9/30/2016

FARGO-MOORHEAD AREA DIVERSION

CLOMR Support Document

CLOMR Submittal

Prepared for FM Diversion Authority

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1 INTRODUCTION

1.1 PROJECT LOCATION

The cities of Fargo, located in southeast North Dakota, and Moorhead, located in northwest Minnesota, straddle the North Dakota-Minnesota border, as shown in Figure 1. The metropolitan area is located along the Red River and near the confluence of the Red and Sheyenne Rivers. The area encompasses land approximately 12 miles west to five miles east of the Red River and from 20 miles north to 20 miles south of Interstate 94. The total Fargo-Moorhead (F-M) metropolitan area is approximately 90 square miles.

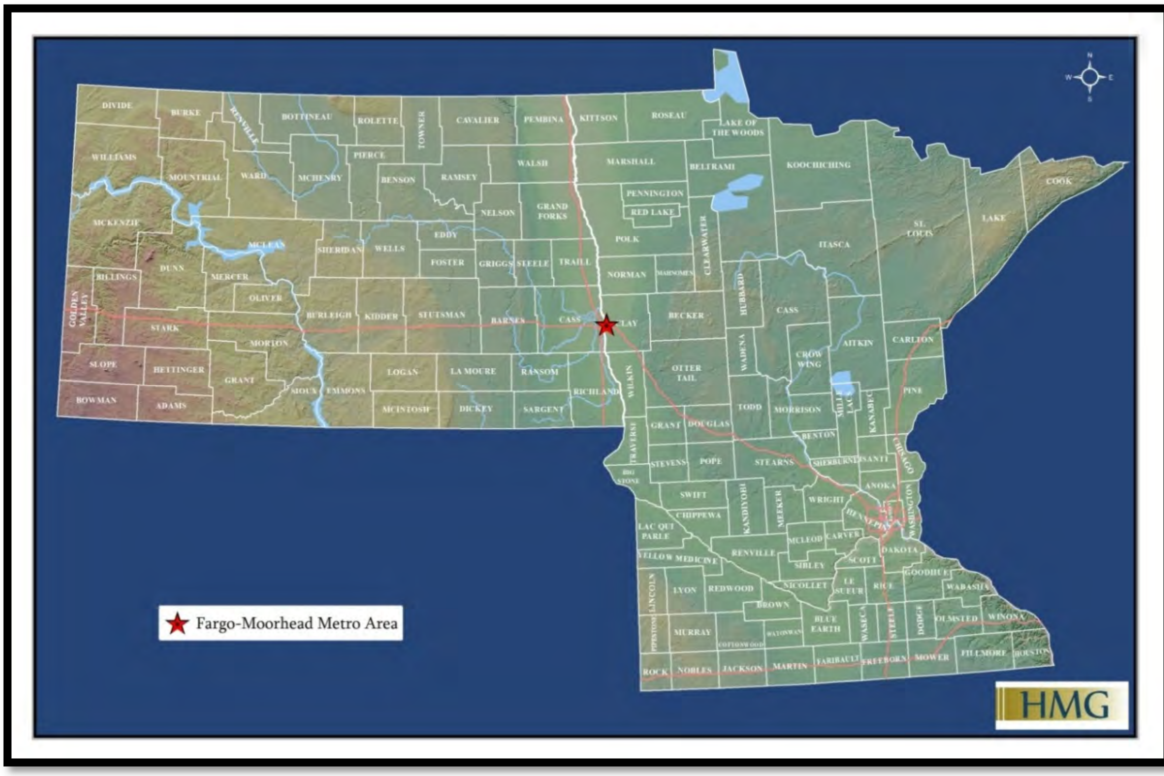


Figure 1 - Fargo-Moorhead General Location

1.2 BACKGROUND

The Red River Valley was once the bed of glacial Lake Agassiz and the resulting terrain is extremely flat and prone to flooding. The National Weather Service (NWS) has designated 18 feet as the minor flood stage at the Fargo USGS gage. This stage has been exceeded by the Red River in 49 of the past 110 years. It was exceeded consecutively from 1993 to 2011, and again in 2013. Figure 2 shows USGS hydrographs from five recent flood events. The Fargo-Moorhead metropolitan area is currently protected by several permanent levees as well as a series of emergency levees that are constructed during flood events. Although the emergency flood protection has been effective for the past flood events, the United States Army Corps of Engineers (USACE) has estimated that the damages would exceed $195 million if emergency measures were to fail during another event equivalent to the 2009 flood.

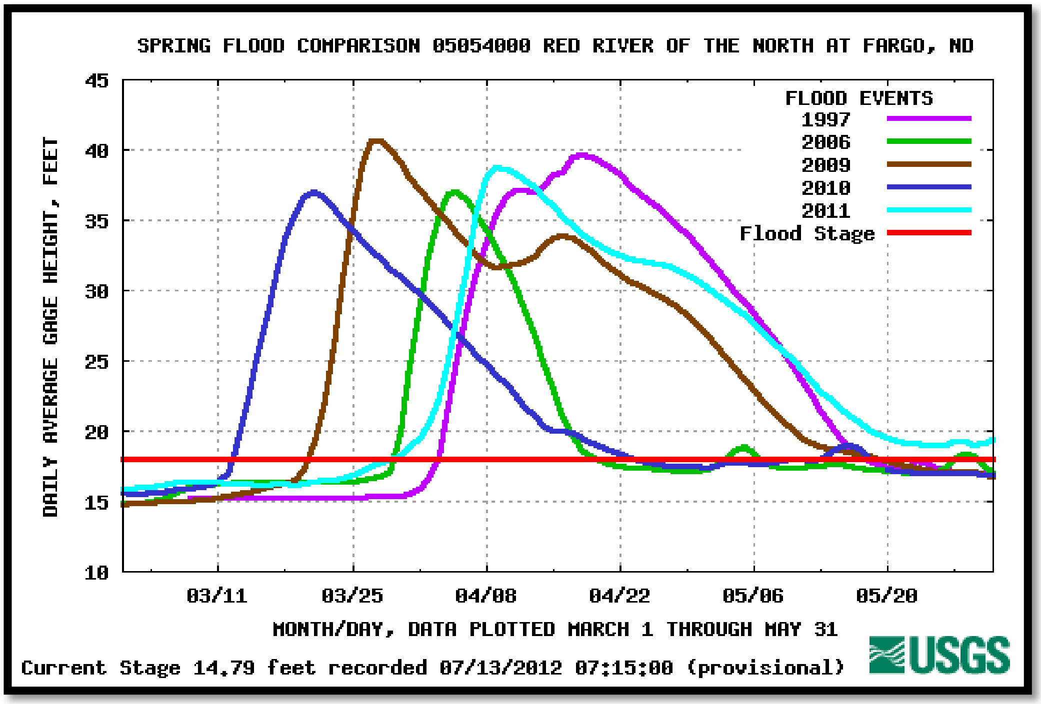


Figure 2 - Fargo USGS Gage Flood Event Comparison

***USGS Gage height can be converted to sea level by adding 861.8 feet (NGVD 1929) or 862.74 (NAVD 1988)**

According to the 2010 census, the populations of Fargo and Moorhead were 105,549 and 38,065 people, respectively. Fargo and Moorhead, along with the cities of West Fargo, Dilworth and several smaller communities, make up the metropolitan area that serves home to over 200,000 people. There was a 20 percent increase in population in the metropolitan area over the last decade.

1.3 PROJECT AUTHORIZATION

Construction of the FM Diversion Project (Project) was authorized by the U.S. Congress as part of the Water Resources Reform and Development Act of 2014, Public Law 113.121. The Diversion Authority and the USACE recognize that advancing the completion of the Project as soon as practical is critical to reducing the flood risk for the Fargo-Moorhead metropolitan area. The estimated $2.2 billion Project, which is comprised of multiple project features, has been selected by USACE as a demonstration project that will be implemented using a Split Delivery model. Under the Split Delivery model, the multiple Project features will be split into those implemented by the Diversion Authority and those implemented by the USACE as highlighted in Figure 3. The majority of the Diversion Authority's features will be delivered through a Public-Private Partnership (PPP) project, whereas the USACE intends to use traditional Design-Bid-Build (DBB) and Design-Build (DB) methods.

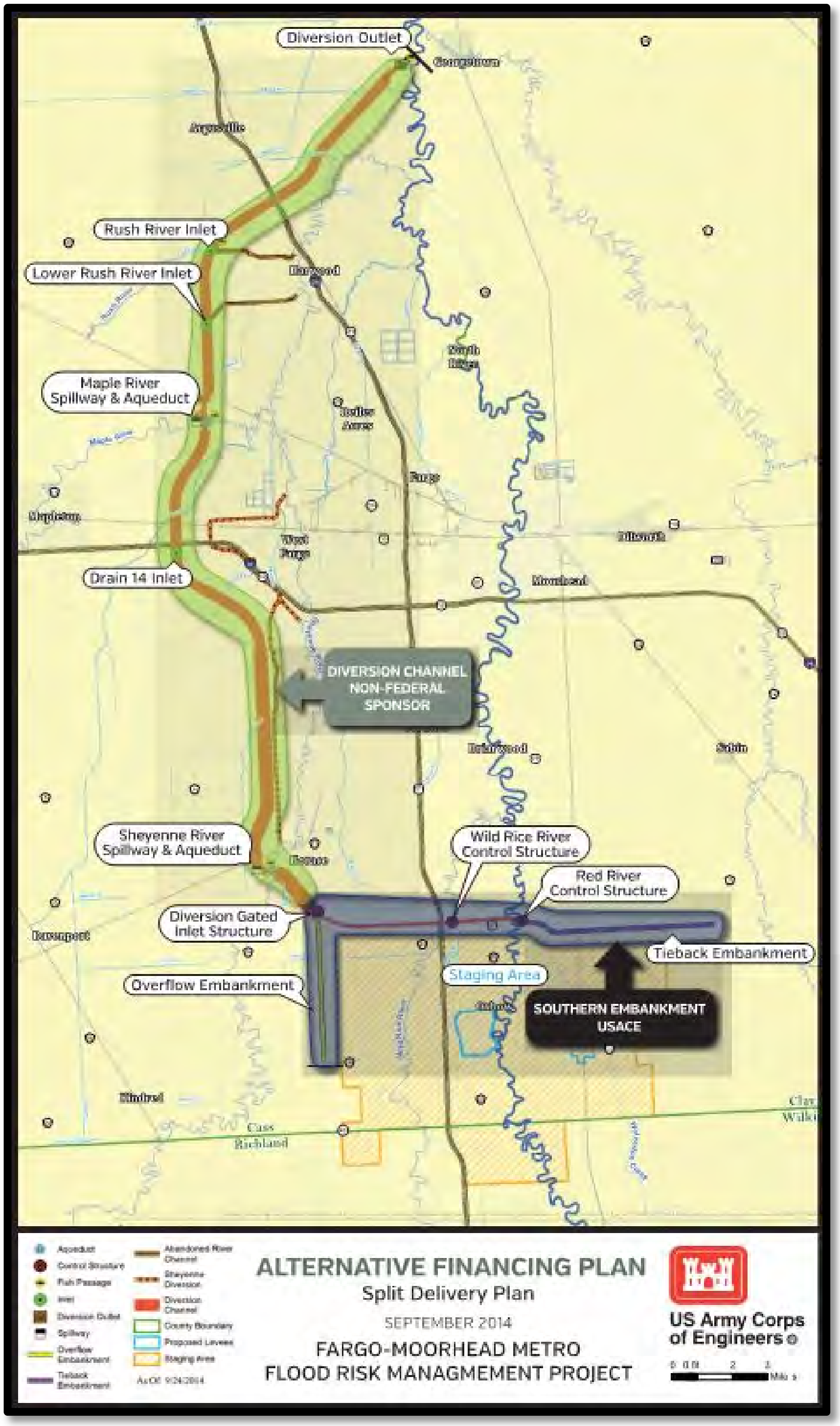


Figure 3 – Split Delivery Model breakdown

The portions of the Project that the Diversion Authority will implement through a PPP are collectively referred to as the Diversion Channel and Associated Infrastructure Work Packages (DCAI WP). The DCAI WP generally consists of 30 miles of channel, 2 aqueducts, 2 river inlets, various local drainage inlets, the channel outfall, 4 railroad bridges, 4 interstate highway bridges, and 10 county road bridges, as well as associated environmental mitigation and recreational features.

The portions of the Project that the USACE will implement through traditional DBB and DB methods are collectively referred to as the Southern Embankment and Associated Infrastructure (SEAI). The SEAI may include multiple and separate construction packages that are yet to be defined by the USACE in cooperation with the Diversion Authority. In addition, the Diversion Authority and the USACE are currently designing and constructing Mitigation and Associated Infrastructure Work Packages (MAI WP) that will not be part of the PP and will be delivered through traditional DBB or DB methods.

The communities of Fargo, ND and Moorhead, MN, along with Cass County, ND, Clay County, MN, and the Cass County Joint Water Resources District have signed a joint powers agreement that forms a Flood Diversion Board of Authority. On July 11, 2016, the Flood Diversion Board of Authority and the U.S. Army Corps of Engineers signed a Project Partnership Agreement (PPA) for the FM Area Diversion Project. The PPA is the official agreement that marks the beginning of the Diversion Project's construction phase and construction is expected to begin this fall.

