

**Fargo-Moorhead Flood Risk
Management Project**
Draft Supplemental Environmental
Impact Statement

08/27/ 2018

Volume 1 (of 2)
EIS and Figures

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COVER SHEET

Draft Supplemental Environmental Impact Statement Fargo-Moorhead Flood Risk Management Project

The Minnesota Department of Natural Resources (DNR) has prepared the Draft Supplemental Environmental Impact Statement (DSEIS) to evaluate a new alternative to the previously-proposed Project in accordance with the Minnesota Environmental Policy Act, Minnesota Statutes 2008, section 116D.

Abstract:

The previously-proposed Fargo-Moorhead Flood Risk Management Project was denied in October 2016. The proposer has developed a new alternative, called Plan B, which was not evaluated in the Final EIS and therefore requires by state law the preparation of a Supplemental Environmental Impact Statement (SEIS).

The Project is located in four counties: Cass and Richland Counties, North Dakota, and Clay and Wilkin Counties, Minnesota. The DSEIS evaluates and discloses potential environmental and socioeconomic impacts and proposed mitigations for Plan B and the No Action Alternative (with Emergency Measures). Examples of information on topics contained in the EIS includes, among others, aquatic resources, Project hydrology, wetlands, cultural resources, agricultural impacts, land use, and Federal Emergency Management Agency (FEMA) regulations associated with the Project. The EIS also includes a cumulative potential effects analysis for impacts of the Project plus other area projects, a comparison of alternatives, and additional recommended mitigation. Intended as a full-disclosure document, the EIS does not recommend a final decision or alternative, but does provide valuable information to decision-makers for permitting and land use. Decisions about whether to proceed with the Project can only be made following completion of an EIS and, for the State of Minnesota, will involve a decision for a dam safety and work in public waters permit.

Public comment submittal:

Public comments will be accepted on the Draft SEIS starting August 28, 2018 and ending September 27, 2018 at 4:30 PM. Comments submitted on the Draft SEIS will become part of the official record and as such, may be made available to the public. Comments and submittals will not be edited to remove any identifying or contact information; therefore, the DNR cautions against using any information that should not be publicly disclosed. Both mailed and emailed submittals will be accepted.

Email submittals should be directed to environmentalrev.dnr@state.mn.us and should include "Fargo-Moorhead" in the subject line. Please include a full name and mailing address.

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Approved for issuance:

August 27, 2018

Date



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- D. FM Diversion Plan B Transportation Master Plan (Diversion Authority)—June 7, 2018
- E. Updated FEMA/USACE Coordination Plan (USACE)— June 26, 2018
- F. Property Rights Acquisition and Mitigation Plan, version 4 (Diversion Authority)—August 13, 2018
- G. Adaptive Management and Monitoring Plan (USACE)—July 2018
- H. Plan B Dam Breach Assessment (USACE)—July 2018

Acronyms

(°) degrees	(EAW) Environmental Assessment Worksheet
(ABA) Architectural Barriers Act	(ECS) Ecological Classification System
(ACMs) Potential Asbestos Containing Materials	(EIS) Environmental Impact Statement
(ADA) Americans with Disabilities Act	(EMB) Excavated Material Berm
(AEP) Annual Exceedance Probability	(EOEP) Expert Opinion Elicitation Panel
(AIS) Aquatic Invasive Species	(ESA) Environmental Site Assessment
(AMP) Adaptive Management Plan	(EQB) Environmental Quality Board
(AMMP) Adaptive Management and Monitoring Plan	(F) Fahrenheit
(AMT) Adaptive Management Team	(FDR) Flood Damage Reduction
(APE) Area of Potential Effect	(FEMA) Federal Emergency Management Agency
(APHIS) USDA Animal and Plant Health Inspection Service	(FIRMs) Flood Insurance Rate Maps
(ASTs) Aboveground Storage Tanks	(FIS) Flood Insurance Study
(ATV) All-terrain Vehicles	(FFREIS) Final Feasibility Report and Environmental Impact Statement
(AUAR) Alternative Urban Areawide Review	(F-M) Fargo-Moorhead
(BFEs) Base Flood Elevations	(FRP) Federally Recommended Plan
(BMPs) Best Management Practices	(ft) feet
(BNSF) Burlington Northern Santa Fe Rail Lines	(ft ²) foot squared
(BRRWD) Buffalo-Red River Watershed District	(GIS) Geographic Information System
(Btu) British thermal unit	(H and H) hydrologic and hydraulic
(BWSR) Minnesota Board of Water and Soil Resources	(HEC-FDA) Hydrologic Engineering Center Flood Damage Reduction Analysis
(CCJWRD) Cass County Joint Water Resource District	(HEC-HMS) Hydrologic Engineering Center Hydrologic Modeling System
(CEQ) Council on Environmental Quality	(HEC-RAS) Hydrologic Engineering Centers River Analysis System
(cfs) cubic feet per second	(hr) hour
(CLOMR) Conditional Letter of Map Revision	(HUR) Halstad Upstream Retention Study
(CRREL) United States' Army Corps of Engineers' Engineer Research and Development Center Cold Regions Research and Engineering Laboratory	(HTRW) Hazardous, Toxic, and Radioactive Wastes
(CUP) conditional use permits	(I-29) Interstate Highway 29
(CWA) Clean Water Act	(I-94) Interstate Highway 94
(DELTA) Deformities, Eroded Fins, Lesions, or Tumors	(IBI) Index of Biotic Integrity
(DFIRM) Digital Flood Insurance Rate Maps	(IMPLAN) IMPact Analysis for PLANning Model
(DSA) Distributed Storage Alternative	(I-O) input-output analysis
(DIS) Diversion Inlet Structure	(IRT) Interagency Review Team
(DSC) Downstream Control	(LBP) Lead Based Paint
(DU) Ducks Unlimited	(LGU) Local Government Unit
(EA) Environmental Assessment	(LiDAR) Light Detection and Ranging
	(LOL) Loss of Life

(LOMR) Letter of Map Revision
(LPP) Locally Preferred Plan
(MDA) Minnesota Department of Agriculture
(MEPA) Minnesota Environmental Policy Act
(MN) Minnesota
(DNR) Minnesota Department of Natural Resources
(MNRAM) Minnesota Routine Assessment
Methodology for Evaluation of Wetland
Functions
(MPCA) Minnesota Pollution Control Agency
(NAA) Northern Alternative Alignment
(NAVD) North American Vertical Datum
(ND) North Dakota
(NDDA) North Dakota Department of Agriculture
(NDDH) North Dakota Department of Health
(NDGF) North Dakota Game and Fish Department
(NDNHI) North Dakota Natural Heritage Inventory
(NEPA) National Environmental Policy Act
(NFIP) National Flood Insurance Program
(NHIS) Minnesota Natural Heritage Information
System
(NHPA) National Historic Preservation Act
(NLCD) National Land Cover Dataset
(NRCS) Natural Resources Conservation Service
(NRHP) National Register of Historic Places
(NWI) National Wetlands Inventory
(O&M) Operations & Maintenance
(OHB) City of Oxbow, Village of Hickson, and Bakke
Subdivision
(OHV) Off-Highway Vehicle
(OHWL) Ordinary High Water Level
(OMRR&R) Operations, Maintenance, Repair,
Rehabilitation, and Replacement
(OSE) Other Social Effects
(PAHs) Poly Aromatic Hydrocarbons
(PCBs) Polychlorinated Biphenyls
(PFSAA) *FM Diversion Post-Feasibility Southern
Alignment Analysis (HMG, 2012)*
(POC) Point of Contact
(POR) Period of Record hydrology
(PWI) Public Waters Inventory
(QA) Quality Assurance
(QC) Quality Control
(QHEI) Qualitative Habitat Evaluation Index
(RECs) Recognized Environmental Conditions
(RG) River Gage
(RGU) Responsible Government Unit
(ROD) Record of Decision
(ROW) Right-of-Way
(RRJWD) Red River Joint Water Resource District
(RRWMB) Red River Watershed Management Board
(RS) River Stage
(RRS) Red River Structure
(SE) Socioeconomics
(SEAW) Scoping Environmental Assessment
Worksheet
(SFHAs) Special Flood Hazard Areas
(SGCN) Species of Greatest Conservation Need
(SHPO) State Historic Preservation Office
(SoCP) Species of Conservation Priority
(SOW) Scope of Work
(SSTS) Subsurface Sewage Treatment Systems
(STS) Storm Sewer
(LS) Lift Station
(SWAPS) State Wildlife Action Plans
(T138 R48) Unnamed Tributary to the Red River
(TCPs) Traditional Cultural Properties
(URS) URS, Corporation
(U.S.) United States
(USACE) United States Army Corps of Engineers
(U.S.C.) United States Code
(USDA) United States Department of Agriculture
(USEPA) United States Environmental Protection
Agency
(USFWS) United States Fish and Wildlife Service
(USGS) United States Geological Survey
(USPS) United States Postal Service
(USTs) Underground Storage Tanks
(WCA) Wetland Conservation Act
(WD) Watershed Districts
(WRAPs) Minnesota Pollution Control Agency
Watershed Restoration and Protection Strategy
(WRRS) Wild Rice River Structure

Definitions for Terms as Used in This Environmental Impact Statement

0.2-percent chance flood: A flood event that has the statistical average of occurring once every 500 years. See also 500-year flood.

1-percent chance flood: A flood event that has the statistical average of occurring once every 100 years. See also 100-year flood.

5-percent chance flood: A flood event that has the statistical average of occurring once every 20 years. See also 20-year flood.

10-percent chance flood: A flood event that has the statistical average of occurring once every 10 years. See also 10-year flood. This would result in an approximate flow of 13,000 or 12,900 cubic feet per second at the Fargo stream gage.

10-year flood: A flood event that has the statistical average of occurring once every 10 years or has a 10-percent chance of occurring or being exceeded in any given year. See also 10-percent chance flood.

20-year flood: A flood event that has the statistical average of occurring once every 20 years or has a 5-percent chance of occurring or being exceeded in any given year. See also 10-percent chance flood.

100-year flood: A flood event that has the statistical average of occurring once every 100 years or has a 1-percent chance of occurring or being exceeded in any given year. See also 1-percent chance flood.

500-year flood: A flood event that has the statistical average of occurring once every 500 years or has a 0.2-percent chance of occurring or being exceeded in any given year. See also 0.2-percent chance flood.

Accessibility: Refers to the ability to access a property from an adjacent roadway.

Accreditation: An accredited levee system is a system that Federal Emergency Management Agency (FEMA) has determined can be shown on a Flood Insurance Rate Map (FIRM) as providing a 100-year flood or greater level of flood protection. This determination is based on the submittal of data and documentation required by 44 CFR Section 65.10 which must be certified by a Professional Engineer. The area landward of an accredited levee system is shown as a moderate-risk area, labeled Zone X (shaded), on the DFIRM except for areas of residual flooding, such as ponding areas, which will be shown as high-risk areas, called Special Flood Hazard Areas (SFHAs). Flood insurance is not mandatory in Zone X (shaded) areas, but is mandatory in SFHAs. (http://www.fema.gov/media-library-data/20130726-1600-20490-4180/lv_accredit_checklist_nov08.pdf)

Action Threshold: The point at which data and information indicate criteria have been met requiring steps to address impacts or potential impacts.

