LITTLE CALUMET RIVER
MARSHALLTOWN LEVEE
GARY, INDIANA

PERIODIC INSPECTION REPORT
JULY 2014

Periodic Inspection Report No. 2

Date of Inspection:
May 8, 2014
MARSHALLTOWN LEVEE – PROJECT SUMMARY

LOCATION

RIVER: LITTLE CALUMET RIVER
SIDE OF RIVER: NORTH BANK
STATE: INDIANA
CITY: GARY
WEST END: SOUTHWEST CORNER OF WISCONSIN DR AND CENTRAL AVE
EAST END: SOUTHEAST CORNER OF MARSHALLTOWN DR AND CENTRAL AVE

PROJECT DETAILS

TOP OF LEVEE ELEVATION: 598.6 NGVD29
LENGTH OF LEVEE: 4,567 LF
GATE STRUCTURES: 2
PUMP STATIONS: 1
- MARSHALLTOWN (8.1 CFS, 1460 GPM)
STREET CLOSURES: 0
OVERFLOW SECTION: 0
PROTECTED AREA: 71.2 ACRES
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EXECUTIVE SUMMARY

Periodic Inspection Results for the Little Calumet River – Marshalltown Levee, Gary, IN

1. Periodic inspections are required to be conducted every five years (Policy Guidance Letter, CECW-CE, 17 Dec 2008) as part of The U.S. Army Corps of Engineers (USACE) Levee Safety Program to assess the integrity and viability of levee systems and recommend actions to reduce the associated flood risks to the public, property, and environment.

2. The Marshalltown Levee System is part of a federally authorized and non-federally operated and maintained urban flood protection project. The Little Calumet River Levee project was authorized for construction by Section 401 of the 1986 Water Resource Development Act (P.L. 99-662). The levee system is located in the City of Gary, Indiana, on the north bank of the Little Calumet River by I-65. The levee system consists of approximately 4,567 ft of embankment, 2 gate structures, and 1 pump station, protecting about 71 acres of the Marshalltown.

3. A review of the project design criteria was performed to evaluate the project with respect to current U.S. Army Corps of Engineers design criteria for levees. This review identified the following items as non-conforming with respect to current levee design standards:
   - Missing seepage analysis to reflect the drainage ditch
   - Missing steady state stability analysis
   - Inadequate subsurface investigation

4. On 8 May 2014, representatives from the Army Corps of Engineers and the Little Calumet River Basin Development Commission met to perform the first Periodic Inspection of the system. This inspection was conducted following the completion of construction of the primary levee features of the project. The findings of the field inspections include the following:
   - Tall grass on the levee was present.
   - Unauthorized farming activity next to the levee was noted.
   - There are ruts less than 6 inches deep on the riverside slope and landside slope as well as some low spots on the crest that could pond water.
   - Multiple animal burrows were noted.
   - Sediment was noted in front of and inside a ditch culvert.
   - There was debris noted in the riprap and a riprap dam installed in the interior ditch without a permit.
• There was silt on the bottom of the sluice gate that prevented the gate from being closed completely and could lead to interior flooding.

• A flap gate was stuck open due to rocks.

• Operation and Maintenance Equipment Manuals were not available at the Marshalltown Pump Station at the time of inspection.

• There were no Arc Flash warning labels in front of the control cabinet.

• A bolt was missing from the trash rack at the intake.

5. The system has previously been on Inactive Status when unacceptable deficiencies were not corrected within a two year period. The Local Sponsor has recently addressed these items. Based on the Interim Policy for determining Rehabilitation Program Status, this levee system has been determined to be ‘Active’ and therefore eligible under the PL84-99 program.

6. The periodic inspection identified maintenance and design issues that need to be addressed. In general, the inspection found that the local sponsor is performing operation and maintenance of the project. Some deficiencies were noted and actions are required. However the items noted are not considered severe enough to prevent the system from performing satisfactorily during the next flood event. Therefore, a rating of ‘Minimally Acceptable’ is assigned for the levee following this inspection. The deficiencies noted need to be addressed to ensure issues do not progress and affect the ability of the levee to perform during a flood.

7. A routine inspection is schedule for spring 2015. The next periodic inspection is scheduled for FY2019.
2 INSPECTION TEAM AND SCHEDULE

The following section contains an overview of the inspection team, date, and associated conditions observed during the periodic inspection of the Marshalltown Levee System.

2.1 Inspection Team

The following is a complete listing of the periodic inspection team and others who participated in the inspection.

Levee Team:

Bill Rochford (USACE Chicago District) – Levee Safety Program Manager
Yuki Galisanao (USACE Chicago District) – Geotechnical, Lead
Tina Kowitz (USACE Detroit District) – Geotechnical
Rick Ackerson (USACE Chicago District) – Hydraulics
Jan Plachta (USACE Chicago District) – Structural (engineering assessment only)
Nikki Chaffin (USACE Chicago District) – GIS, LIS

Pump Station Team:

Robert Sezonov (USACE Chicago District) – Mechanical
Ernesto Go (USACE Chicago District) – Electrical
Jan Plachta (USACE Chicago District) – Structural (engineering assessment only)

Sluice Gate Team:

Laura Vanden Berg (USACE Chicago District) – Civil
Arthur Rundzaitis (USACE Chicago District) – Construction Representative

Sponsor:

Dan Repay (Little Calumet River Basin Development Commission)
Jeff Yatsko (Garcia Consulting)
Brian Beloshapka (Garcia Consulting)

2.2 Date of Inspection

The inspection took place on Thursday, 8 May 2014. Everyone met at the east end of the Marshalltown Levee at 830. The purpose of the Periodic Inspection was explained to the sponsor before the teams split up. The Levee Team started on the east end of the levee and continued to the west end. The Pump Station Team inspected the Marshalltown Pump Station and attached sluice gate. The Sluice Gate Team inspected the gatewell near the pump station.

2.3 Weather Conditions during Inspection

Weather conditions were sunny throughout the day on May 8 with ambient air temperatures
ranging from a low of 69 degrees Fahrenheit (°F) to a high of 92°F, as reported in Gary, IN. The wind speed averaged 10 mph.

![Figure 2.1. Weather Conditions](image)

### 2.4 River Gage or Elevation Readings during Inspection

The most relevant stage gauge for the Marshalltown Levee is located along the Little Calumet River near Lake Station, IN, only about a thousand feet from the levee. This reach of river along the Marshalltown Levee acts very much like a storage lake during a flood event and flood levels are basically level through this reach. The gage is operated by the USGS. USGS flow measurement gages that have an impact at Marshalltown are the Hart Ditch at Munster and Deep River at Lake George Outlet at Hobart gages although the Munster gage is also affected by backwater.

- USGS gage number: 04093250
- Description: LITTLE CALUMET RIVER NEAR LAKE STATION, IN
- Location: Latitude 41°34'21", Longitude 87°17'58", NAD83, Lake County, Indiana
- Hydrologic Unit: 04040001
- Drainage area: 6.76 square miles
- Datum of gage: 579.64 feet above NAVD88.
- Gage height for 100 yr flood event: 16.30 ft

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1 Weather information can be found at: [http://www.wunderground.com/](http://www.wunderground.com/)
2 River gage information can be found at: [http://waterdata.usgs.gov/in/nwis/rt](http://waterdata.usgs.gov/in/nwis/rt)
Figure 2.2. Gage Readings at the Little Calumet River near Lake Station, IN

- **USGS gage number:** 413340087285001
- **Description:** HART DITCH AT MUNSTER, IN
- **Location:** Latitude 41°33'40", Longitude 87°28'50", NAD27, Lake County, Indiana
- **Hydrologic Unit:** 07120003
- **Drainage area:** 70.70 square miles
- **Datum of gage:** 591.27 feet above NGVD29.
- **Gage height for 200 yr flood event:** 9.73 ft

Figure 2.3. Gage Readings at Hart Ditch at Munster, IN
USGS gage number: 04093000
Description: DEEP RIVER AT LAKE GEORGE OUTLET AT HOBART, IN
Location: Latitude 41°32'10", Longitude 87°15'25", NAD27, Lake County, Indiana
Hydrologic Unit: 04040001
Drainage area: 124 square miles
Datum of gage: 588.17 feet above NGVD29.
Gage height for 200 yr flood event\(^3\): 24.3 ft

Figure 2.4. Gage Readings at Deep River at Lake George Outlet at Hobart, IN

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\(^3\) Extrapolated from the last frequency analysis (5990 CFS) and peak data from the 2007 and 2008 flood events. Model no longer includes the gage location.
3 SYSTEM INFORMATION

3.1 BACKGROUND

3.1.1 Location

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 Marshalltown Levee is a ring levee north of the Little Calumet River by I-65. See Figure 3.1.

3.1.2 Project Type

This is a federally authorized and constructed but non-federally operated and maintained urban flood-protection project.

3.1.3 Public Sponsors

The Little Calumet River Basin Development Commission (LCRBDC) is the Project Sponsor for the Marshalltown Levee. The Project Sponsor is responsible for the operation, maintenance, repair, replacement, and rehabilitation of the overall project, as indicated in the Project Cooperation Agreement. For the construction of the Little Calumet River, Indiana Local Flood Protection and Recreation Project, the LCRBDC and the Department of the Army entered into a Project Cooperation Agreement on the 16th day of August, 1990, as required by Public Law (99-662). Amendment 1 (30 July 1999) of the PCA covered the construction of the Marshalltown Levee. A copy of the duly executed PCA is included as Appendix B of the O&M Manual.

3.1.4 Authority

The Little Calumet River Levee 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.”

3.1.5 Estimated Original Cost of Project

In accordance with the Operation and Maintenance (O&M) Manual, the Marshalltown Levee was divided into two contracts. The cost breakdown is as follows: Stage III Drainage Remediation $1,615,111.24 and East Reach Remediation $1,873,784.68. The total award for all contracts was $3,488,895.92. The levee, ditches, and gatewell structure were part of the East Reach Remediation contract. Stage III Drainage Remediation included the pump station and other drainage structures.
Figure 3.1. Location Map
3.1.6 Construction Completion Date of Project

The Marshalltown Levee was completed in two contacts. The East Reach Remediation contract started in August 1999 and was completed in October 2000. The Stage III Drainage Remediation contract started in September 2002 and was completed in May 2005.

3.1.7 Potential Consequences

Per the O&M Manual, the Marshalltown Levee protects approximately 71 acres. The levee system was placed to eliminate most flood damages from storm events on the Little Calumet River having recurrence intervals up to the 100-year flood. The LST counted 213 structures in the protected area. Critical infrastructure includes three oil gas pipelines in the protected area. There is an elementary school just outside of the protected area.

3.1.8 Investigations Prior to Construction

The following investigations were completed prior to the construction of the project:

- Feature Design Memorandum 2 – East Reach Levee System Volume 2 of 3 (March 1991)
- Feature Design Memorandum 2 – East Reach Levee System Volume 3 of 3 (March 1991)
- Feature Design Memorandum 3 – Interior Flood Control, East Reach (March 1991)
- Feature Design Memorandum 5 – West Reach Levee System Volume 2 of 5 (February 1994)
- Feature Design Memorandum 6 – Interior Flood Control, West Reach (September 1993)

3.1.9 History of Remedial Measures and Major Modifications

After original construction of the levee as part of the East Reach Remediation contract, a pump station was added by USACE as part of the Stage III Drainage Remediation contract. The local sponsor submitted a permit request to perform repair work on the levee to address inspection issues. This was assigned as Permit 12-02 and was approved on 21 June 2012. The work included filling animal burrows, remove vegetation within 15 ft of the levee toe, add aggregate to the levee crest, install a new A-frame gate, replace bedding and riprap at the outlet channel, install a new scour hole, and repair cracks in the concrete. Work was completed in 2013.

3.1.10 National Levee Database Survey

A survey was performed on September 9, 2009 by the U.S. Army Corps of Engineers, Chicago District. The survey was performed using an RTK GPS rover system that directly ties to Continuously Operating Reference Stations (CORS) which are currently maintained by the National Geodetic Survey (NGS) agency. The coordinate system used for this survey was the Indiana State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD83) U.S. feet and the vertical datum was the North American Vertical Datum of 1988 (NAVD88) U.S. feet. All horizontal and vertical control points were referenced to NGS monuments ME 2123 and ME 2122. Both NGS monuments checked within an acceptable tolerance of 0.10 of a foot horizontally and vertically.
Additional survey efforts were also taken in September 2009, to recover and re-survey the original control points and benchmarks that were used in the as-built surveys dated May 1997. The as-builts were originally surveyed, horizontally in the North American Datum of 1927 (NAD27) and vertically in the National Geodetic Vertical Datum of 1929 (NGVD29). The original benchmarks and control points were to be used for a site specific conversion ratio between the old vertical datum of NGVD29 and the new vertical datum NAVD88 but only three original benchmarks and control points were found and the vertical differences between these points were sporadic. These points that were found were a P.K. nail numbered 851, a bronze disk numbered “LAK 381”, and a second bronze disk numbered “L-717”. Due to the original as-built points not having a consistent vertical difference between the old datum and the new datum, a site specific conversion was not able to be performed from the September 2009 surveys. Therefore, the vertical data from the September 2009 surveys for these points was entered into a conversion program named Corpscon. Corpscon has the capability to convert the Northings (Y), Eastings (X), and elevations (Z) of each point entered into this program from NAD83 to NAD27 and NAVD88 to NGVD29 and vise-versa. This program was used to convert the three points mentioned above from NAVD88 to NGVD29 which, resulted in a vertical difference of 0.34 of a foot. Based on the efforts mentioned above, it is safe to assume that adding 0.34 of a foot to the NAVD88 elevations for each of the three points will result in elevations on these three points to be in the vertical datum of NGVD29.

3.1.11  Foundation Geology

There were at least three major glaciations during the Pleistocene in Indiana: pre-Illinoian, Illinoian, and Wisconsin. Pre-Illinoian deposits are rare at the surface in Indiana; Illinoian sediments cover bedrock in the southwestern and southeastern counties; and Wisconsin sediments dominate the surface in the northern two-thirds of the state. The unconsolidated sediments range in thickness from zero to over 500 ft, averaging about 250 ft in the center of the state.

The glaciers deposited till (a homogenous, unsorted mixture of particles ranging in size from clay to boulders deposited directly by the ice) and outwash (sediment that is transported and deposited by the direct action of glacial meltwater, and consists of sorted and stratified sand and gravel). Outwash is prevalent in northern Indiana and along major river valleys, notably the Eel, Kankakee, Whitewater, Wabash, White, and Ohio Rivers. Outwash was a source of clay, silt, and sand that was transported and deposited by wind in the form of dunes and loess. Large deposits of dune sand are found in northern Indiana, along the Lake Michigan shoreline and along the eastern margins of the Wabash and White Rivers. Many glacial lakes still hold water today, but many more dried up. The sediment that remains forms flat lake plains, marshes, and peat bogs, providing modest commercial products of clay and peat. Ice retreated from Indiana approximately 13,600 years ago.
A subsurface investigation was performed along the Marshalltown Levee in 1996 by Patrick Engineering. The subsurface generally consists of medium stiff to stiff silty clay, soft black organic clay, loose silty sand, and loose silt near the surface. This is underlain with loose gray fine sand and silt. Below this material is soft to very soft gray silty clay. At about 48 ft below ground surface, stiff to hard gray silty clay was encountered. This material is underlain by medium dense gray fine sand and silt. Groundwater was encountered within three feet of the ground surface.

Figure 3.2. Boring Location and Subsurface Profile

Figure 3.3. Boring Location and Subsurface Profile
3.2 FEATURES

The Marshalltown Levee System consists of 4,567 linear feet of clay levee. There are 2 gate structures, and 1 pump station. See the figure below.

![Figure 3.4. Project features](image)

3.2.1 Levee

The Marshalltown Levee is protected by an earthen levee. The earthen levee typically has 2.5H:1V side-slopes on both its landward and riverward sides. The levee crest width is typically 10 feet. The final constructed grade (crest) provides protection to elevations 598.6 to 599.6 feet (NGVD29). The earthen levee was constructed by primarily using compacted clay (or impervious fill), with a one-foot-thick stripping layer at the base. The levee slopes are covered with a 6-inch-thick layer of top soil. Due to the loose and soft nature of the material in the foundation, settlement was anticipated beneath the levee and the levee was overbuilt. An inspection trench was excavated beneath the levee prior to construction to uncover undesirable features in the foundation. Unsatisfactory material, such as organic material, was removed from beneath the levee footprint and replaced with satisfactory material. No seepage cutoffs or seepage berms were constructed since seepage beneath the levee was considered negligible. The following figures depict the most typical cross-sections for the earthen levee.
3.2.2 Gate Closures

Gate wells are concrete structures that have both a sluice gate and a flap gate to provide a means of gravity drainage into the river. A gate well with 48-inch sluice gate and a 48-inch flap gate was installed as part of the East Reach Remediation project. A 36-inch sluice gate at the inlet box, three 24-inch flap gates at the outlet box, and a 40-inch culvert were installed as part of the pump station under the Stage III Drainage Remediation project. Below is a typical section and gate details from the 1999 East Reach Remediation drawings.

