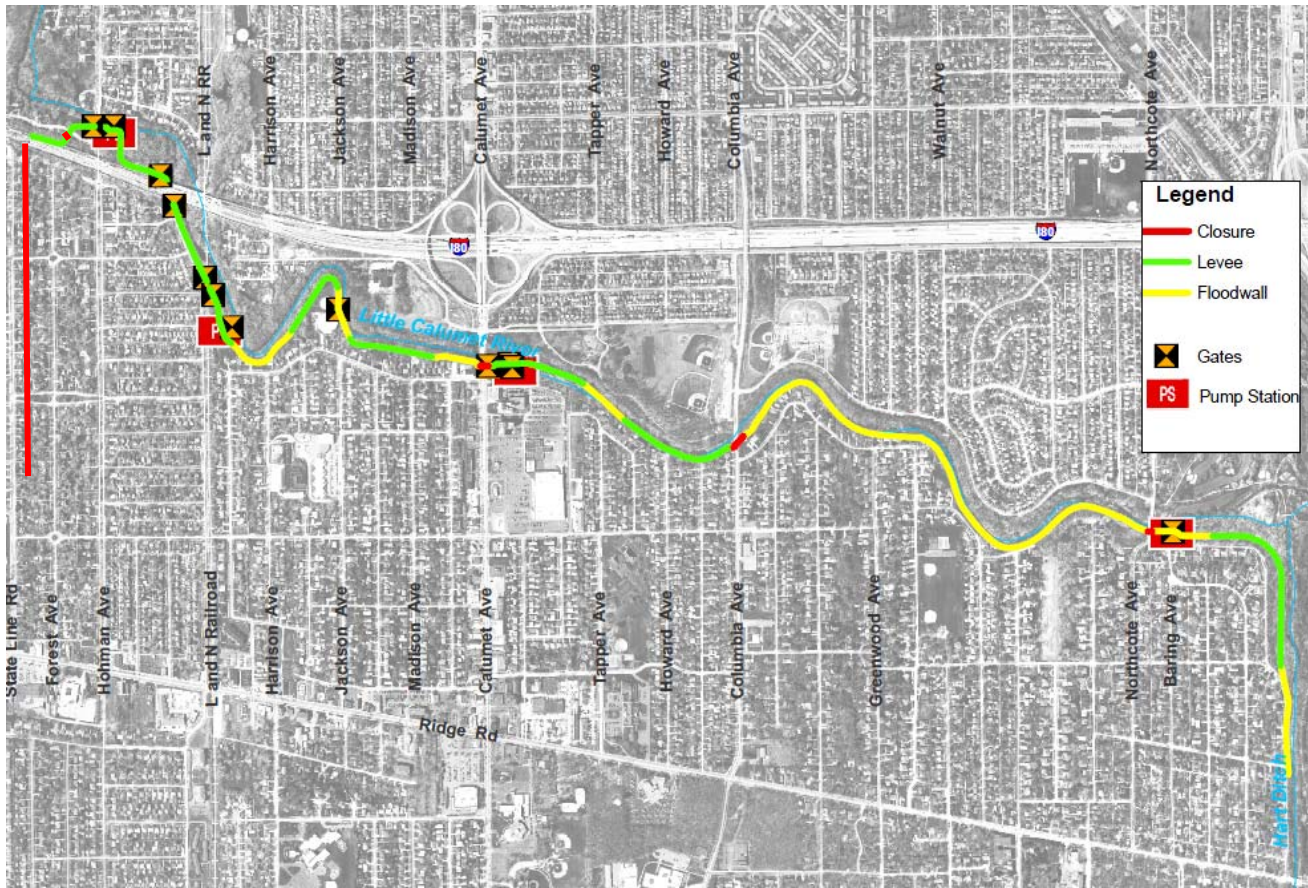




U.S. Army Corps
of Engineers
Chicago District

MUNSTER LEVEE MUNSTER, INDIANA

OPERATION & MAINTENANCE MANUAL



25 February 2011

Prepared For:

Little Calumet River Basin Development Commission
900 Ridge Road, Suite H
Munster, Indiana 46321

Prepared By:

U.S. Army Corps of Engineers, Chicago District
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MUNSTER LEVEE

LOCATION

RIVER: LITTLE CALUMET RIVER
CITY: MUNSTER
STATE: INDIANA

SIDE OF RIVER: SOUTH BANK
WEST END: INDIANA-ILLINOIS BORDER
EAST END: HART DITCH

PUBLIC SPONSOR:

LITTLE CALUMET RIVER BASIN DEVELOPMENT COMMISSION (LCRBDC)
900 RIDGE ROAD, SUITE H
MUNSTER, INDIANA 46321
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LOCAL EMERGENCY CONTACTS

MUNSTER PUBLIC WORKS (219) 836-6970
MUNSTER PUBLIC INFO. OFFICER (219) 836-6999
MUNSTER POLICE DEPARTMENT (219) 836-6600

PROJECT DETAILS

LINE OF PROTECTION ELEVATION: Varies 601.0 to 604.8 NGVD29
LENGTH OF LEVEE (ft): 5,407
LENGTH OF FLOODWALL (ft): 11,175
GATE STRUCTURES: 11
PUMP STATIONS: 4
 -HOHMAN-MUNSTER (63.2 cfs, 28,400)
 -OUTLOT A (241 cfs, 108,000 gpm)
 -CALUMET AVENUE (615 cfs, 276,000 gpm)
 -BARING AVENUE (49 cfs, 22,000 gpm)
STREET CLOSURES: 5
 -STATE LINE (?)
 -RIVER ROAD (599.5 NGVD)
 -CALUMET AVENUE (599.6 NGVD)
 -COLUMBIA AVENUE (597.6 NGVD)
 -NORTHCOTE AVENUE (598.5 NGVD)
OVERFLOW SECTION: 1
 -STATE LINE (SOUTH)
PROTECTED AREA (acres): 559

**MUNSTER LEVEE SEGMENT
MUNSTER, INDIANA
OPERATION & MAINTENANCE MANUAL**

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**MUNSTER LEVEE SEGMENT
MUNSTER, INDIANA
OPERATION & MAINTENANCE MANUAL**

SECTION 1. GENERAL

PURPOSE OF MANUAL

1. The purpose of the Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) Manual is to provide the Little Calumet River Basin Development Commission (LCRBDC), identified as the Project Sponsor, with a document which summarizes the basic design criteria, and presents the requirements for operations and maintenance of the Munster Levee Segment. This information is presented in order to allow the Project Sponsor to understand the design concepts involved and prevent possible damages from occurring through proper operations and maintenance activities, thereby protecting the investment made by the Project Sponsor and the U. S. Army Corps of Engineers (Chicago District). The Project Sponsor is responsible for the operation, maintenance repair, replacement, and rehabilitation of the overall project as indicated in the Project Cooperation Agreement. This manual is in accordance with the U.S. Army Corps of Engineers', ER 1110-2-401, 'Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors', 30 September 1994.
2. This manual covers only a portion of the Little Calumet Levees. The segment addressed in this manual is located within the Town of Munster, Indiana. The entire project is discussed in some portions of the manual to allow for a full understanding of the project.
3. This Manual may be updated as needed by the Little Calumet River Basin Development Commission or by the Chicago District to account for project modifications, changed conditions, or if warranted to correct conditions discovered during inspections. Such updating will be performed in agreement between the Project Sponsor and the Chicago District.
4. Once construction of project segments (Stage Phases) has been completed, the COE will transfer ownership of these segments to the LCRBDC, the project Local Sponsor. The LCRBDC will, thereafter, be responsible for inspecting, operating, maintaining, repairing, and rehabilitating the project facilities in accordance with regulations or directions prescribed by the COE and the State of Indiana Dam and Levee Statute 14-27-7.

LITTLE CALUMET RIVER, INDIANA FLOOD CONTROL AND RECREATION PROJECT

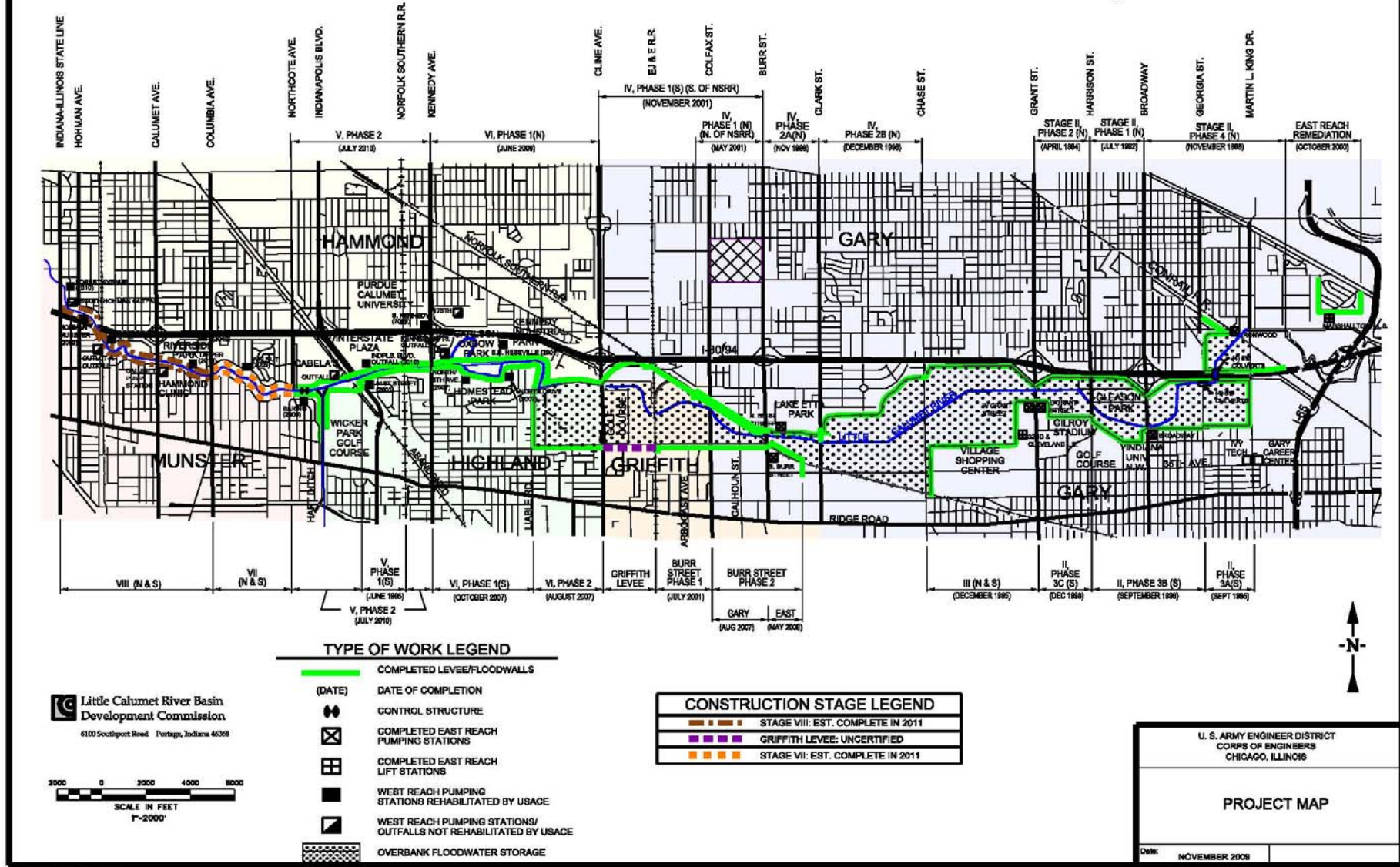


Figure 1: Map showing the locations of Overall Little Calumet River, Indiana Local Flood Protection and Recreation Project

PROJECT DESCRIPTION

5. Levees and floodwalls were constructed on both sides of the Little Calumet River to provide flood protection for the communities of Highland, Griffith, Hammond, Gary, and Munster. In addition, the project provides flood protection to a portion of the vital I-80/94 transportation corridor and provides recreation facilities to the communities shown in Figure 1.

6. The line-of-protection for the section of the Little Calumet River Local Flood Protection and Recreation Project in the Town of Munster includes 4,442 feet of riverbank levees, 965 feet of setback levees, 11,175 feet of I-wall, 4 pumping stations, 4 closure structures, 1 overflow section and interior flood control features. Other features of the flood control system consist of mitigation features, bridge/culvert replacements, and utility remediation/relocations. Design memorandums are available for review at the LCRBDC and COE, Chicago District offices.

SECTION 2. AUTHORIZATION

7. The Little Calumet River, East Reach Remediation project was authorized for construction by Section 401 of the 1986 Water Resource Development Act (P.L. 99-662), which reads as follows:

“THE PROJECT FOR FLOOD CONTROL, LITTLE CALUMET RIVER, INDIANA: IN ACCORDANCE WITH PLAN 3A CONTAINED IN THE REPORT OF THE CHIEF OF ENGINEERS, DATED JULY 2, 1984, PROVIDED THAT ALL OF THE FEATURES OF THE PLAN 3A AS RECOMMENDED BY AND DESCRIBED IN THE REPORT OF THE DISTRICT ENGINEER ARE INCLUDED, AT A TOTAL COST OF \$87,100,000, WITH AN ESTIMATED FIRST FEDERAL COST OF \$65,300,000 AND AN ESTIMATE FIRST NON-FEDERAL COST OF \$21,800,000.”

SECTION 3. LOCATION

8. The Little Calumet River Local Flood Protection and Recreation Project spans five cities and towns in northwestern Indiana: Highland, Griffith, Hammond, Gary, and Munster. The project extends from the I-80/94 and I-65 interchange at the east end to the Indiana-Illinois State border at the west end. The Munster, Indiana reach of the flood control project extends along the south side of the Little Calumet River west from Hart Ditch to the Indiana-Illinois state border. See Figure 1 for a vicinity map and Plate 1 for a project map.

SECTION 4. PERTINENT INFORMATION

ELEVATION CONVERSION

9. Some of the elevation data is given in NAVD88 and some is in NGVD29. For a rough conversion between the two systems for the area along the Little Calumet River Local Flood Protection and Recreation Project, subtract 0.4 feet from the NGVD elevation to get the NAVD elevation.

HISTORICAL FLOODS

10. The Little Calumet River Basin, located in Lake and Porter Counties in northwestern Indiana and Cook and Will Counties in Illinois, presents a complex hydrologic and hydraulic situation. The flooding problem along the Little Calumet River in Lake County is considered among the most critical in the State of Indiana. Floods occur almost every year and last from a few days to several weeks. Such floods may result from either heavy rainfall or rapid snowmelt. However, historically, most of the recorded winter floods were rainfall storms. Snowmelt runoff therefore, has not been a significant factor in the floods of record of the Little Calumet River Basin in Indiana. Some of the more severe floods occurred in March 1908, March 1944, April 1947, March 1948, October 1954, July 1957, April 1959, December 1966, June 1968, August 1968, May 1970, May 1974, June 1981, September 2006, August 2007 and September 2008. During the October 1954 storm, a new record 48-hour rainfall amount of 6.72 inches was set. The Crete, Illinois station reported a 24-hour rainfall of 7.29 inches on 10 October, 1954. This exceeded the 100-year frequency point rainfall (Weather Bureau Rainfall Frequency Atlas, 1961 (T.P. 40)). The Little Calumet River Basin rainfall for the period of 9-11 October, 1954 varied from a minimum of 3.5 inches to a maximum of 8.0 inches. The recent September 2008 event produced 8.12 inches of precipitation in 48 hours as recorded at the Burr Street gage, breaking this record.

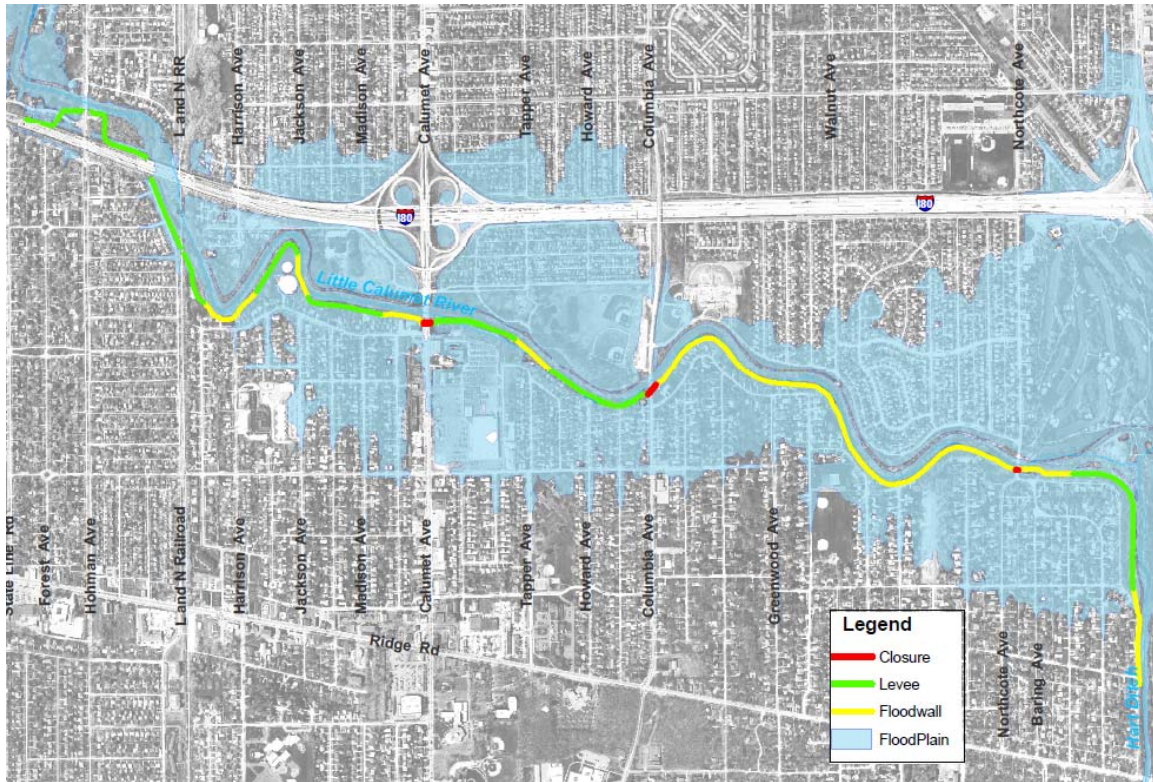


Figure 2. 100 Year Floodplain along the Little Calumet River near the Munster Levee

11. The July 1957 storm set a new 6- and 24-hour rainfall records for Chicago, with 5.5 inches falling in a 6-hour period and 6.24 inches in twelve and one-quarter hours. The Little Calumet River basin rainfall for the period of 12-13 July, 1957 varied from a minimum of 2.0 inches to a maximum of 7.0 inches. In June 1981, four inches of rain fell over much of the Little Calumet Basin in three days. The 1981 storm recurrence is estimated to be a 40-year flood event. Extensive property damage to agricultural areas and homes resulted from the flooding. The August 2007 flood event was estimated to be a 45-year event.

12. In September of 2006 and 2008, major flooding along the Little Calumet River occurred. The 2006 event had a rainfall intensity of about 5.4 inches in 3 hours based on USGS gages at Dyer and Taft. This rate is just over the 500-year event which caused heavy flooding in Highland and Griffith. The Little Calumet River at the Burr Street River Gage reached a level of 596.6 ft NGVD (about 1 foot below 100-year level). The 2008 flood was estimated to be a 200-year flood event. The river gage at Burr Street recorded a water level of 599.48 ft NGVD. Damage was caused throughout the system, including some portions of the completed system in Gary – South. This was due to the road closures not being closed according to the operation plan and floodwaters entering sewer lines (to be addressed by future sewer modifications by others). The Munster area was also severely damaged during the 2008 flooding before construction of the new Munster levee began. Flooding also occurred onto I-80/94 and in areas without complete levees which would have been protected had the levee system been complete.

13. Two other recent severe storms occurred in May 1989 and November 1990. For the 1989 storm, the estimated recurrence interval is 10 years; the peak flows and stages, respectively, at the South Holland gage were 3460 cfs and 593.6 feet (NGVD). For the 1990 storm, the estimated recurrence interval is 25 years. Peak flows and stages, respectively, at the South Holland gage were 4014 cfs and 595.1 feet (NGVD).

HYDROLOGY AND HYDRAULICS

14. The Little Calumet River watershed is located in Cook and Will Counties in Illinois and Lake and Porter Counties in Indiana. The major streams in the watershed are the East Arm Little Calumet River, the West Arm Little Calumet River, Thorn Creek, Hart Ditch, Burns Ditch, Burns waterway and Deep River. There are also a number of tributary streams within the watershed.

15. The Little Calumet River has generally east-west alignment between the Illinois-Indiana state line and the river's confluence with the Deep River, approximately 14 river miles east of Illinois. The channel through this area has very little slope, approximately 0.06 feet per mile. Hart Ditch is the major tributary to this reach of the Little Calumet River. The mouth of Hart Ditch is located approximately three river miles east of the Illinois-Indiana state line. The natural streambed of the Little Calumet River east of Hart Ditch contains a high point or sand bar causing low flows from Hart Ditch westward into Illinois. During flooding periods, runoff from Hart Ditch is divided, a portion of the flow moving eastward across the high point and the remainder moving westward. The Little Calumet River between the state line and Cline Avenue is leveed continuously on both sides. Stages on the Little Calumet River east of Hart Ditch are recorded at the USGS gages at Gary (Burr Street), Hammond (Indianapolis Boulevard), and Highland, Indiana (Kennedy Avenue). The gage on Hart Ditch at Munster, Indiana records the flow on Hart Ditch immediately upstream of the point of flow division. Hart Ditch, with a total drainage area of 71.2 square miles, is a man-made tributary of the Little Calumet River. Hart Ditch serves as an outlet for Plum Creek where they join at U.S. Route 30. It drains a portion of Lake County in northwest Indiana. Cady Marsh Ditch flows into Hart Ditch from the east, through Highland and Griffith. Cady Marsh ditch also has a diversion tunnel at Arbogast Avenue flowing into the Little Calumet River.

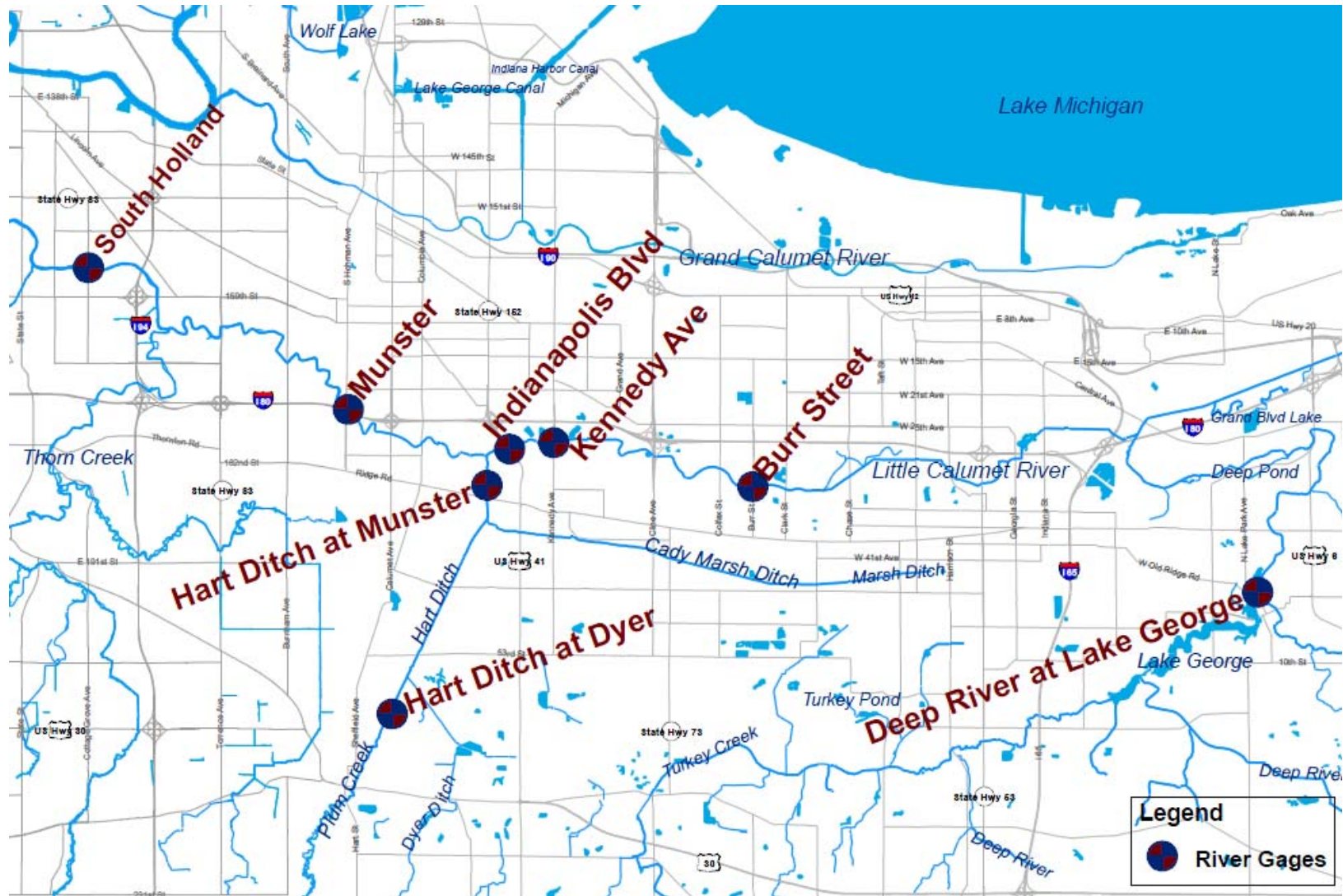


Figure 3: Waterways Near the Little Calumet River and Little Calumet River Gage Locations

16. The Little Calumet River has a generally east-west alignment between the Illinois-Indiana state line at the river's confluence with Thorn Creek near South Holland, Illinois, approximately 4 river miles west of the Illinois-Indiana state line. The two major tributaries contributing to the flow at the South Holland USGS gage are Hart Ditch in Indiana and Thorn Creek in Illinois.

17. The central portion of the Little Calumet River flows through Gary, Griffith, Highland, Hammond, and Munster, Indiana. Principal tributaries are Deep River, Turkey Creek, and Duck Creek. High flows from Deep River divide at the confluence with the Little Calumet River thus creating another temporary reversal of flow at the east end of the study reach. Deep River, with a total drainage area of 151 square miles, drains a major portion of Lake County in northwestern Indiana.

18. Burns Ditch is the extension of the Little Calumet River flowing east from the mouth of Deep River to the juncture with the East Arm Little Calumet River. Flow from Burns Ditch and the East Arm Little Calumet River is carried north to Lake Michigan by Burns Waterway. The East Arm Little Calumet River flows almost directly west to Burns Ditch from a point several miles east of the Porter County boundary with LaPorte County. The total drainage basin area including Salt Creek and Coffee Creek is 151.0 square miles. The channel slope is about 8.2 feet per mile.

19. There are thirty-two river crossings over the Little Calumet River. Eleven of the bridge crossings consist of multiple circular pipe culverts. Historically, flooding at certain bridge crossings has been increased by debris and silt blockages. Because of the flat bottom gradient, debris is easily collected and temporarily affects the available waterway opening causing rises in river stages upstream of the bridges.

CLIMATE

20. The average annual temperature for Gary, Indiana, is recorded at 48.9°F, with a mean January temperature of 22°F, and a mean July temperature of 74°F. The seasonal range of temperature is from a daily winter minimum of approximately 13° F to a daily summer maximum of about 84°F. The daily amplitude of temperature is approximately 20°F. The lowest temperature of record is -29°F in 1983 and the highest temperature is 105°F recorded in 1988. Munster is about 4 miles west of Gary.

21. The precipitation in the Gary area is fairly well distributed throughout the year. The average annual precipitation is approximately 38 inches. The heaviest rainfall usually occurs during the month of June and the lightest rainfall is in February.

SECTION 5. CONSTRUCTION HISTORY

22. The construction of the Munster Levee project was divided into three geographical stages (Stage VIII, VII, and V). Table 1 lists the various stages of construction and pertinent contract information.

Table 1. Construction Contracts

CONSTRUCTION SEGMENT	CONTRACTOR	CONTRACT NUMBER	AMOUNT	START DATE	COMPLETION DATE
Stage VIII	Walsh Construction Company of Illinois	W912P6-09-C-0013	\$12,955,886.79	June 2009	Under construction, estimated complete 2011
Stage VII	Ceres Environmental Services, Inc.	W912P6-09-C-0003	\$13,814,973.70	April 2009	Under construction, estimated complete 2011
Stage V Phase 2	Dyer Construction Co., Inc.	W912P6-07-C-0011	\$13,140,189.41	Sept 2007	Substantially Complete Nov 2010
Pump Stations Rehabilitation Phase 1A	Overstreet Engineering & Construction, Inc.	DACW27-01-C-0001	\$4,292,835.48	Nov 2000	Nov 2004

23. Maps showing the location of specific construction segments are shown in Figure 1 and on the as-built drawings. These as-built drawings are found in Appendix M. Figure 4 shows the project location of the Munster Levee and the location of the three pump stations.

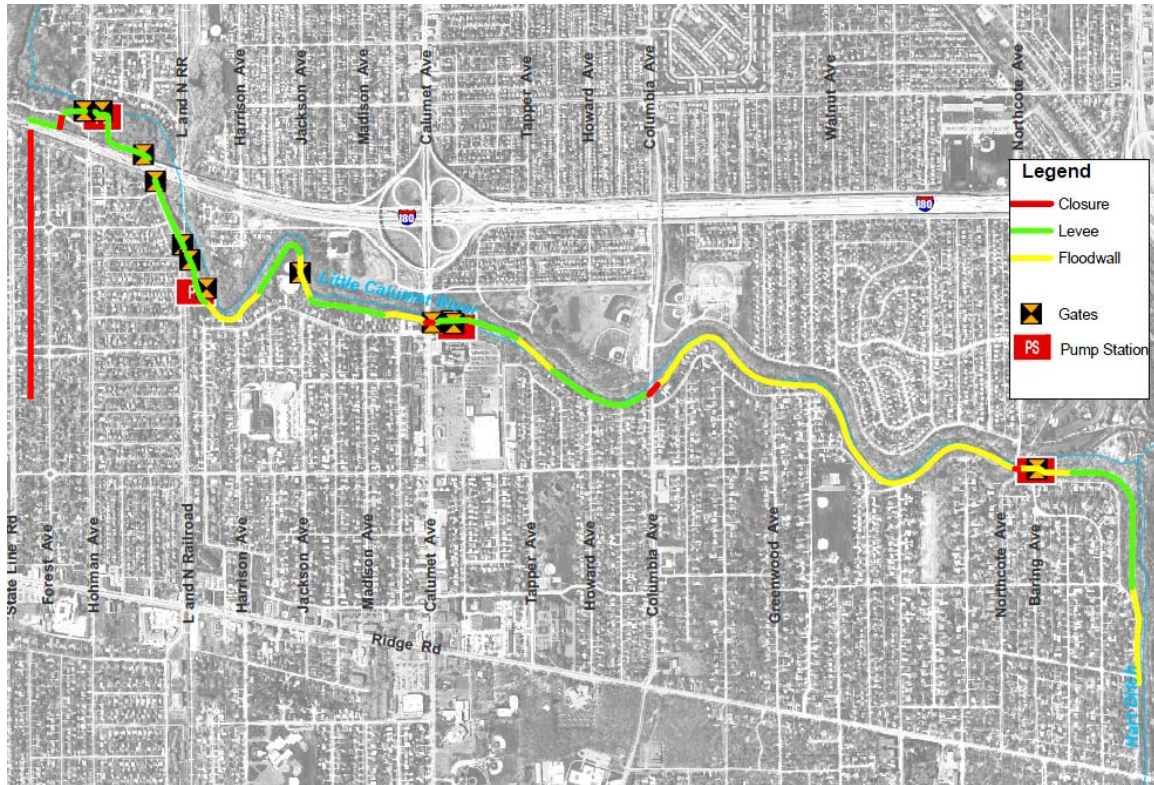


Figure 4: Munster Levee Project Location

PROJECT FEATURES

24. As previously mentioned, the Munster Levee System consists of a variety of features. The following paragraphs discuss each of the project features.