Activity Hubs: Key locations along the proposed trail system offering recreational amenities, such as trail access or interpretive signs.

Activity Nodes: Similar to activity hubs but provide less intensive site-specific activities and could serve as secondary access points to the trails.

Adaptive Management: A process wherein management actions can be changed in response to a monitored result or impact. An adaptive management plan proposes pre-construction and post-construction studies of biota and physical habitat for both impact sites and mitigation sites, including a framework for evaluation and response actions.

Adaptive Management Team/Adaptive Management and Monitoring Team: A decision-making body for the Adaptive Management and Monitoring Plan composed of local, state, and federal agency personnel working collaboratively to address adaptive management needs. The USACE would be the lead for the Adaptive Management Team (or the Adaptive Management and Monitoring Team as referred to in the Draft Adaptive Management and Monitoring Plan included as Appendix G to this document) until the Project would be turned over to the non-Federal sponsor at which time the non-Federal sponsor would be responsible to lead the team.

Adverse Effect: A harmful or undesired effect from the Proposed Project on the environment.

Aggradation: To raise the grade or level of (a river valley, a stream bed, etc.) by depositing detritus, sediment, or the like. (<http://dictionary.reference.com/browse/aggradation>)

Anthropogenic: Relating to or resulting from the influence of human beings on nature.

Associated Facilities: Components of the Project that are not primary, but are necessary for Project construction and operation. Associated facilities for the Project include, for example, utilities and access roads.

Aqueduct: Structures, resembling a bridge, that carry water over other features. For the Project, aqueducts would be used to carry the Maple River and Sheyenne River flows over the diversion channel during flood and non-flood events.

Bankfull: The elevation of the floodplain adjacent to the active channel.

Bankfull Flow: The discharge at channel capacity or the flow at which water fills the channel without over-topping the banks. On average, recurrence of bankfull is 1.5 years. But it ranges from 1.1 to 1.8 for streams in Minnesota.

Base Flood Elevation (BFE): The elevation of surface water resulting from a flood that has a 1-percent (1%) chance of equaling or exceeding that level in any given year. The BFE is shown on the Flood Insurance Rate Map (FIRM) for zones AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, V1–V30 and VE. (<https://www.fema.gov/national-flood-insurance-program/definitions>)

Base Flow (Q_{Base}): The component of streamflow not directly attributed to stormwater runoff. Base flow defines low flow conditions for maintaining viable habitat for stream organisms. While base flow does not transport large amounts of sediment it can be important in maintaining a low-flow channel needed by stream organisms when water levels drop in the summer and fall.

Base No Action Alternative: Project alternative that includes the potential flood risk reduction impact of already completed and currently funded projects such as levee construction and property buyouts.

Benthic Biodiversity: The variety or measure of many different kinds of organisms living on the bottom of a body of water, such as mussels or other bottom-dwelling species.

Berms: An artificial hill or wall of dirt or sand used as a barrier to separate two areas.

Best Management Practices (BMPs): The schedule of activities, prohibition of practices, maintenance procedures, and other management practices to avoid or minimize pollution or habitat destruction to the environment. BMPs can also include treatment requirements, operating procedures and practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Biological Assessment: Biological assessments are evaluations of the condition of waterbodies using surveys and other direct measurements of resident biological organisms (macroinvertebrates, fish, and plants). Biological assessment results are used to answer the question of whether waterbodies support survival and reproduction of desirable fish, shellfish, and other aquatic species -- in other words, if the waterbodies meet their designated aquatic life uses.

Biological Community: All the interacting organisms living together in a specific habitat of varying sizes, larger biological communities may contain smaller communities.

Biota: Flora (plants) and fauna (animals) of a particular location

Biotic: Of, relating to, or caused by living organisms

Biotic Community: A group of interdependent organisms inhabiting the same region and interacting with each other.

Biotic Connectivity: The quality, state or capability of the flora and fauna (i.e., organisms) or biotic processes of a region being connected or being able to move unimpeded.

Blue Books: United States Fish and Wildlife Service habitat assessment models.

Brush/Grassland: Grassland areas dominated by graminoid or herbaceous vegetation and shrub/scrub areas dominated by shrubs less than five meters tall with shrub canopy typically greater than 20 percent of total vegetation, including true shrubs, young trees in an early successional stage, or trees stunted due to harsh environmental conditions. Includes those areas in the Eastern United States that commonly are called brush lands (Anderson et al., 1976).

Buffalo-Red River Watershed District (BRRWD): The Buffalo-Red River Watershed District is a political local government unit which issues permits for a wide variety of construction activities that affect the water resources of the District. Located in northwest Minnesota, the district covers approximately 1,785 square miles that is one of the ten major watersheds in the Red River Basin. (<http://www.brrwd.org/>).

City of Oxbow, Village of Hickson, and Bakke Subdivision (OHB) Ring Levee: A ring levee that encompasses the City of Oxbow, the Village of Hickson, and the Bakke Subdivision.

Class I Dam: A dam (defined in Minnesota Rules, part 6115) whose failure, misoperation, or other occurrences or conditions would probably result in any loss of life or serious hazard, or damage to health, main highways, high-value industrial or commercial properties, major public utilities, or serious direct or indirect, economic loss to the public. (<https://www.revisor.mn.gov/rules/?id=6115.0340>)

Collector Roadway: Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with high-capacity arterial roads. (<http://www.fhwa.dot.gov/environment/publications/flexibility/ch03.cfm>)

Comstock Ring Levee: A ring levee that would be constructed around the city of Comstock, Minnesota, to provide protection from flood inundation as a result of Project operation. Applies to the Project scenario only.

Concrete Baffle: A concrete portion of a water control structure that dissipates energy in the water flowing through the structure.

Conditional Letter of Map Revision (CLOMR): A CLOMR is the Federal Emergency Management Agency's (FEMA) comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective BFEs, or the Special Hazard Area (SFHA). The letter does not revise an effective National Flood Insurance Program (NFIP) map; it does indicate whether the project, if built as proposed, would be recognized by FEMA.

Conditional Use Permit: A conditional use permit is a document a regulatory unit of government issues to grant a conditional use when the general and specific ordinance standards have been met by the applicant. The use is allowed by the permit only if the special concerns are addressed as set forth in the zoning ordinance. Conditional use permits are authorized under state law. (<http://www.lmc.org/media/document/1/conditionalusepermits.pdf?inline=true>)

Connecting Channel: The connecting channel between the Red River of the North and the diversion inlet control structure.

Construction Footprint: Portions of the Project that would result in a direct impact from disturbance during Project construction, such as excavation, piling of earthen material, and equipment movement. In general these areas include the diversion channel, connecting channel, excavated material berms, and embankments.

Control Structure: A structure in the water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water.

Cover Type: A general term referring to the specific land cover of an area.

Cropland: Land used for growing crops, which are typically associated with cultivated, agricultural crops, such as corn and soybeans.

Cubic Feet per Second (cfs): The rate of flow representing a volume of one cubic foot passing a given point in one second.

Cumulative Potential Effects: The effect on the environment that results from incremental effects of the Project in addition to other projects in the environmentally relevant area that might be reasonably expected to affect the same environmental resources. This includes planned future projects or for which a basis of expectation has been laid, regardless of what person undertakes the other projects or what jurisdictions have authority over the projects (Minnesota Rules part 4410.0200 subpart 11a).

Cyprinids: Any of numerous, often small, freshwater fishes of the family Cyprinidae, which includes the minnows, carps, and shiners.

Dam: Any artificial barrier, together with appurtenant works (required components), capable of impounding water, typically with a height greater than six feet and a storage capacity in excess of 15-acre feet (Minnesota Rules, part 6115.0320). Under the Project, the dam is considered the three control structures (structures designed to control flood waters), the Eastern and Western Tieback.

Dam Owner: The owner or lessee of the property to which the dam is attached, unless the dam is sponsored by a governmental agency which would be responsible for operation and maintenance of the dam, in which case that sponsoring agency shall be considered the owner (Minnesota Rules, part 6115.0320) (<https://www.revisor.mn.gov/rules/?id=6115.0320>). For the Project, the Diversion Authority and/or non-Federal Sponsor would be the dam owner. The dam owner is responsible for all operation, maintenance, repair, rehabilitation and replacement of the dam. The non-Federal sponsor would apply for any applicable permits that are required for construction and would be responsible for implementing required mitigation.

Degradation: Erosion of the quality of natural environment caused, directly or indirectly, by human activities. (<http://www.businessdictionary.com/definition/environmental-degradation.html>)

Detritivorous: Of an organism (as an earthworm or a fungus) that feeds on dead and decomposing organic matter.

Drain 14: A drainage ditch which runs generally south to north from Davenport, North Dakota to the Maple River.

Drayton Dam: A dam on the Red River located near Drayton, North Dakota, approximately 125 miles downstream of the project area.

Easement: An interest in land owned by another that entitles its holder to a specific limited use.

Ecological Classification System (ECS): Developed by the Minnesota Department of Natural Resources (DNR) and United States Forest Service, ecological land classifications are used to identify, describe, and map progressively smaller areas of land with increasingly uniform ecological features, including climate, geology, topography, soils, hydrology, and vegetation.

Electronic Data Access (EDA): The Minnesota Pollution Control Agency's database system that allows users to view and download environmental data that is collected and stored by the agency and its partner organizations.

Embankment: A mound or earthen material, typically created from placement and compaction of soil, sand, clay and/or rock, to form a barrier to water seepage. Embankments can be used to form dams or created to form walls on the outside of man-made water channels. The Project would include the Western Tieback, Southern Embankment and Eastern Tieback to form the staging area.

Endangered Species: A species that is threatened with extinction throughout all or a significant portion of its range.

Energy Dissipation Chambers: A device constructed in a waterway to reduce the kinetic energy of fast flowing water. (Technical Manual: Outlet Works Energy Dissipaters: Best Practices for Design,

Construction, Problem Identification and Evaluation, Inspection, Maintenance, Renovation, and Repair. FEMA P-679/June 2010.)

Environmental Assessment Worksheet (EAW): Provides information about a project that may have the potential for significant environmental effects. The EAW is prepared by the Responsible Governmental Unit (RGU) or its agents to determine whether an Environmental Impact Statement should be prepared. If and EIS is to be prepared, the EAW serves as the basis to begin the scoping process for the EIS and becomes known then as the Scoping EAW. (<https://www.revisor.leg.state.mn.us/rules/?id=4410.1000>).

Excavated Material Berms (EMB): A small hill or mound of dirt or sand created from earthen material that was excavated for creation of the diversion channel.

Exceptional Use Threshold: High quality waters with fish and invertebrate communities at or near undisturbed conditions.

Extirpation: To destroy or remove completely, as a species from a particular area, region, or habitat. Compare to Extinction. (<http://www.ecologydictionary.org/EXTIRPATION>)

Fargo Gage: United States Geological Survey stream gage in Fargo, North Dakota.