Table 3.1. Pipe Penetrations

<table>
<thead>
<tr>
<th>ID</th>
<th>Pressure or Gravity Line</th>
<th>Dia.</th>
<th>Mat.</th>
<th>Type</th>
<th>Connection</th>
<th>Closure</th>
<th>Invert Elev. (NGVD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA-1a</td>
<td>Pressure</td>
<td>6</td>
<td>Steel</td>
<td>PRJ – Pump Station</td>
<td>Gate – 32 Marshalltown PS Outlet</td>
<td>Check Valve &amp; Gate Valve</td>
<td>594.4</td>
</tr>
<tr>
<td>MA-1b</td>
<td>Pressure</td>
<td>6</td>
<td>Steel</td>
<td>PRJ – Pump Station</td>
<td>Gate – 32 Marshalltown PS Outlet</td>
<td>Check Valve &amp; Gate Valve</td>
<td>594.4</td>
</tr>
<tr>
<td>MA-1c</td>
<td>Gravity</td>
<td>36</td>
<td>RCP</td>
<td>PRJ – Gravity Outlet</td>
<td>Gate – 312</td>
<td>Sluice Gate</td>
<td>584.4</td>
</tr>
<tr>
<td>MA-2</td>
<td>Gravity</td>
<td>48</td>
<td>RCP</td>
<td>PRJ – Gravity Outlet</td>
<td>Gate – 31</td>
<td>Flap Gate &amp; Sluice Gate</td>
<td>584.9</td>
</tr>
</tbody>
</table>
3.2.3 Pump Stations

There is one pump station in this system. According to the 2005 Stage III Drainage Remediation drawings, the structure is located approximately at Station 13+00 west of the gatewell structure. The pump station has two storm pumps and one sump pump, a 36-inch sluice gate at the inlet box, three 24-inch flap gates at the outlet box, and a 40-inch culvert. The Little Calumet River Basin Development Commission has taken responsibility for maintaining the pump station instead of the City of Gary.

<table>
<thead>
<tr>
<th>Pump No.</th>
<th>Capacity GPM</th>
<th>Head Operating Range (FT H20)</th>
<th>Voltage / Phase</th>
<th>HP</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP-1</td>
<td>730 @ 10'</td>
<td>RCP</td>
<td>460 / 3</td>
<td>5</td>
<td>1750</td>
</tr>
<tr>
<td>SP-2</td>
<td>730 @ 10'</td>
<td>RCP</td>
<td>460 / 3</td>
<td>5</td>
<td>1750</td>
</tr>
<tr>
<td>Sump Pump</td>
<td>75 @ 8'</td>
<td>RCP</td>
<td>460 / 3</td>
<td>0.5</td>
<td>1750</td>
</tr>
</tbody>
</table>

3.3 Significant Flood Events

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. 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. The tables below present some of the largest peak flow data from these gauges.
Table 3.3. Summary of Historical Peak Flows on Hart Ditch at Munster, IN

<table>
<thead>
<tr>
<th>Water Year</th>
<th>Date</th>
<th>Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>14-Sep-2008</td>
<td>3,580</td>
</tr>
<tr>
<td>2006</td>
<td>13-Sep-2006</td>
<td>3,260</td>
</tr>
<tr>
<td>2011</td>
<td>10-Jun-2011</td>
<td>3,220</td>
</tr>
<tr>
<td>2009</td>
<td>28-Dec-2008</td>
<td>3,160</td>
</tr>
<tr>
<td>2007</td>
<td>24-Aug-2007</td>
<td>3,060</td>
</tr>
<tr>
<td>1990</td>
<td>28-Nov-1990</td>
<td>3,010</td>
</tr>
<tr>
<td>1996</td>
<td>18-Jul-1996</td>
<td>2,710</td>
</tr>
<tr>
<td>1997</td>
<td>21-Feb-1997</td>
<td>2,700</td>
</tr>
<tr>
<td>2005</td>
<td>13-Jan-2005</td>
<td>2,670</td>
</tr>
<tr>
<td>1955</td>
<td>11-Oct-1954</td>
<td>2,600</td>
</tr>
<tr>
<td>2002</td>
<td>12-May-2002</td>
<td>2,500</td>
</tr>
<tr>
<td>1999</td>
<td>24-Jan-1999</td>
<td>2,470</td>
</tr>
</tbody>
</table>

Table 3.4. Summary of Historical Peak Flows on Deep River at Lake George Outlet in Hobart, IN

<table>
<thead>
<tr>
<th>Water Year</th>
<th>Date</th>
<th>Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>15-Sep-2008</td>
<td>5,280</td>
</tr>
<tr>
<td>1981</td>
<td>14-Jun-1981</td>
<td>4,000</td>
</tr>
<tr>
<td>1983</td>
<td>02-Jul-1983</td>
<td>3,710</td>
</tr>
<tr>
<td>1989</td>
<td>02-Jun-1989</td>
<td>3,530</td>
</tr>
<tr>
<td>2007</td>
<td>24-Aug-2007</td>
<td>3,390</td>
</tr>
<tr>
<td>1985</td>
<td>24-Feb-1985</td>
<td>2,870</td>
</tr>
<tr>
<td>1986</td>
<td>20-Nov-1985</td>
<td>2,780</td>
</tr>
<tr>
<td>1979</td>
<td>05-Mar-1979</td>
<td>2,540</td>
</tr>
<tr>
<td>1990</td>
<td>19-Aug-1990</td>
<td>2,450</td>
</tr>
<tr>
<td>1966</td>
<td>25-Dec-1965</td>
<td>2,400</td>
</tr>
</tbody>
</table>

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 9-11 October, 1954 varied from a minimum of 3.5 inches to a maximum of 8.0 inches. The Hart Ditch watershed alone had an average basin rainfall of 7.0 inches.

The July 1957 storm set 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 flooding.

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 flow and stages, respectively, at the South Holland gage were 4014 cfs and 595.1 feet (NGVD). Between the May 1989 and November 1990 events, an existing embankment near Indianapolis Boulevard was lowered during the construction of a parking lot adjacent to the old railroad embankment. The overtopping of the lowered embankment resulted in significant flooding in the Wicker Park Manor subdivision during the November 1990 event.

The 2007 flood was an event where the most significant precipitation fell in the Hart Ditch/Plum Creek Basin. The flood overtopped the local levee in Munster along Hart Ditch and sandbagging was required. The sandbagging prevented further overtopping at this location. The local levee that protected the old Woodmar Country Club property (Cabela’s at the time of the flood) was breached and flooded areas north of the Little Calumet River in Hammond. Interstate I-80/94 was also flooded due to a valve that was stuck open with debris at Kennedy Avenue.

The flood of record occurred 13-14 September 2008. The Burr Street Gage, located in the project area, reported 8.1 inches of precipitation in 40 hours. The Hart Ditch and Dyer Gage, located in the central portion of the Hart Ditch Plum Creek Basin, reported 7.9 inches of rainfall in 40 hours. Both gages are centrally located in the basin system applicable to the project. Based on Bulletin 70 rainfall, this translates to approximately a 120 year precipitation event. The 13-14 September flood event was preceded by a 10 day rainfall of almost 5 inches. The rainfall conditions preceding the event likely increase flood stages in the river due to the higher runoff potential and decreased storage in the river system. During an inspection several weeks before the event, obstructed railroad culverts were observed on the east end of the project. These obstructions are significant because the high railroad embankment and the railroad embankments tie-in to the levee system significantly reduced all eastward flow.

Figure 3.8. Four six foot diameter culverts under the railroad embankment upstream of Marshalltown
(Photograph taken in August 2008, approximately 1 month before the flood.)
The 2008 flood event occurred during a period when the USGS stream gage at Hart Ditch had been temporarily relocated because of the construction of Stage V, Phase 2 of the project. The temporary gage allowed stage to be obtained with an approximate relative datum but did not provide a flow reading. Since that time USGS has provided an estimate peak flow for the event. The river stage near Marshalltown was estimated to be 597.5 ft (NGVD 29), which is approximately 0.5 feet below the crest.

Estimating from available gage information and project modeling data, the Marshalltown Levee has been loaded between 25% and 50% of the levee height five times (September 2006, August 2007, September 2008, March 2009, and April 2013), between 50% and 75% of the levee height twice (September 2008 and August 2007), and between 75% and the levee crest one time (September 2008). The levee performed as designed during all these flood events.

During the extreme flood event in September 2008, very little interior flooding was observed at Marshalltown and the flooding was nearly contained within the vegetated swale areas. This limited flooding helps to validate the interior drainage system performed as designed.

3.4 Project Condition Based on Previous Inspection


The following deficiencies were reported as Minimally Acceptable or Unacceptable in the 20143 Inspection Report:

- Vegetation within 15 ft of the levee toe (M)
- Garden on the riverside toe (M)
- 6 inch rutting on the landside slope (M)
- Vegetation in the ditch (M)
- Unauthorized stone check dam placed in ditch by sponsor without permit (M)
- Vegetation at sluice gate structure (M)
- Corrosion inside sluice gate stem casing (M)
- Sluice gate not fully sealed when closed (M)
- Some debris in wet well (M)
- Some debris at outfall (M)
- Missing nut on a bolt holding the trash rack to the pump station wall (M)
4 DESIGN CRITERIA REVIEW

A complete review of the design criteria was completed to assess the ability of the overall system and each feature to function as authorized and to identify potential updates to the design. Hydraulic, geotechnical, structural, civil, mechanical, and electrical functions were reviewed and evaluated against current Corps of Engineers design criteria.

4.1 HYDRAULICS

Some of the key hydrologic and hydraulic information reviewed for this levee segment/system includes:

a) East Reach Remediation Design Analysis, Appendix A, Hydrology and Hydraulics, February 1997
b) Feature Design Memorandum 5 (FDM 5), dated February 1994
c) As-built and final project plans (East Reach Remediation, Stage III Drainage Remediation, Marshalltown Levee Maintenance Project)
d) Little Calumet River Model Update Documentation Letter Report, dated 5 April 2011 (along with the associated HEC-RAS models)
e) Little Calumet River Engineering Documentation Report, dated 11 January 2010
g) Gary FIS, 16 September 1980
h) The Corps Little Calumet River Levee Project was designed for the 200 year flood event, per Feature Design Memorandum 5 (FDM 5), Appendix A, Hydrologic and Hydraulic Analysis, page A-1, paragraph 2, the last sentence states "The project level of protection was established at the 0.5 percent chance exceedance level (200 year) in the previous design documents". Per East Reach Remediation Design Analysis, Appendix A, Hydrology and Hydraulics, February 1997, the Marshalltown Levee was designed for the 100 year flood event (one percent chance exceedance).

Current Corps guidance for assessing a system’s ability to safely handle design discharge is described in EM 1110-2-1619 (August 1996). The original hydrology and hydraulic analysis (Appendix A, February 1997) describes a risk and uncertainty consistent with current guidance. Since the last periodic inspection, an updated risk analysis was included in the “Little Calumet River Model Update Documentation Letter Report”, dated 5 April 2011. Per the letter report, the Marshalltown Levee provides for a non-exceedance probability of 96.6% for the 100 year flood event with two feet of freeboard, which is sufficient for Corps/FEMA standards.

4.1.1 Flood Frequency Analysis

Design flood events (100 year, 200 year, etc.) on gauged streams are often based on a historic period of record. This is collectively referred to as flood frequency analysis. The current Corps Engineering Circular “USACE Process for the National Flood Insurance
Program Levee Evaluation (NFIP) *EC 1110-2-6067* (31 August 2010) is the current document applicable to evaluating levee systems, references the same criteria by stating “compute the discharge-frequency curve based on the gauge annual peaks for the period of record used for the past study and then with the annual peaks extended through the latest available. If the change in the 1% flow [100 year] is small, the old discharge frequency curve can be used for certification. The definition of a small change depends on the particular river but might be less than 5-10%, a change that results in a change in the 1% flood of less than 0.5 feet, or if the old 1% discharge fits within the 95 and 5 percent confidence limits (90% confidence interval) of the new curve.” The purpose of reevaluating the flow frequency analysis is not for evaluating the levee systems for accreditation at this time, however; this criterion is applicable for determining if the current model is appropriate for evaluating alternatives described in the report purpose section and later described in this report.

The Little Calumet River basin has experienced significant flood event in each of the past three years (2006, 2007 and 2008). The flood event in 2008 occurred when the Hart Ditch gauge was temporarily relocated for construction of Stage V, Phase 2. This event also occurred approximately one month after a tornado hit the area. The presence of a large volume of trees, stumps and other wood debris also appears to have contributed to the severe flooding. In addition, these debris jams add complexity to understanding how the flood stages relate to discharge. The river hydrology in the vicinity of Marshalltown is affected by the attenuated flood hydrograph from Hart Ditch, but also from backwater from Deep River. Both rivers have a significant effect on the river stages and level of protection provided by Marshalltown Levee.

For the previous periodic inspection analysis, an annual peak discharge-frequency analysis for the Hart Ditch gauge was performed to include all annual peak flow data up to and including the estimated September 2008 flood event peak flow. Recently USGS provided an estimate for the peak discharge at Hart Ditch since an actual reading could not be obtained. Adjustments were made to the peak flows for the 2007 and 2008 flood events to account for flows diverted through the Cady Marsh Ditch Diversion Tunnel, which bypassed the Hart Ditch gauge location. Peak flow data from the synthetic event models for both with and without the Cady Marsh Ditch Diversion Tunnel were used to estimate the without tunnel peak flow for the annual peak discharge frequency analysis. The discharges used in the current unsteady HEC-RAS model (latest calibration) fall within the 5% and 95% confidence limits for the 1% event of the 2008 discharge-frequency analysis and meet the criteria outlined in *EC 1110-2-6067* (31 August 2010).

For comparison purposes, the same period of record was used to develop a post project flood frequency analysis, where all the annual peak discharges, with the exception of the 2007 and 2008 discharges, were reduced as if the Cady Marsh Ditch Tunnel was in place.
Urban adjustments were also used to increase the flow values based on how the watershed was expected to have been developed through the period of record. This analysis also shows the modeled post project events to be below the new analysis; however, because of the significant adjustments made to the flow record, the computed confidence limits have little applicability.

The updated flood frequency analysis indicates that the current hydrology, while at the lower end of the limit, (95% limit) is appropriate for evaluating the alternatives described in the report purpose section and described later in this report. The frequency analysis was performed with a generalized skew of -0.4 and a mean square error of 0, as was used for previous flood frequency analysis and the analysis was performed using HEC-FDA.

The above three paragraphs describe the previous discharge frequency analysis for the Hart Ditch gage at Munster, which included flood events up to the 2008 flood event. Since that time two large flow events have occurred, as estimated by USGS for water years 2009 and 2011. An updated flow frequency analysis was not performed for this periodic inspection. It is likely that these to major flow events will take the 1% chance exceedance flood event out of the designated confidence limits. It should be noted that this gage is located farther away from Marshalltown and has much less influence on flood conditions in Marshalltown than the flows from Deep River.

A similar flood frequency analysis was performed during the previous periodic inspection on the gauge record for Deep River downstream of Lake George. The 2002 computed flood frequency 100 year discharge (4830 cfs) falls with the 5% and 95% confidence intervals (6800 cfs and 4420 cfs). The 100 year discharge in the current RAS model (5470 cfs) also falls within the confidence limits. Based on this updated flood frequency analysis, the hydrology from Deep River used in the unsteady RAS model is still considered relevant for evaluating the level of protection provided by Marshalltown Levee. The flood events on Deep River since the last periodic inspection have been very minor and would not have a significant impact on the results from the last periodic inspection.

4.1.2 Marshalltown Levee Level of Protection

During the 2008 flood event, the Deep River gauge downstream of Lake George recorded a peak discharge of 5280 cfs. Based on the current RAS model, this is approximately a 100 year flood event; however rainfall estimates in the watershed downstream of the gauge imply that the actual event may have been between a 100 year and 500 year event. The high water marks gathered during the flood event indicate that the stage at Marshalltown reached 575.5 ft (NGVD 29), or approximately two feet above the 100 year and approximately one foot above the 500 year modeled event. The event occurred when there were believed to be a large number of channel obstructions. This event adds validity to the assumptions made for the risk analysis.
The previous Marshalltown periodic inspection pointed out only one hydraulic deficiency and that was that an updated risk analysis was needed to demonstrate minimum reliability. An updated risk analysis was included in the “Little Calumet River Model Update Documentation Letter Report”, dated 5 April 2011. Per the letter report, the Marshalltown Levee provides for a non-exceedance probability of 96.6% for the 100 year flood event with two feet of freeboard, which is sufficient for Corps/FEMA standards.

