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulations 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army", and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans.

ARTICLE XII - RELATIONSHIP OF PARTIES

A. In the exercise of their respective rights and obligations under this Agreement, the Government and the Non-Federal Sponsors each act in an independent capacity, and no party is to be considered the officer, agent, or employee of the other.

B. In the exercise of its rights and obligations under this Agreement, neither party shall provide, without the consent of the other parties, any contractor with a release that waives or purports to waive any rights such other party may have to seek relief or redress against such contractor either pursuant to any cause of action that such other party may have or for violation of any law.

ARTICLE XIII - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, nor any resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XIV - TERMINATION OR SUSPENSION

A. If at any time the Non-Federal Sponsors fail to fulfill their obligations under rticle II.C., II.E., II.F., II.H., VI, XVIII.C. or XVIII.D. of this Agreement the Assistant Secretary of the Army (Civil Works) shall terminate this Agreement or

suspend future performance under this Agreement unless he determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project.

B. If the Government fails to receive annual appropriations in amounts sufficient to meet its share of scheduled Project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Non-Federal Sponsors in writing, and 60 calendar days thereafter either party may elect without penalty to terminate this Agreement or to suspend future performance under this Agreement. In the event that either party elects to suspend future performance under this Agreement pursuant to this paragraph, such suspension shall remain in effect until such time as the Government receives sufficient appropriations or until either the Government or the Non-Federal Sponsors elect to terminate this Agreement.

C. In the event that either the Government or the Non-Federal Sponsors elect to terminate this Agreement pursuant to this Article or Article XV of this Agreement, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI.E. of this Agreement.

D. Any termination of this Agreement or suspension of future performance under this Agreement in accordance with this Article or Article XV of this Agreement shall not relieve the parties of liability for any obligation previously incurred. Any delinquent payment by the Non-Federal Sponsors shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

ARTICLE XV - HAZARDOUS SUBSTANCES

A. After execution of this Agreement and upon direction by the District Engineer, the Non-Federal Sponsors shall perform, or cause to be performed, any investigations for hazardous substances that the Government or the Non-Federal Sponsors determine to be necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (hereinafter "CERCLA"), 42 U.S.C. Sections 9601-9675, that may exist in, on, or under lands, easements, and rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the District Engineer provides the Non-Federal Sponsors with prior specific written direction, in which case the Non-

Federal Sponsors shall perform such investigations in accordance with such written direction. All actual costs incurred by the Non-Federal Sponsors for such investigations for hazardous substances shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared in accordance with the provisions of this Agreement, subject to an audit in accordance with Article X.C. of this Agreement to determine reasonableness, allocability, and allowability of costs.

B. In the event it is discovered through any investigation for hazardous substances or other means that hazardous substances regulated under CERCLA exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project, the Non-Federal Sponsors and the Government shall provide prompt written notice to the other, and the Non-Federal Sponsors shall not proceed with the acquisition of the real property interests until all parties agree that the Non-Federal Sponsors should proceed.

C. The Government and the Non-Federal Sponsors shall determine whether to initiate construction of the Project, or, if already in construction, whether to continue with work on the Project, suspend future performance under this Agreement, or terminate this Agreement for the convenience of the Government, in any case where hazardous substances regulated under CERCLA are found to exist in, on, or under any lands, easements, or rights-of-way that the Government determines, pursuant to Article III of this Agreement, to be required for the construction, operation, and maintenance of the Project. Should the Government and the Non-Federal Sponsors determine to initiate or continue with construction after considering any liability that may arise under CERCLA, the Non-Federal Sponsors shall be responsible, as between the Government and the Non-Federal Sponsors, for the costs of clean-up and response, to include the costs of any studies and investigations necessary to determine an appropriate response to the contamination. Such costs shall not be considered a part of either total project costs or total NED costs. In the event the Non-Federal Sponsors fail to provide any funds necessary to pay for clean up and response costs or to otherwise discharge the Non-Federal Sponsors' responsibilities under this paragraph upon direction by the Government, the Government may, in its sole discretion, either terminate this Agreement for the convenience of the Government, suspend future performance under this Agreement, or continue work on the Project.

D. The Non-Federal Sponsors and the Government shall consult with each other in accordance with Article V of this Agreement in an effort to ensure that responsible parties bear any necessary clean up and response costs as defined in CERCLA. Any decision made pursuant to paragraph C. of this Article shall not relieve any third party from any liability that may arise under CERCLA.

E. As between the Government and the Non-Federal Sponsors, the Non-Federal Sponsors shall be considered the operator of the Project for purposes of CERCLA

liability. To the maximum extent practicable, the Non-Federal Sponsors shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

ARTICLE XVI - NOTICES

A. Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and either delivered personally or by telegram or mailed by first-class, registered, or certified mail, as follows:

If to the Non-Federal Sponsors:

Commissioner
City of Chicago
Department of Environment
30 North LaSalle Street, 25th Floor
Chicago, Illinois 60602

General Superintendent
Chicago Park District
425 East McFetridge Drive
Chicago, Illinois 60605

If to the Government:

District Engineer
U. S. Army Corps of Engineers, Chicago District
111 North Canal Street, Suite 600
Chicago, Illinois 60606

B. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

C. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at the earlier of such time as it is actually received or seven calendar days after it is mailed.

ARTICLE XVII - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XVIII - HISTORIC PRESERVATION

A. The costs of identification, survey and evaluation of historic properties shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared in accordance with the provisions of this Agreement.

B. As specified in Section 7(a) of Public Law 93-291 (16 U.S.C. Section 469c(a)), the costs of mitigation and data recovery activities associated with historic preservation shall be borne entirely by the Government and shall not be included in either total project costs, or total NED costs up to the statutory limit of one percent of the total amount authorized to be appropriated for the Project.

C. The Government shall not incur costs for mitigation and data recovery that exceed the statutory one percent limit specified in paragraph B. of this Article unless and until the Assistant Secretary of the Army (Civil Works) has waived that limit in accordance with Section 208(3) of Public Law 96-515 (16 U.S.C. Section 469c-2(3)). Any costs of mitigation and data recovery that exceed the one percent limit shall be included in total project costs and, as determined by the Government included in total NED costs, and cost shared between the Non-Federal Sponsors and the Government in accordance with the provisions of this Agreement.

D. Notwithstanding the above, the Non-Federal Sponsors shall pay 100 percent of any costs of mitigation and data recovery that are not attributable to the NED Plan.

ARTICLE XIX - SECTION 902 PROJECT COST LIMITS

The Non-Federal Sponsors have reviewed the provisions set forth in Section 902 of Public Law 99-662, as amended, and understand that Section 902 establishes the maximum amount of total project costs for the Authorized Project. Notwithstanding any other provision of this Agreement, the Government shall not make a new Authorized Project financial obligation, make an Authorized Project expenditure, or afford credit toward total project costs for the value of any contribution provided by the Non-Federal Sponsors, if such obligation, expenditure, or credit would result in total project costs exceeding this maximum amount, unless otherwise authorized by law. On the effective date of this Agreement, this maximum amount is estimated to be $276,271,000 as calculated in accordance with ER 1105-2-100 using October, 1998 price levels and allowances for projected future inflation. The Government shall adjust this maximum amount in accordance with Section 902.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY

BY: _____ Date: 17 MAY 1999

Joseph W. Westphal

Assistant Secretary of the Army
(Civil Works)

THE CITY OF CHICAGO

BY: _____ Date: May 10th 1999

Richard M. Daley
Mayor

ATTEST: _____

Brian Crowe
Corporation Counsel

THE CHICAGO PARK DISTRICT

BY: _____ Date: 5/12/99

Carolyn Williams Meza

General Superintendent
Chicago Park District

ATTEST: _____

Carol A. Diver
Secretary
Chicago Park District

CERTIFICATE OF AUTHORITY

I, Joan Fencik, do hereby certify that I am the principal legal officer of the Chicago Park District, that the Chicago Park District is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the Chicago Park District in connection with the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project, and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by section 221 of Public Law 91-611 (42 U.S.C. section 1962d-5b), and that the persons who have executed this Agreement on behalf of the Chicago Park District have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this MAY 12 day of _____ 1999.

Joan Fencik

Joan Fencik
General Counsel
Chicago Park District

CERTIFICATE OF AUTHORITY

I, Brian Crowe, do hereby certify that I am the principal legal officer of the City of Chicago, that the City of Chicago is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the City of Chicago in connection with the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project , and to pay damages in accordance with the terms of this Agreement, if necessary, in the event of the failure to perform, as required by section 221 of Public Law 91-611 (42 U.S.C. section 1962d-5b), and that the persons who have executed this Agreement on behalf of the City of Chicago have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 10th day of May 1999.

Brian Crowe
Corporation Counsel

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

CAROLYN WILLIAMS MEZA

General Superintendent
Chicago Park District

Date 5/12/99

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

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This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

RICHARD M. DALEY
Mayor
City of Chicago

Date May 10th, 1999

EXHIBIT A

Paragraphs 1 through 5 of this Exhibit will establish the methodology for purposes of determining total NED costs. These cost estimates will then be compared to actual costs for the Project plan in order to establish incremental costs for the Project.

1. No additional design will be performed with respect to the features identified in the NED Plan defined in Article 1 (B) of this agreement.

2. If, in any construction contract for the Project, the NED Plan is substantially the same as the Project plan, total NED costs relating to that construction contract will be the same as total Project costs and no other adjustments will be made.

3. Other than as provided in paragraph 2. above, the methodology for determining NED construction costs will be as set forth in the following subparagraphs:

(A) As of the date of award of each construction contract, the Government shall have conducted a market survey of stone material prices from Government inspected and approved Category I sources, F.O.B job site. Stone material prices for the NED Plan will be determined based on the average of the two lowest written quotes, F.O.B. job site as of the date of contract award, from those sources capable of providing sufficient quantities of approved stone for the portion of the NED plan relating to that contract. The Government shall elicit at least 4 written quotes from inspected and approved Category 1 quarries with sufficient quantities and quality of stone to fulfill NED requirements. The Government shall make periodic inspections of these quarries to insure that the quantities and quality of stone quoted exist.

(B) Upon completion of each construction contract, the Government estimates of construction items stated in the approved NED Plan other than those described in paragraph 3.(A) above will be adjusted using the appropriate Engineering News-Record Construction Cost Index to the current price levels as of the date of the construction award for each Contract in each construction contract. If a construction contract is scheduled to extend for more than one calendar year, the above construction items will be adjusted, covering the period commencing with the construction award and ending with contract completion, to reflect cost escalation using the appropriate Engineering News-Record Construction cost indices as of the midpoint date of the scheduled work.

(C) At the time of completion of each construction contract, adjustments to material quantities for the applicable construction contract of the NED Plan will be made based on the construction contractor's pre-construction hydrographic survey data. This data will be superimposed upon the most applicable NED design cross-section, adjusting the "neat lines" for the average of the elevations of the upper and lower tolerance levels. The material quantities will be re-computed from the resultant maps.

(D) A revised NED construction cost will be generated from the approved NED plan MCACES (Micro Computer Assisted Cost Estimating System), or its successor, estimates with adjustments to material quantities and prices as described above. An eight percent (8%) contingency will be included in the MCACES estimate of NED construction costs.

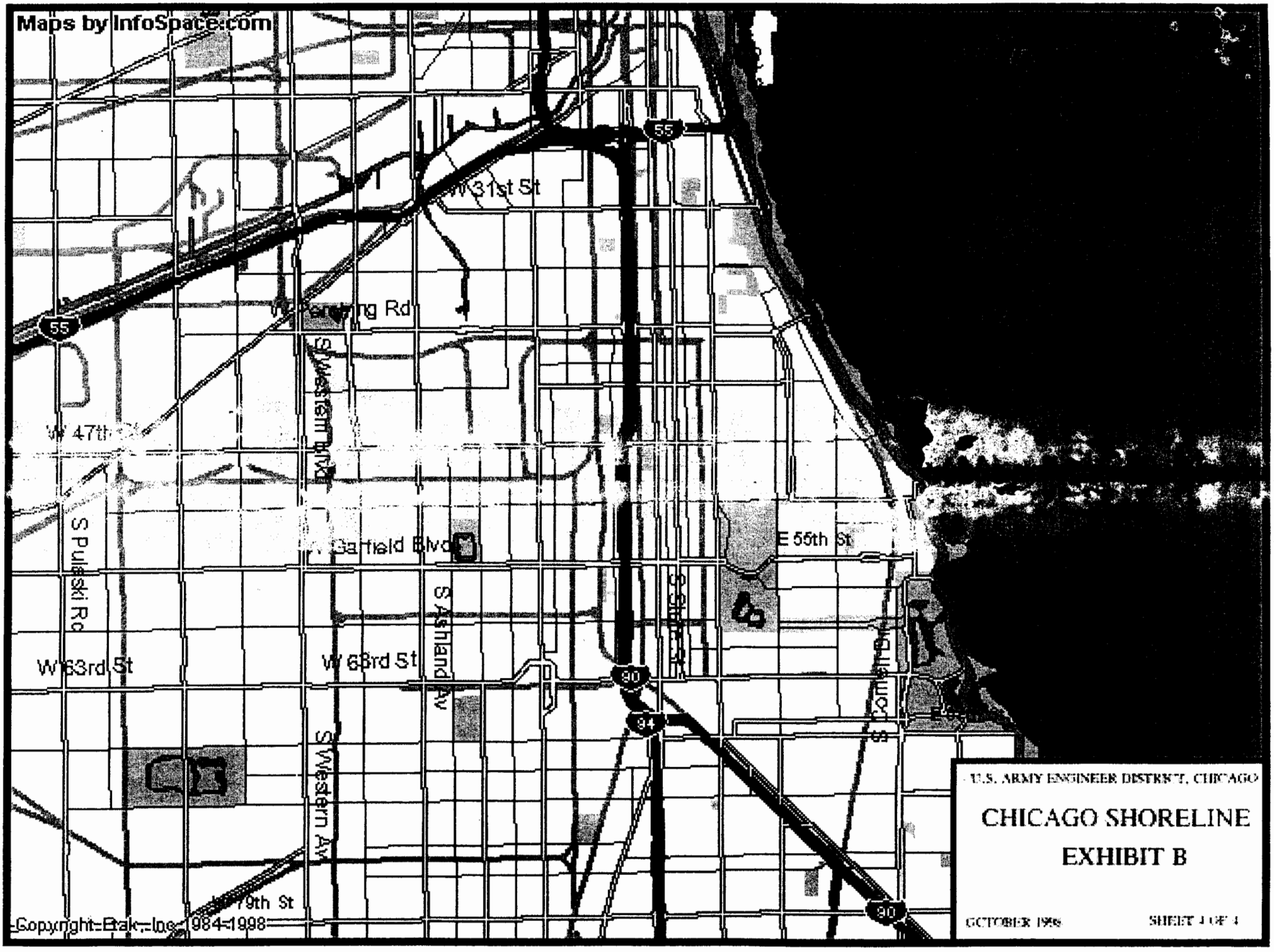
4. The estimated costs of Engineering and Design (E&D) and Construction Management (CM) for the NED Plan will be based on the ratio of the estimated E&D and CM costs of the NED Plan to those for the Project plan as contained in the Chicago Shoreline Project Management Plan dated August, 1993. The ratios for Reach 2 are 88% for E&D and 90% for CM. Those for Reach 4 are 77% for E&D and 77% for CM. For all other Reaches, actual E&D and CM costs for the Authorized Plan will be 100% NED. The NED portion of E&D and CM for each construction contract will be determined by multiplying the applicable ratio for that Reach above by the actual CM and E&D costs incurred for the construction segment.

5. The costs computed in paragraph 2. (if applicable) or the sum of the costs computed in paragraphs 3. and 4. above will be the total NED cost for cost sharing purposes.

6. For the sole purposes of estimating budgetary commitment amounts and escrow deposits by the Non-Federal Sponsor, the NED plan shall be revised during the Design Memorandum for each segment, using current stone material prices and construction estimates as described in Paragraphs 3.(A) and 3.(B) above. Quantities will be adjusted based on Design Memorandum level surveys. Thereafter until the final accounting, the NED cost shall be updated annually utilizing the Cost Estimates-Updating Indices which are published annually by the Government's Office of Management and Budget.

CHICAGO SHORELINE PROJECT				
Reach	**Segment**	**Description**	**Length (ft)**	**Constr. By**
Reach 2F		Fullerton Ave.	1,200	Sponsor
Reach 2	Segment 1	Wilson to Lincoln Park	4,500	Fed. Gov.
Reach 2	Segment 2	Lincoln Park to Belmont	4,450	Fed. Gov.
Reach 2	Segment 3	Belmont to Fullerton	5,600	Fed. Gov.
Reach 3M		Meigs Field	1,200	Sponsor
Reach 3		Solidarity Drive	2,800	Sponsor
Reach 4	Segments 1 & 2	I-55 to 30th St.	3,400	Fed. Gov.
Reach 4	Segment 5	33rd to 37th	2,050	Fed. Gov.
Reach 4	Segment 6	37th to 43rd	6,050	Fed. Gov.
Reach 4	Segment 7	43rd to 50th	6,500	Sponsor
Reach 4	Segment 8a	50th to 54th	1,600	Sponsor
Reach 4	Segment 8b	54th to 56th	3,600	Sponsor


Maps by InfoSpace.com
Pulaski Rd
W Foster Av
W Lawrence Av
W Addison St
W Diversey Pkwy
N Halsted St
N Western Av
W North Av
W Division St
W Augusta Blvd
W Washington Blvd
90
Copyright Etak, Inc 1984-1998
U.S. ARMY ENGINEER DISTRICT, CHICAGO
CHICAGO SHORELINE
EXHIBIT B
OCTOBER 1998
SHEET 2 OF 4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CHICAGO SHORELINE
EXHIBIT B
OCTOBER 1998
SHEET 1 OF 1


Maps by InfoSpace.com
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W Washington Blvd
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CHICAGO SHORELINE
EXHIBIT B
OCTOBER 1998
SHEET 3 OF 4

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Amendment to
Project Cooperation Agreement #3

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AMENDMENT NO. 1
TO
PROJECT COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE CITY OF CHICAGO AND
THE CHICAGO PARK DISTRICT
FOR
CONSTRUCTION OF THE REMAINDER OF THE
CHICAGO SHORELINE, CHICAGO, ILLINOIS PROJECT

THIS AMENDMENT NO. 1 is entered into this 22nd day of DEC, 2009, by and between the Department of the Army (hereinafter the "Government"), represented by District Commander, U.S. Army Engineer District Chicago, and the City of Chicago (hereinafter the "City"), represented by its Mayor, and the Chicago Park District, (hereinafter the "Park District'), represented by its General Superintendent (the City and the Park District hereinafter collectively referred to as the "Non-Federal Sponsors").

WITNESSETH, THAT:

WHEREAS, construction of the Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project (hereinafter the "Authorized Project") along the shoreline of Lake Michigan from Wilson Avenue south to 79th Street at Chicago, Cook County, Illinois was authorized by Section 101 (a)(12) of the Water Resources Development Act of 1996, Public Law 104-303;

WHEREAS, the Government and the Non-Federal Sponsors entered into a Project Cooperation Agreement dated April 28, 1997 for the construction of the South Water Filtration Plant Breakwater within Reach 5, which extends from 57th Street to 79th Street, of the Authorized Project;

WHEREAS, the Government and the Non-Federal Sponsors entered into a subsequent Project Cooperation Agreement dated August 7, 1998 for construction of additional areas of the Authorized Project, including the rehabilitation of the shoreline of Lake Michigan consisting of beach stabilization, a 1,000 ft segment of revetment north of Belmont Harbor entrance between Aldine Street and Roscoe Street, and a revetment between 31st and 33rd Streets at Chicago, Cook County, Illinois (hereinafter the "Interim Agreement");

WHEREAS, the Government and the Non-Federal Sponsors entered into a Project Cooperation Agreement on May 17, 1999 (hereinafter the "Agreement") for construction of the remainder of the rehabilitation of the shoreline of Lake Michigan consisting of

Reach 2, Segments 1 through 3; Reach 2F; Reach 3M; Reach 3; and Reach 4, Segments 1, 2, 5, 6, 7, 8a and 8b as delineated in Exhibit B of the Agreement and as generally described in the Illinois Shoreline Erosion, Interim 3, Wilmette to Illinois/Indiana State Line, Storm Damage reduction, Plan IV, Final Feasibility Study report and Environmental Assessment (EA) dated July, 1993, revised March 1994, and approved April 14, 1994 by the Chief of Engineers, Department of the Army, as supplemented by the Limited Re-Evaluation Report dated March, 1998 and approved on July 9, 1998 by the Assistant Secretary of the Army (Civil Works) (hereinafter the "Project");

WHEREAS, Section 318 of the Water Resources Development Act of 1999, Public Law 106-53, modifies the Authorized Project to authorize the Secretary of the Army to credit or reimburse a non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000; and to authorize the Secretary of the Army to reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000; and

WHEREAS, Exhibit B of the Agreement describes Reach 4, Segment 8b, only as 54th to 56th Street and does not include 56th to 57th Street; and

WHEREAS, the Government and the Non-Federal Sponsors do not intend to construct
Reach 3M (Meigs Field) as part of the Authorized Project.

NOW, THEREFORE, the Government and Non-Federal Sponsors agree to amend the Agreement as follows:

1. The following Whereas Clauses are inserted after the 16th Whereas clause:

> "WHEREAS, Section 318 of the Water Resources Development Act of 1999, Public Law 106-53, modifies the Authorized Project to authorize the Secretary of the Army to credit or reimburse a non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000; and to authorize the Secretary of the Army to reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in

Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.

"WHEREAS, the Government and the Non-Federal Sponsors do not intend to construct Reach 3M (Meigs Field) as part of the Authorized Project.".

2. ARTICLE I – DEFINITIONS AND GENERAL PROVISIONS is amended as follows:

a. The first sentence of Article I.A. is amended by deleting "Reach 3M;".

b. Article I.D. is amended by deleting the fourth sentence and replacing it with the following: "As of the effective date of Amendment No. 1, total NED costs are estimated to be $247,589,863."

c. The first sentence of Article I.N. is amended by deleting "3M;".

d. Article I.O. is amended by deleting the paragraph and replacing it with the following:

"I.O. The term "Solidarity Drive Work" shall mean the portion of Reach 3 – Solidarity Drive consisting of approximately a 3,000 foot segment of shoreline revetment extending from the isthmus at Shedd Aquarium east to the Adler Planetarium and around to the south side of the Planetarium that was completed prior to May 17, 1999, the effective date of the Agreement.

3. ARTICLE II – OBLIGATIONS OF THE GOVERNMENT AND THE NON-FEDERAL SPONSOR is amended by inserting the following between the first and second sentences of Article II.G.: "In accordance with Section 318 of the Water Resources Development Act of 1999, Public Law 106-53, the Government shall afford credit for the Solidarity Drive Work."

4. ARTICLE VI – METHOD OF PAYMENT is amended by deleting the fourth, fifth, and sixth sentences of Article VI.A. and replacing them with the following: "As of the effective date of Amendment No. 1, total project costs are projected to be $337,489,940; total NED costs are projected to be $247,589,863; incremental costs are projected to be $89,900,077; the total contribution required from the Non-Federal Sponsors' by Article II.E. of this Agreement is projected to be $86,656,452; the amount of credit to be afforded against the Non-Federal Sponsors' required contribution toward total project costs in accordance with Article II.G. of this Agreement is projected to be $146,370,425; and the Non-Federal Sponsors' cash contribution required by Article II.E.2. of this Agreement is projected to be $30,186,104; and the Government's total financial obligations for the additional work to be incurred and the Non-Federal Sponsors' contribution of funds for such costs required by Article II.C. of this Agreement are projected to be $35,931,611."

5. ARTICLE XIX - SECTION 902 PROJECT COST LIMITS is amended by replacing "$276,271,000" with "$291,998,000" and replacing "1998" with "2009".

6. Sheet 1 of 4 of Exhibit B is amended as follows:

a. Delete line labled "Reach 3M" in its entirety.

b. The last line (Reach 4, Segment 8b) is amended by replacing "54th to 56th" with "54th to 57th" and replacing "3600" with "4400".

7. All other terms and conditions of the Agreement remain unchanged.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment No. 1 which shall become effective upon the date it is signed by the District Commander.

DEPARTMENT OF THE ARMY

BY: Vincent V. Quarles
Vincent V. Quarles
Colonel, U.S. Army
District Commander

DATE: 12/22/09

CITY OF CHICAGO

BY: Richard M. Daley
Richard M. Daley
Mayor

DATE: 12/22/09

CHICAGO PARK DISTRICT

BY: Timothy J. Mitchell
Timothy J. Mitchell
General Superintendent and CEO

DATE: 12/22/09

CERTIFICATE OF AUTHORITY

I, Mara S. Georges, do hereby certify that I am the principal legal office of the City of Chicago, that the City of Chicago is a legally constituted public body with the full authority and legal capacity to perform the terms of Amendment No. 1, between the Department of the Army and the City of Chicago and Chicago Park District in connection with the construction of the remainder of the Chicago Shoreline, Chicago, Illinois Project, and to pay damages, if necessary, in the event of the failure to perform in accordance with the terms of this Agreement, as required by Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended (42 U.S.C. 1962d-5b), and that the persons who have executed Amendment No. 1 on behalf of the City of Chicago have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 18th day of December, 2009.

Mara S. Georges

chicago park district

Administration Office
541 North Fairbanks
Chicago, Illinois 60611
t (312) 742-PLAY
(312) 747-2001 TTY
www.chicagoparkdistrict.com

CERTIFICATE OF AUTHORITY

I, Maria G. Garcia, do hereby certify that I am the principal legal office of the Chicago Park District, that the Chicago Park District is a legally constituted public body with the full authority and legal capacity to perform the terms of Amendment No. 1, between the Department of the Army and the City of Chicago and Chicago Park District in connection with the construction of the remainder of the Chicago Shoreline, Chicago, Illinois Project, and to pay damages, if necessary, in the event of the failure to perform in accordance with the terms of this Agreement, as required by Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended (42 U.S.C. 1962d-5b), and that the persons who have executed Amendment No. 1 on behalf of the Chicago Park District have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 2nd day of November, 2009.

CERTIFICATION REGARDING LOBBYING

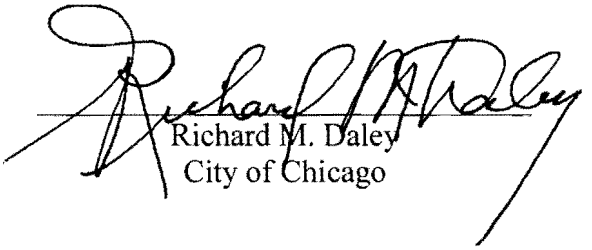
The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form –LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.



Richard M. Daley
City of Chicago

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form –LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

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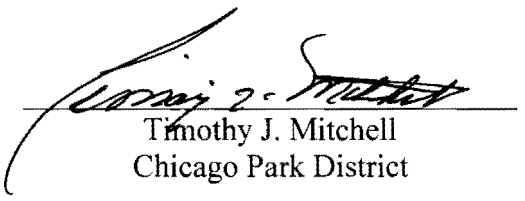

Timothy J. Mitchell
Chicago Park District

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix C

Cost Estimating

Prepared By:

U.S. Army Corps of Engineers
Chicago District

April 2013

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APPENDIX C –Cost Estimating

TABLE OF CONTENTS

1 Cost Methodology

1.1 General

The feasibility cost estimates for the locally preferred plan have been prepared using MCACES 2nd Generation MII Version 4.1. The preparation of the cost estimates is in accordance with guidelines and policies included in: "ER 1110-1-1300 - Cost Engineering Policy and General Requirements, (26 March 1993)"; "ER 1110-2-1302 - Civil Works Cost Engineering, (15 Sept 2008)"; "EI 01D010, Construction Cost Estimates (1 Sept 1997)"; "EM 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region II, (July 2007)"; and "EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS), (30 September 2010)"; "ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works, (30 Sept 2008)." The estimates were completed using the latest guidance from OCE concerning implementation of the Civil Works Breakdown Structure (CWBS) and Chart of Accounts. MII estimate software was used to apply unique crews to detailed work items and obtaining material and supply quotes from prospective vendors/contractors where possible for significant cost items such as armor stone, sheet piling and H pile.

The cost estimates for the NED plan have been prepared in accordance with the various Project Coordination Agreements with the local sponsor.

1.2 Direct Costs

Direct costs are based on anticipated equipment, labor and materials necessary to construct this project. Direct costs have been calculated independent of the contractor assigned to perform the tasks. Following formulation of the direct cost, a determination is made as to whether the work would be performed by the prime contractor or a subcontractor.

1.2.1 Quantities

The estimates for each reach are based on quantity take-offs prepared from the current drawings or anticipated cross sections.

1.2.2 Vendor Quotes

Vendor quotes have been acquired and documented for the key material prices associated with significant features of work. The key material items in these estimates are armor stone, sheet piling and H pile.

1.2.3 Crews

Project specific crews have been developed for use in estimating the direct costs for items not estimated using job quotes or historical cost information. Crew members consist of selected components of labor classifications and equipment pieces assembled to perform specific tasks. Productivity has been assigned to each crew reflective of the expected output per unit of measure for the specific activities listed in the cost estimate. Foremen have also been considered in the crews.

1.2.4 Work Schedules/Overtime

The estimate assumes a 6 day/week 8 hr/day standard work schedule.

1.2.5 Productivty

Crew productivity was calculated for the key items and no additional reduction in productivity was applied.

1.2.6 Sales Tax

The contractor does not have to pay sales tax for incorporated material in Illinois and therefore it is not included in the material costs in the MII estimate.

1.3 **Indirect Costs**

1.3.1 Prime Contractor

For the prime contractor markups of 10% Job Office Overhead, 10% Home office overhead and 8% profit were typically used.

1.3.2 Bond

Bond added as approximately 0.75% and included as a bid item.

1.3.3 Subcontractors

Various subcontractors are assumed for this project and will vary by reach. For the past Chicago Shoreline projects large construction companies have typically been low bidder and have self performed much of the work. Typically landscaping and other smaller items are subcontracted out. For projects with large quantities of pile driving work, an additional subcontractor may be brought in if the prime doesn't have enough equipment/personnel to do the work.

1.4 **Project Feature Accounts**

The cost estimates were prepared and organized according to the Civil Works Breakdown Structure (CWBS). As such, the estimate includes the following feature accounts:

1.4.1 (10) Breakwater and Seawalls

This feature account includes the cost for the construction contract. Key items of work include: existing structure removal and demolition, earth/stone fill, armor stone (Type A, A1, C), reinforced concrete promenade, steps and shear key, battered and vertical H pile, steel sheet piling and walers, pavement path, trees and landscaping items.

1.4.2 (30) Planning, Engineering, and Design

The work covered under this account includes project management, project planning, preliminary design, final design, preparation of plans, preparation of specifications, engineering during construction, advertisement, opening of bids, and contract award. The cost for this account is added in the TPCS. For the remaining reaches done by the Non-federal Sponsor (NFS), the NFS PED percentage is 15%. An additional 5.5% was added for USACE review and oversight for the NFS reaches. For Montrose to Irving, which is a USACE reach, 20% was used.

1.4.3 (31) Supervision and Administration

The work covered under this account includes contract supervision, contract administration, construction administration, technical management activities, and District office supervision and administration costs. The cost for this account is added in the TPCS. For the remaining reaches done by the Non-federal Sponsor (NFS), the NFS CM percentage is 10%. An additional 2.5% was added for USACE review and oversight for the NFS reaches. For Montrose to Irving, which is a USACE reach, 7.5% was used.

1.5 Risk-Based Contingency Development

A Cost and Schedule Risk Analysis (CSRA) was performed on each of the remaining reaches of this project. The Cost Risk Reports for each of the four remaining projects are included in the appendix.

1.6 ESTIMATED COST

The PDT developed a project implementation schedule for the overall project that supports the development of the fully funded cost estimates. The baseline cost estimate for remaining reaches at PL 1 Oct 2012 is $243,867,000.

1.7 FULLY FUNDED COST ESTIMATE

The fully funded cost estimate including inflation to the mid-point of construction as well as past expenditures and local sponsor work in kind through FY12 is $546,148,000 as shown in the Total Project Cost Summary. The fully funded table distributes the base level cost estimate across the appropriate years according to the schedule. Each feature account is inflated to the mid-point of expenditure activity using CWCCIS factors. These inflated feature account totals are summed to yield a total fully funded project cost. Figure B illustrates the distribution of Fully Funded Project Cost over the implementation schedule.

1.8 TOTAL PROJECT COST SUMMARY (LPP)

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

RE-CERTIFICATION STATEMENT

For

LRC PN 113342 - Illinois Shoreline Protection
Post Authorization Calculations
902 Calculation Check - Locally Preferred Plan (LPP)

The Illinois (Chicago) Shoreline Protection LPP, as presented by Chicago District, has undergone a successful Cost Agency Technical Review (Cost ATR) of remaining costs, performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

LPP FY2013 Remaining Costs:	$243,867,000 (Cost ATR Certified)
LPP FY2013 Spent Costs:	$292,146,000 (From Programs & PM)
LPP Fully Funded Costs:	$546,148,000

Note: Cost ATR was devoted to remaining work. It did not focus on spent costs, which is an audit process. It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management throughout the life of the project.

Michael P. Jacobs
Chief, Cost Engineering MCX
Walla Walla District

US Army Corps of Engineers®

Date 2/11/2013

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Chicago Shoreline Protection - PN 113342
LOCATION: Chicago, IL

DISTRICT: LRC Chicago PREPARED: 2/8/2013
POC: CHIEF, COST ENGINEERING, TS-DC

This Estimate reflects the scope and schedule in report: Illinois Shoreline Protection Post Authorization Change Report

Program Year (Budget EC): 2013
Effective Price Level Date: 1 OCT 12

WBS NUMBER	Civil Works Feature & Sub-Feature Description	ESTIMATED COST COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	PROJECT FIRST COST COST ($K)	CNTG ($K)	TOTAL ($K)	TOTAL PROJECT COST (FULLY FUNDED) Spent Thru: 1-Oct-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
10	BREAKWATER & SEAWALLS													
	Completed Projects									$232,308		$232,308		$232,308
	Remaining Projects	$148,840	$35,277	23.7%	$184,117		$148,840	$35,277	$184,117			$155,110	$36,810	$191,920
11	LEVEES & FLOODWALLS													
	Completed Projects									$507		$ 507	$ -	$ 507
	CONSTRUCTION ESTIMATE TOTALS:	$148,840	$35,277		$184,117		$148,840	$35,277	$184,117	$232,815		$387,925	$36,810	$424,735
01	LANDS AND DAMAGES													
	Completed Projects									$124		$124		$124
30	PLANNING, ENGINEERING & DESIGN													
	Completed Projects									$42,445		$42,445		$42,445
	Remaining Projects	$30,439	$7,213	23.7%	$37,652		$30,439	$7,213	$37,652			$30,793	$7,297	$38,089
31	CONSTRUCTION MANAGEMENT													
	Completed Projects									$16,563		$16,563		$16,563
	Remaining Projects	$17,873	$4,225	23.6%	$22,098		$17,873	$4,225	$22,098			$19,407	$4,586	$23,993
32	HTRW													
	Completed Projects									$199		$ 199	$ -	$ 199
	PROJECT COST TOTALS:	$197,152	$46,715	24%	$243,867		$197,152	$46,715	**$243,867**	$292,146		$497,455	$48,693	$546,148

	CHIEF, COST ENGINEERING, TS-DC
	PROJECT MANAGER
	CHIEF, REAL ESTATE
	CHIEF, PLANNING
	CHIEF, ENGINEERING, TS-D
	CHIEF, OPERATIONS
	CHIEF, CONSTRUCTION
	CHIEF, CONTRACTING
	CHIEF, PM-PB
	CHIEF, DPM

ESTIMATED FEDERAL COST:	35%	**$189,134**
ESTIMATED NON-FEDERAL COST:	65%	**$357,014**
ESTIMATED TOTAL PROJECT COST:		**$546,148**

Note: The above Project Costs reflect the Locally Preferred Plan. The Federal cost share is determined as 65% of the NED estimate of $290,975K. Any costs over that are Non-Federal cost.