Fargo-Moorhead Metropolitan Area: The urbanized and rural area within and surrounding the cities of Fargo and Moorhead specific to the United States Army Corps of Engineers' and Diversion Authorities' study and focus area for the Fargo-Moorhead Metro Flood Risk Management Feasibility Study. This area, which would include all of Cass and Clay counties, is larger area than the Fargo-Moorhead urban area.

Fargo-Moorhead urban area (F-M urban area): The urbanized area within and surrounding the cities of Fargo and Moorhead.

Fee acquisition: Purchase of land or of an interest of land for a monetary amount.

Federal Emergency Management Agency (FEMA) Region V: FEMA Region V is comprised of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. (<https://www.fema.gov/region-v-il-mi-mn-oh-wi>)

FEMA Region VIII: FEMA Region VIII is comprised of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. (<http://www.fema.gov/region-viii-co-mt-nd-sd-ut-wy>)

Federally Recommended Plan (FRP): The FRP (Supplemental Environmental Assessment, USACE 2013) is the Locally Preferred Plan (LPP) described in the Final Feasibility Report/Environmental Impact Statement (USACE 2011) that was further modified in the Supplemental Environmental Assessment (USACE 2013). The FRP is presented as the Project within this Environmental Impact Statement.

Final Scoping Decision Document (FSDD): A companion to the Scoping EAW prepared for the Project. The purpose of a FSDD is to identify those project alternatives and environmental impact issues that would be addressed in the Environmental Impact Statement. The FSDD also presents a tentative schedule of the environmental review process. The State FSDD was completed on February 10, 2014.

Flap Gates: Gates that prevent water from backing up out of the diversion channel after the local peaks have passed.

Flood: A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is the policyholder's property) from:

- Overflow of inland or tidal waters; or
- Unusual and rapid accumulation or runoff of surface waters from any source; or
- Mudflow. (<https://www.fema.gov/national-flood-insurance-program/definitions>)

Flood Crest Elevation: The highest stage or level of a flood as it passes a particular location. Gages along a river record the level of water, and the highest level record at each gage is the crest for that gage.

Flood Risk: The chance of an area to flood.

Flood Stage: An established gage height for a given location above which a rise in water surface level begins to create a hazard to lives, property, or commerce. The issuance of flood advisories or warnings is linked to flood stage. Not necessarily the same as bankfull stage.

Floodplain: Any land area susceptible to being inundated by flood waters from any source.

Floodplain Forest: A lowland forest deciduous habitat, included as a separate Type 1 wetland cover type.

Floodproofing: Any combination of structural and nonstructural additions, changes or adjustments to structures, which reduce or eliminate risk of flood damage to real estate or improved real property, water and sanitation facilities or structures with their contents.

Floodwalls: A wall built along a shore or bank to protect an area from floods.

Floodway: The floodway is the portion of the staging area that is required to mitigate downstream impacts from the Project. According to FEMA, a "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

Flowage Easement: A flowage easement provides the legal ability to inundate property as part of the operation of the Project. Value of a flowage easement on an individual property would follow the Federal/United States Army Corps of Engineers (USACE) process and would be determined by appraisal. Factors that would be considered are depth, duration, frequency of additional flooding, and the highest and best use of the property. USACE policy defines a flowage easement as a one-time payment made at the time that the easement is acquired.

Fluvial Geomorphology: The study of stream channels, substrate, bank stability, flow characteristics and features or events influential in altering the river and its floodplain.

Formal Section 7 Consultation: The Endangered Species Act directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. Section 7 of the Act, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. (<http://www.fws.gov/midwest/endangered/section7/section7.html>)

Freeboard: An additional amount of height above the Base Flood Elevation (BFE) used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a structure's lowest floor

must be elevated or flood proofed to be in accordance with state or community floodplain management regulations.

General Use Threshold: Waters with good fish and invertebrate communities that meet or should meet minimum goals.

Glochidia: Larvae expelled from a female mussel, which find a host fish where they attach to fish gills or fins.

Headcutting: the process of a stream to create an erosional feature where an abrupt vertical drop occurs, which typically resembles a very short cliff or bluff. If left to natural processes, the headcut would likely migrate upstream.

Historic Building: Any building that is:

- Listed individually in the National Register of Historic places (a listing maintained by the Department of the Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register; or
- Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary of the Interior to qualify as a registered historic district; or--Individually listed in a state inventory of historic places in states with preservation programs that have been approved by the Secretary of the Interior; or--Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either:
 - By an approved state program as determined by the Secretary of the Interior; or
 - Directly by the Secretary of the Interior in states without approved programs.

Historic Property: Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe that meet the National Register criteria (36 CFR 800.16(l)(1)).

Hydrology: The science dealing with the origin, distribution, and circulation of waters of the earth such as rainfall, streamflow, infiltration, evaporation, and groundwater storage.

Impact: Any change to the environment, whether adverse or beneficial, resulting from an activity (can be direct or indirect).

Impacted Areas: A location that would experience change to the environment, whether adverse or beneficial, resulting from the Project.

Impervious Surfaces: Mainly artificial surfaces—such as pavements (roads, sidewalks, driveways and parking lots) that are covered by impenetrable materials such as asphalt, concrete, brick, and stone--and rooftops. (<http://encyclopedia.thefreedictionary.com/Impervious+surface>)

In-Town Levees: Floodwalls and levees located in the cities of Fargo, North Dakota and Moorhead, Minnesota.

Index of Biotic Integrity (IBI): The stream IBI integrates information from individual, population, community, and ecosystem levels into a single ecologically based index of water resource quality (Karr, 1981). The IBI is a numerical index that is comprised of various measures of the biological community

(called metrics) that are assigned a score (typically 0-10) based on their deviation from reference and summed to provide an integrative expression of site condition. It has been used to express the condition of fish, macroinvertebrate, algal, and terrestrial assemblages throughout the U.S. and in each of five major continents. (<http://www.pca.state.mn.us/index.php/view-document.html?gid=21164>)

Infrastructure: The basic equipment and structures necessary for economic activity and development. Public infrastructure includes roads, power and water supplies, and other structures that provide utility, such as pipelines, bridges, and buildings.

Inundation: To flood, cover, or overspread with water. (<http://www.merriam-webster.com/dictionary/inundation>)

Inundation Area: Applies to any flooded area, regardless of depth, under existing, Project or alternative conditions within the project area.

Invasive Species: A broad term used to define animal or aquatic plant species that is non-native and have been found to be invasive, under the federal definition or are regulated under invasive species law, to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, Appendix 1, 1999) and encompasses all species, including plants and animals, terrestrial or aquatic.

Junk Vehicles: An abandoned, non-functional vehicle.

Jurisdictional: The United States Army Corps of Engineers (USACE) determines jurisdiction by documenting: connections of waters and wetlands to downstream navigable waters; interstate commerce connections; and adjacency of wetlands to other waters. Waters of the United States are protected under the Clean Water Act of 1972.

Key Habitat: Those habitats that are most important to Minnesota's Species of Greatest Conservation Need (SGCN) and are identified with discrete ecological boundaries. Specifically, those habitats 1) used by the greatest number of SGCN, 2) changed the most over the past 100 years, 3) having a high percentage of habitat specialist SGCN, or 4) having been identified as important stream segments by The Nature Conservancy. Key Habitats are equivalent to Landscape Components in North Dakota.

Keystone Species: A plant or animal species that plays a unique and crucial role in the way an ecosystem functions. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether. (<http://education.nationalgeographic.org/encyclopedia/keystone-species/>)

Lands and Damages, and Construction Costs: Expenses related to land acquisitions, damage compensation, and construction of the Project and as applicable to Project alternatives.

Landscape Component: Areas in North Dakota that historically support Species of Conservation Priority and are identified with discrete ecological boundaries. Landscape Components are equivalent to Key Habitats in Minnesota.

Left-Bank: Left side of a stream channel when facing downstream.

Less Than Significant Effect: An effect that is predicted to be below an identified threshold and/or an effect that was determined by the lead agencies to not have a magnitude that is great based on the context and intensity of that effect.

Letter of Map Revision (LOMR): An official amendment to the currently effective Federal Emergency Management Agency (FEMA) map. It is issued by FEMA and changes flood zones, delineations and elevations. (<https://www.fema.gov/letter-map-revision>)

Levee: An embankment or structure used to prevent flood waters from affecting a specific location. (<http://www.merriam-webster.com/dictionary/levee>)

Level I Species: Species having a high level of conservation priority because of declining status either in North Dakota or across their range; or a high rate of occurrence in North Dakota constituting the core of the species' breeding range, but are at-risk range wide, and funding other than State Wildlife Grants is not readily available to them. (<http://gf.nd.gov/magazines/north-dakota-species-conservation-priority/level-1>)

LiDAR: Light Detection and Ranging (LiDAR) is a remote sensing technology that collects 3-dimensional point clouds of the Earth's surface. The technology is used for a wide range of applications including high-resolution topographic mapping and 3-dimensional surface modeling as well as infrastructure and biomass studies. (<https://lta.cr.usgs.gov/LIDAR>)

Lithophile: Simple lithophilic spawners are fish that require clean coarse substrates for spawning. Their absence or low numbers indicates the quality of the substrates is degraded, likely due to siltation. (Konrad Schmidt and Philip Talmage. Minnesota Department of Natural Resources. Special Publication No. 156, Oct 2001. "Fish Community Surveys of Twin City Metropolitan Streams")

Littoral Zone: The portion of a lake that is less than 15 feet in depth (DNR/MPCA); extends from the shoreline of a lake and continues to depth where sufficient light for plant growth reaches the sediments and lake bottom (University of Minnesota Extension).

Locally Preferred Plan (LPP): The LPP is the plan that, in the opinion of the non-Federal sponsors, best met the needs of the local community. The LPP was presented as the ND20K Diversion in the Final Feasibility Report/Environmental Impact Statement (FFREIS) (USACE 2011) and became the USACE's Selected Plan during the development of the FFREIS. The Supplemental Environmental Assessment (USACE 2013) identified the LPP (the Selected Plan) as the Federally Recommended Plan (FRP) for the USACE which was modified and further evaluated in the Supplemental Environmental Assessment (USACE 2013) as the Southern Alignment Alternative. The Project has since has been further modified during the earlier development of the Minnesota environmental impact statement (EIS) and is presented as the Project in this EIS.

Local Sponsor: Synonymous with "non-Federal sponsor" or "non-Federal interest", the preferred term being "non-Federal sponsor" by the United States Army Corps of Engineers (USACE). The USACE defines the "non-Federal sponsor" as a 1) a legally constituted public body (including a federally-recognized Indian tribe); or 2) a nonprofit entity with the consent of the affected local government that has full authority and capability to perform the terms of its agreement and to pay damages, if necessary, in the event of failure to perform. As of the production of this EIS, the "non-Federal sponsors" are the City of Moorhead, City of Fargo, and Flood Diversion Board of Authority.

Macroinvertebrate: An animal without a backbone living in one stage of its life cycle, usually the nymph or larval stage, that can be seen with the naked eye.