Levees and Floodwalls

25. The levee system placed as part of the Little Calumet River project will eliminate most flood damages from storm events with intensities up to the 200-year recurrence interval flood. The levees within the Munster Levee System consist of riverbank levees, setback levees, and I-walls. Levees were used to the greatest extent possible since it is the lowest cost construction method. Where the amount of land available was not enough to construct a levee, floodwalls were used. The levee was constructed with impervious soil materials at a 2.5 horizontal to 1 vertical slope on both sides except for the land side of the levee between Stations 5S 06+40 and 5S 23+16 and both sides of the levee between Stations S1B 00+09 and S1B 08+08. These sections' slopes are shown on Table 2. The I-walls were constructed with steel piles encased in concrete. Table 2 tabulates the locations of the levees and floodwalls.

Table 2. Munster Levee Stations and Types

REACH LIMIT DESCRIPTIONS PER STAGE AND PHASE WITH SUBREACH STATION LIMITS	PROJECT FEATURE Levee H:V, if different from 2.5:1)	START STREET/RR	END STREET/RR
STAGE VIII: Hohman Avenue to Columbia Avenue (S)			
S1A 00+00 to S1A 00+69	SBL	I 80/94	River Rd
S1A 01+31 to S1A 02+20	SBL	River Rd	Hohman Ave
S1A 03+00 to S1A 11+07	SBL	Hohman Ave	I 80/94
S1B 00+09 to S1B 08+08	RBL (2:1B)	I 80/94	Aband. RR
S2 00+03 to S2 04+88	RBL	Aband. RR	PS Outlot A
S2 05+30 to S2 07+80	RBL	PS Outlot A	**
S2 07+70 to S2 14+95	IW	**	**
S2 14+85 to S2 17+40	RBL	**	**
S2 17+30 to S2 19+55	IW	**	**
S2 19+45 to S2 21+05	RBL	**	**
S2 20+95 to S2 25+00	IW	**	**
S2 24+90 to S2 33+07	RBL	**	**
S2 32+97 to S2 37+90	IW	**	
S3 00+28 to S3 00+87	IW	Calumet Ave	Calumet Ave
S3 02+54 to S3 26+80	IW	Concrete Basin	Concrete Basin
			Columbia Ave
STAGE VII: Columbia Avenue to Northcote Avenue (S)			
7S 00+65 to 7S 52+18	IW	Columbia Ave	Northcote Ave
STAGE V: Northcote Avenue to along west side of Hart Ditch (S)			
5S 00+15 to 5S 06+50	IW	Northcote Ave	**
5S 06+40 to 5S 23+16	RBL (4:1L)	**	**
5S 23+08 to 5S 33+62	IW	**	**

Legend: S = South side of river, B = Both Sides of Levee, L = Land Side, RR = Railroad, RBL = Riverbank Levee, SBL = Setback Levee, IW = I-Wall, PS = Pump Station, Aband. = Abandoned, ** = Between major street limit

Overflow Sections

26. Overflow sections are designed to allow for controlled levee overtopping for flood events that exceed the design flood event. The Munster Levee does not have any overflow sections along the line of protection. End around overflow is expected to occur first along the state line to the west of the system.

Table 3. Locations of Overflow Section

OVERFLOW DESIGNATION	STAGE PHASE	APPROX RIVER MILE	OVERFLOW LENGTH (ft)	DEPTH OF NOTCH (ft)	NOTCH CREST DESIGN ELEV (ft, NGVD)
Stateline (South)	End of levee system	16.043	N/A	N/A	599.1

Pump Stations

27. Pump stations are used to return rain falling inside the levee to the river. Table 4 locates the pump stations within the Munster Levee System. Baring Avenue pump station houses 2 storm water pumps that are Fairbanks Morse 20" C5711 stage axial flow pumps. In addition, there is 1 sump pump that is Flygt CS-3085/82 submersible centrifugal. It was completed in 2009 as part of Pump Station Rehabilitation 1A.

28. Outlot A pump station houses 4 storm water pumps. This pump station was not rehabilitated under a USACE contract.

29. Hohman-Munster pump station houses 2 storm water pumps that are Fairbanks Morse 20" C5710 stage axial flow pumps and 2 dry weather pumps that are Fairbanks Morse 8" 5413. In addition, there is 1 sump pump that is Flygt CP-3085/82 submersible centrifugal. It was completed in 2009 as part of Pump Station Rehabilitation 1A.

30. Calumet Avenue pump station houses 4 storm water pumps that are Johnston 54" axial flow propeller pumps. In addition, there is 1 dewatering pump. This pump station was not rehabilitated under a USACE contract.

Table 4. Locations of Pump Stations in the Munster Levee System

PUMP STATION	LOCATION DESCRIPTION	DESIGN CAPACITY (cfs)	NUMBER OF PUMPS		ELECTRICAL POWER INFORMATION
			AND CAPACITY (gpm)	TYPE OF PUMP(S)	
Hohman-Munster	East of Hohman Avenue	63.2	2 @ 13,700 2 @ 500 1 @ 200	SWP DWP SP	480 volts 600 ampere 3-phase 60 Hz
Outlot A	North of River Drive at Frederick Avenue	241	4 @ 27,000	SWP	? volts ? ampere 3-phase 60 Hz
Calumet Avenue	East of Calumet Avenue	615	4 @ 69,000 1 @ ?	SWP DWP	? volts ? ampere 3-phase 60 Hz
Baring Avenue	East of Northcote Avenue	49	2 @ 11,000 1 @ 200	SWP SP	480 volts 600 ampere 3-phase 60 Hz

LEGEND: cfs = cubic feet per second, gpm = gallons per minute, SWP = stormwater pump, DWP = dewatering pump, SP = sump pump

NOTES:

The pump stations are under the jurisdiction of the Town of Munster Department of Public Works. Power is furnished by the Northern Indiana Power Service Company.

Culverts and Utilities

31. Culvert and utility structures present through the line-of-protection are shown on the as-built drawings and are listed in Table 5. There are 11 culvert structures which pass through the line-of-protection. A profile of the culvert and utility locations is shown on Plate 7.

Table 5. Locations of Culverts through the Munster Levee System

STAGE PHASE	CULVERT ID	LOCATION (Station)	CULVERT ID NUMBER	NUMBER OF PIPES
Utility	MU-U1	00+50 S1A	4" Water Line	1
Utility	MU-U2	01+40 S1A	2" Gas Line	1
Stage VIII	MU-1	02+19 S1A	S1-2 36" RCP	1
Utility	MU-U3	02+98 S1A	Water Line	1
Utility	MU-U4	03+95 S1A	12" Combined Sewer	1
Stage VIII	MU-2a	04+40 S1A	S1-3 48" RCP	1
Stage VIII	MU-2b	04+40 S1A	S1-3 54" RCP	1

STAGE PHASE	CULVERT ID	LOCATION (Station)	CULVERT ID NUMBER	NUMBER OF PIPES
Utility	MU-U5	05+30 S1A	30" Combined Sewer	1
Stage VIII	MU-3	10+77 S1A	S1-1 24" RCP	1
Stage VIII	MU-4	00+34 S1B	S1-4 24" RCP	1
Stage VIII	MU-5	07+93 S1B	S1-5 24" RCP	1
Stage VIII	MU-6	00+99 S2	S2-1 36" RCP	1
Stage VIII	MU-7	05+10 S2	36" Outlot A Pump Station Outlet	1
Utility	MU-U6	18+25 S2	18" Water Line	1
Stage VIII	MU-8	22+35 S2	S2-2 36" RCP	1
Utility	MU-U7	38+10 S2	14" Telephone	1
Utility	MU-U8	00+35 S3	12" Water Line	1
Stage VIII	MU-9	00+38 S3	S3-1 54" RCP	1
Stage VIII	MU-10 (a,b)	24+40 S3	S3-2 96" RCP	2
Stage VIII	MU-10(c-f)	24+50 S3	54" Calumet PS	4
Utility	MU-U9	23+65 S3	12" Gas Line	1
Utility	MU-U10 (a,b)	26+50 S3	30" Sanitary Sewer	2
Utility	MU-U11	7S 00+50	18" Water Line	1
Utility	MU-U12	7S 02+20	14" Oil Line	1
Utility	MU-U13	7S 14+95	18" Oil Line	1
Utility	MU-U14	7S 15+15	12" Oil Line	1
Utility	MU-U15	7S 51+15	12" AT&T Line	1
Utility	MU-U16	7S 52+10	12" Combined Sewer	1
Utility	MU-U17	7S 52+25	6" Gas Line	1
Utility	MU-U18	7S 52+50	8" Gas Line	1
Stage V Phase 2	MU-11	5S 02+10	42" Baring Ave Pump Station Outlet	1

Notes:

- 1) For further information on the pipe diameter, length, and invert elevations, material type, and scour hole/riprap, as applicable, see Appendix M.

Gates/Gatewells

32. Several structures that allow for flow through the levee are located and described in Table 6. Gatewells are concrete structures that span the entire width of the levee and have both a sluice gate and a flap gate to provide a means of gravity drainage into the river. In lieu of using a gatewell structure through an earthen levee section due to highly compressible soils, some locations provide gravity drainage with flap gates or check valves mounted on the riverside of the floodwalls. Pump station outlets are also shown on Table 6 which provide forced drainage.

Table 6. Gate and Gatewell Information

STRUCTURE NUMBER/LOCATION	STAGE PHASE	GATE STRUCTURE TYPE	DIAMETER (inches)	NUMBER OF OPENINGS	PRIMARY CLOSURE	SECONDARY CLOSURE	APPROXIMATE CLOSURE TIME PER GATE (minutes)
MU-1, West of Hohman Avenue	Stage VIII	S1-2, Gatewell	36	1	Flap Gate	Sluice Gate	2
MU-2 (a,b), East of Hohman Avenue	Stage VIII	S1-3, Gatewell	60	2	2 Flap Gates	Sluice Gate	5
MU-3, North of I-80/94	Stage VIII	S1-1, Gatewell	24	1	Flap Gate	Sandbags	N/A
MU-4, South of I-80/94	Stage VIII	S2-1, Gatewell	24	1	Flap Gate	Sluice Gate	2
MU-5, West of abandoned railroad	Stage VIII	S2-2, Gatewell	24	1	Flap Gate	Sandbags	N/A
MU-6, East of abandoned railroad	Stage VIII	S3-1, Gatewell	36	1	Flap Gate	Sluice Gate	2
MU-7, Outlot A Pump Station	Stage VIII	Pump Station	36	1	N/A	N/A	N/A
MU-8, North of River Drive at Jackson Avenue	Stage VIII	S3-2, Gatewell	36	1	Flap Gate	Sluice Gate	2

STRUCTURE NUMBER/LOCATION	STAGE PHASE	GATE STRUCTURE TYPE	DIAMETER (inches)	NUMBER OF OPENINGS	PRIMARY CLOSURE	SECONDARY CLOSURE	APPROXIMATE CLOSURE TIME PER GATE (minutes)
MU-9, East of Calumet Avenue	Stage VIII	S3-1, Gate	54	1	Flap Gate	N/A	N/A
MU-10a,b, East of Calumet Avenue	Stage VIII	S3-2, Concrete Basin	96	2	Check Valve	N/A	N/A
MU-10c-f, West of Calumet Avenue Pump Station	Stage VIII	Pump Station Outlet	54	4	Flap Gate	N/A	N/A
MU-11, Baring Avenue Pump Station	Stage V Phase 2	Pump Station Outlet	42	1	Sluice Gate	N/A	3

NOTES:

- 1) Approximately closure times do not include mobilization of crew and equipment required to make the closures.
- 2) The gates can be closed with either special electric drills (e.g., a portable generator is required) or with gasoline powered pneumatic operators

Ponding Areas

33. Ponding areas consist of natural detention ponds that require no grading. These ponds are designed to store water when the river rises. During normal conditions the ponds will be free of water. Land which is required for natural ponding has been identified and a flowage easement shall be obtained before construction a related project reach. However, there are no ponding areas in the Town of Munster.

Precipitation and Stream Gages

34. Two color-coded staff gages are present on the Indianapolis Boulevard Bridge, which crosses the Little Calumet River. Three other USGS gages were employed for the Hammond area: Hart Ditch, Cabela’s Pedestrian Bridge, and Kennedy Pedestrian Bridge were used to evaluate various response to storm events. Precipitation may be monitored via a rain gage at the Highland Public Works garage. These provide information regarding river stages for the levee System. The Burr Street Pump station has both a precipitation and a stream gage and they are located on the gatewell platform on the north side of the river approximately 375 feet east of Burr Street. There are also a precipitation gages in Dyer, Indiana, Crete, Illinois, and Goodenow, Illinois.

Closure Structures

35. There are four water bladder road closures and one sandbag road closure along the Munster Levee. They are as shown in Table 7.

Table 7. Closure Structures

LOCATION	CLOSURE HEIGHT (ft)	CLOSURE WIDTH (ft)	CLOSURE TYPE	MINIMUM REQUIRED SANDBAGS	ESTIMATED TIME TO ASSEMBLE (hours)
State Line	?	?	Water Bladder	N/A	?
River Road	1.0	57	Sandbag	350	0.5
Calumet Avenue	1.4	80	Water Bladder	100	1.0
Columbia Avenue	4.0	80	Water Bladder	250	1.2
Northcote Avenue	4.5	35	Water Bladder	200	1.0

NOTES:

1. Bladder closure assumes a 5 person crew and requires a front end loader/backhoe, fire engine with a 2.5” hose, and a dump truck.
2. Sandbag closure assumes a 25 person crew for each shift, 2 sandbag stacking sites, 4 sandbag filling stations, and a production rate of 19 bags per minute.
3. Mobilization time of 2 hours or more should be assumed.

Recreation Facilities

36. There are no recreation facilities and features in the Town of Munster Levee System.

Miscellaneous Features

37. Miscellaneous features of the project include fencing, fence gates, guardrail, bituminous and precast concrete block pavements, unpaved roads, and drainage ditches. Drainage ditches of the Munster Levee System are listed in Table 8.

Table 8. Drainage Ditches

STAGE AND PHASE	DESCRIPTION OF DITCH LOCATION	DITCH ID NUMBER	SIDE SLOPE (V:H)	BOTTOM WIDTH (feet)	DITCH LENGTH (feet)
Stage V Phase 2	Runs along north side of levee from Station 5S 04+73 to 09+78	5S-D1	1:3	5	505
Stage V Phase 2	Runs along south side of levee from Station 5S 06+04 to 09+81	French Drain	N/A	N/A	377

NOTE:

1) For further information on drainage ditch inverts, see Appendix M.

SECTION 6. PROJECT PERFORMANCE

38. The levee system placed as part of the Little Calumet River project will eliminate most flood damages from storm events with intensities up to the 200-year recurrence interval flood from the Little Calumet River. The Munster Levee System consists of 4,442 feet of riverbank levees, 965 feet of setback levees, 11,175 feet of I-wall, 4 pumping stations, 4 closure structures, 1 overflow section and interior flood control features. See the Plate drawings for detailed project features.

SECTION 7. PROJECT COOPERATION AGREEMENT

39. The Little Calumet River Basin Development Commission for Construction of the Little Calumet River, Indiana Local Flood Protection and Recreation Project and the Department of the Army have entered into a Project Cooperation Agreement (PCA) for this project on the 16th day of August, 1990 as required by Public Law (99-662). A copy of the duly executed PCA is included as Appendix B of this manual.

SECTION 8. OPERATION

GENERAL

40. The structures and facilities constructed by the USACE-Chicago District for local flood protection shall be operated as may be necessary to obtain the maximum benefits. No encroachment shall be permitted upon the rights-of-way for the project. Appropriate measures shall be taken by local authorities to ensure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the LCRBDC during flood periods.

41. Project sponsor is responsible for inspecting, operating, maintaining, repairing, and rehabilitating the project facilities in accordance with regulations or directions prescribed by the State of Indiana Dam and Levee Statute 14-27-7 and 14-28-1.

42. Operations and maintenance of each project feature is governed by Flood Control Regulations, Title 33, Navigation and Navigable Waters and Nationwide Permit #31(Appendix F).

LEVEE OPERATIONS

43. Periodic levee patrols must be performed throughout the year between scheduled inspections and high water/flood events in order to locate any potential danger zones in and around the levee. Repair of these areas should then be undertaken in a non-emergency situation to ensure the integrity of the line-of-protection.

44. Appropriate advance measures will be taken to ensure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

FLOODWALL OPERATIONS

45. Periodic patrols of the floodwalls must be performed throughout the year between scheduled inspections and high water/flood events in order to locate any potential danger zones in the structures. Repair of these areas should then be undertaken in a non-emergency situation to ensure the integrity of the line-of-protection. Table 2 locates the floodwall sections by station number and geographically.

PUMP STATION

46. Competent operators shall be on duty at the pumping stations whenever it appears that necessity for pump operations is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all station equipment. The operator shall be familiar with the equipment manufacturer's instructions and drawings, and with the "Operating Instructions" for the stations. The equipment shall be operated in accordance with the above mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied to all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping stations shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping station operation shall be kept for each station, a copy of which shall be furnished to the District Engineer following each flood. The Project Sponsor shall maintain an operational log of the pump stations. This log shall be kept at the facility or otherwise readily available for update and review.

47. See Appendix L for manufacturer's operating instructions for the pump stations. Plate 3 provides the locations of the pump stations within the Munster Levee System.

GATEWELLS AND GATES

48. Gatewell hatches must be opened during regular inspections and the gates operated to be certain that closure could be made under an emergency situation. Gatewells must be checked for any obvious deficiencies or potentially hazardous conditions during levee operation patrols. Any noted deficiencies that occur during normal, non-flood operation of the gatewell must be corrected as soon as possible.

49. Flap gate operation must be verified during periodic levee patrols. The flap gates must swing freely when moved by hand. If the gates do not swing easily, there may be sediment blocking the operation of the gate. Any required clearance of sediment around the gate outlet must be addressed as soon as possible.

50. Check valves must also be verified during periodic patrols to ensure there is nothing hindering its ability to close when there is no water flow. There should be clearance from any sediment beneath the valve.

51. There must be no debris blocking the flap gates or check valves in a permanently open position. There should be no debris blocking the sluice gate from coming to a fully closed position. Sluice gates must close or open within the time ranges listed in Table 6. The gates must operate smoothly and be able to be placed in a fully closed or fully open position. Any deficiencies in the operation of the gates must be remediated as soon as possible.

52. The Project Sponsor shall maintain an operational log of the gates. This log shall be kept at the facility or otherwise readily available for update and review.

CLOSURE STRUCTURES

53. The Sanitary District is the municipal department responsible for making road closures and is therefore responsible for the operation of the closure structures. Plate 5 locates all closure structures in the Munster Levee System.

54. Trial erection of the street closures will be required every 5-years to ensure proper understanding and training of key personnel and availability of essential resources. Closure exercise plans shall be developed in consultation with the Corps and appropriate agencies.

CULVERTS, FLOWAGE EASEMENTS, PONDING AREAS, RIVER CHANNEL AND RECREATION FACILITIES

55. There are no operation procedures for the culverts, flowage easements, ponding areas, river channel, or recreation facilities.

PRECIPITATION/STREAM GAGE NETWORK

56. Ordinary operation of the stream gaging network will be handled by the United States Geological Survey (USGS) under a support agreement with the COE, Chicago District until the fully constructed project is turned over to the LCRBDC. The local communities involved in flood fights for these portions of the levee project will have to obtain precipitation data from local sources, that is, their own rain and staff gages. The flood fight staff gage location is on the east side of Northcote Ave, Columbia Ave, and Calumet Ave.

BASE STATIONS

57. The base station for the City of Munster is located at the Munster Public Works garage located at 508 Fisher Street in Munster.

SECTION 9. EMERGENCY OPERATIONS

58. Data from the fourteen stage and precipitation gages across the watershed is transmitted to the Lake County Emergency Operation Center (EOC). Once the incoming data to the EOC computer system indicates that a warning level trigger has been exceeded, a knowledgeable, trained individual with authority to issue warnings to communities, monitoring the system will make the decision to warn the affected communities.

59. When a flood event is predicted, inspection and maintenance records shall be checked, if possible, to determine if all components of the levee are in proper condition to protect against a flood. Any levee features that have not been inspected and maintained in the past year shall be quickly inspected. Any new maintenance in addition to any needed maintenance or repairs shall be completed before the start of the flooding, if possible. If time does not permit for repairs prior to the onset of flooding, temporary measures shall be utilized during the flood fight. Refer to Appendix G for emergency construction methods.

60. It is responsibility of the Local Sponsors to maintain an adequate supply of flood fighting materials and tools at known locations; to maintain a listing of related material and tool suppliers; and to maintain an adequate number of trained personnel required to execute emergency operations.

61. In the event of overtopping, the Emergency Flood Protection Handbook should be consulted. See Appendix G.

NOTIFICATION

62. See Appendix A for the list of contacts in case of a flood emergency affecting Munster. This list should be verified yearly and updated as necessary.

EMERGENCY OPERATIONS

Levee and Overflow Embankments

63. When the river reaches a 10-year frequency level at the Munster, Burr and Grant Street gage locations (elevations 593.9, 596.0, and 594.7 feet, NGVD, respectively), continuous patrolling of the levee should begin. Levee locations are listed in Table 2. Patrolling operations should locate potential danger zones to permit prompt actions and correction of any conditions that endanger the integrity of the levee. Implementation of emergency actions shall be done under the direction of local representatives experienced and/or trained in flood fighting activities. Certain levee sections, which should be addressed per special concerns, are listed in Table 9 below.

64. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- a. There are no indications of imminent slides or sloughs developing;
- b. Significant wave wash or scouring action is not occurring at pump station outfalls and drainage outlets;
- c. No low reaches of levee exist which may be overtopped, excluding designed overflow sections; and
- d. No other conditions exist which might endanger the structure.

65. Levee overtopping occurs when flood elevations exceed that of the levee crest; causing floodwater to flow over the levee embankment. It is seldom that an entire levee system is overtopped at once. Inspection will show the low spots where the overtopping will first occur. Regardless of how small a low section may be, the danger from overtopping is evident. Water flowing over a levee crown may wash away material and create a breach in the levee. Once a breach has developed in a levee, it is extremely difficult, if not impossible, to close it until after the flood waters recede. Consequently, overtopping should be prevented as much as possible, without undue risk to flood fighting personnel, for levee reaches not designed as an "overflow section".

Table 9. Locations of General Special Concerns during Emergency Operations

GENERAL LOCATION	APPROXIMATE STATIONING OR SITE DESCRIPTION	SPECIAL CONCERN(S) OF POTENTIAL ACTION(S) OR KNOWN CONDITION(S)	POTENTIAL RESULTING PROBLEM(S)
Levee/ Floodwall Interfaces	** See Table 2 for stationing.**	Seepage, Current Scour	Embankment piping, Separation of embankment from floodwall
Levee Tie-ins With Road & Railroad Embankments	All intersecting road and railroad embankments	Seepage	Embankment piping, Separation of embankment masses
Closure Structures	See Plate 5 for location.	Seepage, Sandbag Displacement	Closure piping, Overtopping
Utility Pipeline Crossing Beneath Line- of-Protection	Utility Corridors	Seepage	Foundation soil piping and/or heave/uplift
	Utility listing is available at Little Calumet River Basin Development Commission		
Utility Pipeline Crossing Over Line-of- Protection	Utility listing is available at Little Calumet River Basin Development Commission	Wave Wash, Current Scour, Slope Attack	Embankment erosion
Levee/Outlet Structure Interfaces	See Plate 4 for location.	Wave Wash, Current Scour	Embankment erosion
Outlet Structure Crossing Through Line- of-Protection	See Plate 4 for location.	Seepage	Embankment piping
Culvert/ Discharge Pipes	See Table 5 for location	Seepage	Embankment piping near pipe, differential settlement, embankment cracking

66. **WARNING:** OVERFLOW SECTIONS HAVE BEEN DESIGNED FOR THIS PROJECT TO ALLOW FOR CONTROLLED LEVEE OVERTOPPING FOR FLOOD EVENTS THAT EXCEED THE DESIGN FLOOD EVENT. FOR THIS REASON, **IT IS IMPERATIVE THAT FLOOD FIGHTING PERSONNEL BE AWARE OF THE INTENT OF THE OVERFLOW SECTIONS.** See Table 3 for designated overflow section.

66. See Table 3 and Plate 6 for designated overflow section; State Line. When overflowing does occur it must be met with the appropriate response. Along Hart Ditch and at Columbia Avenue, overtopping may occur as well, although these areas are not considered designated overflow sections. Table 10, 11, and 12 show the correct response actions when overflowing is experienced at the specified locations. For further reference on the response actions see Appendix G: Emergency Flood Protection Handbook.

Table 10: Overflow Response Based on Calumet Avenue Gage

Calumet Avenue Gage		Overflow
Stage	Stage	Floodwall @Columbia
ft NGVD	ft NAVD	<i>Munster</i>
600.5	600.2	
600.0	599.7	Evacuate
599.5	599.2	
599.0	598.7	Mobilize
598.5	598.2	
598.0	597.7	Alert
597.5	597.2	

Table 11: Overflow Response Based on Hart Ditch Gage

Hart Ditch at Munster (USGS)		Overflow
Stage	Stage	Levee/Floodwall
ft NGVD	ft NAVD	<i>Munster/Highland</i>
603.5	603.2	
603.0	602.7	Evacuate
602.5	602.2	
602.0	601.7	Mobilize
601.5	601.2	
601.0	600.7	Alert

Table 12: Overflow Response Based on Munster Gage

Little Cal @ Munster (USGS)		Overflow
Stage	Stage	State Line
ft NGVD	ft NAVD	<i>Munster</i>
598.5	598.2	
598.0	597.7	Evacuate
597.5	597.2	
597.0	596.7	Mobilize
596.5	596.2	
596.0	595.7	Alert
595.5	595.2	

Floodwalls

67. Continuous patrol of floodwalls shall be maintained during flood periods to locate possible leakage at monolith joints, seepage underneath floodwalls, and/or boils. The bank riverward of floodwalls must be checked for any signs of caving, which might endanger the stability of floodwalls. Floating plants or boats will not be allowed to lie against or tie up to floodwalls. Should it become necessary during a flood emergency to pass anchor cables over floodwalls, adequate measures shall be taken to protect concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers stability of floodwalls. See Table 2 for location of floodwalls.

Pump Stations

68. Pump stations shall be regularly monitored to ensure the equipment is operational and is not experiencing distress (i.e., too frequent cycling). Immediate remedial action(s) shall be taken in the event there is malfunctioning equipment and/or the cycling is too frequent. Table 4 lists pump station locations and other pertinent information.

Gatewells, Gates, and Culverts

69. The gatewells and culverts must be inspected during flood events. Inspection crews and emergency crews must consist of trained community personnel that are familiar with the operation of the structures. The crews must verify that the inlet and outlet channels, the inlet and outlet pipes of the gatewells, and culvert trash racks are not blocked. They must also verify that the gatewells and trash racks are free from debris and excessive sediment deposits, and that the gate closures can be accomplished. If deficiencies are found that directly impact emergency operations of gate structures, every effort must be made on the part of local personnel to correct the problem. Deficiencies that do not seriously affect emergency functions should be noted and addressed in post-flood maintenance of the gatewells and culverts. See Plate 4 for gatewell locations and information.

70. Gate inspections must be performed at the beginning of a flood event, if possible, to verify that all flap gates and check valves are operational and are not jammed in an open position. If a flap gate or check valve is malfunctioning, the secondary closure should be implemented when the river level rises to the invert of the gate.

71. Electric portable operators for the sluice gates have been provided as part of the project. The electric drill requires an electric generator/power supply. Another type of operator, a gas powered handheld unit, is also available at the LCRBDC however it is less practical than the electric operator. All operators are 2"x2" driven and have 2-1/16" drivers. Portable operators must be available to inspectors and emergency crews in the event of a flap gate or check valve failure. Portable operators must be checked prior to use during a flood event to make certain that they are functional. All necessary equipment, fuel, electric cords, and power supplies must be available to field crews before any inspection of gates is initiated. It is especially critical that proper equipment for gate closure be available for an emergency closure.

72. Additional monitoring of check valves, flap gates, and sluice gates must be conducted during a flood event to verify the integrity of these closures. If a flap gate or check valve malfunctions at any time during a flood event, crews must be prepared to close the sluice gate. For culverts through the line-of-protection equipped with only a flap gate or check valve, monitoring must proceed as described for outlets equipped with double closures. In the event flap gate failure is noted during a flood event, the inlet on the riverside must be blocked with sandbags or other inert material so that high river stage waters cannot flood the interior of the levee through the malfunctioning gate/valve. Recommended methods for emergency closure of manhole and gatewell structures are provided in Appendix G, Emergency Flood Protection Handbook.

Closure Structures

73. Closure structure construction, as well as other field practices and emergency construction during floods, is described in Appendix G. Training of local crews will be administered by the LCRBDC and local communities. Technical assistance is available from the COE, Chicago District.

74. Roadway closures shall be implemented based on anticipated stages tied to precipitation amounts. Anticipated closures based on varying precipitation amounts for 3, 6, and 12 hour periods are shown in Table 13. Critical, trigger, monitoring precipitation/stage elevations to be used to determine the requirement for assembly of roadway closures and overflow locations are listed in Table 14 and 15, respectively.

75. These trigger elevations have been derived to aid in determining which level or degree of warning should be transmitted to the local communities. "Warning levels" are presented and defined in Appendix G, Emergency Flood Protection Handbook.

76. Emergency flood fight scenarios have been developed for each construction stage where there was a possible action. Flood fight closure locations and information are illustrated on Plate 5. The quantity of sandbags and anticipated assembly time are stated above in Table 7. Local officials will have to make certain that sufficient materials are on hand for the erection of the closure and that the location of such materials will be readily accessible in times of emergency.

Road Closure Alert System (RCAS)

77. The Road Closure Alert System (RCAS) is a supplemental tool that can be used by local officials to rapidly assess general road closure potential. It estimates the potential future road closure alert levels by using either real time USGS precipitation data updated every half-hour or manually input rainfall amounts. The alert levels are Alert – yellow, Mobilize – orange, or Action – red. It has been provided by USACE to the LCRBDC for use along the entire Little Calumet project. The data provided by RCAS is for general information purposes only and communities should still follow the guidelines set in this O&M manual.