4.1.3 Levee Superiority

A levee superiority analysis was not developed due to the small levee unit size. Also river surface elevations are basically level for the levee and do not vary significantly along the levee reach. Further, the development within the levee precludes locating an overflow into an undeveloped area.

4.1.4 Interior Drainage

Interior drainage analysis was performed with synthetic events and a continuous period simulation. The methodology used considered the coincident river stage and interior precipitation for two gravity outlet alternatives. Neither alternative resulted in significant interior flooding. Since the original design, a small, low capacity pump station has been added for interior drainage. This pump station likely makes the documented analysis slightly conservative but still representative. During an extreme flood event in September 2008, very little interior flooding was observed and the flooding was nearly contained within the vegetated drainage swales. This limited flooding helps to validate the interior analysis.

Table 4.1. Summary of Hydraulic Design Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Guidance</th>
<th>Applicable</th>
<th>Criteria Met</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrologic Analysis of Interior Areas</td>
<td>EM 1110-2-1413</td>
<td>Yes</td>
<td>Yes</td>
<td>• The February 1997 East Reach Remediation Design Analysis provided an interior drainage analysis consistent with the EM guidance</td>
</tr>
<tr>
<td></td>
<td>(15 January 1987)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>River Hydraulics</td>
<td>EM 1110-2-1416</td>
<td>Yes</td>
<td>Yes</td>
<td>• Due to the complex hydraulics (flow splits, flat gradient) unsteady flow modeling was selected as the appropriate hydraulic analysis method</td>
</tr>
<tr>
<td></td>
<td>(15 October 1993)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel Stability Assessment for Flood Control Projects</td>
<td>EM 1110-2-1418</td>
<td>Yes</td>
<td>Yes</td>
<td>• A sediment analysis was provided in FDM 5 Volume 2 Appendix A pages A-23 and A-24, however, the Marshalltown levee is a setback levee in an area where overbank storage has more of an impact on flood stages than channel conveyance.</td>
</tr>
<tr>
<td></td>
<td>(31 October 1994)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria</td>
<td>Guidance</td>
<td>Applicable</td>
<td>Criteria Met</td>
<td>Comment</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Hydraulic Design of Flood Control Channels</td>
<td>EM 1110-2-1601 (30 June 1994)</td>
<td>Yes</td>
<td>Yes</td>
<td>• Adequate erosion protection (rip rap) was included in the design</td>
</tr>
</tbody>
</table>
| Risk Based Analysis for Flood Damage Reduction Studies | EM 1110-2-1619 (1 August 1996) | Yes        | Yes          | • The Little Calumet River Model Update Documentation Letter Report, dated 5 April 2011 includes a risk analysis consistent with the EM requirements.  
• The Corps has not performed a full levee system evaluation in support of the NFIP for the Marshalltown Levee. |
| USACE Process for the National Flood Insurance Program Levee Evaluation (NFIP) | EC 1110-2-6067 (31 August 2010) | Yes        | Yes          | • The Little Calumet River Model Update Documentation Letter Report, dated 5 April 2011 risk analysis is consistent with the EC requirements.  
• The risk analysis developed for the 2011 Letter Report is consistent with the requirements of the ER                                             |
| Risk Analysis for Flood Damage Reduction Studies  | ER 1105-2-101 (3 January 2006) | Yes        | Yes          | • The risk analysis developed for the 2011 Letter Report is consistent with the requirements of the ER                                             |
| Hydraulic Design for Local Flood Protection Projects | ER 1110-2-1405 (30 September 1982) | Yes        | Yes          | • The unsteady flow model developed to evaluate the levee is of sufficient detail and complexity to evaluate the potential flood risk posed by Little Calumet River. |
| Overtopping of Flood Control Levees and Floodwalls | ETL 1110-2-299 (22 August 1986) | Yes        | Yes          | • Levee has a very small unit size and is developed. Flood levels are level in the area of the levee. No superiority analysis is recommended.          |

4.2 GEOTECHNICAL

4.2.1 Construction

Design guidance for construction of levees (EM 1110-2-1913) includes recommendations for subsurface investigations; analysis of seepage, stability, and settlement; and levee construction. EM 1110-2-1913 for levee design and construction was updated in 2000 but the previous version from 1978 was used for design. The field investigation performed on this project spaced borings between the recommended 200 ft to 1,000 ft. The borings exceeded the recommended minimum depth of 10 ft with most of the borings ranging between 25 ft to 50 ft. Laboratory testing was performed and soil parameters were developed using some of the figures from the manual. Design guidance for construction of levees recommends a minimum levee side slope of 2H:1V for ease of construction and a crest width of 10 ft for maintenance and flood fighting purposes. Drawings show slopes of 2.5H:1V and a crest width of 10 ft which meet the recommended minimums. The EM also recommends preparing the foundation by stripping and removing any unsuitable materials and providing sufficient cover from erosion. The drawings depict this method.
4.2.2 Settlement

Settlement analyses were performed according to the design guidance in EM 1110-1-1904. Differential and total vertical deformation under the levee embankment at the east, south, and west leg of the levee was analyzed. The levee was overbuilt for 1.5 ft of settlement and based on surveys performed in 2009, the levee appears to have experienced about 0.5 ft of settlement. Consolidation test data was used in the analysis. A preload embankment was designed where the gatewell structure was to be constructed to account for settlement exceeding 0.5 inches beneath the structure.

4.2.3 Seepage

The seepage principles described in EM 1110-2-1901 were used to perform seepage analyses. Flow nets were drawn according to design guidance to determine seepage quantities, exit gradients, seepage forces, and uplift pressures beneath the levee. These analyses were performed for the east, south, and west leg of the levee. Design guidance for seepage under levees (ETL 1110-2-569) was released after the design was performed for this project. This guidance is based on lessons learned from the Mississippi and Sacramento levees and recommends that the design exit gradient be below 0.5. The original analysis was performed by comparing the calculated factor of safety to a maximum factor of safety of 1.5 for piping and 1.25 for uplift. As part of this criteria review, the seepage analyses performed were reviewed per the new guidance and the exit gradients were determined to fall below the recommended 0.5, and are therefore considered acceptable. There were no issues with through seepage. Interior drainage ditches were installed to address any issues with under seepage and lower exit gradients. No sand boils have been observed on any of the inspections. The levee system performed well during the September 2008 flood event. However, the seepage analysis provided simplified cross sections that did not consider the impact of seepage concentrations at the drainage ditch. It is recommended that a more accurate cross section be analyzed using appropriate software for computation of exit gradients at the ditch per ETL 1110-2-569. ETL 1110-2-569 recommends that a minimum target level of subsurface explorations should be a series of explorations approximately every 1,000 feet, consisting of an exploration at the riverside toe, at the landside toe, and a deep exploration at the levee crest. The Marshalltown subsurface investigation consists of nine (9) borings collected on the interior side of the levee along the 4,570 ft length levee, with spacing between 200 ft to 800 ft. The spacing requirement is met but the location of the borings along a cross section was not. It is recommended that five (5) cross sections be developed perpendicular to the levee stationing as indicated by the guidance through additional borings. ETL 1110-2-569 recommends installing piezometers to monitor and learn from flood events along selected portions of the levee system. This has not been done at the Marshalltown levee. The ETL
provides allowances for exercising engineering judgment. The levee experienced a flood within 6-inches of the crest in Sept 08 and no adverse seepage issues were noted. Based on observations from the Sept 08 flood, additional instrumentation is not believed to be warranted at this time.

### 4.2.4 Stability

Design guidance for slope stability requires analysis for the end of construction, steady state seepage, sudden drawdown, and seismic conditions where applicable (EM 1110-2-1902). The original design analyzed the end of construction at flood stage, steady state seepage with the water level at the base of the levee, and sudden drawdown conditions. A factor of safety of 1.3 was used and met for all of these conditions. Although the criterion for the sudden drawdown condition is a factor of safety of 1.0, a factor of safety of 1.3 was used in the original analysis. Stability analysis for steady state seepage at the maximum storage pool was not performed. To meet current criteria the slopes should be analyzed for steady state seepage with the water level at maximum storage pool using a factor of safety of 1.4.

### 4.2.5 Seismic

Regarding seismic conditions, there is design guidance that recommends projects with potential to fail during major seismic events be analyzed for seismic stability. According to the United States Geological Survey 2008 Seismic Hazard Map, the peak ground acceleration (PGA) for the Marshalltown area is 0.03g for the 10% in 50-yr earthquake. This is very low and does not require a seismic evaluation per the Corps current guidance (ER 1110-2-1806).
4.2.6  Floodwall

This system does not contain any floodwall so criteria related to floodwalls or I-walls are not applicable. There is no documentation of any instrumentation for this system so EM 1110-2-1908 is not applicable. This appears to indicate that stability and seepage is not a concern if monitoring was not required but no design documentation was available to confirm this.

4.2.7  Drainage Structures

This system includes two gatewell structures and a pump stations. Bearing capacity analyses meeting criteria from EM 1110-2-2100 for concrete structures was performed.

Table 4.2. Summary of Geotechnical Design Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Guidance</th>
<th>Applicable</th>
<th>Criteria Met</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement Analysis</td>
<td>EM 1110-1-1904 (30 September 1990)</td>
<td>Yes</td>
<td>Yes</td>
<td>• Design guidance followed for analysis</td>
</tr>
<tr>
<td>Seepage Analysis and Control for Dams</td>
<td>EM 1110-2-1901 (30 April 1993)</td>
<td>Yes</td>
<td>Yes</td>
<td>• Underseepage analyses performed.</td>
</tr>
</tbody>
</table>
| Slope Stability                               | EM 1110-2-1902 (31 October 2003) | Yes        | No           | • Met factor of safety for end of construction and rapid drawdown analysis.  
• Missing steady state analysis.               |
| Instrumentation of Embankment Dams and Levees | EM 1110-2-1908 (30 June 1995) | No         | N/A          | • Not applicable                                              |
| Construction of Levees                        | EM 1110-2-1913 (30 April 2000) | Yes        | Yes          | • Met recommended boring spacing and depth; met recommended crest width and minimum slope |
| Design, Construction and Maintenance of Relief Wells | EM 1110-2-1914 (29 May 1992) | No         | N/A          | • Not applicable                                              |
| Stability Analysis of Concrete Structures     | EM 1110-2-2100 (1 December 2005) | Yes        | Yes          | • Design guidance followed for analysis                      |
| Retaining and Floodwalls                     | EM 1110-2-2502 (29 September 1989) | No         | N/A          | • Not applicable                                              |
| Earthquake Design and Evaluation for Civil Works Projects | ER 1110-2-1806 (31 July 1995) | No         | N/A          | • Not applicable                                              |
| Engineering and Design, Design Guidance for Levee Underseepage | ETL 1110-2-569 (1 May 2005) | Yes        | No           | • Design guidance followed for analysis; met factor of safety criteria  
• Missing seepage analysis to reflect drainage ditch  
• Inadequate subsurface investigation           |
| Evaluation of L-Walls                         | ETL 1110-2-575 (1 Sep 2011) | No         | N/A          | • Not applicable                                              |
4.3 CIVIL

Design guidance for construction of levees (EM 1110-2-1913) recommends a minimum levee side slope of 2H:1V for ease of construction and a crest width of 10 ft for maintenance and flood fighting purposes. Drawings show slopes of 2.5H:1V and a crest width of 10 ft which meet the recommended minimums.

Current survey datum requirements can be found in EM 1110-2-6065 and ER 1110-2-8160. This project was designed with the vertical and horizontal datum in NAD 1927 and NGVD 1929. For future maintenance and inspection purposes, a survey was performed in 2009 to establish the relationship between the existing levee system elevation and the North American Vertical Datum of 1988. It also established one primary benchmark and two secondary benchmarks along the land-side of the levee system, using the above-mentioned horizontal and vertical control datums. The datum conversion was added to the Emergency Flood Protection Handbook in the O&M Manual.

According to ETL 1110-2-571, levees should be maintained in the areas of sufficient sod cover, removal of vegetative and other encroachments, and repair of animal burrows. This guidance recommends a 15-ft vegetation-free zone on either side of the levee to allow access for inspections, flood fighting, and monitoring. The work limits on the drawings do not leave enough room for a 15-ft vegetation-free zone but there were only a few stretches along the west and south legs of the levee that had some tall plants and trees encroaching. According to the maintenance and repair drawings from 2012, these issues have been addressed. There is suitable grass cover on the levee and within the vegetation-free zone to provide erosion protection.

Table 4.3. Summary of Civil Design Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Guidance</th>
<th>Applicable</th>
<th>Criteria Met</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards and Procedures for Referencing Project Elevation Grades to Nationwide Vertical Datums</td>
<td>EM 1110-2-6056 (31 December 2010)</td>
<td>Yes</td>
<td>Yes</td>
<td>• Original project was built in NGVD29 and NAD27, which doesn’t meet current standards. A survey was performed by USACE in 2009 to update the datums to the current standard, NAVD88 and NAD83 and a conversion was found to update the benchmarks. The datum conversion was added to the Emergency Flood Protection Handbook in the O&amp;M manual.</td>
</tr>
<tr>
<td>Design and Construction of Levees</td>
<td>EM 1110-2-1913 (30 April 2000)</td>
<td>Yes</td>
<td>Yes</td>
<td>• Design crest is 10 feet, design slope is 2.5:1. This meets the minimum standard section.</td>
</tr>
<tr>
<td>Conduits, Culverts, and Pipes</td>
<td>EM 1110-2-2902 (31 March 1998 Change 1)</td>
<td>Yes</td>
<td>No</td>
<td>• Culverts were televised in the 2012 update to the project. It should be verified that these photos are kept on file.</td>
</tr>
</tbody>
</table>
4.4 STRUCTURAL

Current Corp guidance for stability evaluation of concrete structures is based on lessons learned from the Hurricane Katrina in New Orleans. Manual EM 1110-2-2100 – “Stability Analysis of Concrete Structures” provides new factors of safety as replacement for the somewhat variable factors of safety previously specified in other Corps guidance documents. Loading conditions are categorized as either usual, unusual, or extreme. Higher factors of safety are specified for conditions where site information is not sufficient to provide a high degree of confidence. Lower factors of safety are used where there is a high degree of confidence. The design analysis of the gatewell and the Inflow/Outflow structure at the Marshalltown Levee have been reviewed and it was found that they have been designed conservatively and are in compliance of the design guidance of EM 1110-2-2100 and the EM 1110-2-2104. Due to the potential of large soil settlements in the area where the gatewell and the inflow/outflow structures at Marshalltown Levee have been constructed they have been founded on 46 feet long steel H-piles that terminate in the stiff clay layer. The H-piles have been designed with a factor of safety 3 that meets the current design criteria of EM 1110-2-2906. Both structures at the Marshalltown Levee, built in 1999 have been inspected and evaluated in accordance with the requirements of EM 1110-2-2002 and have been found to be in very good condition.

Table 4.4. Summary of Structural Design Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Guidance</th>
<th>Applicable</th>
<th>Criteria Met</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation and Repair of Concrete Structures</td>
<td>EM 1110-2-2002 (30 June 1995)</td>
<td>Yes</td>
<td>Yes</td>
<td>Structures have been evaluated and found to be in very good condition</td>
</tr>
<tr>
<td>Structural Design of Concrete Lined flood Control Channels</td>
<td>EM 1110-2-2007 (30 April 1995)</td>
<td>No</td>
<td>N/A</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>
4.5 MECHANICAL/ELECTRICAL

Current USACE guidance for design of pump stations is outlined in EM 1110-2-3102 and EM 1110-2-3105. Mechanical design analysis for this project could not be located for this evaluation; however, other criteria pertinent to satisfactory design of pump stations have been identified and marked as adequate. Items addressed that are necessary for pump station operation are cavitations, sump layout, pump approach, air vent on the piping, pipe support, backflow prevention, and trash racks.

Table 4.5. Summary of Mechanical Design Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Guidance</th>
<th>Applicable</th>
<th>Criteria Met</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Principles of Pumping Station Design and Layout</td>
<td>EM 1110-2-3102 (February 1995)</td>
<td>Yes</td>
<td>Yes</td>
<td>Adequate based on available information</td>
</tr>
<tr>
<td>Mechanical and Electrical Design of Pumping Stations</td>
<td>EM 1110-2-3105 (August 1994)</td>
<td>Yes</td>
<td>Yes</td>
<td>Adequate based on available information</td>
</tr>
</tbody>
</table>
4.6 DATA GAPS

The following information was not available for review during the documentation review and is necessary in order to determine whether the current project meets current Corps design criteria.