Estimated and project first cost are for remaining reaches.

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: Chicago Shoreline Protection - PN 113342
LOCATION: Chicago, IL
This Estimate reflects the scope and schedule in report:

DISTRICT: LRC Chicago PREPARED: 2/8/2013
POC: CHIEF, COST ENGINEERING, TS-DC

Estimate Prepared: 30-Jan-13
Effective Price Level: 1 OCT 12

Program Year (Budget EC): 2013
Effective Price Level Date: 1 OCT 12

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	FULLY FUNDED PROJECT ESTIMATE: Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	FUTURE PROJECTS - NFS													
10	BREAKWATER & SEAWALLS													
	- Fullerton/Theater on the Lake	$21,758	$4,495	20.7%	$26,253		$21,758	$4,495	$26,253	2013Q4	1.5%	$22,081	$4,562	$26,643
	CONSTRUCTION ESTIMATE TOTALS:	$21,758	$4,495	20.7%	**$26,253**		$21,758	$4,495	$26,253			$22,081	$4,562	$26,643
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
15.0%	NFS - PED	$3,264	$674	20.7%	$3,938		$3,264	$674	$3,938	2013Q3	1.2%	$3,304	$683	$3,987
5.5%	USACE - PED (Review, oversight, etc)	$1,197	$247	20.7%	$1,444		$1,197	$247	$1,444	2013Q3	1.2%	$1,212	$250	$1,462
31	CONSTRUCTION MANAGEMENT													
10.0%	NFS - CM	$2,176	$450	20.7%	$2,626		$2,176	$450	$2,626	2015Q3	9.0%	$2,371	$490	$2,861
2.5%	USACE - CM (oversight)	$544	$112	20.7%	$656		$544	$112	$656	2015Q3	9.0%	$593	$122	$715
	CONTRACT COST TOTALS:	$28,939	$5,979		**$34,918**		$28,939	$5,979	$34,918			$29,560	$6,107	**$35,667**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Chicago Shoreline Protection - PN 113342
LOCATION: Chicago, IL
This Estimate reflects the scope and schedule in report;

DISTRICT: LRC Chicago PREPARED: 2/8/2013
POC: CHIEF, COST ENGINEERING, TS-DC

Estimate Prepared: 30-Jan-13
Effective Price Level: 1 OCT 12

Program Year (Budget EC): 2013
Effective Price Level Date: 1 OCT 12

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	FULLY FUNDED PROJECT ESTIMATE COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	FUTURE PROJECTS - NFS													
10	BREAKWATER & SEAWALLS													
	- 45th to 51st	$79,177	$17,775	22.5%	$96,952		$79,177	$17,775	$96,952	2015Q3	4.4%	$82,640	$18,553	$101,192
	CONSTRUCTION ESTIMATE TOTALS:	$79,177	$17,775	22.5%	**$96,952**		$79,177	$17,775	$96,952			$82,640	$18,553	$101,192
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
15.0%	NFS - PED	$11,877	$2,666	22.5%	$14,543		$11,877	$2,666	$14,543	2013Q3	1.2%	$12,022	$2,699	$14,721
5.5%	USACE - PED (Review, oversight, etc)	$4,355	$978	22.5%	$5,333		$4,355	$978	$5,333	2013Q3	1.2%	$4,408	$990	$5,398
31	CONSTRUCTION MANAGEMENT													
10.0%	NFS - CM	$7,918	$1,778	22.5%	$9,696		$7,918	$1,778	$9,696	2015Q3	9.0%	$8,627	$1,937	$10,563
2.5%	USACE - CM (oversight)	$1,979	$444	22.5%	$2,423		$1,979	$444	$2,423	2015Q3	9.0%	$2,156	$484	$2,640
	CONTRACT COST TOTALS:	$105,306	$23,641		**$128,947**		$105,306	$23,641	$128,947			$109,853	$24,662	**$134,515**

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: Chicago Shoreline Protection - PN 113342
LOCATION: Chicago, IL
This Estimate reflects the scope and schedule in report;

DISTRICT: LRC Chicago PREPARED: 2/8/2013
POC: CHIEF, COST ENGINEERING, TS-DC

Estimate Prepared: 30-Jan-13
Effective Price Level: 1 OCT 12

Program Year (Budget EC): 2013
Effective Price Level Date: 1 OCT 12

WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	FULLY FUNDED PROJECT ESTIMATE COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	FUTURE PROJECTS - NFS													
10	BREAKWATER & SEAWALLS													
	- 54th to 56th (Promontory Point)	$33,258	$9,312	28.0%	$42,570		$33,258	$9,312	$42,570	2016Q4	6.7%	$35,496	$9,939	$45,435
	CONSTRUCTION ESTIMATE TOTALS:	$33,258	$9,312	28.0%	**$42,570**		$33,258	$9,312	$42,570			$35,496	$9,939	$45,435
01	LANDS AND DAMAGES													
30	PLANNING, ENGINEERING & DESIGN													
15.0%	NFS - PED	$4,989	$1,397	28.0%	$6,386		$4,989	$1,397	$6,386	2013Q3	1.2%	$5,050	$1,414	$6,464
5.5%	USACE - PED (Review, oversight, etc)	$1,829	$512	28.0%	$2,341		$1,829	$512	$2,341	2013Q3	1.2%	$1,851	$518	$2,370
31	CONSTRUCTION MANAGEMENT													
10.0%	NFS - CM	$3,326	$931	28.0%	$4,257		$3,326	$931	$4,257	2015Q3	9.0%	$3,624	$1,015	$4,638
2.5%	USACE - CM (oversight)	$831	$233	28.0%	$1,064		$831	$233	$1,064	2015Q3	9.0%	$905	$254	$1,159
	CONTRACT COST TOTALS:	$44,233	$12,385		**$56,618**		$44,233	$12,385	$56,618			$46,926	$13,139	**$60,066**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Chicago Shoreline Protection - PN 113342
LOCATION: Chicago, IL
This Estimate reflects the scope and schedule in report;

DISTRICT: LRC Chicago PREPARED: 2/8/2013
POC: CHIEF, COST ENGINEERING, TS-DC

Estimate Prepared: 30-Jan-13
Effective Price Level: 1 OCT 12

Program Year (Budget EC): 2013
Effective Price Level Date: 1 OCT 12

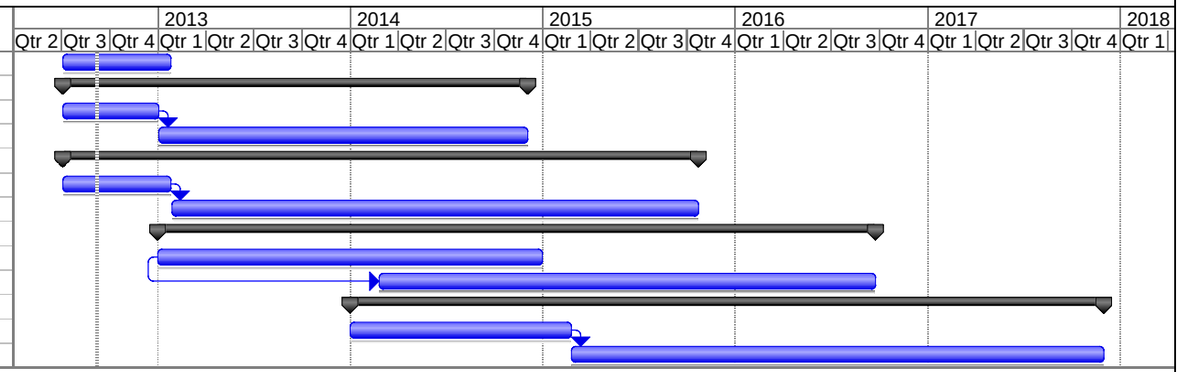
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	FULLY FUNDED PROJECT ESTIMATE COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	FUTURE PROJECT - USACE													
10	BREAKWATER & SEAWALLS													
	- Montrose to Irving	$14,647	$3,694	25.2%	$18,341		$14,647	$3,694	$18,341	2014Q1	1.7%	$14,894	$3,756	$18,650
	CONSTRUCTION ESTIMATE TOTALS:	$14,647	$3,694	25.2%	**$18,341**		$14,647	$3,694	$18,341			$14,894	$3,756	$18,650
01	LANDS AND DAMAGES			25.2%										
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$366	$92	25.2%	$458		$366	$92	$458	2013Q1		$366	$92	$458
1.0%	Planning & Environmental Compliance	$146	$37	25.2%	$183		$146	$37	$183	2013Q1		$146	$37	$183
8.5%	Engineering & Design	$1,245	$314	25.2%	$1,559		$1,245	$314	$1,559	2013Q1		$1,245	$314	$1,559
2.0%	Engineering Tech Review ITR & VE	$293	$74	25.2%	$367		$293	$74	$367	2013Q1		$293	$74	$367
2.0%	Contracting & Reprographics	$293	$74	25.2%	$367		$293	$74	$367	2013Q1		$293	$74	$367
3.0%	Engineering During Construction	$439	$111	25.2%	$550		$439	$111	$550	2014Q1	2.9%	$452	$114	$566
1.0%	Planning During Construction	$146	$37	25.2%	$183		$146	$37	$183	2014Q1	2.9%	$150	$38	$188
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$1,099	$277	25.2%	$1,376		$1,099	$277	$1,376	2014Q1	2.9%	$1,131	$285	$1,417
	CONTRACT COST TOTALS:	$18,674	$4,710		**$23,384**		$18,674	$4,710	$23,384			$18,970	$4,784	**$23,754**

2 PROJECT IMPLEMENTATION SCHEDULE

The total project schedule was developed from the current project implementation schedule developed by the NFS and managed by the Project Manager and expanding the construction schedule based on the significant construction activities and durations from the MII cost estimate. The construction schedule calendars include major holidays and non-work weather days.

Table 1 - Chicago Shoreline Remaining Projects

ID	Early Start	Early Finish	Duration	Cost	Task Name
1	Thu 7/5/12	Fri 1/25/13	147 days	$14,718,000.00	43rd to 45th St Construction
2	**Thu 7/5/12**	**Wed 12/3/14**	**630 days**	**$18,229,000.00**	**Montrose to Irving**
3	Thu 7/5/12	Wed 1/2/13	130 days	$0.00	Montrose to Irving Design
4	Thu 1/3/13	Wed 12/3/14	500 days	$18,229,000.00	Montrose to Irving Construction
5	**Thu 7/5/12**	**Fri 10/23/15**	**862 days**	**$26,204,000.00**	**Fullerton Theater by the Lake**
6	Thu 7/5/12	Fri 1/25/13	147 days	$0.00	Fullerton Theater on the Lake Design
7	Mon 1/28/13	Fri 10/23/15	715 days	$26,204,000.00	Fullerton Theater on the Lake Construction
8	**Tue 1/1/13**	**Fri 9/23/16**	**974 days**	**$96,093,000.00**	**45th to 51st**
9	Tue 1/1/13	Wed 12/31/14	522 days	$0.00	45th to 51st Design
10	Tue 2/25/14	Fri 9/23/16	674 days	$96,093,000.00	45th to 51st Construction
11	**Wed 1/1/14**	**Thu 11/30/17**	**1022 days**	**$42,346,000.00**	**Promontory Point**
12	Wed 1/1/14	Tue 2/24/15	300 days	$0.00	54th to 56th (Promontory) Design
13	Wed 2/25/15	Thu 11/30/17	722 days	$42,346,000.00	54th to 56th (Promontory) Construction



Project: Overall CS Project
Date: Thu 9/6/12

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary
Group By Summary
Deadline

3 RISK ANALYSIS DEVELOPMENT

3.1 **Cost and Schedule Risk Analyis Development**

A Cost and Schedule Risk Analysis (CSRA) was performed on each of the remaining segments of this project to more accurately identify risk and potential impacts to the project. This analysis required participation by entire PDT to identify the 80% confidence level project cost and contingencies. A single risk register was developed and then used as a basis for a CSRA on each of the individual reaches since some risks did not apply to all reaches.

3.2 **Risk Results**

Results of the cost and schedule risk analysis for each of the remaining reaches are shown below.

Fullerton Theater by the Lake	20.7%
45^{th} to 51^{st}	22.5%
54^{th} to 56^{th} (Promontory Point)	28.0%
Montrose to Irving	25.2%

4 DETAILED MII REPORTS (LPP)

MII Cost Estimate Report – Definition of Terms

Bare Costs
Bare costs are defined as project costs that have no markups included. Bare cost excludes direct cost markups for productivity, overtime, and any tax adjustments, along with payroll, taxes and insurance (PTI), contractor markups, special markups, or owner cost markups.

Direct Costs
Direct costs are defined as bare costs which are marked up for productivity adjustments, overtime, taxes and/or other miscellaneous adjustments.

Cost to Prime
Cost to prime is defined as direct costs with markups applied for PTI and any allowances such as small tools for the subcontractor work. The subcontractor markup for job office overhead (JOOH), home office overhead (HOOM), profit, bond and excise tax and/or any miscellaneous adjustment is also included. This is in effect the cost to the performing contractor. Any special markups are included in this cost but are not passed on to the owner's markup cost. Therefore, the special markups are not compounded but are treated as an additional cost.

Contract Cost (Cost To Owner)
Contract Cost (sometimes referred to as "cost to owner") takes the cost to prime and then adds to that the cost for the contractor's PTI as well as any allowance, such as small tools, for the contractor's work. Then the contractor's own markups for JOOH, HOOM, profit, bond, and excise tax and/or any miscellaneous adjustments are included. Any special markups are included in the cost but are not passed on to the owner's markup cost. Therefore, the special markups are not compounded but are treated as an additional cost.

Project Cost
The project cost takes the contract cost and then adds any escalation, contingencies, SIOH (supervision, inspection and overhead) and/or any miscellaneous owner costs. It should be noted that escalation factors are applied in Figure 1 spreadsheet calculations and not using escalation functions in the MII cost estimating software.

Fullerton Theater by the Lake Concept Level Estimate
BACKCHECK

FILE LOCATION: Z:\0_Projects\Chicago Shoreline\LRR-PACR-2012\Cost_ATR_Package\Estimates\Fullerton Theater by the Lake

Project Description: The Contractor will be responsible for providing all necessary facilities, plant, labor, transportation, materials, and equipment to construct perform construction activities consisting of reconstruction of approximately 1,880 feet of deteriorated step stone revetment with steel sheet pile and tiered steps for erosion protection and reduction of flooding due to overtopping and other work items identified in the Bid Schedule. The 25% plans prepared by the A/E (STS) were used to develop quantities. Where no details were provided in the 25% drawings, we used the adjacent constructed reach of Diversey to Fullerton (items such as pile depth, bike path details, back shore drainage, etc.).

The major work items are: -Mobilization -Demobilization -Existing breakwater structure demolition -Steel sheet pile -Battered and Vertical H-piles -Concrete promenade and steps -Earth fill (behind SSP) -Armor stone -Topsoil, sod and tree planting -Bituminous Bike Path -Landside drainage (French drain and catch basins) -Temporary Fencing -Site security -Kiosk utilities

Construction Schedule: Schedule developed by D.Druzbicki. Assumes NTP is Dec 12, and construction is completed by Sept 15 (approx 1,000 cal. days). Time was added for weather delays and winter shutdown. On past projects fill and pile driving has often continued through the winter months. For purposes of schedule development however a winter shutdown was included to be on safe side.

Basis of Estimate: Current Working Estimate

Overtime: Assumed 6 days per week, 8 hour days; for items on the critical path (pile driving, earthwork, concrete, etc.).

Acquisition Plan: Unrestricted competitive bid for qualified bidders. Most Chicago Shoreline projects have been competitively bid and awarded to large civil contractors. This contract will be administered by the City of Chicago.

Sub-Contracting Plan: Landscaping, Pile Driving Contractor, Electrical, Security, Paving, Fencing.

Site Access: The construction site access will be off of Lake Shore Drive. The site will be completely fenced to prevent public access to area and have a security guard or remote monitoring during non-work hours. At times a flagman may be required during heavy trucking of fill when crossing bike path. Fenced site will provide storage and staging area for all construction materials.

Construction Methodology: Construction Methodology for this project utilizes standard industry practices. Assumed vertical H-pile will be driven from land side. SSP and battered H-pile from marine plant. Armor stone placed in front of the SSP using floating plant. SSP and battered piles will be driven ahead of fill placement operations. Vertical pile and concrete work will follow along behind.

Unusual Conditions: N/A

Equipment and Labor Availability & Distance Traveled: Full resources for labor, equipment and materials required under this contract are readily available in area.

Pricing: This estimate uses Davis Bacon labor rates for Cook County, IL; Wage Decision IL120009, dated 6/15/12 (Mod. #7).

Equipment rates used are from EP 1110-1-8, volume 2 Mideast, 2011. Pricing for materials based on quotes for large quantity items (Steel and armor stone), catalogs, UPB and recent similar contracts.

Contingency and Profit: No contingency was added in the MII estimate, this was applied based on the CSRA and added in the TPCS. Profit was applied at 8% for Prime and 10% for subcontractors.

Escalation: Applied in TPCS.

Tax: No sales tax was applied for incorporated materials.

Estimated by	D.Druzbicki
Designed by	A/E - STS
Prepared by	D.Druzbicki
Preparation Date	1/30/2013
Effective Date of Pricing	10/1/2012
Estimated Construction Time	1,000 Days

Description	Quantity	UOM	ProjectCost
Project Summary			21,758,383
10 Breakwater and Seawalls	1.0	EA	21,758,383
0001 Mobilization & Demobilization (3%)	1.0	LS	645,896
0002 Existing Structure Removal and Demolition	1.0	LS	230,048
0003 Traffic Control and Signage	1.0	LS	27,352
0004 Tree Removal and Replacement	1.0	LS	40,001
0005 Existing Tree Protection	1.0	LS	19,591
0006 Fencing and gates	2,100.0	LF	91,044
0007 Temporary Path and Construction Access	1.0	LS	106,771
0008 Site Security	1.0	LS	118,107
0009 Earth Excavation	5,000.0	CY	65,908
0010 Earth Fill (Above Water TACO Tier 1)	183,610.0	CY	4,380,682
0011 Earth Fill (Below Water Conc rubble, slag)	42,223.0	CY	843,582
0012 Furnish & Place Topsoil	1,863.0	CY	63,668
0013 Geotextile (Above water)	5,000.0	SY	19,059
0014 Geotextile (Below water)	6,844.0	SY	26,087
0015 Type 1A Stone	23,481.0	TON	2,410,869
0016 Type C Stone	5,962.0	TON	549,267
0017 Bituminous Pavement Path	46,449.0	SF	267,850
0018 Furnish & Place Sod	1.0	LS	326,906
0019 French Drains and CB's	1.0	LS	24,554
0020 Reinforced Concrete for Revetment	11,463.0	CY	5,043,209
0021 Test Piles	1.0	EA	35,089
0022 Battered HP 14x73	9,823.0	LF	728,942
0023 Vertical HP 14x73	26,947.0	LF	1,549,183
0024 Steel Sheet Pile PZ22	16,192.0	SF	513,512
0025 Steel Sheet Pile PZ27	66,528.0	SF	2,960,947
0026 Waler and Misc Steel (Sections A and B, PZ27)	1,300.0	FT	494,848
0027 Waler and Misc Steel (Section C, PZ22)	408.0	FT	109,806
0028 Misc maint during construction	1.0	LS	16,318

Description	Quantity	UOM	ProjectCost
0029 As-Builts	1.0	LS	26,363
0030 Kiosk Utilities	1.0	LS	22,925

45th to 51st Street Concept Level Estimate
FILE NAME: 45th to 51st Conceptual.mlp
FILE LOCATION: Z:\0_Projects\Chicago Shoreline\LRR-PACR-2012\Cost_ATR_Package\Estimates\45th to 51st

Project Description: The Contractor will be responsible for providing all necessary facilities, plant, labor, transportation, materials, and equipment to construct perform construction activities consisting of reconstruction of approximately 5,000 feet of deteriorated step stone revetment with new rubblemound revetment for erosion protection and reduction of flooding due to overtopping and other work items identified in the Bid Schedule. This project will also provide for the construction of two rubblemound breakwaters as well as a new beach area. The typical cross section sketch and site plan prepared by an A/E (MWH) and were used to develop quantities. Where no details were provided, we used the adjacent constructed reaches of the Chicago Shoreline (items such as pile depth, bike path details, back shore drainage, etc.).

The major work items are:
-Mobilization -Demobilization -Existing breakwater structure demolition - Revetment Termination -Rubblemound Revetment -Rubblemound Breakwaters -Beach Construction -Native landscaping and tree planting -Landside drainage -Temporary Fencing - Pedestrian Boardwalk -Site security

Construction Schedule: Schedule developed by D.Druzbicki. Assumes NTP is 1Q14, and construction is completed by 4Q16 (approx 943 cal. days). Time was added for weather delays and winter shutdown. On past projects pile driving has often continued through the winter months. For purposes of schedule development however a winter shutdown was included to be on safe side. It is anticipated that multiple crews will be working simultaneously on critical items.

Basis of Estimate: Current Working Estimate
Overtime: Assumed 6 days per week, 8 hour days; for items on the critical path (armor stone placement, etc.).
Acquisition Plan: Unrestricted competitive bid for qualified bidders. Most Chicago Shoreline projects have been competitively bid and awarded to large civil contractors. This contract will be administered by the City of Chicago.
Sub-Contracting Plan: Landscaping, Pile Driving Contractor, Carpentry, Site Security, Site Work Contractor.
Site Access: The construction site access will be off of Lake Shore Drive. The site will be completely fenced to prevent public access to area and have a security guard or remote monitoring during non-work hours. At times a flagman may be required during heavy trucking of fill when crossing bike path. Fenced site will provide storage and staging area for all construction materials.
Construction Methodology: Construction Methodology for this project utilizes standard industry practices. Assumed piling will be driven from land side. Revetment stone placed using floating plant.
Unusual Conditions: N/A
Equipment and Labor Availability & Distance Traveled: Full resources for labor, equipment and materials required under this contract are readily available in area.
Pricing: This estimate uses Davis Bacon labor rates for Cook County, IL; Wage Decision IL120009, dated 6/15/12 (Mod. #7).
Equipment rates used are from EP 1110-1-8, volume 2 Mideast, 2011. Pricing for materials based on quotes for large quantity items (Steel and armor stone), catalogs, UPB and recent similar contracts.
Contingency and Profit: No contingency was added in the MII estimate, this was applied based on the CSRA and added in the TPCS. Profit was applied at 8% for Prime and 10% for subcontractors.
Escalation: Applied in TPCS.
Tax: No sales tax was applied for incorporated materials.

Estimated by	Matthew Cunningham (Quantities prepared by A/E)
Designed by	A/E - MWH
Prepared by	Matthew Cunningham
Preparation Date	1/30/2013
Effective Date of Pricing	10/1/2012
Estimated Construction Time	943 Days

Description	Quantity	UOM	ProjectCost
Project Summary			79,176,861
10 Breakwater and Seawalls	1.0	EA	79,176,861
0001 Mobilization & Demobilization	1.0	LS	505,455
0002 Site Security	1.0	LS	275,408
0003 Site Preparation & Demolition	1.0	LS	526,868
0004 Lakefront Trail	5,200.0	LF	519,089
0005 Furnish & Place Topsoil	9,600.0	CY	282,424
0006 Furnish & Place Sod	57,000.0	SY	278,580
0007 Rubblemound Breakwater Stone (North & South)	1.0	EA	17,583,663
0008 Rubblemound Revetment Stone (North & South)	1.0	EA	39,585,689
0009 Beach	1.0	EA	16,429,204
0010 SSP/Concrete Revetment Termination	1.0	EA	3,190,484

Promontory Point Concept Level Estimate
FILE NAME: Promontory Point Conceptual CWE.mlp
FILE LOCATION: Z:\0_Projects\Chicago Shoreline\LRR-PACR-2012\Cost_ATR_Package\Estimates\Promontory Point Project

Project Description: The Contractor will be responsible for providing all necessary facilities, plant, labor, transportation, materials, and equipment to construct perform construction activities consisting of reconstruction of approximately 3,400 feet of deteriorated step stone revetment with steel sheet pile and tiered steps with reused existing limestone block for the back step for erosion protection and reduction of flooding due to overtopping and other work items identified in the Bid Schedule. The typical cross section sketch and site plan prepared by the A/E (STS) were used to develop quantities. Where no details were provided, we used the adjacent constructed reaches of the Chicago Shoreline (items such as pile depth, bike path details, back shore drainage, etc.).

The major work items are:

-Mobilization -Demobilization -Existing breakwater structure demolition
- Reuse existing limestone blocks -Steel sheet pile -Battered and Vertical H-piles
-Concrete promenade and steps -Earth fill (behind SSP) -Armor stone
-Topsoil, sod and tree planting -Bituminous Bike Path -Landside drainage (French drain and catch basins) -Temporary Fencing -Site security

Construction Schedule: Schedule developed by D.Druzbicki. Assumes NTP is 1Q15, and construction is completed by 4Q17 (approx 940 cal. days). Time was added for weather delays and winter shutdown. On past projects fill and pile driving has often continued through the winter months. For purposes of schedule development however a winter shutdown was included to be on safe side. It is anticipated that multiple crews will be working simultaneously on critical items (piling, concrete, etc.).

Basis of Estimate: Current Working Estimate

Overtime: Assumed 6 days per week, 8 hour days; for items on the critical path (pile driving, earthwork, concrete, etc.).

Acquisition Plan: Unrestricted competitive bid for qualified bidders. Most Chicago Shoreline projects have been competitively bid and awarded to large civil contractors. This contract will be administered by the City of Chicago.

Sub-Contracting Plan: Landscaping, Pile Driving Contractor, Electrical, Security, Paving, Fencing.

Site Access: The construction site access will be off of Lake Shore Drive. The site will be completely fenced to prevent public access to area and have a security guard or remote monitoring during non-work hours. At times a flagman may be required during heavy trucking of fill when crossing bike path. Fenced site will provide storage and staging area for all construction materials.

Construction Methodology: Construction Methodology for this project utilizes standard industry practices. Assumed vertical H-pile will be driven from land side. SSP and battered H-pile from marine plant. Armor stone placed in front of the SSP using floating plant. SSP and battered piles will be driven ahead of fill placement operations. Vertical pile and concrete work will follow along behind.

Unusual Conditions: N/A

Equipment and Labor Availability & Distance Traveled: Full resources for labor, equipment and materials required under this contract are readily available in area.

Pricing: This estimate uses Davis Bacon labor rates for Cook County, IL; Wage Decision IL120009, dated 6/15/12 (Mod. #7).

Equipment rates used are from EP 1110-1-8, volume 2 Mideast, 2011. Pricing for materials based on quotes for large quantity items (Steel and armor stone), catalogs, UPB and recent similar contracts.

Contingency and Profit: No contingency was added in the MII estimate, this was applied based on the CSRA and added in the TPCS. Profit was applied at 8% for Prime and 10% for subcontractors.

Escalation: Applied in TPCS.

Tax: No sales tax was applied for incorporated materials.

Estimated by	D.Druzbicki
Designed by	A/E - MWH
Prepared by	D.Druzbicki
Preparation Date	1/30/2013
Effective Date of Pricing	10/1/2012
Estimated Construction Time	940 Days

Description	Quantity	UOM	ProjectCost
Project Summary			33,258,612
Breakwater and Seawalls	1.0	EA	33,258,612
Mobilization & Demobilization (3%)	1.0	LS	988,315
Existing Structure Removal and Demolition	1.0	LS	229,977
Traffic Control and Signage	1.0	LS	27,343
Tree Removal and Replacement	1.0	LS	38,186
Existing Tree Protection	1.0	LS	19,585
Fencing and gates	2,100.0	LF	91,016
Temporary Path and Construction Access	1.0	LS	106,738
Site Security	1.0	LS	149,359
Earth Excavation	5,000.0	CY	65,888
Earth Fill (Below Water Conc rubble, slag)	65,922.0	CY	1,418,181
Furnish & Place Topsoil	1,863.0	CY	60,881
Geotextile (Above water)	5,000.0	SY	19,053
Geotextile (Below water)	6,844.0	SY	26,079
Type 1A Stone	59,437.0	TON	6,061,434
Type C Stone	9,526.0	TON	1,266,976
Bituminous Pavement Path	46,449.0	SF	267,525
Furnish & Place Sod	1.0	LS	113,018
Drainage and CB's	1.0	LS	24,745
Reinforced Concrete for Revetment	16,521.0	CY	9,675,303
Battered HP 14x53	21,414.0	LF	1,206,469
Vertical HP 14x53	22,626.0	LF	1,279,428
Steel Sheet Pile PZ27	204,000.0	SF	8,947,350
Waler and Misc Steel	3,400.0	FT	1,133,095
Misc maint during construction	1.0	LS	16,313
As-Builts	1.0	LS	26,355

Montrose Irving_LRR BACKCHECK
FILE NAME: Montrose Irving Feas.mlp
FILE LOCATION: Z:\0_Projects\Chicago Shoreline\LRR-PACR-2012\Cost_ATR_Package\Estimates\Montrose to Irving

Project Description: The Contractor will be responsible for providing all necessary facilities, plant, labor, transportation, materials, and equipment to construct perform construction activities consisting of reconstruction of approximately 2,400 feet of deteriorated step stone revetment with new armor stone and tiered steps with reused existing limestone block for the back step for erosion protection and reduction of flooding due to overtopping and other work items identified in the Bid Schedule. The typical cross section sketch and site plan prepared by USACE were used to develop quantities. Where no details were provided, we used the adjacent constructed reaches of the Chicago Shoreline (items such as pile depth, bike path details, back shore drainage, etc.).

The major work items are:
-Mobilization -Demobilization -Existing breakwater structure demolition - Reuse existing limestone blocks - Jetty Repair/Rehabilitation -Universal Access Point -Armor stone -Topsoil, sod and tree planting -Landside drainage -Temporary Fencing -Site security

Construction Schedule: Schedule developed by D.Druzbicki. Assumes NTP is 1Q13, and construction is completed by 4Q14 (approx 650 cal. days). Time was added for weather delays and winter shutdown. On past projects pile driving has often continued through the winter months. For purposes of schedule development however a winter shutdown was included to be on safe side. It is anticipated that multiple crews will be working simultaneously on critical items (piling, concrete, etc.).

Basis of Estimate: Current Working Estimate

Overtime: Assumed 6 days per week, 8 hour days; for items on the critical path (pile driving, armor stone placement, etc.).
Acquisition Plan: Unrestricted competitive bid for qualified bidders. Most Chicago Shoreline projects have been competitively bid and awarded to large civil contractors. This contract will be administered by USACE.
Sub-Contracting Plan: Landscaping, Pile Driving Contractor, Electrical, Security, Paving, Fencing.
Site Access: The construction site access will be off of Lake Shore Drive. The site will be completely fenced to prevent public access to area and have a security guard or remote monitoring during non-work hours. At times a flagman may be required during heavy trucking of fill when crossing bike path. Fenced site will provide storage and staging area for all construction materials.
Construction Methodology: Construction Methodology for this project utilizes standard industry practices. Assumed vertical H-pile will be driven from land side. SSP and battered H-pile from marine plant. Armor stone placed in front of the SSP using floating plant. SSP and battered piles will be driven ahead of fill placement operations. Vertical pile and concrete work will follow along behind.
Unusual Conditions: N/A
Equipment and Labor Availability & Distance Traveled: Full resources for labor, equipment and materials required under this contract are readily vailable in area.
Pricing: This estimate uses Davis Bacon labor rates for Cook County, IL; Wage Decision IL120009, dated 6/15/12 (Mod. #7).
Equipment rates used are from EP 1110-1-8, volume 2 Mideast, 2011. Pricing for materials based on quotes for large quantity items (Steel and armor stone), catalogs, UPB and recent similar contracts.
Contingency and Profit: No contingency was added in the MII estimate, this was applied based on the CSRA and added in the TPCS. Profit was applied at 8% for Prime and 10% for subcontractors.
Escalation: Applied in TPCS.
Tax: No sales tax was applied for incorporated materials.

Estimated by	CELRC
Designed by	Vito Kluza
Prepared by	George Chartouni
Preparation Date	1/30/2013
Effective Date of Pricing	10/1/2012
Estimated Construction Time	650 Days

Description	Quantity	UOM	ProjectCost
Project Summary			14,647,317
10 Breakwater and Seawalls	1.0	EA	14,647,317
0001 Mobilization and Demobilization	1.0	LS	362,656
0002 Temporary Field Office Project Signs, Staging and Storage Areas	1.0	LS	354,481
0003 Traffic Control and Signage	1.0	LS	240,500
0004 Demolition and Removal of Existing Structures	1.0	LS	269,026
0006 Earthwork	1.0	LS	13,501
0007 Stone Placement	1.0	LS	4,545,174
0008 Pier at STA 22+50	1.0	EA	718,396
0009 Universal Access Point	1.0	LS	1,342,130
Salvage Existing Limestone	1,892.0	LF	6,801,454

5 NED ESTIMATE

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO IL 60606-7206

REPLY TO
ATTENTION OF:

CELRC-OC

13 December 2012

MEMORANDUM FOR RECORD

SUBJECT: Chicago Shoreline Project Cooperation Agreement Provisions Dictating Specific NED Calculation Methods

1. References

a. Project Cooperation Agreement Between the Department of the Army and the City of Chicago and the Chicago Park District for Construction of the Remainder of the Chicago Shoreline, Chicago, Illinois Project dated 17 May 1999 (PCA #3).

b. Project Cooperation Agreement Between the Department of the Army and the City of Chicago and the Chicago Park District for Construction of Certain Areas of the Chicago Shoreline, Chicago, Illinois Project dated 7 August 1998 (PCA #2).

c. Project Cooperation Agreement Between the Department of the Army and the City of Chicago for Partial Cost Reimbursement for Construction of the South Water Filtration Plant Outer Breakwater, Lake Michigan, Illinois Storm Damage Reduction and Shoreline Erosion Protection Project dated 28 April 1997 (PCA #1).

2. The Lake Michigan, Illinois Storm Damage and Shoreline Erosion Protection Project ("Project") was authorized by Section 101 (a)(12) of the Water Resources Development Act of 1996 (Public Law 104-303). To implement the Project, three Project Cooperation Agreements were entered into by USACE and the local sponsors: PCA #1, ref 1.c; PCA#2, ref 1.b; and c.