Table 13. Projected Actions for Project Feature Operation – 3,6,12 Hour

LOCATION	RIVER MILE	PROJECT FEATURE	3-HOUR PRECIPITATION *												
			(inches)												
			2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	
Illinois-Indiana State Line	16.043	Overflow Structure				3	4								
River Road	16.138	Road Closure					1		2						
Calumet Avenue	17.601	Road Closure				1		2							
Columbia Avenue	18.115	Road Closure		1		2									
Northcote Avenue	19.079	Road Closure			1		2								

LOCATION	RIVER MILE	PROJECT FEATURE	6-HOUR PRECIPITATION *												
			(inches)												
			2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	
Illinois-Indiana State Line	16.043	Overflow Structure				3	4								
River Road	16.138	Road Closure						1		2					
Calumet Avenue	17.601	Road Closure					1		2						
Columbia Avenue	18.115	Road Closure			1		2								
Northcote Avenue	19.079	Road Closure			1		2								

LOCATION	RIVER MILE	PROJECT FEATURE	12-HOUR PRECIPITATION *												
			(inches)												
			2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	
Illinois-Indiana State Line	16.043	Overflow Structure					3	4							
River Road	16.138	Road Closure								1		2			
Calumet Avenue	17.601	Road Closure					1			2					
Columbia Avenue	18.115	Road Closure			1		2								
Northcote Avenue	19.079	Road Closure			1		2								

***This table is based on rainfall events of uniform intensity and uniform areal distribution of rainfall for the period specified. Variations of rainfall intensity and areal distribution can impact watershed runoff response.**

Table Key:

- 1 Monitor precipitation and stages for potential road closure operation
- 2 Road closure likely under these precipitation conditions
- 3 Monitor precipitation and river stage for potential levee overtopping
- 4 Overflow likely under these precipitation conditions

Table 14. Critical Monitoring Stages for Closures Under Slow River Rise Conditions

ACTION LOCATION	REFERENCE STAFF GAGE	CLOSURE PRIORITY	MIN. CLOSURE ELEVATION (ft NGVD)	100 YEAR WATER SURFACE (ft NGVD)	ABOVE 100 YEAR WATER SURFACE (ft)	LEVEE CREST ELEVATION (ft NGVD)
River Road	Munster	Late	599.5	596.0	3.5	600.5
Calumet Avenue	Munster	Late	599.6	596.9	2.7	601.0
Columbia Avenue	Munster	Intermediate	597.6	597.3	0.3	601.6
Northcote Avenue	Munster	Intermediate	598.5	598.2	0.3	603.0

ALERT FOR CLOSURE ACTION: 2” rain forecast in next 1 to 24 hours or 1” rain in last 6 hours and any continued rise in the stage at closure location

Table 15. Critical Monitoring Stages for Overflow Under Slow River Rise Conditions

ACTION LOCATION	REFERENCE STAFF GAGE	FIRST TRIGGER			SECOND TRIGGER	
		ELEVATION AT GAGE* (feet, NGVD)	FREQUENCY OF TRIGGER ELEVATION (years)	REQUIRED ACTION	ELEVATION AT GAGE ** (feet, NGVD)	REQUIRED ACTION
Illinois-Indiana State Line	Munster	596.1	5	Monitor elevation at overflow & gages	597.1	Evacuate

* Elevation is 1.3 feet to 2 feet below the road overtopping elevation and adjusted to the gage water surface elevation.

** Elevation is 1 foot below the road overtopping elevation and adjusted to the gage water surface elevation.

NOTES:

1) When the river stage is within a foot of a critical elevation at a given location and the precipitation alarm levels, i.e., 1.5 inches or 4 inches total rainfall or 2.5 inches in 30 minutes, were not triggered, the river will be considered under slow rise conditions. This should be a fairly infrequent occurrence. Under these conditions, elevation monitoring will take precedence for the flood warning system when small amounts of additional precipitation are anticipated or recorded.

2) In addition to monitoring the water level at the closure location, the gages to the west of the closures, including the gages at South Holland and Thorn Creek should be monitored. If the water levels at Thorn Creek and South Holland have not crested, then a rise in the river elevation should be anticipated, especially in the closures to the west of Hart Ditch.

66. See Table 3 and Plate 6 for designated overflow sections. When overflowing does occur it must be met with the appropriate response. Tables 16 and 17 below show the correct response actions when overflowing is experienced at specified locations. For further reference on the response actions see Appendix G: Emergency Flood Protection Handbook.

Table 16: Road Closure Response Action Based on the Calumet Avenue Gage

Flood Warning Action Levels*			
Calumet Avenue Gage		Calumet	Columbia
Stage	Stage	Calumet	Columbia
ft NGVD	ft NAVD	Munster	Munster
600.5	600.2		
600.0	599.7		
599.5	599.2		
599.0	598.7		
598.5	598.2	Action	
598.0	597.7		
597.5	597.2	Mobilize	
597.0	596.7		
596.5	596.2	Alert	
596.0	595.7		Action
595.5	595.2		
595.0	594.7		Mobilize
594.5	594.2		
594.0	593.7		Alert

Table 17: Road Closure Response Action Based on the Northcote Avenue Gage

Flood Warning Action Levels*			
Northcote Avenue Gage			
Stage	Stage	Columbia	Northcote
ft NGVD	ft NAVD	<i>Munster</i>	<i>Munster</i>
601.5	601.2		
601.0	600.7		
600.5	600.2		
600.0	599.7		
599.5	599.2		
599.0	598.7		
598.5	598.2		
598.0	597.7		
597.5	597.2	Action	Action
597.0	596.7		
596.5	596.2	Mobilize	Mobilize
596.0	595.7		
595.5	595.2	Alert	Alert

Precipitation/Stream Gage Network

78. Since precipitation and stream gages are designed to work under a variety of conditions, operations under emergency conditions should be similar to normal operations (i.e., non-flood situation). However, under extremely high water levels, some gages may be inundated and cease to function. For the existing USGS stream gages, such gage outages should be reported to the appropriate USGS office. For system precipitation gages, those outages should be reported for maintenance and/or repair to the appropriate entity. As previously mentioned, a staff gage is located at the Indianapolis Boulevard Bridge.

Base Stations

79. Base station operation can be disrupted during an extreme event by power outages at the base station location. Redundancy in the system, in the form of additional base stations provides for alternative sources of information for emergency operations. Emergency procedures for power outages should be coordinated between the base stations in the watershed, as well with the NWS Base Station. The possibility of installing a short term power source for the base stations is being investigated. The Munster Base Station is located at the Munster Public Works garage at 508 Fisher Street in Munster.

River Channel Crossings and Control Structures

80. Debris removal shall be performed as needed if it is safely feasible in order to eliminate blockage.

SECTION 10. MAINTENANCE AND INSPECTION

GENERAL

81. No encroachment or trespass which will adversely affect the efficient maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

82. No improvements shall be passed over, under, or through the walls, levees, or floodways, nor shall any excavation or construction be permitted within the limits of the project rights-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer or his authorized representative that such improvements, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished to the District Engineer after completion of the work.

83. It shall be the duty of the LCRBDC to submit an annual report to the District Engineer covering inspections, maintenance, and operation of the performed protective works during the previous calendar year.

84. Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made. Instructions provided by Nationwide Permit #31 included in Appendix F limit maintenance to that approved in a maintenance baseline.

85. Inspection and maintenance activities are governed by Flood Control Regulations, Title 33, Navigation and Navigable Waters also in Appendix F.

MAINTENANCE REQUIREMENTS

86. The local sponsor shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent." The Superintendent shall be responsible for the development and maintenance of an organization responsible for the operation and maintenance of all structures and facilities during flood periods, as well as for continuous inspections and maintenance of the project works during periods of low water, all without cost the United States.

Levees

87. Maintaining the levees should consist of routine mowing/burning of turf levees, cutting of volunteer plants in the landside rockfill sections, filling settled or sloughed areas, elimination of animal burrows, and replacement of rockfill or riprap materials. Routine mowing consists of cutting all turfed areas of the levee (except on the riverside of the levees as described below) which were completed as part of this project. The goal is to maintain all areas of the levees less than one (1) foot in height although local neighborhood concerns will probably demand a lesser height similar to residential lots. By maintaining all turfed areas less than one (1) foot in height, trees and woody vegetation will not be able to get started. **THIS IS CRITICAL TO THE LONG TERM STABILITY AND LOW PERMEABILITY OF THE LEVEE.** Roots from such plants tend to create seepage pathways through the levee and are thus detrimental to it. See the Levee Vegetation Maintenance Schedule in Appendix D for a mowing schedule.

88. Levee repairs shall be made on any noted areas of cracking and/or sloughing of the embankment material, excessive and/or differential settlement, material or section loss, caving, excessive surface erosion, seepage and boils, animal burrows, as well as any man-made excavations through surface impervious layers as soon as possible.

89. These repairs must be completed as soon as possible, as these types of damage threaten the integrity of the flood control system. Maintenance personnel shall advise the appropriate local officials concerning the affected areas; and technical assistance on the repair method will be provided by the COE, Chicago District. Repairs shall be in accordance with original construction specifications and as-built plans or as otherwise approved by the COE, Chicago District.

90. Systematic periodic surveys of the levee crests and side slopes shall be made using consistent stations through time with the elevations being compared with as-built sections, especially design elevations.

Seeded Areas

91. All seeded areas shall be maintained so that a good stand of turf will develop. When any portion of these surfaces become gullied or otherwise damaged, or the turf is destroyed, the affected portion shall be repaired to reestablish condition and grade of the topsoil and good stand of turf prior to damage. This may include reseeded.

92. If reseeded is required, the following steps should be outlined. Fertilizer with a 12-12-12 analysis shall be applied before planting at the rate of 7 pounds per 1000 square feet of turf. This fertilizer shall be incorporated into the soil to a depth of 2 inches by disking, harrowing or other acceptable method. Immediately after seeding, mulching and anchoring of any specified erosion control material, seeded areas will be watered sufficiently to penetrate to a depth of 3 inches. Regular watering will occur within 7 days of seeding and will be sufficient to ensure moist soil conditions to a depth of 1 inch. Turf areas will be mowed once a month during the growing season, April through November such that height of the turf does not exceed one (1) foot. Mowing should occur during dry conditions when rutting or compaction of the soil will be minimized.

Trees and Shrubs

93. Trees and shrubs will be watered as often as necessary to maintain an adequate supply of moisture at the root zone. These plants will also be pruned, cultivated and weeded as required for healthy growth. Dead, unhealthy or improperly pruned plants must be removed and replaced. Fallen or uprooted trees, fallen branches and other debris shall be removed from all channel riprapped and levee areas annually and after each high water/flood event to help prevent riprap displacement or levee damage.

94. No unwanted vegetation (trees, bushes, or undesirable weeds) shall be within 15-feet of the toe of the levee or floodwall, or to the limits of the levee easement. Areas having overbuilt sections for the specific purpose of appropriate vegetation are shown on the As-Builts.

Access Ramps and Roads

95. The access ramps and access roads appurtenant to the levee system shall be maintained for emergency vehicular traffic. If portions of the access road or access ramps become gullied, rutted or otherwise damaged, the affected portion shall be repaired to reestablish conditions prior to the damage.

Riprap

96. All riprapped areas shall be kept free of vegetation including weeds, brush, trees, and saplings. Fallen or uprooted trees, fallen branches and other debris shall be removed from all channel riprapped and levee areas annually and after each high water/flood event to prevent riprap displacement or levee damage. Spraying of herbicides or mechanical removal of vegetation may become necessary. The lines, grades, elevations, and cross sections of riprapped areas shall be reestablished, as needed.

Animal Burrows

97. Any animal burrows located during routine inspections or at other times should be immediately eliminated by filling the hole. This may involve digging out part of the levee with hand tools until the end of the burrow can be located and reasonably filled. In areas where burrows are created repeatedly, the animals should be trapped and removed or otherwise eliminated.

Settled/Sloughed Areas

98. Filing settled areas of the levees and correction of sloughed areas requires the addition of clay materials compacted to at least 95% standard proctor density. In turfed areas, the grass and topsoil should be removed to expose the underlying clay material in the levee core. The topsoil should be replaced following the addition of clay and the turf reestablished. Erosion control blankets will likely be needed to assist with the turf reestablishment on the levee side slopes but will not be needed on top of the levee.

Pump Stations

99. At regular intervals, proper measures shall be taken to provide for cleaning the pump stations, repainting the equipment as necessary, and lubricating all machinery. Adequate supplies of lubricants for each machine, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at each pumping station. All equipment including switchgear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to ensure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed for necessary tests and repairs. Operating personnel for the pump stations shall be present during tests. Any equipment removed from the stations for repair or replacement shall be returned or replaced as soon as possible and shall be trial operated after reinstallation. Repairs requiring removal of equipment from any pump station shall be made during off-flood seasons insofar as practicable. See Table 4 for the location of the pump stations and other pertinent information.

Gates

100. Maintenance on sluice gates consists of replacing worn seals, lubrication of the operators and motors if applicable, and adjusting the gate wedges for a tight fit. Gatewell fencing, access hatches, and locks should be replaced if damaged or missing. The required maintenance work is specified in Appendix K where the specific requirements are listed in the manufacturers' manuals for manual and electrically operated gates.

101. Flap gates are essentially thought of as maintenance free but in fact require some minor maintenance to ensure proper operation. The required maintenance work is specified in Appendix K where the specific requirements are listed in the manufacturers' manuals. In addition to the work specified in the manuals from the manufacturers, the inspections should have any debris removed from the flap gates which would prevent the gate from closing completely. The seal material should be inspected and replaced if worn. The locations of gates are listed in Table 6.

102. Check valves are generally maintenance-free but require periodic inspections. Possible problems could arise if the check valve is not vertically aligned, sediment is touching the bottom of the valve, or the valve is coming off the pipe. The clamp should be tightened if necessary and any objects stuck in the mouth of the valve should be removed. The locations are listed in Table 6.

Culverts

103. Culvert maintenance consists of clearing the culverts and inlet and outlet structures of debris and excessive sediment deposits. The trash racks should also be cleared of debris and the riprap should be maintained as needed. The locations of culverts through the Munster Levee are listed in Table 5.

104. An inspection of the interior of all culverts that penetrate under or through the levee is required every 5 years to evaluate the condition of the culvert. The inspection can be accomplished by direct visual if full access is available or television camera captured on video or other media. For additional information, refer to 'Section 11. Surveillance'.

Flowage Easements

105. As a minimum, these lands must remain in the condition existing at the time the easement was acquired by the LCRBDC. Other than naturally occurring tree and vegetation growth, flowage easement lands must remain open and free from further development. Litter, trash and other debris classified as solid waste must be collected from these lands and properly disposed.

Aggregate Surfaces

106. Maintenance measures for aggregate surfaces generally involve smoothing of ruts, soft spots, corrugations, and holes; reshaping the cross-section to provide adequate surface drainage towards the river; and/or providing compacted, reasonably smooth surface. Such work should be done immediately after a rain or after the aggregate surface has been mechanically watered because loose, dry aggregate material does not compact well. Smoothing cannot correct severe surface problems. Smoothing is accomplished with either a motorized road grader, underbody blades or single/multiple blade drags. Reshaping involves breaking the aggregate surface crust, adjusting the aggregate blend by adding coarse and/or fine aggregate as necessary, adjusting the moisture content to optimum, blading a self-draining cross-section, and finally compacting the aggregate surface in accordance with original specifications and as-built plans.

107. Maintenance activities also include restriction structures such as 'A' frame gates, removable bollards, restrictor bollards, and locks. These should be inspected for general debris cleaning and ensuring the moving parts are in good condition. Any restriction structures missing or in disrepair should be replaced. The locations are shown on the as-builts in Appendix M.

PROJECT SPONSOR INSPECTIONS

108. Inspection activities are necessary to ensure that project features will remain fully operational and are critical as being the principal method of protection against major problems. The requirements for inspections and maintenance are broken down into various categories according to time period when they are to occur. The Project Sponsor shall have organizational structure for carrying out the maintenance and inspection responsibilities associated with the project. The inspection items and frequencies are identified in Table 18. It is the responsibility of the Project Sponsor to complete inspections as required to meet these frequency requirements.

109. Maintenance measures or repairs identified during inspections shall be made within the timeframe specified by the inspector. The Inspection Checklists found in Appendix C are to be used for evaluating the project features and identifying if any maintenance or deficiencies are found during the inspection.

Table 18. Summary of Inspection Frequencies

Feature	Inspection Frequency
Levees	Quarterly
Floodwalls	Quarterly
Pump Stations	Quarterly
Gatewells and Gates	Quarterly
Closure Structures	Quarterly
Fencing	Semi-Annually
Culverts	Annually
Flowage Easements	Annually
Ponding Areas	Annually
Steel Plate Beam Guardrail	Annually
Pavement	Annually
Drainage Ditches	Annually

110. The following paragraphs identify the various inspections and maintenance activities.

SEASONAL INSPECTIONS (QUARTERLY)

111. In order to properly assess the capabilities and conditions of the project, quarterly inspections should be performed by the LCRBDC of the entire project. Seasonal inspections will allow the inspector the opportunity to observe at different times of the year when vegetation, river levels, moisture conditions and other variable conditions may obscure some problems. The inspection should be made immediately prior to the beginning of the normal flooding season, and at intervals not exceeding three (3) months. The inspections should cover all of the features of the project and any deficiencies that have been corrected since the last inspection. An inspection checklist is included in Appendix C. The following paragraphs discuss on a feature by feature basis the observations which should be made in order to properly inspect the flood control project.

Levees

112. Levees are to be inspected for a number of items which over time could prove detrimental to the stability of the levee. During the seasonal inspections, the entire levee surface should be inspected by searching for unusual settlements of the levee top; cracking, erosion, and sloughing of the levee sides; bare spots without turf cover; or noticeable reduction in the grade or cross section of the levee. Damage from seepage, sand boils, unauthorized vehicular traffic, and any currently saturated areas should be located. Finally, inspection for other damaging conditions such as woody vegetation growing on the levees, animal burrows into the side slopes, erosion at the riverside levee toe, damage to the levee slopes, and any other condition which could cause the levee stability or permeability to be compromised.

Floodwalls

113. Walls should be inspected to look for signs of cracking, joint degradation, tipping, settlement, and sliding. Cracking of the wall stem should be monitored if it progresses beyond normal isolated hairline cracks. Cracks which noticeably increase in length over time begin to form into multiple cracks (crazing), or which show discoloration due to water staining should be thoroughly investigated to determine the cause of the problem and remedy it. Tipping, settlement, and sliding are possible signs of major structural failures which may need to be immediately corrected. Tipping occurs when the wall stem is no longer vertical. Tipping is a sign that the wall can not resist overturning forces generally applied from the riverside. Sliding occurs when the wall slides, (usually landward) because of the forces applied by water pressure. Sliding will be evident by buckled pavement or heaved earth at the wall stem or landside edge of the base. Settlement occurs when the base is not adequately supported and may be the result of material being removed below the base by flowing water.

Pump Stations

114. All facets of the pump station should be checked to ensure proper operability. This will probably require that flows be introduced into the system at a cleanout, manhole, or directly into the station if flows are insufficient to test pump operation. The lead pump should be started by the float switch to verify that the relays and connections are operable. The lag pump will probably have to be started manually since the water levels are not likely to be sufficient to start it with the float switch (lag pump float switch is set above the lead pump float switch). While the control panel is open for manual operation of the pumps, all control panel lights, the light for illumination, the 15 amp outlets, and the alarm and alarm light should be checked, too. A generator should be connected to each pump station and operated under temporary power at least one time each year. The pump station location can be found in Table 3.

115. The annual report shall cover inspection and maintenance of the pump stations and shall contain an executive summary of major items found in the inspection. A discussion of the existing conditions shall be included to address any deficiencies of the pump stations along with the proposed remedial measures, sketches (if appropriate), and an estimate of the time and cost for the required maintenance. If temporary or permanent repairs are made, the report shall include a description, photographs, and the date the repairs were completed. Confined area entry and worker protection issues and concerns discussed in the Health and Safety Requirements (Appendix I) section shall be addressed.

Gatewells and Gates

116. Sluice gates should be inspected by operating them to their full up or down position and then returning to the normal position. Full closure is the preferred inspection method. The inspection should verify operability by electric motor or manual backup if both systems exist. Problems in the operation or failure to fully set in the closed position should be noted for maintenance.

117. Flap gates should be inspected to determine if they are fully operable. They should be checked for tight closure and easy opening. Problems shall be corrected.

118. Check valves should be inspected to ensure nothing is hindering the valve from closing. Problems shall be corrected.

Closure Structures

119. Closure structures should be inspected to verify that all assembly parts and tools, including power supply are available for installation.

SEMI-ANNUAL INSPECTIONS

Fencing

120. Fencing shall be inspected for trapped litter and debris and for loose/broken wire ties attaching the wire mesh to the posts. Any vandalism noted should also be reported.

121. The inspection procedures outlined above for fencing trapping debris to snow shall also apply to gates. In addition, gates must swing freely and locks must be in good working order. Gate latches and hinges must be inspected twice a year.

ANNUAL INSPECTIONS

Culverts

122. The culverts shall be inspected for visible structural damage to the culverts and/or trash racks. The culverts and inlet and outlet channels should be checked for debris and excessive sediment deposition and erosion. The areas around the pipes should be inspected for seepage, saturated areas, or boils. The inspection should also verify that riprap at the outlets has not been displaced or removed. Inspection of the culverts should take place in early spring.

Flowage Easements

123. Flowage easement lands shall be inspected annually for illegal dumping, squatters, and other unauthorized construction, disposal and/or occupation. Low-level aerial reconnaissance is an effective method of inspecting the flowage easement lands.

Steel Plate Beam Guardrail

124. Guardrail is installed to protect traffic, to prevent errant vehicles from going beyond safe limits, and to limit vehicle access to off-road areas. While generally maintenance-free, guardrail must be inspected routinely for conditions where an obvious safety hazard exists because the functional integrity of the guardrail has been compromised due to accidents, vandalism, etc.

Pavements and Aggregate Surfaces

125. Bituminous pavements must be inspected for the initial stages of pavement deterioration such as fine cracks, raveling and/or loss of bitumen.

126. Inspect the voids in precast concrete block for adequate vegetative growth and stone fill. Check the blocks for spalled, cracked and/or fractured pieces.

127. If the unpaved road consists of an aggregate surface, then the surface should be inspected for damage such as: corrugations, rutting, soft spots, and holes. If the unpaved road is a grassed surface, the condition of the turf must be checked for healthy, dense growth.

Drainage Ditches

128. Because ditch slopes are relatively flat, they are susceptible to debris build-up and water ponding/stagnation which may result in odor and mosquito problems. Reduced flow capacity can result in a ditch overflowing, often resulting in erosion of overbank areas. Changes in the ditch horizontal and/or vertical alignment require special attention, as scour and/or sediment deposition may occur in these areas.

129. Recurring maintenance problems which require frequent, extensive or expensive repair must be referred to the COE, Chicago District for technical assistance.

INSPECTIONS DURING FLOODING

130. The frequency of patrolling during emergency situations is directly related to the severity of the flood/high water event. Patrols can range from twice a day to an hourly basis. Implementation of emergency actions shall be done under the direction of local representatives experienced and/or trained in flood fighting activities. Certain line-of-protection sections which should be addressed per special concerns are listed in 9.

131. Inspection reports during flooding will consist of problem area descriptions and flood fight facilities which proved to be especially useful. The problem areas descriptions should list the specific location (referring to station numbers on the construction drawings if possible), the problem encountered (wave wash, scour and erosion, overtopping, sand boils, seepage drainage, etc.), the corrective action taken during flooding, and the anticipated necessary corrective action needed during the post flood period. Identifying facilities that performed well will enable a more accurate projection of future flood fight efforts. A sample of the inspection form is included in Appendix C.

132. Closure structures should be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly.

POST-FLOOD INSPECTION

133. The LCRBDC shall prepare a post flood inspection report and forward one copy to the District Engineer. The report shall provide a summary of the flood event. This report shall include a log of operations, a daily tabulation of river stages, a discussion of problems experienced with the flood protection facilities (i.e. sand boils, excessive seepage, clogged toe drains, etc.), damage incurred, repairs required, and other significant factors which occurred during the flood period. The post flood inspection report will provide the supporting documentation to request assistance for repairs to damaged project facilities.

134. Closure structures shall be inspected after flood events to check for damaged or missing parts. Any such parts shall be repaired and/or replaced immediately following the flood event. A project-wide test of the flood warning network and closure operations must be scheduled every five years.

ANNUAL REPORT

135. An Annual Report, summarizing the inspections performed from the period of January to December, shall be submitted to the Chicago District by February 28 of the following year. The report shall cover inspection and maintenance of the project works and will include dated copies of inspection checklists and/or report sheets prepared during the period covered by the report. In the event repairs have been made, either temporary or permanent, the nature and dates of such repairs shall be included in the report. An outline for the Annual Report is included in Appendix E.

CORPS INSPECTIONS

136. Approximately once every year, as well as after any significant flood event, the Chicago District will inspect the project. The Chicago District will coordinate with the Project Sponsor to determine the appropriate dates for inspections. The inspection will identify the condition of the project, describe any deficiencies that have to be corrected, and rate the project as 'Acceptable', 'Minimally Acceptable', or 'Unacceptable' with regards to the required maintenance. Maintaining the project above 'Unacceptable' keeps the project in an active status and eligible for assistance under Public Law 84-99 if the project is damaged from a storm or flood event. A copy of the Corps Inspection Report will be submitted to the Project Sponsor. The Inspection by the Chicago District does not relieve the Project Sponsor from any responsibility of the required inspections or reporting indicated in this manual.

SECTION 11. SURVEILLANCE

SURVEILLANCE REQUIREMENTS

General

137. The surveillance requirements for the Munster Levee System consist of mainly visual and survey observations which are anticipated to take place normally during the various inspections. More advanced continuous surveillance methods such as observation wells, strain gages, movement sensors, and similar devices are not required at this time. If problem areas develop in the future, it may be appropriate to apply one or more of these devices. The following sections generally describe the surveillance to ensure the capabilities of the flood protection improvements are maintained.

Levees

138. The majority of the inspection work performed on levees is sufficient to ensure that dramatic changes are not occurring. Approximately every five years the levee sections need to be surveyed to determine that long term subsidence of the foundation soils or riverbank is not occurring. Such subsidence could occur over time and not be detected by normal visual observations. The survey would check the levee top at 200 to 300 foot intervals to verify that the levee is at or above the design elevation.

Walls

139. Walls are also subject to some subsidence and may also gradually tip from retaining soil and water on one side. Due to this possibility, it is suggested that the wall tops be surveyed similar to the levee section. In addition, periodic checks with a plumb bob or 6 foot carpenters level can determine if tipping is occurring.

Stage Discharge Records

140. Stage discharge records will assist in determining if the design conditions are changing with time. Since the top of protection is set based on a particular stage and discharge it is important to monitor if the stage and discharges are changing over time.

141. Long term stage discharge records should be maintained by the U.S. Army Corps of Engineers and Indiana Department of Natural Resources.

Culverts

142. Culverts passing through the line-of-protection should have their interiors visually inspected by direct means or by video every 5 years, minimum. A video condition assessment of the pipes would be performed to the current industry standard – National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) pipe coding method. For information including certified software, publications, and specifications, see www.nassco.org.

SECTION 12. REPAIR, REPLACEMENT, AND REHABILITATION (RR&R)

GENERAL

143. Repair is considered to entail those activities of a routine nature that maintain the project in a well kept condition. Replacement covers those activities taken when a worn-out element or portion thereof is replaced. Rehabilitation refers to a set of activities as necessary to bring a deteriorated project back to its original condition. RR&R actions are to conform to the project as-built plans and specifications unless other arrangements are made with the Chicago District. These activities are the responsibility of the Project Sponsor.

POST-FLOOD REPAIR, REPLACEMENT, AND REHABILITATION

144. The LCRBDC and affected local communities shall begin a program of repair of damaged project features immediately following a flood event or period of high water. Then, a general description of critical repair items for each project feature shall be made. The term “flood event” shall be used in these descriptions for both a flood event and period of high water. Post-flood inspections shall include all of the items listed and/or discussed in the respective ORDINARY INSPECTION section per project feature. The COE, Chicago District will provide assistance to the LCRBDC in determining repair, replacement and rehabilitation requirements.

Levee and Overflow Embankments

145. Any repair program should include replacing embankment or riverbank materials in eroded areas, relaying or replacing riprap in disturbed areas, resodding or reseeding of damaged sodded areas, and correcting settlement and/or bank caving conditions affecting the stability of the levee. Repair of levee and embankments should be carried out immediately after flood events. Repair or replacement of appurtenant features that do not affect the stability of the levee should be carried out as soon as practicable. Repairs shall be made in accordance with original construction specifications and as-built plans.

Floodwalls

146. Any repair program should address areas of seepage, boils and/or caving, settlement, and deviations from design vertical and horizontal alignments that impact the stability of the floodwalls. Repair of floodwall sections and/or surrounding earthen areas should be carried out immediately after flood events. Repair or replacement of appurtenant features that do not affect the stability of the floodwalls should be carried out as soon as practicable.

Pump Stations

147. Any repair program that addresses critical areas which impact the pumping capability of the pump stations should be carried out immediately after the event. Repairs to any less critical features of the station should be carried out as soon as practicable.

Gatewells and Gates

148. Damage to the gatewells sustained during flood events that impair the function of the structure should be repaired immediately. Non-functional gates or gates damaged during a flood event should be repaired immediately after the event. Repairs to less critical features of the structures should be carried out as soon as practicable.

Closure Structures

149. Damaged or stolen parts should be replaced or repaired immediately.

Culverts

150. Culverts and/or trash racks blocked during a flood event should be cleaned immediately after the event. Erosion to inlets or outlets should be repaired as soon as possible. Inlet and outlet channels blocked by debris during a flood event should be cleared immediately after the event.

Precipitation/Stream Gage Network

151. Repair, replacement or rehabilitation of any of the precipitation/stream gaging equipment damaged during a flood event should be accomplished immediately or as soon as possible. At present, this type of maintenance will be handled by the USGS under contract to the COE, Chicago District. Once management of the system is assumed by the LCRBDC, repair, replacement and/or rehabilitation of any of the gaging network equipment shall be administered by the LCRBDC, in conjunction with the communities protected by such equipment.

Base Stations

152. Repair, replacement or rehabilitation of base stations, computer equipment, and software damaged during a flood event should be accomplished immediately. At present, this type of maintenance will be handled by the USGS, under contract with the COE, Chicago District. Once management of the system is assumed by the LCRBDC, repair, replacement and/or rehabilitation of base stations computer equipment and/or software shall be administered by the LCRBDC, in conjunction with the communities protected by the base stations.

Miscellaneous Features

Access Control

153. Repairs to fencing after flood events shall generally include replacing posts and restringing wire mesh. Repairs should be made using in-kind material(s), as possible.

154. Gates shall be repaired similar to fencing. Severely damaged or broken gates shall be replaced with in-kind materials. Gate latches and hinges shall be lubricated.

155. Tilted posts of the steel plate beam guardrail shall be jacked into alignment, settled posts shall be jacked to grade and elevation, and erosion damage around posts shall be repaired as soon as practicable after the event.

156. Severely damaged areas of bituminous pavements shall be removed and replaced in accordance with original construction specifications and as-built plans.

157. Damaged areas of precast concrete block pavements shall be removed and replaced in accordance with original construction specifications and as-builts. If there is severe pavement deformation or rutting, the entire pavement shall be removed, the sub-grade compacted, and materials replaced in accordance with original construction specifications and as-built plans.

Unpaved Roads

158. If unpaved road consists of an aggregate surface, then the repair and rehabilitation procedures outlined for aggregate roads are applicable. If the unpaved road is a grassed surface, it is reasonable to assume that after prolonged rain has saturated the turf, topsoil, and upper portions of the clay sub-grade, flood fighting traffic may cause surface rutting and turf damage. After the flood fighting operations are over, the levee crest should be inspected for evidence of rutting and turf damage. If damage is minor, topsoil can be added and compacted to bring the rutted areas up to grade, and then reseeded. If the damage is more extensive, the levee crest may require regrading. The levee crest cross-section must be graded to eliminate low spots and provide an adequate slope to facilitate drainage towards the river. All repair work shall be performed in accordance with standard COE levee and topsoil placement specifications. Following such repair work, the crest of the levee shall be surveyed to verify that the levee crest is at or greater than the design elevation.

159. Ditches that have been severely silted in or damaged resulting in loss of grade or cross-section shall be regraded and dressed in accordance with original specifications and as-built plans.

160. Badly damaged sections such as broken-up rock shall be replaced with new materials. Areas that have been completely eroded away shall be regraded, new filter material placed, and new riprap placed in accordance with original construction specifications and as-built plans.

161. Large blockages at bridges over the river should be removed immediately. Scheduled channel maintenance should be accelerated in the event that a large amount of deposition occurred during the event. All snags and other debris shall be removed and all damage to banks, riprap, floodwalls, drainage outlets, or other flood control structures should be repaired as soon as practicable.

162. Sediment and/or debris removal, erosion damage and concrete and/or repair, and side wall realignment(s) of control structures should occur as soon as practicable.

163. Any RR&R item must be documented in the Annual Report. Appropriate updates to this O&M Manual and the Project As-Builts must be made at the completion of these actions.