4.6.1 Geotechnical

- Missing seepage analysis to reflect drainage ditch
- Missing analysis for steady state stability

4.6.2 Mechanical

- Missing design analysis
LITTLE CALUMET RIVER
MARSHALLTOWN LEVEE
GARY, INDANA
PERIODIC INSPECTION REPORT

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5 INSPECTION FINDINGS

5.1 RESULTS OF EXAMINATION FOR EACH FEATURE

Appendix A contains the completed periodic inspection checklist and photos. The rated items for each feature are summarized below. The item numbers shown in the paragraphs correspond to the item numbers in Appendix A. Items rated as Acceptable or Not Applicable were not included in the ratings summary.

Table 5.1. Inspection Ratings Summary

<table>
<thead>
<tr>
<th>Feature</th>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Items</td>
<td>2. Emergency Supplies and Equipment</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>3. Flood Preparedness and Training</td>
<td>M</td>
</tr>
<tr>
<td>Levee Embankments</td>
<td>1. Unwanted Vegetation Growth</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>3. Encroachments</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>8. Depressions/Rutting</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>10. Animal Control</td>
<td>M</td>
</tr>
<tr>
<td>Interior Drainage System</td>
<td>1. Vegetation and Obstructions</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>2. Encroachments</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>10. Sluice/Slide Gates</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>11. Flap Gates/Flap Valves/Pinch Valves</td>
<td>M</td>
</tr>
<tr>
<td>Pump Stations</td>
<td>2. Pump Station Operations and Maintenance Equipment Manuals</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>3. Safety Compliance</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>11. Non-Mechanical Trash Racks</td>
<td>M</td>
</tr>
</tbody>
</table>

5.2 GENERAL ITEMS FOR FLOOD DAMAGE REDUCTION

5.2.1 Operations and Maintenance Manual

The Operation and Maintenance Manual item is rated as Acceptable. The sponsor has a complete set of O&M Manuals.

5.2.2 Emergency Supplies and Equipment

The Emergency Supplies and Equipment item are rated as Minimally Acceptable. Gary has a limited supply of sandbags and flood fighting supplies. They rely on others to provide supplies and assistance. They currently are storing sand bags at a facility on Monroe.

5.2.3 Flood Preparedness and Training

The Flood Preparedness and Training item is rated as Minimally Acceptable. Flood handbooks have been provided to the City. There has been a lot of turnover and resources are low.

5.3 LEVEE EMBANKMENTS

5.3.1 Item 1 – Unwanted Vegetation Growth

This item was rated as Minimally Acceptable. Tall grass on the levee was present. This
vegetation makes it difficult to observe any deficiencies that could threaten the integrity of the levee.

- LCMR_2014_a_0024: 1 ft. tall grass on riverside slope (M)
- LCMR_2014_a_0025: 1 ft. tall grass on crest and landside (M)

### 5.3.2 Item 3 – Encroachments

This item was rated as **Minimally Acceptable**. Unauthorized farming activity next to the levee was noted. This has not been reviewed by the Corps to determine whether there could be seepage issues.

- LCMR_2014_a_0019: Unauthorized farming activity at riverside toe of levee. (M)

### 5.3.3 Item 8 – Depressions/Rutting

This item was rated as **Minimally Acceptable**. There are ruts less than 6 inches deep on the riverside slope and landside slope as well as some low spots on the crest that could pond water. The ruts were caused by mowing activities during wet conditions and animal activity. The ponding could saturate the levee and create stability issues.

- LCMR_2014_a_0001: Rutting on top of landside slope, 6 in. deep on landside slope (M)
- LCMR_2014_a_0004: Low spot on top of levee (M)
- LCMR_2014_a_0005: Low spot on levee crest (M)
- LCMR_2014_a_0007: 3 in. deep hoof prints on riverside slope (M)
- LCMR_2014_a_0010: 2-4 in. deep animal tracks (M)
- LCMR_2014_a_0011: Hoof prints, 3 in. deep on landside (M)
- LCMR_2014_a_0015: Rutting on riverside slope (M)
- LCMR_2014_a_0016: Rutting on landside slope, 7 in. deep (M)
- LCMR_2014_a_0017: Multiple 4 in. hoof prints on riverside slope (M)
- LCMR_2014_a_0018: 4 in. deep rut (M)

### 5.3.4 Item 10 – Animal Control

This item was rated as **Minimally Acceptable**. Multiple animal burrows were noted. These may lead to seepage or slope stability problems if worsen or increase in number.

- LCMR_2014_a_0002: 2 collapsed burrows, 4 in. deep (M)
- LCMR_2014_a_0003: 3 in. deep burrow on landside (M)
- LCMR_2014_a_0006: 5 in. deep burrow on landside (M)
- LCMR_2014_a_0020: 3.5 in. deep animal burrow (M)
- LCMR_2014_a_0021: Multiple 3 in. deep burrows on riverside (M)

### 5.4 Interior Drainage System

#### 5.4.1 Item 1 – Vegetation and Obstructions

This item was rated as **Minimally Acceptable**. Sediment was noted in front of and inside a ditch culvert. The blockage is minor but could impair channel flow capacity or block culvert openings.

- LCMR_2014_a_0022: Sediment in front and inside of ditch culvert on east end (M)
5.4.2 **Item 2 – Encroachments**

This item was rated as **Minimally Acceptable**. There was debris noted in the riprap that could lead to displacement and erosion along the channel as well as potentially block flow. The riprap dam installed in the interior ditch to prevent silting has not been reviewed by the Corps for stability and hydraulics modeling to determine whether there would be any impacts to the system.

- LCMR_2014_a_0014: Riprap dam in ditch not reviewed by Corps (M)
- LCMR_2014_a_0023: Debris on west bank of outlet channel (M)

5.4.3 **Item 10 – Sluice/Slide Gate**

This item was rated as **Minimally Acceptable**. A camera inspection of the culvert was performed in conjunction with the maintenance repairs performed in 2013. The culvert was found to be in good condition. There was silt on the bottom of the sluice gate that prevented the gate from being closed completely and could lead to interior flooding.

- LCMR_2014_a_0029: Silt on bottom (M)

5.4.4 **Item 11 – Flap Gates/Flap Valves/Pinch Valves**

This item was rated as **Minimally Acceptable**. A flap gate was stuck open due to rocks which could lead to interior flooding.

- LCMR_2014_a_0028: MA-2: Flap gate open due to rocks (M)

5.5 **PUMP STATIONS**

5.5.1 **Item 2 – Pump Station Operations and Maintenance Equipment Manuals**

This item was rated as **Minimally Acceptable**. Operation and Maintenance Equipment Manuals were not available at the Marshalltown Pump Station at the time of inspection. These were available last year. Missing manuals would not allow the manuals to be referenced in cases of emergency when required and the issue cannot be addressed.

- LCMR_2014_a_0031: PS-Marshalltown: Manuals available previous year but were not at station this year (M)

5.5.2 **Item 3 – Safety Compliance**

This item was rated as **Minimally Acceptable**. There was a lack of Arc Flash warning labels in front of the control cabinet.

- LCMR_2014_a_0033: PS-Marshalltown: Control cabinet must be posted with proper Arc-Flash warning sign per latest NFPA 70 and NFPA70E (M)
5.5.3 Item 11 – Non-Mechanical Trash Racks

This item was rated as Minimally Acceptable. A bolt was missing from the trash rack at the intake which could make the rack unstable.

- LCMR_2014_a_0032: PS-Marshalltown: Missing nut on a bolt holding the trash rack to the pump station wall. (M)

5.6 INTERIM ELIGIBILITY REQUIREMENTS

Interim Guidance for determining the rehabilitation program status was released in Mar 2014. A subset of items in the existing Inspection Checklist and submittal of the Pre-Inspection form determines eligibility. It was determined that the Local Sponsor met the Initial Eligibility criteria and the levee is considered ‘Active’ in the PL84-99 program.

5.7 EMERGENCY ACTION PLANS

Emergency action plans are described in the Flood Handbooks and O&M manuals for each system. Alert levels, emergency contacts, and evacuation procedures are in place.

5.8 COMPLIANCE WITH PROJECT AGREEMENT

The Little Cal Commission is performing the operation and maintenance of the levee system with support from Garcia Consulting. Previously noted maintenance deficiencies have been addressed and the sponsor is actively performing required maintenance for this levee.

5.9 ENGINEERING ASSESSMENTS

Levee safety issues are defined as deficiencies that may result in the unreliability of the levee system during flood conditions and may present life safety concerns if not immediately addressed. No deficiencies were identified as being serious enough to prevent the Levee System from performing as intended in the next flood event.
6 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this levee-system periodic inspection was to identify deficiencies that pose hazards to human life or property, particularly those which relate to the community protected by the levee system. This assessment of the general condition of the levee system is based on available data and visual inspections. The levee-system periodic inspection is intended to identify issues to facilitate future studies and associated repairs, as appropriate. An assessment of the specific features associated with the levee is provided in the checklist enclosed in Appendix A.

6.1 INSPECTION DEFICIENCY RECOMMENDATIONS

A plan to implement the following recommendations should be developed as soon as practicable after the date of this report. The Chicago District will expect a plan of action in advance of the next annual inspection to address the recommended actions.

6.1.1 Levee Embankments

6.1.1.1 Item 1 – Unwanted Vegetation Growth

Tall vegetation on the levee should be mowed and maintained.

6.1.1.2 Item 3 – Encroachments

Residents should be contacted about the importance of the levee and its guidelines. Submit a permit request with the Corps.

6.1.1.3 Item 8 – Depressions/Rutting

Rutting on the embankment should be filled in to prevent ponding.

6.1.1.4 Item 10 – Animal Control

Animal burrows should be filled with clay.

6.1.2 Interior Drainage System

6.1.2.1 Item 1 – Vegetation and Obstructions

Sediment should be cleaned out in the pipe and ditch.

6.1.2.2 Item 2 – Encroachments

Debris should be removed from the riprap. A permit request should be submitted for the riprap dam in the channel.

6.1.2.3 Item 10 – Sluice/Slide Gate

Clean out silt at the bottom.

6.1.2.4 Item 11 – Flap Gates/Flap Valves/Pinch Valves

Clear obstructions blocking flap gates.
6.1.3 Pump Stations

6.1.3.1 Item 2 – Pump Station Operations and Maintenance Equipment Manuals
Copies of the operation and maintenance equipment manuals should be available at the pump station for quick reference.

6.1.3.2 Item 3 – Safety Compliance
Arc Flash labels should be added to the front of the control cabinet.

6.1.3.3 Item 11 – Non-Mechanical Trash Racks
Replace the missing bolt on the trash rack.

6.2 DESIGN RECOMMENDATIONS
The available design documents for this project were compared against current Corps of Engineers design criteria to assess the ability of the overall system to function as authorized, identify risks associated with the design, and identify the potential need to update the design. The following is a summary of recommendations related to the design criteria review:

6.2.1 Geotechnical
- The seepage analysis provided simplified cross sections that did not consider the impact of seepage concentrations at the drainage ditch. It is recommended that a more accurate cross section be analyzed using appropriate software for computation of exit gradients at the ditch per ETL 1110-2-569.
- Stability analysis for steady state seepage at the maximum storage pool was not performed. To meet current criteria the slopes should be analyzed for steady state seepage with the water level at maximum storage pool using a factor of safety of 1.4.
- ETL 1110-2-569 recommends that a minimum target level of subsurface explorations should be a series of explorations approximately every 1,000 feet, consisting of an exploration at the riverside toe, at the landside toe, and a deep exploration at the levee crest. The Marshalltown subsurface investigation consists of nine (9) borings collected on the interior side of the levee along the 4,570 ft length levee. It is recommended that five (5) cross sections be developed perpendicular to the levee stationing as indicated by the guidance through additional borings.

6.2.2 Mechanical
- The design analysis should be provided to verify that the assumptions for the design were implemented.
6.3 **SYSTEM RATING**

The overall condition assessment of the Marshalltown Levee System is rated ‘Minimally Acceptable’, i.e. one or more items are rated as Minimally Acceptable. This periodic inspection identified some maintenance and a few design deficiencies. These deficiencies are anticipated to be minimal and not jeopardize the performance of the overall system. These items need to be addressed promptly so they do not develop into a more significant problem. It was determined that the Local Sponsor met the Initial Eligibility criteria and the levee is considered ‘Active’ in the PL84-99 program.

6.4 **NEXT PERIODIC INSPECTION**

Routine Inspections of the levee shall be performed on an annual basis. Periodic Inspections are to be conducted on a 5-year cycle. The next periodic inspection is scheduled for 2019.

Submitted by:

Yuki Galisanao
Geotechnical Engineer

Reviewed by:

William Rochford
Levee Safety Program Manager
Chief, Geotechnical and Survey Section

Approved by:

Joseph Schmidt
Levee Safety Officer
Chief, Design Branch
Appendix A
2014 Inspection Checklist
**Flood Damage Reduction Segment / System Inspection Report**

**US Army Corps of Engineers®**

Name of Segment / System: Little Cal - Marshalltown

Public Sponsor(s): Little Calumet River Basin Development Commission

Public Sponsor Representative: Dan Repay (LCRBDC)

Sponsor Phone: 219-595-0599

Sponsor Email: drepay@littlecalumetriverbasin.org

Corps of Engineers Inspector: See attached sign-in sheet and inspection team list

Inspection Start Date: 5/8/2014

Inspection End Date: 5/8/2014

Inspection Report Prepared By: Yuki J. Galisanao, P.E.; John Wethington

Date Report Prepared: 5/22/2014

Internal Technical Review (for Periodic Inspections) By: William A. Rochford, P.E., LSPM

Date of ITR: 6/27/2014

Final Approved By: Joseph Schmidt, PE, LSO

Date Approved: 12 Aug 14

<table>
<thead>
<tr>
<th>Type of Inspection</th>
<th>Overall Segment / System Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acceptable</td>
</tr>
<tr>
<td>Initial Eligibility Inspection</td>
<td></td>
</tr>
<tr>
<td>Continuing Eligibility Inspection (Routine)</td>
<td></td>
</tr>
<tr>
<td>Continuing Eligibility Inspection (Periodic)</td>
<td></td>
</tr>
</tbody>
</table>

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.

Note: This inspection rating represents the Corps evaluation of operations and maintenance of the flood damage reduction system and may be used in conjunction with other information for a levee certification determination for National Flood Insurance Program (NFIP) purposes if applicable. An Acceptable Corps inspection rating, alone, does not equate to a certifiable levee for the NFIP. It is recommended for levee systems currently accredited by the Federal Emergency Management Agency (FEMA) for NFIP purposes receiving a Corps Minimally Acceptable or Unacceptable rating, be evaluated by the levee owner to determine the potential impacts to the certification for FEMA.
General Instructions for the Inspection of Flood Damage Reduction Segments / 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:

<table>
<thead>
<tr>
<th>Initial Eligibility Inspections</th>
<th>Continuing Eligibility Inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEs 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.</td>
<td>RIs are intended to verify proper maintenance, owner preparedness, and component operation.</td>
</tr>
<tr>
<td></td>
<td>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.)</td>
</tr>
</tbody>
</table>

C. Inspection Boundaries:
Inspections should be conducted so as to rate each Flood Damage Reduction "Segment" of the system. The overall system rating will be the lowest segment rating in the system.

<table>
<thead>
<tr>
<th>Project</th>
<th>System</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A flood damage reduction project is made up of one or more flood damage reduction systems which were under the same authorization.</td>
<td>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.</td>
<td>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).</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Agricultural</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected population in the range of zero to 5 households per square mile protected.</td>
<td>Protected population in the range of 6 to 20 households per square mile protected.</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Acceptable Item</th>
<th>Minimally Acceptable Item</th>
<th>Unacceptable Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>

G. Overall Segment / 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.

<table>
<thead>
<tr>
<th>Acceptable System</th>
<th>Minimally Acceptable System</th>
<th>Unacceptable System</th>
</tr>
</thead>
<tbody>
<tr>
<td>All items or components are rated as Acceptable.</td>
<td>One or more items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the segment / system from performing as intended during the next flood event.</td>
<td>One or more items are rated as Unacceptable and would prevent the segment / 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.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>If the Overall System Rating is Acceptable</th>
<th>If the Overall System Rating is Minimally Acceptable</th>
<th>If the Overall System Rating is Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system is active in the RIP and eligible for PL84-99 rehabilitation assistance.</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>If the Overall System Rating is Acceptable</th>
<th>If the Overall System Rating is Minimally Acceptable</th>
<th>If the Overall System Rating is Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reports need to be provided to the local sponsor and the county emergency management agency.</td>
<td>Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, and to the FEMA region.</td>
<td>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.</td>
</tr>
</tbody>
</table>
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)
   - MARSHALLTOWN

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:
   - Routinely (monthly) check pump stations so they are functioning properly. If problems exist with
     station, we have a contractor to fix items. In this last period we had some bugs on the power boxes.
     Also, we also had the grass cut once a month and do a general check for animal burrows.