Map Revision: A change in the Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM) for a community which reflects revised zone, base flood or other information. (Federal Emergency Management Agency)

Meander: Turn or winding of a stream. (<http://www.merriam-webster.com/dictionary/meander>)

Mobility: The ability to move or be moved freely and easily.

Minnesota Pollution Control Agency Index of Biotic Integrity (IBI) Metric: multiple measures of a biological community which reflect aspects of the structure, function, or some other measurable characteristic of the biotic community that responds in a predictable manner to stressors (<http://www.pca.state.mn.us/index.php/view-document.html?gid=6882>) (Fausch, K.D., J. Lyons, J.R. Karr, and P.L. Angermeier. 1990. Fish communities as indicators of environmental degradation. American Fisheries Society Symposium 8:123-144)

Mortality: Death as a result of construction or operation of the Project.

National American Vertical Datum (NAVD) of 1988: A vertical datum is the starting point for measuring elevations. Datums help determine the height differences between points in the ground. There are five different vertical datums at various bench marks across the earth—NAVD88 is one of the five bench marks datums and stands for the North American Vertical Datum of 1988. (National Oceanic and Atmospheric Administration and Federal Emergency Management Agency)

National Flood Insurance Program (NFIP): The program of flood insurance coverage and floodplain management administered under the Act and applicable federal regulations promulgated in Title 44 of the Code of Federal Regulations, Subchapter B. (Federal Emergency Management Agency)

National Geodetic Vertical Datum (NGVD) of 1929: National standard reference datum for elevations, formerly referred to as Mean Sea Level (MSL) of 1929. NGVD 1929 may be used as the reference datum on some Flood Insurance Rate Maps (FIRMS). (Federal Emergency Management Agency)

National Heritage Database: A database containing information on rare plants, animals, native plant communities, and other rare features. (<http://www.dnr.state.mn.us/nhnrp/nhis.html>)

National Pollutant Discharge Elimination System /State Disposal System (NPDES/SDS) Permit: An NPDES/SDS Permit is a document that establishes the terms and conditions that must be met when a facility discharges wastewater to surface or groundwater of the state. The permit is jointly issued under two programs. The NPDES is a federal program established under the Clean Water Act, aimed at protecting the nation's waterways from point and nonpoint sources. In Minnesota, it is administered by the Minnesota Pollution Control Agency (MPCA) under a delegation from the United States Environmental Protection Agency (USEPA). The SDS is a state program established under Minnesota Statutes 2008, section 115. In Minnesota, when both permits are required they are combined into one NPDES/SDS Permit administered by the state. The permits are issued to permittees discharging to a surface water of the state.

Natural Levees: A deposit of sand or mud built up along, and sloping away from, either side of the floodplain of a river or stream. (<http://dictionary.reference.com/browse/natural+levee>)

Newly Inundated: Applies to areas that do not flood under existing conditions, but are predicted to flood under Project conditions.

No Action Alternative (with Emergency Measures): Similar to the Base No Action Alternative, but also assumes that emergency measures currently being pursued in the project area would continue to be

implemented as necessary due to flooding. Emergency measures, include, but are not limited to, sandbagging, temporary levees, and floodwall closures

Non-Federal Sponsor: The United States Army Corps of Engineers (USACE) defines the "non-Federal sponsor" as a 1) a legally constituted public body (including a federally recognized Indian tribe); or 2) a nonprofit entity with the consent of the affected local government that has full authority and capability to perform the terms of its agreement and to pay damages, if necessary, in the event of failure to perform. As of the production of the environmental impact statement, the "non-Federal sponsors" are the City of Moorhead, City of Fargo, and Flood Diversion Board of Authority.

Non-Residential Building (including hotel/motel): This is a commercial or non-habitational building or a mixed-use building that does not qualify as a residential building. This category includes but is not limited to: small businesses, churches, schools, farm buildings (including grain bins and silos), garages, pool houses, clubhouses, recreational buildings, mercantile buildings, agricultural and industrial buildings, warehouses, nursing homes, licensed bed and breakfasts and hotels and motels with normal room rentals for less than six months. (Federal Emergency Management Agency)

Non-Structural Features: Features or measures used to reduce flood risk or provide mitigation, such as buyout, relocation, or raising individual structures. Non-structural features modify the structures being impacted by floods rather than modifying the flooding itself.

Non-Degradation Standards: Minnesota water quality standards (Minnesota Rules, part 7050) include four general components: beneficial uses; numeric standards; narrative standards; and nondegradation. The nondegradation standards provide extra protection for high quality or unique waters and outstanding resource value waters (ORVW) to keep them from being degraded.

Noxious weed: A specific regulatory definition applied to invasive plant species. Noxious weeds refer to invasive/non-native terrestrial plant species regulated by local and state noxious weed laws.

OHB Ring Levee: See City of Oxbow, Village of Hickson, and Bakke Subdivision (OHB) Levee.

Operation and Maintenance (O&M) Plan: Activities performed in accordance with the Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) Manual to operate, maintain and inspect all components of the Project.

Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) Manual: A document providing specific standards and requirements for operation, maintenance, repair, rehabilitation and replacement of the Project that would be developed by the United States Army Corps of Engineers (USACE) prior to Project operation. This manual would be followed by the non-Federal sponsor for the life of the Project.

Orifice: an opening in a wall or dam through which flow occurs. Orifices may be used to measure or control rates of flow.

Outfall: The discharge point of a waste stream into a body of water; alternatively it may be the outlet of a river, drain or a sewer where it discharges into a lake or other body of water.

Oxbow: A place where a river curves in the shape of a "U." (<http://www.merriam-webster.com/dictionary/oxbow>)

Oxbow Basin: A place where a river curved in the shape of a “U” and then was cut off from the current river channel, forming a U-shaped depression.

Passage: The ability for fish and other aquatic organisms to migrate upstream or downstream, on rivers and tributaries.

Phase I Cultural Resources Survey: An archaeological survey conducted to locate and identify all archaeological sites within a survey area, estimate size and boundaries of identified sites, evaluate potential site significance and recommend treatment of identified sites.

Phase II Cultural Resources Evaluation: Further investigates a specific site identified in the Phase I survey, including site-specific archival research, intensive surface survey, site mapping and possibly excavation of test units for the purpose of evaluating that site's eligibility to the National Register of Historic Places.

Phase III Cultural Resources Mitigation: Typically involves data recovery of a National Register of Historic Places (NRHP) eligible site or other archaeologically important site that would be adversely impacted by a project. For NRHP-eligible architectural properties (buildings and structures), mitigation typically involves scaled drawings (elevations, plan views, cross-sections), large-format photographs (four inch by five inch negatives), and a detailed history of the building or structure.

Phase I Environmental Site Assessment (ESA): An investigation of a parcel of land and its associated structures for potential environmental issues.

Phase II Environmental Site Assessment (ESA): Provides a more detailed investigation, which involves chemical analysis of soil and groundwater to detect the presence of hazardous substances and/or petroleum hydrocarbons.

Piscivorous: Feeding on fishes. (<http://www.merriam-webster.com/dictionary/piscivorous>)

Planform: The outline of an object when viewed from above.

Pool-Riffle System: Deep and shallow portions of an undulating stream bed. Pools are most easily seen in a meandering stream where the outer edge of each meander loop is deep and undercut; riffles form in the shallow water of the short, straight, wide reaches between adjacent loops. The pools and riffles form sequences spaced at a repeating distance of about five to seven widths of the channel and often appear in stream development long before the stream produces visible meanders. These patterns are thought to be associated with a form of wave phenomenon and may be initiated by a single gravel patch in a channel; the first channel deviation requires an overcompensation of counter-deviation and sets off a chain reaction type of development. Pools and riffles are present in nearly all perennial channels where the size of the bed material is greater than coarse sand, and they are relatively stable in their position along the channel. At low water stages, the pools generally have a smooth surface while the riffles may show white water. Rapids, similar formations that show white water at all stages of flow, are common in bedrock channels, are generally composed of boulders, and are more random in distribution along channel. (<http://www.britannica.com/science/pool-and-riffle>)

Preferred Alternative: The United States Army Corps of Engineers (USACE) and Diversion Authority's desired project (discussed as the Project in this Environmental Impact Statement (EIS) that meets the purpose and need, is feasible, and gives consideration of the effects to the environment. The Federal Council of Environmental Quality regulations require federal agencies to identify an agency-preferred

alternative in the federal environmental review process. The Minnesota State EIS process does not identify a preferred alternative, but rather includes a proposed project, and applicable project alternatives for evaluation. This term is used in the federal environmental review process. The Minnesota State environmental impact statement does not identify a preferred alternative, but rather includes the Proposed Project and applicable Project alternatives.

Project: The Fargo-Moorhead Metropolitan Area Flood Risk Management Project, as currently designed at the time of the State EIS publication, includes the Project footprint and associated components, and the staging area.

Project Footprint: Comprised of the diversion channel, Southern Embankment, excavated material berms, shallow drainage ditches outside of the berms, tieback embankments, control structures in the Red and Wild Rice Rivers, and aqueducts structures in the Maple and Sheyenne Rivers.

Propagules: A vegetative structure (e.g., a bud, sucker, or spore) that can become detached from a plant and give rise to a new plant (i.e., reproductive material).

Property Right Area: The Property Rights Area is defined by using the probable maximum flood (i.e., the maximum elevation of the spillway, which is expected to be no higher than 923.5 feet (NAV88)).

Protected Area: The area within which flood risk is reduced, such as downstream of the tieback embankment (the F-M urban area) or within the Oxbow/Hickson/Bakke (OHB) ring levee.

Recognized Environmental Condition (REC): The presence or likely presence of any hazardous substances or petroleum products in, on, or at a property that have the potential to release into the environment, and therefore, pose a threat due to the potential for contamination of soil, groundwater, or surface water. (American Society for Testing and Materials (ASTM) 2013)

Red River Basin Commission (RRBC): An organization whose mission is to develop a Red River Basin integrated natural resources framework plan; to achieve commitment to implement the framework plan; and to work toward a unified voice for the Red River Basin. The RRBC has offices in Moorhead, Minnesota, and Winnipeg, Manitoba. The RRBC is not a local government unit. (<http://www.redriverbasincommission.org/index.html>)

Residual Risk: Exposure to loss that remains after structural or non-structural flood management measures have been countered, factored in. (<http://www.businessdictionary.com/definition/residual-risk.html>)

Return Period: The average number of years between floods of a certain size is the recurrence interval or return period. The actual number of years between floods of any given size varies a lot because of natural variability. (<https://water.usgs.gov/edu/100yearflood.html>)

Right Bank: Right side of stream channel when facing downstream.

Ring Levee: An embankment that is designed to surround a feature or specific area for preventing flooding to a given area. (<http://www.merriam-webster.com/dictionary/levee>)

Riparian Floodplain: A bottomland, deciduous or deciduous-conifer forest community occupying low-lying areas adjacent to streams and rivers of third order or greater, and subject to periodic over-the-bank flooding and cycles of erosion and deposition (i.e., floodplain forest).

Rock-ramps: A passage for surplus water to run over or around an obstruction (as a dam) created with rocks.