PROJECT MODIFICATIONS

164. Encroachments shall be not allowed within the project rights-of-way, unless reviewed and approved as a project modification. Improvements that pass over, under, or through the project rights-of-way shall not allowed without prior determination of the Chicago District that such improvements or alterations will not adversely affect the functioning of the project. Any improvements considered by the Project Sponsor to be worthwhile shall be submitted to the Chicago District as a Project Modification Request, with all appropriate design computations and drawings and other pertinent information. These requests must be approved before the modifications can be allowed to proceed. Upon the physical completion of the approved Project Modifications, the Project As-Built drawings and this O&M Manual shall be updated as necessary.

165. The status of any requested project modification shall be included in the Annual Report for the year requested until the year in which the work has been completed or cancelled.

SECTION 13. NOTIFICATION OF DISTRESS AND REPORTING

IDENTIFICATION OF DISTRESS

166. Whenever the Town of Munster and Lake County anticipate that they will be unable to adequately prepare for or fight a flooding event, will require additional materials for a flood fight which may be in the U.S. Army Corps of Engineers possession, or anticipates other difficulties related to the flood control project; it should immediately contact the U.S. Army Corps of Engineers, Chicago District for assistance. Assistance may be provided in many different forms depending on the specific needs of the Town. In order to ensure that the request for assistance to the Corps is made with the full consent of the local authorities and that local resources have been exhausted, a single point of contact with the Corps should be established. This single contact should be familiar with the entire flood control project, the resources of the Town, the current problem or problems which are triggering the request for assistance, and be authorized to deal with the Corps. In this manner the requests to the Corps will be coordinated and conflicting responses or directions will be avoided.

167. Evidence of distress at the project shall be immediately reported to the Chicago District. Typical evidence of distress to be reported may include:

- Sloughs, settlement, cracks or slides in embankments.
- Evidence of piping or muddy water boils.
- Increases in flow through or under embankments or structures.
- Vertical or horizontal movement of structures.
- Significant cracking of concrete structures.
- Damage to structures from manmade or natural causes.
- Any indications of distress that could inhibit the operation of the project or endanger life or property.

168. To report conditions of distress, submit the Annual Report, or request a Project Modification Request, contact:

US Army Corps of Engineers, Chicago District
Chief, Constructions-Operations Branch
111 N. Canal Street, Suite 600
Chicago, IL 60606

Office Phone Number: (312) 846-5470
Emergency Phone Number (24hr/7day): (312) 886-7756
Fax Number: (312) 353-2141








Munster Levee Segment - Plate 1

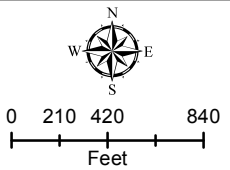
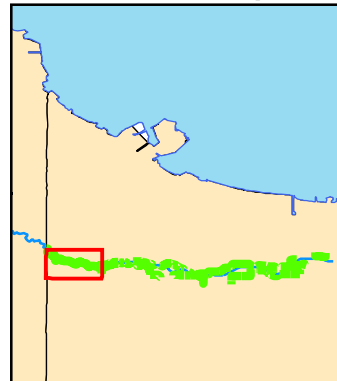
U.S. Army Corps
of Engineers
Chicago District



Legend

-  Closure
-  Levee
-  Floodwall
-  Gates
-  Pump Station

Location Map



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Levee (ft) 5,407
 Floodwall (ft) 11,175
 Pumpstations 4
 Gates 11
 Closures 3



Munster Levee Segment - Plate 2

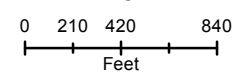
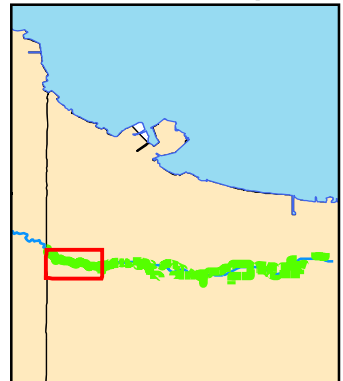
U.S. Army Corps
of Engineers
Chicago District



Legend

- Closure
- Levee
- Floodwall
- Protected Area

Location Map



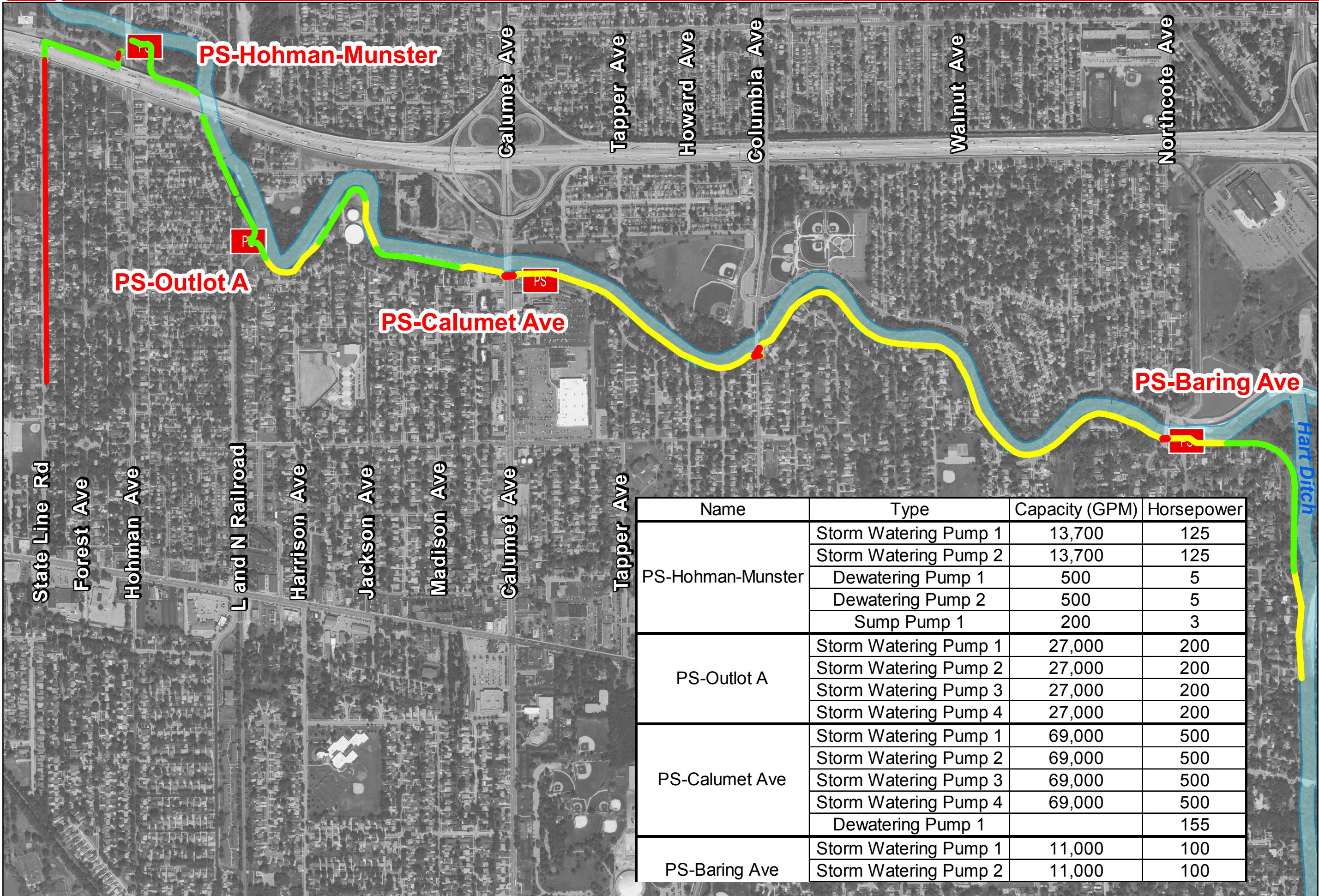
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Protected Area







Munster Levee Segment - Plate 3

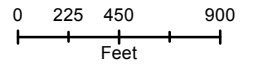
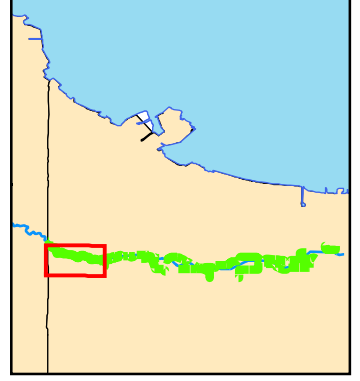
U.S. Army Corps of Engineers
Chicago District



Legend

-  Closure
-  Levee
-  Floodwall
-  Pump Station

Location Map



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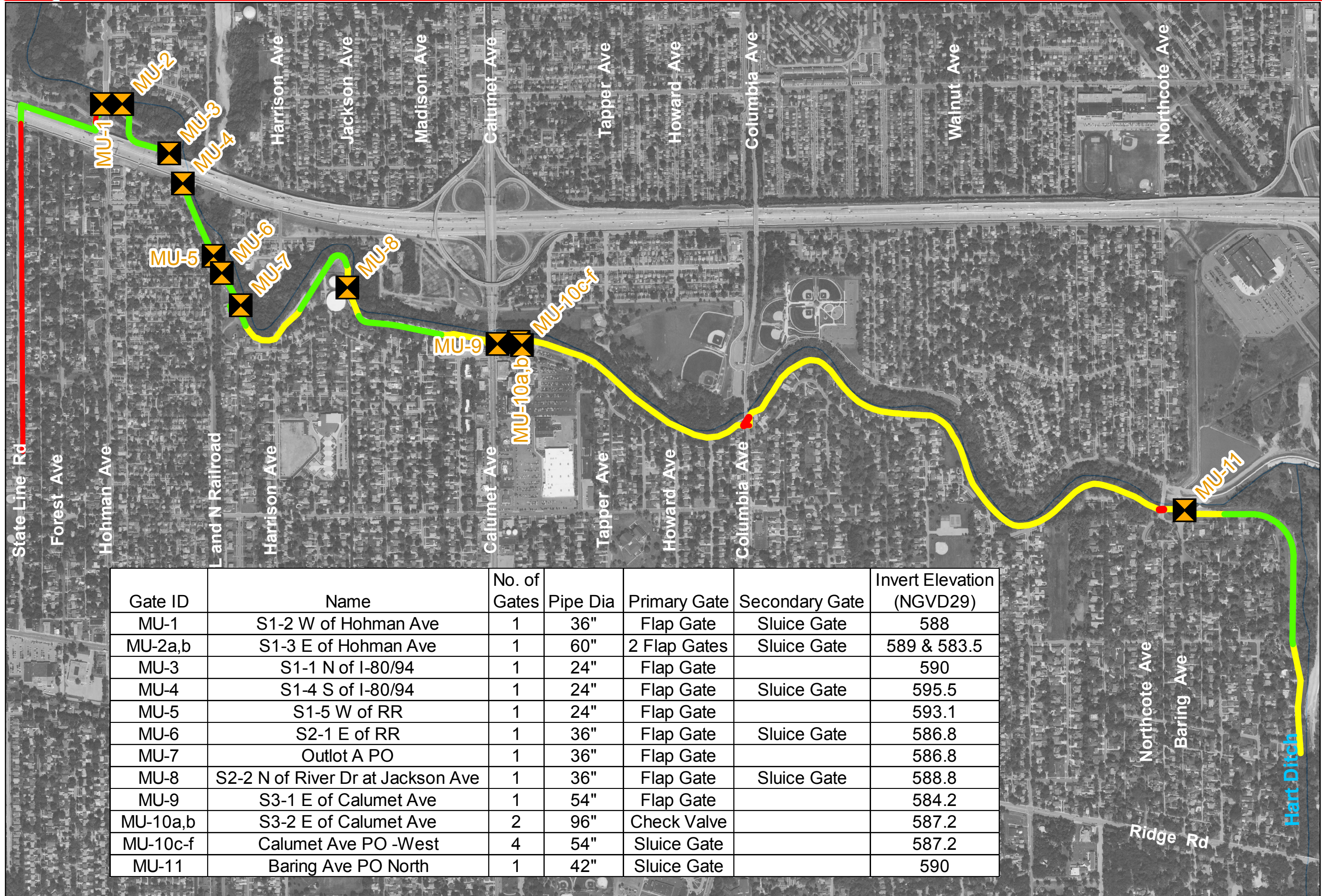
Name	Type	Capacity (GPM)	Horsepower
PS-Hohman-Munster	Storm Watering Pump 1	13,700	125
	Storm Watering Pump 2	13,700	125
	Dewatering Pump 1	500	5
	Dewatering Pump 2	500	5
	Sump Pump 1	200	3
PS-Outlot A	Storm Watering Pump 1	27,000	200
	Storm Watering Pump 2	27,000	200
	Storm Watering Pump 3	27,000	200
	Storm Watering Pump 4	27,000	200
	Dewatering Pump 1		155
PS-Calumet Ave	Storm Watering Pump 1	69,000	500
	Storm Watering Pump 2	69,000	500
	Storm Watering Pump 3	69,000	500
	Storm Watering Pump 4	69,000	500
	Dewatering Pump 1		155
PS-Baring Ave	Storm Watering Pump 1	11,000	100
	Storm Watering Pump 2	11,000	100

Pump Station Locations & Information



Munster Levee Segment - Plate 4

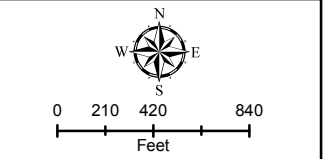
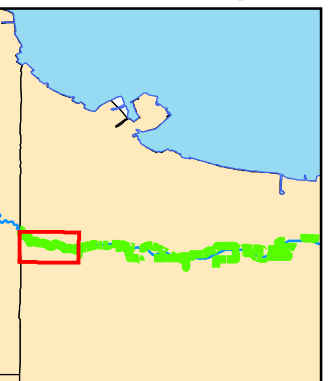
U.S. Army Corps
of Engineers
Chicago District



Legend

- Gates
- Closure
- Levee
- Floodwall

Location Map



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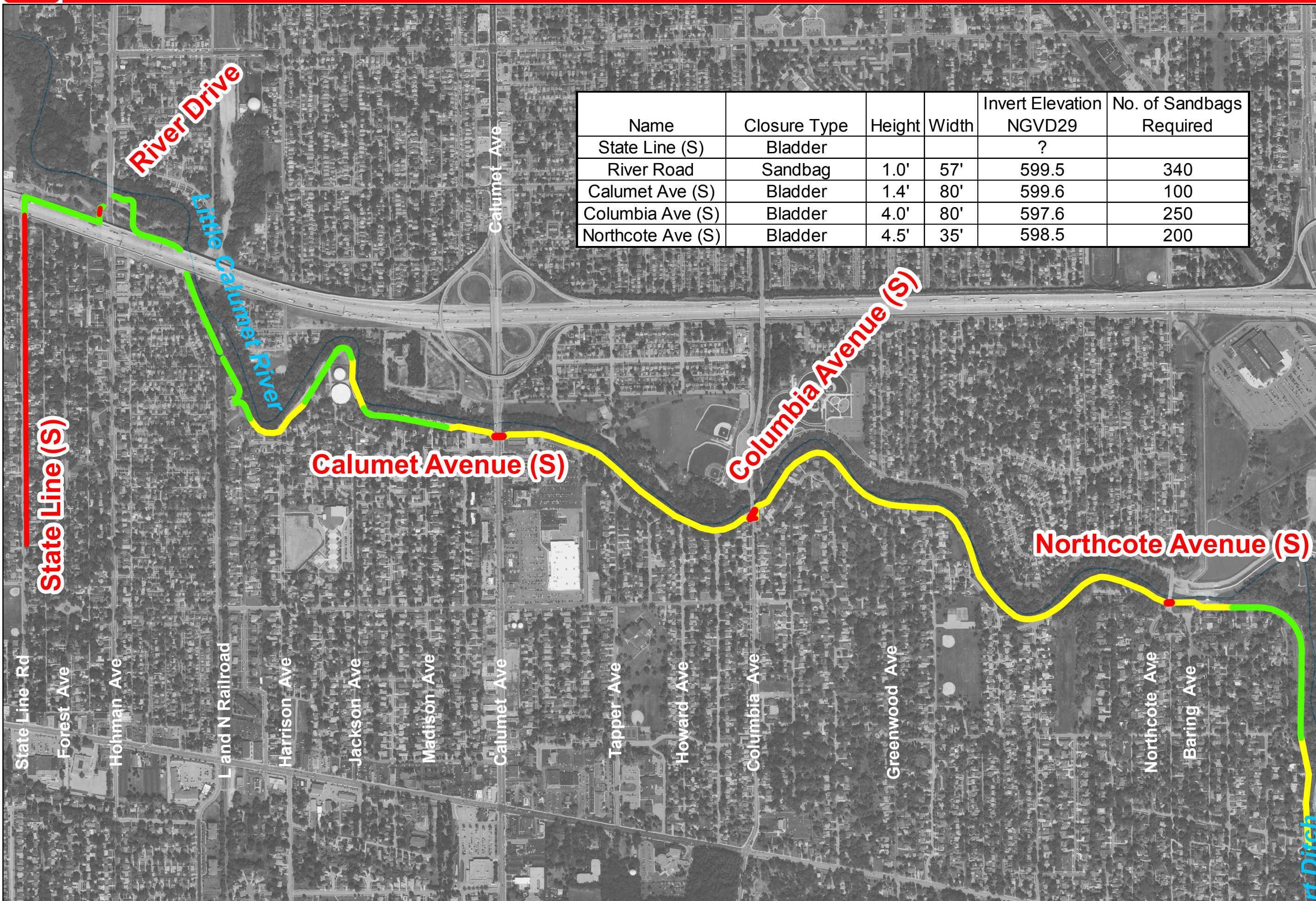
Gatewell Locations

Gate ID	Name	No. of Gates	Pipe Dia	Primary Gate	Secondary Gate	Invert Elevation (NGVD29)
MU-1	S1-2 W of Hohman Ave	1	36"	Flap Gate	Sluice Gate	588
MU-2a,b	S1-3 E of Hohman Ave	1	60"	2 Flap Gates	Sluice Gate	589 & 583.5
MU-3	S1-1 N of I-80/94	1	24"	Flap Gate		590
MU-4	S1-4 S of I-80/94	1	24"	Flap Gate	Sluice Gate	595.5
MU-5	S1-5 W of RR	1	24"	Flap Gate		593.1
MU-6	S2-1 E of RR	1	36"	Flap Gate	Sluice Gate	586.8
MU-7	Outlot A PO	1	36"	Flap Gate		586.8
MU-8	S2-2 N of River Dr at Jackson Ave	1	36"	Flap Gate	Sluice Gate	588.8
MU-9	S3-1 E of Calumet Ave	1	54"	Flap Gate		584.2
MU-10a,b	S3-2 E of Calumet Ave	2	96"	Check Valve		587.2
MU-10c-f	Calumet Ave PO -West	4	54"	Sluice Gate		587.2
MU-11	Baring Ave PO North	1	42"	Sluice Gate		590



Munster Levee Segment - Plate 5

U.S. Army Corps
of Engineers
Chicago District

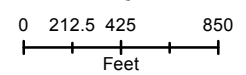
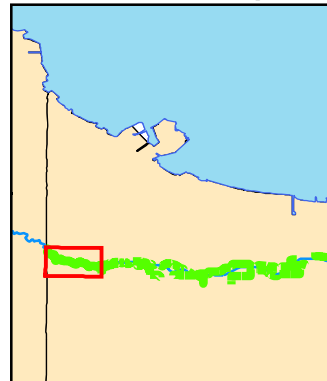


Name	Closure Type	Height	Width	Invert Elevation NGVD29	No. of Sandbags Required
State Line (S)	Bladder			?	
River Road	Sandbag	1.0'	57'	599.5	340
Calumet Ave (S)	Bladder	1.4'	80'	599.6	100
Columbia Ave (S)	Bladder	4.0'	80'	597.6	250
Northcote Ave (S)	Bladder	4.5'	35'	598.5	200

Legend

- █ Closure
- █ Levee
- █ Floodwall

Location Map



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Closure Information & Location



Munster Levee Segment - Plate 6

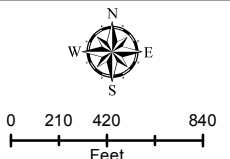
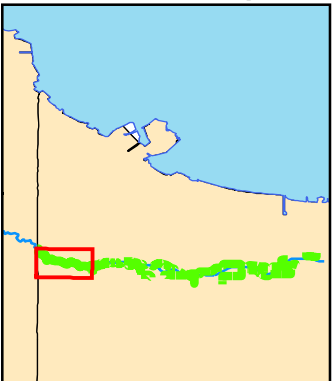
U.S. Army Corps
of Engineers
Chicago District



Legend

- Overflow Section
- Closure Structure
- Levee
- Floodwall

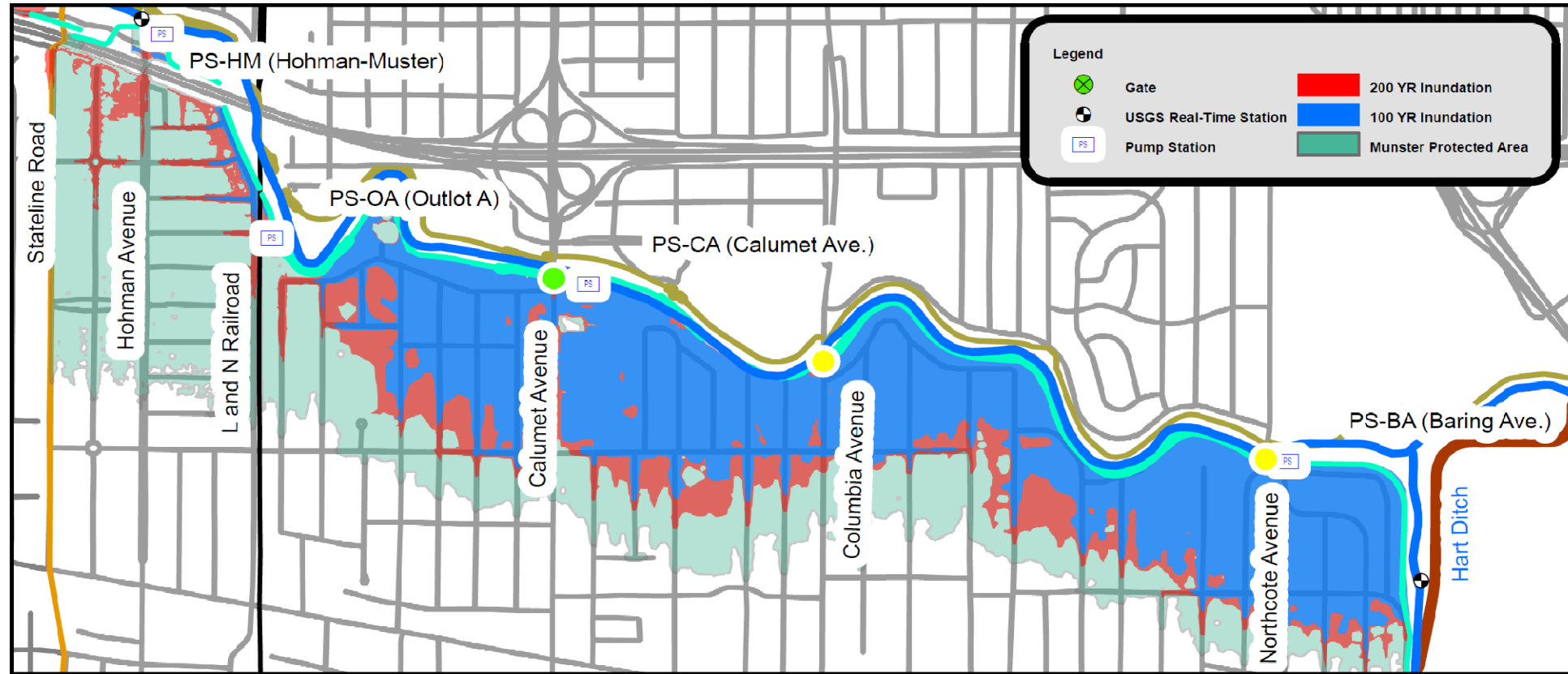
Location Map



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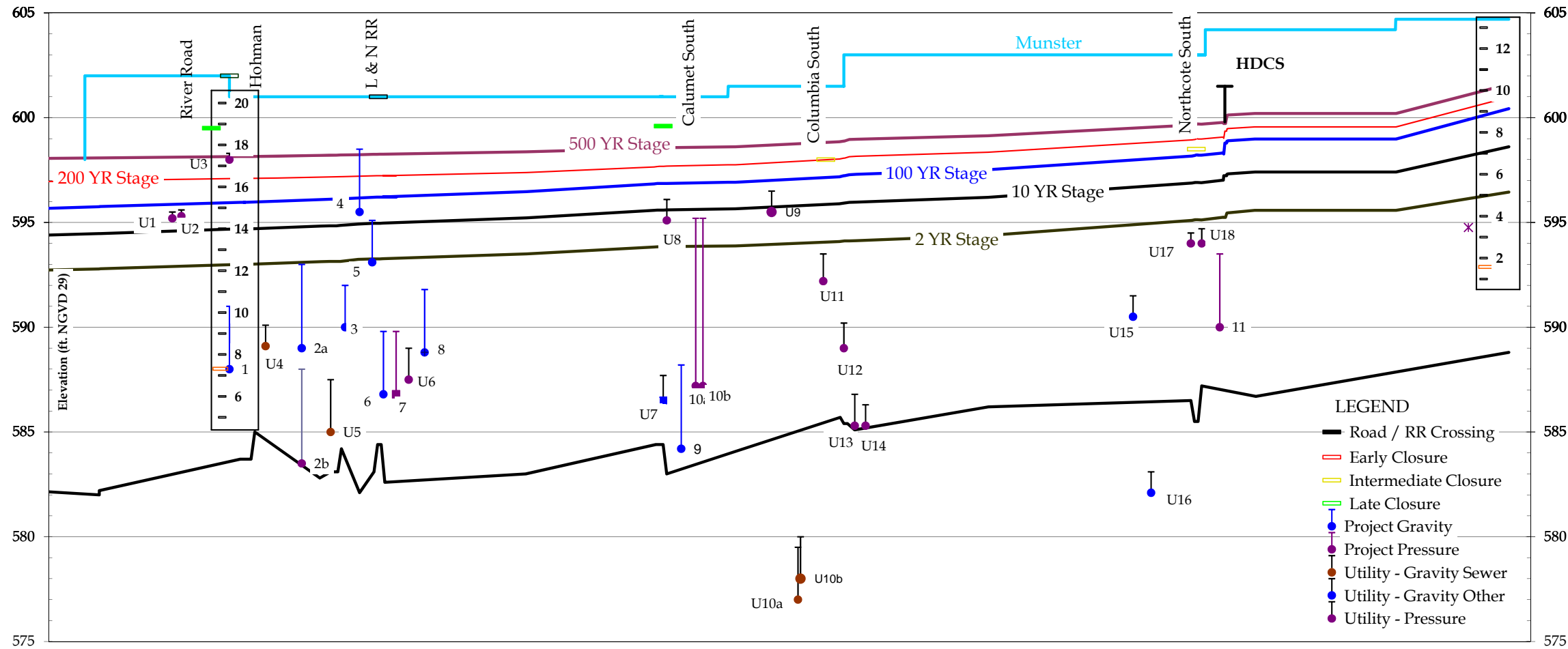
Overflow Location
Stateline (South) at
River Mile 16.043

LCR - PROJECT FEATURES - MUNSTER



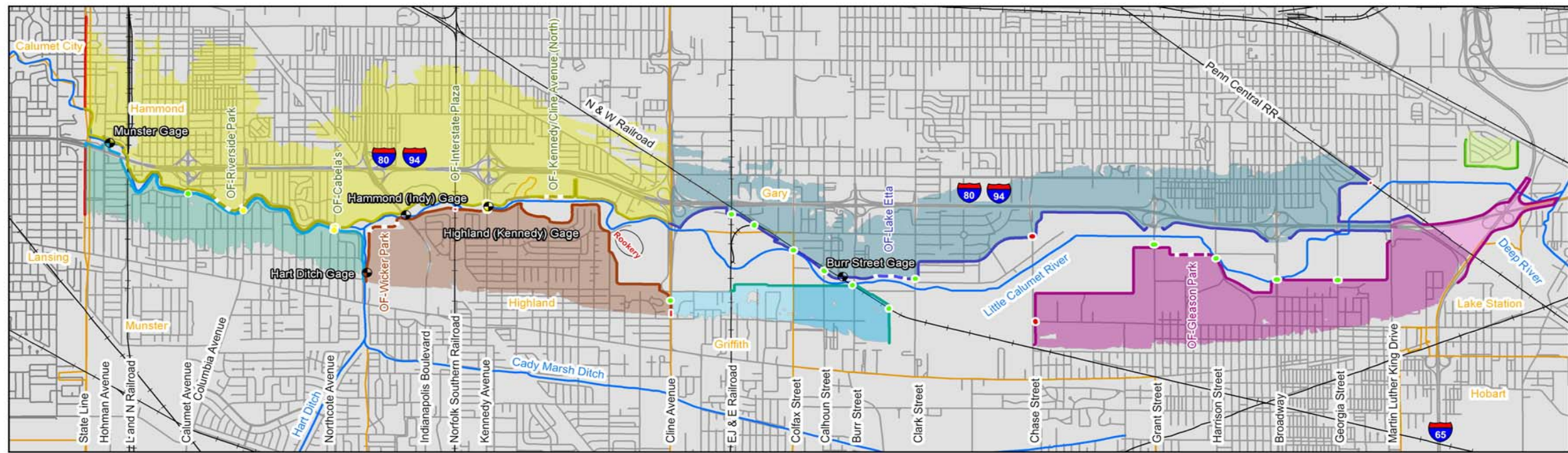
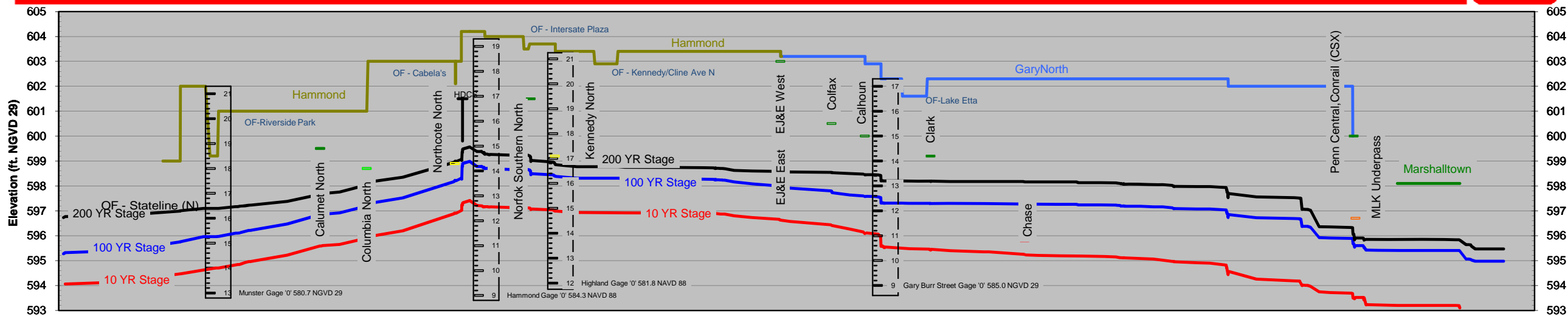
ID	P/G	DIA.	MAT.	TYPE	PROJ. NAME OR CONNECTION
MUNSTER (MU)					
MU- U1	P	4		UTIL - Waterline	
MU- U2	P	2		UTIL - Gas line	
MU- 1	G	36	RCP	PRJ - Gravity Outlet	S1-2
MU- U3	P	2		UTIL - Gas line	
MU- U4	G	12	DIP	UTIL - Combined Sewer	Riverside / Hammond
MU- 2a	G	48	RCP	PRJ - Gravity Outlet	S1-3
MU- 2b	P	54	RCP	PRJ - Pump Station	S1-3, Hohman-Munster PS
MU- U5	G	30	DIP	UTIL - Combined Sewer	Riverside / Hammond
MU- 3	G	24	RCP	PRJ - Gravity Outlet	S1-1
MU- 4	G	36	RCP	PRJ - Gravity Outlet	S1-4
MU- 5	G	24	RCP	PRJ - Gravity Outlet	S1-5
MU- 6	G	36	RCP	PRJ - Gravity Outlet	S2-1
MU- 7	P	36	RCP	PRJ - Pump Station	Outlot A PS Outlet
MU- U6	P	18		UTIL - Waterline	
MU- 8	G	36	RCP	PRJ - Gravity Outlet	S2-2
MU- U7	G	14		UTIL - Telephone duct	
MU- U8	P	12		UTIL - Waterline	
MU- 9	G	54	RCP	PRJ - Gravity Outlet	S3-1
MU- 10a	P	96	RCP	PRJ - Pump Station	Calumet Ave PS, S3-2
MU- 10b	P	96	RCP	PRJ - Pump Station	Calumet Ave PS, S3-2
MU- U9	P	12		UTIL - Gas Line	
MU- U10a	G	30	RCP	UTIL - Sanitary Sewer	Riverside / Hammond
MU- U10b	G	30	RCP	UTIL - Sanitary Sewer	Riverside / Hammond
MU- U11	P	18	CIP	UTIL - Waterline	
MU- U12	P	14		UTIL - Oil line	
MU- U13	P	18		UTIL - Oil line	
MU- U14	P	12		UTIL - Oil line	
MU- U15	G	12		UTIL - AT & T Duct	
MU- U16	G	12		UTIL - Combined Sewer	Riverside / Baring PS
MU- U17	P	6		UTIL - Gas Line	
MU- U18	P	8		UTIL - Gas Line	
MU- 11	P	42	RCP	PRJ - Pump Station	Barring Avenue PS

P/G Pressure or gravity line PRJ - Project Feature UTIL - Utility



Map and profiles current as of 23 March 2011. Project and utility penetrations through and below the line of protection are based on as-built drawings and contract drawings.