5. Summary of maintenance planned next reporting period:
   - We plan on mowing the grass and spraving the riprap once a month at a minimum. We
     will check the pump stations.

6. Summary of changes to system since last inspection:

7. Problems/ issues requiring the assistance of the US Army Corps of Engineers:
   - N/A
Public Sponsor Pre-Inspection Report
The following information is to be provided by the levee district sponsor prior to an inspection

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Mailing Address</th>
<th>Phone Number</th>
<th>Email Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan Repay</td>
<td>Executive Director</td>
<td>900 Ridge Road Suite H</td>
<td>219-575-0589</td>
<td><a href="mailto:drepay@littlecalumetriverbasin.org">drepay@littlecalumetriverbasin.org</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
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</tr>
</tbody>
</table>

Flood Damage Reduction System
Pre-Inspection Report
Page 2 of 2
### Public Sponsor Representative

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan Repay</td>
<td>LCRBDC</td>
<td>Pump Stations</td>
</tr>
<tr>
<td>Jeff Yatsko</td>
<td>Garcia Consulting</td>
<td>Sluice Gates</td>
</tr>
<tr>
<td>Brian Beloshapka</td>
<td>Garcia Consulting</td>
<td>Sluice Gates</td>
</tr>
</tbody>
</table>

### Corps of Engineer Inspection Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bill Rochford</td>
<td>Levee Safety Program Manager</td>
<td>Levee</td>
</tr>
<tr>
<td>Yuki Galisanao</td>
<td>Lead / Geotechnical</td>
<td>Levee</td>
</tr>
<tr>
<td>Tina Kowitz</td>
<td>Geotechnical</td>
<td>Levee</td>
</tr>
<tr>
<td>Nikki Chaffin</td>
<td>GIS</td>
<td>Levee</td>
</tr>
<tr>
<td>Mo Bak-Pylinski</td>
<td>Hydraulics</td>
<td>Levee</td>
</tr>
<tr>
<td>Scott Kozak</td>
<td>Structural</td>
<td>Pump Stations</td>
</tr>
<tr>
<td>Ernie Go</td>
<td>Electrical</td>
<td>Pump Stations</td>
</tr>
<tr>
<td>Arthur Rundzaitis</td>
<td>Construction</td>
<td>Sluice Gates</td>
</tr>
<tr>
<td>Richard Tollefson</td>
<td>Construction</td>
<td>Sluice Gates</td>
</tr>
</tbody>
</table>
## General Items for All Flood Damage Reduction Segments / Systems

For use during all inspections of all Flood Damage Reduction Segments / Systems

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

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<tbody>
<tr>
<td>1. Operations and Maintenance Manuals</td>
<td>A</td>
<td>Levee Owner's Manual, O&amp;M Manuals, and/or manufacturer's operating instructions are present.</td>
<td>Sponsor has complete set of O&amp;M Manuals.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Sponsor manuals are lost or missing or out of date; however, sponsor will obtain manuals prior to next scheduled inspection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Sponsor has not obtained lost or missing manuals identified during previous inspection.</td>
<td></td>
</tr>
<tr>
<td>2. Emergency Supplies and Equipment (A or M only)</td>
<td>M</td>
<td>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.</td>
<td>Gary has a limited supply of sandbags and flood fighting supplies. They rely on others to provide supplies and assistance. They currently are storing sand bags at a facility on Monroe.</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Flood Preparedness and Training (A or M only)</td>
<td>M</td>
<td>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.</td>
<td>Flood handbooks have been provided to the City. There has been a lot of turn over and resources are low.</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

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**US Army Corps of Engineers**

Flood Damage Reduction Segment / System Inspection Report

Little Cal - Marshalltown (LCMR)
# Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

<table>
<thead>
<tr>
<th>Rated Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Unwanted Vegetation Growth(^1)</td>
<td><strong>M</strong></td>
<td>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.</td>
<td>LCMR_2014_a_0024: Station_1 NA: Station_2 NA: 1 ft. tall grass on riverside slope: Maintain grass (M) LCMR_2014_a_0025: Station_1 NA: Station_2 NA: 1 ft. tall grass on crest and landside: Maintain grass (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>2. Sod Cover</td>
<td><strong>A</strong></td>
<td>A There is good coverage of sod over the levee.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U Over 50% of the sod cover is missing or damaged over a significant portion or portions of the levee embankment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A Surface protection is provided by other means.</td>
<td></td>
</tr>
<tr>
<td>3. Encroachments</td>
<td><strong>M</strong></td>
<td>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.</td>
<td>LCMR_2014_a_0019: Station_1 NA: Station_2 NA: Unauthorized farming activity at riverside toe of levee.: Provide permit request (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.</td>
<td></td>
</tr>
<tr>
<td>4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag)</td>
<td><strong>NA</strong></td>
<td>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&amp;M Manual.</td>
<td></td>
</tr>
</tbody>
</table>

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 segments / systems

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<tr>
<th>Rated Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Closures)</td>
<td>U</td>
<td>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&amp;M Manual.</td>
<td>N/A There are no closure structures along this component of the FDR segment / system.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Slope Stability</td>
<td>A</td>
<td>No slides, sloughs, tension cracking, slope depressions, or bulges are present.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Minor slope stability problems that do not pose an immediate threat to the levee embankment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Major slope stability problems (ex. deep seated sliding) identified that must be repaired to reestablish the integrity of the levee embankment.</td>
<td></td>
</tr>
<tr>
<td>6. Erosion/ Bank Caving</td>
<td>A</td>
<td>No erosion or bank caving is observed on the landward or riverward sides of the levee that might endanger its stability.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>7. Settlement</td>
<td>A</td>
<td>No observed depressions in crown. Records exist and indicate no unexplained historical changes.</td>
<td>LCMR_2014_a_0026: Station_1 NA: Settlement over culvert. Culvert was inspected and no issues were identified that would cause settlement. Settlement believed to be due to consolidation of fill over culvert.: Monitor for any changes (A)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.</td>
<td></td>
</tr>
<tr>
<td>8. Depressions/ Rutting</td>
<td>A</td>
<td>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.</td>
<td>LCMR_2014_a_0001: Station_1 NA: Minor rutting on top of landside slope, 6 in. deep on landside slope: Fill in ruts (M) LCMR_2014_a_0004: Station_1 NA: Low spot on top of levee: Fill with screenings to grade and slope to drain (A) LCMR_2014_a_0005: Station_1 NA: Low spot on levee crest: Fill with screenings to grade and slope to drain (A) LCMR_2014_a_0007: Station_1 NA: 3 in. deep hoof prints on riverside slope: Fill (M) LCMR_2014_a_0008: Station_1 NA: Station_2 NA: Rutting on riverside slope: Fill (A) LCMR_2014_a_0009: Station_1 NA: Minor rutting on landside toe and slope: Fill (A)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>There are depressions greater than 6 inches deep that will pond water.</td>
<td></td>
</tr>
</tbody>
</table>

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### Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0010: Station_1 NA: 2 in. deep animal tracks: Fill (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0011: Station_1 NA: Hoof prints, 3 in. deep on landside: Fill (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0012: Station_1 NA: Low spots on crest: Fill with screenings to grade and slope to drain (A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0013: Station_1 NA: Low spot on riverside of crest: Fill with screenings to grade and slope to drain (A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0015: Station_1 NA: Station_2 NA: Rutting on riverside slope: Fill (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0016: Station_1 NA: Rutting on landside slope, 7 in. deep: Fill (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0017: Station_1 NA: Multiple 4 in. hoof prints on riverside slope: Fill (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LCMR_2014_a_0018: Station_1 NA: 4 in. deep rut: Fill (M)</td>
</tr>
</tbody>
</table>

9. Cracking

<table>
<thead>
<tr>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>Minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack. No cracks extend continuously through the levee crest.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

10. Animal Control

<table>
<thead>
<tr>
<th>Item</th>
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<th>Rating Guidelines</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.</td>
<td>LCMR_2014_a_0002: Station_1 NA: 2 collapsed burrows, 4 in. deep: Fill (M)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td>LCMR_2014_a_0003: Station_1 NA: 3 in. deep burrow on landside: Fill (M)</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td>LCMR_2014_a_0006: Station_1 NA: 5 in. deep burrow on landside: Fill (M)</td>
</tr>
</tbody>
</table>

11. Culverts/Discharge Pipes

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>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.</td>
<td>Video inspection performed in 2012. Inspection results were reviewed and no issues were identified. Next inspection should be performed in 2017.</td>
</tr>
</tbody>
</table>

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

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Flood Damage Reduction Segment / System Inspection Report
Little Cal - Marshalltown (LCMR)
## Levee Embankments
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</thead>
<tbody>
<tr>
<td>12. Riprap Revetments &amp; Bank Protection</td>
<td>NA</td>
<td><strong>A</strong> 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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>M</strong> 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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>U</strong> 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.</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td>There are no discharge pipes/ culverts.</td>
<td></td>
</tr>
<tr>
<td>13. Revetments other than Riprap</td>
<td>NA</td>
<td><strong>A</strong> Existing revetment protection is properly maintained, undamaged, and clearly visible.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>M</strong> 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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>U</strong> 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.</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td>There are no such revetments protecting this feature of the segment / system.</td>
<td></td>
</tr>
</tbody>
</table>

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 segments / systems

<table>
<thead>
<tr>
<th>Rated Item</th>
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<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Underseepage Relief Wells/ Toe Drainage Systems</td>
<td>NA</td>
<td><strong>A</strong></td>
<td>Toe drainage systems and pressure relief wells necessary for maintaining FDR segment / 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.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td><strong>A</strong></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td><strong>A</strong></td>
<td>Toe drainage systems or pressure relief wells necessary for maintaining FDR segment / system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td><strong>A</strong></td>
<td>There are no relief wells/ toe drainage systems along this component of the FDR segment / system.</td>
</tr>
</tbody>
</table>

| 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. |

---

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.
2. Detailed survey elevations are normally required during Periodic Inspections, and whenever there are obvious visual settlements.
3. 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.

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---

**Flood Damage Reduction Segment / System Inspection Report**
**Little Cal - Marshalltown (LCMR)**
<table>
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<tr>
<th>Inspect ID: LCMR_2014_a_0024</th>
<th>Title: USACE_CELRC_LCMR_2014_a_0024_1.jpg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Item: 1. Unwanted Vegetation Growth</td>
<td>Caption: Rating: Minimally Acceptable; Remarks: 1 ft. tall grass on riverside slope; Action: Maintain grass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0025</th>
<th>Title: USACE_CELRC_LCMR_2014_a_0025_1.jpg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Item: 1. Unwanted Vegetation Growth</td>
<td>Caption: Rating: Minimally Acceptable; Remarks: 1 ft. tall grass on crest and landside; Action: Maintain grass</td>
</tr>
</tbody>
</table>
Flood Damage Reduction Segment / System Inspection Report
Little Cal - Marshalltown (LCMR)
Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: LCMR_2014_a_0001  Title: USACE_CELRC_LCMR_2014_a_0001_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Minimally Acceptable; Remarks: Minor rutting on top of landside slope, 6 in. deep on landside slope; Action: Fill in ruts; with stone

Inspect ID: LCMR_2014_a_0004  Title: USACE_CELRC_LCMR_2014_a_0004_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Acceptable; Remarks: Low spot on top of levee; Action: Fill with screenings to grade and slope to drain
### Inspect ID: LCMR_2014_a_0005  Title: USACE_CELRC_LCMR_2014_a_0005_1.jpg
#### Rated Item: 8. Depressions/ Rutting  
#### Caption: Rating: Acceptable; Remarks: Low spot on levee crest; Action: Fill with screenings to grade and slope to drain

### Inspect ID: LCMR_2014_a_0007  Title: USACE_CELRC_LCMR_2014_a_0007_1.jpg
#### Rated Item: 8. Depressions/ Rutting  
#### Caption: Rating: Minimally Acceptable; Remarks: 3 in. deep hoof prints on riverside slope; Action: Fill
8. Depressions/ Rutting

**Caption:** Rating: Acceptable; Remarks: Rutting on riverside slope; Action: Fill

**Inspect ID:** LCMR_2014_a_0008  
**Title:** USACE_CELRC_LCMR_2014_a_0008_1.jpg

**Inspect ID:** LCMR_2014_a_0009  
**Title:** USACE_CELRC_LCMR_2014_a_0009_1.jpg

**Rated Item:** 8. Depressions/ Rutting  
**Caption:** Rating: Acceptable; Remarks: Minor rutting on landside toe and slope; Action: Fill
Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: LCMR_2014_a_0010  Title: USACE_CELRC_LCMR_2014_a_0010_1.jpg

Inspect ID: LCMR_2014_a_0011  Title: USACE_CELRC_LCMR_2014_a_0011_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Minimally Acceptable; Remarks: Hoof prints, 3 in. deep on landside; Action: Fill
Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: LCMR_2014_a_0012  Title: USACE_CELRC_LCMR_2014_a_0012_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Acceptable; Remarks: 2 low spots on crest; Action: Fill with screenings to grade and slope to drain

Inspect ID: LCMR_2014_a_0013  Title: USACE_CELRC_LCMR_2014_a_0013_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Acceptable; Remarks: Low spot on riverside of crest; Action: Fill with screenings to grade and slope to drain
Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: LCMR_2014_a_0015  Title: USACE_CELRC_LCMR_2014_a_0015_1.jpg

Inspect ID: LCMR_2014_a_0016  Title: USACE_CELRC_LCMR_2014_a_0016_1.jpg
Rated Item: 8. Depressions/ Rutting  Caption: Rating: Minimally Acceptable; Remarks: Rutting on landside slope, 7 in. deep; Action: Fill
<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0017</th>
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<tr>
<th>Inspect ID: LCMR_2014_a_0018</th>
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Levee Embankments
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Inspect ID: LCMR_2014_a_0002  Title: USACE_CELRC_LCMR_2014_a_0002_1.jpg
Rated Item: 10. Animal Control  Caption: Rating: Minimally Acceptable; Remarks: 2 collapsed burrows, 4 in. deep; Action: Fill

Inspect ID: LCMR_2014_a_0003  Title: USACE_CELRC_LCMR_2014_a_0003_1.jpg
Rated Item: 10. Animal Control  Caption: Rating: Minimally Acceptable; Remarks: 3 in. deep burrow on landside; Action: Fill
Levee Embankments
For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: LCMR_2014_a_0006  Title: USACE_CELRC_LCMR_2014_a_0006_1.jpg
Rated Item: 10. Animal Control  Caption: Rating: Minimally Acceptable; Remarks: 5 in. deep burrow on landside; Action: Fill

Inspect ID: LCMR_2014_a_0020  Title: USACE_CELRC_LCMR_2014_a_0020_1.jpg
Rated Item: 10. Animal Control  Caption: Rating: Minimally Acceptable; Remarks: 3.5 in. deep animal burrow; Action: Fill
<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0021</th>
<th>Title: USACE CELRC LCMR_2014_a_0021_1.jpg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Item: 10. Animal Control</td>
<td>Caption: Rating: Minimally Acceptable; Remarks: Multiple 3 in. deep burrows on riverside; Action: Fill</td>
</tr>
</tbody>
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# Interior Drainage System
For use during Initial and Continuing Eligibility Inspections of interior drainage systems

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</table>
| 1. Vegetation and Obstructions | M | 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 | M | 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 | 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. |
| 4. Fencing and Gates | A | 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. |
| 5. Concrete Surfaces (Such as gate) | A | 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. |

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<tr>
<td>wells, outfalls, intakes, or culverts</td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>There are no concrete items in the interior drainage system.</td>
<td></td>
</tr>
<tr>
<td>6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures² (Such as gate wells, outfalls, intakes, or culverts)</td>
<td>A</td>
<td>A</td>
<td>There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>U</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>There are no concrete items in the interior drainage system.</td>
</tr>
<tr>
<td>7. Foundation of Concrete Structures³ (Such as culverts, inlet and discharge structures, or gatewells.)</td>
<td>A</td>
<td>A</td>
<td>No active erosion, scouring, or bank caving that might endanger the structure's stability.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>U</td>
<td>Erosion or bank caving observed that may lead to structural instabilities before the next inspection.</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>There are no concrete items in the interior drainage system.</td>
</tr>
<tr>
<td>8. Monolith Joints</td>
<td>A</td>
<td>A</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>M</td>
<td>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.</td>
</tr>
</tbody>
</table>

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### Interior Drainage System

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<tr>
<td>U</td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>There are no monolith joints in the interior drainage system.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Culverts/Discharge 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. |

10. Sluice/Slide Gates

| M          | 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. |

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<tbody>
<tr>
<td>11. Flap Gates/Flap Valves/Pinch Valves(^1)</td>
<td>M</td>
<td>A Gates/valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.</td>
<td>LCMR_2014_a_0028: Station_1 NA: MA-2: Flap gate open due to rocks: Clear obstruction (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U Gates/valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A There are no flap gates.</td>
<td></td>
</tr>
<tr>
<td>12. Trash Racks (non-mechanical)</td>
<td>A</td>
<td>A Trash racks are fastened in place and properly maintained.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A There are no trash racks, or they are covered in the pump stations section of the report.</td>
<td></td>
</tr>
<tr>
<td>13. Other Metallic Items</td>
<td>A</td>
<td>A All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M Corrosion seen on metallic parts appears to be maintainable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>U Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A There are no other significant metallic items.</td>
<td></td>
</tr>
<tr>
<td>14. Riprap Revetments of Inlet/Discharge Areas</td>
<td>A</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.</td>
<td></td>
</tr>
<tr>
<td>15. Revetments other than Riprap</td>
<td>NA</td>
<td>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.</td>
<td></td>
</tr>
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<tr>
<td></td>
<td>M</td>
<td>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 appropriate herbicide.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>There are no such revetments protecting this feature of the segment / system.</td>
<td></td>
</tr>
</tbody>
</table>

1. Proper operation of this item must be demonstrated during the inspection.
2. The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.
3. 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.
4. 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.
5. 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.