1.4 PROJECT DESCRIPTION

The FM Diversion, as shown in Figure 4 primarily consists of a dam and diversion channel system including the following major components: a tieback embankment and limited service spillway; excavated channels; diversion inlet control structure; aqueducts on the Maple and Sheyenne Rivers; control structures on the Red and Wild Rice Rivers; an upstream flood water staging area (staging area); inlet control structures on tributaries; a rock ramp diversion outlet structure; the City of Oxbow, Village of Hickson, Bakke Subdivision (OHB) ring levee; Comstock ring levee; levees and floodwalls in the F-M urban area; non-structural features (such as buyout, relocation, or raising individual structures); and recreation features (such as multipurpose trails). The Project also consists of environmental mitigation projects, which would be located inside and outside the project area.

The dam would extend from high ground in Minnesota to high ground in North Dakota and would be constructed to connect the Red River, Wild Rice River, and diversion inlet control structures. The dam and control structures would impound water in an upstream staging area. The dam would be designed to meet USACE dam safety standards.

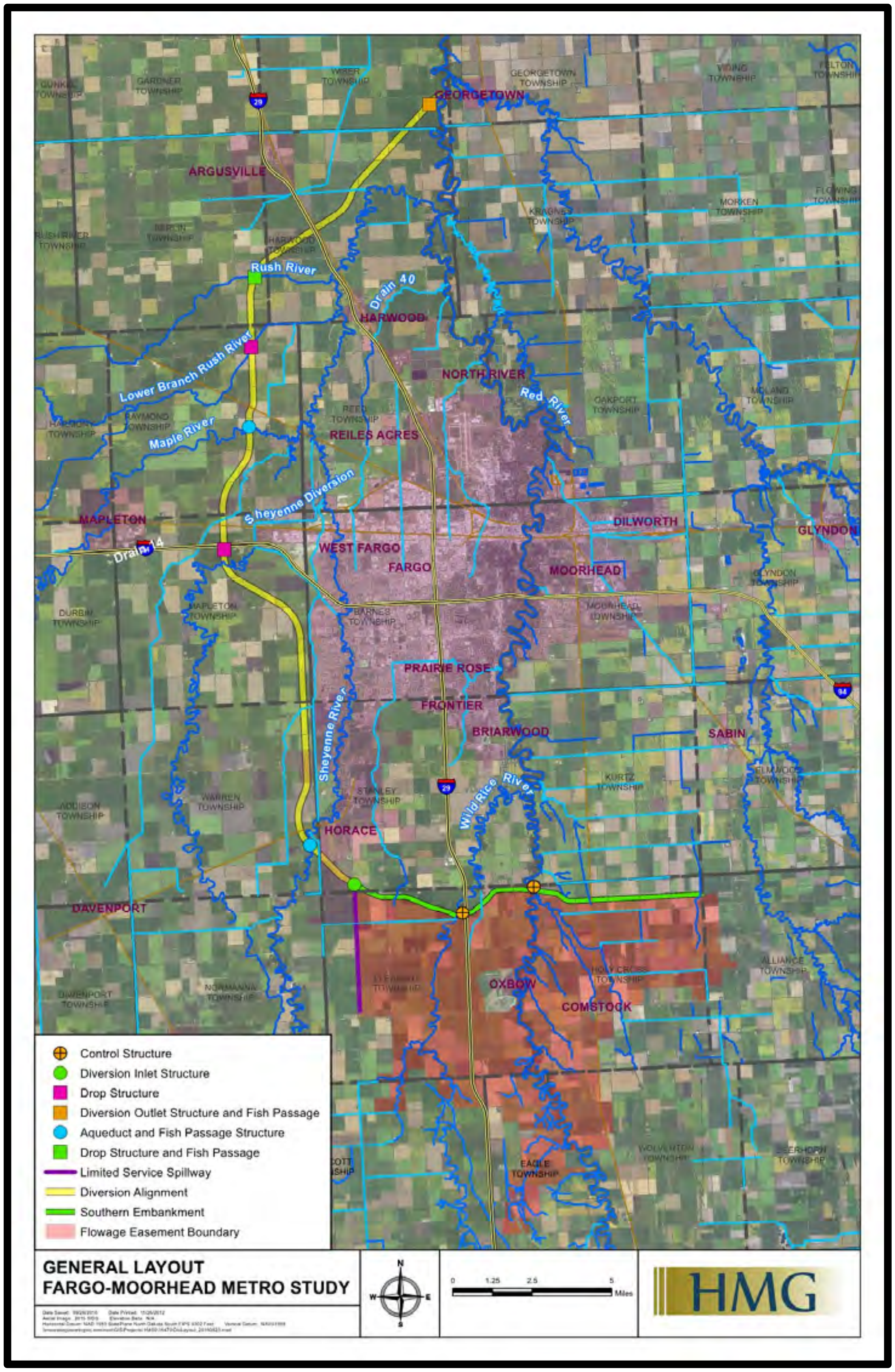


Figure 4 - General Layout Fargo-Moorhead Metro Study

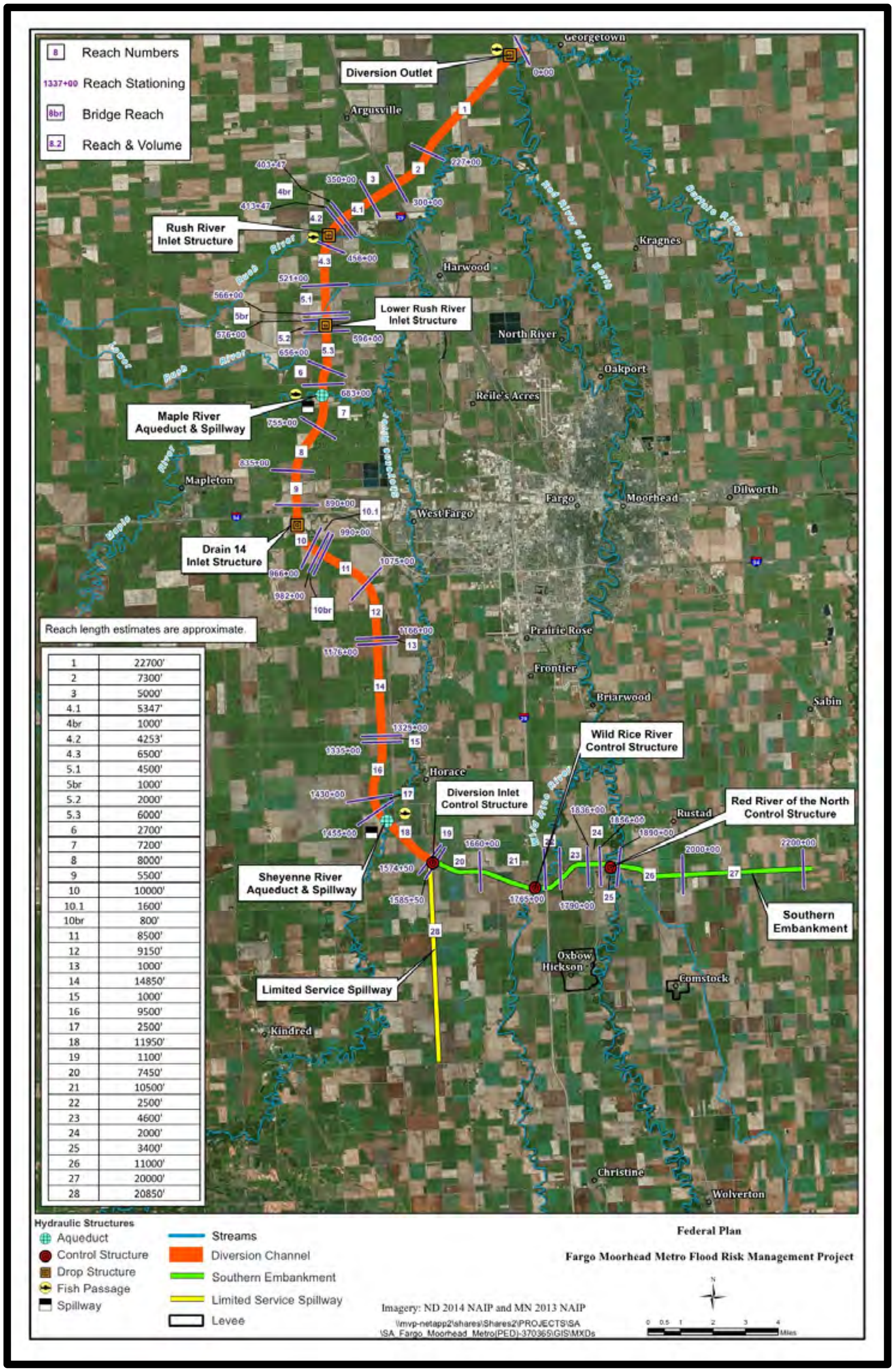
As proposed, the Project would create a 30-mile long diversion channel on the North Dakota side of the F-M area. There would be a 6-mile long connecting channel between the Red River and the diversion inlet control structure. When operated, the Project would divert a portion of the Red River flow upstream of the F-M urban area, intercept flow at the Wild Rice, Sheyenne, Maple, Lower Rush and Rush Rivers, and return it to the Red River downstream of the F-M urban area.

Operation of the Project would occur when it becomes known that a stage of 35.0 feet would be exceeded at the Fargo gage. At this stage, the flow through Fargo would be approximately 17,000 cubic feet per second (cfs). A flow of 17,000 cfs at the Fargo gage is approximately a 10-percent chance flood (10-year flood). Operation begins by partially closing the gates at the Red River and Wild Rice River control structures. Once the gates are partially closed, water would begin to accumulate in the inundation areas, south of the tieback embankment. Water would not be released through the diversion inlet control structure gates until the Red River and Wild Rice River control structures are partially closed. The diversion inlet control structure gates would be opened only after the initial diversion tributary (Sheyenne River, Maple River, Lower Rush River, and Rush River) flow peaks have made it to the diversion.

The Project would reduce flood damages and flood risk in the F-M urban area, but it would not completely eliminate flood risk. The Project would reduce flood stages on the Red River in the cities of Fargo and Moorhead and would also reduce stages on the Wild Rice, Sheyenne, Maple, Rush and Lower Rush Rivers between the Red River and the diversion channel. With the Project operational, the stage from a 100-year flood on the Red River would be reduced from approximately 42.1 feet (assuming emergency levees confine the flow) to 35.0 feet at the Fargo gage.

1.5 PROJECT COMPONENTS

The major project components that are included in this Conditional Letter of Map Revision (CLOMR) include the FM Diversion, which includes the SEAI and DCAI; the In-Town Levee Features; the OHB Levee; and the Comstock Levee. The level of design for these features varies from as-built design for features that have been constructed, to feasibility level design. The design for the SEAI and DCAI are broken down by Reach as shown in Figure 5. The design details are summarized in Design Documentation Reports (DDR), prior LOMR submittals, and the FEIS and appendices. The project features and design details are described in the following sections and design details are summarized in the tables. The digital design documents are included in the Appendices on the portable hard drive that is attached to this CLOMR submittal.



1	22700'
2	7300'
3	5000'
4.1	5347'
4br	1000'
4.2	4253'
4.3	6500'
5.1	4500'
5br	1000'
5.2	2000'
5.3	6000'
6	2700'
7	7200'
8	8000'
9	5500'
10	10000'
10.1	1600'
10br	800'
11	8500'
12	9150'
13	1000'
14	14850'
15	1000'
16	9500'
17	2500'
18	11950'
19	1100'
20	7450'
21	10500'
22	2500'
23	4600'
24	2000'
25	3400'
26	11000'
27	20000'
28	20850'

Figure 5 – FM Diversion Project Reaches

1.5.1 PROJECT COMPONENTS – FM DIVERSION

The FM Diversion includes the SEAI and DCAI project components. The following are more detailed descriptions of the major project features for the FM Diversion:

Dam

The dam includes the three control structures (i.e., Red River, Wild Rice, and Diversion Inlet) and embankments. The control structures are gated structures that span the river to control the flow of water downstream. The embankments are raised structures constructed of soil and include the tieback embankment and the Limited Service Spillway embankment.

The length of dam between high ground in Minnesota to the diversion inlet control structure would be approximately 12 miles (six miles in Minnesota and six miles in North Dakota) and would be generally in an east/west direction. A four-mile long section of the embankment that serves as a Limited Service Spillway would be built south of the diversion inlet control structure along Cass County Highway 17 (a north/south configuration).

Staging Area

The staging area will be used to store water upstream from the dam during project operation to mitigate downstream impacts. Water would begin to pool and inundate behind the dam when the Red and Wild Rice River control structure gates are partially closed to limit flows through the F-M urban area. The Red River, Wild Rice River, and Diversion Inlet control structures would be operated to raise water surface elevations to approximately 922.5 feet (North American Vertical Datum (NAVD) 88) at the diversion inlet for all events up to a 500-year flood.