LITTLE CALUMET RIVER PROFILES AND CLOSURES



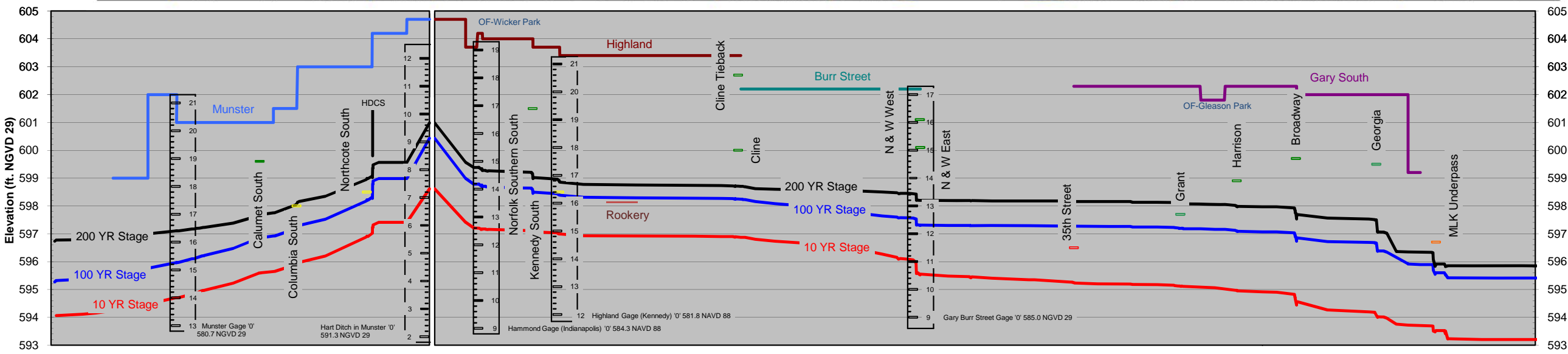
Legend

- US_River_Gages_USGS
- Early Closure
- Intermediate Closure
- Late Closure

Protected Area-Segments

- Marshalltown
- IHDOT
- Gary South
- Gary North
- Gary Burr Street
- Griffith River Rd Levee
- Highland
- Munster
- Hammond & Forest Ave

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APPENDIX A. CONTACT LIST

1. In any flood emergency affecting the Munster Levee System, the initial warning notification should go to:

1. Public Works
2. Public Information Officer
3. Munster Police Department

For any flood emergency, the community officials to be notified are as follows:

DEPARTMENT	TITLE & PHONE	NAME*
Munster Town Hall 1005 Ridge Road Munster, IN 46321	Town Manager 219 836-6900	Thomas DeGiulio
Police Department 1001 Ridge Road Munster, IN 46321	Non-Emergency 219 836-6600	Steve Scheckel
Fire Department 1005 Ridge Road Munster, IN 46321	Non-Emergency 219 836-6600	Bill O'Brien
Public Works (Streets, Sanitation, and Water) 1005 Ridge Road Munster, IN 46321	219 836-6970	Bev Paris
Health Department (Lake County) Building A, 3 rd Floor 2293 N. Main Street Crown Point, IN 46307	Health Officer 219 755-3655	Susan Best
Public Information Office 1005 Ridge Road Munster, IN 46321	Public Information Officer 219 836-6999	Charlene Stout
Town Engineer 1005 Ridge Road Munster, IN 46321	219 853-6336	James Mandon

*The points of contact should be verified annually and updated as necessary.

Flood Response Team

2. For severe flooding situations, Warning Level 5 - Overtop Mobilize, the Town of Munster will establish a flood response coordinating committee consisting of the individuals indicated in the table below. The Town Manager of Munster will have ultimate decision making authority. The committee headquarters will be located at the Munster Town Hall.

Flood Response Coordinating Committee

TITLE	FUNCTION	NAME*	PHONE NUMBER
Town Manager	Coordinate all activities	Thomas DeGiulio	(219) 836-6900
Sanitary District Manager	Crews, barricades, closure of roadways and railroads, equipment, and sandbagging	Bev Paris	(219) 836-6970
Police Chief	Traffic control, security, and evacuation	Steve Scheckel	(219) 836-6600
Fire Chief	Emergency medical service, contact utilities, evacuation, assist in sandbagging, contact the Red Cross and Salvation Army	Bill O'Brien	(219) 836-6600
Superintendent of Schools	Emergency shelters, buses for evacuation, if needed	William Pfister	(219) 836-9111 ext. 1012
Director of Parks & Recreation	Assist Town Manager with coordination of activities	Robert O'Shaughnessy	(219) 836-7275 ext. 6925

*The points of contact should be verified annually and updated as necessary.

APPENDIX B. PROJECT COOPERATION AGREEMENT

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE LITTLE CALUMET RIVER BASIN DEVELOPMENT COMMISSION
FOR CONSTRUCTION OF THE
LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION
AND RECREATION PROJECT

THIS AGREEMENT, entered into this 16th day of August, 1990, 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 Little Calumet River Basin Development Commission (hereinafter referred to as the "Commission"), acting by and through its Chairperson,

WITNESSETH, THAT:

WHEREAS, construction of the Little Calumet River, Indiana Local Flood Protection and Recreation Project at the Little Calumet River between the Illinois – Indiana State line and the Consolidated Rail Corporation Railroad crossing in Gary, Indiana (hereinafter referred to as the "Project", as defined in Article I.a. of this Agreement), was authorized by Section 401 of the Water Resource Development Act of 1986 (P.L. 99-662), to be constructed substantially in accordance with Plan 3A contained in the Report of the Chief of Engineers, dated June 2, 1984; and

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

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provides that the construction of any water resources project by the Secretary of the Army of the Army shall not be commenced until each non-federal interest has entered into a written agreement to furnish its required cooperation for the project; and,

WHEREAS, on 1 June 1988, the Assistant Secretary of the Army (Civil Works) approved a credit with an estimated value of \$1,667,200 for the Little Calumet River Basin Development Commission toward the Commission's share of project cost in accordance with Section 104 of the Act; and,

WHEREAS, the Commission does not qualify for a reduction of the maximum non-Federal cost share pursuant to the guidelines which implement Section 103(m) of the Water Resources Development Act of 1986, Public Law 99-662, published in 33 C.F.R., sections 241.1 – 6, entitled "Flood Control Cost-Sharing Requirements Under the Ability to Pay Provision"; and,

WHEREAS, the Commission has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in cost-sharing and financing in accordance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

ARTICLE I – DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

a. The term “Project shall mean the structural and non-structural flood control measures at Little Calumet together with construction of recreation hiking trails throughout the project area with the construction of associated recreation support areas within the project ravine corridor and at the borrow site in the town of Schererville; construction of disposal facilities; preserving land designated as wetlands; and construction of fish and wildlife mitigation and enhancement measures, as generally described in the Little Calumet Phase II, General Design Memorandum dated September 1986, and approved June 1990.

b. The term “structural flood control features of the Project” shall mean staged construction of replacing existing berms with new levees along the north and south banks of the Little Calumet River between the Illinois – Indiana State line and Cline Avenue in the towns of Munster, Highland, and Griffith and the city of Hammond; replacing one storm water pumping station and modifying pumping stations owned by the Hammond Sanitary District, the town of Highland, and the Gary Sanitary District; relocation of Indianapolis Boulevard bridge owned by the Indiana Department of Highways; construction of a water control structure on the Little Calumet River near the confluence of Hart Ditch; constructing of new levees in the city of Gary between Cline Avenue and the Consolidated Rail Corporation near the Martin Luther Kind, Jr. Drive at an alignment similar to that as shown in the Phase II General Design Memorandum for the Authorized Plan; modifying the channel between Illinois – Indiana State line and Indianapolis Boulevard and between Chase Street and the Consolidated Rail Corporation in the city of Gary with associated highway crossing relocations at Chase Street, Grant Street, Georgia Street, Borman Expressway (Interstate Highway 80/94);

c. The term “non-structural flood control features of the Project” shall mean providing flood damage protection to the interior of a structure up to the design level of protection by: permanently or during emergencies sealing all points of entry of flood waters into the structure; raising the structure above its existing first floor elevation; constructing ring levees to protect structures; and/or temporary or permanent evacuation.

d. The term “total project costs” shall mean all costs incurred by the Commission and the Government directly related to construction of the Project. Such cost shall include, but not necessarily be limited to, continuing planning and engineering costs incurred after October 1, 1985; costs of applicable engineering and design; actual construction costs; supervision and administration costs; costs of contract dispute settlements or awards, and the value of lands, easements and rights-of-way, utility and facility alterations or relocations, and dredged material disposal areas provided for the Project by the Commission, but shall not include any costs for betterments, operation, repair, maintenance, replacement or rehabilitation.

e. The term “separable cost of recreation features” shall mean all separable costs incurred by the Commission and the Government for construction of the project recreation features (excluding betterments and operation and maintenance costs). Such recreation costs shall include, but not necessarily be limited to continuing planning and engineering costs incurred after October 1, 1985; costs of applicable engineering and design; actual construction costs; supervision and administration costs; costs of contract dispute settlements or awards; and the value of any separable lands necessary for access, parking, public health, and safety.

f. The term “period of construction” shall mean the time from the advertisement of the first construction contract to the time of acceptance of the Project by the Contracting Officer/

g. The term “Contracting Officer” shall mean the U.S. Army District Engineer for the Chicago District, or his designee.

h. The term “highway” shall mean any highway, thoroughfare, roadway, street, or other public road or way.

i. The term “relocations” shall mean alterations, modifications, lowering or raising in place, and/or new highways, bridges, railroad bridges and approaches thereto, buildings, commercial and gas pipelines, public utilities (such as municipal water and sanitary sewer lines, telephone lines, and storm drains), aerial utilities, cemeteries, and other facilities, structures, and improvements determined by the Government to be necessary for the construction, operation and maintenance of the Project.

j. The term “fiscal year” shall mean one fiscal year of the United States Government, unless otherwise specifically indicated. The Government fiscal year begins on October 1 and ends September 30.

k. The term “involuntary acquisition” shall mean the acquisition of lands, easements, and rights-of-way by eminent domain.

l. The term “functional portion of the Project” shall mean a completed portion of the Project as determined by the Contracting Officer to be suitable for tender to the Commission to operate and maintain in advance of completion of construction of the entire Project.

ARTICLE II – OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the Commission and appropriated by the Congress of the United States, shall expeditiously construct the Project (including relocations of railroad bridges and approaches thereto), applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The Commission shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bid. The Commission will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the comments of the Commission, but award of contracts, modifications or change orders, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government.

b. When the Government determines that the Project or a functional portion of the Project is complete, the Government shall turn the completed Project or functional portion over to the Commission, which shall accept the Project or functional portion and be solely responsible for operating, repairing, maintaining, replacing, and rehabilitating the Project or functional portion in accordance with Article VIII thereof. The Commission shall have the right to contract with local municipalities, drainage districts or municipal corporations for the operation, maintenance, repair, replacement and rehabilitation of the project. However, such contractual agreements shall not relieve the Commission of its responsibility for the operation, maintenance, repair, replacement and rehabilitation of the project and the Commission shall remain solely responsible for assuring performance of all operation, maintenance, repair, replacement and rehabilitation as required under P.L. 99-662.

1. Prior to the Government's determination that the Project or functional portion of the Project is complete, the Government will request that the Commission participate in a joint inspection. In the event the Commission objects to the Government's proposed determination of completion, it shall within 30 days of receiving notice of such determination, file with the Government, a written objection to said determination, listing, therein, the reasons for its objection. The Government will consider and respond, in writing, to the Commission's objections prior to turning over the Project or functional portion to the Commission to operate, maintain, repair, replace and rehabilitate.

c. As further specified in Article VI herein, the Commission shall provide, during the period of construction, a cash contribution of 5 percent of the costs of structural flood control measures.

d. As further specified in Article III herein, the Commission shall provide all lands, easements, rights-of-way, borrow, spoil and dredged material disposal areas, and perform all relocations (excluding railroad bridges and approaches thereto) determined by the Government to be necessary for construction of the structural flood control features of the Project.

e. If the value of the contributions provided under paragraphs c. and d. of this Article represents less than 25 percent of total costs of the structural flood control features of the project, the Commission shall provide, during the period of construction, an additional cash contribution in the amount necessary to make its total contribution equal to 25 percent of the costs of structural features of the Project.

f. As further specified in Article VI herein the Commission shall provide 25 percent of the total cost of the non-structural features of the Project.

g. As further specified in Article III herein, the Commission shall provide all lands, easements, rights-of-way, together with any dredged material disposal areas, utility and facility relocations or alterations determined by the Government to be necessary for construction of the non-structural flood control features of the Project.

h. If the value of the contributions provided under paragraph f. and g. of this Article represents less than 25 percent of total costs of the non-structural flood control features of the project, the Commission shall pay, upon completion of construction, such additional amounts as are necessary to make the Commission's share equal to 25 percent of the total cost of the non-structural flood control measures.

i. At its sole discretion, the Government may perform relocations in cases where it appears that the Commission's contributions will exceed the maximum non-Federal cost share set out in Article VI.f.

j. The Government shall afford credit for integral compatible work performed by the Commission toward the Commission's project contributions in accordance with Section 104 of the Act. Such credit shall not exceed \$1,667,200. The credit shall be afforded against the Commission's cost sharing requirements for the Project, less the Commission's share of the five percent cash contribution required under Article II.c of this Agreement.

k. As further specified in Article VI hereof, the Commission shall provide during the period of construction, a cash contribution of 50 percent of total project costs allowed to separable recreation features.

l. As further specified in Article VI hereof, the Commission shall provide during the period of construction, a cash contribution of 25 percent of total subject costs allocated to fish and wildlife enhancement.

m. No Federal funds may be used to meet the Commission's share of project costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified in writing by the granting agency.

n. The Commission Agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs.

o. The Government shall install a flood monitoring and warning system. The Government and the Commission will collaborate on the formulation and operation of the monitoring and warning plan to be implemented.

p. No less than once each year the Commission shall inform affected interests of the limitations of the protection afforded by the Project.

q. The Commission shall publicize floodplain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be in the floodplain 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. The Commission shall fulfill its obligation outlined in paragraph p. and q. of this Article by publishing said information in a local newspaper and posting notice at local post offices or other local newspaper or posting locations.

s. The Commission shall prevent encroachment of any of the flood protection structures, including ponding areas, and if ponding areas are impaired, provide substitute storage capacity or equivalent pumping capacity promptly without cost to the Government.

ARTICLE III – LANDS, FACILITIES, AND PUBLIC LAW 91-646 RELOCATION ASSISTANCE

a. The Commission shall furnish to the Government all lands, easements and rights-of-way, including suitable borrow, spoil and dredged material disposal areas, as may be determined by the Government to be necessary for the construction, operation, and maintenance of the Project, and shall furnish to the Government evidence supporting the Commission's legal authority to grant rights-of-entry to such lands, to include any real estate interests that may be required to allow access to structures identified for non-structural flood proofing. The Government will delineate all lands, easements and rights-of-way needed for the particular functional element to be constructed prior to anticipated contract advertisement so as to afford the Commission adequate time to acquire same. The necessary lands, easements, and rights-of-way may be provided incrementally, but all lands, easements, and rights-of-way determined by the Government to be necessary for work to be performed under a construction contract must be furnished prior to the advertisement of the construction contract.

b. The Commission shall provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the Project.

c. Upon notification from the Government, the Commission shall accomplish or arrange for accomplishment at no cost to the Government all relocations (excluding railroad bridges and approaches thereto) determined by the Government to be necessary for construction of the Project.

d. The Commission 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 CFR Part 24, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

e. The Commission shall acquire fee title, or such lesser interest as is determined by the Government to be necessary to allow access and to insure public control to public recreation areas.

ARTICLE IV – VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be included in total project costs and credited towards the Commission's share of total project costs will be determined in accordance with the following procedures:

1. If the lands, easements, or rights-of-way are owned by the Commission as of the date the first construction contract for the Project is awarded, the credit shall be the fair market value of the interest at the time of such award. The fair market value shall be determined by an appraisal, to be obtained by the Commission, which has been prepared by a qualified appraiser who is acceptable to both the Commission and the Government. The appraisal shall be reviewed and approved by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the Commission after the date of award of the first construction contract for the Project, the credit shall be the fair market value of the interest at the time such interest is acquired. The fair market value shall be determined as specified in Article IV.a.1 of this Agreement. If the Commission pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the Commission has secured prior written approval from the Government of its offer to purchase such interest.

3. If the Commission acquires more lands, easements, or rights-of-way than are necessary for Project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in total project costs and credited towards the Commission's share.

4. Credit for lands, easements, and rights-of-way in the case of involuntary acquisitions which occur within a one-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior written Government approval.

5. Credit for lands, easements, or rights-of-way acquired by the Commission within a five-year period preceding the date this Agreement is signed, or at any time after this Agreement is signed, will also include the actual incidental costs of acquiring 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 the obligations under this Agreement.

b. The costs of relocations which will be included in total project costs and credited towards the Commission's share of total project costs shall be that portion of the actual costs as set forth below, and approved by the Government:

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of Indiana would use in constructing a new bridge or highway under similar conditions of geography and traffic loads.

2. Utilities and Facilities (including railroads): Actual relocation costs, less salvage value, plus cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any alterations or relocation if materials of value and usability equal to those in the existing facility are availability or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in total project costs.

ARTICLE V – CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the Commission and the Government during the period of construction, the Commission and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project. The Commission will be informed of any changes in cost estimates.

b. The representatives appointed above shall meet as necessary, but at least monthly on an established date of the month, during the term of project construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to construction of the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations. If any written recommendations of the Commission's representative are rejected or modified, the Contracting Officer shall communicate that fact, as well as the basis for the rejections or modification, in writing to the Commission's representative.

ARTICLE VI – METHOD OF PAYMENT

a. The Commission shall provide, during the period of construction, the cash payments required under Article II of this Agreement. Total project costs are presently estimated to be \$91,353,570. In order to meet its share, the Commission must provide a cash contribution presently estimated to be \$4,824,329. The dollar amounts set forth in the Article are based upon the Government's best estimated which will reflect projection of costs, price level changes, and anticipated inflation. Such cost estimates are subject to adjustments based upon cost actually incurred and are not to be construed as the total financial responsibilities of the Government and the Commission.

b. The Commission shall provide its required cash contribution in accordance with the following provisions.

1. For purposes of budget planning, the Government shall notify the Commission by 30 April of each year of the estimated funds that will be required from the Commission to meet its share of total project costs for the upcoming fiscal year.

2. No later than 60 calendar days prior to the award of the first construction contract, the Government shall notify the Commission of the Commission's share of total project costs, including its share of costs attributable to the Project incurred prior to the initiation of construction, for the first fiscal year of construction. No later than 30 calendar days thereafter, the Commission shall verify to the satisfaction of the Government that it has deposited the requisite amount in an escrow account acceptable to the Government, with interest accruing to the Commission.

3. For the second and subsequent fiscal year of project construction, the Government shall, no later than 60 calendar days prior to the beginning of the fiscal year, notify the Commission of the Commission's share of total project costs for the fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the Commission shall make the necessary funds available to the Government through the funding mechanism specified in Article VI.b.2. of this Agreement. As construction of the Project proceeds, the Government shall adjust the amounts required to be provided under this paragraph to reflect actual costs.

4. If at any time during the period of construction the Government determines that additional funds will be needed from the Commission, the Government shall so notify the Commission and the Commission, no later than 60 calendar days from receipt of such notice, shall make necessary fund available through the funding mechanism specified in Article VI.b.2. of this Agreement. If at any time the Commission fails to make the payments required under this Article, the Government shall terminate or suspend work or otherwise proceed in accordance with its rights in Article XVII.

c. The Government will draw on the escrow account, provided by the Commission, such sums as the Government deems necessary to cover contractual and in-house fiscal obligations attributable to the Project as they are incurred, as well as costs incurred by the Government prior to the initiation of construction.

d. Upon completion of the Project and resolution of all relevant claims and appeals, the Government shall compute the total project costs and tender to the Commission a final accounting of the Commission's share of total project costs. In the event the total contribution by the Commission is less than its minimum required share of total project costs, the Commission 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 its minimum required share of total project costs.

e. In the event the Commission has made cash contributions in excess of 5 percent of total costs of the structural flood control which result in the Commission's having provided more than its required share of the total costs of the structural features of the project, the Government shall, not later than 90 calendar days after the final accounting is complete, subject to the availability of appropriations, return said excess to the Commission; however, the Commission shall not be entitled to any refund of the 5 percent cash contribution required pursuant to Article II.c. of this Agreement.

f. If the Commission's contribution for the non-structural portion of the project exceeds 25 percent of the costs assigned to that portion, the Government shall, subject to the availability or appropriations, refund the excess to the Commission within 90 days of the final accounting.

g. If the Commission's contribution for the recreational portion of the Project exceeds 50 percent of the costs assigned to that portion, the Government shall, subject to the availability of appropriations, refund the excess to the Commission within 90 days of the final accounting.

h. If the Commission's total contribution under this Agreement (including lands, easements, right-of-way, utility and relocations, and dredged material disposal areas provided by the Commission) exceeds 50 percent of costs assigned to the structural flood control features of the project, the Government shall, subject to the availability of appropriations for that purpose, refund the excess to the Commission no later than 90 calendar days after the final accounting is complete.

ARTICLE VII – DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of non-binding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VIII – OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION

a. After the Government has turned the completed Project, or functional portion of the Project over to the Commission, the Commission shall operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the Project, in accordance with regulations or directions prescribed by the Government.

b. The Commission hereby give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it 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 Commission for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the Commission. If the Commission persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the Commission 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 Commission of responsibility to meet its obligations as set forth in this Agreement or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE IX – RELEASE OF CLAIMS

The Commission shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X – HAZARDOUS SUBSTANCES

a. After execution of this Agreement and upon direction by the Contracting Officer, the Commission shall perform, or cause to be performed, such environmental investigations as are determined necessary by the Government or the Commission to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 USC 9601-9675, on lands necessary for Project construction, operation, and maintenance. All actual costs incurred by the Commission which are properly allowable and allocable to performance of any such environmental investigations shall be included in total project costs and cost shared as a construction cost in accordance with Section 103 of Public Law 99-662.

b. In the event it is discovered through an environmental investigation or other means that any lands, easements, rights-of-way, or disposal areas to be acquired or provided for the Project contain any hazardous substances regulated under CERCLA, the Commission and the Government shall provide prompt notice to each other, and the Commission shall not proceed with the acquisition of such lands, easements, rights-of-way, or disposal areas until mutually agreed.

c. The Government and the Commission shall determine whether to initiate construction of the Project, or if already in construction, to continue with construction on the Project, or to terminate construction of the Project for the convenience of the Government in any case where hazardous substances regulated under CERCLA are found to exist on any lands necessary for the Project. Should the Government and the Commission determine to proceed or continue with construction after considering any liability that may arise under CERCLA, as between the Government and the Commission, the Commission shall be solely responsible for any and all necessary clean up and response costs, 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 total project costs as defined in this Agreement. In the event the Commission fails to provide any funds necessary to pay for clean up and response costs or to otherwise discharge its responsibilities under this paragraph upon direction by the Government, the Government may either terminate or suspend work on the Project or proceed with further work as provided in Article XVII.

d. The Commission and the Government shall consult with each other under the Construction Phasing and Management Article of this Agreement to assure that responsible parties bear any necessary cleanup and response costs as defined in CERCLA. Any decision made pursuant to paragraph c. of this Article shall not relieve any party from any liability that may arise under CERCLA.

e. The Commission shall operate, maintain, repair, replace, and rehabilitate the Project in a manner so that liability will not arise under CERCLA.

ARTICLE XI – MAINTENANCE OF RECORDS

The Government and the Commission shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the Commission shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all relevant claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XII – GOVERNMENT AUDIT

The Government shall conduct an audit when appropriate of the Commission's records for the Project to ascertain the allowability, reasonableness, and allocability of its costs for inclusion as credit against the non-Federal share of project costs.

ARTICLE XIII – FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Commission agrees to comply with all applicable Federal and State laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5000.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, 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".

ARTICLE XIV – RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XV- OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XVI – COVENANT AGAINST CONTINGENT FEES

The Commission warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Commission for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement or consideration, or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XVII – TERMINATION OR SUSPENSION

a. If at any time the Commission fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the Project until the Commission is no longer in arrears, unless the Secretary of the Army determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreement with any other non-Federal interests in connection with the Project. Any delinquent payment 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 become delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations for the Project in amounts sufficient to meet project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Commission. After 60 calendar days either party may elect without penalty to terminate this Agreement or to deter future performance hereunder; however, deferral of future performance under this Agreement shall not effect existing obligations or relieve the parties of liability for any obligation previously incurred. In the event that either party elects to terminate this Agreement pursuant to this Article, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI. of this Agreement. In the event that either party elects to defer future performance under this Agreement pursuant to this Article, such deferral shall remain in effect until such time as the government receives sufficient appropriations or until either party elects to terminate this Agreement.

ARTICLE XVIII – NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage prepaid), registered, or certified mail, as follows:

If to the Commission:

Executive Director
Little Calumet River Basin
Development Commission
8149 Kennedy Avenue
Highland, Indiana 46322

If to the Government:

District Engineer
U.S. Army Corps of Engineers
Chicago District
111 North Canal Street
Chicago, Illinois 60606-7206

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 such time as it is personally delivered or seven calendar days after its is mailed, as the case may be.

ARTICLE XIX – 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 XX – SECTION 902 PROJECT COST LIMITS

The Commission has reviewed the provisions set forth in Section 902 of P.L. 99-662, as amended, and understands that Section 902 establishes a maximum construction cost for the project. For purposes of this Agreement, the Section 902 cost limit is \$125,300,000 as calculated on October 18, 1989. This amount shall be adjusted to allow for appropriate increases for inflation and changes in the project cost as provided in Section 902. Should this cost maximum be reached, no additional funds may be expended on the project until authority is obtained from Congress.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date and year first above written.

THE DEPARTMENT OF THE ARMY

BY: *Randall R. Inouye*
RANDALL R. INOUYE
LTC, Corps of Engineers
Contracting Officer

THE LITTLE CALUMET RIVER BASIN
DEVELOPMENT COMMISSION

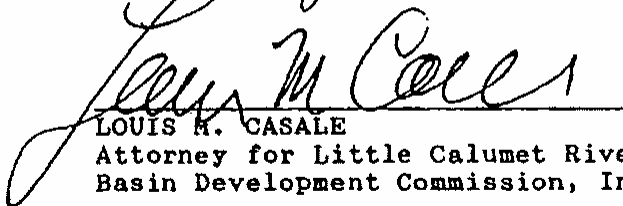
BY: *Arlene Colvin*
ARLENE COLVIN
Chairperson of the Board,
The Little Calumet River
Basin Development Commission

ATTEST: *Don Gardner*

CERTIFICATE OF AUTHORITY

I, LOUIS M. CASALE, do hereby certify that I am the chief legal officer for the Little Calumet River Basin Development Commission, State of Indiana, that the Little Calumet River Basin Development Commission is a legally constituted public body with full authority and legal capability to perform terms of the agreement between the Department of the Army and the Little Calumet River Basin Development Commission in connection with the Little Calumet River, Indiana Local Flood Protection and Recreation Project, Indiana and to pay damages, If necessary, in the event of its failure to perform, in accordance with Section 221 of Public Law 91-661, as amended, and that the persons who has executed this agreement on behalf of the Little Calumet River Basin Development Commission have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this
Certification this 16 day of August, 1990.


LOUIS M. CASALE
Attorney for Little Calumet River
Basin Development Commission, Indiana

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of this 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 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, and 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 failure.



ARLENE COLVIN
Chairperson of the Board
The Little Calumet River
Basin Development Commission

DATE: August 16, 1990

AMENDMENT NO. 1
TO
LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE LITTLE CALUMET RIVER BASIN DEVELOPMENT COMMISSION
FOR CONSTRUCTION OF THE
LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION
AND RECREATION PROJECT

THIS AMENDMENT, entered into this 30 day of JULY, 1999, 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 Little Calumet River Basin Development Commission, (hereinafter referred to as the "Commission"), acting by and through its Chairperson,

WITNESSETH, THAT:

WHEREAS, the parties hereto have heretofore entered into an agreement entitled, "Agreement Between the Department of the Army and the Little Calumet River Basin Development Commission for Construction of the Little Calumet River, Indiana Local Flood Control and Recreation Project" (hereinafter the "Agreement"), dated August 16, 1990; and

WHEREAS, due to the possibility of Project induced flooding in the Marshalltown, Indiana, area the Project boundaries, as defined in the Agreement, must be expanded.

WHEREAS, Section 902 of Public Law 99-662, as amended, establishes the maximum costs for the Little Calumet River, Indiana, Local Flood Protection and Recreation Project and sets forth procedures for adjusting such maximum amount.

NOW, THEREFORE, the parties agree as follows:

That said August 16, 1990 Agreement be amended with the addition of the below listed changes and no other.

1. Amend the Agreement by replacing the term "contracting officer", as it appears throughout the Agreement, with the term "District Engineer."
2. Amend the Project definition by modifying the first WHEREAS clause by deleting the phrase "Consolidated Rail Corporation crossing located in Gary, Indiana", and replacing it with "the intersection of the Little Calumet River and Colorado Street, just east of Interstate 65."

3. Amend Article I.a by deleting subparagraph "a" and replacing it with the following and no more: "The term 'Project' shall mean the structural and non-structural flood control measures at Little Calumet together with construction of recreational hiking trails throughout the project area and the construction of associated recreation support areas within the project ravine corridor and at the borrow site in the town of Schererville; construction of disposal facilities; preserving land designated as wetlands; and construction of fish and wildlife mitigation and enhancement measures, as generally described in the Little Calumet Phase II, General Design Memorandum dated September 1986, and approved June 1990, as modified by the Post Authorization Change Report dated May 1999 and approved on 14 May 1999 (hereinafter referred to as the "PAC")."

4. Amend Article I.b to include the work described in the PAC by adding the following phrase to the end of the subparagraph: "construction of levees around the east, west and south sides of the Marshalltown subdivision in Gary, and nonstructural acquisition and relocation measures related to two trailers and five structures, as further described in the PAC."