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### Inspect ID: LCMR_2014_a_0022  Title: USACE_CELRC_LCMR_2014_a_0022_1.jpg
**Rated Item:** 1. Vegetation and Obstructions  **Caption:** Rating: Minimally Acceptable; Remarks: Sediment in front and inside of ditch culvert on east end; Action: Clean out ditch and pipe

### Inspect ID: LCMR_2014_a_0014  Title: USACE_CELRC_LCMR_2014_a_0014_1.jpg
**Rated Item:** 2. Encroachments  **Caption:** Rating: Minimally Acceptable; Remarks: Riprap dam in ditch not reviewed by Corps; Action: Submit permit request
<table>
<thead>
<tr>
<th>Inspect ID</th>
<th>Title</th>
<th>Rated Item</th>
<th>Caption</th>
<th>Rating: Minimally Acceptable; Remarks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCMR_2014_a_0023</td>
<td>USACE_CELRC_LCMR_2014_a_0023_1.jpg</td>
<td>2. Encroachments</td>
<td>Debris on west bank of outlet channel; Action: Remove debris</td>
<td></td>
</tr>
<tr>
<td>LCMR_2014_a_0029</td>
<td>USACE_CELRC_LCMR_2014_a_0029_1.jpg</td>
<td>10. Sluice/ Slide Gates</td>
<td>MA-2: Silt on bottom; Action: Clean</td>
<td></td>
</tr>
</tbody>
</table>
**Interior Drainage System**
For use during Initial and Continuing Eligibility Inspections of interior drainage systems

<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0028</th>
<th>Title: USACE_CELRC_LCMR_2014_a_0028_1.jpg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Item: 11. Flap Gates/Flap Valves/ Pinch Valves</td>
<td><strong>Caption:</strong> Rating: Minimally Acceptable; Remarks: MA-2: Flap gate open due to rocks; Action: Clear obstruction</td>
</tr>
</tbody>
</table>

**Image:**
![Flap gate with rocks obstructing flow](image_url)

8:53 MAY/ 8/2014
# Pump Stations

For use during Initial and Continuing Eligibility Inspections of pump stations

## Flood Damage Reduction Segment / System

**Inspection Report**

**Little Cal - Marshalltown (LCMR)**

<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Rating Guidelines</th>
<th>Location/ Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pump Stations, Operating, Maintenance, Training, &amp; Inspection Records</td>
<td>A</td>
<td>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.</td>
<td>LCMR_2014_a_0030: Station_1 NA: PS-Marshalltown: Records are available online. Maintenance personnel check records once a month. No action (A)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Operation, maintenance and inspection records are present but not adequately used and updated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>No operation, maintenance and inspection records are present, or refresher training for personnel has not been conducted.</td>
<td></td>
</tr>
<tr>
<td>2. Pump Station Operations and Maintenance Equipment Manuals</td>
<td>M</td>
<td>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&amp;M manuals include points of contact for manufacturers and suppliers of major equipment used in the facility.</td>
<td>LCMR_2014_a_0031: Station_1 NA: PS-Marshalltown: Manuals available previous year but were not at station this year: Maintain manuals at pump station (M)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Operation and Maintenance Equipment Manuals are not available.</td>
<td></td>
</tr>
<tr>
<td>3. Safety Compliance</td>
<td>M</td>
<td>Safety compliance inspection reports by applicable local, state, or federal agencies available for review.</td>
<td>LCMR_2014_a_0033: Station_1 NA: PS-Marshalltown: Control cabinet must be posted with proper Arc-Flash warning sign per latest NFPA 70 and NFPA70E: Post Arc-Flash warning sign (M)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>No safety compliance inspection reports are available for review.</td>
<td></td>
</tr>
<tr>
<td>4. Communications (A or M only)</td>
<td>A</td>
<td>A telephone, cellular phone, two-way radio, or similar device is available to pump station operator and maintenance personnel.</td>
<td>LCMR_2014_a_0027: Station_1 NA: PS-Marshalltown: Minor concrete spalling of outlet wingwall: No action (A)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>A telephone, cellular phone, two-way radio, or similar device is not available to pump station operator and maintenance personnel.</td>
<td></td>
</tr>
<tr>
<td>5. Plant Building</td>
<td>A</td>
<td>The building is in good structural condition with no major foundation settlement problems. The roof is not leaking, intake &amp; exhaust louvers are clear of debris, fans are operational, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>6. Fencing and Gates</td>
<td>A</td>
<td>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.</td>
<td>LCMR_2014_a_0034: Station_1 NA: PS-Marshalltown: Minor corrosion on fence: No action (A)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.</td>
<td></td>
</tr>
</tbody>
</table>

Key: **A** = Acceptable. **M** = Minimally Acceptable; Maintenance is required. **U** = Unacceptable. **N/A** = Not Applicable. **FDR** = Flood Damage Reduction
# Pump Stations
For use during Initial and Continuing Eligibility Inspections of pump stations

<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Rating Guidelines</th>
<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Pumps</td>
<td>A</td>
<td>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.</td>
<td>N/A There are no features noted that require safety fencing.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>8. Motors, Engines, Fans, Gear Reducers, Back Stop Devices, etc.</td>
<td>A</td>
<td>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.</td>
<td>N/A There are no features noted that require safety fencing.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Systems have minor deficiencies, but are operational and will function adequately through the next flood. Bearing sensors are not operational.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>One or more of the primary motors or systems is not operational, or noted deficiencies have not been corrected.</td>
<td></td>
</tr>
<tr>
<td>9. Sumps / Wet well</td>
<td>A</td>
<td>Clear of debris, sediment, or other obstructions. Procedures are in place to remove debris accumulation during operation.</td>
<td>N/A There are no mechanical trash rakes.</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Large debris or excessive silt present which will hinder or damage pumps during operation, or no procedures established to remove debris accumulation during operation.</td>
<td></td>
</tr>
<tr>
<td>10. Mechanical Operating Trash Rakes¹</td>
<td>NA</td>
<td>Drive chain, bearing, gear reducers, and other components are in good operating condition and are being properly maintained.</td>
<td>LCMR_2014_a_0032: Station 1 NA: PS-Marshalltown: Missing nut on a bolt holding the trash rack to the pump station wall.: Recommend replacing (M)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>The trash rake is in need of maintenance, but is still operational.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Trash rake not operational or deficiencies will inhibit operations during the next flood event.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>There are no mechanical trash rakes.</td>
<td></td>
</tr>
<tr>
<td>11. Non-Mechanical Trash Racks</td>
<td>M</td>
<td>Trash racks are fastened in place and properly maintained.</td>
<td>LCMR_2014_a_0032: Station 1 NA: PS-Marshalltown: Missing nut on a bolt holding the trash rack to the pump station wall.: Recommend replacing (M)</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Rating Guidelines</th>
<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12. Fuel System for Pump Engines</strong></td>
<td>NA</td>
<td>A</td>
<td>Fuel system is operational, day tank present and operational, fuel fresh and rotated regularly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>Fuel system is operational and of adequate capacity, but day tank is missing or fuel is not fresh and rotated regularly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>Fuel system not functional.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A</td>
<td>No fuel system.</td>
</tr>
<tr>
<td><strong>13. Power Source</strong></td>
<td>A</td>
<td>A</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>Normal power source or generators are not operational and must be repaired; or generator, if required, is not on site.</td>
</tr>
<tr>
<td><strong>14. Electrical Systems²</strong></td>
<td>A</td>
<td>A</td>
<td>Operational and maintained free of damage, corrosion, and debris. Preventative maintenance and system testing is being performed periodically.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>Operational with minor discrepancies. Preventative maintenance or repairs are required, but the components are expected to function adequately during the next flood event.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>Components of the electrical system will not function adequately during the next flood event and must be replaced.</td>
</tr>
<tr>
<td><strong>15. Megger Testing on Pump Motors and Critical Power Cables</strong></td>
<td>A</td>
<td>A</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>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.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>U</td>
<td>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.</td>
</tr>
</tbody>
</table>

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## Pump Stations
For use during Initial and Continuing Eligibility Inspections of pump stations

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<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Rating Guidelines</th>
<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Enclosures, Panels, Conduit and Ducts</td>
<td>A</td>
<td>All enclosures, panels, conduits, and ducts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Minor surface corrosion which appears to be maintainable. Cleaning and painting required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Severely corroded and must be replaced to prevent failure, equipment damage, or safety issues.</td>
<td></td>
</tr>
<tr>
<td>17. Intake and Discharge Pipelines</td>
<td>A</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>18. Sluice/ Slide Gates³</td>
<td>A</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>19. Flap Gates/ Flap Valves/ Pinch Valves¹</td>
<td>A</td>
<td>Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U</td>
<td>Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>There are no sluice/ slide gates.</td>
<td></td>
</tr>
<tr>
<td>20. Cranes²</td>
<td>A</td>
<td>Cranes operational and have been inspected and load tested in accordance with applicable standards within the last year. Documentation is on hand.</td>
<td></td>
</tr>
</tbody>
</table>

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## Pump Stations
For use during Initial and Continuing Eligibility Inspections of pump stations

### Rating Guidelines

<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranes have not been inspected or operationally tested within the past year, or there are visible signs of corrosion, oil leakage, etc, requiring maintenance.</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Cranes are not operational, and this may prevent the pump station from functioning as required. No documentation available on cranes.</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>There are no cranes.</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

### Other Metallic Items (Equipment, Ladders, Platform Anchors, etc)

<table>
<thead>
<tr>
<th>Rated Item</th>
<th>Rating</th>
<th>Location/Remarks/Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Corrosion seen on metallic parts appears to be maintainable.</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.</td>
<td>U</td>
<td></td>
</tr>
<tr>
<td>There are no other significant metallic items.</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

1. Proper operation of this item must be demonstrated during the inspection.
2. 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.
3. 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.

### Key
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- **N/A** = Not Applicable
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<table>
<thead>
<tr>
<th>Inspect ID</th>
<th>Title</th>
<th>Rated Item</th>
<th>Caption</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCMR_2014_a_0033</td>
<td>USACE_CELRC_LCMR_2014_a_0033_1.jpg</td>
<td>3. Safety Compliance</td>
<td>Rating: Minimally Acceptable; Remarks: PS-Marshalltown: Control cabinet must be posted with proper Arc-Flash warning sign per latest NFPA 70 and NFPA70E; Action: Post Arc-Flash warning sign</td>
</tr>
</tbody>
</table>

Pump Stations
For use during Initial and Continuing Eligibility Inspections of pump stations
<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0034</th>
<th>Title: USACE CELRC LCMR_2014_a_0034_1.jpg</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Inspect ID: LCMR_2014_a_0032</th>
<th>Title: USACE CELRC LCMR_2014_a_0032_1.jpg</th>
</tr>
</thead>
</table>
DISCLAIMER - While the United States Army Corps of Engineers, (hereinafter referred to USACE) has made a reasonable effort to insure the accuracy of the maps and associated data, it should be explicitly noted that USACE makes no warranty, representation or guaranty, either express or implied, as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The USACE, its officers, agents, employees, or servants shall assume no liability of any nature for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The USACE, its officers, agents, employees or servants shall assume no liability for any decisions made or actions taken or not taken by the user of the maps and associated data in reliance upon any information or data furnished here. By using these maps and associated data the user does so entirely at their own risk and explicitly acknowledges that he/she is aware of and agrees to be bound by this disclaimer and agrees not to present any claim or demand of any nature against the USACE, its officers, agents, employees or servants in any forum whatsoever for any damages of any nature whatsoever that may result from or may be caused in any way by the use of the maps and associated data.
Enclosure 3: Subset of Inspection Items for Rehabilitation Program Eligibility Determination

In order to be eligible, all of the following items must be rated A, M, N/A or Yes.

Note: Item numbers listed below refer to their placement in the Inspection Checklist (Enclosure 2).

<table>
<thead>
<tr>
<th>Rehabilitation Program Eligibility Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes ☑ Public sponsor provided maintenance information per the Public Sponsor Pre-Inspection Form.</td>
</tr>
<tr>
<td>No ☑ □</td>
</tr>
<tr>
<td>Yes ☑ □ Non-federal levee system meets Initial Eligibility criteria.</td>
</tr>
<tr>
<td>No ☑ □</td>
</tr>
<tr>
<td>N/A ☑ ✔</td>
</tr>
</tbody>
</table>

If either of the above items is marked “No” the levee system is not eligible.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Rated Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Levee Embankments</strong></td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>3. Encroachments</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>A □</td>
<td>4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag Closures)</td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>N/A ☑ ✔</td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>5. Slope Stability</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>6. Erosion/ Bank Caving</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>10. Animal Control</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>11. Culverts/Discharge Pipes (This item includes both concrete and corrugated metal pipes.)</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>N/A ☑ ✔</td>
<td></td>
</tr>
<tr>
<td>A ☑</td>
<td>14. Underseepage Relief Wells/Toe Drainage Systems</td>
</tr>
<tr>
<td>M ☐</td>
<td></td>
</tr>
<tr>
<td>U ☑</td>
<td></td>
</tr>
<tr>
<td>N/A ☑ ✔</td>
<td></td>
</tr>
</tbody>
</table>

<p>| <strong>Floodwalls</strong> |
| A ☑ | 2. Encroachments |
| M ☐ | |
| U ☑ | |
| A □ | 3. Closure Structures (Stop Log Closures and Gates) |
| U ☑ | |
| N/A ☑ ✔ | |
| A ☑ | 5. Tilting, Sliding, or Settlement of Concrete Structures |
| M ☐ | |
| U ☑ | |</p>
<table>
<thead>
<tr>
<th>AMU</th>
<th>6. Foundation of Concrete Structures</th>
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</thead>
<tbody>
<tr>
<td>AMU</td>
<td>8. Underseepage Relief Wells/Toe Drainage Systems</td>
</tr>
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**Interior Drainage System**

<table>
<thead>
<tr>
<th>AMU</th>
<th>9. Culverts/Discharge Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMU</td>
<td>10. Sluice/Slide Gates</td>
</tr>
<tr>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>AMU</td>
<td>11. Flap Gates/Flap Valves/Pinch Valves</td>
</tr>
<tr>
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</tbody>
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**Pump Stations**

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<tr>
<th>AMU</th>
<th>17. Intake and Discharge Pipelines</th>
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<tr>
<td>AMU</td>
<td>18. Sluice/Slide Gates</td>
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<td>AMU</td>
<td>19. Flap Gates/Flap Valves/Pinch Valves</td>
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**Rehabilitation Program Status**

<table>
<thead>
<tr>
<th>Active</th>
<th>System meets all interim eligibility criteria, including having received a rating of A, M, N/A or Yes for all subset items and is therefore eligible for rehabilitation assistance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive</td>
<td>System does not meet interim eligibility requirements.</td>
</tr>
</tbody>
</table>

**Comments:** Sponsor submitted pre-inspection form
Appendix B
As-Built Drawings
LITTLE CALUMET RIVER, INDIANA
LOCAL FLOOD PROTECTION
EAST REACH REMEDIATION

VICINITY MAP
N 5

LOCALITY MAP

LEGEND

WORK "AS-BUILT"