3. Each PCA for this project included provisions requiring that specific calculations be used to determine the National Economic Development costs ("NED costs"). Specifically, Article I.D of PCA #3 says that "Total NED cost shall be calculated pursuant to Exhibit A", ref 1.a. Exhibit A to PCA#3 sets forth a detailed methodology for determining the NED costs. Exhibit A states "Paragraphs 1 through 5 of this Exhibit will establish the methodology for purposes of determining total NED costs." Similar provisions are found in PCA #2 and PCA #1. See Art. I.D of PCA #2 ("Total NED cost shall include costs of placed stone under the NED Plan as calculated pursuant to Exhibit A"); Art. I.D of PCA #1 (same).

4. In sum, we are required by the terms of all three PCAs to calculate the NED costs for this Project in accordance with the detailed methodology set forth in Exhibit A to the PCA. Because we have entered into a binding agreement with the local sponsor, we may not use a different methodology.

5. Please direct any questions you may have to me at 312-846-5350.

KIM J. SABO
District Counsel
Office of Counsel
Chicago District

Federal Cost Share - Chicago Shoreline

NED Estimate = % of LPP

	E&D	CM	PM	LERRD
Reach 2	88%	90%	100%	100%
Reach 4	78%	77%	100%	100%
Other	100%	100%	100%	100%

Federal Cost Share (% of NED)	65%

NED Totals	**Total NED Cost**	**Federal Share**
PCA #1	$ 9,440,860	$ 6,136,559
PCA #2	$ 12,453,441	$ 8,094,737
PCA #3	$ 269,081,043	$ 174,902,678
Total:	**$ 290,975,344**	**$ 189,133,974**

Reach / Price Level	**Segment**	**LPP Costs**			**NED estimate**
		Federal	**Non-Federal**	**Total**	
PCA #2 Segments					
Reach 2	**Belmont Harbor Penisula**				
02/1999	Construction	$ -	$ 3,978,569	$ 3,978,569	$ 4,453,413
	PED	$ 8,384	$ -	$ 12,898	$ 12,898
	E&D	$ 126,353	$ 251,730	$ 378,083	$ 332,713
	CM	$ 64,002	$ 281,632	$ 345,634	$ 311,071
	PM	$ 6,117	$ 221,417	$ 227,534	$ 227,534
	LERRDS	$ -	$ -	$ -	$ -
	Subtotal:	**$ 204,855**	**$ 4,733,348**	**$ 4,942,718**	**$ 2,500,000**
Reach 2	**31st Street Beach**				
05/1999	Construction	$ -	$ 5,084,087	$ 5,084,087	$ 3,134,847
	PED	$ 6,600	$ -	$ 10,153	$ 10,153
	E&D	$ 226,894	$ 529,263	$ 756,157	$ 665,418
	CM	$ 39,911	$ 308,719	$ 348,630	$ 313,767
	PM	$ 14,240	$ 221,417	$ 235,657	$ 235,657
	LERRDS	$ -	$ -	$ -	$ -
	Subtotal:	**$ 287,644**	**$ 6,143,486**	**$ 6,434,684**	**$ 2,500,000**
Reach 2	**31st to 33rd Street**				
04/1999	Construction	$ 5,198,587	$ -	$ 5,198,587	$ 5,572,414
	PED	$ 11,549	$ -	$ 17,768	$ 17,768
	E&D	$ 1,479,575	$ 242	$ 1,479,817	$ 1,302,239
	CM	$ 244,570		$ 244,570	$ 220,113
	PM	$ 67,378	$ 115,566	$ 182,944	$ 182,944
	PCA	$ 142,962		$ 142,962	$ 142,962
	LERRDS	$ -	$ 15,000	$ 15,000	$ 15,000
	Subtotal:	**$ 7,144,622**	**$ 130,808**	**$ 7,281,649**	**$ 7,453,441**
	PCA #2 Totals:	**$ 7,637,121**	**$ 11,007,642**	**$ 18,659,050**	**$ 12,453,441**
PCA #3 Segments					
Reach 2	**Montrose North**				
06/2003	Construction	$ 22,964,649	$ 7,372,674	$ 30,337,323	$ 15,871,134
	PED	$ -	$ -	$ -	$ -
	E&D	$ 3,356,127	$ 44,477	$ 3,400,604	$ 2,992,532
	CM	$ 2,010,288	$ 110,000	$ 2,120,288	$ 1,908,259
	PM	$ 308,421	$ 200,000	$ 508,421	$ 508,421
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 28,639,485**	**$ 7,732,151**	**$ 36,371,636**	**$ 21,285,345**
Reach 2	**Montrose to Irving**				
01/2014	Construction	$ 2,000,000	$ 16,859,000	$ 18,859,000	$ 10,379,280
	PED	$ -	$ -	$ -	$ -
	E&D	$ 1,425,977	$ 700,000	$ 2,125,977	$ 1,870,860
	CM	$ 500,000	$ 1,080,000	$ 1,580,000	$ 1,422,000
	PM	$ 149,728	$ 200,000	$ 349,728	$ 349,728
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 4,075,705**	**$ 18,844,000**	**$ 22,919,705**	**$ 14,026,867**

Federal Cost Share - Chicago Shoreline

NED Estimate = % of LPP

	E&D	CM	PM	LERRD
Reach 2	88%	90%	100%	100%
Reach 4	78%	77%	100%	100%
Other	100%	100%	100%	100%

Federal Cost Share (% of NED)	65%

NED Totals	**Total NED Cost**	**Federal Share**
PCA #1	$ 9,440,860	$ 6,136,559
PCA #2	$ 12,453,441	$ 8,094,737
PCA #3	$ 269,081,043	$ 174,902,678
Total:	**$ 290,975,344**	**$ 189,133,974**

		LPP Costs			NED estimate
Reach / Price Level	**Segment**	**Federal**	**Non-Federal**	**Total**	
Reach 2	**Irving to Belmont**				
08/2000	Construction	$ 16,522,353	$ -	$ 16,522,353	$ 16,592,134
	PED	$ -	$ -	$ -	$ -
	E&D	$ 1,472,256	$ 18,317	$ 1,490,573	$ 1,311,704
	CM	$ 926,004	$ 24,471	$ 950,476	$ 855,428
	PM	$ 226,532	$ 200,000	$ 426,532	$ 426,532
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 19,147,145**	**$ 247,789**	**$ 19,394,934**	**$ 19,190,798**
Reach 2	**Belmont to Diversey North**				
09/2003	Construction	$ 6,835,266	$ 3,654,125	$ 10,489,390	$ 7,007,975
	PED	$ 472	$ -	$ 725	$ 725
	E&D	$ 2,957,867	$ 185,448	$ 3,143,315	$ 2,766,117
	CM	$ 511,747	$ 47,958	$ 559,705	$ 503,735
	PM	$ 286,913	$ 200,000	$ 486,913	$ 486,913
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 10,592,265**	**$ 4,092,531**	**$ 14,685,050**	**$ 10,770,466**
Reach 2	**Belmont to Diversey South**				
11/2007	Construction	$ 10,550,107	$ 494,320	$ 11,044,428	$ 5,135,780
	PED	$ -	$ -	$ -	$ -
	E&D	$ 1,392,242	$ 170,000	$ 1,562,242	$ 1,374,773
	CM	$ 1,137,704	$ 65,000	$ 1,202,704	$ 1,082,433
	PM	$ 180,017	$ 200,000	$ 380,017	$ 380,017
	LERRDS		$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 13,260,070**	**$ 934,320**	**$ 14,194,390**	**$ 7,978,003**
Reach 2	**Diversey Revetment**				
10/2009	Construction	$ 7,177,413	$ 882,651	$ 8,060,064	$ 2,223,725
	PED	$ -	$ -	$ -	$ -
	E&D	$ 544,722	$ 150,000	$ 694,722	$ 611,355
	CM	$ 353,878	$ 50,000	$ 403,878	$ 363,490
	PM	$ 149,948	$ 20,000	$ 169,948	$ 169,948
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 8,225,961**	**$ 1,107,651**	**$ 9,333,612**	**$ 3,373,518**
Reach 2	**Diversey to Fullerton**				
03/2004	Construction	$ 9,642,419	$ 7,530,438	$ 17,172,857	$ 12,391,568
	PED	$ -	$ -	$ -	$ -
	E&D	$ 1,915,067	$ 113,748	$ 2,028,815	$ 1,785,357
	CM	$ 1,145,686	$ 22,269	$ 1,167,955	$ 1,051,159
	PM	$ 114,904	$ 200,000	$ 314,904	$ 314,904
	LERRDS		$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 12,818,076**	**$ 7,871,455**	**$ 20,689,531**	**$ 15,547,988**
Reach 2	**2F - Fullerton**				
03/2014	Construction	$ -	$ 27,010,000	$ 27,010,000	$ 4,771,600
	PED	$ -	$ -	$ -	$ -
	E&D	$ 140,771	$ 700,000	$ 840,771	$ 739,878
	CM	$ 540,000	$ 600,000	$ 1,140,000	$ 1,026,000

Federal Cost Share - Chicago Shoreline

NED Estimate = % of LPP

	E&D	CM	PM	LERRD
Reach 2	88%	90%	100%	100%
Reach 4	78%	77%	100%	100%
Other	100%	100%	100%	100%

Federal Cost Share (% of NED)	65%

NED Totals	**Total NED Cost**	**Federal Share**
PCA #1	$ 9,440,860	$ 6,136,559
PCA #2	$ 12,453,441	$ 8,094,737
PCA #3	$ 269,081,043	$ 174,902,678
Total:	**$ 290,975,344**	**$ 189,133,974**

		LPP Costs			**NED estimate**
Reach / Price Level	**Segment**	**Federal**	**Non-Federal**	**Total**	
	PM	$ 50,000	$ 200,000	$ 250,000	$ 250,000
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 730,771**	**$ 28,515,000**	**$ 29,245,771**	**$ 6,792,478**
Reach 2&4	**Retrofit 1**				
	Construction	$ 2,552,445	$ -	$ 2,552,445	$ -
	PED	$ -	$ -	$ -	$ -
	E&D	$ 66,489	$ -	$ 66,489	$ -
	CM	$ 178,061	$ -	$ 178,061	$ -
	PM	$ 15,368	$ -	$ 15,368	$ -
	LERRDS	$ -	$ -	$ -	$ -
	Subtotal:	**$ 2,812,363**	**$ -**	**$ 2,812,363**	**$ -**
Reach 2 & 4	**Retrofit 2, Landscape & Mock-Up**				
	Construction	$ 1,272,439	$ -	$ 1,272,439	$ -
	PED	$ -	$ -	$ -	$ -
	E&D	$ 394,786	$ -	$ 394,786	$ -
	CM	$ 140,340	$ -	$ 140,340	$ -
	PM	$ 55,665	$ -	$ 55,665	$ -
	LERRDS	$ -	$ -	$ -	$ -
	Subtotal:	**$ 1,863,229**	**$ -**	**$ 1,863,229**	**$ -**
Reach 3	**3M - Meigs Field**				
	Construction	$ -	$ -	$ -	$ -
	PED	$ 55,599	$ -	$ 85,537	$ 85,537
	E&D	$ -	$ -	$ -	$ -
	CM	$ -	$ -	$ -	$ -
	PM	$ -	$ -	$ -	$ -
	LERRDS	$ -	$ -	$ -	$ -
	Subtotal:	**$ 55,599**	**$ -**	**$ 85,537**	**$ 85,537**
Reach 3	**Solidarity Drive**				
	Construction	$ -	$ 10,379,935	$ 10,379,935	$ 10,379,935
	PED	$ 303,756	$ -	$ 467,317	$ 467,317
	E&D	$ 50,210	$ 422,675	$ 472,885	$ 472,885
	CM	$ -	$ 443,880	$ 443,880	$ 443,880
	PM	$ -	$ 20,000	$ 20,000	$ 20,000
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 353,966**	**$ 11,271,490**	**$ 11,789,017**	**$ 11,789,017**
Reach 4	**I-55 to 30th Street**				
03/2000	Construction	$ 13,848,889	$ -	$ 13,848,889	$ 17,842,151
	PED	$ 39,108	$ -	$ 60,167	$ 60,167
	E&D	$ 2,113,649	$ 139,904	$ 2,253,553	$ 1,757,771
	CM	$ 477,402	$ 74,814	$ 552,216	$ 425,206
	PM	$ 115,967	$ 200,000	$ 315,967	$ 315,967
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 16,595,015**	**$ 419,718**	**$ 17,035,791**	**$ 20,406,261**
Reach 4	**33rd to 37th Street**				

Federal Cost Share - Chicago Shoreline

NED Estimate = % of LPP

	E&D	CM	PM	LERRD
Reach 2	88%	90%	100%	100%
Reach 4	78%	77%	100%	100%
Other	100%	100%	100%	100%

Federal Cost Share (% of NED)	65%

NED Totals	**Total NED Cost**	**Federal Share**
PCA #1	$ 9,440,860	$ 6,136,559
PCA #2	$ 12,453,441	$ 8,094,737
PCA #3	$ 269,081,043	$ 174,902,678
Total:	**$ 290,975,344**	**$ 189,133,974**

		LPP Costs			NED estimate
Reach / Price Level	**Segment**	**Federal**	**Non-Federal**	**Total**	
04/2000	Construction	$ 13,012,879	$ -	$ 13,012,879	$ 10,183,741
	PED	$ -	$ -	$ -	$ -
	E&D	$ 1,301,542	$ 40,150	$ 1,341,692	$ 1,046,520
	CM	$ 950,732	$ 32,000	$ 982,732	$ 756,703
	PM	$ 78,619	$ 200,000	$ 278,619	$ 278,619
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 15,343,772**	**$ 277,150**	**$ 15,620,922**	**$ 12,270,583**
Reach 4	**37th to 40th Street**				
10/2003	Construction	$ 7,032,451	$ 15,666,873	$ 22,699,324	$ 13,197,395
	PED	$ -	$ -	$ -	$ -
	E&D	$ 2,918,897	$ 440,674	$ 3,359,571	$ 2,620,466
	CM	$ 910,501	$ 64,769	$ 975,271	$ 750,958
	PM	$ 232,052	$ 200,000	$ 432,052	$ 432,052
	LERRDS		$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 11,093,902**	**$ 16,377,317**	**$ 27,471,219**	**$ 17,005,871**
Reach 4	**40th to 41st Street**				
03/2007	Construction	$ 14,180,095	$ 2,999,917	$ 17,180,012	$ 9,788,530
	PED	$ -	$ -	$ -	$ -
	E&D	$ 870,350	$ -	$ 870,350	$ -
	CM	$ 1,415,224	$ -	$ 1,415,224	$ 1,089,722
	PM	$ 456,599	$ 200,000	$ 656,599	$ 656,599
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 16,922,268**	**$ 3,204,917**	**$ 20,127,186**	**$ 11,539,851**
Reach 4	**41st to 43rd Street**				
08/2002	Construction	$ 6,923,961	$ -	$ 6,923,961	$ 8,423,007
	PED	$ -	$ -	$ -	$ -
	E&D	$ 305,116	$ -	$ 305,116	$ 237,990
	CM	$ 513,352	$ -	$ 513,352	$ 395,281
	PM	$ 109,842	$ 200,000	$ 309,842	$ 309,842
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 7,852,270**	**$ 205,000**	**$ 8,057,270**	**$ 9,371,119**
Reach 4	**43rd to 45th Street**				
02/2012	Construction	$ -	$ 14,858,000	$ 14,858,000	$ 12,117,295
	PED	$ -	$ -	$ -	$ -
	E&D	$ 24,911	$ 1,200,000	$ 1,224,911	$ 955,431
	CM	$ 297,000	$ 1,395,000	$ 1,692,000	$ 1,302,840
	PM	$ 7,473	$ 200,000	$ 207,473	$ 207,473
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 329,385**	**$ 17,658,000**	**$ 17,987,385**	**$ 14,588,039**
Reach 4	**45th to 51st Street**				
05/2016	Construction	$ -	$ 102,047,000	$ 102,047,000	$ 32,881,253
	PED	$ -	$ -	$ -	$ -
	E&D	$ 417,346	$ 2,700,000	$ 3,117,346	$ 2,431,530
	CM	$ 2,041,000	$ 3,500,000	$ 5,541,000	$ 4,266,570
	PM	$ 56,657	$ 200,000	$ 256,657	$ 256,657

Federal Cost Share - Chicago Shoreline

NED Estimate = % of LPP

	E&D	CM	PM	LERRD
Reach 2	88%	90%	100%	100%
Reach 4	78%	77%	100%	100%
Other	100%	100%	100%	100%

Federal Cost Share (% of NED)	65%

NED Totals	**Total NED Cost**	**Federal Share**
PCA #1	$ 9,440,860	$ 6,136,559
PCA #2	$ 12,453,441	$ 8,094,737
PCA #3	$ 269,081,043	$ 174,902,678
Total:	**$ 290,975,344**	**$ 189,133,974**

		LPP Costs			**NED estimate**
Reach / Price Level	**Segment**	**Federal**	**Non-Federal**	**Total**	
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 2,515,003**	**$ 108,452,000**	**$ 110,967,003**	**$ 39,841,010**
Reach 4	**51st to 54th Street**				
05/2002	Construction	$ -	$ 9,171,978	$ 9,171,978	$ 6,908,461
	PED	$ -	$ -	$ -	$ -
	E&D	$ 159,681	$ 400,855	$ 560,537	$ 437,219
	CM	$ -	$ 375,499	$ 375,499	$ 289,134
	PM	$ 100,000	$ 200,000	$ 300,000	$ 300,000
	LERRDS	$ -	$ 500	$ 500	$ 500
	Subtotal:	**$ 259,681**	**$ 10,148,832**	**$ 10,408,514**	**$ 7,935,314**
Reach 4	**54th to 56th Street**				
08/2015	Construction	$ -	$ 45,985,000	$ 45,985,000	$ 17,520,480
	PED	$ -	$ -	$ -	$ -
	E&D	$ 229,925	$ 2,100,000	$ 2,329,925	$ 1,817,342
	CM	$ 920,000	$ 1,550,000	$ 2,470,000	$ 1,901,900
	PM	$ 50,000	$ 200,000	$ 250,000	$ 250,000
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 1,199,925**	**$ 49,840,000**	**$ 51,039,925**	**$ 21,494,722**
Reach 4	**56th to 57th Street**				
05/2002	Construction	$ -	$ 6,265,463	$ 6,265,463	$ 1,718,304
	PED	$ -	$ -	$ -	$ -
	E&D	$ 181,323	$ 1,610,228	$ 1,791,552	$ 1,397,410
	CM	$ 9,384	$ 563,892	$ 573,276	$ 441,423
	PM	$ 26,116	$ 200,000	$ 226,116	$ 226,116
	LERRDS	$ -	$ 5,000	$ 5,000	$ 5,000
	Subtotal:	**$ 216,824**	**$ 8,644,583**	**$ 8,861,407**	**$ 3,788,254**
	PCA #3 Totals:	**$ 174,902,678**	**$ 295,843,904**	**$ 470,961,393**	**$ 269,081,043**

6 PROJECT COST AND SCHEDULE RISK REPORTS

US Army Corps
of Engineers®

Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline) Post Authorization Change Report

Project Cost and Schedule Risk Report For the Remaining Reaches As of January 2013

Prepared by:

D. Druzbicki, USACE Chicago District

Date: 30 January 2013

This Cost and Schedule Report is comprised of four separate CSRA's for the remaining projects of the Chicago Shoreline. Although the projects are similar, individual CSRA's were done to capture the unique features and risk associated with each reach. The remaining reaches are:

Project	Estimate	Contingency ($)	Contingency	Total Cost incl Contingency
Fullerton Theater by the Lake	$28.9M	$6.0M	21%	$34.9M
45th to 51st	$105.3M	$23.6M	22%	$128.9M
54th to 56th (Promontory Point)	$44.2M	$12.4M	28%	$56.6M
Montrose to Irving	$18.7M	$4.7M	25%	$23.4M

US Army Corps
of Engineers®

Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline) Post Authorization Change Report

Fullerton Theater by the Lake

Project Cost and Schedule Risk Report

Prepared by:

D. Druzbicki, USACE Chicago District

Date: _30 January 2013

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APPENDIX

EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Fullerton Theater by the Lake reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline). In compliance with Engineer Regulation (ER) 1110-2-1302, Civil Works Cost Engineering a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the Fullerton Theater by the Lake Project, the most likely constant dollar program year cost (First Cost at FY13 price level) is estimated at approximately $35 million including a contingency value of $6 Million or approximately 21 percent on all feature accounts.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Plan quantities at early stage of development

These drivers contribute over 82 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Differing Site Conditions
- Modifications and Claims
- USACE has to assume design
- Permitting issues

These drivers contribute close to 89 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the remaining construction, and proactive monitoring and control of risk identified in this study.

1. PURPOSE

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Fullerton Theater by the Lake reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline).

2. BACKGROUND

Chicago's shoreline is largely man-made and constructed on landfill an average of 1,500 feet wide. This landfill is a key-contributing factor to the creation of an extensive series of lakeshore parks that began in the mid to late 1800s and continued through the 1940s. During the turn of the last century and into the 1930s, wooden cribs structures were constructed primarily to contain the stone fill material in order to provide a base upon which 4 to 8 ton cut limestone blocks would be placed in step-stone fashion to construct the existing revetment structure. This project provides storm damage protection to the Lake Michigan shoreline and, in particular, to Lake Shore Drive, a major transportation artery in the City of Chicago. The previous shoreline structures, built in the early 1900s, had deteriorated and no longer functioned to protect against storms, flooding and erosion.

The Chicago Shoreline project was authorized under the Water Resources Development Act of 1996 (P.L. 104–303) Section 101(12) which stipulated:

> *The project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. The project shall include the breakwater near the South Water Filtration Plant described in the report as a separate element of the project, at a total cost of $11,470,000, with an estimated Federal cost of $7,460,000 and an estimated non-Federal cost of $4,010,000. The Secretary shall reimburse the non-Federal interest for the Federal share of any costs incurred by the non-Federal interest— (A) in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the project; and (B) in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois.*

Additional authorization was provided under Water Resources Development Act of 1999 (P.L. 106–53) Section 318 which stipulated:

> *The project for storm damage reduction and shore protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), is modified to provide for reimbursement for*

> *additional project work undertaken by the non-Federal interest. The Secretary shall credit or reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000. The Secretary shall reimburse the non- Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.*

The construction of the Chicago Shoreline Project began in 1997 and design and construction responsibility was divided between the U.S. Army Corps of Engineers (USACE), Chicago District and the non-Federal sponsor under the terms of the project cooperation agreements. Project segments were constructed by USACE, Chicago District or by the City of Chicago, Department of Transportation and the Chicago Park District. Remaining construction contracts to be pursued by the non-Federal sponsors will likely exceed the maximum project cost limit according to Section 902 of the Water Resources Development Act of 1986, as amended.

There are four additional reaches to be completed:

- Fullerton Theater by the Lake
- Montrose to Irving
- 45^{th} to 51^{st}
- Promontory Point

Due to the differences in the various reaches (design stages, project features, etc.), a separate CSRA was prepared for each.

3. REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features. The study and presentation excludes consideration for operation and maintenance or life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register for the remaining reaches to be completed along the Chicago Shoreline. The analysis process evaluated the most likely Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a Monte Carlo simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL), 1110-2-573, Construction Cost Estimating Guide for Civil Works, dated September 30, 2008**.**

- The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.
- The approximate design stage varies for each of the upcoming reaches from feasibility level drawings to roughly 50% plans and specifications.

3.2 USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.

- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

4. METHODOLOGY/PROCESS

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the

Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

Cost Engineering facilitated a risk identification and qualitative analysis meeting with the Project Delivery Team (PDT) on May 10, 2012. Representatives from the following disciplines were in attendance:

- Cost Engineering
- Project Management
- Civil
- Construction
- Planning
- Hydraulic/Coastal
- Environmental
- Structural
- Geotechnical

This meeting focused primarily on risk factor identification using brainstorming techniques, but also included some discussions based on risk factors common to projects of similar scope and geographic location.

Additionally, numerous phone calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near

critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

Key assumptions are those that are most likely to significantly effect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The Cost Engineering Team has identified the following key assumptions for the risk analysis:

- **Level of design**: The cost comparisons and risk analyses performed and reflected in this report are based upon design scope and estimates that are slightly beyond feasibility level.
- **Design Scope**: Some areas of scope are not fully developed and required significant assumptions by the cost engineer.
- **Contract Acquisition Strategy**: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is unrestricted IFB. However, the final determination on acquisition strategy may change depending on funding availability or other requirements. Use of other acquisition strategies may impact costs and schedules.
- **Project Schedule**: For development purposes the project is being developed assuming various reaches would be constructed nearly simultaneously. Also, depending on how funding is received; the project could be split into smaller phases or have the start of construction delayed.
- **Confidence Levels**: The Cost Engineering and ATR MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk adverse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
- **Operations and Maintenance**: Was not included in this analysis.
- **ATR status**: Successfully complete.
- **Impacts Studied**: Moderate and High impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Moderate and High level risk impacts were only applied to critical path and near critical path schedule tasks for the purposes of calculating schedule contingency. Low and moderate level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list” for further monitoring and evaluation.

6. RISK ANALYSIS RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) should be presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register would be provided in appendix A. The detailed risk registers of appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

In simple terms, a correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. For this project no correlations between risks were identified or used. There were similar risk items that were combined to avoid double counting or placing too much emphasis on them.

6.2 Cost Risk Analysis - Cost Contingency Results

Table 1 provides the Base Estimate Construction Cost contingencies calculated for the P80 confidence level. This is quantified as approximately $4.5 million at the P80

confidence level (about 21 percent of the base cost estimate). For comparison, the cost contingency at the P100 and P50 confidence levels was quantified as 14 percent and 45 percent of the base cost estimate, respectively. The 21 percent contingency percentage is applied to the cost estimate on the Total Project Cost Summary to calculate the final contingency amount.

Table 1. Construction Cost Contingency Summary

Risk Analysis Forecast	Approximate Base Estimate	Total Contingency ($)	Total Contingency (%)
50% Confidence Level			
Construction Feature Cost	$21.8M	$3.0M	13.6%
80% Confidence Level			
Construction Feature Cost	$21.8M	$4.5M	20.7%
100% Confidence Level			
Construction Feature Cost	$21.8M	$9.7M	44.5%

Notes:
1) Includes construction cost and schedule contingency impacts.
2) Contingency excludes PED and construction management costs.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to total project cost. It should be noted that an understanding of the risk model is also required to understand the outputs of the sensitivity. In general, the larger the potential cost variation of an element the more likely it will show up as being a highly sensitive item. The actual value of risk (contingency) that it is contributing may actually be significantly smaller than other items listed much lower on the sensitivity chart. Figure 1 and 2 shows the Cost and Schedule Sensitivity of the Model.

Figure 1. Cost Sensitivity Analysis

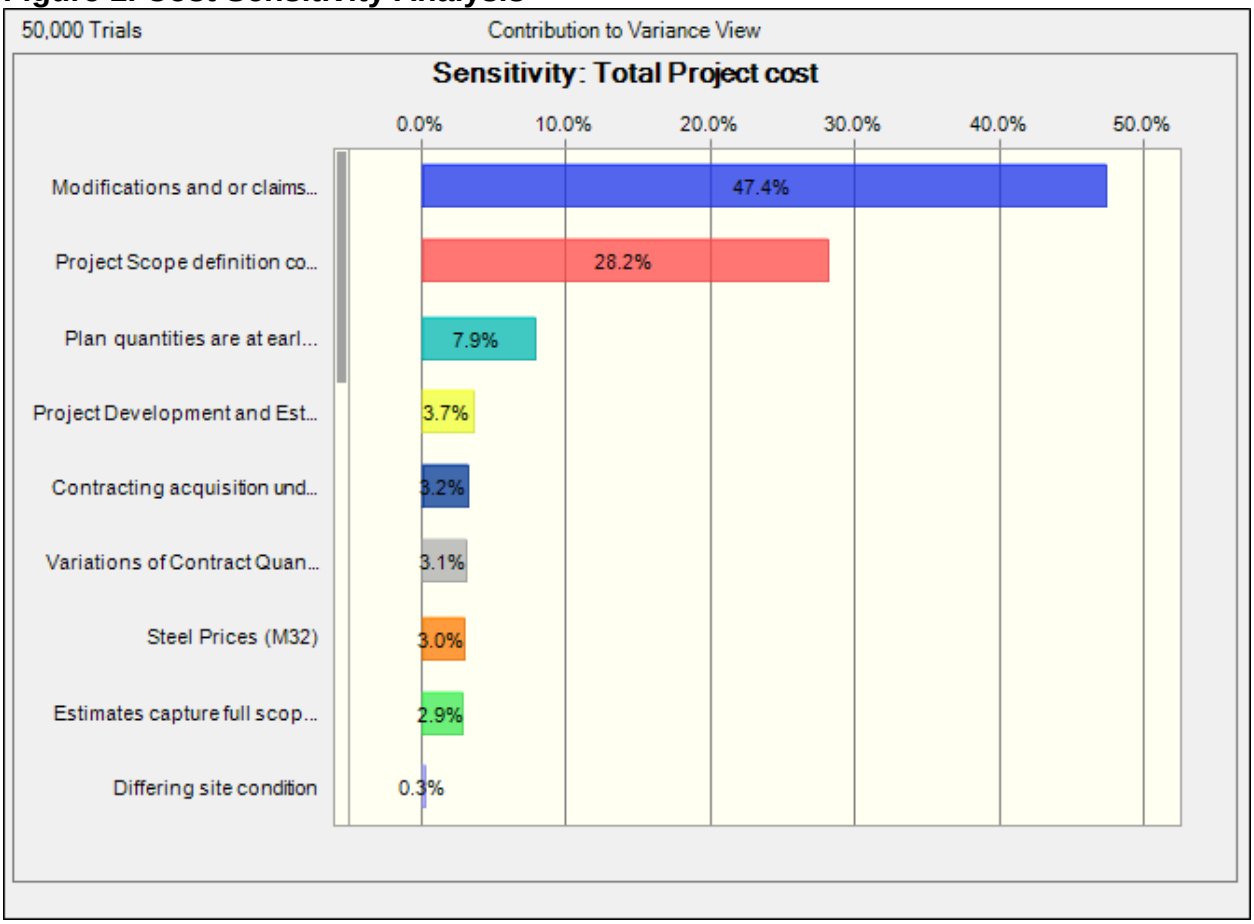
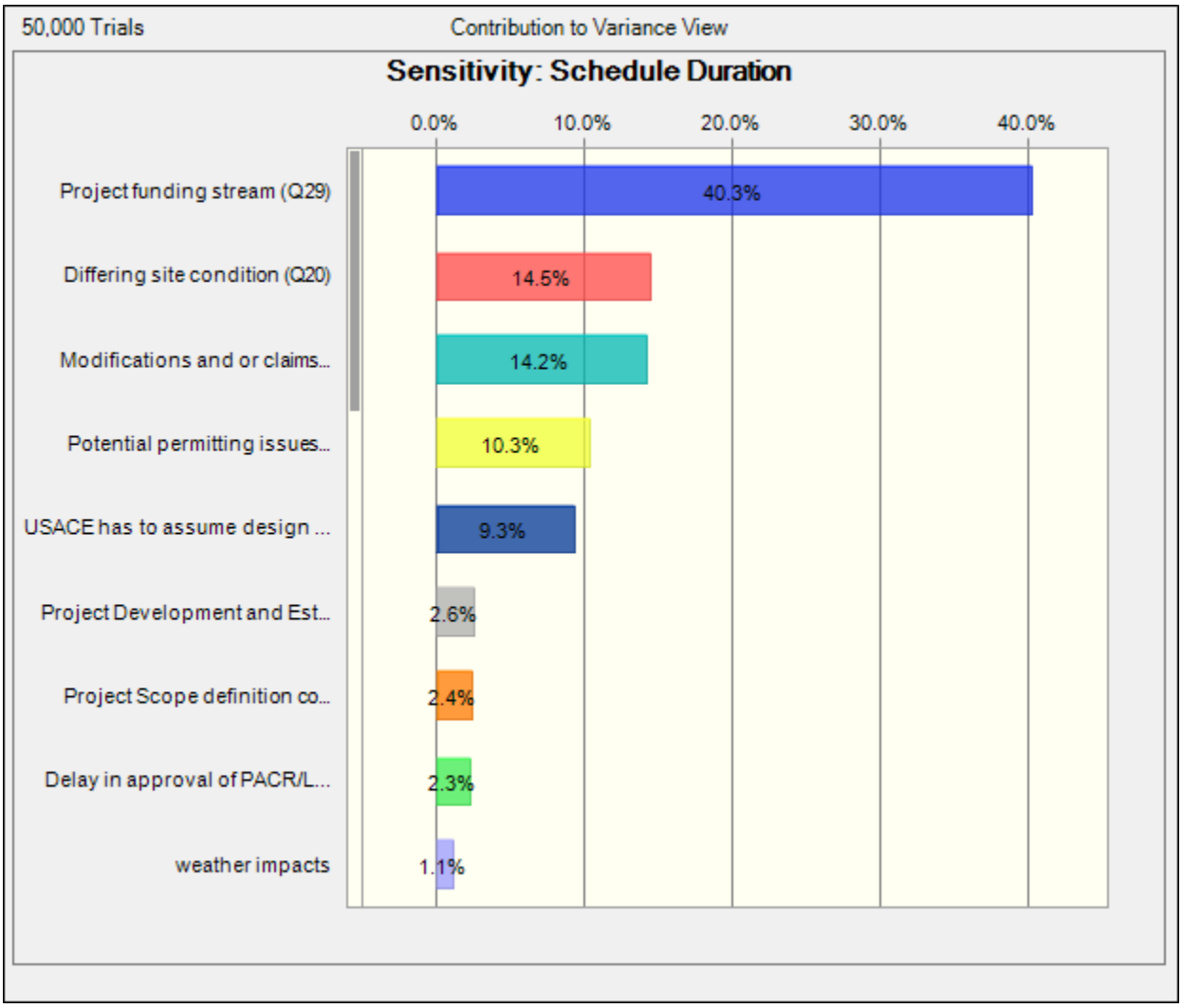


Figure 2. Schedule Sensitivity Analysis



6.3 Schedule Risk Analysis

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 50 months based on the P80 level of confidence. The schedule contingencies were calculated by applying the moderate and high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Base Construction Schedule Duration (months)	Contingency (months)	Contingency (%)
50% Confidence Level			
FPF Construction Duration	29	17	57.8%
80% Confidence Level			
FPF Construction Duration	29	21	71.6%
100% Confidence Level			
FPF Construction Duration	29	36	125.5%

7. MAJOR FINDINGS/OBSERVATIONS

This section provides a summary of significant risk analysis results in this section, which have been identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted. Table 2 presents project contingencies, which include base cost plus cost and schedule contingencies.