5. Amend Article I by adding the following additional paragraph "n": "The term "betterment" shall mean a change in the design and construction of an element of the Project accomplished at the request of the Commission 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."

6. Replace Article II.b with the following: "When the Government determines that the Project, or a functional portion of the Project, is complete, the Government shall turn the completed Project, or functional portion, over to the Commission, which shall accept the Project or functional portion, and be solely responsible for operating, repairing, maintaining, replacing, and rehabilitating the Project, or functional portion, in accordance with Article VIII thereof. The Commission shall have the right to contract with local municipalities, drainage districts or municipal corporations for the operation, maintenance, repair, replacement and rehabilitation of the Project. However, such contractual agreements shall not relieve the Commission of its responsibility for the operation, maintenance, repair, replacement, and rehabilitation of the Project and the Commission shall remain solely responsible for assuring performance of all operation, maintenance, repair, replacement and rehabilitation as required under Public Law 99-662."

7. Amend Article VI.a. by deleting "91,353,570" and substituting "\$176,786,000", and by deleting "\$4,824,329" and substituting "\$8,839,300". The parties recognize that as of the date that this Amendment becomes effective, the Government's estimate of total project cost exceeds the limitation on expenditures contained in Section 902 of P.L. 99-662, as amended, and that this project is subject to the provisions contained in Article XX of this Agreement."

8. Amend Article XIII by adding the following phrase to the end of the last sentence in the Article: "...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.”

9. Delete Article XX and replace it with the following:

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 Little Calumet River, Indiana Local Flood Control and Recreation Project. 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 \$139,000,000 as calculated in accordance with ER 1105-2-100 using October 1, 1999 price levels and allowances for projected future inflation. The Government shall adjust this maximum amount in accordance with Section 902.

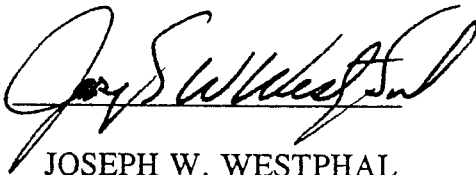
10. All other provisions of the Agreement remain unchanged.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment, which shall become effective the date and year first above written.

THE DEPARTMENT OF THE ARMY

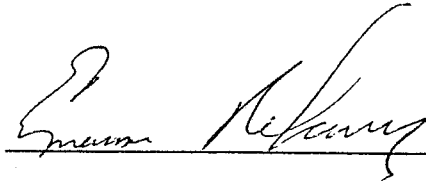
THE LITTLE CALUMET RIVER BASIN
DEVELOPMENT COMMISSION

BY:



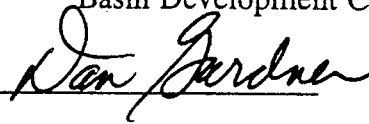
JOSEPH W. WESTPHAL
Assistant Secretary of the Army
(Civil Works)

BY:



EMERSON DELANEY
Chairperson of the Board,
The Little Calumet River
Basin Development Commission

ATTEST:



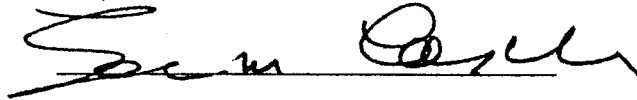
DATE: 30 JUL 1999

DATE: 7-20-99

CERTIFICATE OF AUTHORITY

I, Louis Casate, do hereby certify that I am the principal legal officer of the Little Calumet River Basin Development Commission, State of Indiana, that the Little Calumet River Basin Development Commission 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 Little Calumet River Basin Development Commission in connection with the Little Calumet River, Indiana, Flood Control and Recreation Project, Indiana 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 Little Calumet River Basin Development Commission have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this
20th day of July 1999.



Attorney for Little Calumet River Basin Development
Commission, Indiana

CERTIFICATION REGARDING LOBBYING

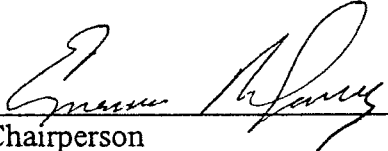
The undersigned certifies, to the best of his or her knowledge and belief that:

(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.



Chairperson
Little Calumet River Basin Development
Commission, Indiana

Date: 7-20-99

AMENDMENT NO. 2
TO
LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE LITTLE CALUMET RIVER BASIN DEVELOPMENT COMMISSION
FOR CONSTRUCTION OF THE
LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION
AND RECREATION PROJECT

THIS AMENDMENT, entered into this 26th day of April, 2000, 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 Little Calumet River Basin Development Commission, (hereinafter referred to as the "Commission"), acting by and through its Chairman,

WITNESSETH, THAT:

WHEREAS, the parties entered into an agreement entitled, "Agreement Between the Department of the Army and the Little Calumet River Basin Development Commission for Construction of the Little Calumet River, Indiana Local Flood Control and Recreation Project" (hereinafter the "Project"), dated August 16, 1990 and amended July 30, 1999 (hereinafter the "Agreement"); and,

WHEREAS, the Commission desires the construction of additional structural flood control structures that will provide a 100-year level of protection and that exceed the standards set forth in the Agreement; and,

WHEREAS, these additional structural flood control structures (hereinafter the "Burr Street Levee Betterment") are described in a report titled, "Burr Street Levee Feature Design Memorandum" dated December 1997"

WHEREAS, inclusion of the Burr Street Levee Betterment will require deletion of certain non-structural features of the Project; and,

WHEREAS, the Commission shall be responsible for the additional costs attributable to the Burr Street Levee Betterment over and above the costs of the deleted non-structural features;

NOW, THEREFORE, the parties agree as follows:

That said August 16, 1990 Agreement be amended with the addition of the below listed changes and no other.

1. Amend Article I.n. of the Agreement by adding the following to the end of the paragraph: "For the purposes of this Agreement, the construction of the Burr Street Levee Betterment, comprising the construction of structural flood control measures between the E., J., & E. railroad to the west and Colfax Street to the east, as generally described in the Burr Street Levee Feature Design Memorandum dated December 1997 and approved by the District Commander, Chicago District on December 1, 1997, shall be considered a betterment within the meaning of this Agreement."

2. Add a new Article I.o. to the Agreement as follows: "The term "deleted non-structural flood control features" shall mean those features of the Project that are no longer necessary in view of the proposed construction of the Burr Street Levee Betterment described in Article I.n. of this Agreement. The deleted non-structural flood control features are non-structural flood control measures of the Project between the E., J., and E. railroad to the west and Colfax Street to the east. The Government agrees not to implement the deleted non-structural flood control features."

3. Add a new Article I.p. to the Agreement as follows: The term "Burr Street Levee Betterment cost" shall mean the cost of construction of the Burr Street Levee Betterment, less the cost, as estimated by the Government, that would have been incurred for the Federal share of the deleted non-structural flood control features. In accordance with Article II.t. of this Agreement, the Non-Federal Sponsor shall be responsible for the Burr Street Levee Betterment cost."

4. Add a new Article II.t. to the Agreement as follows:

"t. The Non-Federal Sponsor 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 Sponsor 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 Sponsor shall be solely responsible for all costs due to the requested betterments including the costs of any additional lands, easements and rights-of-way required solely for the betterments, and shall pay all such costs in accordance with Article VI.d. of this Agreement. The Government agrees to construct the Burr Street Betterment Levee in accordance with the provisions of this Agreement."

5. Amend Article III.a by inserting the following sentence after the sentence ending with "time to acquire same," "The Government in that general description shall delineate

which of the required lands, easements, and rights-of-way are required for the Project and which are required for the Burr Street Levee Betterment.”

6. Amend Article III.b by inserting the following sentence at the end of the paragraph, “The Government shall delineate which of the retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins that may be required at any dredged material disposal areas are required for the Project and which are required for the Burr Street Levee Betterment.”

7. Amend Article III.c by inserting the following sentence at the end of the paragraph, “The Government shall delineate which of the relocations are required for the Project and which are required for the Burr Street Levee Betterment.”

8. Amend Article IV.a. of the Agreement by adding a new paragraph “6” as follows: “6. The value of lands, easements and rights-of-way required for the construction of the Burr Street Levee Betterment, but not required for the construction of the Project, shall not be included in total project costs and shall not be credited against the Commission’s share of total project costs.”

9. Amend Article IV.b. of the Agreement by adding a new paragraph “3” as follows: “3. The costs of relocations required for the construction of the Burr Street Levee Betterment, but not required for the construction of the Project, shall not be included in total project costs and shall not be credited against the Commission’s share of total project costs.”

10. Amend Article VI.a by adding the following sentence directly behind the second sentence in the paragraph: “Total Burr Street Levee Betterment costs are projected to be \$3,995,190.”

11. Amend Article VI.d. by adding immediately after the first sentence the following: “The final accounting shall determine total project costs, total Burr Street Levee betterment costs, each party's contribution provided thereto, and each party's required share thereof. The final accounting also shall determine costs due to any additional betterments and the Non-Federal Sponsor's cash contribution provided pursuant to Article II.t. of this Agreement.”

12. Amend Article VI of the Agreement by adding a new paragraph “d”. as set forth below, and re-letter paragraphs “d” through “h” of the Agreement as “e” through “i”:

“d. In advance of the Government incurring any financial obligation associated with additional work under Article II.t. of this Agreement, the Commission shall provide the Government with the full amount of the funds required to pay for such financial obligation through the payment mechanism specified in Article VI.b. of this Agreement, or by providing a check payable to “FAO USAED, Chicago” to the District Engineer, or by providing an Electronic Funds Transfer of the required funds in accordance with procedures established by the Government. The Government shall draw from the funds provided by the Commission 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 Commission must provide additional funds to meet such financial obligations, the Government shall notify the Commission in writing of the additional funds required. Within 30 calendar days thereafter, the Commission shall provide the Government with the full amount of the additional required funds through any of the payment mechanisms specified in this paragraph.”

13. Amend Article IX of the Agreement by adding the following after “Project” and before “except”: “and any betterments, including the Burr Street Levee Betterment,”

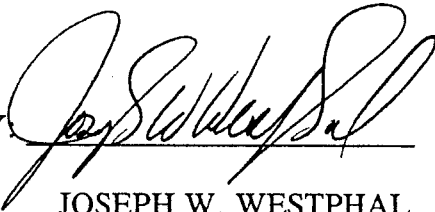
14. Amend Article XVIII by deleting “8149 Kennedy Avenue” and replacing it with “6100 Southport Road”, deleting “Highland” and replacing it with “Portage” and deleting “46322” and replacing it with “46368”.

15. All other provisions of the Agreement remain unchanged.

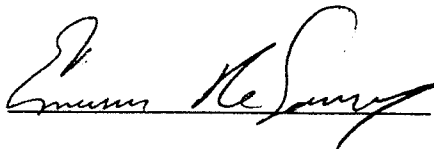
IN WITNESS WHEREOF, the parties hereto have executed this Amendment, which shall become effective the date and year first above written.

THE DEPARTMENT OF THE ARMY

THE LITTLE CALUMET RIVER BASIN
DEVELOPMENT COMMISSION

BY: 

JOSEPH W. WESTPHAL
Assistant Secretary of the Army
(Civil Works)

BY: 

EMERSON DELANEY
Chairperson of the Board,
The Little Calumet River
Basin Development Commission

ATTEST: 

DAN GARDNER
Executive Director

DATE: 26 APR 2000

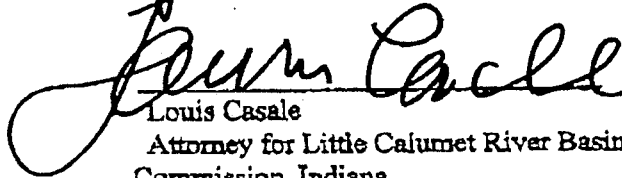
DATE: APRIL 18, 2000

CERTIFICATE OF AUTHORITY

I, Louis M. Casale, do hereby certify that I am the principal legal officer of the Little Calumet River Basin Development Commission, State of Indiana, that the Little Calumet River Basin Development Commission 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 Little Calumet River Basin Development Commission in connection with the Little Calumet River, Indiana, Flood Control and Recreation Project, Indiana 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 Little Calumet River Basin Development Commission have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this

18 day of April 2000


Louis Casale
Attorney for Little Calumet River Basin Development
Commission, Indiana

CERTIFICATION REGARDING LOBBYING

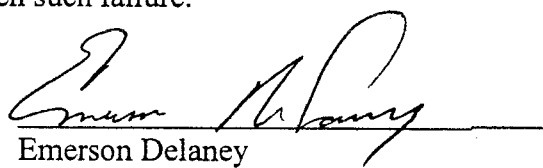
The undersigned certifies, to the best of his or her knowledge and belief that:

(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.



Emerson Delaney

Chairperson

Little Calumet River Basin Development
Commission, Indiana

Date: APRIL 18, 2000

APPENDIX C. INSPECTION CHECKLIST AND SCHEDULE

**LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION AND RECREATION PROJECT
OPERATION AND MAINTENANCE MANUAL**

		MUNSTER LEVEE: EXAMPLE PERIODIC INSPECTION SCHEDULE				YEAR: _____			
CONSTRUCTION STAGE	INSPECTION PERIOD #1		INSPECTION PERIOD #2		INSPECTION PERIOD #3		INSPECTION PERIOD #4		
PROJECT FEATURE		CONFIRMATION DATE		CONFIRMATION DATE		CONFIRMATION DATE		CONFIRMATION DATE	
LEVEES AND OVERFLOWS	INSPECT		INSPECT		INSPECT		INSPECT		
FLOODWALLS	INSPECT		INSPECT		INSPECT		INSPECT		
PUMP STATIONS	INSPECT				INSPECT				
GATEWELLS	INSPECT		INSPECT		INSPECT		INSPECT		
GATES	INSPECT		INSPECT		INSPECT		INSPECT		
CLOSURE STRUCTURES	INSPECT		INSPECT		INSPECT		INSPECT		
CULVERTS	INSPECT		INSPECT		INSPECT		INSPECT		
FLOWAGE EASEMENTS	INSPECT						INSPECT		
MISCELLANEOUS FEATURES	INSPECT						INSPECT		
CHANNEL MAINTENANCE	INSPECT						INSPECT		
CONTROL STRUCTURE	INSPECT						INSPECT		

NOTES:

1. Systematic periodic surveys of the levee crests and side slopes and floodwall tops shall be made using consistent stations through time with the elevations being compared with as-built sections, especially design elevations.
2. Levee vegetation maintenance schedule and inspection checklists are contained in Attachment D.

**LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION AND RECREATION PROJECT
OPERATION AND MAINTENANCE MANUAL**

MUNSTER LEVEE: EXAMPLE PERIODIC INSPECTION CHECKLIST					
PROJECT FEATURE	INSPECTION ITEM	SCHEDULED MAINTENANCE	PERIODIC MAINTENANCE	CONDITION AT INSPECTION	DATE MAINTENANCE PERFORMED
LEVEE AND OVERFLOW EMBANKMENTS	(1) Slopes clear of woody plants, debris, encroachments				
	(2) Riprap protection free of vegetation				
	(3) Turf and Seeded area-repairs				
	(4) Turf and Seeded areas-mowing				
	(5) Access ramps and roads				
	(6) Condition of slopes and sections				
	(7) Existence of seepage, saturated areas, boils				
	(8) Indication of settlement (uniform to differential)				
	(9) Integrity of erosion protection				
	(10) Toe drainage systems are functional & clear of debris				
FLOODWALLS	(1) Existence of seepage, saturated areas, boils				
	(2) Indication of settlement or tilting				
	(3) Trees growing near walls - seepage				
	(4) Condition of concrete				
	(5) Right-of-way free of encroachment				
	(6) Accumulation of trash and debris				
	(7) Bank caving riverward of the wall				
PUMP STATIONS	(1) Check all visible pump parts and installation				
	(2) Pump casing and impeller				
	(3) Oil quantity and condition				
	(4) Inspect and check sensors and monitoring eqp.				
	(5) Condition of discharge piping and valving				
	(6) Cooling system				
	(7) Cable and cable entry				
	(8) Heating and Ventilation system				

LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION AND RECREATION PROJECT
OPERATION AND MAINTENANCE MANUAL

MUNSTER LEVEE: EXAMPLE PERIODIC INSPECTION CHECKLIST

PROJECT FEATURE	INSPECTION ITEM	SCHEDULED MAINTENANCE	PERIODIC MAINTENANCE	CONDITION AT INSPECTION	DATE MAINTENANCE PERFORMED
GATEWELLS	(1) Condition of inlet/outlet blockages				
	(2) Condition of inlet/outlet channel				
	(3) Debris & silt in gatewell				
	(4) Condition of trashrack				
	(5) Check for erosion at inlet/outlet				
	(6) Condition of erosion protection				
	(7) Existence of seepage, saturated areas, boils				
GATES	(1) Sluice gates free of debris				
	(2) Flap gates free of debris & opening				
	(3) Sluice gates operable				
	(4) Lubrication of moving parts				
	(5) Repair/replacement of damaged parts				
	(6) Clean/lubricate portable operators				
CLOSURE STRUCTURES	(1) Remove panel closure structure steel plates-clean trench				
	(2) Check parts inventory & condition - reorder, as needed				
	(3) Verify all parts & tools are available & in good condition				
	(4) Confirm proper closure can be made promptly				
	(5) Check integrity & functionality of concrete sills				
	(6) Verify sufficient sandbagging materials are available				
CULVERTS	(1) Clean inlet/outlet of culvert-debris & silt				
	(2) Check erosion protection is in place				
	(3) Clear debris from trashrack, if any				
	(4) Existence of seepage, saturated areas, boils around pipe				

LITTLE CALUMET RIVER, INDIANA LOCAL FLOOD PROTECTION AND RECREATION PROJECT
OPERATION AND MAINTENANCE MANUAL

MUNSTER LEVEE: EXAMPLE PERIODIC INSPECTION CHECKLIST					
PROJECT FEATURE	INSPECTION ITEM	SCHEDULED MAINTENANCE	PERIODIC MAINTENANCE	CONDITION AT INSPECTION	DATE MAINTENANCE PERFORMED
FLOWAGE EASEMENTS	(1) Existence of illegal dumping, squatters, unauthorized activity				
MISCELLANEOUS FEATURES	(1) Fencing				
	(2) Fence Gates				
	(3) Steel Plate Beam Guardrail				
	(4) Bituminous Pavements				
	(5) Precast Concrete Block Pavements				
	(6) Unpaved Roads				
	(7) Drainage Ditches				
	(8) Erosion & Sedimentation Control				
CHANNEL MAINTENANCE AND DEBRIS REMOVAL	(1) Remove sediment or encroachments from channel				
	(2) Remove debris blockages from bridges				
	(3) Formation of shoals				
	(4) Damage of riverbanks by rain or wave wash				
	(5) Riprap in good condition				
CONTROL STRUCTURE	(1) Remove sediment and/or debris				
	(2) Condition of concrete				
	(3) Indication of settlement or tilting of side walls				
	(4) Damage of riverbanks by rain or wave wash				

NOTES:

1. REFER TO THE MAIN MANUAL FOR FURTHER INSPECTION ITEM DETAILS AND DEFINITION OF SCHEDULED AND PERIODIC MAINTENANCE.
2. THIS FORM SERVES AS A GUIDE AND SHOULD BE REVISED AND EXPANDED AS THE INSPECTION PROGRAM IS IMPLEMENTED. FOR EXAMPLE, SEVERAL COPIES OF THIS FORM AND/OR SEPARATE FORMS SHALL BE REQUIRED TO NOTE "CONDITION AT INSPECTION" DUE TO THE EXPANSE OF THE LINE-OF-PROTECTION.



US Army Corps
of Engineers®

Flood Damage Reduction System Inspection Report

Name of System: Little Calumet River - Munster Levee

Public Sponsor(s): Little Calumet River Basin Commission

Public Sponsor Representative: _____

Sponsor Phone: _____

Sponsor Email: _____

Corps of Engineers Inspector: _____ Date of Inspection: _____

Inspection Report Prepared By: _____ Date Report Prepared: _____

Internal Technical Review (for Periodic Inspections) By: _____ Date of ITR: _____

Final Approval By: _____ Date Approved: _____

Type of Inspection: **Initial Eligibility Inspection**
 Continuing Eligibility Inspection (Routine)
 Continuing Eligibility Inspection (Periodic)

Overall System Rating: **Acceptable**
 Minimally Acceptable
 Unacceptable

Contents of this Report: **Pre-Inspection Report**
 Instructions
 Initial Eligibility Inspection
 General Items for All Flood Control Works
 Levee Embankments
 Floodwalls
 Interior Drainage System
 Pump Stations
 FDR system Channels

Note: In addition to the report contents indicated here, a plan view drawing of the system, with stationing, should be included with this report to reference locations of items rated less than acceptable. Photos of general system condition and any noted deficiencies should also be attached.



**US Army Corps
of Engineers®**

Flood Damage Reduction System Public Sponsor Pre-Inspection Report

The following information is to be provided by the levee district sponsor prior to an inspection. This information will be used to help evaluate the organizational capability of the levee district to manage the levee system maintenance program.

1. Levee system and district: (name of the system and levee district)
2. Reporting period: (month/day/year to month/day/year)
3. Summary of maintenance required by last inspection report:
4. Summary of maintenance performed this reporting period:
5. Summary of maintenance planned next reporting period:
6. Summary of changes to system since last inspection:
7. Problems/ issues requiring the assistance of the US Army Corps of Engineers:

General Instructions for the Inspection of Flood Damage Reduction Systems

A. Purpose of USACE Inspections:

The primary purpose of these inspections is to prevent loss of life and catastrophic damages; preserve the value of Federal investments, and to encourage non-Federal sponsors to bear responsibility for their own protection. Inspections should assure that Flood Damage Reduction structures and facilities are continually maintained and operated as necessary to obtain the maximum benefits. Inspections are also conducted to determine eligibility for Rehabilitation Assistance under authority of PL 84-99 for Federal and non-Federal systems. (ER 1130-2-530, ER 500-1-1)

B. Types of Inspections:

The Corps conducts several types of inspections of Flood Damage Reduction systems, as outlined below:

Initial Eligibility Inspections	Continuing Eligibility Inspections	
	Routine Inspections	Periodic Inspections
IEIs are conducted to determine whether a non-Federally constructed Flood Damage Reduction system meets the minimum criteria and standards set forth by the Corps for initial inclusion into the Rehabilitation and Inspection Program.	RIs are intended to verify proper maintenance, owner preparedness, and component operation.	PIs are intended to verify proper maintenance and component operation and to evaluate operational adequacy, structural stability, and safety of the system. Periodic Inspections evaluate the system's original design criteria vs. current design criteria to determine potential performance impacts, evaluate the current conditions, and compare the design loads and design analysis used against current design standards. This is to be done to identify components and features for the sponsor that need to be monitored more closely over time or corrected as needed. (Periodic Inspections are used as the basis of risk assessments.)

C. Inspection Boundaries:

Inspections should be conducted so as to rate Flood Damage Reduction "systems" as complete and independent units, regardless of relevant "project" or "segment" boundaries.

Project	System	Segment
A flood damage reduction project is made up of one or more flood damage reduction systems which were under the same authorization.	A flood damage reduction system is made up of one or more flood damage reduction segments which collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.	A flood damage reduction segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A flood damage reduction segment can be made up of one or more features (levee, floodwall, pump stations, etc).

D. Land Use Definitions:

The following three definitions are intended for use in determining minimum required inspection intervals and initial requirements for inclusion into the Rehabilitation and Inspection Program. Inspections should be considered for all systems that would result in significant environmental or economic impact upon failure regardless of specific land use.

Agricultural	Rural	Urban
Protected population in the range of zero to 5 households per square mile protected.	Protected population in the range of 6 to 20 households per square mile protected.	Greater than 20 households per square mile; major industrial areas with significant infrastructure investment. Some protected urban areas have no permanent population but may be industrial areas with high value infrastructure with no overnight population.

E. Use of the Inspection Report Template:

The report template is intended for use in all Army Corps of Engineers inspections of levee and floodwall systems and flood damage reduction channels. The section of the template labeled "Initial Eligibility" only needs to be completed during Initial Eligibility Inspections of Non-Federally constructed Flood Damage Reduction Systems. The section labeled "General Items" needs to be completed with every inspection, along with all other sections that correspond to features in the system. The section labeled "Public Sponsor Pre-Inspection Report" is intended for completion before the inspection, if possible.

F. Individual Item / Component Ratings:

Assessment of individual components rated during the inspection should be based on the criteria provided in the inspection report template, though inspectors may incorporate additional items into the report based on the characteristics of the system. The assessment of individual components should be based on the following definitions.

Acceptable Item	Minimally Acceptable Item	Unacceptable Item
The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.	The inspected item has one or more minor deficiencies that need to be corrected. The minor deficiency or deficiencies will not seriously impair the functioning of the item as intended during the next flood event.	The inspected item has one or more serious deficiencies that need to be corrected. The serious deficiency or deficiencies will seriously impair the functioning of the item as intended during the next flood event.

G. Overall System Ratings:

Determination of the overall system rating is based on the definitions below. Note that an Unacceptable System Rating may be either based on an engineering determination that concluded that noted deficiencies would prevent the system from functioning as intended during the next flood event, or based on the sponsor's demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner.

Acceptable System	Minimally Acceptable System	Unacceptable System
All items or components are rated as Acceptable.	One or more items are rated as Minimally Acceptable and one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the system from performing as intended during the next flood event.	One or more items are rated as Unacceptable and would prevent the system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

H. Eligibility for PL84-99 Rehabilitation Assistance:

Inspected systems that are not operated and maintained by the Federal government may be Active in the Corps' Rehabilitation and Inspection Program (RIP) and eligible for rehabilitation assistance from the Corps as defined below:

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
The system is active in the RIP and eligible for PL84-99 rehabilitation assistance.	The system is Active in the RIP during the time that it takes to make needed corrections. Active systems are eligible for rehabilitation assistance. However, if the sponsor does not present USACE with proof that serious deficiencies (which had previously resulted in a minimally acceptable system rating) were corrected within the established timeframe, then the system will become Inactive in the RIP.	The system is Inactive in the RIP, and the status will remain Inactive until the sponsor presents USACE with proof that all items rated Unacceptable have been corrected. Inactive systems are ineligible for rehabilitation assistance.

I. Reporting:

After the inspection, the Corps is responsible for assembling an inspection report (or a summary report if it was a Periodic Inspection) including the following information:

- a. All sections of the report template used during the inspection, including the cover and pre-inspection materials. (Supplemental data collected, and any sections of the template that weren't used during the inspection do not need to be included with the report.)
- b. Photos of the general system condition and noted deficiencies.
- c. A plan view drawing of the system, with stationing, to reference locations of items rated less than acceptable.
- d. The relative importance of the identified maintenance issues should be specified in the transmittal letter.
- e. If the Overall System Rating is Minimally Acceptable, the report needs to establish a timeframe for correction of serious deficiencies noted (not to exceed two years) and indicate that if these items are not corrected within the required timeframe, the system will be rated as Unacceptable and made Inactive in the Rehabilitation Inspection Program.

J. Notification:

Reports are to be disseminated as follows within 30 days of the inspection date.

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
Reports need to be provided to the local sponsor and the county emergency management agency.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, and to the FEMA region.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, FEMA region, and to the Congressional delegation within 30 days of the inspection.

General Items for All Flood Damage Reduction Systems

For use during all inspections of all Flood Damage Reduction Systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Operations and Maintenance Manuals	A	Levee Owner's Manual, O&M Manuals, and/or manufacturer's operating instructions are present.	
	M	Sponsor manuals are lost or missing or out of date; however, sponsor will obtain manuals prior to next scheduled inspection.	
	U	Sponsor has not obtained lost or missing manuals identified during previous inspection.	
2. Emergency Supplies and Equipment (A or M only)	A	The sponsor maintains a stockpile of sandbags, shovels, and other flood fight supplies which will adequately supply all needs for the initial days of a flood fight. Sponsor determines required quantity of supplies after consulting with inspector.	
	M	The sponsor does not maintain an adequate supply of flood fighting materials as part of their preparedness activities.	
3. Flood Preparedness and Training (A or M only)	A	Sponsor has a written system-specific flood response plan and a solid understanding of how to operate, maintain, and staff the FDR system during a flood. Sponsor maintains a list of emergency contact information for appropriate personnel and other emergency response agencies.	
	M	The sponsor maintains a good working knowledge of flood response activities, but documentation of system-specific emergency procedures and emergency contact personnel is insufficient or out of date.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Unwanted Vegetation Growth ¹	A	The levee has little or no unwanted vegetation (trees, bush, or undesirable weeds), except for vegetation that is properly contained and/or situated on overbuilt sections, such that the mandatory 3-foot root-free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation-free zone extends 15 feet from both the landside and riverside toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits. Reference EM 1110-2-301 or Corps policy for regional vegetation variance.	
	M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee.	
	U	Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above and must to be removed to reestablish or ascertain levee integrity.	
2. Sod Cover	A	There is good coverage of sod over the levee.	
	M	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
	U	Over 50% of the sod cover is missing or damaged over a significant portion or portions of the levee embankment.	
	N/A	Surface protection is provided by other means.	
3. Encroachments	A	No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the levee.	
	M	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
	U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	
4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag Closures) (A or U only)	A	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions/ procedures readily available. Trial erections have been accomplished in accordance with the O&M Manual.	
	U	Any of the following issues is cause for this rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instructions/ procedures are not readily available. Trial erections have not been accomplished in accordance with the O&M Manual.	
	N/A	There are no closure structures along this component of the FDR system.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

¹ If there is significant growth on the levee that inhibits the inspection of animal burrows or other items, the inspection should be ended until this item is corrected.



Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
5. Slope Stability	A	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	
	M	Minor slope stability problems that do not pose an immediate threat to the levee embankment.	
	U	Major slope stability problems (ex. deep seated sliding) identified that must be repaired to reestablish the integrity of the levee embankment.	
6. Erosion/ Bank Caving	A	No erosion or bank caving is observed on the landward or riverward sides of the levee that might endanger its stability.	
	M	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
	U	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
7. Settlement ¹	A	No observed depressions in crown. Records exist and indicate no unexplained historical changes.	
	M	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive.	
	U	Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	
8. Depressions/ Rutting	A	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are unrelated to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
	M	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	
	U	There are depressions greater than 6 inches deep that will pond water.	
9. Cracking	A	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack. No cracks extend continuously through the levee crest.	
	M	Longitudinal and/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
	U	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through the entire levee width.	
10. Animal Control	A	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	
	M	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and they require immediate attention.	
	U	Animal burrow control program is not effective or is nonexistent. Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	

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¹ Detailed survey elevations are normally required during Periodic Inspections, and whenever there are obvious visual settlements.

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
11. Culverts/ Discharge Pipes ¹ (This item includes both concrete and corrugated metal pipes.)	A	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
	M	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
	U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
	N/A	There are no discharge pipes/ culverts.	