The staging area boundary contains approximately 75,000 acre-feet of existing floodplain storage for the 1-percent-annual-chance flood event (i.e. 100-year flood). In order to minimize downstream impacts, an additional 150,000 acre-feet of storage would be needed. 225,000 acre-feet is the total amount of storage in the staging area for both the 100-year and the 500-year floods. Per the FEMA/USACE Coordination Plan (April 14, 2015), the aerial extent of flood inundation required by the Project for operation in the Staging Area will be mapped as floodway to ensure that the required storage volume is available for the project during the 1-percent-annual-chance flood event. Any additional flood inundation area beyond the extents of what is required by the project during the 1-percent-annual-chance event will be mapped as floodplain in order to portray the elevated flood risk outside of the required staging area.

Red River and Wild Rice River Control Structures

A gated control structure, which will consist of 3-50’ wide radial gates will be constructed adjacent to the Red River in Holy Cross Township (Clay County), Minnesota. A similar control structure, that consists of 2-40’ wide radial gates will be constructed adjacent to the Wild Rice River in Pleasant Township (Cass

County), North Dakota. The structures will be constructed adjacent to the existing channels in order to keep the sites dry during construction.

Once the control structures are built, the Red River and Wild Rice River will be rerouted through the control structures. When operated during flood events, these structures will limit flows downstream in the natural channels and cause the water to accumulate upstream from the dam.

Connecting Channel

The Project will include a six-mile long connecting channel between the Red River and the diversion inlet control structure. The connecting channel bottom width will be approximately 100 feet and will slope toward the Wild Rice and Red Rivers to drain the area upstream from the dam when flood flows have receded.

Diversion Inlet Control Structure

The diversion inlet control structure will be located near Cass County Highway 17 and consist of a 150-foot wide spillway with 3-50’ wide operable gates to control flows going into the diversion channel as highlighted in Figure 6.

Figure 6 – Diversion Inlet Structure Schematic

The main function of the Diversion Inlet Structure is to control the timing of flow releases from the staging area into the diversion channel. This control is necessary to prevent flow from the staging area from combining with tributary flows (mainly from the Sheyenne and Maple Rivers) and causing water surface elevation increases on the Red River of the North downstream of the diversion channel outlet.

As shown in Figure 5, the Diversion Inlet Structure will be located at the west end of the dam (southern embankment Sta 1587+00) just northeast of the intersection of County Road 17 and County Road 16. These two county roads will be re-routed and combined as they cross the Diversion Channel, via a bridge.

Diversion Channel

The diversion channel will start from the diversion inlet control structure near Cass County Highway 17 and extend approximately 30 miles downstream to its outlet north of the confluence of the Red and Sheyenne Rivers as shown in Figure 5. The diversion channel will route west of Horace, North Dakota and then continue north, crossing the Sheyenne, Maple, Lower Rush and Rush Rivers.

The diversion outlet structure, located where the diversion channel returns to the Red River in Wiser Township (Cass County), North Dakota, will consist of a rock ramp with a crest width of 300 feet designed to allow fish passage.

The diversion channel is designed to receive 20,000 cfs for the 100-year flood at the diversion inlet control structure and additional water from drainages intersected downstream of the inlet control structure. The diversion is designed to keep the 100-year flood flows below existing ground elevations as much as practicable to limit impacts to drainage outside the channel. The diversion channel will have a bottom width of up to 300 feet and a variable-width, low-flow channel that has been sized based on sediment transport considerations (Figure 7). The low-flow channel will meander within a 200-foot belt width within the 300-foot bottom width from just upstream of the diversion channel outlet to just downstream of the Maple River aqueduct. The meandering portion of the low-flow channel will also serve as a way of substituting for the aquatic habitat lost due to the diversion channel construction in the Lower Rush and Rush River channels between the diversion channel and the Sheyenne River.

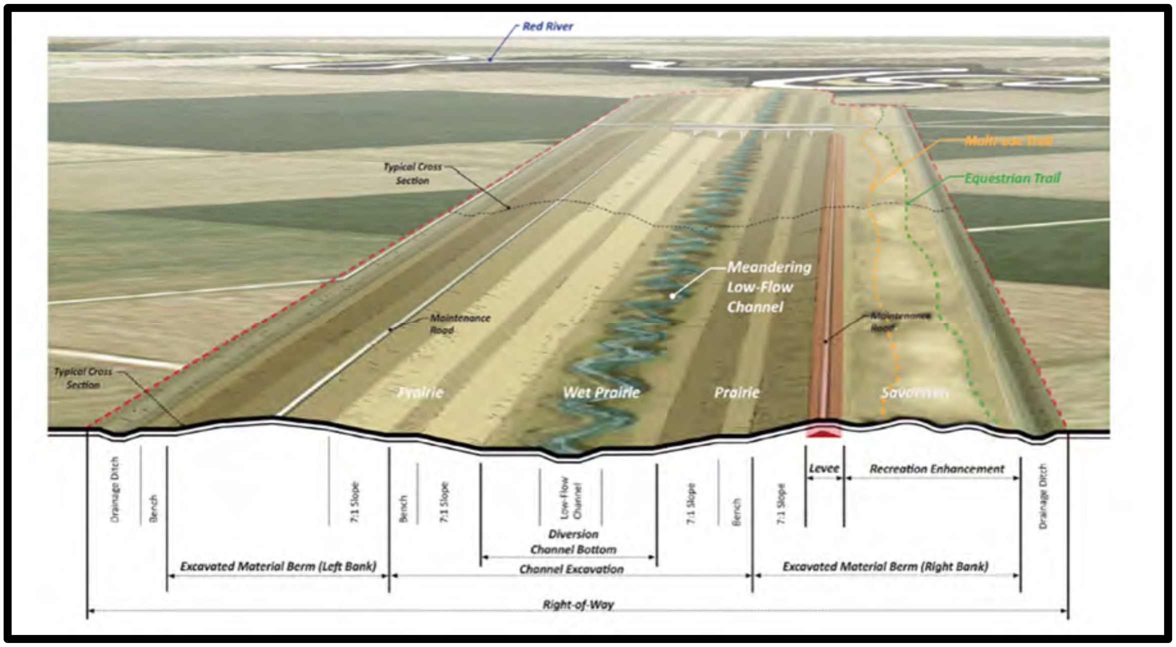


Figure 7 – Reach 1 Diversion Channel

The depth of the diversion channel will range from 15 to 25 feet deep excluding the low-flow channel and 20 to 30 feet deep including the low-flow channel. The side slopes away from the 210-foot to 300-foot bottom width and will be one vertical step to seven horizontal steps. This includes geotechnical “benches” of 0 to 30 feet wide, as needed, to provide additional stability to meet the required factors of safety.

Soil excavated from the diversion channel will be placed into excavated material berms adjacent to the channel to a typical height of 16 feet. The excavated material berms will be as wide as necessary to contain the excavated material. Portions of the berms on the east side of the channel will be constructed to serve as levees when the water surface in the channel is higher than the natural grade. The maximum width of the footprint along the diversion channel will be approximately one half mile including the diversion channel and excavated material berms.

Drainage ditches adjacent to the berms will be necessary to intercept local drainage and direct it to the nearest downstream diversion inlet control structure. The drainage ditches will run along the exterior excavated material berm toe on both sides of the diversion channel.

Maple River and Sheyenne River Aqueducts

Aqueducts (bridge-like structures that convey water over the diversion channel) will be constructed for the Maple River (Figure 8) and Sheyenne River that will allow for the continuous connectivity of these two rivers.

Figure 8 – Maple River Aqueduct Schematic

During flood events, fixed-crest weir spillways will direct flood flows into the diversion channel and allow for flows in the diversion channel to pass underneath the aqueducts while allowing the existing river bankfull (i.e., flows at which water fills the channel without overtopping the banks – the average recurrence for the Maple River is 1.16 years and 1.67 years for the Sheyenne River (West 2012)) to continue downstream. The intent of the Sheyenne and Maple River aqueducts, as planned and operated, will be to maintain biological connectivity and fish passage in the rivers. The two aqueducts are similar in concept; each includes a grade control structure to prevent headcutting on the tributary, an inlet structure to control diversion of tributary flows, heating components for cold weather operation, and an aqueduct to pass a limited flow over the diversion channel to maintain the desired downstream flow. The aqueducts will be constructed off-channel with the river diverted across the aqueduct upon completion.

Lower Rush River and Rush River Rock Ramps

At the Lower Rush River and Rush River, rock ramps will be used to continuously divert the entire flow into the diversion channel. The Lower Rush River and Rush River will be diverted into the diversion channel and no longer will flow into the Sheyenne River downstream.

Rush River Inlet Drop Structure

An inlet/drop structure at the confluence of the Rush River and diversion channel will accommodate head loss using a series of rock armored drops. This multi-drop ramp consists of a gradual drop of 1V:50H from the Rush River to the invert of the low-flow channel, and will contain a series of boulder steps to create a pool-riffle system to accommodate fish passage for all types of flow conditions. The boulder steps will consist of lines of 4-5 ft diameter boulders placed in upstream-facing arches to create the appropriate water depths and resting areas for fish passage, while also providing the required energy dissipation and erosion protection necessary for the channel outlet.

The boulder steps placed in upstream facing arches will create the appropriate depths and resting speeds for pools and to localize higher velocities to the riffles in the vicinity of the boulders. These large boulders will be partially embedded into the ground and placed on a sub-layer of base material. The rows will be spaced 30 ft apart so that each pool will drop approximately 0.6 ft as the pools descend down the overall 1V:50H slope.

Inlets, Ditches, and Smaller Control Structures

Ditches and smaller control structures will be required to accept existing drainages intersected by the diversion channel. Ditches running outside and parallel to the diversion channel will direct local drainage to a reasonable number of inlet structure locations. Existing ditches, field swales, and drain tile will be directed into these parallel ditches. The larger inlet structures will be open with concrete drop structures or rock ramps like the Lower Rush River and Rush River. The smaller inlet structures will be culvert structures with flap gates at the outlet to prevent backflow from the diversion channel after peak flows.

Uncontrolled inlet structures (inlet structures without backflow prevention) will be placed at drainages that have either natural or manmade levees which will prevent widespread flooding from diversion channel backflow for events up through the 100-year flood. The project design purpose is to maintain the existing 100-year flood floodplain in adjacent upstream drainages.

1.5.1.1 PROJECT DESIGN – FM DIVERSION

Design for the various Project components has been performed by the U.S. Army Corps of Engineers and Houston-Moore Group, serving as Design Engineers for the Flood Diversion Authority. Designs levels vary from Final Design for the Diversion Inlet Structure, to feasibility level design for other project components. Table 1-1 summarizes the Project components, the current level of design and the location of the design documents in the Appendices on the attached portable hard drive.

Table 1-1 - FM Diversion Reaches

Project Section	Design Level	Type	Stationing	Sub-Folder*
Diversion Reach 1	**95%**	**Channel**	**0+00 to 227+00**	**Diversion Reach 1/Reach 1**
	95%	Rock Spillway Outlet	30+00 to 37+25	Diversion Reach 1/Reach 1-Channel
	95%	CR31/4 Bridge/Channel	81+86 to 91+86	Diversion Reach 1/Reach 1-Bridge
Diversion Reach 2	**95%**	**Channel**	**227+00 to 300+00**	**Diversion Reach 2/ Reach 2- Channel**
Diversion Reach 3	**95%**	**Channel**	**300+00 to 350+00**	**Diversion Reach 3/ Reach 3**
	95%	I29 NB&SB Bridge/Channel	313+00 to 314+50	Diversion Reach 3/ Reach 3-Bridge Channel
	95%	BNSF Railway Bridge/Channel	311+00 to 312+50	Diversion Reach 3/ Reach 3-Bridge Channel
	95%	CR81 Bridge/Channel	309+25 to 311+00	Diversion Reach 3/ Reach 3-Bridge Channel
Diversion Reach 4	**95%**	**Channel**	**350+00 to 521+00**	**Diversion Reach 4/ Reach 4**
	95%	Channel Volume 1	350+00 to 403+47	Diversion Reach 4/ Reach 4-Channel
	95%	CR32 Bridge/Channel	403+47 to 413+47	Diversion Reach 4/ Reach 4-Bridge
	95%	Channel Volume 2	413+47 to 456+00	Diversion Reach 4/ Reach 4-Channel
	95%	Rush River Inlet Structure	429+00 to 433+00	Diversion Reach 4/ Reach 4-Channel
	95%	Channel Volume 3	456+00 to 521+00	Diversion Reach 4/ Reach 4-Channel
Diversion Reach 5	**95%**	**Channel**	**521+00 to 656+00**	**Diversion Reach 5/ Reach 5**
	95%	Channel Volume 1	521+00 to 566+00	Diversion Reach 5/ Reach 5-Channel
	95%	CR22 Bridge/Channel	566+00 to 576+00	Diversion Reach 5/ Reach 5-Bridge
	95%	Channel Volume 2	576+00 to 596+00	Diversion Reach 5/ Reach 5-Channel
	95%	Lower Rush River Inlet Structure	578+30 to 581+80	Diversion Reach 5/ Reach 5-Channel
	95%	Channel Volume 3	596+00 to 656+00	Diversion Reach 5/ Reach 5-Channel