SCALE IN FEET
1/2000

19096

SHEET REFERENCE NUMBER
G-1

One project was designed by the Corps District of the U.S. Army Corps of Engineers. The plans and specifications were prepared for use in the design and construction of this project. The project plans and specifications were reviewed by the Corps District to ensure that the project was completed in accordance with the Corps District requirements. The project was reviewed by the Corps District to ensure that the project was completed in accordance with the Corps District requirements. The project was reviewed by the Corps District to ensure that the project was completed in accordance with the Corps District requirements.
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<th>SHEET REFERENCE NUMBER</th>
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<tr>
<td>1</td>
<td>G-1</td>
<td>LOCALITY MAP AND VICINITY MAP</td>
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<tr>
<td>2</td>
<td>G-2</td>
<td>SHEET INDEX</td>
</tr>
<tr>
<td>3</td>
<td>G-3</td>
<td>SYMBOLS, ABBREVIATIONS AND GENERAL NOTES</td>
</tr>
<tr>
<td>4</td>
<td>C-1</td>
<td>SITE PLAN</td>
</tr>
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<td>5</td>
<td>C-2</td>
<td>WORK LIMITS, EXISTING CONDITIONS, ACCESS RAMPS, DITCHES AND LEVEE ALIGNMENTS</td>
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<tr>
<td>10</td>
<td>C-7</td>
<td>SIMULATION AREA, AND DRAINAGE STRUCTURES</td>
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<td>11</td>
<td>C-8</td>
<td>PLAN AND PROFILE SHEET INDEX</td>
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<td>C-9</td>
<td>PLAN AND PROFILE STA. 0-00 THROUGH STA. 12-20</td>
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<td>13</td>
<td>C-10</td>
<td>PLAN AND PROFILE STA. 12-20 THROUGH STA. 22-20</td>
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<td>PLAN AND PROFILE STA. 22-20 THROUGH STA. 33-70</td>
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<td>C-13</td>
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<td>TYPICAL ELEV EMANKMENT AND MISCELLANEOUS SECTIONS</td>
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<td>C-17</td>
<td>ACCESS ROAD DETAILS</td>
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<td>MISCELLANEOUS DETAILS</td>
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<td>PRE-LOADING EMANKMENT PLAN SECTION AND DETAILS</td>
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<td>M-1</td>
<td>SLUICE AND FLAP GATE TYPICAL DETAILS</td>
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<td>DRAINTÉ SYSTEM DIMENSIONS AND ELEVATIONS</td>
</tr>
<tr>
<td>25</td>
<td>S-2</td>
<td>48&quot; DRAINTÉ DIMENSIONS AND REINFORCEMENT</td>
</tr>
<tr>
<td>26</td>
<td>S-3</td>
<td>48&quot; DRAINTÉ HEAwall DIMENSIONS AND REINFORCEMENT</td>
</tr>
<tr>
<td>27</td>
<td>S-4</td>
<td>48&quot; DRAINTÉ OUTLET WALL DIMENSIONS AND REINFORCEMENT</td>
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<tr>
<td>28</td>
<td>S-5</td>
<td>INLET BOX DIMENSIONS &amp; REINFORCEMENT</td>
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<td>29</td>
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<td>OUTLET BOX DIMENSIONS &amp; REINFORCEMENT</td>
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<tr>
<td>30</td>
<td>S-7</td>
<td>STANDARD DETAILS</td>
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<tr>
<td>31</td>
<td>S-8</td>
<td>TYPICAL PIPE DETAILS</td>
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REFERENCES:
1. FOR SYMBOLS AND ABBREVIATIONS, SEE SHEET C-5.
2. FOR ALIGNMENT DETAILS, CONTROL POINT
   COORDINATES AND BEND WAYS, SEE SHEET C-3.
3. FOR TYPICAL SECTIONS AND SETTLEMENT GAGE DETAILS,
   SEE SHEET C-16.
4. INTERIOR DITCH PLAN AND PROFILE SEE SHEETS C-13 AND C-14.
5. THE AREA BETWEEN THE LEVEE TOE AND INTERIOR DRAINAGE
   DITCH HAS BEEN GRADED TO DRAIN TOWARDS THE DITCH.
REFERENCES:
1. FOR SYMBOLS AND ABBREVIATIONS, SEE SHEET C-3.
2. LEVEE PLAN AND PROFILE SHOWN ON SHEET C-11.
3. TYPICAL SECTIONS AND SETTLEMENT GAGE DETAIL SHOWN ON SHEET C-16.
4. THE AREA BETWEEN THE LEVEE TOE AND INTERIOR DRAINAGE DITCH HAS BEEN GRADED TO DRAIN TOWARD THE DITCH.
REFERENCES:
1. FOR SYMBOLS AND ABBREVIATIONS SEE SHEET C-3.
2. FOR SCOUR HOLE AND RIPRAP DETAILS SEE SHEET C-4.
3. FOR CULVERT SYSTEM DETAILS SEE SHEETS S-1 AND S-2.
4. FOR TYPICAL SECTIONS AND SETTLEMENT GAGE DETAIL SEE SHEET C-18.
NOTE:

1. SLUICE GATE NOT SHOWN FOR CLARITY.
2. SEE SHEET W-1 FOR SLUICE GATE DETAILS.
3. SEE SHEET S-1 FOR GATEWELL SYSTEM LAYOUT.
4. FENCE NOT SHOWN FOR CLARITY.
   SEE SHEET S-8 FOR FENCE MOUNTING DETAILS.
5. SEE SHEET S-7 FOR LADDER DETAILS.
6. LADDERS NOT SHOWN IN SECTIONS FOR CLARITY.
7. SEE SHEET S-8 FOR PIPE TO GATEWELL CONNECTION.
1. See Sheet S-7 for trash rack details.
2. See Sheet S-1 for gatewell system layout and elevations.
3. The weep hole has been cast in place and has 3" dia. schedule 40 PVC pipe. A small inside end of the pipe against the geotextile fabric which encloses the granular set aside collar. See S-1.
4. Trash rack not shown in sections for clarity.
NOTES:
1. All existing ground and water elevations shown on this drawing are approximate.
2.1 All reinforcing bar cover is 3 inches unless otherwise noted.
3.1 See sheet S-7 for quadrant and grate details.
4.1 See sheet M-1 for gate details.
5.1 See sheets C-1 and C-2 for structure location.
6.1 Sluice gate and quadrant not shown on section for clarity.
7.1 Trim 54" CMP back 2'-0".
8.1 For description of inlet box work items, see specification sections D0050, and D1100.
OUTLET BOX PLAN

OUTLET BOX ELEVATION

EXTRA ROOF REINFORCING

SECTION A

SECTION B

SECTION C

NOTES:

1. ALL EXISTING GROUND AND WATER ELEVATIONS SHOWN ON THIS DRAWING ARE APPROXIMATE.

2. ALL REINFORCING BAR COVER IS 3 INCHES UNLESS OTHERWISE NOTED.

3. ALL REINFORCING BARS ARE #6 BARS SPACED AT 12 INCHES O.C. UNLESS OTHERWISE NOTED. ALL SLAB REINFORCING BARS ARE #3 BARS SPACED AT 12 INCHES O.C. UNLESS OTHERWISE NOTED.

4. INSTALLED ACCESS HATCH PER MANUFACTURERS RECOMMENDATIONS.

5. SEE SHEET M-1 FOR GATE DETAILS.

6. SEE SHEETS 0-4 AND 0-6 FOR STRUCTURE LOCATION.

7. EXCAVATE AROUND THE EXISTING 6" CIP TO EXPOSE 4 TO 5 FEET OF PIPE AND CUT BACK THE PIPE 2" O.D.

8. SEE SHEET S-7 FOR GUARD RAIL AND LADDER DETAILS

SCALE: 1/" = 1'-0"
LITTLE CALUMET RIVER, INDIANA
LOCAL FLOOD PROTECTION
STAGE III DRAINAGE REMEDIATION

AS-BUILT DECEMBER 2005
THE LEVEE. THE REMAINING OPEN ENDS WILL BE PLUGGED.

EXISTING GRADE

DATE:

FILENAME:
PLOT DATE:

TRACK TO A POINT AS NEAR AS PRACTICABLE TO THE TOE OF

VERTICAL SCALE IN FEET

BE ENCOUNTERED, THE TILE SHALL BE REMOVED FROM THE

C-08

OF 6'. DEWATERING WILL BE REQUIRED. SHOULD DRAIN TILES

PROFILE

TO A DEPTH SUFFICIENT TO EXPOSE DRAIN TILES, MINIMUM

SEGMENT OF THE LEVEE AS SHOWN. THE TRENCH SHALL BE CUT

LANDWARD TOE OF THE LEVEE AND PARALLEL TO THE EAST-WEST

EXPLORATORY TRENCHING. EXPLORATORY TRENCHING SHALL

REFERENCE

CHAIRMAN EL. 563.3

STATIONING ALONG > EXTERIOR DITCH

TOP SOIL SHALL BE STRIPPED AND STOCKPILED PRIOR TO

EXTERIOR DITCH

LITTLE CALUMET RIVER, INDIANA

STA 14+20 TO STA. 23+91

FOR SYMBOLS AND ABBREVIATIONS,

FOR ALIGNMENT, CONTROL POINT COORDINATES,

SEE SHEET C-13.

SEE SHEETS C-02 AND C-04.

WHERE LITTLE CALUMET RIVER, INDIANA

FOR DETAILS, SEE SHEET R-3

NOTE:

NOTE:

NOTE:

NOTE:

NOTE:

NOTES:

1. FOR SYMBOLS AND ABBREVIATIONS.

2. FOR ALIGNMENT, CONTROL POINT COORDINATES.

3. FOR STANDARD Ditch SECTIONS,

4. FOR WORK LIMITS

5. FOR WORK LIMITS

6. FOR WORK LIMITS

7. FOR SYMBOLS AND ABBREVIATIONS.
SEE DETAIL PROFILE
STATIONING BASED ALONG CL PUMP STATION
STATIONING BASED ON CL DITCH
S3DRC11.DGN
EXISTING DITCH GRADE
EXISTING GRADE
J.O'R/D.B.
REFERENCE DRAWINGS FOR AS-BUILT CONDITIONS AT MARSHALLTOWN
MARSHALLTOWN PUMP STATION
SITE PLAN AND MISC. DETAILS
FOR PLAN AND PROFILE AND BORING LOGS,
SEE SHEET ERRC10B0.
FOR EXTERIOR DITCH, SEE SHEET ERRC15B0.
FOR ACCESS ROAD DETAILS, SEE SHEET ERRC17B0.
ACCESS ROAD AND CULVERT ADDITION
RIP-RAP SEE S-26 FOR TYPICAL BEDDING AND DETAIL
SEE S-04b FOR SECTION AND DETAIL
OF PUMP STATION OUTFALL MODIFICATION
SEE S-26 FOR TYPICAL SECTION AND DETAIL
WORKING LIMITS
EXIST. DITCH FOR GATEWELL
EXIST. DITCH EXTENTS
OUTLET DITCH FOR PUMP STATION
EXIST. SCOUR HOLE
LEVEE MAINTENANCE ROAD
METER PANEL SYSTEM
7' HIGH FENCE
SURROUNDING 8'X 8'
CONCRETE PAD (SEE NOTE 2)
NEW UNDERGROUND SECONDARY SERVICE (SEE SHEET E-01)
LIGHT POLE
NEW PUMP STATION
EXIST. GATEWELL STRUCTURE
LEVEE MAINTENANCE ROAD
1V:2.5H
EXIST. GRADE
EXISTING GRADE
J.O'R/D.B.
REFERENCE DRAWINGS FOR AS-BUILT CONDITIONS AT MARSHALLTOWN
MARSHALLTOWN PUMP STATION
SITE PLAN AND MISC. DETAILS
FOR PLAN AND PROFILE AND BORING LOGS,
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EXISTING GRADE
J.O'R/D.B.
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SEE SHEET ERRC10B0.
FOR EXTERIOR DITCH, SEE SHEET ERRC15B0.
FOR ACCESS ROAD DETAILS, SEE SHEET ERRC17B0.
ACCESS ROAD AND CULVERT ADDITION
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OF PUMP STATION OUTFALL MODIFICATION
SEE S-26 FOR TYPICAL SECTION AND DETAIL
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LEVEE MAINTENANCE ROAD
METER PANEL SYSTEM
7' HIGH FENCE
SURROUNDING 8'X 8'
CONCRETE PAD (SEE NOTE 2)
NEW UNDERGROUND SECONDARY SERVICE (SEE SHEET E-01)
LIGHT POLE
NEW PUMP STATION
EXIST. GATEWELL STRUCTURE
LEVEE MAINTENANCE ROAD
1V:2.5H
EXIST. GRADE
EXISTING GRADE
J.O'R/D.B.
REFERENCE DRAWINGS FOR AS-BUILT CONDITIONS AT MARSHALLTOWN
MARSHALLTOWN PUMP STATION
SITE PLAN AND MISC. DETAILS
FOR PLAN AND PROFILE AND BORING LOGS,
SEE SHEET ERRC10B0.
FOR EXTERIOR DITCH, SEE SHEET ERRC15B0.
FOR ACCESS ROAD DETAILS, SEE SHEET ERRC17B0.
ACCESS ROAD AND CULVERT ADDITION
RIP-RAP SEE S-26 FOR TYPICAL BEDDING AND DETAIL
SEE S-04b FOR SECTION AND DETAIL
OF PUMP STATION OUTFALL MODIFICATION
SEE S-26 FOR TYPICAL SECTION AND DETAIL
WORKING LIMITS
EXIST. DITCH FOR GATEWELL
EXIST. DITCH EXTENTS
OUTLET DITCH FOR PUMP STATION
EXIST. SCOUR HOLE
LEVEE MAINTENANCE ROAD
METER PANEL SYSTEM
7' HIGH FENCE
SURROUNDING 8'X 8'
CONCRETE PAD (SEE NOTE 2)
NEW UNDERGROUND SECONDARY SERVICE (SEE SHEET E-01)
LIGHT POLE
NEW PUMP STATION
EXIST. GATEWELL STRUCTURE
LEVEE MAINTENANCE ROAD
1V:2.5H
EXIST. GRADE
EXISTING GRADE
J.O'R/D.B.
REFERENCE DRAWINGS FOR AS-BUILT CONDITIONS AT MARSHALLTOWN
MARSHALLTOWN PUMP STATION
SITE PLAN AND MISC. DETAILS
FOR PLAN AND PROFILE AND BORING LOGS,
SEE SHEET ERRC10B0.
FOR EXTERIOR DITCH, SEE SHEET ERRC15B0.
FOR ACCESS ROAD DETAILS, SEE SHEET ERRC17B0.
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RIP-RAP SEE S-26 FOR TYPICAL BEDDING AND DETAIL
SEE S-04b FOR SECTION AND DETAIL
OF PUMP STATION OUTFALL MODIFICATION
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WORKING LIMITS
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EXIST. DITCH EXTENTS
OUTLET DITCH FOR PUMP STATION
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LEVEE MAINTENANCE ROAD
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7' HIGH FENCE
SURROUNDING 8'X 8'
CONCRETE PAD (SEE NOTE 2)
NEW UNDERGROUND SECONDARY SERVICE (SEE SHEET E-01)
LIGHT POLE
NEW PUMP STATION
EXIST. GATEWELL STRUCTURE
LEVEE MAINTENANCE ROAD
1V:2.5H
EXIST. GRADE
EXISTING GRADE
J.O'R/D.B.
NOTE:
PROVIDE SMOOTH TRANSITION AT ALL PVI'S

REFERENCES:
S3DRC12.DGN
FLOW 2%
2%
9'-0"
10'-0"

2. FOR ALIGNMENT, CONTROL POINT COORDINATES, AND BENCHMARKS OF WORK LIMITS, AND IMPROVEMENTS, SEE SHEET C-04.

3. FOR CULVERT EXTENSION SEE SHEETS S-01 AND S-02.

1. FOR PLAN AND PROFILE ALONG LEVEE SEE SHEET S2P3CC03.
2. FOR I-WALL, DRAINAGE STRUCTURE, AND ACCESS RAMP LAYOUT SEE SHEET S2P3CC07.
3. FOR CULVERT DETAILS SEE SHEET S2P3CC08.
4. FOR I-WALL AND DRAINAGE STRUCTURE PLAN AND PROFILE SEE SHEET S2P3CS01.
N.T.S.

TYPICAL RIPRAP BEDDING DETAIL

1. AREAS WITHIN WORK LIMITS SHALL BE CLEARED AND GRUBBED.

2. APPROXIMATE WEIGHT OF STEEL SHOWN INCLUDES TOTAL WEIGHT OF GRATING, BOLTS, ROD WITH WASHERS AND NUTS AS NEEDED.

3. MULTIPLE PIPE CULVERTS SHALL UTILIZE THE CHART "Y" DIMENSION AS SHOWN.

4. THE CONNECTOR SECTION SHALL BE ATTACHED TO THE END SECTION BY BOLTS AND SHALL BE THE SAME METAL THICKNESS AS THE END SECTION. STUB SHALL BE EITHER 68 MM (APPROX.) (H:V) 2.5:1 4 SPACES AT 9"=3'-0".