Rosgen Level II: A classification described as a morphological description of Stream types A1-A6 to G1-G6 developed by Dave Rosgen. (http://www.fgmorph.com/fg_4_21.php)

Rosgen Level III: A classification described as a Stream State or condition for Stream Types earlier characterized in Level 2 as developed by Dave Rosgen. (http://www.fgmorph.com/fg_4_22.php)

Schumm Stream Classification: Nine subclasses of river channels defined on the basis of channel stability and the dominant mode of sediment transport developed by S.A Schumm. (<http://pubs.usgs.gov/circ/1963/0477/report.pdf>)

Sensitive Species: Those species which are often the first to decline in environments that experience anthropogenic disturbance and associated environmental stressors (Sandberg, 2014).

Shear Stress: The force applied by flowing water parallel to the stream bed (or bank). (http://www.phillywatersheds.org/what_were_doing/waterways_assessment/FGM)

Sheyenne River Diversion: A system of two existing diversion channels that divert the Sheyenne River around Horace and West Fargo, North Dakota. (<http://www.westfargond.gov/Home/Departments/PublicWorks/FloodInformation/SheyenneDiversion.aspx>)

Significant effect: An effect that is predicted to be above an identified threshold and/or an effect that was determined by the lead agencies to have a magnitude that is great based on the context and intensity of that effect.

Significant Nexus: A connection affecting the biological integrity of an adjacent federal navigable water.

Sinuuous: A stream pattern that appears to meander back and forth along its corridor in a wavy form. (<http://www.merriam-webster.com/dictionary/sinuuous>)

Southern Embankment: The embankment constructed between the diversion inlet control structure and the Clay/Wilkin county line.**Special Flood Hazard Area (SFHA):** An area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V. For the purpose of determining Community Rating System (CRS) premium discounts, all AR and A99 zones are treated as non-SFHAs. (FEMA)

Species of Special Concern: Although the species is not categorized as endangered or threatened, it is extremely uncommon in Minnesota, or has unique or highly specific habitat requirements and deserves careful monitoring of its status. May include species that were once threatened or endangered but now have increasing or protected, stable populations.

Spoil Piles: excavated materials consisting of topsoil or subsoils that have been removed and temporarily stored during the construction activity. (https://www.michigan.gov/documents/deq/deq-wb-nps-sp_250905_7.pdf)

Staging Area: The staging area is a Project component that is being used as a management tool for land use/development and application of mitigation by the United States Army Corps of Engineers (USACE),

such as property acquisition. Zone 1 and Zone 2 comprise the area formerly known as the staging area. These areas will be used to define the federal requirements for land mitigation. The USACE would impose use and development limitations on lands where Project impacts produce more than 1 foot of stage for either the 100-year or the 500-year flood event. Zone 1 is a more restrictive inner area, while Zone 2 is a less restrictive outer area.

Taxa: Species.

Temporal Loss: The time it takes to re-establish vegetation, such as floodplain, that was lost due to disturbance. Temporal loss is greater the longer it takes to re-establish previously established vegetation.

Threatened Species: Those likely to become endangered in the foreseeable future throughout all or a significant portion of its range within Minnesota.

Tieback Embankment: The embankment constructed between the diversion inlet control structure and high ground in North Dakota, as well as the embankment constructed east-west along the Clay/Wilkin County line that ties into high ground in Minnesota.

Tolerant: Species that can withstand a broader range of diversity conditions in comparison to a sensitive species. (http://www.epa.gov/caddis/pecbo_intro4.html)

Turbidity: The measure of the relative clarity of a liquid. (<https://water.usgs.gov/edu/turbidity.html>)

Uncontrolled Inlets: Inlets without flap gates.

Wadeable Stream: Streams, creeks and small rivers that are shallow enough to be sampled using methods that involve wading into the water. They typically include waters classified as 1st through 4th order (and sometimes 5th) in the Strahler Stream Order classification system (based on the number of tributaries upstream). (http://water.epa.gov/type/rsl/monitoring/streamsurvey/web_qa_06.cfm#1)

Waters of the State: Waters of the State for Minnesota regulatory agencies are defined in Minnesota Statute 2008, section 115.01, subdivision 22 as *“all streams, lakes, ponds, marshes, watercourses, ...and all other bodies or accumulations of water...which are within...the state or any portion thereof..”* also referred to as Public Waters.

Watershed: A geographic area from which water is drained by a river and its tributaries to a common outlet. A gage or drainage divide separates a watershed from adjacent watersheds.

Weir: A low wall or dam built across a stream or river to raise the level of the water or to change the direction of its flow.

Wetlands: Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

Executive Summary

See Separate Document

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1.0 Introduction

1.1 PROJECT BACKGROUND

The previously proposed Fargo-Moorhead (FM) Flood Risk Management Project was a dam and diversion channel system flood control project designed to divert flood waters around the cities of Fargo, Moorhead, and surrounding metropolitan areas. The FM Project called for the dam and associated staging area not be used until flood levels reached or exceeded the 10-year flood. Project components included, but were not limited to: a system of excavated channels; a channel inlet control structure; dam and tieback embankments; river control structures on the Red and Wild Rice Rivers; an upstream floodwater staging area (staging area); aqueducts and inlet structures on tributaries; levees and floodwalls in the FM metropolitan area and the upstream staging area; community ring levees; non-structural features (such as buy-outs, relocations, or raising individual, existing structures); recreational features (such as multipurpose trails and pedestrian bridges); and environmental mitigation projects located inside and outside the Project area.

The Minnesota Department of Natural Resources (DNR) prepared a state Environmental Impact Statement (EIS) for the Project. The EIS was completed in accordance with the provisions of the Minnesota Environmental Policy Act (MEPA; Minn. Stat. Ch. 116D) and concluded in June 2016 with DNR's EIS adequacy determination.

On February 18, 2016, prior to completion of the state environmental review process, the DNR received an application for a Dam Safety and Public Waters Work permit (2018-0386) for the FM Project, listing the Flood Diversion Board of Authority (the Diversion Authority) as the applicant. Based on the October 2016 Findings of Fact for the Dam Safety and Public Water Work Permit Application, the DNR denied the permit application for the proposed FM Project.

In early 2017, the Diversion Authority informally coordinated with DNR staff regarding the permit denial by engaging in work sessions aimed at addressing DNR's concerns and discussing potential options moving forward. Later in 2017, North Dakota Governor Doug Burgum and Minnesota Governor Mark Dayton created a joint task force to discuss flood control options and make recommendations. The task force created a technical advisory group that included engineers and staff from the Diversion Authority and DNR. The technical advisory group presented the task force with engineering options to address concerns about project impacts.

The key variables discussed and decisions reached included:

- Level of Protection: Consensus on 100-year protection at 33,000 cubic-feet/second (cfs).
- Western Tieback: Consensus to shift the alignment to the west.
- Eastern portion of Southern Embankment: Recommendation to shift the Minnesota-side of the embankment at an angle so that it is relatively parallel to Wolverton Creek.
- Flows Through Town: Recommendation to design for a river stage of 37 feet through town.

- Northern Staging Area: Design feature that would move the northwest segment of the diversion channel closer to the metropolitan area in order to stage additional water in the northwest portion of the project area. The task force did not make recommendation for the alignment of the diversion.
- Southern Embankment: For the purpose of identifying a potential alignment recommendation, the technical advisory group considered three different options for the dam alignment. The task force did not make recommendation for the alignment of the embankment.

On March 16, 2018, after considering the recommendations of the task force and technical advisory group, and engaging in additional discussions with the DNR, U.S. Army Corps of Engineers (USACE), and Richland-Wilkin Joint Powers Authority, the Diversion Authority submitted a permit application for a revised FM Project, known as “Plan B”. The Plan B project changes the alignments of the Southern Embankment alignment, the Eastern Tieback, and the Western Tieback. Plan B also allows more flows through town. These component changes result in a different inundation and staging area that was not analyzed in the 2016 EIS, and also result in modifications to, and elimination of, some project structures, such as the Comstock Ring Levee.

1.2 NEED FOR A STATE OF MINNESOTA SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

On June 29, 2016 the DNR issued an Adequacy Decision for the Fargo-Moorhead Flood Risk Reduction Project Final Environmental Impact Statement (EIS). This decision marked the completion of the environmental review process for the previously proposed project. On October 3, 2016 the DNR denied the Dam Safety and Public Water Works permits for the previously proposed project. As discussed above in Section 1.1, the Diversion Authority submitted a new Dam Safety application on March 16, 2018 for the newly-proposed Plan B Project. DNR compared the proposed changes to the Project elements that were evaluated in the 2016 EIS to the current Project proposal. The changes to the Project include:

- Approximately four miles of earth embankment associated with the Western Tieback alignment of the Dam/Southern Embankment was shifted about 45 degrees to the west to be oriented northeast to southwest to tie into high ground. Portions of this realignment are relocated over two miles from the previous configuration. This shift also changed the location of the Limited Service Spillway that is proposed as part of the embankment.
- Over five miles of earthen embankment in Minnesota has been relocated by 90 degrees to be oriented in a mainly north-south alignment just east of the Red River and west of Wolverton Creek. The length of the embankment in Minnesota has been increased by about one mile. This relocation changes the site of the proposed Red River Control Structure. Under the revised Project proposal, box culverts would allow Wolverton Creek to pass through the Eastern Tieback levee. Based on this relocation of the embankment in Minnesota, the City of Comstock ring levee has been removed from the Plan B proposed Project.
- The Dam/Southern Embankment has been modified in several areas. In the area around the Wild Rice River, the Embankment reaches south into what was previously the Staging Area, which also changes the location of the Wild Rice River Control Structure. In the area between the Wild Rice River and the Diversion Inlet Control Structure, the alignment has been shifted north into what was previously the protected area. The elevation of the top of the Dam/Southern Embankment has been reduced from 930.1 to 928.5 feet MSL NAVD 1988 and the associated 100-year flood event staging area elevation would be reduced from 922.2 to

921.0 feet MSL NAVD 1988. All of these changes would result in between a two and five mile upstream shift of the area that would be inundated by the proposed Project.

- The previous project proposed to begin operation at 17,000 cfs. The Plan B Project proposal indicates that operations would not begin until the river stage at the USGS Fargo stream gage reaches 37 feet, thus increasing the flow through town by 4,000 cfs under the Plan B Project proposal. This would imply a river discharge of greater than 21,000 cfs. Additional in-town flood protection measures would be needed to accommodate this flow through town.
- The Diversion Authority is currently proposing that the Project be evaluated using a 100-year flood event that is calculated with the full period of record (POR) hydrology. This flood event is approximately 33,000 cfs with a 41.3 foot river stage. The previous evaluation in the 2016 Final EIS used a 100-year flood event that was calculated with a wet period identified by an expert opinion elicitation panel (EOEP) that was approximately 34,700 cfs with a 42.1 foot river stage.