Diversion Reach 6	**95%**	**Bridge Channel**	**656+00 to 683+00**	**Diversion Reach 6/ Reach 6**
	95%	BNSF Bridge/Channel	659+00 to 663+00	Diversion Reach 6/ Reach 6-Bridge Channel
	95%	CR20 Bridge/ Channel	676+00 to 681+00	Diversion Reach 6/ Reach 6-Bridge Channel
Diversion Reaches 7 to 18	**10%**	**Channel, Bridges, and Inlet**	**683+00 to 1574+50**	**FEIS, Supplemental EA, and PFSAA/ Reaches 7 to 18**
Maple River Aqueduct & Spillway	<35%	Aqueduct	683+00 to 755+00	Maple River Aqueduct/ Reach 7
Sheyenne River Aqueduct & Spillway	10%	Aqueduct	1475+00 to 1490+00	FEIS, Supplemental EA, and PFSAA/ Reaches 7 to 18
Diversion Inlet	**100%**	**Diversion Inlet Control Structure**	**1574+50 to 1585+50**	**Diversion Inlet/ Reach 19**
	95%	Reach 19 and CH16/17 Bridge/ Channel	1574+50 to 1585+50	Diversion Reach 19/ Reach 19
Southern Embankment and Associated	**10%**	**Dam, Connecting Channel**	**1585+50 to 2200+00**	**FEIS, Supplemental EA, and PFSAA /Reaches 20 to 27**
	10%	Wild Rice River Control Structure	1775+00 to 1795+00	FEIS, Supplemental EA, and PFSAA /Reaches 20 to 27-Channel
	10%	Red River of the North Control Structure	1860+00 to 1900+00	FEIS, Supplemental EA, and PFSAA /Reaches 20 to 27-Channel

*See digital files on the attached Portable Hard Drive under folder: FMDiversion_CLOMR_Submittal_20160930/Appendix G – Diversion Design

1.5.2 PROJECT COMPONENTS – IN-TOWN LEVEES

The Project also includes floodwalls and levees in Fargo and Moorhead, which will allow more flows to pass through town and reduce Project operation frequency. The in-town levees will be such that FEMA would be able to accredit the levees for the 100-year flood once the Project is complete. Houston-Moore Group prepared a report entitled “Final Technical Memorandum AWD-00002 – Flows through Flood Damage Reduction Area” under contract with the FM Diversion Authority in July 2012 (Included in Appendix I). Since completion of this report, the FM Diversion Authority, in conjunction with the United States Army Corps of Engineers (USACE), has selected the residual flood stage of RS35’ to be incorporated into the project design. At RS35’, there are several flood control measures within the flood damage reduction area that would need to be implemented or enhanced as detailed in the report. These have since become referred to as the “In Town Levees” component of the overall project.

The In-Town Levee component are highlighted in Figure 9 and include a combination of existing levees that have been or are in the process of being accredited by FEMA based on the Effective FEMA FIS, which has a 100-year flood stage of 39.3 feet.

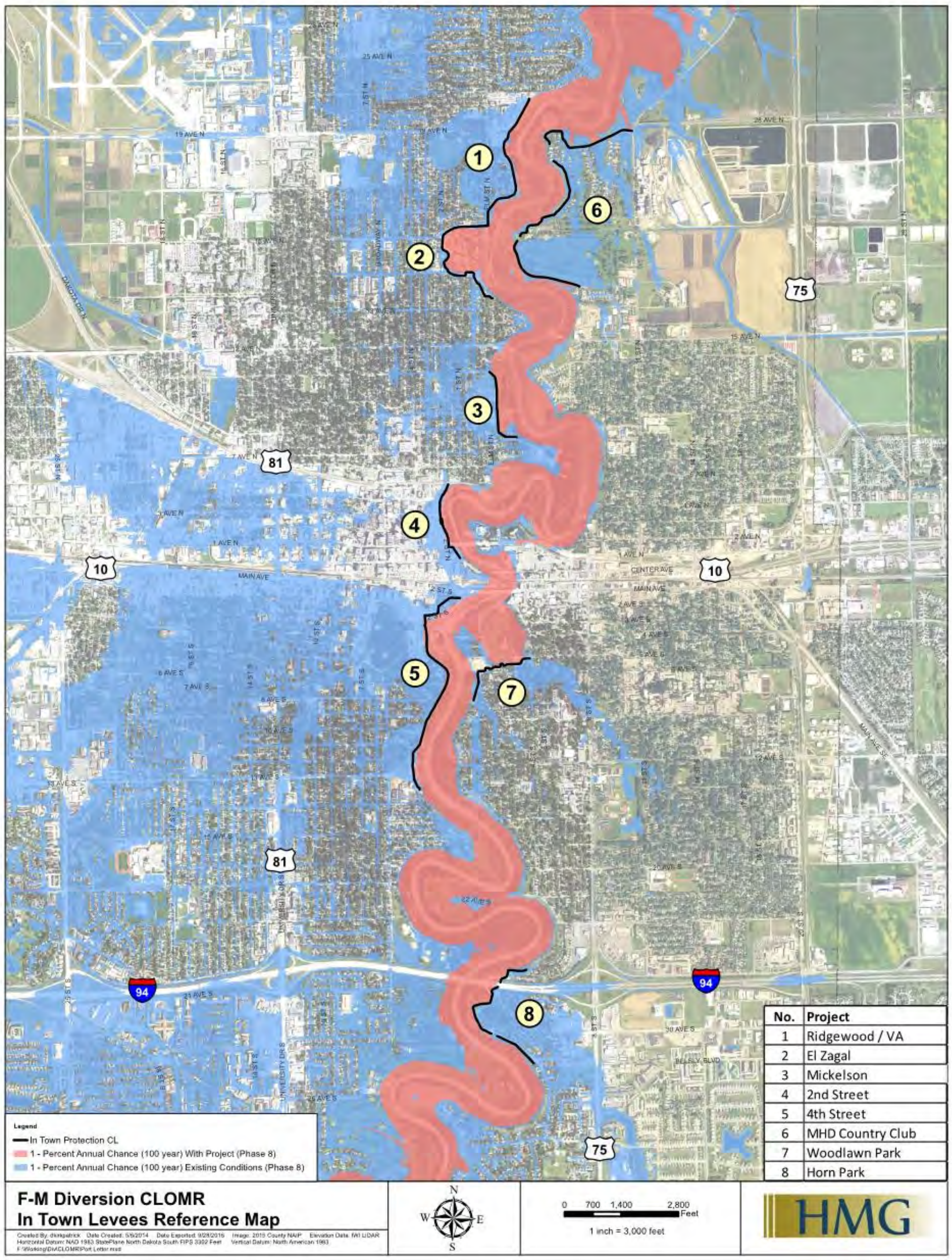


Figure 9 – In-Town Levee Features

The In-Town Levee components of the Project include:

- Ridgewood/VA Levee – An existing levee and floodwall system that has been accredited by FEMA, Region VIII. A copy of the LOMR submittal for the Ridgewood/VA project is included in Appendix I.

- Moorhead Country Club Area F1 Levee – An existing levee and floodwall system that has been submitted as a LOMR to FEMA, Region V. A copy of the LOMR submittal for Moorhead Country Club Area F1 project is included in Appendix I.

- El Zagal Area Flood Control (Work Package 42H2) – A levee and floodwall project that protects the El Zagal area of north Fargo. The Design Documentation Report for WP42H2 is included in Appendix I.

- Mickelson Field Levee and Mickelson Levee Extension (WP42I1) – An existing levee system that protects the Mickelson Field area of north Fargo. The Design Documentation Report for WP42I1, which includes the Mickelson Levee Extension is include in Appendix I. The design documents for the Mickelson Field Levee is also included as part of the DDR for WP42I1.

- 2nd Street/Downtown - The most extensive reach of the In-Town Levees would occur in the 2nd Street/Downtown Fargo area. This is essentially the area between the existing railroad embankment near 5th Avenue North and the north end of the existing 4th Street levee (near 2nd Street South). The 2nd Street/Downtown Area component of the In-Town Levees is broken down into several work packages (WP42A through WP42G) as described below and as shown in Figure 10. The Design Documentation Reports for WP42I are included in Appendix I.

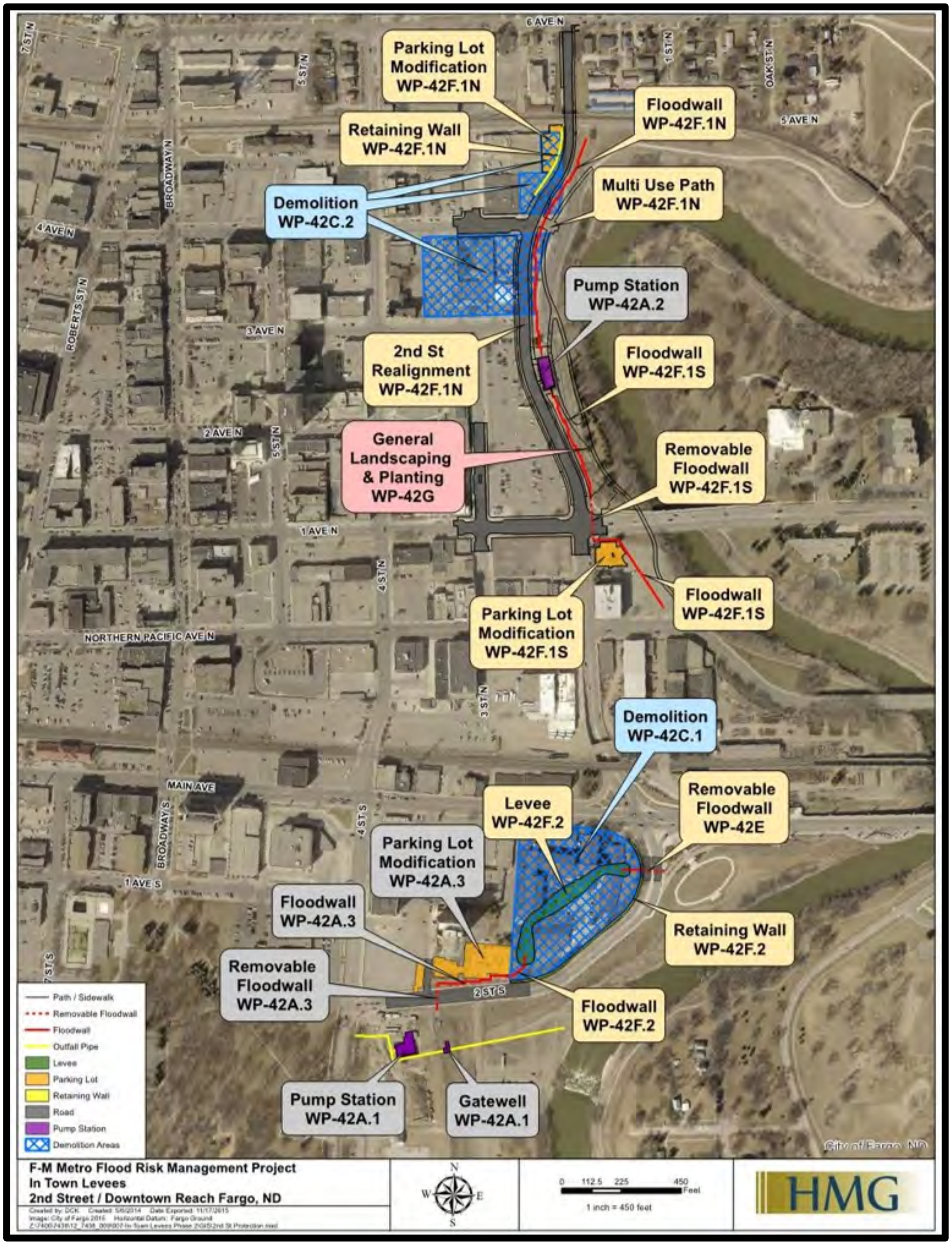


Figure 10 – 2nd Street/Downtown Work Packages

A description of the 2nd Street/Downtown components is as follows:

WP-42A.1 includes a new stormwater pump station, gatewell structure and outfall structure for the existing 4th Street Levee. The pump station is located near the intersection of 2nd Street South and 4th Street South. Replacement of the 4th Street South pump station is required to allow the passage of RS35' through the flood damage reduction area as well as to maintain FEMA accreditation for the 4th Street Levee system. Construction of WP-42A.1 began in late, 2014 and is expected to be completed in early 2017.

WP-42A.2 includes a new stormwater pump station and gatewell structure for the 2nd Street North floodwall, located near the intersection of 2nd Street North and 3rd Avenue North. The project is substantially completed.

WP-42A.3 includes flood control features associated with the southern portion (south of Main Avenue) of the 2nd Street/Downtown area of the In-Town Levees and includes the construction of an approximately 350-foot long segment of concrete floodwall along the north side of 2nd Street South near the Fargo High Rise. It also includes the construction of a structural closure on 2nd Street South near the entrance to the Fargo High Rise, removal and replacement of sanitary sewer, water main, storm sewer, and paving, along with modifications to the parking lot and access to the High Rise. The storm sewer modifications include approximately 1,165 LF of storm sewer pipe, 820 LF of 8'x5' RCBC, 18 storm sewer manholes, and 4 cast in place concrete storm sewer structures. Construction for WP-42A.3 began in November 18, 2014 and is expected to be completed in late, 2016.