Table 3. Project Contingencies (Base Cost Plus Cost and Schedule Contingencies)

Confidence Level	Project Cost	Contingency ($)	Contingency (%)
P0	$25,229,000	($3,710,000)	-13%
P10	$30,016,000	$1,077,000	4%
P20	$30,960,000	$2,021,000	7%
P30	$31,648,000	$2,709,000	9%
P40	$32,278,000	$3,339,000	12%
P50	$32,879,000	$3,941,000	14%
P60	$33,487,000	$4,548,000	16%
P70	$34,144,000	$5,206,000	18%
P80	$34,918,000	$5,979,000	21%
P90	$35,992,000	$7,053,000	24%
P100	$41,812,000	$12,873,000	44%

Note: Costs include PED and S&A.

The key cost risk drivers identified through sensitivity analysis are

- Modifications and Claims
- Project Scope Definition
- Plan quantities at early stage of development

Together these factors contribute over 82 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are

- Project Funding Stream
- Differing Site Conditions
- Modifications and Claims
- USACE taking over design if an A/E can't finish design work
- Permitting issues

These risks contribute close to 89 percent of the statistical schedule variance. The greatest risk is lack of adequate funding which could significantly change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims (or differing site conditions) come up, the project schedule could also be delayed.

8. MITIGATION RECOMMENDATIONS

This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all-inclusive.

Risk Drivers:

1. Cost Risk: The key risk driver of Modifications and Claims is partially within the PDT's scope of influence. Modifications and claims should be minimized as the project scope is further developed during the Plans and Specifications phase. Monitoring and updates of the Total Project Cost and implementation of risk mitigation strategies should be managed for identified risks as well as new risks that arise. Whereas the developed contingency, itself, is a response to the potential for these risks, these risks warrant consideration of other potential responses and proactive monitoring and control.

2. Schedule Risk: Project Funding is beyond the PDT's influence. Proactive monitoring and development of mitigation strategies can minimize the adverse schedule effects of these risks. Annual funding received could significantly affect the overall project duration and the PDT must integrate it fully with the anticipated funding profile. Other risks relating to USACE completing the design or permitting issues are unlikely at this stage of the Chicago Shoreline project. The

A/E's associated with the project have completed past designs without issue but it can' be completely dismissed at this point. Permitting issues should also be known at this point but are included on the outside chance something unforeseen comes up.

3. Risk Management: Accurate representation of estimates and risks throughout the development of the project is critical, and the risk analysis study and technical review of said estimate is a critical mitigation strategy. Cost Engineering recommends continuous, proactive, and timely updates to the estimate in conjunction with proactive contract placement and phasing planning and execution. It is recommended that the outputs created during the initial risk analysis effort serve as tools in future risk management processes. The risk register should be updated at each major project milestone and estimate update. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings. As an example, recommended uses of the risk register include:

    - Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.

    - Providing project sponsors, stakeholders and leadership/management with a documented framework from which risk status can be reported in the context of project controls.

    - Communicating risk management issues.

    - Providing a mechanism for eliciting risk analysis feedback and project control input.

    - Identifying risk transfer, elimination or mitigation actions required for implementation of risk management plans.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

DETAILED RISK REGISTER

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions	Project Cost				Project Schedule			
				Likelihood *	Impact*	Risk Level*		Likelihood *	Impact*	Risk Level*	
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)											
	PROJECT & PROGRAM MGMT										
PPM-1	Project Scope definition could change	Due to public pressure the City changes the design to address concerns (all 3 proj)	Based on past project experience this is likely to occur	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
PPM-2	USACE has to assume design responsibility	City hired A/E cannot finish design	Based on past experience with other local sponsors	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	CONTRACT ACQUISITION RISKS										
CA-1	Contracting acquisition undecided	Local Sponsor could send out as SBA and increase the price	PDT feels the PM should address contract risks after this meeting	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

	TECHNICAL RISKS										
TL-1	Design Confidence in Products by A/E	Is USACE confident in the designs/quantities by A/E?	USACE is confident. USACE provides review/comments through out design. A/E is using USACE guide specifications. Risk is typically low.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
TL-2	Sufficiency/condition of borrow/fill sites	Quality of fill, sand, and stone in large quantities	Environmental concerns with sand and fill none with stone. Can mitigate risks by requiring contractor to perform testing before bringing it on job (written in specs)	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	LANDS AND DAMAGES RISKS										
LD-1	Utilities locations not marked on current prints	Unknown utilities and or unplanned utility relocations/diversions to existing sites could cause a delay and or add costs.	Previous reaches have encountered some unmarked utilities that required relocation. Additional costs to LS and additional time to relocate may be required. Given location near lake, unmarked	Likely	Negligible	LOW		Likely	Negligible	LOW	

			utilities should not be a major concern. Possibly by Fullerton Theater by the Lake.								
LD-2	All land owned by LS.	No issues anticipated regarding RE.	No issues.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
	REGULATORY AND ENVIRONMENTAL RISKS										
RE-1	Potential permitting issues with placing large amounts of fill in lake (behind SSP).	Permitting delays could delay start of construction.	Even though the city is performing the work USACE still has to obtain the 401 permit and perform EA's and NEPA. Obtaining these items fall on a agency outside our control.	Unlikely	Negligible	LOW		Unlikely	Significant	MODERATE	
RE-2	Historical/Cultural Site (Prom. Point)	Getting a approved plan approved by the public/SHPO	High level of uncernity of how the proposed design will be acceptedby public/SHPO	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
	CONSTRUCTION RISKS										
CON-1	Modifications and or claims on contracts	Claims or modifications could cause the actual contract cost to increase	We know mods will happen, just uncertain of the magnitude. Look at historical data.	Very Likely	Significant	HIGH		Very Likely	Marginal	MODERATE	

CON-2	Discovering grey material	May encounter material that could require removal/remediation.	Encountering grey material would result in higher cost, delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-3	Bed Rock	Bed rock elevation impacting SSP driving,	If top of bedrock varies from plan, differing site condition could result in design changes & delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-4	weather impacts	temperature too low for concrete placement, storm events washing out fresh concrete	Working along shore may result in delays, rework. Need to include enough weather days in schedule. Schedule impact will be covered under CON-1 Mods and Claims.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	
CON-5	Site access by contractor	Contractor access may be severly limited in Promontory Point decreasing productivity.	Since we are near Field Museum, may be additional requirements by city limiting contractor activity resulting in decreased productivity, longer schedule.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	

CON-6	Impacts from City Events	City events could delay construction of the remaining projects.	Events such as the air show, festivals, etc. may prevent contractor from timely completion of work. This can be mitigated since most of the events can be determined prior to award and therefore accounted for in the costs. Most events are short term induration.	Likely	Negligible	LOW		Likely	Negligible	LOW	
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Project Development and Estimate Risk	Estimate development based on unit costs may not be reflective of actual costs. Quantities based on 25 to 50% drawings and are not complete	There will be changes to scope and quantity before designs are finalized. Assuming Local Sponsor will want to keep changes to a minimum to limit their costs since this is all Non Fed expenditures.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
EST-2	Plan quantities are at early stage of development.	Quantities may vary once designs are finalized.	Major qtys have been checked. Pile lengths are still TBD. Used adjacent reaches which should get us close.	Unlikely	Significant	MODERATE		Unlikely	Marginal	LOW	

EST-3	Estimates capture full scope for all project features.	Given prelim design, final scope may include additional features that are not currently shown.	Scope may increase causing costs to go up also. Since these are fully LS funded they will try to minimize scope/cost increases.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
	FEATURE LEVEL RISKS										
FL-1	For Promontory Point, local groups may influence final design.	Final design may incorporate more limestone versus concrete resulting in different scope.	Delays in getting local groups to agree to final plan may continue to delay project.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)											
PR-1	Project funding stream	Local Sponsor funding delay contracts or cause major delays or a complete stop to project.	It could be very likely that the City may have funding issues to complete the project by 2018	Likely	Negligible	LOW		Likely	Significant	HIGH	
PR-2	Delay in approval of PACR/LRR	Delay in approval could delay future reaches.	Although not likely to occur, this should be considered as a possibility.	Unlikely	Marginal	LOW		Unlikely	Significant	MODERATE	
PR-3	Fuel Prices	Fluctuations in fuel costs could have a profound impact on the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	
PR-4	Steel Prices	Fluctuations in steel prices could have a profound impact on the sheet pile and H pile costs, which is a significant portion of the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	

PR-5	Stone Prices	Fluctuations in stone prices could have a profound impact on project cost.	PDT agrees this could likely occur. Prices have typically been more stable than for fuel or steel.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	
PR-6	Variations of Contract Quantities	Potential quantity variations, particularly overruns, will impact project costs.	Based on prior projects, variations in qtys averaged XX%.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
PR-7	Bidding Climate	Climate may change by time last of these contracts is awarded.	Current climate is favorable to LS (many bidders for each project). This may change a few years out resulting in higher costs.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

US Army Corps
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Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline) Post Authorization Change Report

45th to 51st

Project Cost and Schedule Risk Report

Prepared by:

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Date: _30 January 2013

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APPENDIX

EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the 45th to 51st reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline). In compliance with Engineer Regulation (ER) 1110-2-1302, Civil Works Cost Engineering a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the 45th to 51st Project, the most likely constant dollar program year cost (First Cost at FY13 price level) is estimated at approximately $129 million including a contingency value of $24 Million or approximately 22 percent on all feature accounts.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Plan Quantities are at early stage of development
- Estimate Captures full scope of work

These drivers contribute close to 89 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and Claims
- Permitting issues
- USACE has to assume design

These risks contribute close to 83 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the remaining construction, and proactive monitoring and control of risk identified in this study.

1. PURPOSE

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the 45th to 51st reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline).

2. BACKGROUND

Chicago's shoreline is largely man-made and constructed on landfill an average of 1,500 feet wide. This landfill is a key-contributing factor to the creation of an extensive series of lakeshore parks that began in the mid to late 1800s and continued through the 1940s. During the turn of the last century and into the 1930s, wooden cribs structures were constructed primarily to contain the stone fill material in order to provide a base upon which 4 to 8 ton cut limestone blocks would be placed in step-stone fashion to construct the existing revetment structure. This project provides storm damage protection to the Lake Michigan shoreline and, in particular, to Lake Shore Drive, a major transportation artery in the City of Chicago. The previous shoreline structures, built in the early 1900s, had deteriorated and no longer functioned to protect against storms, flooding and erosion.

The Chicago Shoreline project was authorized under the Water Resources Development Act of 1996 (P.L. 104–303) Section 101(12) which stipulated:

> *The project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. The project shall include the breakwater near the South Water Filtration Plant described in the report as a separate element of the project, at a total cost of $11,470,000, with an estimated Federal cost of $7,460,000 and an estimated non-Federal cost of $4,010,000. The Secretary shall reimburse the non-Federal interest for the Federal share of any costs incurred by the non-Federal interest— (A) in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the project; and (B) in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois.*

Additional authorization was provided under Water Resources Development Act of 1999 (P.L. 106–53) Section 318 which stipulated:

> *The project for storm damage reduction and shore protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), is modified to provide for reimbursement for*

> *additional project work undertaken by the non-Federal interest. The Secretary shall credit or reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000. The Secretary shall reimburse the non- Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.*

The construction of the Chicago Shoreline Project began in 1997 and design and construction responsibility was divided between the U.S. Army Corps of Engineers (USACE), Chicago District and the non-Federal sponsor under the terms of the project cooperation agreements. Project segments were constructed by USACE, Chicago District or by the City of Chicago, Department of Transportation and the Chicago Park District. Remaining construction contracts to be pursued by the non-Federal sponsors will likely exceed the maximum project cost limit according to Section 902 of the Water Resources Development Act of 1986, as amended.

There are four additional reaches to be completed:

- Fullerton Theater by the Lake
- Montrose to Irving
- 45th to 51st
- Promontory Point

Due to the differences in the various reaches (design stages, project features, etc.), a separate CSRA was prepared for each.

3. REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features. The study and presentation excludes consideration for operation and maintenance or life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register for the remaining reaches to be completed along the Chicago Shoreline. The analysis process evaluated the most likely Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a Monte Carlo simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL), 1110-2-573, Construction Cost Estimating Guide for Civil Works, dated September 30, 2008**.**

- The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.
- The approximate design stage varies for each of the upcoming reaches from feasibility level drawings to roughly 50% plans and specifications.

3.2 USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.

- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

4. METHODOLOGY/PROCESS

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the

Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

Cost Engineering facilitated a risk identification and qualitative analysis meeting with the Project Delivery Team (PDT) on May 10, 2012. Representatives from the following disciplines were in attendance:

- Cost Engineering
- Project Management
- Civil
- Construction
- Planning
- Hydraulic/Coastal
- Environmental
- Structural
- Geotechnical

This meeting focused primarily on risk factor identification using brainstorming techniques, but also included some discussions based on risk factors common to projects of similar scope and geographic location.

Additionally, numerous phone calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near

critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

Key assumptions are those that are most likely to significantly effect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The Cost Engineering Team has identified the following key assumptions for the risk analysis:

- **Level of design**: The cost comparisons and risk analyses performed and reflected in this report are based upon design scope and estimates that are slightly beyond feasibility level.
- **Design Scope**: Some areas of scope are not fully developed and required significant assumptions by the cost engineer.
- **Contract Acquisition Strategy**: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is unrestricted IFB. However, the final determination on acquisition strategy may change depending on funding availability or other requirements. Use of other acquisition strategies may impact costs and schedules.
- **Project Schedule**: For development purposes the project is being developed assuming various reaches would be constructed nearly simultaneously. Also, depending on how funding is received; the project could be split into smaller phases or have the start of construction delayed.
- **Confidence Levels**: The Cost Engineering and ATR MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk adverse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
- **Operations and Maintenance**: Was not included in this analysis.
- **ATR status**: Successfully complete.
- **Impacts Studied**: Moderate and High impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Moderate and High level risk impacts were only applied to critical path and near critical path schedule tasks for the purposes of calculating schedule contingency. Low and moderate level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list” for further monitoring and evaluation.

6. RISK ANALYSIS RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) should be presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register would be provided in appendix A. The detailed risk registers of appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

In simple terms, a correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. For this project no correlations between risks were identified or used. There were similar risk items that were combined to avoid double counting or placing too much emphasis on them.

6.2 Cost Risk Analysis - Cost Contingency Results

Table 1 provides the Base Estimate Construction Cost contingencies calculated for the P80 confidence level. This is quantified as approximately $17.8 million at the P80

confidence level (about 22 percent of the base cost estimate). For comparison, the cost contingency at the P100 and P50 confidence levels was quantified as 15 percent and 48 percent of the base cost estimate, respectively. The 22 percent contingency percentage is applied to the cost estimate on the Total Project Cost Summary to calculate the final contingency amount.

Table 1. Construction Cost Contingency Summary

Risk Analysis Forecast	Approximate Base Estimate	Total Contingency ($)	Total Contingency (%)
50% Confidence Level			
Construction Feature Cost	$79.2M	$12.2M	15.4%
80% Confidence Level			
Construction Feature Cost	$79.2M	$17.8M	22.5%
100% Confidence Level			
Construction Feature Cost	$79.2M	$38.4M	48.4%

Notes:
1) Includes construction cost and schedule contingency impacts.
2) Contingency excludes PED and construction management costs.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to total project cost. It should be noted that an understanding of the risk model is also required to understand the outputs of the sensitivity. In general, the larger the potential cost variation of an element the more likely it will show up as being a highly sensitive item. The actual value of risk (contingency) that it is contributing may actually be significantly smaller than other items listed much lower on the sensitivity chart. Figure 1 and 2 shows the Cost and Schedule Sensitivity of the Model.

Figure 1. Cost Sensitivity Analysis

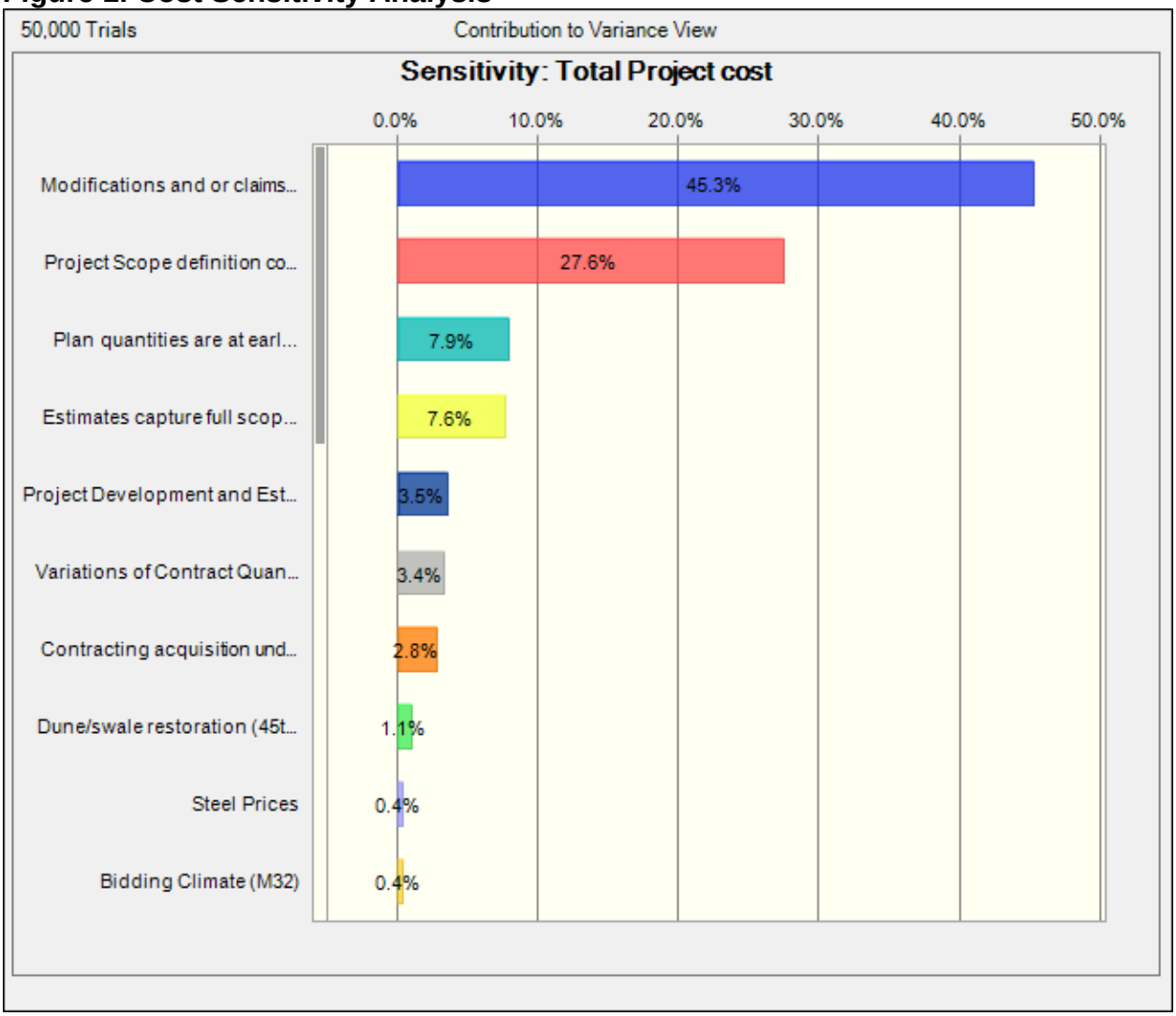
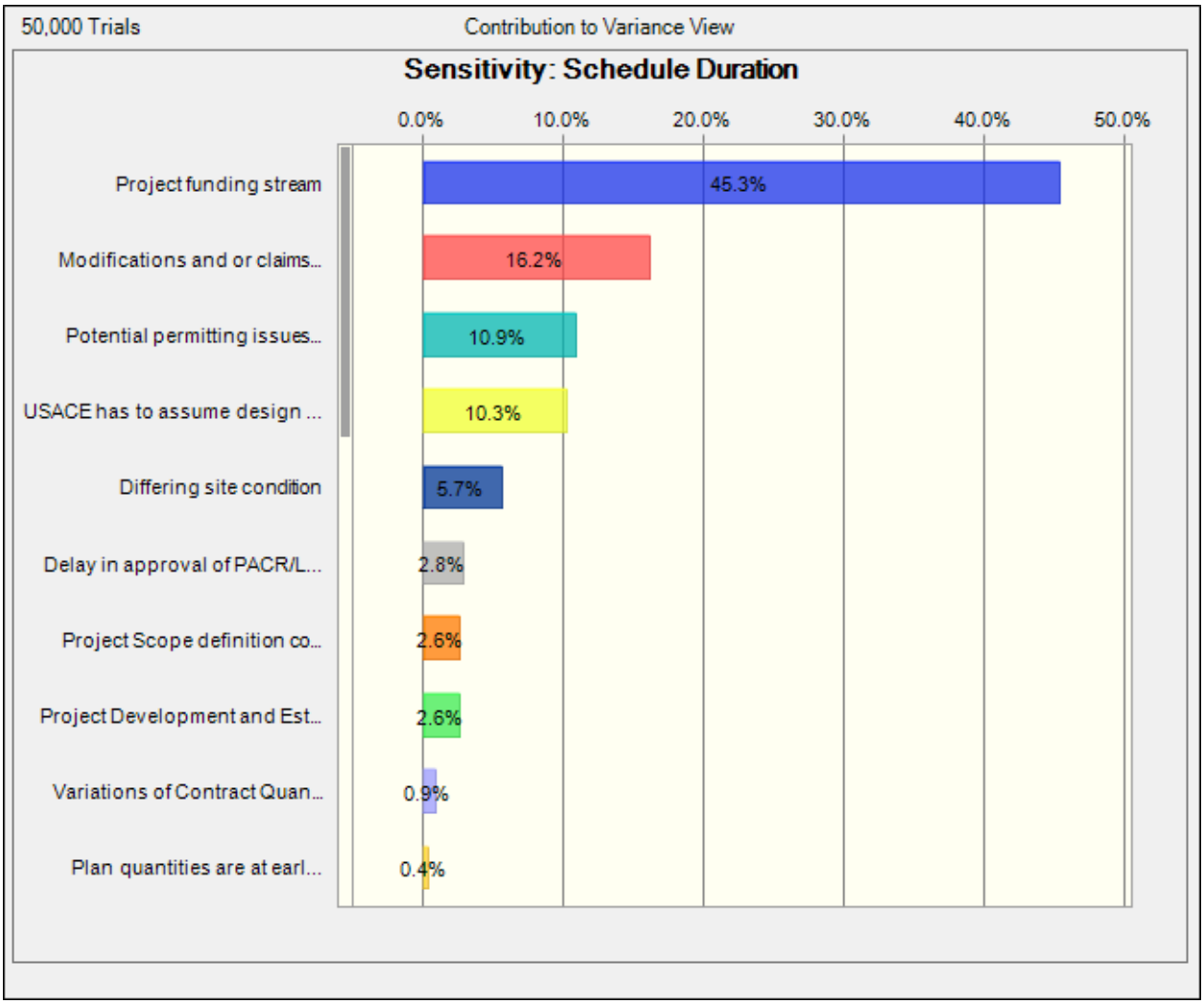


Figure 2. Schedule Sensitivity Analysis



6.3 Schedule Risk Analysis

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 52 months based on the P80 level of confidence. The schedule contingencies were calculated by applying the moderate and high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Base Construction Schedule Duration (months)	Contingency (months)	Contingency (%)
50% Confidence Level			
FPF Construction Duration	33	15	45.9%
80% Confidence Level			
FPF Construction Duration	33	19	57.4%
100% Confidence Level			
FPF Construction Duration	33	34	101.4%

7. MAJOR FINDINGS/OBSERVATIONS

This section provides a summary of significant risk analysis results in this section, which have been identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted. Table 2 presents project contingencies, which include base cost plus cost and schedule contingencies.

Table 3. Project Contingencies (Base Cost Plus Cost and Schedule Contingencies)

Confidence Level	Project Cost	Contingency ($)	Contingency (%)
P0	$93,579,000	($11,726,000)	-11%
P10	$110,637,000	$5,332,000	5%
P20	$114,238,000	$8,932,000	8%
P30	$116,944,000	$11,639,000	11%
P40	$119,252,000	$13,947,000	13%
P50	$121,489,000	$16,183,000	15%
P60	$123,720,000	$18,415,000	18%
P70	$126,131,000	$20,826,000	20%
P80	$128,946,000	$23,641,000	22%
P90	$132,753,000	$27,448,000	26%
P100	$156,365,000	$51,060,000	48%

Note: Costs include PED and S&A.

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Plan quantities are at early stages of development
- Estimates fully capture scope of work

These risks contribute over 89 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and Claims
- Permitting issues
- USACE taking over design if an A/E can't finish design work

These risks contribute close to 83 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

8. MITIGATION RECOMMENDATIONS

This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all-inclusive.

Risk Drivers:

1. Cost Risk: The key risk driver of Modifications and Claims is partially within the PDT's scope of influence. Modifications and claims should be minimized as the project scope is further developed during the Plans and Specifications phase. The same can be said for Project Scope Definition. Monitoring and updates of the Total Project Cost and implementation of risk mitigation strategies should be managed for identified risks as well as new risks that arise. Whereas the developed contingency, itself, is a response to the potential for these risks, these risks warrant consideration of other potential responses and proactive monitoring and control.

1. Schedule Risk: Project Funding is beyond the PDT's influence. Proactive monitoring and development of mitigation strategies can minimize the adverse

schedule effects of these risks. Annual funding received could significantly affect the overall project duration and the PDT must integrate it fully with the anticipated funding profile. Other risks relating to USACE completing the design or permitting issues are unlikely at this stage of the Chicago Shoreline project. The A/E's associated with the project have completed past designs without issue but it can' be completely dismissed at this point. Permitting issues should also be known at this point but are included on the outside chance something unforeseen comes up.

2. Risk Management: Accurate representation of estimates and risks throughout the development of the project is critical, and the risk analysis study and technical review of said estimate is a critical mitigation strategy. Cost Engineering recommends continuous, proactive, and timely updates to the estimate in conjunction with proactive contract placement and phasing planning and execution. It is recommended that the outputs created during the initial risk analysis effort serve as tools in future risk management processes. The risk register should be updated at each major project milestone and estimate update. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings. As an example, recommended uses of the risk register include:

   - Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
   - Providing project sponsors, stakeholders and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
   - Communicating risk management issues.
   - Providing a mechanism for eliciting risk analysis feedback and project control input.
   - Identifying risk transfer, elimination or mitigation actions required for implementation of risk management plans.

3. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

DETAILED RISK REGISTER

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions	Project Cost				Project Schedule			
				Likelihood *	Impact*	Risk Level*		Likelihood *	Impact*	Risk Level*	
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)											
	PROJECT & PROGRAM MGMT										
PPM-1	Project Scope definition could change	Due to public pressure the City changes the design to address concerns (all 3 proj)	Based on past project experience this is likely to occur	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
PPM-2	USACE has to assume design responsibility	City hired A/E cannot finish design	Based on past experience with other local sponsors	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	CONTRACT ACQUISITION RISKS										
CA-1	Contracting acquisition undecided	Local Sponsor could send out as SBA and increase the price	PDT feels the PM should address contract risks after this meeting	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

	TECHNICAL RISKS										
TL-1	Design Confidence in Products by A/E	Is USACE confident in the designs/quantities by A/E?	USACE is confident. USACE provides review/comments through out design. A/E is using USACE guide specifications. Risk is typically low.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
TL-2	Sufficiency/condition of borrow/fill sites	Quality of fill, sand, and stone in large quantities	Environmental concerns with sand and fill none with stone. Can mitigate risks by requiring contractor to perform testing before bringing it on job (written in specs)	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	LANDS AND DAMAGES RISKS										
LD-1	Utilities locations not marked on current prints	Unknown utilities and or unplanned utility relocations/diversions to existing sites could cause a delay and or add costs.	Previous reaches have encountered some unmarked utilities that required relocation. Additional costs to LS and additional time to relocate may be required. Given location near lake, unmarked	Likely	Negligible	LOW		Likely	Negligible	LOW	

			utilities should not be a major concern. Possibly by Fullerton Theater by the Lake.								
LD-2	All land owned by LS.	No issues anticipated regarding RE.	No issues.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
	REGULATORY AND ENVIRONMENTAL RISKS										
RE-1	Potential permitting issues with placing large amounts of fill in lake (behind SSP).	Permitting delays could delay start of construction.	Even though the city is performing the work USACE still has to obtain the 401 permit and perform EA's and NEPA. Obtaining these items fall on a agency outside our control.	Unlikely	Negligible	LOW		Unlikely	Significant	MODERATE	
RE-2	Historical/Cultural Site (Prom. Point)	Getting a approved plan approved by the public/SHPO	High level of uncernity of how the proposed design will be acceptedby public/SHPO	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
	CONSTRUCTION RISKS										
CON-1	Modifications and or claims on contracts	Claims or modifications could cause the actual contract cost to increase	We know mods will happen, just uncertain of the magnitude. Look at historical data.	Very Likely	Significant	HIGH		Very Likely	Marginal	MODERATE	

CON-2	Discovering grey material	May encounter material that could require removal/remediation.	Encountering grey material would result in higher cost, delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-3	Bed Rock	Bed rock elevation impacting SSP driving,	If top of bedrock varies from plan, differing site condition could result in design changes & delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-4	weather impacts	temperature too low for concrete placement, storm events washing out fresh concrete	Working along shore may result in delays, rework. Need to include enough weather days in schedule. Schedule impact will be covered under CON-1 Mods and Claims.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	
CON-5	Site access by contractor	Contractor access may be severly limited in Promontory Point decreasing productivity.	Since we are near Field Museum, may be additional requirements by city limiting contractor activity resulting in decreased productivity, longer schedule.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	

CON-6	Impacts from City Events	City events could delay construction of the remaining projects.	Events such as the air show, festivals, etc. may prevent contractor from timely completion of work. This can be mitigated since most of the events can be determined prior to award and therefore accounted for in the costs. Most events are short term induration.	Likely	Negligible	LOW		Likely	Negligible	LOW	
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Project Development and Estimate Risk	Estimate development based on unit costs may not be reflective of actual costs. Quantities based on 25 to 50% drawings and are not complete	There will be changes to scope and quantity before designs are finalized. Assuming Local Sponsor will want to keep changes to a minimum to limit their costs since this is all Non Fed expenditures.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
EST-2	Plan quantities are at early stage of development.	Quantities may vary once designs are finalized.	Major qtys have been checked. Pile lengths are still TBD. Used adjacent reaches which should get us close.	Unlikely	Significant	MODERATE		Unlikely	Marginal	LOW	

EST-3	Estimates capture full scope for all project features.	Given prelim design, final scope may include additional features that are not currently shown.	Scope may increase causing costs to go up also. Since these are fully LS funded they will try to minimize scope/cost increases.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
	FEATURE LEVEL RISKS										
FL-1	For Promontory Point, local groups may influence final design.	Final design may incorporate more limestone versus concrete resulting in different scope.	Delays in getting local groups to agree to final plan may continue to delay project.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)											
PR-1	Project funding stream	Local Sponsor funding delay contracts or cause major delays or a complete stop to project.	It could be very likely that the City may have funding issues to complete the project by 2018	Likely	Negligible	LOW		Likely	Significant	HIGH	
PR-2	Delay in approval of PACR/LRR	Delay in approval could delay future reaches.	Although not likely to occur, this should be considered as a possibility.	Unlikely	Marginal	LOW		Unlikely	Significant	MODERATE	
PR-3	Fuel Prices	Fluctuations in fuel costs could have a profound impact on the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	
PR-4	Steel Prices	Fluctuations in steel prices could have a profound impact on the sheet pile and H pile costs, which is a significant portion of the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	

PR-5	Stone Prices	Fluctuations in stone prices could have a profound impact on project cost.	PDT agrees this could likely occur. Prices have typically been more stable than for fuel or steel.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	
PR-6	Variations of Contract Quantities	Potential quantity variations, particularly overruns, will impact project costs.	Based on prior projects, variations in qtys averaged XX%.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
PR-7	Bidding Climate	Climate may change by time last of these contracts is awarded.	Current climate is favorable to LS (many bidders for each project). This may change a few years out resulting in higher costs.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

US Army Corps
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Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline) Post Authorization Change Report

Promontory Point

Project Cost and Schedule Risk Report

Prepared by:

D. Druzbicki, USACE Chicago District

Date: _30 January 2013

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APPENDIX

EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Promontory Point reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline). In compliance with Engineer Regulation (ER) 1110-2-1302, Civil Works Cost Engineering a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the Promontory Point Project, the most likely constant dollar program year cost (First Cost at FY13 price level) is estimated at approximately $57 million including a contingency value of $12 Million or approximately 28 percent on all feature accounts.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Historical/Cultural Site
- Plan quantities are at early stages of development

These drivers contribute over 80 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%). The high cultural and historical profile of this area could also result in a different scope/cost for this work as the needs of various groups are taken into consideration.

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and Claims
- USACE has to assume design
- Permitting issues

These drivers contribute close to 82 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to

funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the remaining construction, and proactive monitoring and control of risk identified in this study.

1. PURPOSE

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Promontory Point reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline).

2. BACKGROUND

Chicago's shoreline is largely man-made and constructed on landfill an average of 1,500 feet wide. This landfill is a key-contributing factor to the creation of an extensive series of lakeshore parks that began in the mid to late 1800s and continued through the 1940s. During the turn of the last century and into the 1930s, wooden cribs structures were constructed primarily to contain the stone fill material in order to provide a base upon which 4 to 8 ton cut limestone blocks would be placed in step-stone fashion to construct the existing revetment structure. This project provides storm damage protection to the Lake Michigan shoreline and, in particular, to Lake Shore Drive, a major transportation artery in the City of Chicago. The previous shoreline structures, built in the early 1900s, had deteriorated and no longer functioned to protect against storms, flooding and erosion.

The Chicago Shoreline project was authorized under the Water Resources Development Act of 1996 (P.L. 104–303) Section 101(12) which stipulated:

> *The project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. The project shall include the breakwater near the South Water Filtration Plant described in the report as a separate element of the project, at a total cost of $11,470,000, with an estimated Federal cost of $7,460,000 and an estimated non-Federal cost of $4,010,000. The Secretary shall reimburse the non-Federal interest for the Federal share of any costs incurred by the non-Federal interest— (A) in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the project; and (B) in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois.*

Additional authorization was provided under Water Resources Development Act of 1999 (P.L. 106–53) Section 318 which stipulated:

> *The project for storm damage reduction and shore protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), is modified to provide for reimbursement for*

> *additional project work undertaken by the non-Federal interest. The Secretary shall credit or reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000. The Secretary shall reimburse the non- Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.*

The construction of the Chicago Shoreline Project began in 1997 and design and construction responsibility was divided between the U.S. Army Corps of Engineers (USACE), Chicago District and the non-Federal sponsor under the terms of the project cooperation agreements. Project segments were constructed by USACE, Chicago District or by the City of Chicago, Department of Transportation and the Chicago Park District. Remaining construction contracts to be pursued by the non-Federal sponsors will likely exceed the maximum project cost limit according to Section 902 of the Water Resources Development Act of 1986, as amended.

There are four additional reaches to be completed:

- Fullerton Theater by the Lake
- Montrose to Irving
- 45^{th} to 51^{st}
- Promontory Point

Due to the differences in the various reaches (design stages, project features, etc.), a separate CSRA was prepared for each.

3. REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features. The study and presentation excludes consideration for operation and maintenance or life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register for the remaining reaches to be completed along the Chicago Shoreline. The analysis process evaluated the most likely Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a Monte Carlo simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL), 1110-2-573, Construction Cost Estimating Guide for Civil Works, dated September 30, 2008**.**

- The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.
- The approximate design stage varies for each of the upcoming reaches from feasibility level drawings to roughly 50% plans and specifications.

3.2 USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.

- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

4. METHODOLOGY/PROCESS

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the

Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

Cost Engineering facilitated a risk identification and qualitative analysis meeting with the Project Delivery Team (PDT) on May 10, 2012. Representatives from the following disciplines were in attendance:

- Cost Engineering
- Project Management
- Civil
- Construction
- Planning
- Hydraulic/Coastal
- Environmental
- Structural
- Geotechnical

This meeting focused primarily on risk factor identification using brainstorming techniques, but also included some discussions based on risk factors common to projects of similar scope and geographic location.

Additionally, numerous phone calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near

critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

Key assumptions are those that are most likely to significantly effect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The Cost Engineering Team has identified the following key assumptions for the risk analysis:

- **Level of design**: The cost comparisons and risk analyses performed and reflected in this report are based upon design scope and estimates that are slightly beyond feasibility level.
- **Design Scope**: Some areas of scope are not fully developed and required significant assumptions by the cost engineer.
- **Contract Acquisition Strategy**: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is unrestricted IFB. However, the final determination on acquisition strategy may change depending on funding availability or other requirements. Use of other acquisition strategies may impact costs and schedules.
- **Project Schedule**: For development purposes the project is being developed assuming various reaches would be constructed nearly simultaneously. Also, depending on how funding is received; the project could be split into smaller phases or have the start of construction delayed.
- **Confidence Levels**: The Cost Engineering and ATR MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk adverse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
- **Operations and Maintenance**: Was not included in this analysis.
- **ATR status**: Successfully complete.
- **Impacts Studied**: Moderate and High impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Moderate and High level risk impacts were only applied to critical path and near critical path schedule tasks for the purposes of calculating schedule contingency. Low and moderate level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list” for further monitoring and evaluation.

6. RISK ANALYSIS RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) should be presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register would be provided in appendix A. The detailed risk registers of appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

In simple terms, a correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. For this project no correlations between risks were identified or used. There were similar risk items that were combined to avoid double counting or placing too much emphasis on them.

6.2 Cost Risk Analysis - Cost Contingency Results

Table 1 provides the Base Estimate Construction Cost contingencies calculated for the P80 confidence level. This is quantified as approximately $9.3 million at the P80

confidence level (about 28 percent of the base cost estimate). For comparison, the cost contingency at the P100 and P50 confidence levels was quantified as 20 percent and 58 percent of the base cost estimate, respectively. The 28 percent contingency percentage is applied to the cost estimate on the Total Project Cost Summary to calculate the final contingency amount.

Table 1. Construction Cost Contingency Summary

Risk Analysis Forecast	Approximate Base Estimate	Total Contingency ($)	Total Contingency (%)
50% Confidence Level			
Construction Feature Cost	$33.1M	$6.7M	20.3%
80% Confidence Level			
Construction Feature Cost	$33.1M	$9.3M	28.0%
100% Confidence Level			
Construction Feature Cost	$33.1M	$19.1M	57.6%

Notes:
1) Includes construction cost and schedule contingency impacts.
2) Contingency excludes PED and construction management costs.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to total project cost. It should be noted that an understanding of the risk model is also required to understand the outputs of the sensitivity. In general, the larger the potential cost variation of an element the more likely it will show up as being a highly sensitive item. The actual value of risk (contingency) that it is contributing may actually be significantly smaller than other items listed much lower on the sensitivity chart. Figure 1 and 2 shows the Cost and Schedule Sensitivity of the Model.

Figure 1. Cost Sensitivity Analysis

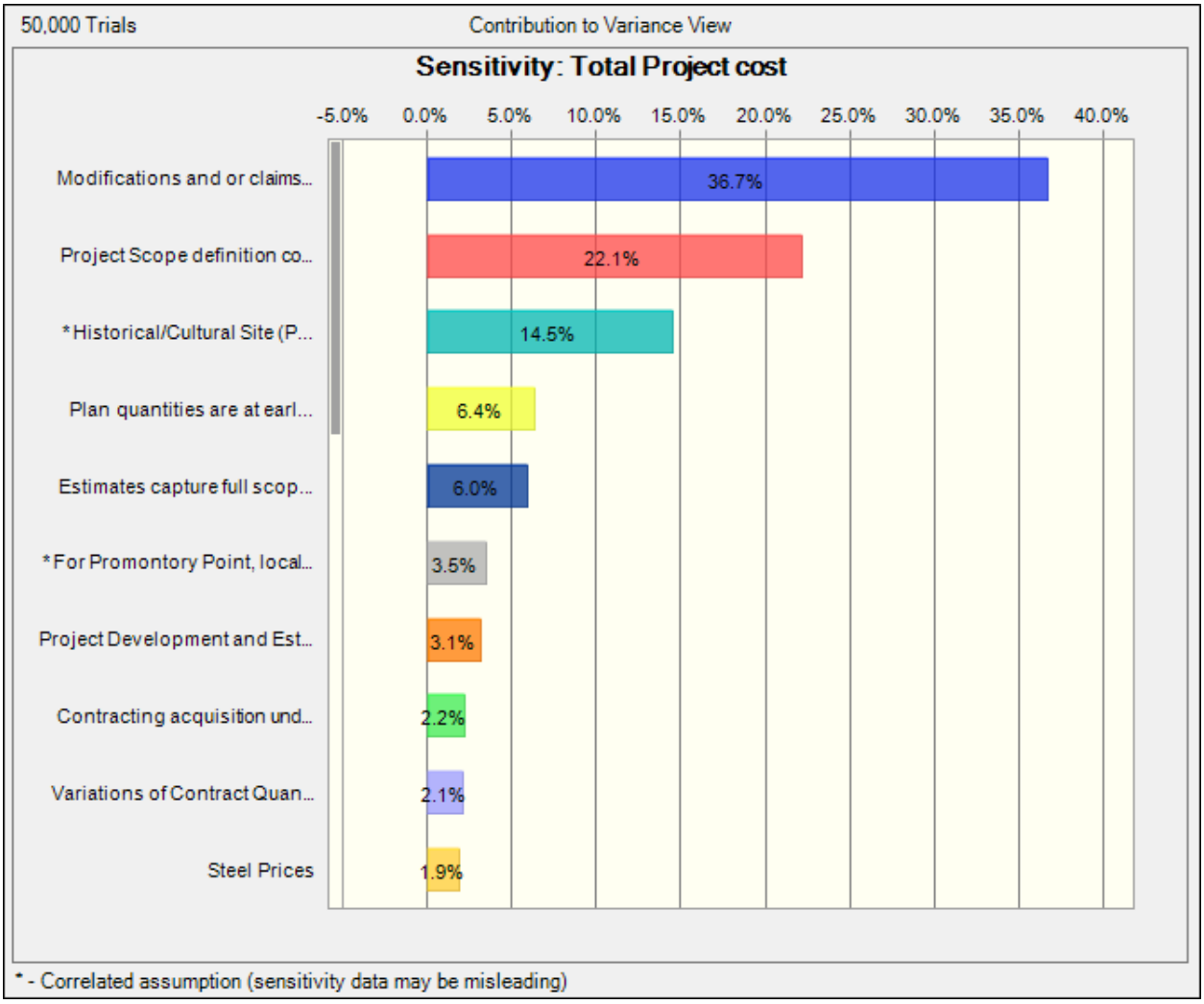
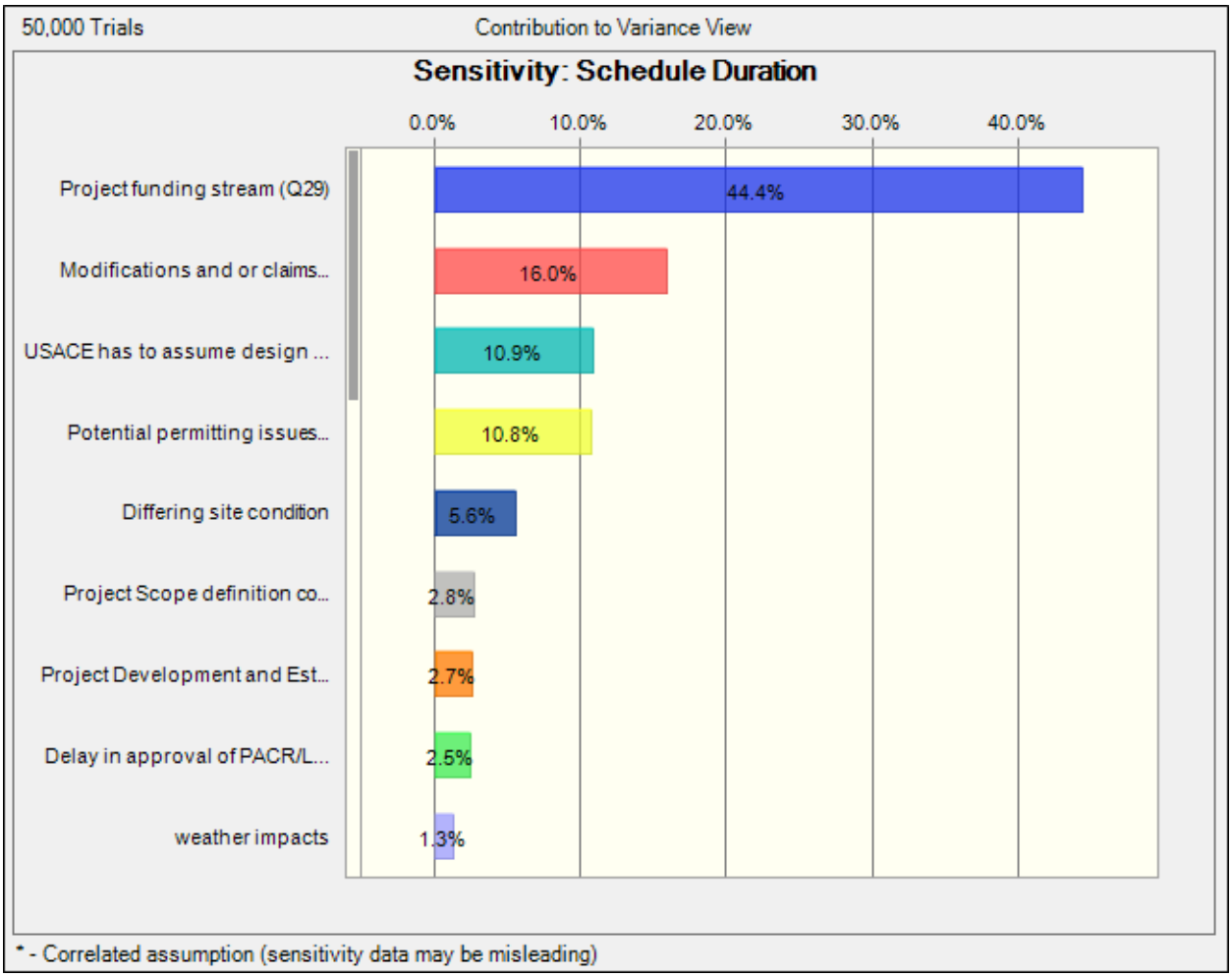


Figure 2. Schedule Sensitivity Analysis



6.3 Schedule Risk Analysis

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 50 months based on the P80 level of confidence. The schedule contingencies were calculated by applying the moderate and high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Base Construction Schedule Duration (months)	Contingency (months)	Contingency (%)
50% Confidence Level			
FPF Construction Duration	31	16	50.0%
80% Confidence Level			
FPF Construction Duration	31	19	62.4%
100% Confidence Level			
FPF Construction Duration	31	33	106.7%

7. MAJOR FINDINGS/OBSERVATIONS

This section provides a summary of significant risk analysis results in this section, which have been identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted. Table 2 presents project contingencies, which include base cost plus cost and schedule contingencies.

Table 3. Project Contingencies (Base Cost Plus Cost and Schedule Contingencies)

Confidence Level	Project Cost	Contingency ($)	Contingency (%)
P0	$38,762,000	($5,472,000)	-12%
P10	$48,280,000	$4,046,000	9%
P20	$49,903,000	$5,669,000	13%
P30	$51,104,000	$6,870,000	16%
P40	$52,173,000	$7,939,000	18%
P50	$53,192,000	$8,958,000	20%
P60	$54,217,000	$9,983,000	23%
P70	$55,318,000	$11,084,000	25%
P80	$56,620,000	$12,387,000	28%
P90	$58,453,000	$14,219,000	32%
P100	$69,699,000	$25,465,000	58%

Note: Costs include PED and S&A.

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Historical/Cultural Site
- Plan quantities are at early stages of development

These drivers contribute over 80 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%). The high cultural and historical profile of this area could also result in a different scope/costs for this work as the needs of various groups are taken into consideration.

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and claims
- USACE has to assume design
- Permitting issues

These drivers contribute close to 82 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

8. MITIGATION RECOMMENDATIONS

This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all-inclusive.

Risk Drivers:

1. Cost Risk: The key risk driver of Modifications and Claims is partially within the PDT's scope of influence. Modifications and claims should be minimized as the project scope is further developed during the Plans and Specifications phase. The same can be said for the remaining larger risk items. Input from outside groups due to the sites historical/cultural significance will also help in the development of the final design. Including the requirement of these groups earlier in the design process as opposed to later will help minimize the cost impact. Monitoring and updates of the Total Project Cost and implementation of risk mitigation strategies should be managed for identified risks as well as new risks that arise. Whereas the developed contingency, itself, is a response to the

potential for these risks, these risks warrant consideration of other potential responses and proactive monitoring and control.

2. Schedule Risk: Project Funding is beyond the PDT's influence. Proactive monitoring and development of mitigation strategies can minimize the adverse schedule effects of these risks. Annual funding received could significantly affect the overall project duration and the PDT must integrate it fully with the anticipated funding profile. Other risks relating to USACE completing the design or permitting issues are unlikely at this stage of the Chicago Shoreline project. The A/E's associated with the project have completed past designs without issue but it can' be completely dismissed at this point. Permitting issues should also be known at this point but are included on the outside chance something unforeseen comes up.

3. Risk Management: Accurate representation of estimates and risks throughout the development of the project is critical, and the risk analysis study and technical review of said estimate is a critical mitigation strategy. Cost Engineering recommends continuous, proactive, and timely updates to the estimate in conjunction with proactive contract placement and phasing planning and execution. It is recommended that the outputs created during the initial risk analysis effort serve as tools in future risk management processes. The risk register should be updated at each major project milestone and estimate update. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings. As an example, recommended uses of the risk register include:

    - Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.

    - Providing project sponsors, stakeholders and leadership/management with a documented framework from which risk status can be reported in the context of project controls.

    - Communicating risk management issues.

    - Providing a mechanism for eliciting risk analysis feedback and project control input.

    - Identifying risk transfer, elimination or mitigation actions required for implementation of risk management plans.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's

likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

DETAILED RISK REGISTER

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions	Project Cost				Project Schedule			
				Likelihood *	Impact*	Risk Level*		Likelihood *	Impact*	Risk Level*	
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)											
	PROJECT & PROGRAM MGMT										
PPM-1	Project Scope definition could change	Due to public pressure the City changes the design to address concerns (all 3 proj)	Based on past project experience this is likely to occur	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
PPM-2	USACE has to assume design responsibility	City hired A/E cannot finish design	Based on past experience with other local sponsors	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	CONTRACT ACQUISITION RISKS										
CA-1	Contracting acquisition undecided	Local Sponsor could send out as SBA and increase the price	PDT feels the PM should address contract risks after this meeting	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

	TECHNICAL RISKS										
TL-1	Design Confidence in Products by A/E	Is USACE confident in the designs/quantities by A/E?	USACE is confident. USACE provides review/comments through out design. A/E is using USACE guide specifications. Risk is typically low.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
TL-2	Sufficiency/condition of borrow/fill sites	Quality of fill, sand, and stone in large quantities	Environmental concerns with sand and fill none with stone. Can mitigate risks by requiring contractor to perform testing before bringing it on job (written in specs)	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	LANDS AND DAMAGES RISKS										
LD-1	Utilities locations not marked on current prints	Unknown utilities and or unplanned utility relocations/diversions to existing sites could cause a delay and or add costs.	Previous reaches have encountered some unmarked utilities that required relocation. Additional costs to LS and additional time to relocate may be required. Given location near lake, unmarked	Likely	Negligible	LOW		Likely	Negligible	LOW	

			utilities should not be a major concern. Possibly by Fullerton Theater by the Lake.								
LD-2	All land owned by LS.	No issues anticipated regarding RE.	No issues.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
	REGULATORY AND ENVIRONMENTAL RISKS										
RE-1	Potential permitting issues with placing large amounts of fill in lake (behind SSP).	Permitting delays could delay start of construction.	Even though the city is performing the work USACE still has to obtain the 401 permit and perform EA's and NEPA. Obtaining these items fall on a agency outside our control.	Unlikely	Negligible	LOW		Unlikely	Significant	MODERATE	
RE-2	Historical/Cultural Site (Prom. Point)	Getting a approved plan approved by the public/SHPO	High level of uncernity of how the proposed design will be acceptedby public/SHPO	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
	CONSTRUCTION RISKS										
CON-1	Modifications and or claims on contracts	Claims or modifications could cause the actual contract cost to increase	We know mods will happen, just uncertain of the magnitude. Look at historical data.	Very Likely	Significant	HIGH		Very Likely	Marginal	MODERATE	

CON-2	Discovering grey material	May encounter material that could require removal/remediation.	Encountering grey material would result in higher cost, delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-3	Bed Rock	Bed rock elevation impacting SSP driving,	If top of bedrock varies from plan, differing site condition could result in design changes & delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-4	weather impacts	temperature too low for concrete placement, storm events washing out fresh concrete	Working along shore may result in delays, rework. Need to include enough weather days in schedule. Schedule impact will be covered under CON-1 Mods and Claims.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	
CON-5	Site access by contractor	Contractor access may be severly limited in Promontory Point decreasing productivity.	Since we are near Field Museum, may be additional requirements by city limiting contractor activity resulting in decreased productivity, longer schedule.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	

CON-6	Impacts from City Events	City events could delay construction of the remaining projects.	Events such as the air show, festivals, etc. may prevent contractor from timely completion of work. This can be mitigated since most of the events can be determined prior to award and therefore accounted for in the costs. Most events are short term induration.	Likely	Negligible	LOW		Likely	Negligible	LOW	
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Project Development and Estimate Risk	Estimate development based on unit costs may not be reflective of actual costs. Quantities based on 25 to 50% drawings and are not complete	There will be changes to scope and quantity before designs are finalized. Assuming Local Sponsor will want to keep changes to a minimum to limit their costs since this is all Non Fed expenditures.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
EST-2	Plan quantities are at early stage of development.	Quantities may vary once designs are finalized.	Major qtys have been checked. Pile lengths are still TBD. Used adjacent reaches which should get us close.	Unlikely	Significant	MODERATE		Unlikely	Marginal	LOW	

EST-3	Estimates capture full scope for all project features.	Given prelim design, final scope may include additional features that are not currently shown.	Scope may increase causing costs to go up also. Since these are fully LS funded they will try to minimize scope/cost increases.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
	FEATURE LEVEL RISKS										
FL-1	For Promontory Point, local groups may influence final design.	Final design may incorporate more limestone versus concrete resulting in different scope.	Delays in getting local groups to agree to final plan may continue to delay project.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)											
PR-1	Project funding stream	Local Sponsor funding delay contracts or cause major delays or a complete stop to project.	It could be very likely that the City may have funding issues to complete the project by 2018	Likely	Negligible	LOW		Likely	Significant	HIGH	
PR-2	Delay in approval of PACR/LRR	Delay in approval could delay future reaches.	Although not likely to occur, this should be considered as a possibility.	Unlikely	Marginal	LOW		Unlikely	Significant	MODERATE	
PR-3	Fuel Prices	Fluctuations in fuel costs could have a profound impact on the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	
PR-4	Steel Prices	Fluctuations in steel prices could have a profound impact on the sheet pile and H pile costs, which is a significant portion of the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	

PR-5	Stone Prices	Fluctuations in stone prices could have a profound impact on project cost.	PDT agrees this could likely occur. Prices have typically been more stable than for fuel or steel.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	
PR-6	Variations of Contract Quantities	Potential quantity variations, particularly overruns, will impact project costs.	Based on prior projects, variations in qtys averaged XX%.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
PR-7	Bidding Climate	Climate may change by time last of these contracts is awarded.	Current climate is favorable to LS (many bidders for each project). This may change a few years out resulting in higher costs.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

US Army Corps
of Engineers®

Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline) Post Authorization Change Report

Montrose to Irving

Project Cost and Schedule Risk Report

Prepared by:

D. Druzbicki, USACE Chicago District

Date: _30 January 2013

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APPENDIX

EXECUTIVE SUMMARY

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Montrose to Irving reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline). In compliance with Engineer Regulation (ER) 1110-2-1302, Civil Works Cost Engineering a formal risk analysis study was conducted for the development of contingency on the total project cost. The purpose of this risk analysis study was to establish project contingencies by identifying and measuring the cost and schedule impact of project uncertainties with respect to the estimated total project cost.

Specific to the Montrose to Irving Project, the most likely constant dollar program year cost (First Cost at FY13 price level) is estimated at approximately $23 million including a contingency value of $5 Million or approximately 25 percent on all feature accounts.

KEY FINDINGS/OBSERVATIONS RECOMMENDATIONS

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Estimate Captures full Scope of Project
- Plan Quantities at early Stage of Development

These drivers contribute over 87 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and Claims
- USACE has to assume design
- Permitting issues

These risks contribute close to 88 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

Recommendations, as detailed within the main report, include the implementation of cost and schedule contingencies, further iterative study of risks throughout the project life-cycle, potential mitigation throughout the remaining construction, and proactive monitoring and control of risk identified in this study.

1. PURPOSE

Under the auspices of the U.S. Army Corps of Engineers (USACE), Chicago District, this report presents a recommendation for the total project cost and schedule contingencies for the Montrose to Irving reach of the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line Project (Chicago Shoreline).

2. BACKGROUND

Chicago's shoreline is largely man-made and constructed on landfill an average of 1,500 feet wide. This landfill is a key-contributing factor to the creation of an extensive series of lakeshore parks that began in the mid to late 1800s and continued through the 1940s. During the turn of the last century and into the 1930s, wooden cribs structures were constructed primarily to contain the stone fill material in order to provide a base upon which 4 to 8 ton cut limestone blocks would be placed in step-stone fashion to construct the existing revetment structure. This project provides storm damage protection to the Lake Michigan shoreline and, in particular, to Lake Shore Drive, a major transportation artery in the City of Chicago. The previous shoreline structures, built in the early 1900s, had deteriorated and no longer functioned to protect against storms, flooding and erosion.

The Chicago Shoreline project was authorized under the Water Resources Development Act of 1996 (P.L. 104–303) Section 101(12) which stipulated:

> *The project for storm damage reduction and shoreline erosion protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line: Report of the Chief of Engineers, dated April 14, 1994, at a total cost of $204,000,000, with an estimated Federal cost of $110,000,000 and an estimated non-Federal cost of $94,000,000. The project shall include the breakwater near the South Water Filtration Plant described in the report as a separate element of the project, at a total cost of $11,470,000, with an estimated Federal cost of $7,460,000 and an estimated non-Federal cost of $4,010,000. The Secretary shall reimburse the non-Federal interest for the Federal share of any costs incurred by the non-Federal interest— (A) in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, if such work is determined by the Secretary to be a component of the project; and (B) in constructing the breakwater near the South Water Filtration Plant in Chicago, Illinois.*

Additional authorization was provided under Water Resources Development Act of 1999 (P.L. 106–53) Section 318 which stipulated:

> *The project for storm damage reduction and shore protection, Lake Michigan, Illinois, from Wilmette, Illinois, to the Illinois-Indiana State line, authorized by section 101(a)(12) of the Water Resources Development Act of 1996 (110 Stat. 3664), is modified to provide for reimbursement for*

> *additional project work undertaken by the non-Federal interest. The Secretary shall credit or reimburse the non-Federal interest for the Federal share of project costs incurred by the non-Federal interest in designing, constructing, or reconstructing reach 2F (700 feet south of Fullerton Avenue and 500 feet north of Fullerton Avenue), reach 3M (Meigs Field), and segments 7 and 8 of reach 4 (43rd Street to 57th Street), if the non-Federal interest carries out the work in accordance with plans approved by the Secretary, at an estimated total cost of $83,300,000. The Secretary shall reimburse the non- Federal interest for the Federal share of project costs incurred by the non-Federal interest in reconstructing the revetment structures protecting Solidarity Drive in Chicago, Illinois, before the signing of the project cooperation agreement, at an estimated total cost of $7,600,000.*

The construction of the Chicago Shoreline Project began in 1997 and design and construction responsibility was divided between the U.S. Army Corps of Engineers (USACE), Chicago District and the non-Federal sponsor under the terms of the project cooperation agreements. Project segments were constructed by USACE, Chicago District or by the City of Chicago, Department of Transportation and the Chicago Park District. Remaining construction contracts to be pursued by the non-Federal sponsors will likely exceed the maximum project cost limit according to Section 902 of the Water Resources Development Act of 1986, as amended.

There are four additional reaches to be completed:

- Fullerton Theater by the Lake
- Montrose to Irving
- 45^{th} to 51^{st}
- Promontory Point

Due to the differences in the various reaches (design stages, project features, etc.), a separate CSRA was prepared for each.

3. REPORT SCOPE

The scope of the risk analysis report is to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The report presents the contingency results for both cost and schedule risks for all project features. The study and presentation excludes consideration for operation and maintenance or life cycle costs.

3.1 Project Scope

The formal process included extensive involvement of the PDT for risk identification and the development of the risk register for the remaining reaches to be completed along the Chicago Shoreline. The analysis process evaluated the most likely Micro Computer Aided Cost Estimating System (MCACES) cost estimate, schedule, and funding profiles using Crystal Ball software to conduct a Monte Carlo simulation and statistical sensitivity analysis, per the guidance in Engineer Technical Letter (ETL), 1110-2-573, Construction Cost Estimating Guide for Civil Works, dated September 30, 2008**.**

- The project technical scope, estimates and schedules were developed and presented by the District. Consequently, these documents serve as the basis for the risk analysis.
- The approximate design stage varies for each of the upcoming reaches from feasibility level drawings to roughly 50% plans and specifications.

3.2 USACE Risk Analysis Process

The risk analysis process follows the USACE Headquarters requirements as well as the guidance provided by the Cost Engineering Directory of Expertise for Civil Works (Cost Engineering DX). The risk analysis process reflected within the risk analysis report uses probabilistic cost and schedule risk analysis methods within the framework of the Crystal Ball software. The risk analysis results are intended to serve several functions, one being the establishment of reasonable contingencies reflective of an 80 percent confidence level to successfully accomplish the project work within that established contingency amount. Furthermore, the scope of the report includes the identification and communication of important steps, logic, key assumptions, limitations, and decisions to help ensure that risk analysis results can be appropriately interpreted.

Risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, cost and schedule risk analyses should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting, and scheduling.

In addition to broadly defined risk analysis standards and recommended practices, the risk analysis is performed to meet the requirements and recommendations of the following documents and sources:

- ER 1110-2-1150, Engineering and Design for Civil Works Projects.
- ER 1110-2-1302, Civil Works Cost Engineering.
- ETL 1110-2-573, Construction Cost Estimating Guide for Civil Works.
- Cost and Schedule Risk Analysis Process guidance prepared by the USACE Cost Engineering DX.

- Memorandum from Major General Don T. Riley (U.S. Army Director of Civil Works), dated July 3, 2007.
- Engineering and Construction Bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.

4. METHODOLOGY/PROCESS

The risk analysis process for this study is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of cost confidence. A parallel process is also used to determine the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of schedule confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions, or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk of project overruns. The less risk that project leadership is willing to accept the more contingency should be applied in the project control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

The Cost Engineering DX guidance for cost and schedule risk analysis generally focuses on the 80-percent level of confidence (P80) for cost contingency calculation. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than 50 percent would be risk seeking). Thus, a P80 confidence level results in greater contingency as compared to a P50 confidence level.

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. Cost estimates are packaged into an Excel format and used directly for cost risk analysis purposes. Because Crystal Ball is an Excel add-in, the schedules for each option are recreated in an Excel format from their native format. The level of detail recreated in the Excel-format schedule is sufficient for risk analysis purposes that reflect the established risk register, but generally less than that of the native format.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results would be provided in section 6.

4.1 Identify and Assess Risk Factors

Identifying the risk factors via the PDT are considered a qualitative process that results in establishing a risk register that serves as the document for the further study using the

Crystal Ball risk software. Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire PDT is obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the PDT and empirical data from similar projects is desirable and is considered.

Cost Engineering facilitated a risk identification and qualitative analysis meeting with the Project Delivery Team (PDT) on May 10, 2012. Representatives from the following disciplines were in attendance:

- Cost Engineering
- Project Management
- Civil
- Construction
- Planning
- Hydraulic/Coastal
- Environmental
- Structural
- Geotechnical

This meeting focused primarily on risk factor identification using brainstorming techniques, but also included some discussions based on risk factors common to projects of similar scope and geographic location.

Additionally, numerous phone calls and informal meetings were conducted throughout the risk analysis process on an as-needed basis to further facilitate risk factor identification, market analysis, and risk assessment.

4.2 Quantify Risk Factor Impacts

The quantitative impacts of risk factors on project plans are analyzed using a combination of professional judgment, empirical data, and analytical techniques. Risk factor impacts are quantified using probability distributions (density functions), because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involves multiple project team disciplines and functions. However, the quantification process relies more extensively on collaboration between cost engineering, designers, and risk analysis team members with lesser inputs from other functions and disciplines.

The following is an example of the PDT quantifying risk factor impacts by using an iterative, consensus-building approach to estimate the elements of each risk factor:

- Maximum possible value for the risk factor.
- Minimum possible value for the risk factor.
- Most likely value (the statistical mode), if applicable.
- Nature of the probability density function used to approximate risk factor uncertainty.
- Mathematical correlations between risk factors.
- Affected cost estimate and schedule elements.

The resulting product from the PDT discussions is captured within a risk register as presented in section 6 for both cost and schedule risk concerns. Note that the risk register records the PDT's risk concerns, discussions related to those concerns, and potential impacts to the current cost and schedule estimates. The concerns and discussions are meant to support the team's decisions related to event likelihood, impact, and the resulting risk levels for each risk event.

4.3 Analyze Cost Estimate and Schedule Contingency

Contingency is analyzed using the Crystal Ball software, an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations are performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the PDT. Contingencies are calculated by applying only the moderate and high level risks identified for each option (i.e., low-level risks are typically not considered, but remain within the risk register to serve historical purposes as well as support follow-on risk studies as the project and risks evolve).

For the cost estimate, the contingency is calculated as the difference between the P80 cost forecast and the base cost estimate. Each option-specific contingency is then allocated on a civil works feature level based on the dollar-weighted relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation is used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of all the project feature cost contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the option schedule contingency is calculated as the difference between the P80 option duration forecast and the base schedule duration. These contingencies are then used to calculate the time value of money impact of project delays that are included in the presentation of total cost contingency in section 6. The resulting time value of money, or added risk escalation, is then added into the contingency amount to reflect the USACE standard for presenting the "total project cost" for the fully funded project amount.

Schedule contingency is analyzed only on the basis of each option and not allocated to specific tasks. Based on Cost Engineering DX guidance, only critical path and near

critical path tasks are considered to be uncertain for the purposes of contingency analysis.

5. KEY ASSUMPTIONS

Key assumptions are those that are most likely to significantly effect the determinations and/or estimates of risk presented in the risk analysis. The key assumptions are important to help ensure that project leadership and other decision makers understand the steps, logic, limitations, and decisions made in the risk analysis, as well as any resultant limitations on the use of outcomes and results.

The Cost Engineering Team has identified the following key assumptions for the risk analysis:

- **Level of design**: The cost comparisons and risk analyses performed and reflected in this report are based upon design scope and estimates that are slightly beyond feasibility level.
- **Design Scope**: Some areas of scope are not fully developed and required significant assumptions by the cost engineer.
- **Contract Acquisition Strategy**: Consistent with cost estimate and schedule assumptions, it is assumed that the contract acquisition strategy is unrestricted IFB. However, the final determination on acquisition strategy may change depending on funding availability or other requirements. Use of other acquisition strategies may impact costs and schedules.
- **Project Schedule**: For development purposes the project is being developed assuming various reaches would be constructed nearly simultaneously. Also, depending on how funding is received; the project could be split into smaller phases or have the start of construction delayed.
- **Confidence Levels**: The Cost Engineering and ATR MCX guidance generally focuses on the eighty-percent level of confidence (P80) for cost contingency calculation. For this risk analysis, the eighty-percent level of confidence (P80) was used. It should be noted that the use of P80 as a decision criteria is a moderately risk adverse approach, generally resulting in higher cost contingencies. However, the P80 level of confidence also assumes a small degree of risk that the recommended contingencies may be inadequate to completely capture actual project costs.
- **Operations and Maintenance**: Was not included in this analysis.
- **ATR status**: Successfully complete.
- **Impacts Studied**: Moderate and High impacts, as identified in the risk register, were considered for the purposes of calculating cost contingency. Moderate and High level risk impacts were only applied to critical path and near critical path schedule tasks for the purposes of calculating schedule contingency. Low and moderate level risk impacts should be maintained in project management documentation, and reviewed at each project milestone to determine if they should be placed on the risk “watch list” for further monitoring and evaluation.

6. RISK ANALYSIS RESULTS

The cost and schedule risk analysis results are provided in the following sections. In addition to contingency calculation results, sensitivity analyses are presented to provide decision makers with an understanding of variability and the key contributors to the cause of this variability.

6.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis and serves as the basis for the risk studies and Crystal Ball risk models. A summary risk register that includes typical risk events studied (high and moderate levels) should be presented in a table in this section. The risk register reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis. A more detailed risk register would be provided in appendix A. The detailed risk registers of appendix A include low level and unrated risks, as well as additional information regarding the specific nature and impacts of each risk.

It is important to note that a risk register can be an effective tool for managing identified risks throughout the project life cycle. As such, it is generally recommended that risk registers be updated as the designs, cost estimates, and schedule are further refined, especially on large projects with extended schedules. Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders, and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues.
- Providing a mechanism for eliciting risk analysis feedback and project control input.
- Identifying risk transfer, elimination, or mitigation actions required for implementation of risk management plans.

In simple terms, a correlation is a dependency that exists between two risks and may be direct or indirect. An indirect correlation is one in which large values of one risk are associated with small values of the other. Indirect correlations have correlation coefficients between 0 and -1. A direct correlation is one in which large values of one risk are associated with large values of the other. Direct correlations have correlation coefficients between 0 and 1. For this project no correlations between risks were identified or used. There were similar risk items that were combined to avoid double counting or placing too much emphasis on them.