Minnesota Rules, part 4410.3000 Subpart 3A identifies the situations that require a Responsible Governmental Unit (RGU) to prepare a Supplemental EIS. The specific situations that are relevant to the 2018 permit application are:

Substantial changes have been made in the proposed project that affect the potential significant adverse environmental effects of the project; or

There is substantial new information or new circumstances that significantly affect the potential environmental effects from the proposed project that have not been considered in the final EIS or that significantly affect the availability of prudent and feasible alternatives with lesser environmental effects

The relocation of the Dam/Southern Embankment and associated change in locations of the Red River and Wild Rice River Control Structures would result in a different inundation area and construction footprints within the rivers than what was evaluated in the 2016 EIS.

Relocation of the Eastern and Western Tieback levees also result in approximately 25 square miles of different inundation area that were not evaluated in the 2016 EIS. These relocations also change approximately ten miles of embankment construction footprint area.

The change in operations from 17,000 cfs to over 21,000 cfs would require additional in-town flood protection measures that were not evaluated in the 2016 EIS.

Using the full period of record for determining the 100-year flood event is not a project change. However, this is a lower 100-year event that what was used to evaluate the Project in the 2016 EIS. Given that one of the articulated Project purposes was for 100-year flood accreditation for substantial portions of the Fargo-Moorhead Metropolitan Area, this change could potentially change how the Project (or project alternatives) would achieve one of the stated project purposes. As such, it could affect the availability of prudent and feasible alternatives.

The environmental review rules and guidance provided by the Environmental Quality Board do not define or attempt to describe what constitutes a “substantial” change. The 1988 Statement of Need and Reasonableness for the revisions of the environmental review rules describes the intent of Minnesota Rules, part 4410.3100 Subpart 3A:

“Subparagraph one establishes the two situations in which a supplemental EIS may be necessary. In the first situation a project may be altered in scope such that the potential for significant adverse effects may be changed to a degree that it may cause a governmental unit with jurisdiction to reassess a revocable decision or to require additional information prior to making a decision yet outstanding...”

While the DNR denial of the 2016 permit application is not a revocable decision, the 2018 revision and resubmittal of the Plan B permit application is a clear indication that the Diversion Authority would like DNR to reconsider the 2016 application denial in light of these proposed Project changes.

These project revisions have changed the nature and location of certain Project features. Based on the above information, the DNR as RGU for this project has determined that these changes in location of potentially significant environmental effects, combined with the change in circumstance for evaluating the 100-year flood event, should be interpreted as “substantial and may affect the potential significant adverse environmental effects of the Project” (Minnesota Rules, part 4410.3000, subpart 3, item A(1)), and therefore warrant preparation of a Supplement Environmental Impact Statement (SEIS).

1.3 SEIS PROCESS, SCOPE AND TIMELINE

The SEIS process, scope and timeline are established in Minnesota Rules parts 4410.3000, subpart 5; 4410.1500; 4410.2300 items D-J; 4410.2400; 4410.2500; and 4410.2600, subparts 2-10, 4410.2700 and 4410.2800. The rules dictate that the RGU shall prepare, distribute, and review the SEIS as described below.

1.3.1 Process

1. Developing and sharing the topics and information to be studied:
 - a. The RGU will develop and adopt a scope for the SEIS document that is limited to information not addressed, or determined inadequately addressed, in the 2016 EIS, which could include impacts, alternatives, and mitigation measures.
 - b. Upon adopting a scope, the RGU distributes a notice of preparation of the SEIS for a 20-calendar day public comment period. This notice of preparation contains the following:
 - The title of the EIS being supplemented, the proposed time schedule for preparation, and its approximate date of completion;
 - The reason for needing the SEIS, including how changes in the proposed project may affect the potential significant environmental effects from the project or the availability of prudent and feasible alternatives; and
 - The scope of the SEIS including issues to be analyzed, alternatives to be examined, and studies to be undertaken.

Distribution of the preparation notice is required to be sent to all persons who received the 2016 final EIS, to all individuals or organizations on the EAW distribution list under Minn. R. part 4410.1500, and to any person who requested that a supplement be prepared under Minn. R. 4410.3000, subpart 4. The Minnesota Environmental Quality Board (EQB) shall publish a summary of the preparation notice in the EQB Monitor.

Minnesota Rules directs the RGU to give due consideration to written comments received within the 20-day publication period of the SEIS preparation notice. Written comments and a response shall be included in the draft SEIS (DSEIS).

2. Draft SEIS development and distribution:

Minnesota Rules direct the RGU to prepare and distribute a DSEIS for the purposes of receiving public comment.

 - a. The RGU must hold a public, informational meeting not less than ten days after publication of notice in the *EQB Monitor*.
3. The RGU shall prepare and distribute a final supplement to an EIS in accordance with part 4410.2700.
4. Adequacy determination:
 - The RGU must determine the adequacy of the final EIS 120 days after publishing the Supplement EIS preparation notice is published in the *EQB Monitor*.
 - Interested persons may submit written comments on the adequacy of the final EIS to the RGU, during a ten business-day comment period after the final EIS is published in the *EQB Monitor*. The notice of availability of the final EIS shall indicate length of the comment period and when it expires.
 - An EIS shall be determined adequate if it:
 - A. addresses the potentially significant issues and alternatives raised in scoping so that all significant issues for which information can be reasonably obtained have been analyzed in conformance with Minnesota Rules part 4410.2300, items G and H;
 - B. provides responses to the substantive comments received during the draft EIS review concerning issues raised in scoping; and
 - C. was prepared in compliance with the procedures of the act and Minnesota Rules parts 4410.0200 to 4410.6500.
 - If the RGU determines that the EIS is inadequate, the RGU shall have 60 days in which to prepare an adequate SEIS. The revised SEIS shall be circulated in the same manner as accord with part 4410.2700, subpart 3.
 - The RGU then distributes within five days its adequacy decision to all persons who received copies of the final EIS. The decision is also published in the *EQB Monitor*.

1.3.2 Scope

In accordance with Minnesota Rules 4410.3000 subpart 5A, the information presented in the SEIS focuses on the proposed Fargo-Moorhead Flood Risk Management Diversion Plan B Project.

Alternatives considered for inclusion must pass a multi-part test assessing first whether the alternative would meet the basic need for or purpose of the Project, and secondly whether the alternative is feasible. The third test determines if the alternative is potentially environmentally superior or similar to the Project and fourth, whether the economic, employment, or sociological impacts of the alternative would be substantially superior. A detailed discussion of the SEIS alternative screening is located in Section 2.2.

On May 22, 2018, the DNR published the SEIS Preparation Notice in the EQB Monitor to identify potentially significant environmental effects and request a 20-day public comment period. The comment period extended from May 22, 2018 through June 11, 2018. A total of 46 comments were received and are categorized and included in Appendix A. DNR considered these comments in revising the issues identified in the Preparation Notice for evaluation in the SEIS.

1.3.3 Timeline

Minnesota Rules part 4410.3000, subpart 6 establishes that a determination of adequacy must be made within 120 calendar days of the order for preparation of the supplement, unless an extension is consented to by the proposer and RGU or directed by the governor for good cause. The SEIS process began on May 22, 2018 with the Preparation Notice publication.

1.4 PURPOSE AND NEED

The proposer has not changed the purpose and need statement from the 2016 EIS. When assessing the viability of various alternatives to include in the SEIS, the DNR considered the fundamental need for the Project in addition to the environmental and socioeconomic merits of each alternative.

The following purpose and need statements were developed by the Diversion Authority to meet the needs of the state environmental review process and are not the same as those used in the Final Feasibility Report and Environmental Impact Statement (FFREIS).

The purpose of the Project is to reduce flood risk, flood damages, and flood protection costs related to flooding in the F-M metropolitan area. To the extent technically and fiscally feasible, the Project will:

- Reduce flood risk potential associated with a long history of frequent flooding on local streams including the Red River, Sheyenne, Wild Rice, Maple, Rush and Lower Rush Rivers passing through or into the F-M metropolitan area,
- Qualify substantial portions of the F-M metropolitan area for 100-year flood accreditation (i.e., meets the standard to be shown on Flood Insurance Rate Maps as providing protection) by the Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program; and
- Reduce flood risk for floods exceeding the 100-year flood or greater, given the importance of the F-M metropolitan area to the region and recent frequencies of potentially catastrophic flood events.

1.5 GOVERNMENT APPROVALS AND FEDERAL REGULATORY PROGRAM AND LAW REQUIREMENTS

The EIS provides information and evaluation on potential environmental impacts resulting from the Project, as well as identifies the possible need for additional mitigation measures. The EIS is not a decision-making document, but is to be used by governmental units as information and a guide for the permitting process (Minnesota Rules, part 4410.0300: Authority, Scope, Purpose, and Objectives). All Minnesota local and state government bodies identified in an environmental impact statement with permitting authority shall consider the report in making any decision to authorize the project according to Minnesota Rules, part 4410.7055. Also, if an EIS is required for a governmental action (defined by Minnesota Rules, part 4410.0200, subpart 33); no permits or approvals may be granted, nor can a

project begin until environmental review is completed, including an EIS Determination of Adequacy by the DNR, according to Minnesota Rules, part 4410.3100.

Although the EIS provides information for use in permit issuance or denial, it is not required to gather or present all necessary permit-related information. Additional information may be required as part of the various permitting processes depending on the permit and the permitting authority. A Determination of Adequacy does not mean a permit will be granted.

The permits and approvals required or potentially required for the Plan B Project are listed in Table 1-1 and includes the same required permits as the Project design assessed by the 2016 EIS. Prior to Project implementation, the non-Federal sponsors are required to comply with all applicable federal and state laws and regulations (USACE, 2011b). The USACE has indicated regulations would be followed as required by federal law, and that they would continue to work with state and local entities for Project implementation.