WP-42E includes a new stormwater pump station and gatewell structure for the 2nd Street North underpass area located near the intersection of 2nd Street North and Main Avenue. This new pump station will replace the existing stormwater pump station in the same area. WP-42E also includes a structural closure across 2nd Street South that ties into the Main Avenue bridge floodwall. Design of WP42E is just beginning and construction will begin in 2017 or 2018.

WP-42F.1 - South includes flood control features that extend from NP Avenue to the 2nd Street North pump station (WP-42A.2) and roadway/underground utilities that extend from 1st Avenue North to 3rd Avenue North. It includes a 400 foot long segment of concrete floodwall extending from NP Avenue to 1st Avenue North; a 460 foot long segment of concrete floodwall extending from 1st Avenue North to the 2nd Street North pump station being constructed as part of WP-42A.2; a structural closure at 1st Avenue North; construction of a new stormwater outfall for the pump station being constructed as part of WP-42A.2; and 960 feet of roadway relocation for 2nd Street North and 570 feet of roadway relocation for 1st Avenue North. Construction of WP-42F.1-South began in fall, 2015 and should be substantially complete in late 2016 or early 2017.

WP42-F.1-North includes flood control features that extend from the 2nd Street North Pump Station (WP-42A.2) to near the BNSF Railway grade and roadway/underground utilities that extend from 3rd Avenue North to the BNSF Railway. It includes an 865-foot long segment of concrete floodwall extending from 3rd Avenue North to the BNSF Railway grade; a structural closure at 4th Avenue North; construction of 350 feet of concrete retaining wall along the west side of 2nd Street North; and 1340 feet of roadway construction and relocation for 2nd Street North and 4th Avenue North. Construction of WP-42F.1-North began in spring 2016 and is expected to be completed in 2017.

WP-42F.2 includes the construction of an approximately 80 foot long segment of concrete floodwall extending from the existing concrete floodwall constructed as part of WP42A.3 and approximately 600 feet of earth levee across the Park East Apartments site; and underground utilities. Construction of WP-42F.2 began in summer 2016.

WP-42G includes recreation and landscaping feature associated with the 2nd Street/Downtown area of the In-Town Levees. Construction of WP-42G will begin in 2017 or 2018.

- Woodlawn Park Levee – An existing levee system near downtown Moorhead, MN that has been accredited by FEMA, Region V. A copy of the LOMR submittal for Woodlawn Park is included in Appendix I.

- Horn Park Area Levee – An existing levee and floodwall system in south Moorhead, MN that has been accredited by FEMA, Region V. A copy of the LOMR submittal for Horn is included in Appendix I.

- 4th Street Levee – An existing levee and floodwall that is Provisionally Accredited and going through the Re-accreditation process with FEMA, Region VIII. A copy of the design report for the 4th Street Levee is included in Appendix I.

Design for the various In-Town Levee Project components was performed by Houston-Moore Group, serving as Design Engineers for the Flood Diversion Authority; consultants working for the City of Fargo (4th Street, Mickelson Field Levee, and portions of El Zagal) or City of Moorhead (Moorhead Country Club Area F1; Horn Park; and Woodlawn Park); and the USACE – St. Paul District (Ridgewood/VA). Table 2-1 summarizes the Project components, the current level of design and the location of the design documents in Appendix I.

Table 1-2 - In-Town Levees Sections

Reference No.	Sub Ref. No.	Project Title	Plan Set Name	Model Stationing Upstream	Model Stationing Downstream	Sub-Folder*
1		**Ridgewood/VA**	**Ridgewood Flood Control Project**	**2359755**	**2364089**	**/Ridgewood_VA_LOMR/ Levee Certification Submittal**
2		**El Zagal**		**2364089**	**2365587**	
	2a		El Zagal Area Flood Risk Management- Phase 1	2364089	2365287	/El Zagal-Phase 1
	2b		FM Metro Flood Risk Management-In-Town Levees El Zagal Area- Phase 2	2365287	2365587	/El Zagal- Phase 2
3		**Mickelson**		**2369656**	**2371080**	
	2a	Mickelson Field Levee	Mickelson Field Area Flood Risk Management Project	2369656	2370874	/Mickelson
	2b	Mickelson Extension	Mickelson Levee Extension	2370874	2371080	/Mickelson Extension
4		**2nd Street/Downtown-In-Town-Levees**		**2380030**	**2381550**	
	4a		2nd Street N Floodwall Project No. WP-42F.1.N	2380030	2380150	/2nd Street_Downtown/WP
	4b		2nd Street N Pump Station Project No. WP-42A.2	2380585	2380690	/2nd Street_Downtown/WP
	4c		2nd Street N Floodwall Project No. WP-42F.1.S	2380150	2381550	/2nd Street_Downtown/WP
	4d		Park East Apartment Flood Mitigation Project No. WP-42F.2	2383968	2384551	/2nd Street_Downtown/WP
	4e		4th Street Pump Station & 2nd Street S Floodwall Project Nos. WP-42A.3 and	2384551	2384610	/2nd Street_Downtown/WP
5		**4th Street**		**2384610**	**2388800**	
	5a		Operation and Maintenance Manual Appendix A (1962)	2384610	2387371	/4th Street Levee/OMM
	5b		4th Street Dike Improvements (1997)	2387371	2388491	/4th Street Levee/Dike Improvement
	5c		Flood Protection Project No. 5909	2384610	2387521	/4th Street Levee/5909 Road Raise

	5d		4th Street Flood Risk Management Phase 1	2384610	2387521	/4th Street Levee
	5e		4th Street Flood Risk Management Phase 2	2388061	2388800	/4th Street Levee
	5f		4th Street Flood Risk Management Phase 3	2387521	2388061	/4th Street Levee
6		**Moorhead Country Club**	**Country Club Area LOMR**	**2357783**	**2367250**	**/Moorhead Country Club_LOMR**
7		**Woodlawn Park**	**Woodlawn Park Area LOMR**	**2385855**	**2386442**	**/Woodlawn Park_LOMR**
8		**Horn Park**	**Horn Park Area LOMR**	**2400047**	**2404553**	**/Horn Park_LOMR**

*See digital files on the attached Portable Hard Drive under folder:
FMDiversion_CLOMR_Submittal_20160930/Appendix I-In_Town Levee Design

1.5.3 PROJECT COMPONENTS – OXBOW/HICKSON/BAKKE (OHB) RING LEVEE

Under Project operation, the City of Oxbow, Village of Hickson, and Bakke Subdivision (OHB) in North Dakota would be inundated up to eight feet during the 100-year flood. A ring levee around these communities was proposed by the USACE in the Supplemental EA as a modification to the Project to address these impacts. The OHB ring levee would be constructed to the Project operation elevation for the 100-year flood plus four feet of freeboard (Figure 11). OHB ring levee construction also requires roadway modifications. The existing sanitary sewer system, water main, and storm sewer system would be modified to accommodate the ring levee and new residential areas.

The OHB Ring Levee design would be distributed into 3 levee design packages, an interior flood control and road raise package, and a demolition and utility relocation package, as shown in Figure 11. The United States Army Corps of Engineers (USACE) is completing the design of Work Package 43B (WP-43B) while Houston-Moore Group (HMG) is completing the other 4 Work Packages.

WP-43A

WP-43A is the levee portion on the south side of the City of Oxbow that will surround the new residential lots and golf course area. The east boundary of WP-43A parallels the Red River beginning at the existing southern limits of the City of Oxbow, while the south boundary of WP-43A runs adjacent to and north of County Road 18. The west boundary of WP-43A design ends 365 feet east of County Road 81; however, WP-43A will be constructed in two phases. The first phase will be built in 2014. This phase will begin at the City of Oxbow and will end east of County Road 81. There will be an opening left in the levee at the existing drainage swale to allow the swale to stay in operation until WP-43B can be constructed which will include the realignment of the existing swale around the outside of the WP-43B Ring Levee. WP-43B will include the Phase 2 construction of WP-43A levee in 2017. The total length of levee is 6,758 feet with

6,608 feet being constructed in 2014 and 150 feet being constructed in 2017. HMG is designing both phases of the OHB Ring Levee Project.

WP-43B

WP-43B is the levee portion on the west side of County Road 81 and around the Bakke Subdivision. The west boundary of WP-43B runs through an existing agricultural field beginning 365 feet east of the intersection of County Roads 18 and 81 to the west side of the Bakke Subdivision. The north boundary of WP-43B runs parallel on the north side of the Bakke Subdivision and ends 1,200 east of Main Street. The total length of levee is 11,900 feet. The USACE is designing this portion of the OHB Ring Levee Project. As stated above, a portion of WP-43A levee will not be built in 2014 to allow the existing drainage swale to stay in operation. The construction contract for WP-43B will include this portion of levee from the 43A Work Package in order to complete the overall project in 2017.

WP-43C

WP-43C is the levee portion on the east side of the City of Oxbow that will run adjacent to the Red River. WP-43C will be constructed in two phases similar to WP-43A. The first phase will be built in 2016, beginning at County Road 81 on the northeastern portion of the OHB Ring Levee where WP-43B ends and ending at the existing southern limits of the City of Oxbow where WP-43A begins. There will be an opening left in the levee at levee station C28+00 to allow the existing golf course to stay in operation until all features of the OHB ring levee can be constructed and the new golf course holes are established. WP-43B will include the Phase 2 construction of WP-43C levee in 2017. The total length of levee is 4,633 feet with 4,348 feet being constructed in 2016 and 285 feet being constructed in 2017. HMG is designing this portion of the OHB Ring Levee Project.

Table 1-3 summarizes the Project Components of the OHB ring levee and the location of design documents in Appendix H.

Figure 11 - OHB Ring Levee Work Packages

Table 1-3 – Oxbox/Hickson/Bakke Sections

Phase	Work Package	Design Level	Type	Levee Stationing	Sub-Folder*
Phase A	WP 43A	Built	Levee	A1+00 to A56+90 A58+40 to A67+58	/WP-43A
Phase B	WP 43B	95% 65%	Levee	B5+68 to B73+80 B73+80 to B119+00	/WP43B
Phase C	WP 43C	Post 95%	Levee	C0+00 to C46+33	/WP-43C
Phase D	WP 43D	BCOE BCOE 65%	Levee	B0+00 to B5+68 B119+00 to B124+58 A56+90 to A58+40 B124+58 to B128+06	/WP-43D

*See digital files on the attached Portable Hard Drive under folder: FMDiversion_CLOMR_Submittal_20160930/Appendix H – OHB Design

1.5.4 PROJECT COMPONENTS – COMSTOCK LEVEE

A ring levee would be also constructed around the city of Comstock, Minnesota, which under existing conditions, is located outside of the 100-year floodplain. Operation of the Project would cause new inundation in this community during and above the 100-year flood. The design of the Comstock Ring Levee is conceptual at this time. The details that follow are subject to revision pending further design and coordination between the Diversion Authority and the City of Comstock. Clay County Highway 2 would be raised at both places where it crosses the ring levee. The Burlington Northern Santa Fe (BNSF) Moorhead Subdivision Rail Line on the north and south side would require protection measures above a 100-year flood.

Table 1-3 summarizes the project components of the Comstock Levee and their location in Appendix J.