6.2 Cost Risk Analysis - Cost Contingency Results

Table 1 provides the Base Estimate Construction Cost contingencies calculated for the P80 confidence level. This is quantified as approximately $3.7 million at the P80

confidence level (about 25 percent of the base cost estimate). For comparison, the cost contingency at the P100 and P50 confidence levels was quantified as 18 percent and 57 percent of the base cost estimate, respectively. The 25 percent contingency percentage is applied to the cost estimate on the Total Project Cost Summary to calculate the final contingency amount.

Table 1. Construction Cost Contingency Summary

Risk Analysis Forecast	Approximate Base Estimate	Total Contingency ($)	Total Contingency (%)
50% Confidence Level			
Construction Feature Cost	$14.6M	$2.6M	17.5%
80% Confidence Level			
Construction Feature Cost	$14.6M	$3.7M	25.2%
100% Confidence Level			
Construction Feature Cost	$14.6M	$8.2M	56.5%

Notes:
1) Includes construction cost and schedule contingency impacts.
2) Contingency excludes PED and construction management costs.

6.2.1 Sensitivity Analysis

Sensitivity analysis generally ranks the relative impact of each risk/opportunity as a percentage of total cost uncertainty. The Crystal Ball software uses a statistical measure (contribution to variance) that approximates the impact of each risk/opportunity contributing to variability of cost outcomes during *Monte Carlo* simulation.

Key cost drivers identified in the sensitivity analysis can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept or transfer key risks.

6.2.2 Sensitivity Analysis Results

The risks/opportunities considered as key or primary cost drivers are ranked in order of importance in contribution to variance bar charts. Opportunities that have a potential to reduce project cost and are shown with a negative sign; risks are shown with a positive sign to reflect the potential to increase project cost. A longer bar in the sensitivity analysis chart represents a greater potential impact to total project cost. It should be noted that an understanding of the risk model is also required to understand the outputs of the sensitivity. In general, the larger the potential cost variation of an element the more likely it will show up as being a highly sensitive item. The actual value of risk (contingency) that it is contributing may actually be significantly smaller than other items listed much lower on the sensitivity chart. Figure 1 and 2 shows the Cost and Schedule Sensitivity of the Model.

Figure 1. Cost Sensitivity Analysis

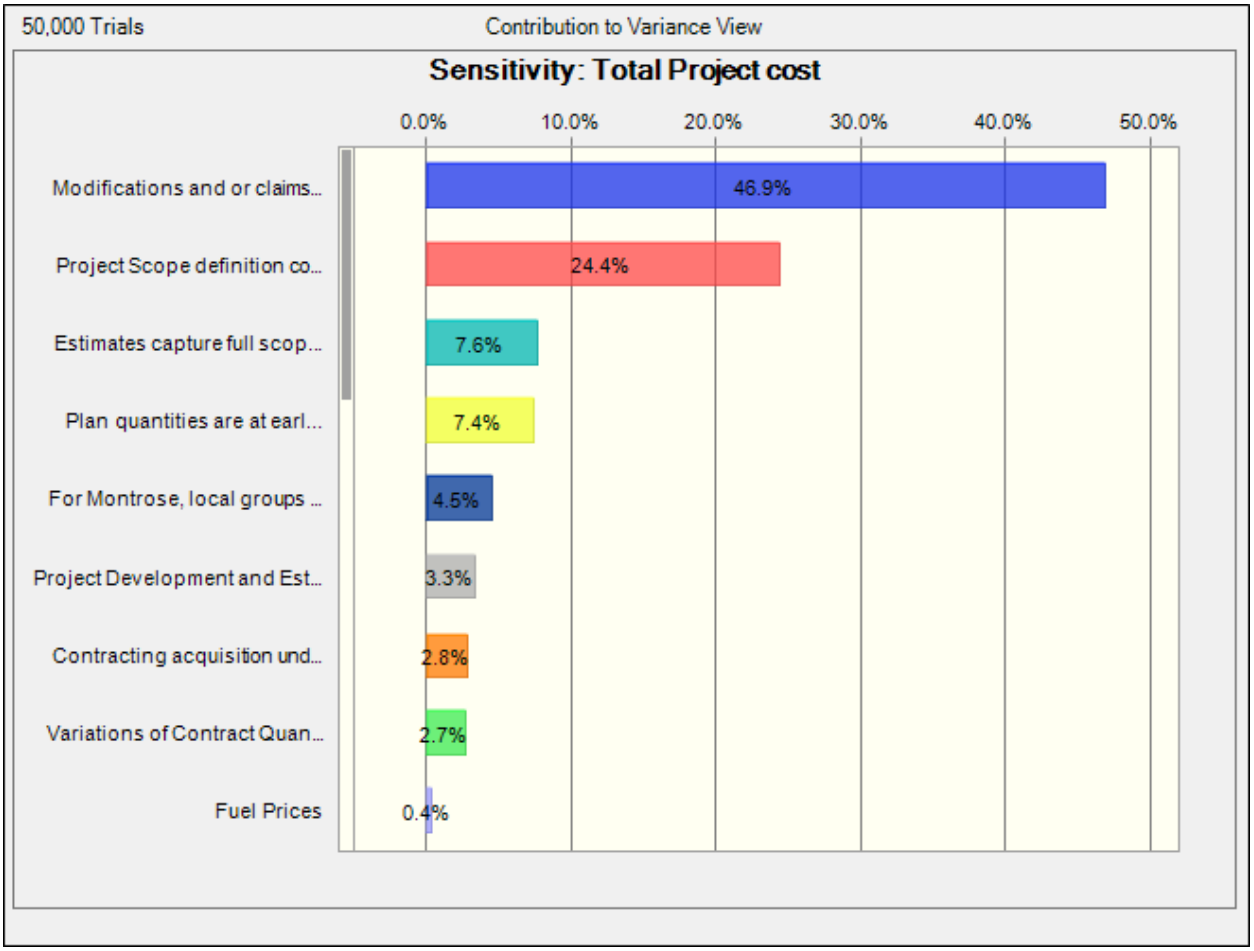
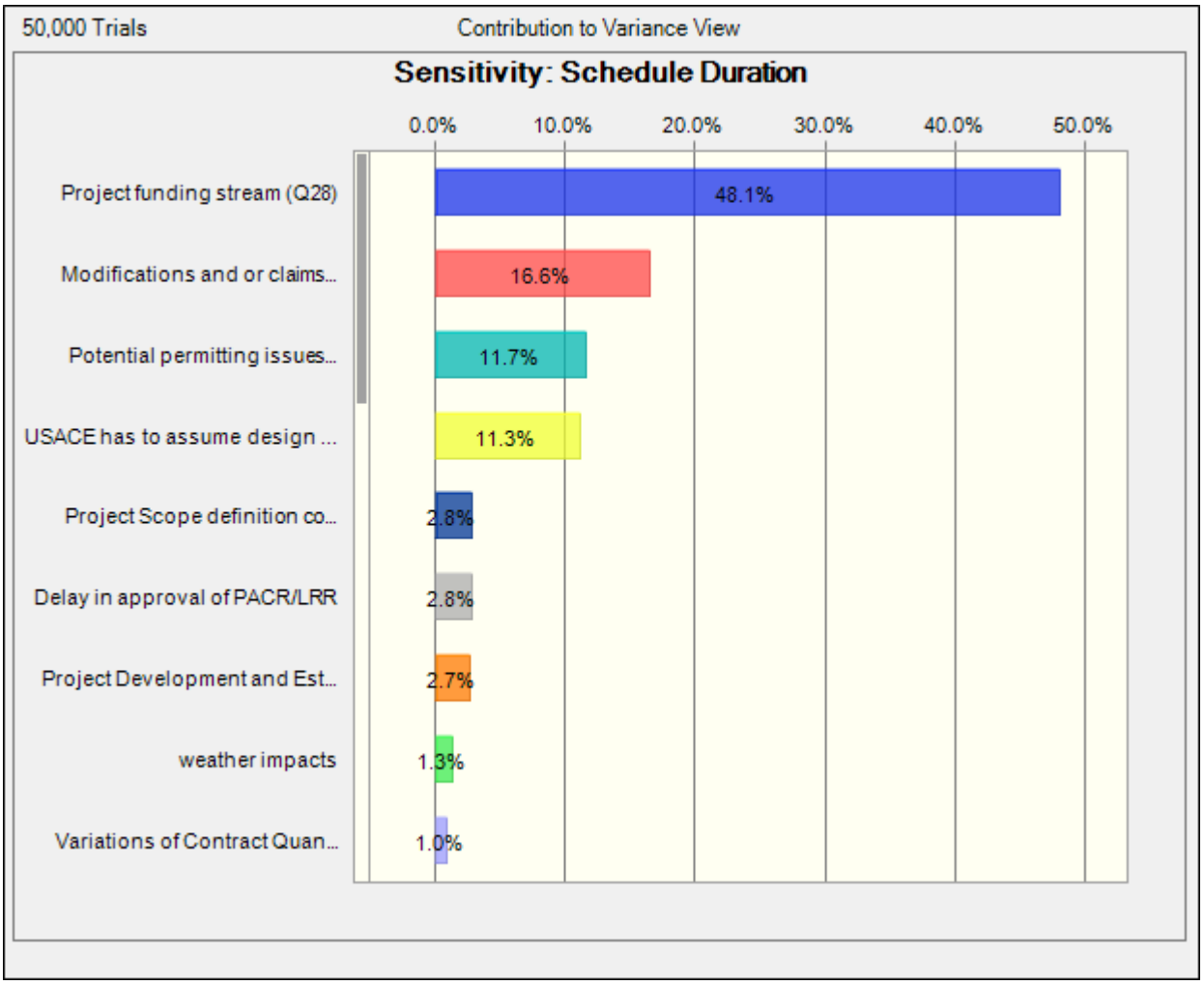


Figure 2. Schedule Sensitivity Analysis



6.3 Schedule Risk Analysis

Table 2 provides the schedule duration contingencies calculated for the P80 confidence level. The schedule duration contingencies for the P50 and P100 confidence levels are also provided for illustrative purposes.

Schedule duration contingency was quantified as 50 months based on the P80 level of confidence. The schedule contingencies were calculated by applying the moderate and high level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

Table 2. Schedule Duration Contingency Summary

Risk Analysis Forecast	Base Construction Schedule Duration (months)	Contingency (months)	Contingency (%)
50% Confidence Level			
FPF Construction Duration	31	15	47.8%
80% Confidence Level			
FPF Construction Duration	31	19	59.8%
100% Confidence Level			
FPF Construction Duration	31	31	100.4%

7. MAJOR FINDINGS/OBSERVATIONS

This section provides a summary of significant risk analysis results in this section, which have been identified in the preceding sections of the report. Risk analysis results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as projects progress through planning and implementation. Because of the potential for use of risk analysis results for such diverse purposes, this section also reiterates and highlights important steps, logic, key assumptions, limitations, and decisions to help ensure that the risk analysis results are appropriately interpreted. Table 2 presents project contingencies, which include base cost plus cost and schedule contingencies.

Table 3. Project Contingencies (Base Cost Plus Cost and Schedule Contingencies)

Confidence Level	Project Cost	Contingency ($)	Contingency (%)
P0	$16,800,000	($1,875,000)	-10%
P10	$19,987,000	$1,312,000	7%
P20	$20,625,000	$1,950,000	10%
P30	$21,097,000	$2,422,000	13%
P40	$21,527,000	$2,851,000	15%
P50	$21,934,000	$3,258,000	17%
P60	$22,351,000	$3,676,000	20%
P70	$22,819,000	$4,144,000	22%
P80	$23,386,000	$4,711,000	25%
P90	$24,153,000	$5,477,000	29%
P100	$29,220,000	$10,545,000	56%

Note: Costs include PED and S&A.

The key cost risk drivers identified through sensitivity analysis are:

- Modifications and Claims
- Project Scope Definition
- Estimate Captures full Scope of Project
- Plan Quantities at early Stage of Development

These risks contribute over 87 percent of the statistical cost variance. The costs of modifications on past reaches have varied widely. If the modifications are typical of what has been seen in the past it should not have a significant impact on cost or schedule. However, there have been major modifications in the past that have resulted in significant cost increases (>25%).

The key schedule risk drivers identified through sensitivity analysis are:

- Project Funding Stream
- Modifications and Claims
- USACE taking over design if an A/E can't finish design work
- Permitting issues

These risks contribute close to 88 percent of the statistical schedule variance. The lack of adequate funding could change the project as it moves forward and potentially split the project into smaller contracts and or draw out start of construction due to funding issues. Should significant modifications or claims come up, the project schedule could also be delayed.

8. MITIGATION RECOMMENDATIONS

This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all-inclusive.

Risk Drivers:

1. Cost Risk: The key risk driver of Modifications and Claims is partially within the PDT's scope of influence. Modifications and claims should be minimized as the project scope is further developed during the Plans and Specifications phase. The same can be said for the remaining larger risk items. Monitoring and updates of the Total Project Cost and implementation of risk mitigation strategies should be managed for identified risks as well as new risks that arise. Whereas the developed contingency, itself, is a response to the potential for these risks, these risks warrant consideration of other potential responses and proactive monitoring and control.

2. Schedule Risk: Project Funding is beyond the PDT's influence. Proactive monitoring and development of mitigation strategies can minimize the adverse

schedule effects of these risks. Annual funding received could significantly affect the overall project duration and the PDT must integrate it fully with the anticipated funding profile. Other risks relating to USACE completing the design or permitting issues are unlikely at this stage of the Chicago Shoreline project. The A/E's associated with the project have completed past designs without issue but it can' be completely dismissed at this point. Permitting issues should also be known at this point but are included on the outside chance something unforeseen comes up.

3. Risk Management: Accurate representation of estimates and risks throughout the development of the project is critical, and the risk analysis study and technical review of said estimate is a critical mitigation strategy. Cost Engineering recommends continuous, proactive, and timely updates to the estimate in conjunction with proactive contract placement and phasing planning and execution. It is recommended that the outputs created during the initial risk analysis effort serve as tools in future risk management processes. The risk register should be updated at each major project milestone and estimate update. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings. As an example, recommended uses of the risk register include:

    - Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.

    - Providing project sponsors, stakeholders and leadership/management with a documented framework from which risk status can be reported in the context of project controls.

    - Communicating risk management issues.

    - Providing a mechanism for eliciting risk analysis feedback and project control input.

    - Identifying risk transfer, elimination or mitigation actions required for implementation of risk management plans.

4. Risk Analysis Updates: Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life-cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk's likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

APPENDIX A

DETAILED RISK REGISTER

Risk No.	Risk/Opportunity Event	Concerns	PDT Discussions	Project Cost				Project Schedule			
				Likelihood *	Impact*	Risk Level*		Likelihood *	Impact*	Risk Level*	
Contract Risks (Internal Risk Items are those that are generated, caused, or controlled within the PDT's sphere of influence.)											
	PROJECT & PROGRAM MGMT										
PPM-1	Project Scope definition could change	Due to public pressure the City changes the design to address concerns (all 3 proj)	Based on past project experience this is likely to occur	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
PPM-2	USACE has to assume design responsibility	City hired A/E cannot finish design	Based on past experience with other local sponsors	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	CONTRACT ACQUISITION RISKS										
CA-1	Contracting acquisition undecided	Local Sponsor could send out as SBA and increase the price	PDT feels the PM should address contract risks after this meeting	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

	TECHNICAL RISKS										
TL-1	Design Confidence in Products by A/E	Is USACE confident in the designs/quantities by A/E?	USACE is confident. USACE provides review/comments through out design. A/E is using USACE guide specifications. Risk is typically low.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
TL-2	Sufficiency/condition of borrow/fill sites	Quality of fill, sand, and stone in large quantities	Environmental concerns with sand and fill none with stone. Can mitigate risks by requiring contractor to perform testing before bringing it on job (written in specs)	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	
	LANDS AND DAMAGES RISKS										
LD-1	Utilities locations not marked on current prints	Unknown utilities and or unplanned utility relocations/diversions to existing sites could cause a delay and or add costs.	Previous reaches have encountered some unmarked utilities that required relocation. Additional costs to LS and additional time to relocate may be required. Given location near lake, unmarked	Likely	Negligible	LOW		Likely	Negligible	LOW	

			utilities should not be a major concern. Possibly by Fullerton Theater by the Lake.								
LD-2	All land owned by LS.	No issues anticipated regarding RE.	No issues.	Very Unlikely	Negligible	LOW		Very Unlikely	Negligible	LOW	
	REGULATORY AND ENVIRONMENTAL RISKS										
RE-1	Potential permitting issues with placing large amounts of fill in lake (behind SSP).	Permitting delays could delay start of construction.	Even though the city is performing the work USACE still has to obtain the 401 permit and perform EA's and NEPA. Obtaining these items fall on a agency outside our control.	Unlikely	Negligible	LOW		Unlikely	Significant	MODERATE	
RE-2	Historical/Cultural Site (Prom. Point)	Getting a approved plan approved by the public/SHPO	High level of uncernity of how the proposed design will be acceptedby public/SHPO	Very Likely	Significant	HIGH		Very Likely	Significant	HIGH	
	CONSTRUCTION RISKS										
CON-1	Modifications and or claims on contracts	Claims or modifications could cause the actual contract cost to increase	We know mods will happen, just uncertain of the magnitude. Look at historical data.	Very Likely	Significant	HIGH		Very Likely	Marginal	MODERATE	

CON-2	Discovering grey material	May encounter material that could require removal/remediation.	Encountering grey material would result in higher cost, delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-3	Bed Rock	Bed rock elevation impacting SSP driving,	If top of bedrock varies from plan, differing site condition could result in design changes & delays.	Unlikely	Significant	MODERATE		Unlikely	Significant	MODERATE	
CON-4	weather impacts	temperature too low for concrete placement, storm events washing out fresh concrete	Working along shore may result in delays, rework. Need to include enough weather days in schedule. Schedule impact will be covered under CON-1 Mods and Claims.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	
CON-5	Site access by contractor	Contractor access may be severly limited in Promontory Point decreasing productivity.	Since we are near Field Museum, may be additional requirements by city limiting contractor activity resulting in decreased productivity, longer schedule.	Likely	Negligible	LOW		Likely	Marginal	MODERATE	

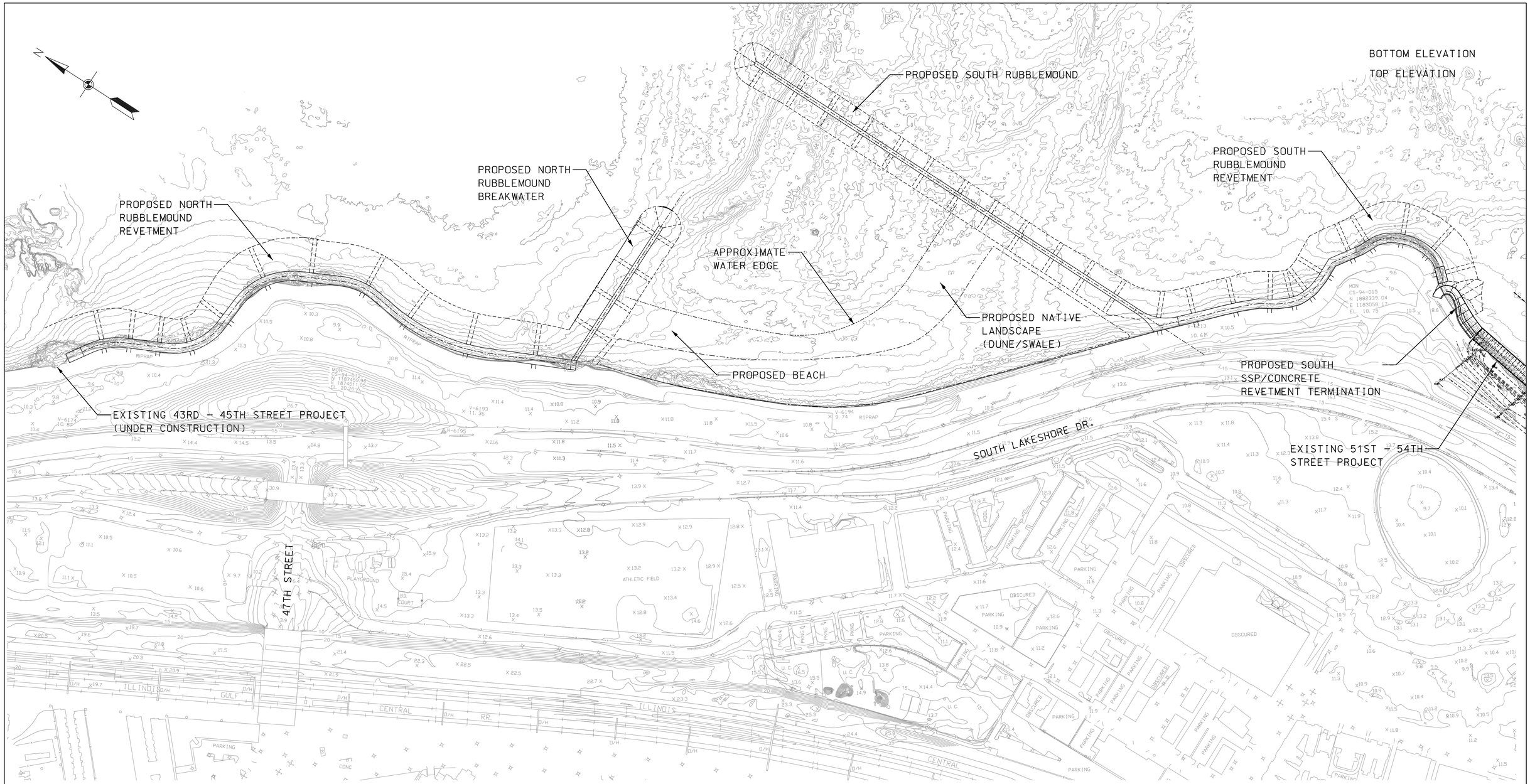
CON-6	Impacts from City Events	City events could delay construction of the remaining projects.	Events such as the air show, festivals, etc. may prevent contractor from timely completion of work. This can be mitigated since most of the events can be determined prior to award and therefore accounted for in the costs. Most events are short term induration.	Likely	Negligible	LOW		Likely	Negligible	LOW	
	ESTIMATE AND SCHEDULE RISKS										
EST-1	Project Development and Estimate Risk	Estimate development based on unit costs may not be reflective of actual costs. Quantities based on 25 to 50% drawings and are not complete	There will be changes to scope and quantity before designs are finalized. Assuming Local Sponsor will want to keep changes to a minimum to limit their costs since this is all Non Fed expenditures.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
EST-2	Plan quantities are at early stage of development.	Quantities may vary once designs are finalized.	Major qtys have been checked. Pile lengths are still TBD. Used adjacent reaches which should get us close.	Unlikely	Significant	MODERATE		Unlikely	Marginal	LOW	

EST-3	Estimates capture full scope for all project features.	Given prelim design, final scope may include additional features that are not currently shown.	Scope may increase causing costs to go up also. Since these are fully LS funded they will try to minimize scope/cost increases.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
	FEATURE LEVEL RISKS										
FL-1	For Promontory Point, local groups may influence final design.	Final design may incorporate more limestone versus concrete resulting in different scope.	Delays in getting local groups to agree to final plan may continue to delay project.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
Programmatic Risks (External Risk Items are those that are generated, caused, or controlled exclusively outside the PDT's sphere of influence.)											
PR-1	Project funding stream	Local Sponsor funding delay contracts or cause major delays or a complete stop to project.	It could be very likely that the City may have funding issues to complete the project by 2018	Likely	Negligible	LOW		Likely	Significant	HIGH	
PR-2	Delay in approval of PACR/LRR	Delay in approval could delay future reaches.	Although not likely to occur, this should be considered as a possibility.	Unlikely	Marginal	LOW		Unlikely	Significant	MODERATE	
PR-3	Fuel Prices	Fluctuations in fuel costs could have a profound impact on the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	
PR-4	Steel Prices	Fluctuations in steel prices could have a profound impact on the sheet pile and H pile costs, which is a significant portion of the project cost.	PDT agrees this could likely occur.	Likely	Marginal	MODERATE		Likely	Negligible	LOW	

PR-5	Stone Prices	Fluctuations in stone prices could have a profound impact on project cost.	PDT agrees this could likely occur. Prices have typically been more stable than for fuel or steel.	Unlikely	Marginal	LOW		Unlikely	Negligible	LOW	
PR-6	Variations of Contract Quantities	Potential quantity variations, particularly overruns, will impact project costs.	Based on prior projects, variations in qtys averaged XX%.	Likely	Marginal	MODERATE		Likely	Marginal	MODERATE	
PR-7	Bidding Climate	Climate may change by time last of these contracts is awarded.	Current climate is favorable to LS (many bidders for each project). This may change a few years out resulting in higher costs.	Unlikely	Marginal	LOW		Unlikely	Marginal	LOW	

7 PROJECT DRAWINGS AND TYPICAL CROSS SECTION

7.1 **Plate 1 – 45th to 51st St - Conceptual Site Layout**
7.2 **Plate 2 – 45th to 51st St - Typical Section**
7.3 **Plate 3 – 45th to 51st St - Profile Along Beach**
7.4 **Plate 4 – 45th to 51st St - Typical Section Rubblemound Breakwater**
7.5 **Plate 5 – 45th to 51st St - Typical Section SSP/Concrete Structure**
7.6 **Plate 6 – Promontory Point (54th to 56th) - Site Plan**
7.7 **Plate 7 – Promontory Point (54th to 56th) - Cross Section**
7.8 **Plate 8 – Fullerton Theater by the Lake - Site Plan**
7.9 **Plate 9 – Fullerton Theater by the Lake - Cross Section A**
7.10 **Plate 10 – Fullerton Theater by the Lake - Cross Section B**
7.11 **Plate 11 – Fullerton Theater by the Lake - Cross Section**
7.12 **Plate 12 – Montrose to Irving - Conceptual Site Plan**



0 300' 600'

SCALE:1"=300'

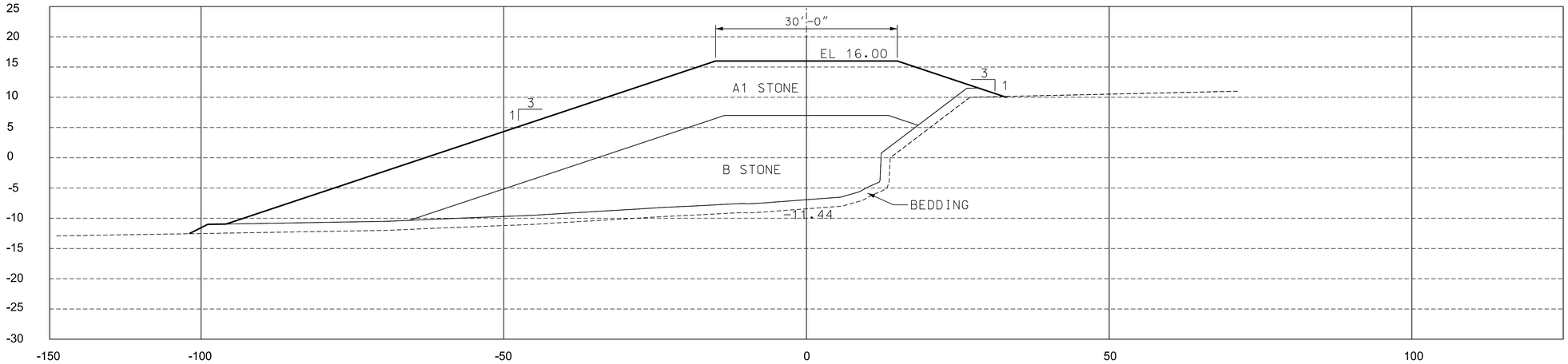
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE 45TH - 51TH STREET CONCEPTUAL PLANS

CONCEPTUAL SITE LAYOUT

SCALE:	DATE:	DRAWING CODE:
1" = 300'	JULY 2012	PLATE 1.DGN

PLATE 01



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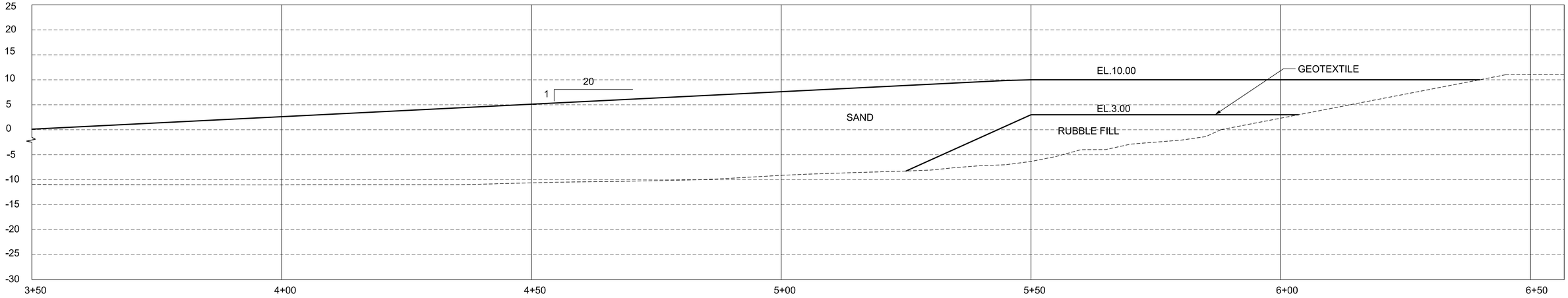
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
45TH – 51TH STREET
CONCEPTUAL PLANS

TYPICAL SECTON ALONG NORTH AND SOUTH RUBBLEMOUND REVETMENT

SCALE:	DATE:	DRAWING CODE:
1" = 20'	JULY 2012	PLATE 2.DGN

PLATE 02



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SCALE:1"=20'

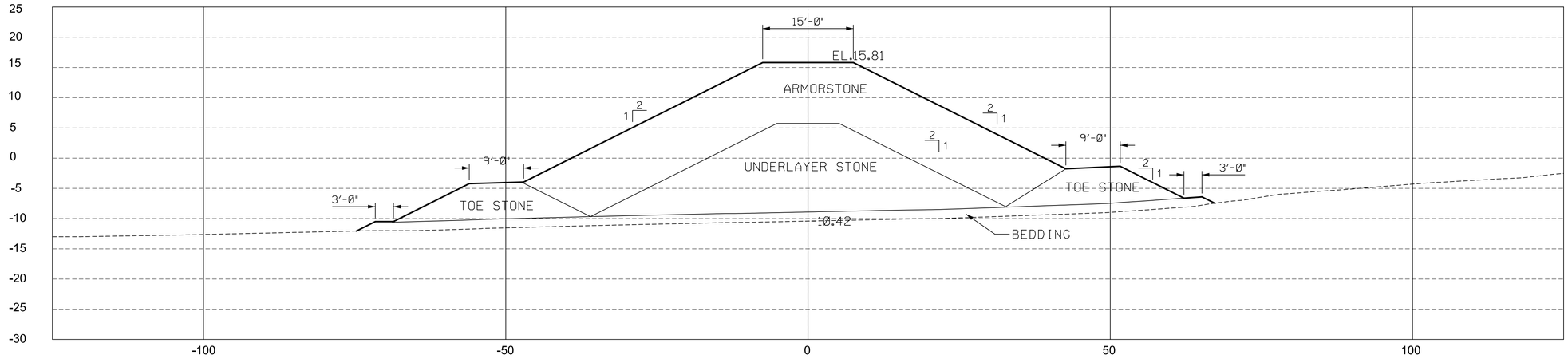
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
45TH – 51TH STREET
CONCEPTUAL PLANS

PROFILE ALONG BEACH

SCALE:	DATE:	DRAWING CODE:
1" = 20'	JULY 2012	PLATE 3.DGN

PLATE 03



0 10' 20' 40'

SCALE:1"=20'

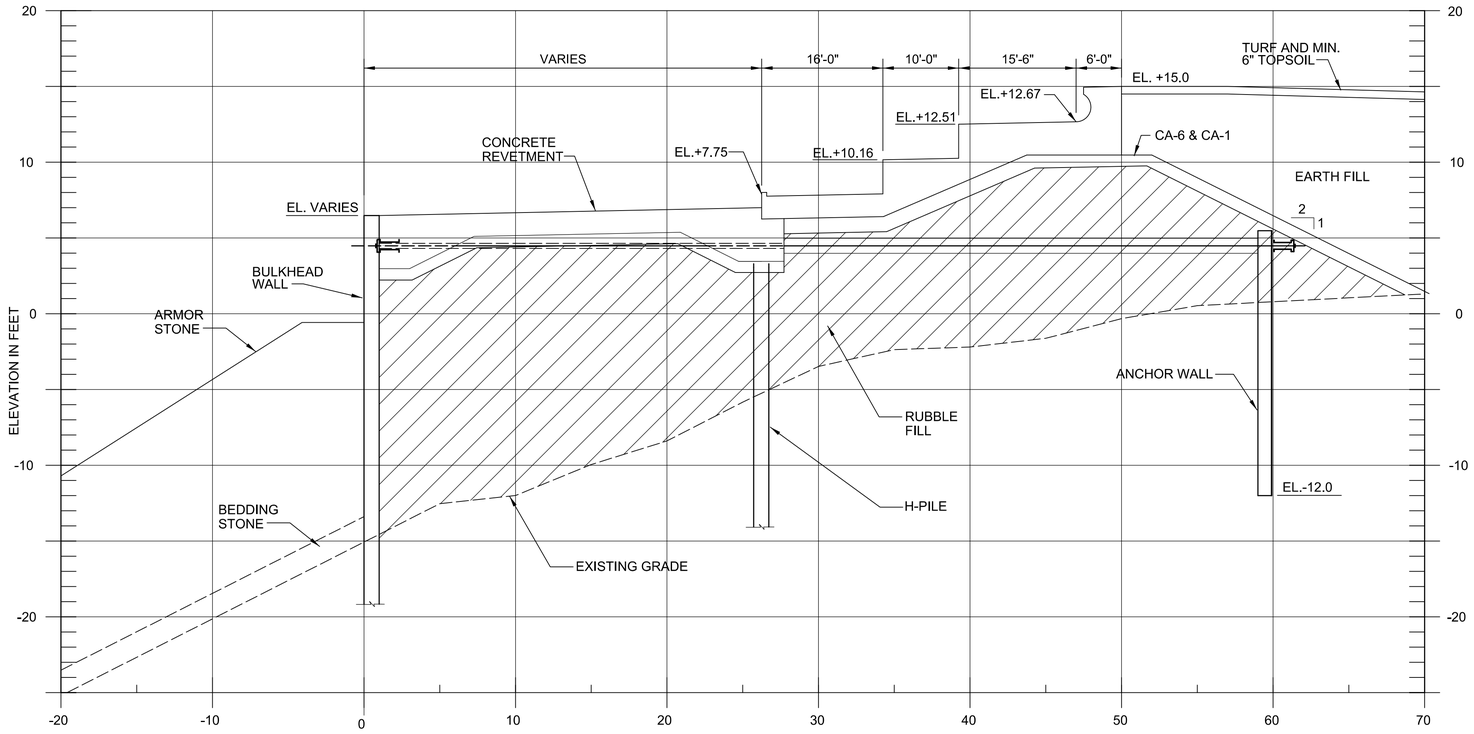
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
45TH – 51TH STREET
CONCEPTUAL PLANS