Table 1-1 Summary of Federal, State and Local Permits, Approvals, and Federal Regulatory Programs and Laws Related to Plan B

Federal Agencies

Permit/Approval/Compliance	Governing Agency	Responsibility
Clean Water Act – Section 404	USACE	Non-Federal Sponsor if constructed by Non-Federal Sponsor ¹
Section 7 of the Endangered Species Act Coordination	United States Fish and Wildlife Service (USFWS)	USACE
Executive Order 11988: Floodplain Management	USACE	USACE
Rivers and Harbors Act of 1899 – Sections 9 and 10	USACE	Non-Federal Sponsor if constructed by Non-Federal Sponsors
Conditional Letter of Map Revision (CLOMR)	FEMA	Non-Federal Sponsors
Letter of Map Revision (LOMR)	FEMA	Non-Federal Sponsors
Prime and Unique Farmlands	Natural Resources Conservation Service	USACE

State Agencies: North Dakota

Permit/Approval/Compliance	Governing Agency	Responsibility
Clean Water Act – Section 401 Certification, Water Quality - ND	North Dakota Department of Health (NDDH)	USACE
Dewatering Permit	NDDH	Contractor
NPDES Stormwater Permit	NDDH	Contractor/Owner
Aquatic Nuisance Species Rule	North Dakota Game and Fish Dept.	Contractor

Permit/Approval/Compliance	Governing Agency	Responsibility
Memorandum of Understanding	North Dakota Department of Transportation (NDDOT)	Non-Federal Sponsors
Permit(s) for work in right-of-way	NDDOT	Non-Federal Sponsors
Section 106 Consultation	Archaeology and Historic Preservation Division, State Historical Society of North Dakota	USACE
Waters Drain Permit	North Dakota State Water Commission (ND State Water Commission)	Non-Federal Sponsors
Construction Permit	North Dakota Office of State Engineer	Non-Federal Sponsors
Sovereign Lands Permit	North Dakota Office of State Engineer	Non-Federal Sponsors
Surface Drain Permit	North Dakota Office of the State Engineer	Non-Federal Sponsors

State Agencies: Minnesota

Permit/Approval/Compliance	Governing Agency	Responsibility
Dam Safety Permit	Minnesota Department of Natural Resources (DNR)	Non-Federal Sponsors
Water Appropriations Permit	DNR	Non-Federal Sponsors
Work in Public Waters Permit	DNR	Non-Federal Sponsors
Burning Permit	DNR	Non-Federal Sponsors
Infested Waters Permit	DNR	Non-Federal Sponsors
Prohibited Invasive Species Permit	DNR	Non-Federal Sponsors
Cooperative Construction Agreement	Minnesota Department of Transportation (MNDOT)	Non-Federal Sponsors
Clean Water Act (CWA) – Section 401 Certification, Water Quality – MN	Minnesota Pollution Control Agency (MPCA)	USACE
NPDES Stormwater Construction Permit	MPCA	Contractor/Owner
Section 106 Consultation	Minnesota State Preservation Historic Office	USACE

Counties: Minnesota

Permit/Approval/Compliance	Governing Agency	Responsibility
Floodplain	Clay County, Minnesota	Non-Federal Sponsors
MN Wetland Conservation Act	Clay Soil and Water Conservation District	Non-Federal Sponsors

Permit/Approval/Compliance	Governing Agency	Responsibility
MN Wetland Conservation Act	Wilkin County, Minnesota	Non-Federal Sponsors

Townships: North Dakota

Permit/Approval/Compliance	Governing Agency	Responsibility
Building Permit	Harwood Township, North Dakota	Non-Federal Sponsors
Floodplain Permit	Harwood Township, North Dakota	Non-Federal Sponsors
Conditional Use Permit -Site Approval for General Ground Excavation	Mapleton Township, North Dakota	Non-Federal Sponsors
Conditional Use Permit -Site Approval for General Ground Excavation	Pleasant Township, North Dakota	Non-Federal Sponsors
Conditional Use Permit -Site Approval for General Ground Excavation	Warren Township, North Dakota	Non-Federal Sponsors

Townships: Minnesota

Permit/Approval/Compliance	Governing Agency	Responsibility
Interim Zoning Ordinance	Holy Cross, Minnesota	Non-Federal Sponsors

Municipalities: North Dakota

Permit/Approval/Compliance	Governing Agency	Responsibility
Floodplain Permit	City of Fargo, North Dakota	Non-Federal Sponsors
Stormwater Permit	City of Fargo, North Dakota	Non-Federal Sponsors
Conditional Use Permit -Site Approval for General Ground Excavation	City of Horace, North Dakota	Non-Federal Sponsors
Conditional Use Permit	City of West Fargo, North Dakota	Non-Federal Sponsors
Conditional Use Permit -Site Approval for General Ground Excavation	City of Argusville, North Dakota	Non-Federal Sponsors

Municipalities: Minnesota

Permit/Approval/Compliance	Governing Agency	Responsibility
Floodplain Permit	City of Moorhead, Minnesota	Non-Federal Sponsors
Stormwater Permit	City of Moorhead, Minnesota	Non-Federal Sponsors

Other Jurisdictions

Permit/Approval/Compliance	Governing Agency	Responsibility
Application to Drain	Cass County Joint Water Resource District, North Dakota (Cass County Joint WRD)	Non-Federal Sponsors

Permit/Approval/Compliance	Governing Agency	Responsibility
Construction/Floodplain Approval	Buffalo-Red River Watershed District, Minnesota (BRRWD)	Non-Federal Sponsors
Two Rivers Watershed District (WD) Application	Two Rivers WD, Minnesota	Non-Federal Sponsors

¹A section 404 permit would be required for construction of the Project if construction is completed by an entity other than the USACE as they are the governing agency. However, the USACE is required to adhere to Section 404 requirements for construction.

2.0 Plan B and Alternatives

The previously-proposed Project would primarily serve the Fargo-Moorhead (F-M) area as described in the 2016 Final EIS. This chapter provides updated descriptions and discussion on Plan B and alternatives considered. Section 2.2.1 provides an Alternatives Screening Summary to describe the alternatives and the criteria used to determine if a Supplemental EIS (SEIS) analysis was warranted.

2.1 PLAN B OVERVIEW

The previously-proposed Project was described in detail in the 2016 Final EIS section 2.1.1. Many of the Plan B components are similar to those from the previously-proposed Project. The Plan B Project changes the alignment of the Southern Embankment, the Eastern Tieback and the Western Tieback (Figure 1). Plan B allows more flows through town. These component changes result in a new inundation area, and result in modifications to, and elimination of, some project structures.

Direct disturbance of approximately 9,200 acres would occur with construction of the Plan B components. Project operation would increase the depth and duration of existing flooded areas in portions of the project area. Any land that becomes flooded (including areas that are flooded without the Project), regardless of depth, and as a result of Project operation is referred to as inundation area(s) for this SEIS. A 1-percent chance flood (100-year flood), with construction and operation of the Project, has the potential to create an inundation area totaling approximately 123,954 acres, of which 111,905 acres which would be inundated with or without the Project and 12,049 acres would be new inundation (see Figure 2).

Going east to west, the Eastern Tieback would extend from high ground in Minnesota along the Clay/Wilkin county line to near U.S. Highway 75 south of Comstock, Minnesota. The dam/Southern Embankment would extend from this point to the diversion inlet control structure. The Western Tieback would start at the Diversion Inlet Control Structure and head in a southwesterly direction along a high ridge. The Western Tieback, Eastern Tieback dam/Southern Embankment, and control structures would impound water in the inundation areas and would be designed to meet USACE dam safety standards. Also, the embankments, tiebacks and control structures collectively fall within the definition of a Class I dam under Minnesota Rules, part 6115.0340.

As proposed, Plan B would retain an approximate 30-mile long diversion channel on the North Dakota side of the F-M area. Plan B would also include about 20 miles of dam/southern embankment and tieback levees. When operated, Plan B would divert a portion of the Red, Wild Rice, Sheyenne and Maple Rivers' flow upstream of the F-M urban area, intercept flow at the Lower Rush and Rush Rivers, and return it to the Red River downstream of the F-M urban area. Operation of the Red and Wild Rice River control structures would occur when it becomes known that a stage of 37.0 feet would be exceeded at the United States (U.S.) Geological Survey (USGS) gage in Fargo (Fargo gage). At this stage, the flow through Fargo would be approximately 21,000 cubic feet per second (cfs). A flow of 21,000 cfs at the Fargo gage is approximately a five-percent chance flood (i.e., 20-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.

The Project would remove large portions of existing floodplain downstream of County Road 16 and within the F-M area downstream of the tieback embankment. This 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. When the Project operates, the stage from a 100-year flood on the Red River would be reduced from approximately 41.4 feet (assuming emergency levees confine the flow) to 37.0 feet at the Fargo gage.

2.1.1 Detailed Project Description

Components of Plan B are described below in terms of whether they changed from the previously-proposed Project. Many of the components can be viewed on the Project Component Map (Figure 1).

2.1.1.1 Dam

A “dam” is an artificial barrier that may impound water, so the “dam” includes the control structures and tiebacks, and collectively fall within the definition of a Class I dam under Minnesota Rules, part 6115.0340. Regulated dams subject to existing dam safety rules are defined in Minnesota Rules, part 6115.0320, subpart 5, and typically include dams with a height of greater than six feet and an impoundment volume greater than 15 acre-feet. The control structures are gated structures that span the river and control the flow of water downstream and include the Red River control structure, the Wild Rice River control structure, and the diversion inlet control structure. The embankments are raised structures constructed of soil and include the dam/Southern Embankment and both the western and Eastern Tieback embankments.

Dam/Southern Embankment

The Southern Embankment was called the tieback embankment for the previously-proposed dam. The embankment formerly extended from the diversion inlet control structure east into Minnesota. Plan B adds a square-shaped jog cutout to the north in the alignment (what was previously described as Storage Area #1 in USACE alternative analyses). Starting near the diversion inlet control structure, the alignment jogs north for about 1.7 miles, then east for 2.8 miles, then south for 2.5 miles, before meeting up again very near the previously-proposed alignment just west of the Wild Rice River control structure. The purpose of this jog is to store additional water.

The Southern Embankment alignment in Minnesota previously extended easterly from the Red River control structure. The Plan B alignment of the Southern Embankment in Minnesota would extend in a southerly direction roughly parallel with Wolverton Creek and ending just north of the Clay/Wilkin county line. The crest of the embankment in Minnesota would have an elevation of 929.0 feet at the north end and would transition up to an elevation of 931.0 feet at the south end.

Western Tieback

The Western Tieback previously extended directly south. The Plan B Western Tieback would extend in a southwesterly direction towards the Sheyenne River, as shown in Figure 1. The previous location of the Western Tieback assumed that a portion of Cass County Road 17 would serve as a dam embankment, but this is no longer the case. The proposed alignment of the

Western Tieback would not follow an existing road. However, as proposed with the previous alignment, a portion of the Western Tieback would be constructed at the maximum pool elevation. The portion of the Western Tieback constructed at the maximum pool elevation would only be overtopped in the event of a significant gate failure at one of the control structures and/or during extreme flood events.

Specifically, the Western Tieback crest profile would transition from 931.0 feet just southwest of the Diversion Inlet Control Structure down to the maximum pool elevation, which would be no greater than 924.0 feet. The crest would remain at an elevation no greater than 924.0 feet for approximately 3,800 feet in a southwesterly direction until a natural ridge is intersected. At the natural ridge the crest would rise to an elevation of 929.0 feet to again provide at least 5 feet of freeboard. The crest would remain at an elevation of 929.0 feet in a southwesterly direction until natural ground having an elevation of 929.0 feet is reached. This occurs approximately 1,200 feet west of County Road 36 (168th Avenue SE).

Eastern Tieback and Wolverton Creek Structure

The Eastern Tieback runs east-west in Minnesota, shown in Figure 1, would be located approximately 500 feet north of the Wilkin/Clay County line. This section would begin as a transition from an elevation of approximately 931.0 feet to an elevation of 926.0 feet at Highway 75. This transition would not require a raise of the Highway 75 roadway profile. Between Highway 75 and the eastern edge of the Burlington Northern Santa Fe Rail Lines (BNSF) railroad embankment, the Eastern Tieback would be built to an elevation of 925.9 feet. The railroad embankment elevation would not need to be altered as part of this plan. Between the eastern edge of the railroad and natural high ground to the east of Wolverton Creek, the embankment would be built to an elevation of 924.3 feet. The eastern edge of this reach would tie-in to ground that is naturally at an elevation of 924.3 feet. Because the alignment would cross Wolverton Creek, three 10-foot by 10-foot box culverts would be installed at the Wolverton Creek crossing location. The culvert sizes were selected to ensure water surface elevations would not increase for the 100-year and 500-year flood events. Figure 3 displays the preliminary plan and profile drawings for the Wolverton Creek Crossing.