Table 1-4 - Comstock Levee Sections

Project Section	Plan Set
Comstock Ring Levee	Preliminary Design Documents (Dated 6-17-13)

2 SUPPLEMENTAL INFORMATION FOR MT-2 FORMS

2.1 FORM 1 – OVERVIEW AND CONCURANCE FORM

2.1.1 A. REQUESTED RESPONSE FROM DHS-FEMA

This is a CLOMR request

2.1.2 B. OVERVIEW:

1. The panels affected are

Table 2-1 Affected NFIP Map Panels

CID	POL_NAME1	State	Map_Number	FIRM_PAN	EFF_DATE
380022	City of Horace	ND	38017C	0762G	1/16/2015
380022	City of Horace	ND	38017C	0764G	1/16/2015
380022	City of Horace	ND	38017C	0766G	1/16/2015
380022	City of Horace	ND	38017C	0767G	1/16/2015
380022	City of Horace	ND	38017C	0768G	1/16/2015
380022	City of Horace	ND	38017C	0769G	1/16/2015
380022	City of Horace	ND	38017C	0790G	1/16/2015
380022	City of Horace	ND	38017C	0955H	9/9/9999
380022	City of Horace	ND	38017C	0957G	1/16/2015
380022	City of Horace	ND	38017C	0960G	1/16/2015
380022	City of Horace	ND	38017C	0980G	1/16/2015
380024	City of West Fargo	ND	38017C	0555H	9/9/9999
380024	City of West Fargo	ND	38017C	0558G	1/16/2015
380024	City of West Fargo	ND	38017C	0559G	1/16/2015
380024	City of West Fargo	ND	38017C	0565G	1/16/2015
380024	City of West Fargo	ND	38017C	0566G	1/16/2015
380024	City of West Fargo	ND	38017C	0567G	1/16/2015
380024	City of West Fargo	ND	38017C	0568G	1/16/2015

380024	City of West Fargo	ND	38017C	0569G	1/16/2015
380024	City of West Fargo	ND	38017C	0588G	1/16/2015
380024	City of West Fargo	ND	38017C	0754G	1/16/2015
380024	City of West Fargo	ND	38017C	0755G	1/16/2015
380024	City of West Fargo	ND	38017C	0756G	1/16/2015
380024	City of West Fargo	ND	38017C	0757G	1/16/2015
380024	City of West Fargo	ND	38017C	0758G	1/16/2015
380024	City of West Fargo	ND	38017C	0759G	1/16/2015
380024	City of West Fargo	ND	38017C	0762G	1/16/2015
380024	City of West Fargo	ND	38017C	0766G	1/16/2015
380024	City of West Fargo	ND	38017C	0767G	1/16/2015
380024	City of West Fargo	ND	38017C	0776G	1/16/2015
380257	Township of Reed	ND	38017C	0556G	1/16/2015
380257	Township of Reed	ND	38017C	0558G	1/16/2015
380257	Township of Reed	ND	38017C	0559G	1/16/2015
380258	Township of Stanley	ND	38017C	0957G	1/16/2015
380258	Township of Stanley	ND	38017C	0960G	1/16/2015
380258	Township of Stanley	ND	38017C	0980G	1/16/2015
380258	Township of Stanley	ND	38017C	0985G	1/16/2015
380259	Township of Harwood	ND	38017C	0365H	9/9/9999
380259	Township of Harwood	ND	38017C	0370G	1/16/2015
380259	Township of Harwood	ND	38017C	0380H	9/9/9999
380259	Township of Harwood	ND	38017C	0390G	1/16/2015
380259	Township of Harwood	ND	38017C	0395G	1/16/2015
380259	Township of Harwood	ND	38017C	0555H	9/9/9999
380259	Township of Harwood	ND	38017C	0556G	1/16/2015
380259	Township of Harwood	ND	38017C	0557G	1/16/2015
380259	Township of Harwood	ND	38017C	0576G	1/16/2015
380259	Township of Harwood	ND	38017C	0577G	1/16/2015
380261	Township of Raymond	ND	38017C	0555H	9/9/9999
380261	Township of Raymond	ND	38017C	0556G	1/16/2015
380261	Township of Raymond	ND	38017C	0558G	1/16/2015
380261	Township of Raymond	ND	38017C	0565G	1/16/2015
380262	Township of Mapleton	ND	38017C	0754G	1/16/2015
380262	Township of Mapleton	ND	38017C	0755G	1/16/2015
380262	Township of Mapleton	ND	38017C	0762G	1/16/2015
380263	Township of Pleasant	ND	38017C	0960G	1/16/2015
380263	Township of Pleasant	ND	38017C	0970G	1/16/2015
380263	Township of Pleasant	ND	38017C	0980G	1/16/2015
380263	Township of Pleasant	ND	38017C	0985G	1/16/2015

380263	Township of Pleasant	ND	38017C	0990G	1/16/2015
380263	Township of Pleasant	ND	38017C	0995G	1/16/2015
380264	Township of Normanna	ND	38017C	0955H	9/9/9999
380264	Township of Normanna	ND	38017C	0960G	1/16/2015
380264	Township of Normanna	ND	38017C	0970G	1/16/2015
380265	Township of Warren	ND	38017C	0762G	1/16/2015
380265	Township of Warren	ND	38017C	0764G	1/16/2015
380265	Township of Warren	ND	38017C	0768G	1/16/2015
380265	Township of Warren	ND	38017C	0955H	9/9/9999
380267	Township of Wiser	ND	38017C	0380H	9/9/9999
380324	City of Reiles Acres	ND	38017C	0559G	1/16/2015
380324	City of Reiles Acres	ND	38017C	0567G	1/16/2015
380324	City of Reiles Acres	ND	38017C	0578G	1/16/2015
380324	City of Reiles Acres	ND	38017C	0586G	1/16/2015
380338	City of Harwood	ND	38017C	0370G	1/16/2015
380338	City of Harwood	ND	38017C	0390G	1/16/2015
380338	City of Harwood	ND	38017C	0556G	1/16/2015
380338	City of Harwood	ND	38017C	0557G	1/16/2015
380338	City of Harwood	ND	38017C	0558G	1/16/2015
380338	City of Harwood	ND	38017C	0559G	1/16/2015
380338	City of Harwood	ND	38017C	0576G	1/16/2015
380338	City of Harwood	ND	38017C	0578G	1/16/2015
380347	City of Frontier	ND	38017C	0787G	1/16/2015
380620	Township of Berlin	ND	38017C	0365H	9/9/9999
380620	Township of Berlin	ND	38017C	0555H	9/9/9999
380623	City of North River	ND	38017C	0583G	1/16/2015
380639	City of Argusville	ND	38017C	0362G	1/16/2015
380639	City of Argusville	ND	38017C	0365H	9/9/9999
380639	City of Argusville	ND	38017C	0370G	1/16/2015
380651	City of Briarwood	ND	38017C	0791G	1/16/2015
380655	City of Prairie Rose	ND	38017C	0779G	1/16/2015
380681	City of Oxbow	ND	38017C	0990G	1/16/2015
380681	City of Oxbow	ND	38017C	0995G	1/16/2015
385364	City of Fargo	ND	38017C	0559G	1/16/2015
385364	City of Fargo	ND	38017C	0567G	1/16/2015
385364	City of Fargo	ND	38017C	0569G	1/16/2015
385364	City of Fargo	ND	38017C	0576G	1/16/2015
385364	City of Fargo	ND	38017C	0577G	1/16/2015
385364	City of Fargo	ND	38017C	0578G	1/16/2015
385364	City of Fargo	ND	38017C	0579G	1/16/2015

385364	City of Fargo	ND	38017C	0583G	1/16/2015
385364	City of Fargo	ND	38017C	0586G	1/16/2015
385364	City of Fargo	ND	38017C	0587G	1/16/2015
385364	City of Fargo	ND	38017C	0588G	1/16/2015
385364	City of Fargo	ND	38017C	0589G	1/16/2015
385364	City of Fargo	ND	38017C	0591G	1/16/2015
385364	City of Fargo	ND	38017C	0592G	1/16/2015
385364	City of Fargo	ND	38017C	0593G	1/16/2015
385364	City of Fargo	ND	38017C	0594G	1/16/2015
385364	City of Fargo	ND	38017C	0757G	1/16/2015
385364	City of Fargo	ND	38017C	0759G	1/16/2015
385364	City of Fargo	ND	38017C	0767G	1/16/2015
385364	City of Fargo	ND	38017C	0769G	1/16/2015
385364	City of Fargo	ND	38017C	0776G	1/16/2015
385364	City of Fargo	ND	38017C	0777G	1/16/2015
385364	City of Fargo	ND	38017C	0778G	1/16/2015
385364	City of Fargo	ND	38017C	0779G	1/16/2015
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385364	City of Fargo	ND	38017C	0783G	1/16/2015
385364	City of Fargo	ND	38017C	0784G	1/16/2015
385364	City of Fargo	ND	38017C	0786G	1/16/2015
385364	City of Fargo	ND	38017C	0787G	1/16/2015
385364	City of Fargo	ND	38017C	0790G	1/16/2015
385364	City of Fargo	ND	38017C	0791G	1/16/2015
385364	City of Fargo	ND	38017C	0795G	1/16/2015
385364	City of Fargo	ND	38017C	0957G	1/16/2015
385364	City of Fargo	ND	38017C	0960G	1/16/2015
385364	City of Fargo	ND	38017C	0980G	1/16/2015
385364	City of Fargo	ND	38017C	0985G	1/16/2015
270079	City of Comstock	MN	27027C	0620E	4/17/2012
270079	City of Comstock	MN	27027C	0640E	4/17/2012
270080	City of Dilworth	MN	27027C	0338E	4/17/2012
270082	City of Georgetown	MN	27027C	0158E	4/17/2012
275235	Clay County	MN	27027C	0155E	4/17/2012
275235	Clay County	MN	27027C	0158E	4/17/2012
275235	Clay County	MN	27027C	0165E	4/17/2012
275235	Clay County	MN	27027C	0170E	4/17/2012
275235	Clay County	MN	27027C	0305E	4/17/2012
275235	Clay County	MN	27027C	0306E	4/17/2012

275235	Clay County	MN	27027C	0307E	4/17/2012
275235	Clay County	MN	27027C	0308E	4/17/2012
275235	Clay County	MN	27027C	0309E	4/17/2012
275235	Clay County	MN	27027C	0316E	4/17/2012
275235	Clay County	MN	27027C	0317E	4/17/2012
275235	Clay County	MN	27027C	0319E	4/17/2012
275235	Clay County	MN	27027C	0338E	4/17/2012
275235	Clay County	MN	27027C	0340E	4/17/2012
275235	Clay County	MN	27027C	0458E	4/17/2012
275235	Clay County	MN	27027C	0459E	4/17/2012
275235	Clay County	MN	27027C	0470E	4/17/2012
275235	Clay County	MN	27027C	0610E	4/17/2012
275235	Clay County	MN	27027C	0620E	4/17/2012
275235	Clay County	MN	27027C	0630E	4/17/2012
275235	Clay County	MN	27027C	0635E	4/17/2012
275235	Clay County	MN	27027C	0640E	4/17/2012
275235	Clay County	MN	27027C	0645E	4/17/2012
275244	City of Moorhead	MN	27027C	0317E	4/17/2012
275244	City of Moorhead	MN	27027C	0319E	4/17/2012
275244	City of Moorhead	MN	27027C	0338E	4/17/2012
275244	City of Moorhead	MN	27027C	0340E	4/17/2012
275244	City of Moorhead	MN	27027C	0456E	4/17/2012
275244	City of Moorhead	MN	27027C	0457E	4/17/2012
275244	City of Moorhead	MN	27027C	0458E	4/17/2012
275244	City of Moorhead	MN	27027C	0459E	4/17/2012
275244	City of Moorhead	MN	27027C	0470E	4/17/2012
380098	Richland County	ND	38077C	0240D	12/18/2009
380291	City of Christine	ND	38077C	0235D	12/18/2009
380340	Township of Walcott	ND	38077C	0095D	12/18/2009
380340	Township of Walcott	ND	38077C	0125D	12/18/2009
380340	Township of Walcott	ND	38077C	0210D	12/18/2009
380340	Township of Walcott	ND	38077C	0230D	12/18/2009
380340	Township of Walcott	ND	38077C	0240D	12/18/2009
380688	Township of Eagle	ND	38077C	0125D	12/18/2009
380688	Township of Eagle	ND	38077C	0230D	12/18/2009
380688	Township of Eagle	ND	38077C	0235D	12/18/2009
380688	Township of Eagle	ND	38077C	0240D	12/18/2009
380688	Township of Eagle	ND	38077C	0245D	12/18/2009
380688	Township of Eagle	ND	38077C	0275D	12/18/2009
270519	Wilkin County	MN	27167C	0020C	5/18/2015

270519	Wilkin County	MN	27167C	0050C	5/18/2015
270519	Wilkin County	MN	27167C	0135C	5/18/2015
270519	Wilkin County	MN	27167C	0155C	5/18/2015
270519	Wilkin County	MN	27167C	0165C	5/18/2015
270519	Wilkin County	MN	27167C	0175C	5/18/2015
270524	City of Wolverton	MN	27167C	0155C	5/18/2015
270524	City of Wolverton	MN	27167C	0165C	5/18/2015

2. The flooding source is: *Red River of the North, Wild Rice River, Sheyenne River, Maple River, Rush River, Lower Rush River, Wolverton Creek (Comstock Coulee).*
3. The project name is: *FM Diversion*
4. The FEMA zone designation affected is *Zone A, AE, and X*
5. The request is based upon: Physical Change, Regulatory Floodway Revision, Hydraulic Analysis, Hydrologic Analysis, and Levee Certification
6. The Fargo Moorhead Flood Risk Management Project is in compliance with the Endangered Species Act (ESA). Coordination with the Fish and Wildlife Service (FWS) has been ongoing since the beginning of the planning phase in 2008. Documents produced as part of this collaboration include the Feasibility Report and Environmental Impact Statement FEIS (2011) (Appendix C on attached Portable Hard Drive), Fish and Wildlife Coordination Act Report (2011), Supplemental Environmental Assessment SEA (2013) (Appendix D on attached Portable Hard Drive), and the most recent coordination on the recently listed northern long-eared bat 2015. This coordination is shown in Appendix E, which is a letter from FWS dated December 10, 2015.

   As described in the FEIS and SEA there are no concerns about impacting any federally listed Threatened or Endangered Species as a result from impacts caused by construction of this project. Since these documents were finalized the northern long-eared bat has been listed as threatened under the Endangered Species Act on April 2nd, 2015. Coordination with FWS on how to comply with ESA for this species was ongoing even before it was listed and has concluded with the agreement that no tree greater than 3” diameter at breast height will be removed during the time from June 1st – July 31st, letter attached.