TYPICAL SECTION ALONG NORTH AND SOUTH RUBBLEMOUND BREAKWATER

SCALE:	DATE:	DRAWING CODE:
1" = 20'	JULY 2012	PLATE 4.DGN

PLATE 04



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SCALE:1"=20'

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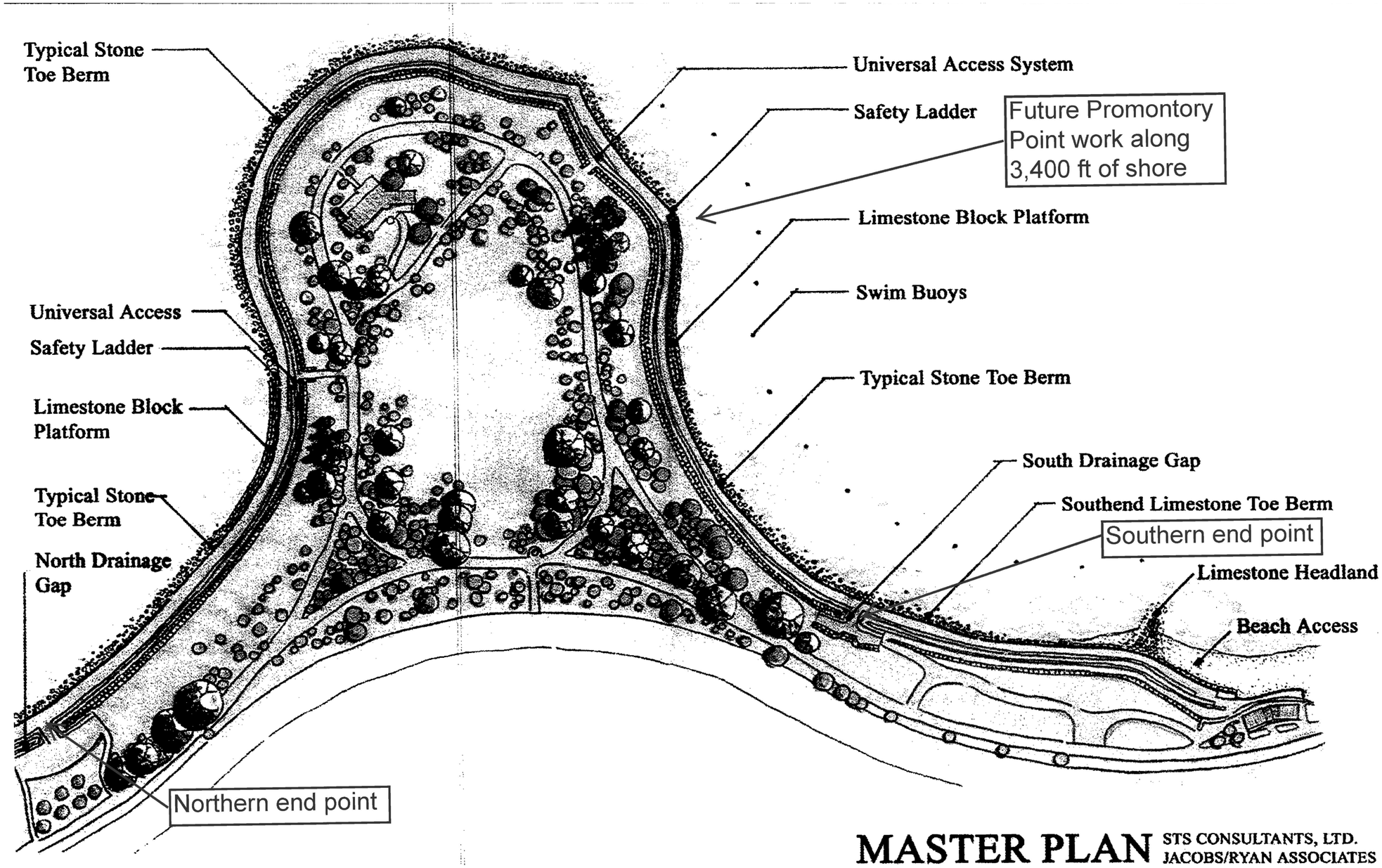
Chicago District

CHICAGO SHORELINE
45TH – 51TH STREET
CONCEPTUAL PLANS

TYPICAL SECTION OF SOUTH SSP/CONCRETE REVETMENT STRUCTURE

SCALE:	DATE:	DRAWING CODE:
1" = 20'	JULY 2012	PLATE 5.DGN

PLATE 05



MASTER PLAN

STS CONSULTANTS, LTD.
JACOBS/RYAN ASSOCIATES

0 10' 20' 40'

SCALE:1"=20'

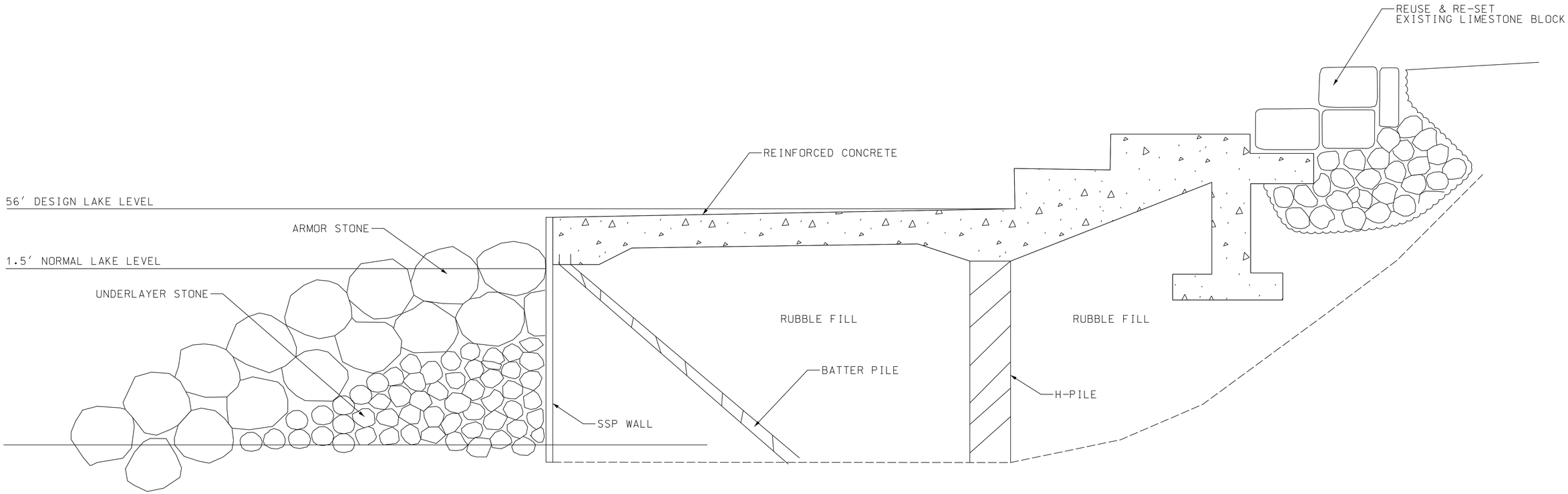
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
54TH – 56TH STREET
CONCEPTUAL PLANS

PROMONTORY POINT
SITE PLAN

SCALE:	DATE:	DRAWING CODE:
1" = 20'	JULY 2012	PLATE 6.DGN

PLATE 06



N.T.S

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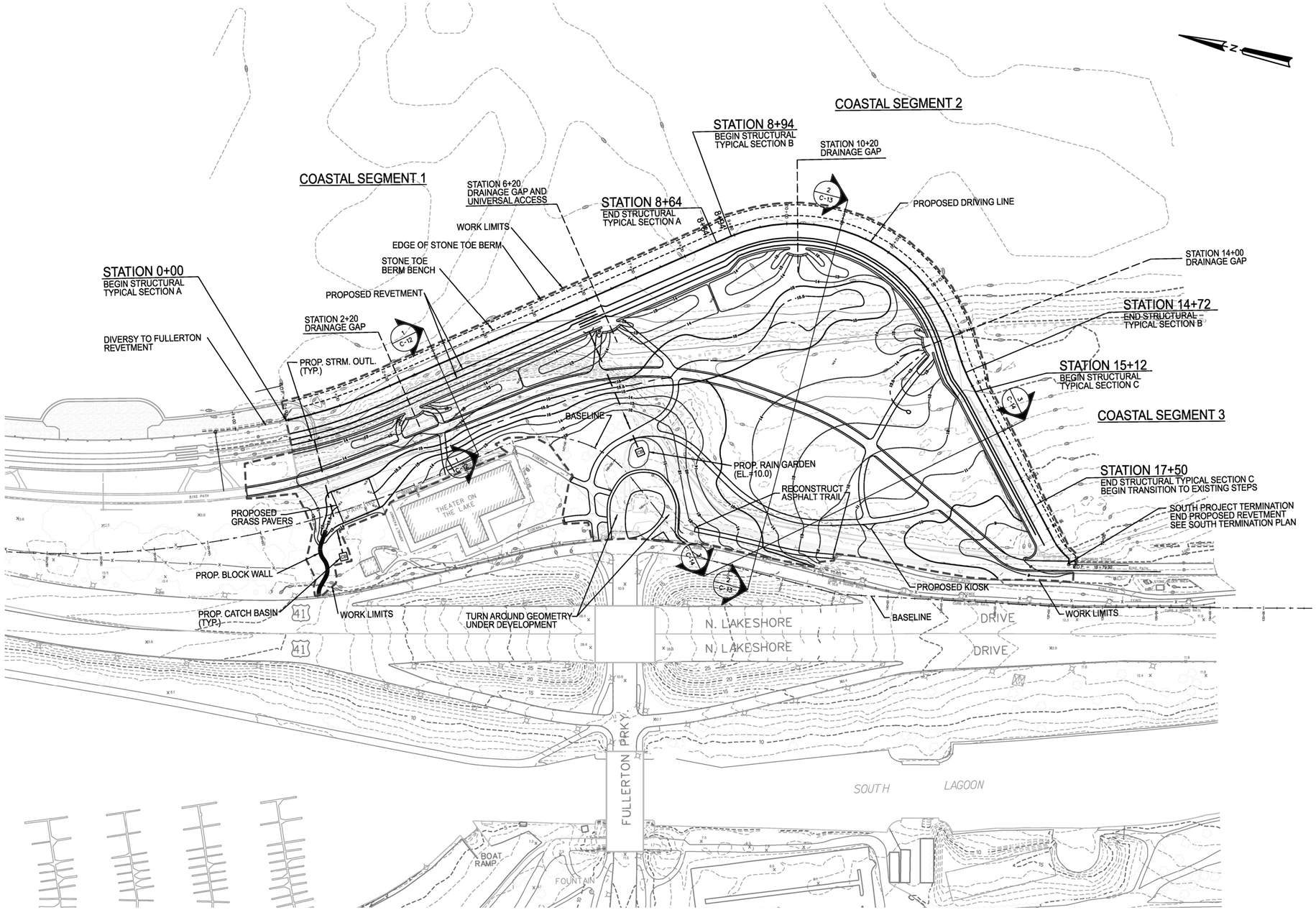
Chicago District

CHICAGO SHORELINE
54TH - 56TH STREET
CONCEPTUAL PLANS

PROMONTORY POINT
CROSS SECTION

SCALE:	DATE:	DRAWING CODE:
N.T.S	JULY 2012	PLATE 7.DGN

PLATE 07



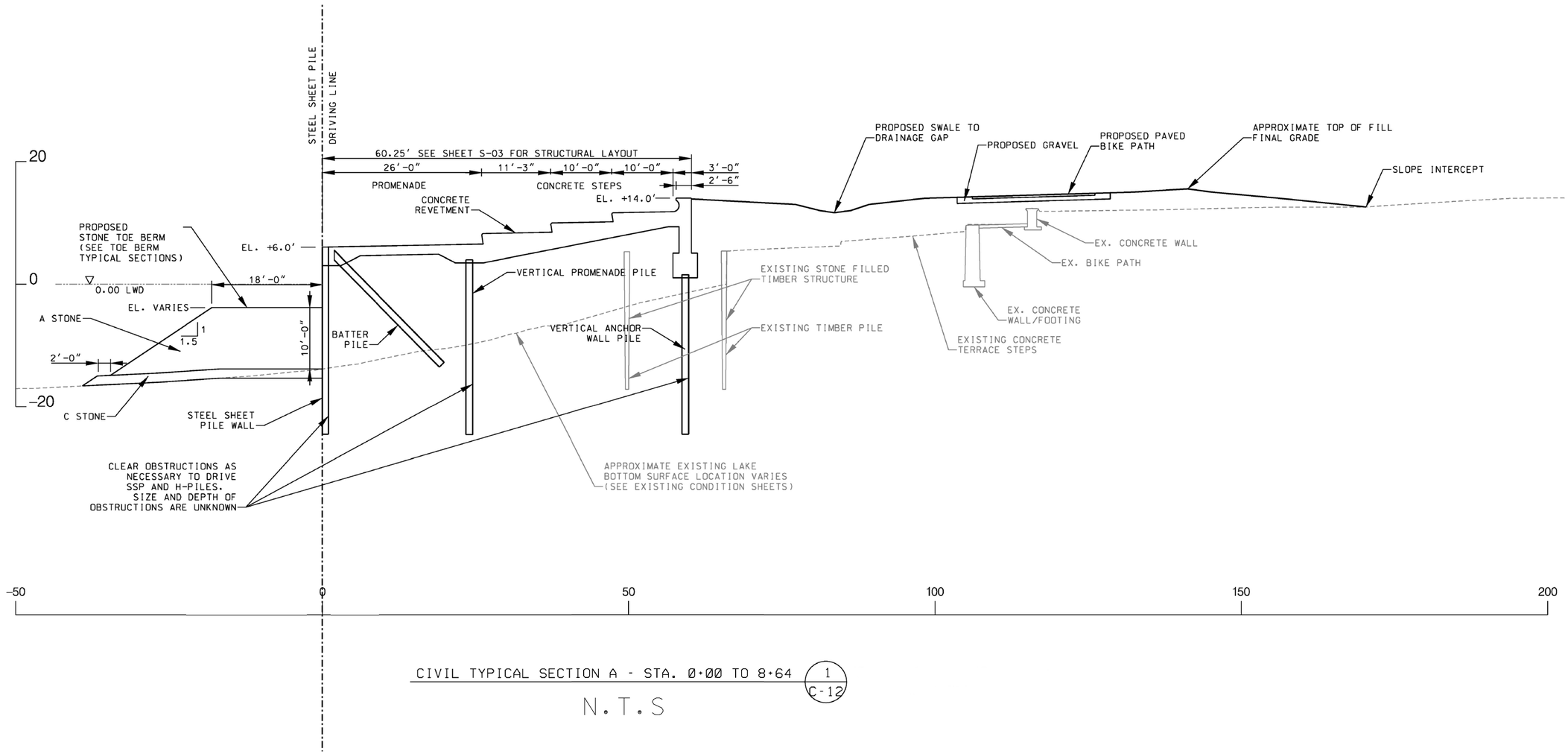
U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
FULLERTON PARKWAY
THEATER ON THE LAKE

OVERALL SITE PLAN

SCALE:	DATE:	DRAWING CODE:
N.T.S	JULY 2012	PLATE 8.DGN

PLATE 08

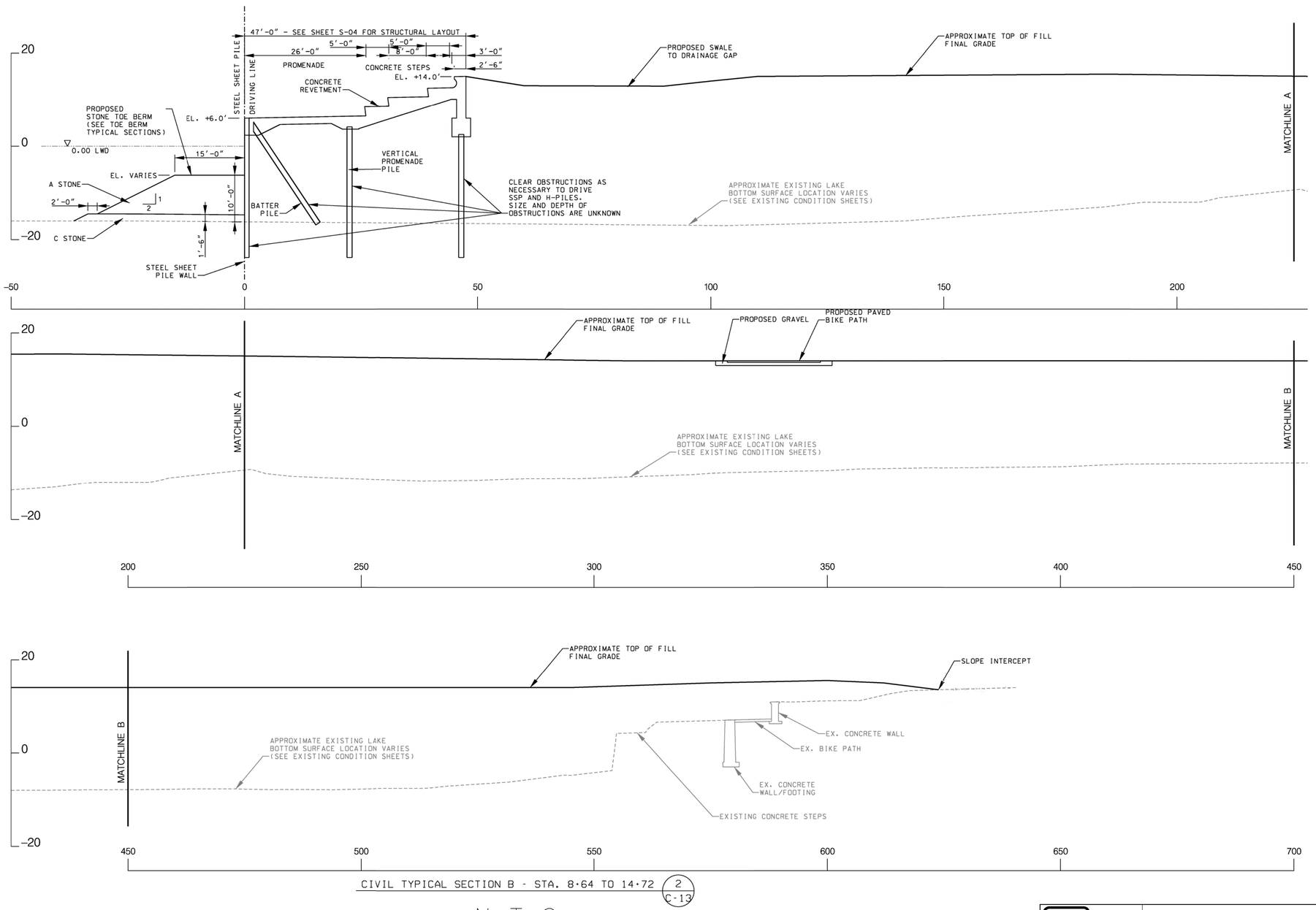


CIVIL TYPICAL SECTION A - STA. 0+00 TO 8+64 (1 / C-12)

N.T.S

U.S. Army Corps of Engineers Chicago District	CHICAGO SHORELINE FULLERTON PARKWAY THEATER ON THE LAKE	
CIVIL TYPICAL SECTION A		
SCALE: N.T.S	DATE: JULY 2012	DRAWING CODE: PLATE 9.DGN

PLATE 09



CIVIL TYPICAL SECTION B - STA. 8+64 TO 14+72 (2 / C-13)

N.T.S

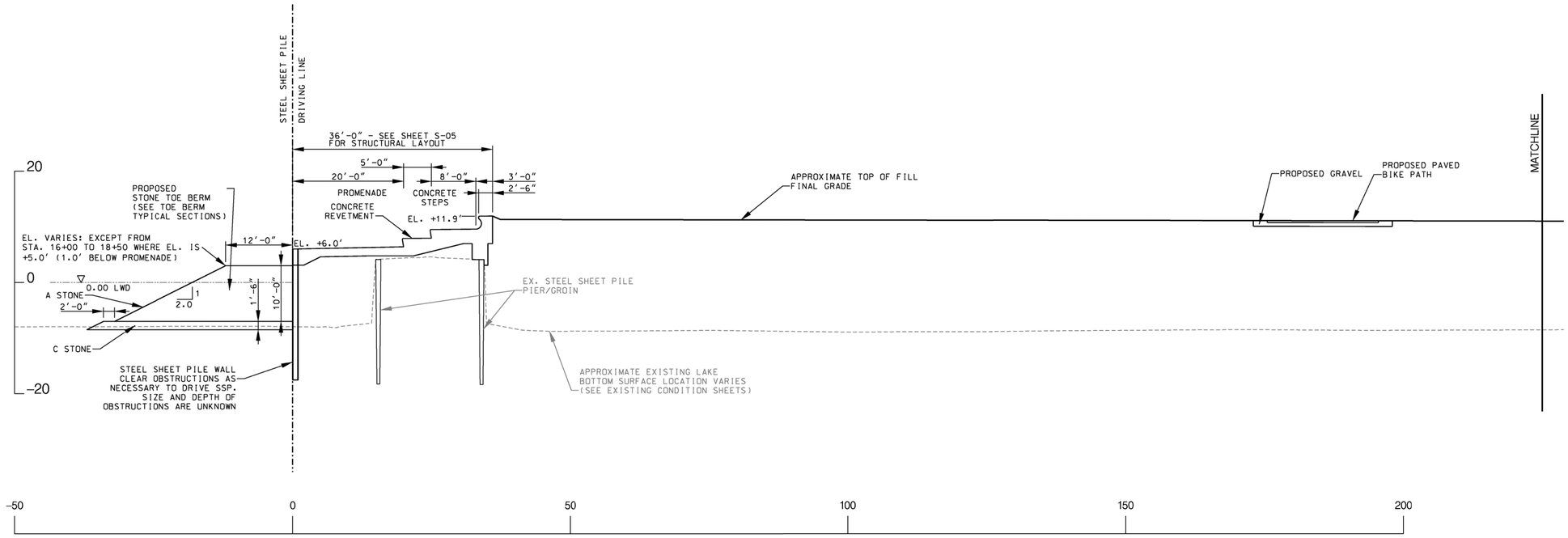
U.S. Army Corps of Engineers
Chicago District

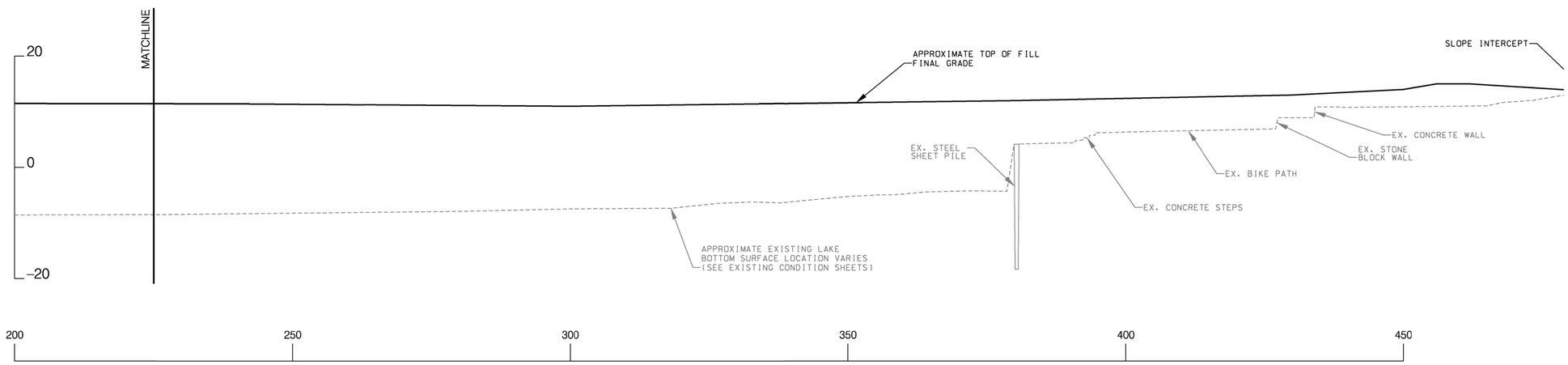
CHICAGO SHORELINE
FULLERTON PARKWAY
THEATER ON THE LAKE

CIVIL TYPICAL SECTION B

SCALE:	DATE:	DRAWING CODE:
N.T.S	JULY 2012	PLATE 10.DGN

PLATE 10





CIVIL TYPICAL SECTION C - STA. 14+72 TO 17+50 (3 / C-14)

N.T.S

U.S. Army Corps of Engineers
Chicago District

CHICAGO SHORELINE
FULLERTON PARKWAY
THEATER ON THE LAKE

CIVIL TYPICAL SECTION

SCALE:	DATE:	DRAWING CODE:
N.T.S	JULY 2012	PLATE 11.DGN

PLATE 11

0 100' 200'

SCALE:1"=100'

U.S. Army Corps
of Engineers
Chicago District

CHICAGO SHORELINE
MONTROSE TO IRVING

CONCEPTUAL SITE PLAN

SCALE:	DATE:	DRAWING CODE:
1" = 100'	JULY 2012	PLATE 12.DGN

PLATE 12

8 IEPR RESPONSE (COMMENT 4) APRIL 2013

Cost estimates for the remaining reaches were based on previously prepared independent government estimates (IGE's), bid abstracts and contract modifications on past projects. The estimates are based on the most likely costs with contingencies applied based on Cost and Schedule Risk Analysis (CSRA) prepared for each reach. One of the factors considered within the CSRA's is the amount of past contract changes. Using USACE's Resident Management System (RMS), the amount of the final contract compared to the award amount was evaluated to determine what typical ranges were encountered. The dollar amount of contract changes varied from -10% (quantity under runs primarily) to as high as 25% (differing site conditions) of the original contract value with an average of 3.3%. This range was used in the development of the cost risk models. Contract modifications were typically one of if not the largest driver of risk and the contingencies for all of the remaining reaches.

The other concern was with the stone prices being affected by availability. The following page is an email discussing the large amounts of stone required. The vendor states that there are no issues with availability for the remaining reaches.

From:	Cunningham, Matthew W LRC
To:	Zaborowski, Kendall LRC; Nguyen, Mike LRC
Cc:	Druzbicki, David E LRC
Subject:	FW: Large Stone Quantites Needed for Future Projects (UNCLASSIFIED)
Date:	Friday, March 15, 2013 2:53:17 PM

Classification: UNCLASSIFIED
Caveats: NONE

All,

Please see my email and the stone supplier's email about the stone. They would have no problem supplying it.

Regards

Matthew W. Cunningham
Civil Engineer - Civil Design (CADD\GIS), Specification, and Cost Section
---
U.S. Army Corps Engineers
111 N Canal St, Suite 600
Chicago, IL 60606-7206
Email: Matthew.W.Cunningham@USACE.Army.Mil
Phone: 312-846-5416

-----Original Message-----
From: M.O. Bohrer [mailto:MBOHRER@michels.us]
Sent: Friday, March 15, 2013 2:27 PM
To: Cunningham, Matthew W LRC
Subject: Re: Large Stone Quantites Needed for Future Projects (UNCLASSIFIED)

Matt thanks for asking. we should have no problem, with 5 granite quarries and a quartzite quarry we could supply all of that stone with hard stone. Between all of those we presently have tens of thousands of tons already on the ground. We also have our Hayton limestone quarry we are presently using to supply over 200,000 tons for your Cat Island project in Green Bay.

In conclusion, we should have no problem supplying all of the stone you need.

Moe Bohrer
AB&J/Michels
Office: 1-920-924-4300 ext.2384
Cell:920-988-3017
Sent from I-Phone

On Mar 15, 2013, at 2:13 PM, "Cunningham, Matthew W LRC"
<Matthew.W.Cunningham@usace.army.mil> wrote:

> Classification: UNCLASSIFIED
> Caveats: NONE
>
> Mr. Bohrer:
>
> In the next few years there could be some Chicago shoreline projects that require a large amount of types A, B, and C stone sizes. The Corps has been asked by project reviewers if these large amounts of stone will still be available from suppliers who we have received price quotes from recently. Here is a summary of the stone that would likely be needed for all the jobs:

>
> 1. Type A stone Needed: 433,000 tons
> 2. Type B Stone Needed: 210,700 tons
> 3. Type C stone Needed: 50,000 tons
>
> I would really appreciate if you could let me know if your company would in fact be able to supply these amounts of stone over the next few years.
>
> Thanks you in advance for your help.
>
> Regards
>
>
> Matthew W. Cunningham
> Civil Engineer - Civil Design (CADD\GIS), Specification, and Cost Section
> ---
> U.S. Army Corps Engineers
> 111 N Canal St, Suite 600
> Chicago, IL 60606-7206
> Email: Matthew.W.Cunningham@USACE.Army.Mil
> Phone: 312-846-5416
>
>
>
> Classification: UNCLASSIFIED
> Caveats: NONE
>
>

Classification: UNCLASSIFIED
Caveats: NONE

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Authorized Cost Increase Computation

Prepared By:

U.S. Army Corps of Engineers
Chicago District

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Column	A	B	C	C - B	D
Project Feature	**Current Congressionally Authorized Cost Estimate * (Oct-96 PL)**	**Authorized Cost Estimate (Oct-12 PL)**	**Recommended Cost Estimate (Oct-12 PL)**	**Cost Change (Oct-12 PL)**	**Recommended Cost Estimate (Fully Funded)**
Lands and Damages	$308,000	$489,000	$124,000	-$365,000	$124,000
Breakwaters/Seawalls	$178,022,000	$282,800,000	$411,340,000	$128,540,000	$424,228,000
Levees and Floodwalls	$0	$0	$507,000	$507,000	$507,000
Beach Replenishment	$2,108,000	$3,349,000	$5,084,000	$1,735,000	$0
PED	$11,321,000	$17,984,000	$80,097,000	$62,113,000	$80,534,000
CM	$12,242,000	$19,447,000	$38,659,000	$19,212,000	$40,556,000
HTRW	$0	$0	$199,000	$199,000	$199,000
Total	$204,000,000	$324,069,000	$536,013,000	$211,944,000	$546,148,000

Escalation Factors	
CWCCIS	CWCCIS
FY97 (10 - Breakwaters)	FY13 (10 - Breakwaters)
499.73	777.83
	1.55650051
FY97 (11 - Levees)	FY13 (11 - Levees)
486.21	799.7
	1.644762551
FY97 (17 - Beach Replenishment)	FY13 (17 - Beach Replenishment)
495.55	813.28
	1.641166381
CPI	CPI
FY97 (Oct 96)	FY13 (Oct 12)
158.8	223.227
	1.405711587
FY97 (Oct 96)	FY13 (Oct 12)
177.9	283.142
	1.591579539

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix D

Cost Increase Details

Prepared By:

U.S. Army Corps of Engineers
Chicago District

April 2013

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The following is an account of the cost increases to the Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line Project by each construction contract for the specific project reaches. Some cost increases for project reaches happened prior to the administration of a construction contract. For example, the 40th - 41st Street Beach original plan was approximately half the size of the constructed project. This design change was a result of a comment received during a public information meeting. Hence, changes to the initial cost estimate may also be explained by changes in scope and design prior to the award of construction contracts, not all of which are captured in this Appendix. Detailed information on the cost increases for each construction contract was not readily available due to the fact that several of the contracts were administered by the local sponsor and some contracts were administered before the RMS system was implemented by USACE. Below is a list of contracts, their associated cost changes from the original contract amount and a brief description of why the cost deviated from the original amount.

Montrose North (+$10,073,950.06)

Modifications to the contract resulted in a net increase of $10,073,950.06.

Modifications to the contract that resulted in cost increases were:

- relocating a box pile wall;
- a partnering conference between the government and contractor was required;
- change in design of the earth anchors;
- additional pile splices;
- compensation to the contractor for costs incurred during a suspension of work;
- changes to the proposed access ramps;
- jetty rehabilitation redesign work;
- adding tooled joints on surfaces of the revetment steps for appearance purposes;
- additional harbor concrete step stone revetment to replace additional failing areas;
- access road turn-around reconfiguration;
- redesign of the north end;
- joint sealant change;
- royko grove relocation;
- additional grab bars at ladder locations;
- royko grove subsoil improvement change;
- seiche cable system change;
- revising the access path;
- repainting warning signs;
- clearing obstructions from the driving line;
- delete topsoil and turf and add a stone block wall;
- provide an additional check survey of the A1 toe stone placed;
- fence relocation;
- increased armor stone quantity variation;
- adding H-pile and sheet pile cut-offs to account for them in the contract cost;
- re-positioning of armor stone;
- and equitable adjustment for additional earth fill hauling performed by the contractor.

Modifications to the contract that resulted in cost decreases were:

- changes to the stone fill contract requirements;
- credit to the government for non-conforming concrete;
- changing proposed stone pathways to concrete pathways;
- changing proposed sod to seed;
- credit to the government for completing the as-built drawings;
- and a reduction in final quantities submitted by the contractor.

Irving Park Road to Belmont Avenue (-$155,128.55)

Modifications to the contract resulted in a net decrease of $155,128.55.

Modifications to the contract that resulted in cost increases were:

- the need for a security guard service;
- a partnering conference between the government and contractor was required;
- revised grade beam design;
- additional length of batter piles;
- replacement of handicap access ramps;
- changes to the wave deflector;
- and changing a proposed concrete sidewalk to a granite stone path.

Modifications to the contract that resulted in cost decreases were:

- deletion of intermediate steps located at 36 locations along the revetment;
- and for a large reduction in final quantities submitted by the contractor.

Belmont to Diversey North (+$1,837,490.49)

Modifications to the contract resulted in a net increase of $1,837,490.49.

Modifications to the contract that resulted in cost increases were:

- installation of additional pile caps,
- a partnering conference between the government and contractor was required;
- variation in estimated quantities;
- additional handling of type A stone;
- additional construction joints in the wave deflector;
- work point drawing changes;
- delay costs for redesign/survey work;
- additional fence fabric;
- installation of a permanent barricade west of the bike path;
- installation of additional grab bar extensions on ladders;
- changes to tree planting schedule;
- storage of art stones;

- installation of an additional stone pathway;
- a revision to the wave deflector at the access ramp;
- changes to the cross section details of the raised toe berm;
- additional repairs to an existing breakwater;
- restoration of the south end of the project site;
- installation of a termination fence at the south end of the project site;
- indirect cost increases associated with the time extension of the contract;
- increased costs for topsoil and earthfill;
- additional maintenance on the fence fabric;
- additional concrete curb cuts;
- installation of an additional swing gate;
- removal of trees damaged by ice;
- equitable adjustment for the delay in obtaining the harbor permit;
- equitable adjustment for overtime;
- equitable adjustment for cutting and re-welding sheet pile;
- and a increase in final quantities submitted by the contractor.

There were no modifications to this contract that resulted in a decrease to the contract value.

Belmont to Diversey South (-$83,155.51)

Modifications to the contract resulted in a net decrease of $83,155.51.