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¹ The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
12. Riprap Revetments & Bank Protection	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
	M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
	U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
	N/A	There is no riprap protecting this feature of the system, or riprap is discussed in another section.	
13. Revetments other than Riprap	A	Existing revetment protection is properly maintained, undamaged, and clearly visible.	
	M	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
	U	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
	N/A	There are no such revetments protecting this feature of the system.	
14. Underseepage Relief Wells/ Toe Drainage Systems	A	Toe drainage systems and pressure relief wells necessary for maintaining FDR system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning. Wells have been pumped tested within the past 5 years and documentation is provided.	
	M	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular cleaning and pump testing.	
	U	Toe drainage systems or pressure relief wells necessary for maintaining FDR system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.	
	N/A	There are no relief wells/ toe drainage systems along this component of the FDR system.	
15. Seepage	A	No evidence or history of unrepaired seepage, saturated areas, or boils.	
	M	Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport.	
	U	Evidence or history of active seepage, extensive saturated areas, or boils.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Floodwalls

For use during Initial and Continuing Eligibility Inspections of all floodwalls

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Unwanted Vegetation Growth ¹	A	A grass-only or paved zone is maintained on both sides of the floodwall, free of all trees, brush, and undesirable weeds. The vegetation-free zone extends 15 feet from both the land and riverside of the floodwall, at ground-level, to the centerline of the tree. Additionally, an 8-foot root-free zone is maintained around the entire structure, including the floodwall toe, heel, and any toe-drains. If the floodwall access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits. Reference EM 1110-2-301 and/or Corps policy for regional vegetation variance.	
	M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the floodwall.	
	U	Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above. This vegetation threatens the operation or integrity of the floodwall and must be removed.	
2. Encroachments	A	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the floodwall.	
	M	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
	U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the floodwall.	
3. Closure Structures (Stop Log Closures and Gates) (A or U only)	A	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions/ procedures readily available. Trial erections have been accomplished in accordance with the O&M Manual.	
	U	Any of the following issues is cause for this rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instructions/ procedures are not readily available. Trial erections have not been accomplished in accordance with the O&M Manual.	
	N/A	There are no closure structures along this component of the FDR system.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

¹ Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

Floodwalls

For use during Initial and Continuing Eligibility Inspections of all floodwalls

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
4. Concrete Surfaces	A	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
	M	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
	U	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
5. Tilting, Sliding or Settlement of Concrete Structures ¹	A	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
	M	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
	U	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
6. Foundation of Concrete Structures ²	A	No active erosion, scouring, or bank caving that might endanger the structure's stability.	
	M	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. For the purposes of inspection, the erosion or scour is not closer to the riverside face of the wall than twice the floodwall's underground base width if the wall is of L-wall or T-wall construction; or if the wall is of sheetpile or I-wall construction, the erosion is not closer than twice the wall's visible height. Additionally, rate of erosion is such that the wall is expected to remain stable until the next inspection.	
	U	Erosion or bank caving observed that is closer to the wall than the limits described above, or is outside these limits but may lead to structural instabilities before the next inspection. Additionally, if the floodwall is of I-wall or sheetpile construction, the foundation is unacceptable if any turf, soil or pavement material got washed away from the landside of the I-wall as the result of a previous overtopping event.	

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¹ The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

² Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

Floodwalls

For use during Initial and Continuing Eligibility Inspections of all floodwalls

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
7. Monolith Joints	A	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
	M	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	
	U	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
	N/A	There are no monolith joints in the floodwall.	
8. Underseepage Relief Wells/ Toe Drainage Systems	A	Toe drainage systems and pressure relief wells necessary for maintaining FDR system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning. Wells have been pumped tested within the past 5 years and documentation is provided.	
	M	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular cleaning and pump testing.	
	U	Toe drainage systems or pressure relief wells necessary for maintaining FDR system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.	
	N/A	There are no relief wells/ toe drainage systems along this component of the FDR system.	
9. Seepage	A	No evidence or history of unrepaired seepage, saturated areas, or boils.	
	M	Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport.	
	U	Evidence or history of active seepage, extensive saturated areas, or boils.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Vegetation and Obstructions	A	No obstructions, vegetation, debris, or sediment accumulation noted within interior drainage channels or blocking the culverts, inlets, or discharge areas. Concrete joints and weep holes are free of grass and weeds.	
	M	Obstructions, vegetation, debris, or sediment are minor and have not impaired channel flow capacity or blocked more than 10% of any culvert openings, but should be removed. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
	U	Obstructions, vegetation, debris, or sediment have impaired the channel flow capacity or blocked more than 10% of a culvert opening. Sediment and debris removal required to re-establish flow capacity.	
2. Encroachments	A	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the interior drainage system.	
	M	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
	U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of this component of the interior drainage system.	
3. Ponding Areas	A	No trash, debris, structures, or other obstructions present within the ponding areas. Sediment deposits do not exceed 10% of capacity.	
	M	Trash, debris, excavations, structures, or other obstructions present, or inappropriate activities that will not inhibit operations and maintenance. Sediment deposits do not exceed 30% of capacity.	
	U	Trash, debris, excavations, structures, or other obstructions, or other encroachments or activities noted that will inhibit operations, maintenance, or emergency work. Sediment deposits exceeds 30% of capacity.	
	N/A	There are no ponding areas associated with the interior drainage system.	
4. Fencing and Gates ¹	A	Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts.	
	M	Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.	
	U	Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.	
	N/A	There are no features noted that require safety fencing.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

¹ Proper operation of this item must be demonstrated during the inspection.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
5. Concrete Surfaces (Such as gate wells, outfalls, intakes, or culverts)	A	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
	M	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
	U	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
	N/A	There are no concrete items in the interior drainage system.	
6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures ¹ (Such as gate wells, outfalls, intakes, or culverts)	A	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
	M	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
	U	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
	N/A	There are no concrete items in the interior drainage system.	
7. Foundation of Concrete Structures ² (Such as culverts, inlet and discharge structures, or gatewells.)	A	No active erosion, scouring, or bank caving that might endanger the structure's stability.	
	M	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. The rate of erosion is such that the structure is expected to remain stable until the next inspection.	
	U	Erosion or bank caving observed that may lead to structural instabilities before the next inspection.	
	N/A	There are no concrete items in the interior drainage system.	

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¹ The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

² Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/ Remarks/ Recommendations
8. Monolith Joints		A	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		M	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	
		U	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		N/A	There are no monolith joints in the interior drainage system.	
9. Culverts/Discharge Pipes ¹		A	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		M	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		N/A	There are no discharge pipes/ culverts.	

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¹ The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
10. Sluice / Slide Gates ¹	A	Gates open and close freely to a tight seal or minor leakage. Gate operators are in good working condition and are properly maintained. Sill is free of sediment and other obstructions. Gates and lifters have been maintained and are free of corrosion. Documentation provided during the inspection.	
	M	Gates and/or operators have been damaged or have minor corrosion, and open and close with resistance or binding. Leakage quantity is controllable, but maintenance is required. Sill is free of sediment and other obstructions.	
	U	Gates do not open or close and/or operators do not function. Gate, stem, lifter and/or guides may be damaged or have major corrosion.	
	N/A	There are no sluice/ slide gates.	
11. Flap Gates/ Flap Valves/ Pinch Valves ²	A	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	
	M	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
	U	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
	N/A	There are no flap gates.	
12. Trash Racks (non-mechanical)	A	Trash racks are fastened in place and properly maintained.	
	M	Trash racks are in place but are unfastened or have bent bars that allow debris to enter into the pipe or pump station, bars are corroded to the point that up to 10% of the sectional area may be lost. Repair or replacement is required.	
	U	Trash racks are missing or damaged to the extent that they are no longer functional and must be replaced. (For example, more than 10% of the sectional area may be lost.)	
	N/A	There are no trash racks, or they are covered in the pump stations section of the report.	
13. Other Metallic Items	A	All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
	M	Corrosion seen on metallic parts appears to be maintainable.	
	U	Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
	N/A	There are no other significant metallic items.	

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¹ Proper operation of the gates (full open and closed) must be demonstrated during the inspection if no documentation is available. Be aware of both manual and electrical operators.

² Proper operation of this item must be demonstrated during the inspection.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/ Remarks/ Recommendations
14. Riprap Revetments of Inlet/ Discharge Areas	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.		
	M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.		
	U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.		
	N/A	There is no riprap protecting this feature of the system, or riprap is discussed in another section.		
15. Revetments other than Riprap	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.		
	M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.		
	U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.		
	N/A	There are no such revetments protecting this feature of the system.		

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Pump Stations

For use during Initial and Continuing Eligibility Inspections of pump stations

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Pump Stations Operating, Maintenance, Training, & Inspection Records	A	Operation, maintenance and inspection records are present at the pump station and are being used and updated, and personnel have been trained in pump station operations. Names and last training date shown in the record book.	
	M	Operation, maintenance and inspection records are present but not adequately used and updated.	
	U	No operation, maintenance and inspection records are present, or refresher training for personnel has not been conducted.	
2. Pump Station Operations and Maintenance Equipment Manuals	A	Operation and Maintenance Equipment Manuals and/or posted operating instructions are present and updated as required, and adequately cover all pertinent pump station features. O&M manuals include points of contact for manufacturers and suppliers of major equipment used in the facility.	
	M	Operation and Maintenance Equipment Manuals and/or posted operating instructions are present and adequately cover all pertinent pump station features. However, they are incomplete and the necessary updates have not been made.	
	U	Operation and Maintenance Equipment Manuals are not available.	
3. Safety Compliance	A	Safety compliance inspection reports by applicable local, state, or federal agencies available for review.	
	M	No safety compliance inspection reports are available for review.	
4. Communications (A or M only)	A	A telephone, cellular phone, two-way radio, or similar device is available to pump station operator and maintenance personnel.	
	M	A telephone, cellular phone, two-way radio, or similar device is not available to pump station operator and maintenance personnel.	
5. Plant Building	A	The building is in good structural condition with no major foundation settlement problems. The roof is not leaking, intake & exhaust louvers are clear of debris, fans are operational, etc.	
	M	There are minor structural defects, minimal foundation settlement, leaks, or other conditions noted that need repair. Defects do not threaten the structural integrity or stability of the building, and will not impact pumping operations.	
	U	The structural integrity or stability of the building is threatened, or there is damage to the building that threatens safety of the operator or impacts pumping operations.	
6. Fencing and Gates ¹	A	Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts.	
	M	Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.	
	U	Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.	
	N/A	There are no features noted that require safety fencing.	

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¹ Proper operation of this item must be demonstrated during the inspection.

Pump Stations

For use during Initial and Continuing Eligibility Inspections of pump stations

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
7. Pumps ¹	A	All pumps are properly maintained and lubricated. Systems are periodically tested and documented for review. No vibration, cavitation noises or unusual sounds are noted when the pump is operated. Bearing temperature sensor records don't indicate any problems.	
	M	Minor deficiencies noted that need to be closely monitored or repaired, such as the presence of slight vibrations, leakage of packing gland, bearing temperature sensors are inoperable or no record is present. However, the pumps are operational and are expected to perform through the next period of usage.	
	U	Major deficiencies identified that may significantly reduce pumping operations. For example, bearing sensor records indicate problems, excessive vibration noted, impellers are badly corroded, or there are eroded or missing blades.	
8. Motors, Engines, Fans, Gear Reducers, Back Stop Devices, etc.	A	All items are operational. Preventative maintenance and lubrication is being performed and the system is periodically subjected to performance testing. Instrumentation, alarms, bearing sensors and auto shutdowns are operational.	
	M	Systems have minor deficiencies, but are operational and will function adequately through the next flood. Bearing sensors are not operational.	
	U	One or more of the primary motors or systems is not operational, or noted deficiencies have not been corrected.	
9. Sumps / Wet well	A	Clear of debris, sediment, or other obstructions. Procedures are in place to remove debris accumulation during operation.	
	M	Debris, sediment, or other obstructions may be present and must be removed, but the sump/ wet well will function as intended during the next flood. Procedures are in place to remove debris accumulation during operation.	
	U	Large debris or excessive silt present which will hinder or damage pumps during operation, or no procedures established to remove debris accumulation during operation.	
10. Mechanical Operating Trash Rakes ¹	A	Drive chain, bearing, gear reducers, and other components are in good operating condition and are being properly maintained.	
	M	The trash rake is in need of maintenance, but is still operational.	
	U	Trash rake not operational or deficiencies will inhibit operations during the next flood event.	
	N/A	There are no mechanical trash rakes.	
11. Non-Mechanical Trash Racks	A	Trash racks are fastened in place and properly maintained.	
	M	Trash racks are in place but are unfastened or have bent bars that allow debris to enter into the pipe or pump station, bars are corroded to the point that up to 10% of the sectional area may be lost. Repair or replacement is required.	
	U	Trash racks are missing or damaged to the extent that they are no longer functional and must be replaced. (For example, more than 10% of the sectional area may be lost.)	
	N/A	There are no trash racks, or they are covered in the pump stations section of the report.	

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¹ Proper operation of this item must be demonstrated during the inspection.

Pump Stations

For use during Initial and Continuing Eligibility Inspections of pump stations

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
12. Fuel System for Pump Engines	A	Fuel system is operational, day tank present and operational, fuel fresh and rotated regularly.	
	M	Fuel system is operational and of adequate capacity, but day tank is missing or fuel is not fresh and rotated regularly.	
	U	Fuel system not functional.	
	N/A	No fuel system.	
13. Power Source	A	The normal power source and backup generators, if installed, are operational, properly exercised and well maintained. Surge protection, grounding, lightning protection, transformers, and automatic/manual transfer of main power to backup system is working.	
	M	Normal power source and backup units, if applicable, are operational with minor discrepancies or maintenance, inspection and exercising record is present but not up to date. Preventative maintenance or repairs are required.	
	U	Normal power source or generators are not operational and must be repaired; or generator, if required, is not on site.	
14. Electrical Systems ¹	A	Operational and maintained free of damage, corrosion, and debris. Preventative maintenance and system testing is being performed periodically.	
	M	Operational with minor discrepancies. Preventative maintenance or repairs are required, but the components are expected to function adequately during the next flood event.	
	U	Components of the electrical system will not function adequately during the next flood event and must be replaced.	
15. Megger Testing on Pump Motors and Critical Power Cables	A	Results of megger tests on pump motors or critical power cables show that the insulation meets manufacturer's or industry standards. Tested within the last year.	
	M	Megger testing not conducted within the past year. If megger tests on pump motors indicate that insulation resistance is below the manufacturer's or industry standard, but the resistance can be corrected with proper application of heat, this is minimally acceptable. (The application of heat does not relate to critical power cables.)	
	U	Megger tests not conducted within past two years, or tests indicate that insulation resistance is low enough that the equipment will not be able to meet design standards of operation; or evidence of arcing or shorting is detected visually.	
16. Enclosures, Panels, Conduit and Ducts	A	All enclosures, panels, conduits, and ducts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
	M	Minor surface corrosion which appears to be maintainable. Cleaning and painting required.	
	U	Severely corroded and must be replaced to prevent failure, equipment damage, or safety issues.	

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¹ Check motor control center, circuit breakers, pilot lights, volt meters, ammeters, sump level indicator, gate position indicators, remote operating systems, including SCADA and telemetry systems. Also, check interior and exterior lighting; especially lighting near trash rack screens, ladders, walkways, etc.

Pump Stations

For use during Initial and Continuing Eligibility Inspections of pump stations

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
17. Intake and Discharge Pipelines	A	Intake and discharge pipelines have no corrosion and paint is intact, except for minor touch up required. Pipe couplings and anchors have no leakage or corrosion.	
	M	Intake and discharge pipelines have minor corrosion and repair and painting is required. Pipe coupling with anchors have minor leakage, corrosion and require bolts to be tightened.	
	U	Intake and discharge pipelines have major corrosion and replacement is required. Pipe coupling with anchors have major leakage and is heavily corroded and requires replacement.	
18. Sluice/ Slide Gates ¹	A	Gates open and close freely to a tight seal or minor leakage. Gate operators are in good working condition and are properly maintained. Sill is free of sediment and other obstructions. Gates and lifters have been maintained and are free of corrosion. Documentation provided during the inspection.	
	M	Gates and/or operators have been damaged or have minor corrosion, and open and close with resistance or binding. Leakage quantity is controllable, but maintenance is required. Sill is free of sediment and other obstructions.	
	U	Gates do not open or close and/or operators do not function. Gate, stem, lifter and/or guides may be damaged or have major corrosion.	
	N/A	There are no sluice/ slide gates.	
19. Flap Gates/ Flap Valves/ Pinch Valves ²	A	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	
	M	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
	U	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
	N/A	There are no gates on discharge lines from pump station.	
20. Cranes ²	A	Cranes operational and have been inspected and load tested in accordance with applicable standards within the last year. Documentation is on hand.	
	M	Cranes have not been inspected or operationally tested within the past year, or there are visible signs of corrosion, oil leakage, etc, requiring maintenance.	
	U	Cranes are not operational, and this may prevent the pump station from functioning as required. No documentation available on cranes.	
	N/A	There are no cranes.	
21. Other Metallic Items (Equipment, Ladders, Platform, Anchors, etc)	A	All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
	M	Corrosion seen on metallic parts appears to be maintainable.	
	U	Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
	N/A	There are no other significant metallic items.	

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¹ Proper operation of the gates (full open and closed) must be demonstrated during the inspection if no documentation is available. Be aware of both manual and electrical operators.

² Proper operation of this item must be demonstrated during the inspection.



Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
1. Vegetation and Obstructions	A	No obstructions, vegetation, debris, or sediment accumulation within the channel. Concrete channel joints and weep holes are free of grass and weeds.	
	M	Obstructions (including log jams), vegetation, debris, or sediment are minor and have not impaired channel flow capacity, but should be removed. Sediment shoals have not developed to the extent that they can support vegetation other than non-aquatic grasses. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
	U	Obstructions (including log jams), vegetation, debris or sediment have impaired the channel flow capacity. Sediment shoals are well established and support woody and/or brushy vegetation. Sediment and debris removal required to re-establish flow capacity.	
2. Shoaling ¹ (sediment deposition)	A	No shoaling or minor, non-vegetated shoaling is present.	
	M	More widespread vegetated and non-vegetated shoaling is present. Non-aquatic grasses are present on shoal. No trees or brush is present on shoal, and channel flow is not significantly reduced. Sediment and debris removal recommended.	
	U	Shoaling is well established, stabilized by saplings, brush, or other vegetation. Shoals are diverting flow to channel walls. Channel flow capacity is reduced and maintenance is required.	
3. Encroachments	A	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the channel.	
	M	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
	U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the channel.	
4. Erosion	A	No head cutting or horizontal deviation observed.	
	M	Head cutting and horizontal deviation evident, but is less than 1 foot from the designed grade or cross section.	
	U	Head cutting and horizontal deviation of more than 1 foot from the designed grade or cross section. Corrective actions required to stop or slow erosion.	

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¹ If weather and flow conditions allow, inspectors should walk in the channel and probe shoal areas in order to estimate extent of blockage of the cross-sectional area where shoaling is present.

Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
5. Concrete Surfaces	A	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
	M	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
	U	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
	N/A	There are no concrete items in the channel.	
6. Tilting, Sliding or Settlement of Concrete Structures ¹	A	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
	M	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
	U	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
	N/A	There are no concrete items in the channel.	
7. Foundation of Concrete Structures ²	A	No active erosion, scouring, or bank caving that might endanger the structure's stability.	
	M	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. For the purposes of inspection, the erosion or scour is not closer to the riverside face of the wall than twice the floodwall's underground base width if the wall is of L-wall or T-wall construction; or if the wall is of sheetpile or I-wall construction, the erosion is not closer than twice the wall's visible height. Additionally, rate of erosion is such that the wall is expected to remain stable until the next inspection.	
	U	Erosion or bank caving observed that is closer to the wall than the limits described above, or is outside these limits but may lead to structural instabilities before the next inspection. Additionally, if the floodwall is of I-wall or sheetpile construction, the foundation is unacceptable if any turf, soil or pavement material got washed away from the landside of the I-wall as the result of a previous overtopping event.	
	N/A	There are no concrete items in the channel.	

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¹ The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

² Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

Rated Item	Rating	Rating Guidelines	Location/ Remarks/ Recommendations
8. Slab and Monolith Joints	A	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
	M	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	
	U	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
	N/A	There are no concrete items in the channel.	
9. Flap Gates/Flap Valves/ Pinch Valves ¹	A	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	
	M	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
	U	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
	N/A	There are no flap gates.	
10. Riprap Revetments & Banks	A	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
	M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
	U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
	N/A	There is no riprap protecting this feature of the system, or riprap is discussed in another section.	
11 Revetments other than Riprap	A	Existing revetment protection is properly maintained, undamaged, and clearly visible.	
	M	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
	U	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
	N/A	There are no such revetments protecting this feature of the system.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

¹ Proper operation of this item must be demonstrated during the inspection.

Instructions for the Inspection Guide

GENERAL INSTRUCTIONS.

1. The sections of this report labeled "Basic Eligibility" and "FCW Engineering" only need to be completed during Initial Eligibility Inspections.
 2. Determination of Minimum Elevation for Levees and Floodwalls (#1 under FCW Engineering):
Depending on available data and local Corps policy, the minimum elevation required may be calculated using traditional methods, with the addition of 1 foot of freeboard in agricultural areas and 2 feet of freeboard in urban areas, or using annual exceedance probability, which numerically accounts for the natural variation and uncertainty when estimating discharge-probability and stage-discharge functions so that additional requirements for elevation are based on the level of risk in the data.
 3. All other sections of this guide that correspond to project features in the Flood Control Work must be fully completed during every Continuing and Initial Eligibility Inspection.
 4. RODI stands for "Requires Operation During Inspection". Items marked "RODI" will be rated based on the way they work during the inspection.
 5. Additional areas for inspection will be incorporated by the inspector into this guide if the layout or physical characteristics of the project warrant this. Appropriate entries will be made in the REMARKS block.
-

RATINGS OF INDIVIDUAL ITEMS:

The following terms and definitions are used when determining the rating for each item and/or component in the flood control work.

A - Acceptable: The rated item is in satisfactory condition, with no deficiencies, and will function as designed and intended during the next flood event.

M - Minimally Acceptable: This rated item has minor deficiencies that need to be corrected. The minor deficiencies will not seriously impair the functioning of the item during the next flood event. The overall reliability of the project will be lowered because of the minor deficiency.

U - Unacceptable: The deficiencies are serious enough that the rated item will not adequately function during the next flood event, compromising the project's ability to provide reliable flood protection.

DETERMINATION OF OVERALL PROJECT CONDITION CODE:

The lowest single rating given for a rated item will determine the overall condition of the project:

1. If all items are rated as Acceptable, the overall project condition will be rated as Acceptable.
 2. If one or more items are rated as Minimally Acceptable, the overall project condition will be rated Minimally Acceptable.
 3. If one or more item is rated as Unacceptable, the overall project condition will be rated as Unacceptable.
-

PROJECT CONDITION AND ELIGIBILITY FOR PL84-99 ASSISTANCE:

1. Projects rated as Acceptable are considered "Active" and eligible for PL84-99 post flood or storm damage rehabilitation assistance from the U.S. Army Corps of Engineers.
2. Projects rated Minimally Acceptable are considered "Active" and eligible for PL84-99 rehabilitation assistance during the time that it takes to make needed corrections. This timeframe will be agreed upon between the project sponsor and Corps inspector at the time of the inspection (or shortly thereafter). If the project sponsor does not present the Corps with proof of completion of the repairs/maintenance by the end of this timeframe, then the project will be "Inactive" and will be ineligible for PL84-99 rehabilitation assistance.
3. Projects rated as Unacceptable are immediately put in an "Inactive" status and are not eligible for PL84-99 post flood or storm damage rehabilitation assistance from the Corps of Engineers. The project will remain in an inactive status until the project sponsor presents the Corps with proof that all of the required repairs/maintenance has been completed. (This includes any repairs/ maintenance required for project features rated minimally Acceptable, as well as those rated Unacceptable.)

FLOODING INSPECTION REPORT

This form should be used to identify one problem or useful feature. Additional problems or useful features should be described on additional reports.

Name and Title of Inspection:

Date and Time of Inspection:

Weather Conditions:

Identification of Problem or Useful Feature (Circle One)

Seepage Sand Boils Settlement Sloughing Soil Cracking Erosion

Wave Wash Shoals or Bar Formation Saturated Areas Plantings

Leaking Wall Joints Seepage through Wall Wall Sliding Wall Tipping

Leaking Stoplogs Unworkable Stoplog Pieces Toe Drains Discharging Muddy Water

Detailed Description and Location of Problem:

Detailed Description of Useful Feature or Suggestion for Improvement:

POST FLOOD INSPECTION REPORT

Name and Title of Inspector:

Dates of Flooding:

Date of Report:

Describe in general terms the history of the flood (conditions prior to and causing flood, date flood declared, predicted crest heights throughout flooding, weather conditions, river ice/debris conditions, etc.)

Daily log of flood heights and general description of operations undertaken by City:

Significant problems encountered during flooding:

Existing improvements which performed well:

Labor/Time saving features employed or potentially useful in the future:

Describe damage sustained to improvements:

Describe damage control efforts required to mitigate further damage:

Describe repair/rehabilitation efforts which will be needed:

Detailed summary of manpower, expenses, equipment and materials used in flood fight:

APPENDIX D – LEVEE VEGETATION MAINTENANCE SCHEDULE

**LITTLE CALUMET RIVER, INDIANA
 LOCAL FLOOD PROTECTION AND RECREATION PROJECT
 OPERATION AND MAINTENANCE MANUAL
 STAGES PHASES**

MUNSTER LEVEE VEGETATION MAINTENANCE SCHEDULE			
CONSTRUCTION STAGE	VEGETATION TYPES	RECOMMENDED MAINTENANCE	MAINTENANCE INTERVAL
STAGE VIII	TURF	MOWING	ONCE A MONTH
STAGE VII	TURF	MOWING	ONCE A MONTH
STAGE V PHASE 2	TURF	MOWING	ONCE A MONTH

NOTES:

1. Refer to the main manual for further information regarding maintenance of levee vegetation.
2. Burning is preferred to mowing for prairie and wet prairie, and mowing is allowed only as a last resort.

**LITTLE CALUMET RIVER, INDIANA
 LOCAL FLOOD PROTECTION AND RECREATION PROJECT
 OPERATION AND MAINTENANCE MANUAL
 STAGES PHASES**

MUNSTER LEVEE VEGETATION INSPECTION CHECKLIST					
PROJECT FEATURE	INSPECTION ITEM	SCHEDULED MAINTENANCE	PERIODIC MAINTENANCE	CONDITION AT INSPECTION	DATE MAINTENANCE PERFORMED
STAGE VIII	(1) Slopes clear of woody plants (i.e., nonlandscape shrubs/trees)				
	(2) Riprap protection free of vegetation				
	(3) Turf repairs				
	(4) Turf mowing				
STAGE VII	(1) Slopes clear of woody plants (i.e., nonlandscape shrubs/trees)				
	(2) Riprap protection free of vegetation				
	(3) Turf repairs				
	(4) Turf mowing				

NOTES:

1. REFER TO THE MAIN MANUAL FOR FURTHER INSPECTION ITEM DETAILS AND DEFINITION OF SCHEDULED AND PERIODIC MAINTENANCE.
2. THIS FORM SERVES AS A GUIDE AND SHOULD BE REVISED AND EXPANDED AS THE INSPECTION PROGRAM IS IMPLEMENTED.

**LITTLE CALUMET RIVER, INDIANA
 LOCAL FLOOD PROTECTION AND RECREATION PROJECT
 OPERATION AND MAINTENANCE MANUAL
 STAGES PHASES**

MUNSTER LEVEE VEGETATION INSPECTION CHECKLIST					
PROJECT FEATURE	INSPECTION ITEM	SCHEDULED MAINTENANCE	PERIODIC MAINTENANCE	CONDITION AT INSPECTION	DATE MAINTENANCE PERFORMED
STAGE V PHASE 2	(1) Slopes clear of woody plants (i.e., nonlandscape shrubs/trees)				
	(2) Riprap protection free of vegetation				
	(3) Turf repairs				
	(4) Turf mowing				

NOTES:

1. REFER TO THE MAIN MANUAL FOR FURTHER INSPECTION ITEM DETAILS AND DEFINITION OF SCHEDULED AND PERIODIC MAINTENANCE.
2. THIS FORM SERVES AS A GUIDE AND SHOULD BE REVISED AND EXPANDED AS THE INSPECTION PROGRAM IS IMPLEMENTED.

APPENDIX E. Annual Report Outline

Project Title

Project Sponsor

Annual Report for Year

Inspection Results

Repair, Replacement, Rehabilitation Activities

Project Modification Request Status

Updates to Organization Structure in O&M Manual

APPENDIX F. Flood Control Regulations, Title 33, Navigation and Navigable Waters and Nationwide Permit #31

Title 33 – NAVIGATION AND NAVIGABLE WATERS

Chapter II – Corps of Engineers

Department of the Army

Part 208 – FLOOD CONTROL REGULATIONS
MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

AUTHORITY: The provisions of this Part 208 issued under sec. 7, 58 Stat. 890, 33 U.S.C. 709, unless otherwise noted.

208.10 Local flood protection works; maintenance and operation of structures and facilities.

(a) GENERAL

(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

- (5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-ways, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.
- (6) It shall be the duty of the Superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works.
- (7) The District Engineer or this authorized representative shall have access at all times to all portions of the protective works.
- (8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.
- (9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.
- (10) The Department of the Army will furnish local interests with an Operation and Maintenance Manual, for each completed project, or separate useful thereof, to assist them in carrying out their obligations under this part.
- (b) LEVEES
- (1) MAINTENANCE

The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

- (i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;
- (ii) No caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;
- (iii) No seepage, saturated areas, or sand boils are occurring;
- (iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;
- (v) Drains through the levees and gates on said drains are in good working condition;
- (vi) No revetment work or riprap has been displaced, washed out, or removed;
- (vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;
- (viii) Access roads to and on the levee are being properly maintained;
- (ix) Cattle guards and gates are in good condition;
- (x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;
- (xi) There is not unauthorized grazing or vehicular traffic on the levees; and
- (xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 1 year, and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) OPERATION

During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- (i) There are no indications of slides or sloughs developing;
- (ii) Wave wash or scouring action is not occurring;
- (iii) No low reaches or levee exist which may be overtopped; and
- (iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure that availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any conditions which endangers the levee and to repair the damaged section.

(c) FLOODWALLS

(1) MAINTENANCE

Periodic inspection shall be made by the Superintendent to be certain that:

- (i) No seepage, saturated areas, or sand boils are occurring;
- (ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;
- (iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;
- (iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;
- (v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its function in time of flood;
- (vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;
- (vii) No bank caving conditions exist riverward of the wall which might endanger its stability; and
- (viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 1 year. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) OPERATION

Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) DRAINAGE STRUCTURES

(1) MAINTENANCE

Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 1 year. Where drainage structures are provided with stoplogs or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

- (i) Pipes, gates, operating mechanisms, riprap, and headwalls are in good condition;
- (ii) Inlet and outlet channels are open;
- (iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes; and
- (iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) OPERATION

Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) CLOSURE STRUCTURES

(1) MAINTENANCE

Closure structures for traffic operations shall be inspected by the Superintendent every year to be certain that:

- (i) No parts are missing;
- (ii) Metal parts are adequately covered with paint;
- (iii) All movable parts are in satisfactory working order;
- (iv) Proper closure can be made promptly when necessary; and
- (v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill operating personnel may be substituted therefore. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) OPERATION

Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimated of time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plants shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) PUMPING PLANTS

(1) MAINTENANCE

Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flashlights or lanterns for emergency lighting shall be kept on hands at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 1 year. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results so of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) OPERATION

Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operation Instructions" and care shall be exercised that proper lubrication is being supplied to all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed and equipment thoroughly inspected, oiled, and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) CHANNELS AND FLOODWAYS

(1) MAINTENANCE

Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

- (i) The channel or floodway is cleared of debris, weeds, and wild growth;
- (ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;
- (iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;
- (iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;
- (v) Riprap sections and deflection dikes and walls are in good condition; and
- (vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 1 year. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) OPERATION

Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams or ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) MISCELLANEOUS FACILITIES

(1) MAINTENANCE

Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior runoff during flood periods shall not be allowed to become filled with silt, debris, or dumped materials. The Superintendent shall be proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges with restrict channel capacities during periods of high flows.

(2) OPERATION

Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection with approval of the District Engineer unless designed therefore.