   Coordination with FWS is ongoing in the form of coordination meetings that include all natural resource agencies where updates are provided as well as collaboration on mitigation, monitoring and adaptive management efforts for the project.

2.1.3 C. REVIEW FEE

A fee of $7,250 is attached based on this being a request for: CLOMR based on Levee, Berm, or Other Structural Measures.

2.1.4 D. SIGNATURE

See the attached MT-2 Form 1 pages with the signatures from the appropriate requester, community officials, and Registered Professional Engineer.

2.2 FORM 2 – RIVERINE HYRDOLOGY & HYDRAULICS FORM

2.2.1 A. HYDROLOGY

The hydrologic analysis for the Project was developed by the USACE and was updated over a number of modeling phases. The Project study limits for the Hydrologic analyses are from Hickson, ND to Emerson, MB. The USACE carried out the Hydrologic analysis for the Project. The first phase of the study began with a draft report issued by the USACE in March, 2009, which was followed by multiple published reports and updates as the Project progressed. The more detailed description of the Project Hydrology is included as part of the FEIS, which is included on the attached digital submittal. (Appendix C – Consultants Reports and Appendix L). Table 2-2 summarizes the progression of the hydrology:

Table 2-2 - Project Hydrology Progression Summary

Study Phase	Report Date	Description	Sub-Appendix
Phase 1	March 2009/August 2009	Draft Report – Hydrological Analysis based on the period of record	Appendix A-1A*
Phase 2a	October 2009	Expert Opinion Elicitation	Appendix A-1B*
Phase 2b	February 2010	HEC Report	Appendix A-1C*
Phase 3	May 2010	Hydrology Updated for Wet and Dry Cycles	Appendix A-2*
Phase 3.1	July 2010	Study Area Extended	Appendix A-3*
Phase 3.2	July 2010	Hydrology Amended – Fargo to Halstad	Appendix A-4A & 4B*
Phase 4	January 2011	Hydrological Analysis in Support of Unsteady RAS Modeling and Design	Appendix A-B*
Phase 8	June 2013	Development of updated balanced hydrographs at Fargo, ND	Technical Memorandum**
Phase 8	January 2013	Development of updated balanced hydrographs at Hickson, ND	Technical Memorandum**

Phase 8	July 2016	Lower Sheyenne River Balanced Hydrograph Update	Technical Memorandum**

*See attached Portable Hard Drive folders: FM Diversion_CLOMR_Submittal_20160930/Appendix C – FEIS/Consultant Reports/
** See attached Portable Hard Drive folders: FM Diversion_CLOMR_Submittal_20160930/Appendix L – Hydrology

The Hydrology serves as an input into the unsteady HEC-RAS model that is described in Section 2.2.2 – Hydraulic Modeling. The unsteady HEC-RAS model is used to determine the more detailed flow distribution within the Project area. The hydrology includes discharge information based on a Red River of the North (RRN) peak flood event, along with coincident tributary discharges, and a tributary peak flood event, along with coincident RRN discharges. The following tables summarize the hydrology. Table 2-3 includes a summary of historic and synthetic discharges at USGS Gage 05054000 at Fargo, ND. Table 2-4 and Table 2-5 include discharge summaries for the RRN and Tributary Peak hydrology.

Table 2-3 - Historic and Synthetic Discharges at Fargo

Summary of Historic and Synthetic Discharges at Fargo, ND			
Synthetic Discharges (cfs) at USGS Gage at Fargo, ND			
	FEMA (Effective)	*USACE EOE (Wet)*	*USACE POR*
10% (10yr)	10,300	17,000	13,865
2% (50yr)	22,300	29,300	26,000
1% (100yr)	29,300	34,700	33,000
0.2% (500yr)	50,000	61,700	66,000
Historic Discharges (cfs) at USGS Gage at Fargo, ND			
1997 Historic	28,000		
2006 Historic	19,900		
2009 Historic	29,500		
2010 Historic	21,200		
2011 Historic	27,200		

Definitions:

EOE – Expert Opinion Elicitation. A panel of hydrology experts was convened to elicit opinions regarding historic flooding trends on the Red River. The panel selected to use a representative wet hydrologic cycle from 1942-2009. Details of the analysis can be found in Appendix A of the Final Feasibility Report and Environmental Impact Statement for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project, dated July 2011.

FEMA – Federal Emergency Management Agency

POR – Period of Record. For the analysis at the Fargo gage, the POR is 1902-2009.

RRN – Red River of the North

USGS – United States Geological Survey

USACE – United States Army Corps of Engineers

Table 2-4 - Summary Discharge - Frequencies for the Red River

LOCATION	Drainage Area	DISCHARGES in cfs										
		Recurrence Interval										
	sq. mi.	2-YR	4-YR	5-YR	10-YR	20-YR	50-YR	100-YR	200-YR	500-YR	1000-yr	10000-yr
Emerson	**30,030**	**27,937**		**50,081**	**66,650**	**83,572**	**106,697**	**124,815**	**143,483**	**169,000**		
Pembina River coincidental	3,950	1,002		3,640	5,728	7,399	8,831	9,189	9,308	9,427		
Two Rivers coincidental	1,230	1,082		3,149	4,625	5,806	6,691	6,790	6,888	6,986		
Drayton	**24,670**	**26,009**		**47,027**	**62,847**	**79,061**	**101,292**	**118,757**	**136,789**	**161,486**		
Park River coincidental	1,010	550		1,700	2,800	4,300	6,000	7,000	7,500	8,000		
Snake River coincidental	950	342		1,174	2,004	2,921	3,912	4,592	5,084	5,694		
Forest River coincidental	900	210		750	1,300	1,800	2,350	2,700	2,850	3,000		
Oslo	**21,105**	**24,056**		**43,920**	**58,970**	**74,459**	**95,773**	**112,569**	**129,950**	**153,811**		
Turtle River coincidental	635	547		1,282	1,885	2,524	3,422	4,132	4,867	5,868		
Grand Forks	**20,015**	**23,295**		**42,139**	**56,354**	**70,956**	**91,026**	**106,838**	**123,201**	**145,675**		
Red Lake coincidental	3,800	7,379		11,604	13,399	15,437	18,128	20,073	22,200	24,595		
Thompson	**16,095**	**15,792**		**30,535**	**42,899**	**55,519**	**72,898**	**86,765**	**101,001**	**121,080**		
Sandhill River coincidental	430	763		1,801	2,700	3,451	4,000	4,226	4,367	4,532		
Marsh River coincidental	150	712		1,511	2,420	3,145	3,996	4,709	5,151	5,543		
Goose River coincidental	1,160	657		1,964	2,650	3,908	5,596	7,032	8,612	11,292		
Halstad	**13,775**	**13,074**	**22,261**	**25,260**	**34,871**	**45,014**	**59,306**	**70,798**	**82,872**	**99,713**	**113,103**	**162,000**
Wild Rice River, MN coincidental	1,650	2,348	4,089	4,647	6,393	8,165	10,547	12,450	12,600	12,950	13,200	13,700
Buffalo River coincidental	1,190	1,312	2,615	3,061	4,431	5,809	7,604	9,100	9,275	9,600	9,850	10,450
Sheyenne River coincidental	4,850	2,949	3,834	4,177	5,446	6,985	9,163	11,242	11,488	12,048	12,530	13,203
Fargo	**4,625[1]** **3,220[2]**	**5,600**	**10,600**	**12,150**	**17,000**	**22,000**	**29,300**	**34,700**	**46,200**	**61,700**	**74,000**	**121,000**
Drain 53 coincidental	30	26		70	113	158	213	252	289	336		
Wild Rice River coin @ Abercrombie	1,640	1,419	2,587	3,021	6,185	8,648	11,655	13,780	15,801	18,342		
Wolverton coincidental	105	91	210	250	396	554	746	882	1,012	1,174		

[1] 4,625 sq. mi. is the total contributing drainage area upstream of Fargo, including the area upstream of the dams. This was used in interpolating flows between Fargo and Emerson.

[2] 3,220 sq. mi. is the incremental local contributing area between Fargo and the upstream dams. This was used in interpolating flows between Hickson and Fargo.

Table 2-5 - Summary Discharge - Frequencies for the Red River Tributary Peaks

LOCATION	Drainage Area	DISCHARGES in cfs												
		Percent Chance Exceedance, Annual												
		99	95	90	80	66.7	50	20	10	5	2	1	0.5	0.2
		Recurrence Interval												
	sq. mi.	1.01-YR	1.05-YR	1.11-YR	1.25-YR	1.5-YR	2-YR	5-YR	10-YR	20-YR	50-YR	100-YR	200-YR	500-YR
Sheyenne River at Gol Bridge		138	297	436	680	1,000	1,490	3,000	4,190	5,430	7,140	8,500	9,900	11800
Rush River at U/S study limit	139	17	47	83	154	264	454	1,175	1,838	2,592	3,717	4,656	5,665	7091
Lower Rush River at U/S study limit	51.5	12	32	52	90	160	250	600	892	1,200	1,696	2,077	2,400	3034
Maple River near Mapleton, ND	1,380	124	310	492	835	1,333	2,123	4,549	6,282	8,556	12,564	16,247	19,787	24297

2.2.2 B. HYDRAULICS

Hydraulic modeling has primarily been performed using unsteady HEC-RAS. The HEC-RAS unsteady flow model is a key component of the Project as it is used for both the evaluation of Project impacts upstream and downstream from the Project as well as to establish hydraulic design criteria. The model also serves as the platform for the Project operations plan. The development of the unsteady HEC-RAS model has evolved since its initial development as part of the FEIS, with the current version being referred to as the "Phase 8" unsteady HEC-RAS model. The following summarizes the development of the unsteady HEC-RAS model prior to the current Phase 8 version, beginning with Phase 4, which is the initial model phase where the unsteady HEC-RAS model was used for Project design:

Phase 4: Appendix B of the Fargo-Moorhead Metro Flood Risk Management Project Feasibility Study Phase 4 report (Houston Engineering, April 2011) provides a thorough overview of the development and calibration of the existing conditions hydraulic model of the RRN and Tributaries. Hydraulic models available for the RRN were used to start development of this existing conditions model, and a summary of the previous modeling efforts and the new data collected for this modeling effort is included in Appendix B of the Phase 4 report. The Phase 4 model extends from approximately Drayton, ND to Abercrombie, ND and is available for the 1997, 2006, 2009, and 2010 historic flood events and the 10-, 2-, 1-, and 0.2-percent annual chance synthetic flood events.

Appendix C of the Phase 4 documentation (Moore Engineering, April 2011) includes the modifications made to the existing conditions hydraulic model in order to represent proposed diversion options. The documentation covers two diversion options: the Locally Preferred Plan (LPP), with the diversion channel on the North Dakota side of Fargo-Moorhead, and the Federally Comparable Plan (FCP), with the diversion channel on the Minnesota side of Fargo-Moorhead. Appendix C also summarizes the documentation of hydraulic analyses on different diversion options completed prior to Phase 4. A description of the Phase 4 hydraulics is included as part of the FEIS, which is included on the attached digital submittal.

Phase 5 modifications: Geometry modifications made as part of Phase 5 are summarized in the Feasibility Study, Phase 5 Hydraulic Analysis and Additional Studies report (Moore Engineering, October, 2011). These modifications were all made in the Phase 4 existing-conditions and with-project hydraulic models. Changes to the geometry included truncating cross sections and adding storage areas, modifying effective and ineffective flow areas, changing roughness coefficients, adjusting the overbank reach lengths, and applying new weir coefficients to lateral structures and storage connections. The majority of the geometry modifications made in Phase 5 were intended to improve model calibration. In Phase 4 the model calibration favored matching discharges, while in Phase 5 the model calibration favored matching stages.

Additional geometry modifications were made to the with-project model. Different with-project model hydrographs were evaluated by using different operational schemes for the gates at the RRN and Wild Rice River control structures.

Phase 6 modifications: The FM Diversion Post-Feasibility Southern Alignment Analysis (PFSAA): VE13, North of the Wild Rice River, South of Oxbow report (Houston-Moore Group, 2012) briefly summarizes the Phase 6 geometry modifications. Phase 6 modifications were made to the Phase 5 version of the hydraulic model, and the LPP was at this time considered the Federally Recommended Plan (FRP). The document mentions that changes to the geometry along the diversion channel were made to better define hydraulic interactions, and that changes were made to the storage areas in the upstream staging area to improve conveyance.

Phase 7 modifications: The alignment alternative selected after the release of the PFSAA report in October 2012 was Value Engineering Comment 13 Option A (VE13A). With this alignment, the southern portion of the diversion channel is shifted further north to eliminate the need for the Wolverton Creek structure and to decrease the length of the tieback embankment. This alignment resulted in a reduction in the length of the diversion channel between the inlet structure and the RRN and also eliminated Storage Area 1. The storage areas along the new alignment were modified to better characterize the floodplain. These modifications are discussed in detail in Appendix D, Hydrology and Hydraulics of the Environmental Assessment document (USACE 2013), and the PFSAA report.