Modifications to the contract that resulted in cost increases were:

- changes to the raised toe berm design;
- equitable adjustment on the form liner mold;
- adding a double check valve on an existing water main;
- installation of a new drinking fountain;
- steel wale connection changes at the north end;
- adding a new gate valve on a water main;
- and the inspection and repair of concrete cracking at the north end connection.

Modifications to the contract that resulted in cost decreases were:

- deleting 125 linear feet of water main;
- a value engineering decision that replaced the use of stone/rubble fill with IDOT CA-1 bedding stone;
- deleting the requirement for tree planting,;
- deleting a new stone pathway;
- and a reduction in final quantities submitted by the contractor.

Belmont Harbor Peninsula

USACE is waiting on cost change information from the City of Chicago.

Diversey Revetment (-$19,013.75)

Modifications to the contract resulted in a net decrease of $19,013.75.

Modifications to the contract that resulted in cost increases were:

- increases in B-stone quantities needed;
- outer harbor sheet pile quantity increases;
- revising the sheet pile connection of the outer harbor;
- relocation of existing art stones;
- additional concrete repairs on an existing pier;
- changes in pile quantities to account for cut-off lengths and splices;
- and the addition of joints at a retaining wall footing.

Modifications to the contract that resulted in cost decreases were:

- reduction of the final quantities of topsoil, sod, sand, stone, geotextile fabric, and earth fill to the actual quantities that were placed;
- deletion of 1,100 linear feet of temporary chain link fencing.

Diversey to Fullerton (+$4,727,607.02)

Modifications to the contract resulted in a net increase of $4,727,607.02.

Modifications to the contract that resulted in cost increases were:

- additional pile testing;
- government's share of partnering session,
- increased rubble fill and battered H-pile quantities,
- additional promenade pile splices,
- winter erosion control,
- concrete joint changes,
- wave deflector redesign,
- modify a portion of the concrete access ramp,
- add 140 linear feet of fence,
- extend waler for 6 linear feet,
- change a proposed path from granite to concrete,
- additional control joints at north end,
- bike path relocation, installation of an additional French drain,
- leaving 80 linear feet of temporary fencing in place,
- compensation of concrete changes (claim settlement),
- compensation of earthfill changes (claim settlement),
- and additional interest on the concrete and earthfill claims.

A contract modification that deleted the planting of proposed trees resulted in a decrease to the contract value of -$145,521.60.

Solidarity Drive

USACE is waiting on cost change information from the City of Chicago.

I-55 to 30th Street (+$3,029,247.74)

This contract was administered by USACE before the RMS computer software was mandated for use. Details on the modifications that were executed are in hard copy form in the archive under the contract number. USACE will have to retrieve the files from the archive in order to document the changes here in this report.

31st Street Beach

USACE is waiting on cost change information from the City of Chicago.

31st to 33rd Street (+$55,611.82)

This contract was administered by USACE before the RMS computer software was mandated for use. Details on the modifications that were executed are in hard copy form in the archive under the contract number. USACE will have to retrieve the files from the archive in order to document the changes here in this report.

33rd to 37th Street (No Increase or Decrease)

This contract was administered by USACE before the RMS computer software was mandated for use. Details on the modifications that were executed are in hard copy form in the archive under the contract number. USACE will have to retrieve the files from the archive in order to document the changes here in this report.

37th to 40th Street (+$433,923.01)

Modifications to the contract resulted in a net increase of $433,923.01.

Modifications to the contract that resulted in cost increases were:

- construction of an alternate access road;
- relocation of 146 linear feet of security fence at the site entrance;
- installation of new concrete control joints in the wave deflector;

- installation of ladder grab bars at all ladder locations;
- installation 36.5 linear feet of 24-inch reinforced concrete pipe;
- construction of an additional stone parking lot;
- replacement of an existing bike path;
- revision to the existing stone pathway;
- revision to contract quantities for additional materials needed;
- and additional local sponsor requests for changes to the bike path.

Modifications to the contract that resulted in cost decreases were:

- using stockpiled material from the 33rd to 37th St Project as earth fill on this project;
- a value engineering decision regarding the specified stone for the job;
- deletion of a proposed storm drainage system extension;
- and a reduction in final quantities submitted by the contractor.

40th to 41st Street (+$341,035.52)

Modifications to the contract resulted in a net increase of $341,035.52.

Modifications to the contract that resulted in cost increases were:

- relocation of a bike path;
- installing a project information sign;
- relocation of a parking lot electrical feed;
- tree replacement;
- delay costs due to a Presidential visit;
- construction of an additional access road;
- removal and disposal of a buried foundation;
- additional stone toe protection at the north terminus of the revetment;
- installation of a snow fence around the bio-retention area;
- revision of the north revetment bench;
- a change in ground cover type;
- additional traffic striping;
- plant species changes;
- and removing an existing gravel parking lot that was restored with topsoil and sod.

Modifications to the contract that resulted in cost decreases were:

- two value engineering decisions for an alternate wale design on the north and south sheet pile walls;
- deletion of a proposed water line;
- deletion of proposed plantings;
- and a reduction in final quantities submitted by the contractor.

41st to 43rd Street (-$747,986.59)

Modifications to the contract resulted in a net decrease of $747,986.59.

Modifications to the contract that resulted in cost increases were:

- the need to import 9,000 tons of stone fill;
- a partnering conference between the government and contractor was required;
- and adjustments to final restoration activities on site.

Modifications to the contract that resulted in cost decreases were:

- the government furnished steel sheet pile and H-piles in lieu of contractor furnished;
- the local sponsor requested changes that resulted in cost savings;
- and a reduction in final quantities submitted by the contractor.

43rd to 45th Street – Active Construction Job (+/-$TBD)

USACE is awaiting cost change information from the City of Chicago.

51st to 54th Street

USACE is waiting on cost change information from the City of Chicago.

56th to 57th Street

USACE is waiting on cost change information from the City of Chicago.

South Water Purification Plant

USACE is waiting on cost change information from the City of Chicago.

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix E

Computation of FY13 902 Limit

Prepared By:

U.S. Army Corps of Engineers
Chicago District

April 2013

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Determining the Section 902 Limit

Section 902 of the Water Resources Development Act (WRDA) of 1986 defines the maximum amount that a project may cost. This is often called the 902 Limit or Project Cost Cap. It is, “The maximum project cost limit imposed by Section 902 is a numerical value specified by law which must be computed in a legal manner (ER 1105-2-100, Appendix G).”

The maximum project cost includes the authorized cost (adjusted for inflation), the current cost of any studies, modifications, and action authorized by WRDA 86 or any later law, and 20 percent of the authorized cost (without adjustment for inflation). The cost of modifications required by law is to be kept separate and added to other allowable costs. These three components equal the maximum project cost allowed by section 902.

The total project cost is the cost of all work associated with preconstruction engineering and design and construction, including real estate and appropriate credit provisions of Section 104 of the WRDA of 1986. The project was authorized at a cost of $204,000,000 in the Section 101, WRDA 96, Public Law 104-303.

The authorized cost may be increased from the price level in the authorizing document to include inflation. The construction component of the authorized cost will be updated to account for historical inflation using the Civil Works Construction Cost Index System (EM 1110-2-1304).

The real estate component of the authorized cost will be updated to account for historical inflation based on changes to the Consumer Price Index, specifically, the unadjusted percentage changes reflected under the "Rent, residential" expenditure category.

The maximum project cost limit imposed by Section 902 is a numerical value specified by law which was computed in a legally supportable manner. It is not an estimate of the current cost of the project. The limit on project cost was computed including an allowance for inflation through the construction period and adding an additional 20 percent.

The total betterments for the Chicago Shoreline project are $10,360,451. This represents the sunk cost for three betterment projects spanning three project reaches over a period of time. The Betterment Calculation Table depicts the distribution of betterments and the price level change. The 2012 Price level for the betterments is $13,011,000.

Betterment Calculation Table

Projects	Reach	Date Started	Date Completed	Date Reach Completed	Months (Segment start to Reach Complete)	Betterment Cost ($1,000)	Index (CWCCIS)	Betterment Cost ($1,000) 2012 PL
Water Filtration Plant	5	1/1/1997	1/1/1998	1/1/1998	12	$0	1.48	$0
Belmont Harbor	2	1/1/1998	1/1/1999	1/1/2016	219	$562	1.45	$818
31st Street Beach	4	1/1/1998	1/1/1999	1/1/2018	244	$562	1.45	$818
31st - 33rd Street	4	1/1/1998	1/1/1999	1/1/2018	244	$562	1.45	$818
Solidarity Drive	3	1/1/1998	1/1/1999	1/1/1999	12	$562	1.45	$818
I-55 to 30th Street	4	1/1/1999	1/1/2000	1/1/2018	231	$562	1.43	$803
Irving to Belmont	2	1/1/1999	1/1/2002	1/1/2016	207	$305	1.39	$424
33rd to 37th Street	4	1/1/1999	1/1/2002	1/1/2018	231	$305	1.39	$424
56th to 57th Street	4	1/1/2001	1/1/2002	1/1/2018	207	$305	1.39	$424
41st to 43rd Street	4	1/1/2001	1/1/2003	1/1/2018	207	$305	1.34	$408
51st to 54th Street	4	1/1/2002	1/1/2003	1/1/2018	195	$305	1.34	$408
Belmont to Diversey North	2	1/1/2002	1/1/2004	1/1/2016	170	$305	1.31	$399
37th to 40th Street	4	1/1/2002	1/1/2004	1/1/2018	195	$305	1.31	$399
Montrose North	2	1/1/2000	1/1/2005	1/1/2016	195	$0	1.24	$0
Diversey to Fullerton	2	1/1/2002	1/1/2005	1/1/2016	170	$0	1.24	$0
40th to 41st Street	4	1/1/2005	1/1/2008	1/1/2018	158	$5,416	1.12	$6,049
Belmont to Diversey South	2	1/1/2006	1/1/2008	1/1/2016	122	$0	1.12	$0
Diversey Revetment	2	1/1/2008	1/1/2010	1/1/2016	97	$0	1.05	$0
43rd to 45th Street	4	1/1/2011	1/1/2013	1/1/2018	85	$0	1.00	$0
Montrose to Irving	2	1/1/2011	1/1/2015	1/1/2016	61	$0	1.00	$0
Fullerton/Theater on the Lake	2	1/1/2010	1/1/2016	1/1/2016	73	$0	1.00	$0
45th to 51st Street	4	1/1/2012	1/1/2017	1/1/2018	73	$0	1.00	$0
54th to 56th Street	4	1/1/2013	1/1/2018	1/1/2018	61	$0	1.00	$0
PACR	NA	1/1/2010	3/1/2013	NA	NA	$0	1.00	NA
Total For Revetment						$10,360		$13,011
Total For Breakwater						$0		$0

Section 902 Limit Certified Worksheet Tool

Using the Section 902 Limit Tool that was certified by HQUSACE in November 2010, the following tables as described in ER 1105-2-100 Appendix G were developed to determine the project's current 902 limit. The following tables shown were generated output from the certified tool. Table G-1 shows the methodology used to calculate the annual inflation factors associated with the construction component of the project. Table G-2 shows the methodology use to calculate the annual inflation factors associated with the real estate component of the project. Table G-3 shows the methodology used to escalate the authorized cost to current price levels based on the current estimated project schedule which includes actual obligations to date. Table G-4 illustrates the methodology used to calculate the new Section 902 maximum limit for the Little Calumet River Local Flood Control and Recreation Project. A project cost increase fact sheet is provided including information from Table G-5 that shows implementation status at the time estimated total costs exceed the 902 Limit.

Input Data for 902 Limit Tool

Project Name:	**Chicago Shoreline**
Date Prepared:	**3/6/2013**
Total Authorized Cost:	$204,000
Authorized Cost for Construction	$204,000
Authorized Cost for Real Estate	$0
Date of Authorized Price Level:	10/1/1995
First Year of Expenditure:	10/1/1996
Current Cost Estimate (At Current price level):	$521,050
Current Cost for Construction (Construction Portion of Current Cost):	$521,050
Current Cost for Real Estate (Real Estate Portion of Current Cost):	$0
Current Fully Funded Cost Estimate (Inflated thru mid-point of Construction):	$531,184
Date of Current Price Level:	10/1/2012
Costs of modifications specified by Law	$0
Project Purpose:	10 - BREAKWATER & SEAWA
Date of EM 1110-2-1304 Used	9/30/2012
Type of CWCCIS Used	Quarterly Purpose
Date of Real Estate Index Used	10-Jan-12
Type of Real Estate Index Used	CUURA207SEHA,CUUSA207SEHA

INDEX INPUTS

Fiscal Year	CWCCIS Index	Rent-Residential Index
FY 96	486.300	172.300
FY 97	497.410	177.900
FY 98	508.280	185.600
FY 99	515.930	192.600
FY 00	526.040	199.100
FY 01	533.000	207.900
FY 02	539.670	218.800
FY 03	560.300	224.400
FY 04	572.430	231.900
FY 05	603.210	237.800
FY 06	633.850	242.400
FY 07	654.970	249.300
FY 08	672.170	260.058
FY 09	704.840	266.778
FY 10	714.390	270.564
FY 11	730.490	272.291
FY 12	757.760	277.672
FY 13	772.520	283.142

EXPENDITURE INPUTS

Fiscal Year	Construction Expenditures	Real Estate Expenditures
FY 97	$5,252.84	$0.00
FY 98	$19,044.96	$0.00
FY 99	$21,370.80	$0.00
FY 00	$25,221.88	$0.00
FY 01	$25,631.76	$0.00
FY 02	$44,449.42	$0.00
FY 03	$35,394.13	$0.00
FY 04	$29,609.59	$0.00
FY 05	$11,234.60	$0.00
FY 06	$8,905.98	$0.00
FY 07	$12,562.58	$0.00
FY 08	$11,115.82	$0.00
FY 09	$9,463.63	$0.00
FY 10	$2,256.49	$0.00
FY 11	$9,173.96	$0.00
FY 12	$9,144.79	$0.00

Table G-1 (ER 1105-2-100 Appendix G)									
CWCCIS Index(s)									
				Index	Yearly Inflat Rate	Cumul Inflat Rate	Cumul rate to Begin FY	One Half rate of Infl FY	Tot Allow Inflat for FY
Item		(b)	(c)	(d)	(e)	(f)	(h)	(i)	(j)
Date of Price Level			10/1/1995						
Authorized Estimate			204,000	486.300		1.00			
First Fiscal year			FY 96		0.02		1.00	1.01	1.01
1st Qtr, 2nd yr		FY 97		497.410		1.02			
Second Fiscal year			FY 97		0.02		1.02	1.01	1.03
1st Qtr, 3rd yr		FY 98		508.280		1.05			
Third Fiscal year			FY 98		0.02		1.05	1.01	1.05
1st Qtr, 4th yr		FY 99		515.930		1.06			
Fourth Fiscal year			FY 99		0.02		1.06	1.01	1.07
1st Qtr, 5th yr		FY 00		526.040		1.08			
Fifth Fiscal year			FY 00		0.01		1.08	1.01	1.09
1st Qtr, 6th yr		FY 01		533.000		1.10			
Sixth Fiscal year			FY 01		0.01		1.10	1.01	1.10
1st Qtr, 7th yr		FY 02		539.670		1.11			
Seventh Fiscal year			FY 02		0.04		1.11	1.02	1.13
1st Qtr, 8th yr		FY 03		560.300		1.15			
Eighth Fiscal year			FY 03		0.02		1.15	1.01	1.16
1st Qtr, 9th yr		FY 04		572.430		1.18			
Nineth Fiscal year			FY 04		0.05		1.18	1.03	1.21
1st Qtr, 10th yr		FY 05		603.210		1.24			
Tenth Fiscal year			FY 05		0.05		1.24	1.03	1.27
1st Qtr, 11th yr		FY 06		633.850		1.30			
Eleventh Fiscal year			FY 06		0.03		1.30	1.02	1.33
1st Qtr, 12th yr		FY 07		654.970		1.35			
Twelfth Fiscal year			FY 07		0.03		1.35	1.01	1.36
1st Qtr, 13th yr		FY 08		672.170		1.38			
Thirteenth Fiscal year			FY 08		0.05		1.38	1.02	1.42
1st Qtr, 14th yr		FY 09		704.840		1.45			
Fourteenth Fiscal year			FY 09		0.01		1.45	1.01	1.46
1st Qtr, 15th yr		FY 10		714.390		1.47			
Fifteenth Fiscal year			FY 10		0.02		1.47	1.01	1.49
1st Qtr, 16th yr		FY 11		730.490		1.50			
Sixteenth Fiscal year			FY 11		0.04		1.50	1.02	1.53
1st Qtr, 17th yr		FY 12		757.760		1.56			
Seventeenth Fiscal year			FY 12		0.02		1.56	1.01	1.57
1st Qtr, 18th yr		FY 13		772.520		1.59			

INDEX SOURCE: EM 1110-2-1304, 30 Sep 2011
b. Date of the authorized cost and the beginning date of following fiscal years.
c. These entries are the fiscal years.
d. These are the index numbers from the referenced publications and must all be expressed with the same base year.
e. This column equals the index at the beginning of the next year, divided by the index at the beginning of the year, minus one.
f. The cumulative inflation rate equals the index (column (d)) at the beginning of the year divided by the index of the first line of the table.
g. The allowed inflation rate equals the cumulative rate through the beginning of the FY (equals one for the first FY after project authorization) times one plus 1/2 of the rate of inflation through the beginning of the FY. For the remaining balance, it equals the cumulative rate to the beginning of the next fiscal year.
h. These are the cumulative rates through the beginning of the FY. They are the amounts in column (f) one-half line above.
i. This is one plus 1/2 the rate of inflation during the fiscal year, 1 + 1/2 x column (e)
j. The total inflation is the product of the last two entries.
k. The inflation rate for the remaining balance is the last entry in column (f).

Table G-2 (ER 1105-2-100 Appendix G)									
CPI Index(s)									
				Index	Yearly Inflat Rate	Cumul Inflat Rate	Cumul rate to Begin FY	One Half rate of Infl FY	Tot Allow Inflat for FY
Item		(b)	(c)	(d)	(e)	(f)	(h)	(i)	(j)
Date of Price Level			10/1/1995						
Authorized Estimate			0	172.300		1.00			
First Fiscal year			FY 96		0.03		1.00	1.02	1.02
1st Qtr, 2nd yr		FY 97		177.900		1.03			
Second Fiscal year			FY 97		0.04		1.03	1.02	1.05
1st Qtr, 3rd yr		FY 98		185.600		1.08			
Third Fiscal year			FY 98		0.04		1.08	1.02	1.10
1st Qtr, 4th yr		FY 99		192.600		1.12			
Fourth Fiscal year			FY 99		0.03		1.12	1.02	1.14
1st Qtr, 5th yr		FY 00		199.100		1.16			
Fifth Fiscal year			FY 00		0.04		1.16	1.02	1.18
1st Qtr, 6th yr		FY 01		207.900		1.21			
Sixth Fiscal year			FY 01		0.05		1.21	1.03	1.24
1st Qtr, 7th yr		FY 02		218.800		1.27			
Seventh Fiscal year			FY 02		0.03		1.27	1.01	1.29
1st Qtr, 8th yr		FY 03		224.400		1.30			
Eighth Fiscal year			FY 03		0.03		1.30	1.02	1.32
1st Qtr, 9th yr		FY 04		231.900		1.35			
Nineth Fiscal year			FY 04		0.03		1.35	1.01	1.36
1st Qtr, 10th yr		FY 05		237.800		1.38			
Tenth Fiscal year			FY 05		0.02		1.38	1.01	1.39
1st Qtr, 11th yr		FY 06		242.400		1.41			
Eleventh Fiscal year			FY 06		0.03		1.41	1.01	1.43
1st Qtr, 12th yr		FY 07		249.300		1.45			
Twelfth Fiscal year			FY 07		0.04		1.45	1.02	1.48
1st Qtr, 13th yr		FY 08		260.058		1.51			
Thirteenth Fiscal year			FY 08		0.03		1.51	1.01	1.53
1st Qtr, 14th yr		FY 09		266.778		1.55			
Fourteenth Fiscal year			FY 09		0.01		1.55	1.01	1.56
1st Qtr, 15th yr		FY 10		270.564		1.57			
Fifteenth Fiscal year			FY 10		0.01		1.57	1.00	1.58
1st Qtr, 16th yr		FY 11		272.291		1.58			
Sixteenth Fiscal year			FY 11		0.02		1.58	1.01	1.60
1st Qtr, 17th yr		FY 12		277.672		1.61			
Seventeenth Fiscal year			FY 12		0.02		1.61	1.01	1.63
1st Qtr, 18th yr		FY 13		283.142		1.64			

INDEX SOURCE: Consumer Price Index for All Urban Consumers: Selected Areas, U.S. Department of Labor, Bureau of Labor Statistics, (BLS). Percentage change reflected under the "Rent, residential" category for Chicago Metropolitan Area was used.
b. Date of the authorized cost and the beginning date of following fiscal years.
c. These entries are the fiscal years.
d. These are the index numbers from the referenced publications and must all be expressed with the same base year.
e. This column equals the index at the beginning of the next year, divided by the index at the beginning of the year, minus one.
f. The cumulative inflation rate equals the index (column (d)) at the beginning of the year divided by the index of the first line of the table.
g. The allowed inflation rate equals the cumulative rate through the beginning of the FY (equals one for the first FY after project authorization) times one plus 1/2 of the rate of inflation through the beginning of the FY. For the remaining balance, it equals the cumulative rate to the beginning of the next fiscal year.
h. These are the cumulative rates through the beginning of the FY. They are the amounts in column (f) one-half line above.
i. This is one plus 1/2 the rate of inflation during the fiscal year, 1 + 1/2 x column (e)
j. The total inflation is the product of the last two entries.
k. The inflation rate for the remaining balance is the last entry in column (f).

Table G-3 (ER 1105-2-100 Appendix G)

Authorized Cost Increase Computation

FY	Current Project Cost			Current Sched (%)		Authorized Cost Sched			Auth Cost Inflat	
	Total	Constr	R.E.	Constr	R.E.	Constr	R.E.		Constr	R.E.
	(a)	(b)	(c)	(d)	(e)	(f)	(g)		(h)	(i)
FY 97	$5,252.84	$5,252.84	$0	1.008	0.00	$2,056.58	$0.00		$2,126.55	$0.00
FY 98	$19,044.96	$19,044.96	$0	3.655	0.00	$7,456.43	$0.00		$7,852.10	$0.00
FY 99	$21,370.80	$21,370.80	$0	4.101	0.00	$8,367.03	$0.00		$8,963.81	$0.00
FY 00	$25,221.88	$25,221.88	$0	4.841	0.00	$9,874.80	$0.00		$10,752.42	$0.00
FY 01	$25,631.76	$25,631.76	$0	4.919	0.00	$10,035.27	$0.00		$11,067.79	$0.00
FY 02	$44,449.42	$44,449.42	$0	8.531	0.00	$17,402.71	$0.00		$19,681.74	$0.00
FY 03	$35,394.13	$35,394.13	$0	6.793	0.00	$13,857.41	$0.00		$16,138.91	$0.00
FY 04	$29,609.59	$29,609.59	$0	5.683	0.00	$11,592.66	$0.00		$14,012.75	$0.00
FY 05	$11,234.60	$11,234.60	$0	2.156	0.00	$4,398.54	$0.00		$5,594.55	$0.00
FY 06	$8,905.98	$8,905.98	$0	1.709	0.00	$3,486.84	$0.00		$4,620.52	$0.00
FY 07	$12,562.58	$12,562.58	$0	2.411	0.00	$4,918.47	$0.00		$6,711.38	$0.00
FY 08	$11,116	$11,116	$0	2.133	0.00	$4,352	$0		$6,161.63	$0.00
FY 09	$9,464	$9,464	$0	1.816	0.00	$3,705	$0		$5,406.64	$0.00
FY 10	$2,256	$2,256	$0	0.433	0.00	$883	$0		$1,312.45	$0.00
FY 11	$9,174	$9,174	$0	1.761	0.00	$3,592	$0		$5,496.03	$0.00
FY 12	$9,145	$9,145	$0	1.755	0.00	$3,580	$0		$5,633.28	$0.00
Balance to complete	$241,217	$241,217	$0	46.294	0.00	$94,440	$0		$150,025	$0
Total	$521,050	$521,050	$0	100.00	0.00	$204,000	$0		$281,558	$0

a. The total of column (a) is the current working estimate of project cost at the current price level, less the cost of any modifications required by law. The entries for all years from authorization to the current year are the actual obligations made that year. The balance to complete is the remaining cost at current price levels.
b. Column (b) is the construction component of the cost in column (a).
c. Column (c) is the real estate component of column (a). Column (b) plus column (c) must equal column (a).
d. Column (d) is the percent distribution of the construction cost in column (b). It must total 100 percent.
e. Column (e) is the percent distribution of the real estate cost in column (c). It must total 100 percent.
f. The total of column (f) is the construction component of the authorized cost, from the authorizing legislation. The yearly entries are the distribution of the total by the percentage distributions in column (d).
g. The total of column (g) is the real estate component of the authorized cost. The yearly entries are the distribution of the total by the percentage distributions in column (e). The total of column (f) and the total of column (g) must equal the cost in the authorizing legislation.
h. The entries in column (h) are the amounts in column (f) increased by the appropriate inflation factor which is derived from the Corps of Engineers CWCCIS index. Table G-1 would contain a computation of appropriate construction inflation factors .
i. The entries in column (i) are the amounts in column (g) increased by the appropriate real estate inflation factor, which is derived from the CPI index. Table G-2 would contain a computation of the appropriate real estate inflation factors.

Table G-4 (ER 1105-2-100 Appendix G)		
MAXIMUM COST INCLUDING INFLATION THROUGH CONSTRUCTION		
FY 12 - **Thousands Dollars (000's)**		
Line 1		
a.	Current Project estimate at current price levels:	$521,050
b.	Current project estimate, inflated through construction:	$531,184
c.	Ratio: Line 1b / line 1a	1.0194
d.	Authorized cost at current price levels:	$281,558
	(Column (h) plus (i) from table G-3)	
e.	Authorized cost, inflated through construction:	$287,034
	(Line c x Line d)	
Line 2	Cost of modifications required by law:	$0
Line 3	20 percent of authorized cost:	$40,800
	.20 x (table G-3, columns (f) + (g)	
Line 4	Maximum cost limited by section 902:	$327,834
	Line 1e + line 2 + line 3	

Notes:
a. Line 1a is the current project cost estimate.
b. Line 1b requires the current project cost estimate including inflation through the construction period ($546,148,000). Betterments of $13,011,000, current price level, were subtracted from this total to arrive at the $533,137,000. This is required each year by the annual budget guidance EC. This cost estimate will be developed by the appropriate cost engineering element. The ratio of this inflated project estimate to the current project estimate is used to inflate the totals of column (h) and (i) from Table G-1 to determine the authorized cost including inflation through the construction period.
c. Line 1c is the ratio of the current estimate including inflation through construction to the current estimate.
d. Line 1d is the authorized cost at current prices. It is the total of columns (h) and (i) from Table G-1.
e. Line 1e is the authorized cost including inflation through construction. It is computed as the authorized cost at current price levels times the ratio on line 1c.
f. Line 2 is the cost of any modifications required by law. This is the total cost and includes actual obligations and future obligations including inflation through construction.
g. Line 3 is 20 percent of the cost specified in the authorizing legislation. The authorized cost is the total of columns (f) and (g) in Table G-8.1.
h. Line 4 is the maximum project cost, including inflation through the construction period, allowed by Section 902. It is the total of lines 1e, 2, and 3.

PROJECT COST INCREASE FACT SHEET
(ER 1105-2-100 Appendix G Exhibit G-11)

1. Name of Project: Illinois Shoreline Erosion, Interim III, Wilmette to Illinois/Indiana State Line (Chicago Shoreline)

2. Section and Law That Authorized or Modified the Project:
Water Resources Development Act of 1996, October 1996

3. Section 902 Limit on Project Cost:

a.	Authorized Project Cost: (1 Oct 1996 Price Level):	$204,000,000
b.	Price level increases from date of authorized cost*****:	$83,034,000
c.	Current cost of modifications required by law******:	$0
d.	20% of line 3a:	$40,800,000
e.	Maximum project cost limited by Section 902:	$327,834,000

4. Current Project Cost Including Inflation Through Construction:

a.	Sunk Cost from FY92 to FY96	$1,953,000
b.	Sunk Cost from FY97 to FY12	$290,194,000
c.	Future Construction Cost	$243,867,000
d.	Total Authorized Project (4b and 4c)	$534,061,000
e.	Betterment at 2012 Price Level	$13,011,000
f.	Current cost estimate (4d – 4e)	$521,050,000
g.	Current Fully Funded Cost Estimate	$546,148,000
h.	Current Fully Funded Estimate Less Betterments (4g – 4e – 4a)	$531,184,000

5. Computation of Percentage Increase:

a.	Current estimate: (Line 4h)	$531,184,000
b.	Less total of lines 3a, b and c:	$287,034,000
c.	Subtotal:	$244,150,000
d.	Percentage increase: (Line 5c/3a)	122.37%

* Line 1e from Table G-4, less the authorized cost.
** This includes cost of external credit under Section 104 of WRDA `86, for example. (Integral Section 104 credit is included in the authorized project cost on line 3a.) (See ER 1165-2-29).

6. Explain cost indices used in 3b; whether national or regional for real estate, and single state or two state average for construction:
Construction cost were updated for historical inflation by applying composite index listed in Table A-1, Quarterly Cost Indexes by CWBS Feature Code of EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS) 30 Sep 2012. The real estate component of the authorized cost was updated to account for historical inflation based on changes to the Consumer Price Index as published monthly by the U.S. Department of Labor, Bureau of Labor Statistics, (BLS). Because this project was located in a metropolitan area specifically identified in Table 17 of the BLS publication (Consumer Price Index for All Urban Consumers: Selected Areas), the percentage change reflected under the "Rent, residential" category will be the appropriate index.

7. Explain increases in 3c; Legislation requiring the modification, and how accommodated.
N/A

8. Explain reasons for cost changes other that inflation:
The majority of the cost increases to the Chicago Shoreline Project are a result of the changes to the Locally Preferred Plan. The projected NED costs (which is the basis for the cost sharing agreement with the local sponsor) has not seen significant price changes since the start of the project. The NED plan for all project reaches was clearly defined in the original authorizing documentation and the design has remained relatively unchanged throughout the life of the project. The NED plan cost estimate has remained relatively unchanged since project authorization. Due to many design changes to the LPP on a reach by reach basis the overall project cost has risen.

9. Explain any changes in benefits and provide current BCR.
The Chicago District has submitted a PACR as a Limited Reevaluation Report performed a limited economic analysis on project benefits and costs. The BCR at the Federal Discount Rate of 3.75% is 7.04. The RBRCR at the Federal Discount Rate of 3.75% is 14.4. Changes in project benefits can be attributed, but are not limited to: a rise in average daily traffic on Lakeshore Drive and the depreciated replacement value of the shoreline structures and facilities.

10. Provide detailed explanation of the status of the project.
From Table G-5 (ER 1105-2-100, Appendix G), the Chicago Shoreline Project has three PCAs with multiple contracts, and has one or more contracts awarded with future contracts, the project status is such that LRC is continuing implementation of the project until the award of the next contract will require funds in excess of the 902 limit. LRC is in the process of submitting a PACR that will support legislation to permit the authorization committees to consider inclusion of the legislative proposal in an authorizing document in time to prevent a break in project implementation.

Table G- 5 Section 902 Cost Limitation Action Matrix

IMPLEMENTATION STATUS AT TIME ESTIMATED TOTAL COSTS EXCEED SEC 902 LIMIT

	PRIOR TO EXECUTION OF THE PCA	*PCA EXECUTED, BUT NO CONTRACTS AWARDED*	*ONE OR MORE CONTRACTS AWARDED, FUTURE CONTRACTS/FUTURE PCA's*	*UNDER CONSTRUCTION LAST CONTRACT*
1. PROJECTS THAT HAVE ONE PCA, AND ONE CONTRACT	*1/*	*1/*	*N.A.*	*3/*
2. PROJECTS THAT HAVE ONE PCA, AND MULTIPLE CONTRACTS	*1/*	*1/*	*2/*	*3/*
3. PROJECTS THAT HAVE MULTIPLE PCAs AND MULTIPLE CONTRACTS	*1/*	*1/*	*2/*	*3/*

1. Await new legislation before proceeding with executing the PCA or award of the first contract if a PCA has already been approved.
2. Continue implementation of the project until implementation of the next PCA increment (or award of the next contract when the last PCA increment is already under construction) would require funds in excess of the 902 limit. Submit legislation to permit the authorization committees to consider inclusion of the legislative proposal in a biennial WRDA in time to prevent a break in project implementation whenever possible.
3. If completion of the current contract(s) would require funds in excess of the 902 limit, conclude current contract activities in the most practical and cost effective manner consistent with public safety and to minimize any obligations that exceed the 902 limit.

ILLINOIS SHORELINE EROSION, INTERIM III
WILMETTE TO ILLINOIS/INDIANA STATE LINE
(CHICAGO SHORELINE)
POST AUTHORIZATION CHANGE REPORT

Appendix F

NEPA History

Prepared By:

U.S. Army Corps of Engineers
Chicago District

April 2013

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The first National Environmental Policy Act (NEPA) documents for the Illinois Shoreline Erosion, Interim III Wilmette to Illinois/Indiana State Line (Chicago Shoreline) Project was an Environmental Assessment (EA) with a signed Finding of No Significant Impact (FONSI) from July 1993 that accompanied the April 14, 1994 Chief's Report. Since then, there have been several supplemental EAs for the project, conducted on an as needed basis for various construction segments of the project. For example, the EA for Belmont – Diversey South was done in large part to address the cultural issue of existing art stones along the shoreline. Other EAs, such as 40th – 41st Street and the ongoing Montrose to Irving Park were done to update coordination of Historic Structures that may be affected by a project with the Illinois Historic Preservation Agency. The next expected NEPA documents for the project are associated with the Montrose to Irving Park Road and Fullerton/Theater on the Lake construction reaches. Below is a listing of all associated NEPA documents to the Chicago Shoreline Project.

Chicago Shoreline
Associated NEPA Documents

- First Environmental Assessment (EA) and unsigned Finding Of No Significant Impact (FONSI) released December 1992;
- Illinois Shoreline Erosion, Interim III EA 1993 "Final" EA, July 1993, FONSI signed 2 July 1993
- EA 31st-33rd Streets, FONSI signed 2 July 1993
- EA Reach 5 (South Water Purification Plant) FONSI signed 26 March 1996
- EA 51st Street to 54th Street, FONSI signed 9 August 1999
- EA 54th-57th Street (Promontory Point); FONSI draft dated September 2001 unsigned due to public opposition. This resulted in the 2007 WRDA legislation requiring a Third Party Review of this Construction Segment.
- EA 37th - 40th Streets, signed FONSI on 22 January 2003
- EA 40th - 41st Streets FONSI signed 3 June 2005
- EA Belmont – Diversey - South, FONSI signed 11 September 2006
- EA 43rd - 45th Streets FONSI signed 8 March 2007
- EA for Fullerton/Theater on the Lake (in draft stage)
- EA for Montrose to Irving Park (in draft stage)