(Sec. 3, 49 Stat. 1571, as amended; 33 U.S.C. 701c)(9 F.R. 9999, Aug. 17, 1994; 9 F.R. 10203, Aug. 22, 1944)

Nationwide Permit #31
Maintenance of Existing Flood Control Facilities

Discharge of dredge or fill materials resulting from activities associated with the maintenance of existing flood control facilities, including debris basins, retention/detention basins, and channels that

- i. were previously authorized by the Corps by Individual Permit, General Permit, by 33 CFR 330.3, or did not require a permit at the time it was constructed or
- ii. were constructed by the Corps and transferred to a non-federal sponsor for operation and maintenance. Activities authorized by this NWP are limited to those resulting from maintenance activities that are conducted within the “maintenance baseline,” as described in the definition below. Activities including the discharges of dredged or fill materials, associated with maintenance activities in flood control facilities in any watercourse that has previously been determined to be within the maintenance baseline, are authorized under this NWP. The NWP does not authorize the removal of sediment and associated vegetation from the natural water courses except to the extent that these have been included in the maintenance baseline. All dredged material must be placed in an upland site or an authorized disposal site in waters of the U.S., and proper siltation controls must be used. (Activities of any kind that result in only incidental fallback, or only the cutting and removing of vegetation above the ground, e.g., mowing, rotary cutting, and chainsawing, where the activity neither substantially disturbs the root system nor involves mechanized pushing, dragging, or other similar activities that redeposit excavated soil material, do not require a Section 404 permit in accordance with 33 CFR 32.3(d)(2)).

Notification: After the maintenance baseline is established, and before any maintenance work is conducted, the permittee must notify the District Engineer in accordance with the “Notification” General Condition. The notification may be for activity-specific maintenance or for maintenance of the entire flood control facility by submitting a five year (or less) maintenance plan.

Maintenance Baseline: The maintenance baseline is a description of the physical characteristics (e.g., depth, width, length, location, configuration, or design flood capacity, etc.) of a flood control project within which maintenance activities are normally authorized by NWP 31, subject to any case-specific conditions required by the District Engineer will approve the maintenance baseline based on the approved or constructed capacity of the flood control facility, whichever is smaller, including any areas where there are no constructed channels, but are part of the facility. If no evidence of the constructed capacity exist, the approved constructed capacity will be used. The prospective permittee will provide documentation of the physical characteristics of the flood control facility (which will normally consist of as-built or approved drawings) and documentation of the design capacities of the flood control facility. The documentation will also include BMPs to ensure that the impacts to the aquatic environment are minimal, especially in maintenance areas where there are no constructed channels. (The Corps may request maintenance records in areas where there has not been recent maintenance.) Revocation or modification of the final determination of the maintenance baseline can only be done in accordance with 33 CFR 330.5. Except in emergencies as described below, this NWP can not be used until the District Engineer approves the maintenance baseline and determines the need for mitigation and any regional or activity-specific conditions. Once determined, the maintenance baseline will remain valid for any subsequent reissuance of this NWP. This permit does not authorize maintenance of a flood control facility that has been abandoned. A flood control facility will be considered abandoned if it has operated at a significantly reduced capacity without needed maintenance being accomplished in a timely manner.

Mitigation: The District Engineer will determine any required mitigation one-time only for impacts associated with maintenance work at the same time that the maintenance baseline is approved. Such one-time mitigation will be required when necessary to ensure that adverse environmental impacts are no more than minimal, individually and cumulatively. Such mitigation will only be required once for any specific reach of a flood control project.

However, if one-time mitigation is required for impacts associated with maintenance activities, the District Engineer will not delay needed maintenance, provided the District Engineer and the permittee establish a schedule for identification, approval, development, construction and completion of any such required mitigation. Once the one-time mitigation described above has been completed, or a determination made that mitigation is not required, no further mitigation will be required for maintenance activities within the maintenance baseline. In determining appropriate mitigation, the District Engineer will give special consideration to natural water courses that have been included in the maintenance baseline and require compensatory mitigation and/or BMPs as appropriate.

Emergency Situations: In emergency situations, this NWP may be used to authorize maintenance activities in flood control facilities for which no maintenance baseline has been approved. Emergency situations are those which would result in an unacceptable hazard of life, a significant loss of property, or and immediate, unforeseen, and significant economic hardship if action is not taken before a maintenance baseline can be approved. In such situations, the determination of mitigation requirements, if any, may be deferred until the emergency has been resolved. Once the emergency has ended, a maintenance baseline must be established expeditiously, and mitigation, including for maintenance conducted during the emergency, must be required as appropriate.

(Section 10 and 404)

APPENDIX G – EMERGENCY FLOOD PROTECTION HANDBOOK

(REFER TO CD FOR CONTENTS OF THIS APPENDIX)

APPENDIX H – FLOOD WARNING AND PREPAREDNESS PLAN

Refer to 'Appendix G – Emergency Flood Protection Handbook' for flood warning tables based on rainfall and gage levels, as well as, emergency construction methods.

Refer to the Road Closure Alert System (RCAS) program to estimate the potential future road closure alert levels. RCAS is based on either real time USGS precipitation data updated every half-hour or manually input rainfall amounts. It was provided by USACE to the LCRBDC to use along the entire Little Calumet project.

APPENDIX I – HEALTH AND SAFETY REQUIREMENTS

HEALTH AND SAFETY REQUIREMENTS

GENERAL

The safety of personnel during all aspects routine, emergency and post-flood operation and maintenance procedures is of utmost importance. Areas of concern include confined area entry (e.g., oxygen deficiency, explosion, toxic gases), hazardous materials (e.g., dust, metals), chemical burns, eye injury, and normal industrial safety concerns such as moving equipment, falls, etcetera. With proper planning, safety equipment and established procedures, operation and maintenance and inspections can be performed safely without risk of injury.

Many of the potential hazards and proper procedures for addressing them are discussed in this section. Further information on confined area entry and manufacturers of safety equipment can be found in specific vendor maintenance manuals on installed units and in Occupation Safety and Health Administration (OSHA), National Institute of Occupational Safety and Health publications and the COE Safety and Health Requirements Manual (EM 385-1-1). The COE, Chicago District will assist the LCRBDC and local communities in establishing a health and safety program for operation and maintenance of the project.

The health and safety program shall address, as a minimum, the following requirements as presented in EM 385-1-1 and/or equivalent OSHA requirements (e.g., OSHA 29 CFR 1910 and OSHA 29 CFR 1926):

<u>SECTION</u>	<u>SUBSECTIONS</u>	<u>HEALTH AND SAFETY PLAN REQUIREMENT</u>
5	A through (-) F, H-J	Personal Protective and Safety Equipment
6	A, B, G, I, J	Hazardous Substances, Agents and Environments
7	All	Lighting
8	All	Accident Prevention Signs, Tags, Labels, and Signals and Piping Systems
9	A-H	Fire Prevention and Protection
11	A-G	Electrical
12	All	Control of Hazardous Energy (Lockout/Tagout)
13	A, D, E, F	Hand and Power Tools
14	All	Material Handling, Storage and Disposal
15	All	Rigging
18	A-D	Motor Vehicles
21	A-F, I	Safe Access and Fall Protection
25	All	Excavations
27	A, B, C, H	Concrete and Masonry Construction
28	A-F, H-J	Hazardous, Toxic and Radioactive Waste
31	All	Tree Maintenance and Removal
APPENDIX A	Minimum Basic Outline for Accident Prevention Plan	
APPENDIX B	Emergency Operations	

<u>SECTION</u>	<u>HEALTH AND SAFETY PLAN REQUIREMENT</u>
APPENDIX D	Assure Equipment Grounding Conductor Program
APPENDIX F	Rigging Inspection and Removal Criteria
APPENDIX J	Ladders, Ramps, Stairs and Fixed Ladders
APPENDIX O	Recommended Safe Practices for Tree Maintenance and Removal Operations

Personnel shall be trained in the use of protective equipment, potential hazards, early warning signs of exposure (symptoms), and rescue procedures (e.g., first aid, CPR). It is extremely important that each person recognize that multiple fatalities can occur if proper rescue procedures are not followed. For example, if a worker is affected within a confined area and cannot remove oneself, rescue personnel must not enter the area without complete self-contained breathing equipment. If the first worker is affected by an unknown agent, it is highly probable that rescue personnel will be similarly affected unless they have proper protective equipment. Because of the casual agent is not known, maximum protection must be used during any rescue attempt.

CONFINED AREA ENTRY

GENERAL

A confined space is an enclosure in which dangerous air contamination cannot be prevented or removed by natural ventilation through opening of the space. Access to the enclosed area may be restricted such that it is difficult for personnel to escape or be rescued. Depressed areas (e.g., trenches, sumps, wells) also may have poor ventilation and be considered a confined space. Confined spaces of this project primarily consist of gatewells and pump stations.

The LCRBDC and local communities shall establish a confined-space entry policy that includes recognition of the hazards, atmospheric testing and analysis, ventilation requirements, selection and use of protective equipment, training and education of personnel, and administrative procedures. Permit-required confined space (PRCS) evaluation procedures and decision logic presented in Figure 6-1, PRCS program elements in Table 6-1, and permit-required confined space training in Table 6-2 of EM 385-1-1 and/or similar OSHA procedures, program elements and training shall be incorporated into the confined-space entry policy.

Potential dangers of confined space fall into three categories: oxygen deficiency, explosion, and exposure to toxic chemicals and agents. Personnel entering a confined space for inspection or maintenance must assess the risks and potential dangers in each category and follow specific safety precautions.

OXYGEN DEFICIENCY

Oxygen deficiency is the most common hazard. Any gas generated in a confined space displaces the atmosphere and can reduce the oxygen content below the normal value of 20.9 percent. Out-gassing of combustible gases (e.g., methane, organic vapors) from

collected particulate matter can result in local pockets with reduced oxygen levels.

Reduction of oxygen pressure below normal conditions has increasingly severe effects on a person and eventually can lead to death. Oxygen levels less than 16.5 percent result in rapid disability to death. Because of the subtle effects of oxygen deficiency, the average person does not recognize the symptoms and may ignore the danger. By the time the person does recognize the problem, he may no longer be able to remove himself from the dangerous environment.

EXPLOSION

Explosive atmospheres can be created in confined spaces by the evaporation of volatile components. Three elements are necessary to initiate an explosion: oxygen, a flammable gas, vapor or dust, and an ignition source. A flammable atmosphere is defined as one in which a gas concentration is between two extremes: the lower explosive limit (LEL) and the upper explosive limit. A mixture of gas and oxygen in a concentration between these values can explode if a source of ignition is present.

Possible sources of ignition include cigarettes, matches, welding and cutting torches, and grinding equipment. The best means of preventing explosion is to dilute the flammable gas below the LEL by ventilation. It is not safe to assume that a source of ignition can be eliminated and to allow work to continue in a potentially explosive atmosphere. Work in a confined area may release flammable gases, which can increase in concentration. Constant ventilation should be provided to maintain the concentration below the LEL.

Because many vapors are heavier than air, pockets of flammable gases may develop. An effective monitoring program should be used to check concentrations at multiple locations and times during the personnel exposure period.

EXPOSURE TO TOXIC CHEMICALS AND AGENTS

Collected dust may contain toxic chemicals or harmful physical agents. These compounds may exist in the system or be created as a result of operations in the confined area. Inhalation, ingestion or skin contact can have adverse health effects. Most agents have threshold limit doses below which harmful effects do not occur. Exposure above these threshold doses can cause acute to chronic symptoms, depending on the compound. A quantitative assessment of each compound and the threshold dose levels should be made before personnel enter a confined area.

LOCKOUT/TAGOUT

Before an employee performs any servicing or maintenance on a system where the unexpected energizing, start up, or release of kinetic or stored energy could occur and cause injury to damage, the system shall be isolated in accordance with "Control of Hazardous Energy (Lockout/Tagout)" requirements specified in Section 12 of EM 385-1-1 and/or similar OSHA requirements. Personnel and resources shall not be considered protected until hazardous energy control procedures have been implemented.

WORKER PROTECTION

EYE PROTECTION

Eyes may be subjected to physical damage as a result of airborne particles (e.g., soil, rock chips, concrete chips) or direct impact with objects (e.g., suspended or protruding pipes or rods). Eyes may be subjected to chemical damage as a result of the dust composition or species condensed onto the dust particles. Common active agents are sulfuric acid on fly ash particles and alkali agents in cement applications.

HEARING PROTECTION

When inspectors are inside confined spaces or around construction or mechanical equipment, proper hearing protection should be used to limit sound levels to maximum permitted exposure. Many types of hearing protection devices (e.g., cotton, premolded inserts, foam, ear muffs) are available; selection depends on individual preference and expected sound levels. Limits of worker exposure to noise are based on both duration of exposures and sound levels.

SKIN IRRITATION

Skin may become burned or irritated by exposure to fuels or cleaning solvents. Depending on its composition, dust can be acidic, alkaline and/or abrasive. When it contacts the skin, this dust can cause burns or irritation. Workers can limit skin contact area and thus prevent potential irritation by wearing long-sleeved shirts and gloves during inspections and operation and maintenance procedures. Depending on temperature conditions and activity levels, coveralls or other full covering may be worn.

THERMAL STRESS

Thermal stress associated with inspections and maintenance must be considered in defining the time required for repairs. Thermal effects may be severe for dusty, humid conditions and limited access. The thermal stress placed on a worker is a function of several variables, such as air velocity, evaporation rate, humidity, temperature, radiation, and metabolic rate (work). In effect, the stress is indicated by the need to evaporate perspiration.

FALL PROTECTION

Measures shall be taken to reduce the risk of worker injury or death as the result of falls in or around the facility. Fall protection countermeasures shall be in complete accordance with applicable OSHA regulations found at 29 CFR 1910 Subpart M and/or 19 CFR 1910.23.

APPENDIX J. ESTIMATED OPERATION & MAINTENANCE COSTS

1 LEVEES & OVERFLOW EMBANKMENTS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 times / 1 year	5,407	LF	2	5,000	\$100.00	\$0.00	\$0.16	\$0.00	\$0.00	\$0.16	\$3,460
Burning	1 time / 2 years	-	AC	6	10	\$261.00	\$114.00	\$208.80	\$91.20	\$0.00	\$300.00	\$0
Fill / Repair	1 time / 5 years	270	CY	6	800	\$298.30	\$156.00	\$2.98	\$1.56	\$0.00	\$4.54	\$246
Debris Removal & Litter Control	1 times / 1 year	27	TON	5	10	\$224.35	\$24.72	\$179.48	\$19.78	\$41.25	\$240.51	\$6,502
Vermin Control	1 time / 1 year	5,407	LF	1	6,000	\$43.50	\$0.00	\$0.06	\$0.00	\$0.25	\$0.31	\$1,665
Toe Drains												
Inspect	1 time / 5 years	0	LF	2	4,000	\$130.00	\$0.00	\$0.26	\$0.00	\$0.00	\$0.26	\$0
Flush	1 time / 10 years	0	EA	3	4	\$130.50	\$0.00	\$261.00	\$0.00	\$5.00	\$266.00	\$0
Access Roads												
Regrade	1 time / 1 year	5,407	LF	2	1,000	\$98.80	\$125.00	\$0.79	\$1.00	\$0.00	\$1.79	\$9,681
Repair (Soil Stabilized)	1 time / 1 year	5,407	LF	7	2,500	\$339.90	\$79.75	\$1.09	\$0.26	\$0.15	\$1.49	\$8,072
Survey, incl. Settlement Gauges	1 time / 10 years	5,407	LF	2	1,500	\$130.00	\$50.00	\$0.69	\$0.27	\$0.00	\$0.96	\$519
Landscaping												
Tree & Brush Removal/Trimming	1 time / 5 years	5,407	LF	5	3,000	\$217.50	\$55.07	\$0.58	\$0.15	\$0.00	\$0.73	\$786
ITEM SUBTOTAL:												\$30,931

2 FLOODWALLS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 times / 1 year	25,686	SF	2	10,000	\$100.00	\$0.00	\$0.08	\$0.00	\$0.00	\$0.08	\$8,220
Cleaning / Treating												
Concrete (both sides; but only 50% will require)	1 time / 2 years	25,686	SF	5	1,250	\$225.00	\$50.00	\$1.44	\$0.32	\$0.35	\$2.11	\$27,099
Railings, Walkways, & Misc. Metal	1 time / 5 years	3	LS							ALLOW:	\$1,000.00	\$600
Repairs												
Waterstops (replace 70%)	1 time / 20 year	642	LF	6	10	\$240.00	\$100.00	\$192.00	\$80.00	\$60.00	\$332.00	\$10,660
Cracks	1 time / 10 years	771	LF	2	50	\$80.00	\$25.00	\$12.80	\$4.00	\$0.35	\$17.15	\$1,322
Railings / Walkways	1 time / 10 years	3	LS							ALLOW:	\$3,000.00	\$900
ITEM SUBTOTAL:												\$48,799

3 PUMP STATION

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Semi-annual Report (all features)	2 times / 1 year	4	EA	2	0.15	\$100.00	\$0.00	\$5,333.33	\$0.00	\$40.00	\$5,373.33	\$42,987
Inspection	4 times / 1 year	4	EA	2	2.50	\$100.00	\$0.00	\$320.00	\$0.00	\$0.00	\$320.00	\$5,120
Oil & Grease	1 time / 1 year	16	PUMP	2	4	\$90.00	\$0.00	\$180.00	\$0.00	\$0.00	\$180.00	\$2,880
Trash Rack Equipment Maint.	1 time / 1 year	4	RACK	2	8	\$90.00	\$0.00	\$90.00	\$0.00	\$0.00	\$90.00	\$360
Recondition / Rehab.	1 time / 20 years	4	LS							ALLOW:	\$72,000	\$14,400
Replacement	1 time / 50 years	4	LS							ALLOW:	\$120,000	\$9,600
ITEM SUBTOTAL:												\$75,347

4 GATES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspect/Clean/Lube Gate	4 times / 1 year	21	EA	2	4	\$90.00	\$0.00	\$180.00	\$0.00	\$0.00	\$180.00	\$15,120
Inspect/Clean/Lube Gate Operator	1 time / 1 year	21	EA	1	8	\$45.00	\$0.00	\$45.00	\$0.00	\$0.00	\$45.00	\$945
Debris Removal	2 times / 1 year	5.25	TON	3	12	\$80.00	\$7.50	\$53.33	\$5.00	\$38.75	\$97.08	\$1,019
Repair / Replace	1 time / 20 years	21	EA							ALLOW:	\$10,000.00	\$8,400
ITEM SUBTOTAL:											\$25,484	

5 GATEWELLS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 times / 1 year	7	EA	2	5,000	\$100.00	\$0.00	\$0.16	\$0.00	\$0.00	\$0.16	\$4
Survey for Settlement	1 time / 10 years	7	EA	3	5,000	\$100.00	\$0.00	\$0.16	\$0.00	\$0.00	\$0.16	\$0
Debris Removal / Clear Vegetation	2 times / 1 year	1.75	TON	3	5,000	\$100.00	\$0.00	\$0.16	\$0.00	\$0.00	\$0.16	\$1
Bar Screen Maintenance	1 time / 1 year	7	RACK	1	5,000	\$100.00	\$0.00	\$0.16	\$0.00	\$0.00	\$0.16	\$1
Riprap Replacement												
Riprap	1 time / 5 years	280	TON	3	800	\$298.30	\$156.00	\$2.98	\$1.56	\$0.00	\$4.54	\$254
Bedding	1 time / 10 years	84	TON	5	10	\$224.35	\$24.72	\$179.48	\$19.78	\$41.25	\$240.51	\$2,020
Cleaning / Treating												
Concrete (only 25% of exposed surfaces will require)	1 time / 5 years	3,500	SF	5	6,000	\$43.50	\$0.00	\$0.06	\$0.00	\$0.25	\$0.31	\$216
Metal	1 time / 5 years	7	LS							ALLOW:	\$500.00	\$700
Repairs												
Waterstops (replace 70%)	1 time / 20 years	980	LF	6	10	\$240.00	\$100.00	\$192.00	\$80.00	\$60.00	\$332.00	\$16,268
Cracks	1 time / 10 years	700	LF	2	50	\$80.00	\$25.00	\$12.80	\$4.00	\$0.35	\$17.15	\$1,201
ITEM SUBTOTAL:											\$20,665	

6 CLOSURE STRUCTURES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 times / 1 year	3	EA	2	12	\$100.00	\$7.00	\$66.67	\$4.67	\$0.00	\$71.33	\$856
Clean	3 times / 1 year	3	EA	2	16	\$90.00	\$25.00	\$45.00	\$12.50	\$0.00	\$57.50	\$518
Repair / Replace	1 time / 30 years	3	EA							ALLOW:	\$15,000.00	\$1,500
ITEM SUBTOTAL:											\$2,874	

7 CULVERTS / DRAINAGE STRUCTURES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 times / 1 year	20	EA	2	16	\$100.00	\$5.00	\$50.00	\$2.50	\$0.00	\$52.50	\$4,200
Debris Removal	1 time / 1 year	2.00	TON	3	12	\$120.00	\$7.00	\$80.00	\$4.67	\$45.00	\$129.67	\$259
Replace Riprap	1 time / 5 years	100	TON	3	200	\$135.30	\$2.00	\$5.41	\$0.08	\$45.00	\$50.49	\$1,010
Replace Bedding	1 time / 5 years	20	TON	5	120	\$100.00	\$1.00	\$6.67	\$0.07	\$17.50	\$24.23	\$97
ITEM SUBTOTAL:											\$5,566	

8 PRECIPITATION / STREAM GAGE NETWORK

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	1 time / 1 year	0	EA									
Clean / Flush	1 time / 1 year	0	EA									
Repair	1 time / 5 years	0	EA									
Obtained per ED-HF (Davis) Memo to ED-P, dated 13 NOV 96 Included in Total Annual Maintenance Cost Listed above Included in Total Annual Maintenance Cost Listed above											\$25,000.00	\$0
ITEM SUBTOTAL:												\$0

9 BASE STATION

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Replacement	1 time / 20 years	0	EA									
INCLUDED in Precip./Stream Gauge Network Total Annual Maintenance Costs listed above, obtained per ED-HF (Davis) Memo to ED-P, dated 13 NOV 96												
ITEM SUBTOTAL:												\$0

10 FIELD STATION

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	TOTAL Crew Labor Cost (per Crew MH)	Equipment Cost per Unit	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Replacement	1 time / 30 years	0	EA									
Repairs	12 times / 1 year	0	EA	2	2	\$80.00	\$0.00	\$320.00	\$0.00	\$0.00	\$320.00	\$0
Both "Replacement" and "Repairs" per ED-HF (Davis) Memo to ED-P, dated 21 DEC 94												
ITEM SUBTOTAL:												\$0

11 RECREATION FACILITIES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	1 time / 1 year	0	EA	2	16	\$100.00	\$5.00	\$50.00	\$2.50	\$0.00	\$52.50	\$0
Trails		0	LF									
Bituminous												
Reseal	1 time / 5 years	0	SF	4	10,800	\$160.00	\$0.05	\$0.12	\$0.00	\$0.20	\$0.32	\$0
Patch / Seal Potholes	1 time / 3 years	0	LS	5	6.40	\$200.00	\$70.00	\$250.00	\$87.50	\$70.00	\$407.50	\$0
Resurface	1 time / 15 years	0	SF	7	4,000	\$280.00	\$0.30	\$0.56	\$0.00	\$0.12	\$0.68	\$0
Aggregate												
Smooth / Regrade	1 time / 1 years	0	SF	3	16,000	\$447.45	\$0.05	\$0.22	\$0.00	\$0.08	\$0.30	\$0
Replace	1 time / 10 years	0	SF	6	8,000	\$673.05	\$0.30	\$0.67	\$0.00	\$0.40	\$1.07	\$0
Prefabricated Bridges												
Strip and Reseal Wooden Deck	1 time / 4 years	0	SF	2	560	\$80.00	\$0.20	\$1.14	\$0.00	\$0.25	\$1.40	\$0
Sandblast & Repaint Steel Structure	1 time / 5 years	0	LF	2	50	\$80.00	\$5.00	\$12.80	\$0.80	\$6.00	\$19.60	\$0
Boardwalk												
Strip and Reseal Wooden Deck	1 time / 4 years	0	SF	2	560	\$80.00	\$0.20	\$1.14	\$0.00	\$0.25	\$1.40	\$0
Sandblast & Repaint Steel Structure	1 time / 25 years	0	SF	2	200	\$80.00	\$0.75	\$3.20	\$0.03	\$2.00	\$5.23	\$0
Signage												
Inspect / Clean	2 times / 1 year	8	EA									
Replace	1 time / 20 years	8	EA	3	6.00	\$120.00	\$12.00	\$160.00	\$16.00	\$450.00	\$626.00	\$250
Vehicle Barriers (Bollards)												
Inspect	2 times / 1 year	6	SET									
Replace	1 time / 20 years	6	SET	4	1.60	\$160.00	\$225.00	\$800.00	\$1,125.00	\$325.00	\$2,250.00	\$675
Decks / Piers												
Repair	1 time / 6 years	0	SF	4	3,500	\$160.00	\$0.04	\$0.37	\$0.00	\$0.20	\$0.57	\$0
Clean / Treat	1 time / 4 years	0	SF	2	560	\$80.00	\$0.20	\$1.14	\$0.00	\$0.25	\$1.40	\$0
Parking												
Slope Erosion	1 time / 7 years	0	LS	3	4	\$120.00	\$25.00	\$240.00	\$50.00	\$150.00	\$440.00	\$0
Bituminous												
Reseal	1 time / 5 years	0	SF	4	10,800	\$160.00	\$0.05	\$0.12	\$0.00	\$0.20	\$0.32	\$0
Patch / Seal Potholes	1 time / 3 years	0	LS	5	6.40	\$400.00	\$70.00	\$500.00	\$87.50	\$75.00	\$662.50	\$0
Resurface	1 time / 15 years	0	SF	5	10,000	\$400.00	\$0.20	\$0.32	\$0.00	\$0.80	\$1.12	\$0
Pavement Markings Repainted	1 time / 3 years	0	SF	4	20,000	\$320.00	\$0.05	\$0.13	\$0.00	\$0.08	\$0.21	\$0
Snow Plowing & Salt Application	5 times / 1 year	0	SF	1	80,000	\$40.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0
ITEM SUBTOTAL:												\$925

12 CHANNELS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspect	4 times / 1 year	0	LF	2	8,000	\$100.00	\$0.02	\$0.10	\$0.00	\$0.00	\$0.10	\$0
Debris Removal	1 time / 1 year	0	TON	5	165	\$200.00	\$1.25	\$9.70	\$0.06	\$50.00	\$59.76	\$0
Sediment Dredging	1 time / 10 years	0	CY	10	700	\$400.00	\$5.25	\$4.57	\$0.06	\$0.00	\$4.63	\$0
Clear Vegetation	1 time / 1 year	0	CY	5	60	\$200.00	\$10.00	\$26.67	\$1.33	\$50.00	\$78.00	\$0
ITEM SUBTOTAL:												\$0

13 RELOCATIONS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspect	4 times / 1 year	0	EA	2	12	\$100.00	\$6.00	\$66.67	\$4.00	\$0.00	\$70.67	\$0
Repair	1 time / 25 years	0	EA							ALLOW:	\$800.00	\$0
Clean	1 time / 5 years	0	EA	2	8	\$80.00	\$12.00	\$80.00	\$12.00	\$12.00	\$104.00	\$0
ITEM SUBTOTAL:												\$0

14 FLOWAGE EASEMENTS

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspect	1 time / 1 year	0	EA	2	8	\$100.00	\$9.00	\$100.00	\$9.00	\$0.00	\$109.00	\$0
Debris Removal	1 time / 1 year	0	TON	5	165	\$200.00	\$1.50	\$9.70	\$0.07	\$50.00	\$59.77	\$0
ITEM SUBTOTAL:												\$0

15 MISCELLANEOUS FEATURES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspection	4 time / 1 year	0	EA	2	16	\$100.00	\$5.00	\$50.00	\$2.50	\$0.00	\$52.50	\$0
Access Control												
Fencing												
Repair	1 time / 5 years	0	FT	3	100	\$120.00	\$3.50	\$9.60	\$0.28	\$5.00	\$14.88	\$0
Replace	1 time / 30 years	0	LF	4	100	\$160.00	\$3.50	\$12.80	\$0.28	\$7.00	\$20.08	\$0
Gates												
Repair / Grease	1 time / 2 years	5	EA	3	4	\$120.00	\$20.00	\$240.00	\$40.00	\$25.00	\$305.00	\$763
Replace	1 time / 25 years	5	EA	4	1.60	\$160.00	\$350.00	\$800.00	\$1,750.00	\$2,000.00	\$4,550.00	\$910
Guardrail Repair	1 time / 7 years	0	LF	4	100	\$160.00	\$4.00	\$12.80	\$0.32	\$12.00	\$25.12	\$0
Roads												
Bituminous												
Reseal	1 time / 5 years	1,350	SF	4	10,800	\$160.00	\$0.05	\$0.12	\$0.00	\$0.20	\$0.32	\$86
Patch / Seal Potholes	1 time / 3 years	1	LS	5	6.40	\$200.00	\$70.00	\$250.00	\$87.50	\$70.00	\$407.50	\$183
Resurface	1 time / 15 years	1,350	SF	7	4,000	\$280.00	\$0.30	\$0.56	\$0.00	\$0.12	\$0.68	\$61
Unpaved												
Smooth / Regrade	1 time / 1 years	0	SF	3	16,000	\$120.00	\$0.06	\$0.06	\$0.00	\$0.08	\$0.14	\$0
Replace	1 time / 10 years	0	SF	6	8,000	\$240.00	\$0.30	\$0.24	\$0.00	\$0.50	\$0.74	\$0
Concrete												
Patch	1 time / 3 years	0	LS	5	0.33	\$200.00	\$125.00	\$4,848.48	\$3,030.30	\$500.00	\$8,378.79	\$0
Replace	1 time / 30 years	0	LS	3	0.33	\$120.00	\$125.00	\$2,909.09	\$3,030.30	\$500.00	\$6,439.39	\$0
Railroad Crossings - Replace	1 time / 1 year	0	EA	5	0.50	\$200.00	\$150.00	\$3,200.00	\$2,400.00	\$600.00	\$6,200.00	\$0
Drainage Ditches		882	LF									
Debris Removal	1 time / 1 year	5	TON	3	12	\$120.00	\$7.00	\$80.00	\$4.67	\$50.00	\$134.67	\$660
Replace Riprap	1 time / 5 years	163	TON	3	200	\$120.00	\$1.75	\$4.80	\$0.07	\$50.00	\$54.87	\$1,792
Clear Vegetation	1 time / 1 year	2	CY	5	60	\$200.00	\$10.00	\$26.67	\$1.33	\$50.00	\$78.00	\$127
Dredge	1 time / 20 years	163	CY	5	80	\$200.00	\$12.00	\$20.00	\$1.20	\$0.00	\$21.20	\$173
Interlocking Concrete Block Repair	1 time / 5 years	0	SF							ALLOW:	\$20.00	\$0
Interlocking Concrete Block Replacement	1 time / 10 years	0	SF							ALLOW:	\$30.00	\$0
ITEM SUBTOTAL:												\$4,756

16 BRIDGES

Task	Frequency	Quantity	Unit	Crew	Crew Production Output Quant./Day	Total Labor Cost (per Crew MH)	Total Equipment Cost (per Crew MH)	Labor Cost per Unit	Equipment Cost per Unit	Materials Cost per Unit	Total Cost of Operation per Unit	Total Annual Cost
Inspect	4 times / 1 year	0	EA	2	12	\$100.00	\$6.00	\$66.67	\$4.00	\$0.00	\$70.67	\$0
Debris Removal	2 time / 1 year	0	TON	5	165	\$200.00	\$10.00	\$9.70	\$0.48	\$50.00	\$60.18	\$0
Clear Vegetation	1 time / 1 year	0.00	CY	5	60	\$200.00	\$10.00	\$26.67	\$1.33	\$50.00	\$78.00	\$0

ITEM SUBTOTAL: \$0

ASSUMPTIONS: No General & Administrative Expenses are included

TOTAL: \$215,348

APPENDIX K. GATE MANUFACTURER'S OPERATIONS & MAINTENANCE
MANUAL

(REFER TO CD FOR CONTENTS OF THIS APPENDIX)

APPENDIX L. PUMP STATION MANUFACTURER'S OPERATIONS &
MAINTENANCE MANUAL

(REFER TO CD FOR CONTENTS OF THIS APPENDIX)

APPENDIX M. AS-BUILTS

(REFER TO CD FOR CONTENTS OF THIS APPENDIX)