In addition to incorporating the VE13A alignment into the hydraulic model, there were other minor modifications made to the model as part of the Phase 7 updates. These modifications are summarized in Appendix D of the Environmental Assessment document and include the addition of gates to the inlet control structure and the provision of in-town protection to 35 feet.

Phase 7.1 modifications: Geometry modifications made in Phase 7.1 are summarized in the Technical Memorandum of Unsteady HEC-RAS Modeling Phase 7.1 (Houston-Moore Group, 2013). These modifications were made to the Phase 7 hydraulic model. The focus of the Phase 7.1 modeling was to add detail to the model in preparation of the Phase 8 modifications to the hydrology.

Modifications to the geometry of the existing-conditions and with-project models included the addition of culverts or ditches between storage areas to allow for drainage after the flood event; cross sections truncated and converted to storage areas to better calibrate water surface elevations near Grand Forks; and the use of as-built plans to better define culverts and ditches near the proposed project. Modifications made to the with-project model included geometry changes to bridges over the diversion; updates to several diversion inlets; updates to in-town emergency and permanent protection measures; and incorporation of the updated proposed levee design around Bakke, Oxbow, and Hickson.

Phase 8 modifications: Geometry modifications made in Phase 8.0 are summarized in the Technical Memorandum of Unsteady HEC-RAS Modeling Phase 8.0 (Houston-Moore Group, 2016). These modifications were made to the Phase 7.1 hydraulic model based on comments received during an Independent Technical Review of the Phase 7.1 model that was performed by Barr Engineering as well as model updates requested by the USACE and Design Team. Phase 8 model updates include:

- More Detailed Modeling and Refinement of conveyance through the developed portion of the Fargo-Moorhead Metro area.
- Modification of the downstream reach lengths and minor overbank losses on the Red River.
- Revised modeling of meandered areas through the developed portion of the Fargo-Moorhead Metro area.
- Revised modeling of river Junctions.
- Additional detail for storage areas and connecting culverts, along with the additional culvert connections in the upstream Staging area.
- Incorporation of updated Phase hydrology and detail.
- Incorporation of some aspects of the Western Cass FIS hydraulic model.

1. A description of the hydraulic modeling is described in the FEIS (Appendix C – Consultants Report); Supplemental EA (Appendix D) and Phase 8 Modeling Report (Appendix M).
2. HEC-RAS v5.0
3. CHECK-RAS was not used on this project
4. See **Table 2-6**

Table 2-6 - HEC-RAS Model Submitted

Models Submitted	Natural Run		Floodway Run		Datum
	Appendix:	**Folder:**	**Appendix:**	**Folder**	
Corrected Effective Model (CEM) – Effective FIS Steady-State Model	N/A	N/A	N/A	N/A	N/A
Existing or Pre-Project Conditions Model (Phase 8 unsteady HEC-RAS Model)	Appendix M – Hydraulics/ Models: Existing Conditions Models:	10-, 25-, 50-, 100-, and 500-yr Red River ECM; 10-, 25-, 50-, 100-, and 500-yr TribPeak ECM	N/A	N/A	NAVD 88
Revised or Post-Project Conditions Model (Phase 8 unsteady HEC-RAS Model)	Appendix M – Hydraulics/ Models: Post Project Conditions Models:	10-, 25-, 50-, 100-, and 500-yr Red River RCM; 10-, 25-, 50-, 100-, and 500-yr TribPeak RCM	Appendix M – Hydraulics/ Models:	Post-Project Conditions Model RCM Floodway Runs	NAVD 88
☒ Digital Models Submitted? (Required): See E-Submittal					

2.2.3 C. MAPPING REQUIREMENTS

Digital mapping files, along with Annotated Preliminary FIRM (ECM) workmaps and Annotated Proposed FIRM (RCM) workmaps can be found in Appendix O.

2.2.4 D. COMMON REGULATORY REQUIREMENTS

A detailed mitigation plan has been developed for the properties impacted by the Project and has been included in Appendix M. The Fargo Moorhead Flood Risk Management Project is in compliance with the Endangered Species Act (ESA). Coordination with the Fish and Wildlife Service (FWS) has been ongoing since the beginning of the planning phase in 2008. Documents produced as part of this collaboration include the Feasibility Report and Environmental Impact Statement FEIS (2011) (Appendix C on attached Portable Hard Drive), Fish and Wildlife Coordination Act Report (2011), Supplemental Environmental Assessment SEA (2013) (Appendix D on attached Portable Hard Drive), and the most recent coordination on the recently listed northern long-eared bat 2015. This coordination is shown in Appendix E, which is a letter from FWS dated December 10, 2015.

As described in the FEIS and SEA there are no concerns about impacting any federally listed Threatened or Endangered Species as a result from impacts caused by construction of this project. Since these documents were finalized the northern long-eared bat has been listed as threatened under the Endangered Species Act on April 2nd, 2015. Coordination with FWS on how to comply with ESA for this species was ongoing even before it was listed and has concluded with the agreement that no tree greater than 3" diameter at breast height will be removed during the time from June 1st – July 31st, letter attached.

Coordination with FWS is ongoing in the form of coordination meetings that include all natural resource agencies where updates are provided as well as collaboration on mitigation, monitoring and adaptive management efforts for the project.

2.3 FORM 3 – RIVERINE STRUCTURES FORM

2.3.1 A. GENERAL

Please see CLOMR Support Document Section 1.5 and Tables 1-1 through 1-4 for Project features and details.

The most recent plans and design documentation reports for each of these features have been provided in Appendices C – FEIS; D – Supplemental EA; F – PFSAA and Wild Rice River Micrositing; G – Diversion Design; H – OHB Design; I – In Town Levees Design; and J – Comstock Levee Design.

2.3.2 B. CHANNELIZATION

Please see CLOMR Support Document Section 1.5 and Tables 1-1 through 1-4 for project features and details. Please see Appendix C – FEIS, Appendix D – Supplemental EA, and Appendix G – Diversion Design for design information on the Diversion channel.

2.3.3 C. BRIDGE/CULVERT

Multiple new bridges will be constructed over the Diversion Channel. The design levels vary from feasibility-level to 95%. Please see Appendix G – Diversion Design and Appendix C – FEIS (Consultants Reports) for design information for the various bridge structures for the project.

2.3.4 D. DAM/BASIN

The Project includes the construction of a new dam on the Red River and Wild Rice River as detailed in Section 1.5.1 of this report. Please see Appendix C – FEIS, and Appendix D – Supplemental EA and Appendix F – PFSAA and Wild Rice River Micrositing for design details on the dam.

2.3.5 E. LEVEE/FLOODWALL

2.3.5.1 SYSTEM ELEMENTS

The Project includes an embedded levee adjacent to the Diversion Channel, In-Town Levees, the OHB Levee, and Comstock Levee as features. Sections 1.5.1, 1.5.2, 1.5.3, and 1.5.4, along with Tables 1-1 through 1-4 provide additional detail on these features and also the location of design details that are included as appendices' to the application.

2.3.5.2 FREEBOARD

Appendix K includes plans and profile sheets showing freeboard for the various project features that include levees and floodwalls.

2.3.5.3 CLOSURES

Project Closures

Closure structures that are included in the design for In Town Levees and the OHB Levee are summarized in Table 2-7.

Table 2-7 - Project Closures

Project	Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device
Woodlawn Park Area LOMR	2+77	Right	Storm Sewer Gatewell	889.39	Sluice Gate
Woodlawn Park Area LOMR	13+01	Right	Sanitary Sewer Gatewell	N/A	N/A
Woodlawn Park Area LOMR	13+58	Right	Storm Sewer Gatewell	885.35	Sluice Gate
Woodlawn Park Area LOMR	18+00	Right	Storm Sewer Gatewell	882.14	Sluice Gate

Woodlawn Park Area LOMR	18+80	Right	Lift Station Outfall	881.56	Sluice Gate
Country Club Area LOMR	20+10	Right	Storm Sewer Gatewell	877.19	Sluice Gate
Country Club Area LOMR	37+30	Right	Lift Station Outfall	878	Sluice Gate
Country Club Area LOMR	48+65	Right	Storm Sewer Gatewell	887.55	Sluice Gate
Country Club Area LOMR	58+90	Right	Storm Sewer Gatewell	891.41	Sluice Gate
Country Club Area LOMR	72+15	Right	Lift Station Outfall	873.79	Sluice Gate
Horn Park Area LOMR	.-9+00	Right	Storm Sewer Gatewell	878.6	Sluice Gate
Horn Park Area LOMR	0+93	Right	Lift Station Outfall	887.12	Sluice Gate
Horn Park Area LOMR	11+89 to 12+85	Right	Auquafence Structural	905	Auquafence Structural
Horn Park Area LOMR	25+91	Right	Lift Station Outfall	883	Sluice Gate
Horn Park Area LOMR	28+07 to 28+67	Right	Floodwall Road Opening	899.74	IBS Removable Strcture
Horn Park Area LOMR	30+00	Right	Storm Sewer Gatewell	888.78	Sluice Gate
Horn Park Area LOMR	33+14	Right	Lift Station Outfall	892.46	Sluice Gate
Horn Park Area LOMR	34+93	Right	Storm Sewer Gatewell	887.27	Sluice Gate
Horn Park Area LOMR	35+51 to 36+11	Right	Floodwall Road Opening	898.87	IBS Removable Strcture
El Zagal Area Phase 1	12+51	Left	Gatewell	883.35	Sluice Gate
El Zagal Area Phase 1	16+22	Left	Gatewell	879.5	Sluice Gate
El Zagal Area Phase 2	6+50	Left	Gatewell	885.6	Sluice Gate
Mickelson Field Area	0+30	Center	Gatewell	875.99	Sluice Gate
Mickelson Field Area	12+20	Left	Lift Station	874.45	Sluice Gate

Ridgewood	7+02	Left	VA Storm Sewer Lift	872	Sluice Gate
Ridgewood	14+70	Left	Ridgewood Storm Sewer	871.75	Sluice Gate
Ridgewood	37+72	Left	Removable Closure	896.96	Removable Closure
4th Street Phase 1	19+16	Left	Gatewell	877.35	Slide Gate
4th Street Phase 1	4+70 to 7+40	Left	Gatewell Pump Station	874.22	Sluce Gate
4th Street Phase 3	2+43 to 2+53	Left	Gatewell	881.48	Sluice Gate
2nd Street N Floodwall	14+30 to 15+98	Left	Removable Floodwall	895.75	Removable Closure
2nd Street N Floodwall	20+58 to 22+13	Left	Lift Station Gatewell	875	Sluice Gate
2nd Street N Floodwall	27+23 to 27+62	Left	Removable Floodwall	886.8	Removable Closure
Oxbow, Hickson, Bakke Ring Levee- Phase B1 and D	A 56+90 to A 58+40	Left	Levee Closure	909	Levee Closure
Oxbow, Hickson, Bakke Ring Levee- Phase B1 and D	121+60 to 121+70	Left	Gatewell	896.55	Sluice Gate

2.3.5.4 EMBANKMENT PROTECTION

Please see Appendix C – FEIS, Appendix D – Supplemental EA, Appendix H – OHB Design, Appendix I – In-Town Levees Design, and Appendix J – Comstock Levee Design for designs and plans for Project Features.

2.3.5.5 EMBANKMENT AND FOUNDATION STABILITY

Please see Appendix C – FEIS, Appendix D – Supplemental EA, Appendix H – OHB Design, Appendix I – In-Town Levees Design, and Appendix J – Comstock Levee Design for designs and plans for Project Features.

2.3.5.6 FLOODWALL AND FOUNDATION STABILITY

Please see Appendix C – FEIS, Appendix D – Supplemental EA, Appendix H – OHB Design, Appendix I – In-Town Levees Design, and Appendix J – Comstock Levee Design for designs and plans for Project Features.

2.3.5.7 SETTLEMENT

Please see Appendix C – FEIS, Appendix D – Supplemental EA, Appendix H – OHB Design, Appendix I – In-Town Levees Design, and Appendix J – Comstock Levee Design for designs and plans for Project Features.

2.3.5.8 INTERIOR DRAINAGE

Interior Drainage features for components of In-Town levees, the OHB levee, and Comstock levee are described in Sections 1.5.2, 1.5.3, and 1.5.4 and Tables 1-2 through 1-4 of this CLOMR support document. Design information for any pump stations is included in Appendix H – OHB Design, Appendix I – In-Town Levees Design, and Appendix J – Comstock Levee Design.

2.3.5.9 OTHER DESIGN CRITERIA

Please reference Appendices C, G, H, I, and J for detailed design information on the project.

2.3.5.10 OPERATIONAL PLAN AND CRITERIA

An O&M Plan is currently being developed and will be provided as part of a future LOMR submittal.

2.3.5.11 MAINTENANCE PLAN

An O&M Plan is currently being developed and will be provided as part of a future LOMR submittal.

2.3.5.12 OPERATIONS AND MAINTENANCE PLAN

An O&M Plan is currently being developed and will be provided as part of a future LOMR submittal.

2.3.6 F. SEDIMENT TRANSPORT CONSIDERATIONS

Sediment transport has been analyzed as a part of project design. Please see Appendix C – FEIS and Appendix D – Supplemental EA, along with the more detailed design documents included in Appendices G, H, I, and J for details.