5. APPROX. WEIGHT OF STEEL=150 LBS.

6. USE IN PLANTING ZONES.

FROM DITCH EXCAVATION FOR OUTLET PROTECTION.

NOTE: STOCKPILE SUITABLE MATERIAL.

STD. PIPE CAP (TYP.)

CMP END SECTION DIMENSIONS

1 PC

4 SPACES @ 4"

4'-0" CONCRETE DIMENSION

1'-5" DIAMETER

20" I.D. PIPE OR SIDE SLOPE AREA

ADJACENT DITCH INVERT MATCH SURFACE ELEV. OF RIPRAP LESS THAN 4 FT.

4.5 FT DIA.

4.0 FT TO 20 FT.

3.5 FT. DIA.

3.0 FT. TO 12 FT.

2.5 FT. DIA.

2.0 FT. TO 8 FT.

2 FT. DIA.

ROADWAYS ARE PLACED.

REPLACEMENT OF TOP SOIL WILL NOT BE REQUIRED.

AREAS WITHIN WORK LIMITS SHALL BE CLEARED AND GRUBBED.

SEEDING SHALL BE APPLIED TO ALL SURFACES WHERE TOPSOIL WAS APPLIED, ALL SURFACES THAT WERE CLEARED AND GRUBBED, AND ALL SURFACES, EXCLUDING AGGREGATE AREAS WHERE RIPRAP OR ACCESS ROADWAYS ARE PLACED.

EXCAVATION MATERIAL MAY BE USED FOR BACKFILL, IF DEEMED SATISFACTORY ACCORDING TO THE PROVISIONS OF THE SPEC.

ALL EROSION PROTECTION SURFACES THAT WERE DAMAGED BY CONSTRUCTION OPERATIONS.

APPLIED, ALL SURFACES THAT WERE CLEARED AND GRUBBED, AND ALL SURFACES, EXCLUDING AGGREGATE AREAS WHERE RIPRAP OR ACCESS ROADWAYS ARE PLACED.

REPLACEMENT OF TOP SOIL WILL NOT BE REQUIRED.

AREAS WITHIN WORK LIMITS SHALL BE CLEARED AND GRUBBED.

SEEDING SHALL BE APPLIED TO ALL SURFACES WHERE TOPSOIL WAS APPLIED, ALL SURFACES THAT WERE CLEARED AND GRUBBED, AND ALL SURFACES, EXCLUDING AGGREGATE AREAS WHERE RIPRAP OR ACCESS ROADWAYS ARE PLACED.

EXCAVATION MATERIAL MAY BE USED FOR BACKFILL, IF DEEMED SATISFACTORY ACCORDING TO THE PROVISIONS OF THE SPEC.

ALL EROSION PROTECTION SURFACES THAT WERE DAMAGED BY CONSTRUCTION OPERATIONS.

APPLIED, ALL SURFACES THAT WERE CLEARED AND GRUBBED, AND ALL SURFACES, EXCLUDING AGGREGATE AREAS WHERE RIPRAP OR ACCESS ROADWAYS ARE PLACED.

REPLACEMENT OF TOP SOIL WILL NOT BE REQUIRED.
REFERENCES:
1. FOR LOCATION OF STAGING AREA
   SEE SHEET C-02.

SECURITY LIGHT FIXTURES
150W INCANDESCENT LAMP
WALL MOUNTED RAINTIGHT,
WEATHER RESISTANT AND
VANDAL RESISTANT

CORNER POST
(TYP)

LINE POST
(TYP)

FENCE
LINE

3' MIN

TEMPORARY FIELD OFFICE

SECURITY FENCE LAYOUT

N.T.S.
Prior to initiation of construction, the Town of Gary will require a meeting with the contractor to discuss:

A) Size and weight of trucks used for hauling material,
B) The hours of operation,
C) Liability and insurance for any damages occurring to the right-of-way,
D) Method of operations for material placement,
E) Additional coordination per specification section 1100.

Note: The plan is subject to change without prior notice.
RECREATION TRAIL RESURFACING

REFERENCES:
1. FOR GENERAL LOCATION OF RAMPS, SEE SHEET G-03.
2. FOR TYPICAL EXISTING AND RESURFACED RAMP SECTION, SEE SHEET R-07.

10 FEET BEYOND TOP OF RAMPS

RECORD DRAWING
CHIEF CONSTRUCTION DIV
DATE
WORK "AS-BUILT"
SHAMEL ABOU-EL-SEOUD   1 DEC 2005

DESIGNED BY:
DATE:

SHEET     OF  46

J.O'R/D.B.
RAMP 4
CHASE STREET - WEST ACCESS

RAMP 15
CHASE STREET - WEST ACCESS

U.S. ARMY ENGINEER DISTRICT
CHICAGO, ILLINOIS

LITTLE CALUMET RIVER, INDIANA
LOCAL FLOOD PROTECTION
Stage III Drainage Remediation
FEBRUARY 2002

U.S. ARMY CORPS
OF ENGINEERS
CHICAGO DISTRICT

SOLICITATION NUMBER:
DACW23-02-C-0010
REFERENCES:

1. FOR GENERAL LOCATION OF RAMPS, SEE SHEET G-03.
2. FOR TYPICAL EXISTING AND RESURFACED RAMP SECTION, SEE SHEET R-07.

NOTE:
RELOCATE TRAFFIC RESTRAINTS AT RAMP 7. CONTRACTOR SHALL REMOVE AND REPLACE TWO (2) FIXED BOLLARDS AND REMOVE, PROTECT AND REUSE ONE (1) REMOVABLE BOLLARD. NEW LOCATIONS OF TRAFFIC RESTRAINTS SHALL BE DETERMINED BY THE CONTRACTING OFFICER.
RECREATION TRAIL RESURFACING

GRANT ST

EXISTING TRAIL

J.O'R/D.B.

RAMP 6

GRANT STREET-EAST ACCESS

RAMP 5

GRANT STREET-WEST ACCESS

START ASPHALT PAVEMENT

NOTE: NEW ASPHALT PAVING SHALL FOLLOW AFTER CONSTRUCTION OF BOX CULVERT EXTENSION AND AFTER USE AND RESTORATION OF RAMP AS A HAUL ROUTE IS COMPLETE

NOTE: NEW ASPHALT PAVING SHALL FOLLOW AFTER USE AND RESTORATION OF RAMP AS A HAUL ROUTE IS COMPLETE

END OF ASPHALT PAVEMENT 10 FEET BEYOND TOP OF RAMPS

REFERENCES:
1. FOR GENERAL LOCATION OF RAMPS, SEE SHEET G-03.
2. FOR TYPICAL EXISTING AND RESURFACED RAMP SECTION, SEE SHEET R-07.
**VEHICLE BARRIER DETAILS**

-N.T.S.-

**SECTION A-A**

**ASPHALT PAVING NOTES:**

1. Remove limestone screening as indicated.
2. Grind, replace, and compact existing base course.
3. Apply prime coat to area to receive asphalt pavement.
4. Place and compact 2" bituminous binder 8 or 9, HV 2".
5. Apply tack coat to area receiving surface course.
6. Place and compact 1" aggregate or bituminous surface.
7. Regrade existing topsoil to cover the edges of the asphalt pavement.
8. Where removable center bollards exist, remove existing stone as necessary to maintain clearings for lock after completion of paving.

**RESURFACED RECREATION TRAIL RAMPS**

**TYPICAL SECTION**

-N.T.S.-
1. The stone for riprap shall have a weight per piece of 5 to 150 pounds with a specific gravity of 2.5 to 2.8. Thirty to seventy (30 to 70) percent of the stones shall be greater than 60 pounds per piece. No more than 5 percent of the stone shall weigh less than 5 pounds per piece. Elongated stones shall not be allowed if the ratio of the longest to shortest dimension is greater than 3.

2. Compacted Aggregate Base: Compacted aggregate base shall be Course Aggregate Class A, B, C, or D, CA No. 53, as listed in INDOT Std. Spec., Section 904.02.

FILL WITH SATISFACTORY MATERIAL TO ELEVATION 592'

SEE STRUCTURAL DRAWING S-07b

TYPICAL SECTION ACCESS RAMP

TYPICAL SECTION RECREATION TRAIL

TYPICAL RIPRAP BEDDING DETAIL

QUANTITIES

ITEM          AMOUNT
SATISFACTORY FILL 2463 CY
TOPSOIL        210 CY
SEEDING        0.26 ACRES
FINE AGGREGATE 11 TONS
CRUSHED AGGREGATE 77 TONS
ASPHALT:
SURFACE         197 SY
BINDER          197 SY
CULVERT PIPE    90 LF
RIPRAP          114 TONS

R-08
NOTES:
1. SEE SHEET C-12 FOR STRUCTURE LOCATION.
2. THERE ARE TWO EXISTING OPEN ENDED 72" DIAMETER CULVERTS. THE WEST ONE IS TO BE REMOVED AND REPLACED WITH THE CLOSED CULVERT SHOWN. THE NEW CLOSED CULVERT WILL TIE INTO THE EXISTING CLOSED CULVERT THAT CURRENTLY DISCHARGES INTO THE EXISTING DITCH.
3. THE NEW CULVERT STRUCTURE SHALL BE DOWELED INTO THE EXISTING STRUCTURES. SEE SHEET S-02.
4. ALL CAST-IN-PLACE CONCRETE SHALL BE DOWELLED INTO THE EXISTING CONCRETE FACE WITH EPOXY GROUT.
5. HATCHING INDICATES EXISTING STRUCTURES.
NOTE: FIELD VERIFY ALL EXISTING DIMENSIONS.

EXISTING ELEVATION

THE TOPS OF THE TOP AND MID RAILS SHALL LINE UP WITH THE TOPS OF THE EXISTING RAILS.

NOTE: FIELD VERIFY ALL EXISTING DIMENSIONS.

EXISTING ELEVATION

1. SEE REFERENCE SHEET S-1 FOR THE EXISTING GUARDRAIL AS-BUILT DRAWINGS.
2. ALL METAL FABRICATIONS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. FIELD VERIFY STRUCTURE DIMENSIONS PRIOR TO MISCELLANEOUS METAL FABRICATION.
4. SEE SHEET S-10 FOR LADDER DETAILS.

WELD A ROUND RING ON THE END OF THE CUT SECTION OF THE EXISTING GUARDRAIL. TOUCH UP THE WELDED METAL WITH GALVANIZE PAINT. TYPICAL FOR CUT ENDS OF EXISTING GUARDRAILS.

THE TOPS OF THE TOP AND MID RAILS SHALL LINE UP WITH THE TOPS OF THE EXISTING RAILS.

SEE SHEET S-10 FOR GRATING DETAILS.

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*EXISTING STRUCTURE*

**PLAN**

**SECTION**

**ELEVATION**

Notes:
1. All concrete clear cover shall be 3" unless otherwise noted.
2. Field verify all dimensions prior to construction.

Details:
- 3'-2" 5'-8" 1'-2"
- 1'-4"" 1'-7" 1'-0"
- 1'-8" 1'-4" 2'-8"
- 2'-6" 1'-0" 4'-0" 13'-8"
- 4'-6" 1'-0" 1'-0" 1'-4"
- 8'-5" 1'-0" 1'-0" 1'-0"
- 1'-0" 1'-0" 1'-0" 1'-4"
- 1'-0" 1'-0" 1'-0" 1'-4"

Materials:
- 1" x 12" epoxy coated dowel with an expansion cap placed as shown and spaced 12" on center.
- Lubricate the end of the epoxy dowel inserted into the expansion cap and epoxy grout the other end into the existing slab and wall.
- 9" thick expansion joint filler, typ.
- 4" clear joint sealant
- #5 @ 12" typ.
- #5 @ 6" typ.
- 16" long #5 dowels epoxy grouted into the existing structure @ 12"
- 2" clear typ.
- For 12" thick members

**DATE**

S-04b

MARSHALL TOWN PUMP STATION
OUTFALL MODIFICATION

SHAMEL ABOU-EL-SEOUD    1 DEC 2005
NOTES:
1. ALL METAL FABRICATIONS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION UNLESS OTHERWISE NOTED.
2. ALL STEEL A36 UNLESS OTHERWISE NOTED.
3. FIELD VERIFY TRASH RACK OPENING DIMENSIONS PRIOR TO FABRICATION.

MARSHALLTOWN PUMP STATION
SECTIONS AND DETAILS

DETAIL NTS

TRASH RACK

OUTSIDE BAR & BAR, TYP. PLUG WELD, TYP. OUTSIDE BAR

INSIDE BAR & BAR, TYP.

1" ROUND STEEL BAR CONTINUOUS THROUGH & FLAT OUTSIDE BAR & BAR, TYP.

NOTES:
1. ALL STEEL FABRICATIONS SHALL BE HOT-DIPPED GALVANIZED.
2. ALL STEEL A36 UNLESS OTHERWISE NOTED.
3. FIELD VERIFY TRASH RACK OPENING DIMENSIONS PRIOR TO FABRICATION.

DETAIL NTS

TRASH RACK

OUTSIDE BAR & BAR, TYP. PLUG WELD, TYP. OUTSIDE BAR

INSIDE BAR & BAR, TYP.
NOTE: GUARDRAIL NOT SHOWN FOR CLARITY.

1. SEE SHEET C-01 FOR SITE LOCATION.
2. ALL CONCRETE COVER 3" UNLESS OTHERWISE NOTED.
3. FRACTURED FINISH NOT REQUIRED ON THIS STRUCTURE
4. SEE SHEET S-10 FOR STANDARD LADDER DETAILS.
5. SEE SHEET S-10 FOR FENCE AND GRATING DETAILS.
6. SEE SHEET S-09 FOR EXPANSION JOINT (EJ) DETAILS.
7. SEE SHEET S-10 FOR TRASH RACK DETAILS.

FENCE POSTS AND FABRIC NOT SHOWN FOR CLARITY.

RECORD DRAWING
CHIEF CONSTRUCTION DIV

SHAMEL ABOU-EL-SEOUD    1 DEC 2005
TABLE 1

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GENERAL CONCRETE NOTES:

1. Top bars are horizontal bars in the top face layers of beams and slabs so placed that more than 12 inches of fresh concrete is cast below the development length or splice. All other horizontal bars in columns, walls, etc. shall be classified as other bars, unless otherwise noted on the drawings.

2. Lap splices shall not be used in location of maximum moments unless permitted on the drawings.

3. Reinforcement shall have a minimum concrete cover of 3" except as otherwise noted or shown on the drawings.

4. All exposed concrete edges shall have a 1" chapter.

5. Abbreviations: d - Bar Diameter; ldh - Development Length with Hook

VALUES OF ldh (in)

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<th>Bar Size</th>
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W/3
1. The horsepower of the storm water pumps (SP-1 & SP-2) may vary.

2. The motor control circuits including the level sensor system shall be designed in accordance with pump operation schedule.

3. The contractor shall submit MCC for approval. They shall be mounted per manufacturer's recommendation to ensure proper operation.

4. The level transducer with different pump manufacturers. The contractor shall make all required changes to the electrical system and equipment if the ratings are different from what is shown on the drawings.

5. The pump controller shall interface with the motor leakage and unit are not shown. See specifications for detail.

6. The non-reversing magnetic motor starter, and pole as shown in the drawing.

7. The catalog number SHP-4201POM53 by Marshalltown Pump Station.

8. The motor control cabinet shall be designed in accordance with pump operation schedule.

9. The motor control cabinet shall be manufactured requirements.

10. The motor control cabinet shall be installed by the utility company.

11. The 20-foot, square tapered shaft steel pole, gray paint finish.

12. The 2016.0x2880.0 page dimensions.
SOIL BORING LOG LEGEND

- UNIFIED CLASSIFICATION STANDARD OF SOILS, RECOMMENDED BY THE AMERICAN SOCIETY FOR TEST AND MATERIALS, 1984
- MODIFICATION OF SOILS LEGEND AS SHOWN
- GENERAL NOTES:
  1. WHERE THE SYMBOLS ARE REPEATED, THE EFFECTIVE LOCATION OF THE SYMBOL IS INDICATED ON THE SOIL BORING LOGS. SIMILAR SYMBOLS ARE USED TO CONVEY THE SAME MEANING.
  2. WATER LEVEL IMMEDIATELY AFTER DRILLING IS SHOWN AS A CIRCULAR MARK.
  3. WATER LEVEL AFTER 24 HRS IS SHOWN AS A SQUARE MARK.
<table>
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**LEGEND**

- **Drilling time, water loss, depth of weathering, etc., if significant:**
- **In Files:**
- **Manual Rosario:**
- **Chicago District:**
- **North Central:**
- **Manual Rosario:**
- **Installation:**
- **December 03:**

**RECORD DRAWING**

**PROJECT**

**HOLE NO.**

**DATE**

**APPROVED**

**CHECKED BY:**

**DESIGNED BY:**