The Eastern Tieback embankment elevations were selected to allow flow to overtop during the Probable Maximum Flood (PMF) event. However, flows passing over the embankment and through the culverts during the PMF event would not be greater than the flows passing through this location under existing conditions, ensuring that PMF water surface elevations in Comstock would not increase.

The lengths of the Plan B dam components compared to the previously-proposed Project are summarized in Table 2-1, below.

Table 2-1 Dam Component Length in Feet/Miles

Project Component	Original Plan (feet/miles)	Plan B (feet/miles)	Approximate Change
Western Tieback	16,745/3.2	16,462/3.1	-1.7%
Diversion Inlet to Red River	33,737/6.4	49,179/9.3	31.4%
Red River to the East	33,608/6.4	40,759/7.7	17.5%
Total Length	84,090/15.9	106,400/20.2	21.0%

2.1.1.2 Red River and Wild Rice River Control Structures

The updated dam alignment changes the potential location of the Red River (RRS) and Wild Rice River Control Structures (WRRS). The proposed location of the Red River Structure is approximately two-thirds of a mile (straight-line distance) south of the previously-proposed location on the North Dakota side of the Red River. While the proposed location has changed, the design of the Red River Structure is expected to be very similar to what had been previously-proposed. The structure is expected to consist of three tainter gates, each having a width of 50 feet and a sill elevation of 873.0 feet. Figure 4 shows the preliminary plan for the Red River Structure and Figure 5 shows the preliminary profiles.

The new proposed location of the Wild Rice River Structure is approximately one mile (straight-line distance) southwest of the previously-proposed location. While the proposed location has changed, the design of the Wild Rice River Structure is expected to be very similar to what had been proposed previously. The structure would consist of two tainter gates, each having a width of 40 feet and a sill elevation of 886.6 feet. Figure 6 shows the preliminary plan for the Wild Rice River Structure and Figure 7 shows the preliminary profiles.

2.1.1.3 Connecting Channel

Prior to Plan B, the connecting channel would have provided the geometry necessary to convey large flows to the Diversion Inlet Structure (DIS) for extreme flood events and aid with pool drawdown as well serving as the path for local drainage. With the Plan B alignment, these needs would be accomplished differently. Conveying large flows to the DIS would be accomplished by an arc of excavation upstream of the DIS, not a long channel (the connecting channel). The borrow ditch along the south side of the dam will serve as the path for local drainage and will aid with pool drawdown.

2.1.1.4 Diversion Inlet Control Structure

The Diversion Inlet Control Structure (DIS) for Plan B would be designed the same as described for the previously-proposed Project. The location of the diversion inlet control structure would change slightly; it would be located where the diversion channel crosses Cass County Highway 17 in the southwest quarter of Section 32 (formerly 31), Stanley Township, Cass County, North Dakota, as shown in Figure 1. Conditions on the Red, Wild Rice, Sheyenne, and Maple Rivers were proposed to be monitored to determine gate operation need and minimize downstream impacts. Plan B will expand monitoring to include the Rush Rivers and Wolverton Creek.

2.1.1.5 Staging Area

The USACE has replaced the term “staging area” with two zones: Zone 1 and Zone 2. However, the relative area still serves the same purpose:

“...a defined area immediately upstream of the dam. When the project is operated, water will be temporarily detained in the staging area to minimize impacts downstream of the diversion outlet. The staging area encompasses the area where the Project increases the 100-year flood water surface elevation by 1 foot or more over existing conditions and encroachment must be prevented to preserve operability of the project. The staging area is a Project component that is being used as a management tool for land use/development and application of mitigation by the USACE, such as property acquisition, easements, and programmatic agreements, and it does not constitute the total area affected by Project operation.”

Zones 1 and 2 would be used to define the federal requirements for land mitigation. The USACE would impose use and development limitations on lands where Project impacts produce more than 1 foot of stage for either the 100-year or the 500-year flood event. Zone 1 is a more restrictive inner area, while Zone 2 is a less restrictive outer area.

As with the previously-proposed Project, there are areas outside of the zones that would become newly-inundated or would experience additional depths of flooding as a result of Project operation. The majority of these inundated areas outside the zones would experience less than one foot of additional flood depth and are not considered part of the required volume for Project operation. For the purposes of the EIS, the term “staging area” or “zones” is used when referring to a Project component. The term “inundation area(s)” is used to describe any land that becomes flooded, regardless of depth. “Inundation area” is not tied to use with any specific flood event or to the Project or Project alternatives.

The Plan B “staging area” would be shifted slightly north and west due to changes to the tieback and embankment locations and allowing more flows through town. The “staging area” boundary under Plan B is a little smaller than with the previously-proposed Project. With the previously-proposed Project, roughly 32,000 acres was required for water storage for Project operation. Plan B requires about 4,000 fewer acres (i.e., 28,000 acres) for Project operation water storage. In order to minimize downstream impacts, the previously-proposed Project required an additional 150,000 acre-feet of storage; whereas Plan B reduces this additional storage to approximately 110,000 acre-feet.

2.1.1.6 Diversion Channel

The diversion channel features for Plan B are the same as those described for the previously-proposed Project.

2.1.1.7 Maple River and Sheyenne River Aqueducts

The Maple River and Sheyenne River aqueducts for Plan B are the same as those described for the previously-proposed Project.

2.1.1.8 Lower Rush River and Rush River Rock Ramps

The Lower Rush River and Rush River spillways for Plan B are the same as those described for the previously-proposed Project.

2.1.1.9 Inlets, Ditches, and Smaller Control Structures

The proposed locations and flow paths of the drainage ditches within the upstream inundation area have been modified from the previously-proposed Project and currently-proposed structures are described in detail in Appendix C.

On the North Dakota side, Cass County Drain 47 would be intersected by the Western Tieback. Cass County Drain 27 would be intersected by the Southern Embankment. The portion of Drain 27 south of the Southern Embankment would no longer flow north through the City of Fargo, but would flow east and south parallel with the Southern Embankment and outlet just south of the Wild Rice River Structure.

On the Minnesota side, the Southern Embankment would be realigned such that it follows relatively high ground from the Red River to Highway 75. Then, it would extend south to a location that is approximately 500 feet north of the Clay/Wilkin County border, at which point the Eastern Tieback would extend east across Wolverton Creek to a location of high ground. This new proposed alignment eliminates the need for many local drainage pattern changes. New box culverts through the Eastern Tieback levee would allow Wolverton Creek to flow through its existing channel. All other Creek tributaries would drain away from the proposed alignment. A local ditch would be constructed on either side of the Eastern Tieback to drain local water to Wolverton Creek. All water adjacent to the Southern Embankment would flow in a local drainage ditch parallel to the Southern Embankment that is then directed toward the Red River.

2.1.1.10 Oxbow/Hickson/Bakke Ring Levee

Without flood protection, under Plan B operation, the city of Oxbow, village of Hickson, and Bakke Subdivision (OHB) in North Dakota would be inundated between 2.5 and 6 feet during a 100-year flood. A ring levee is proposed as part of the Project to protect these communities from inundation. This ring levee was also part of the previously-proposed Project. There are no anticipated changes to the top of levee elevation for the OHB Levee, nor are there any anticipated changes with the interior drainage system. The design water surface elevation remains at 922.5, and the top of levee elevation remains at 927.6. The 100-year flood peak water surface elevation with Plan B has decreased about one foot, but the 500-year flood has increased about 0.4 feet. The interior drainage system was designed for gravity flow conditions into the Red River, and pumped conditions into the Red River. The Plan B changes are not anticipated to affect the operation and performance of these two conditions.

2.1.1.11 Comstock Ring Levee

The community of Comstock, Minnesota would have been located on the “wet” side of the dam under the previously-proposed Project. Plan B would locate Comstock on the “dry” side of the dam; therefore, this project component is not included as part of Plan B.

2.1.1.12 Floodwalls and In-Town Levees

One of the major changes for Plan B as compared to the previously-proposed Project includes allowing water to flow through the Fargo-Moorhead urban area (Flow Through Town) that would result in a river stage (RS) of 37' at the USGS Fargo stream gage during the 100-year flood event. This equates to a discharge of approximately 21,000 cfs at the Fargo gage. Plan B would include floodwalls and levees in Fargo and Moorhead, which would provide protection for RS37'. The in-town levees would be such that Federal Emergency Management Agency (FEMA) would be able to accredit the levees for the 100-year flood once the Plan B Project is complete.

A number of the in-town levee features have been designed and constructed as part of the previously-proposed Project and do not require modifications to accommodate RS37'. These include the following features:

- Maintain certification of existing 4th Street levee (Fargo)
- Certification of the existing Ridgewood/VA levee (Fargo)
- Certification of the existing project area F1 levee (Moorhead)
- Certification of the Mickelson Field levee and Mickelson Levee Extension (Fargo)
- Certification of El Zagal levee/flood wall (Fargo)
- Certification of the 2nd Street/Downtown levee/flood wall project (Fargo)

- Certification of the existing Woodlawn Area levee (Moorhead)
- Certification of the existing Horn Park Area levee and flood wall (Moorhead)

In addition to the measures identified above, there are a number of flood protection measures that have been or are being designed and constructed by the cities of Fargo and Moorhead using state and local funding that would address areas with ground elevations below the minimum freeboard height (RS37' plus 2.5 ft) associated with Plan B. The unconstructed in-town measures are address in Chapter 4, Cumulative Potential Effects.

2.1.1.13 Transportation, Utility and Drainage Features

A Transportation Master Plan has been prepared for Plan B and is included as Appendix D. As part of Plan B, key roads, including Interstate 29 would be raised within the staging area. Additional roads, including 3rd Street South, 140th Avenue South and 160th Avenue South in Clay County, Minnesota and 168th Avenue Southeast, Cass County Highway 81 and Cass County Highways 16/17 in Cass County, North Dakota would be raised where they cross the dam/Southern Embankment, but the remaining portions of these roads would not be raised. Portions of the remaining roads within the staging area would be inundated for a period of time during project operation. With Plan B, no grade raises are planned for U.S. Highway 75 nor the BNSF Moorhead Subdivision rail line. After completion of the Project, all parcels of land would continue to have direct access from an adjacent road. The following are major transportation feature changes associated with Plan B when compared to the previously-proposed Project:

- Interstate 29 – Slight reduction in the amount of grade raise with Plan B.
- U.S. Highway 75 – No grade raise needed with Plan B.
- BNSF Moorhead Subdivision Rail Line – No grade raise needed with Plan B.
- Clay County, Minnesota:
 - Clay County Highway 7 – No Southern Embankment/dam crossing required with Plan B.
 - Clay County Highway 61 – No Southern Embankment/dam crossing required with Plan B.
 - 3rd Street South – Southern Embankment/dam crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - 140th Avenue South - Southern Embankment/dam crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - 160th Avenue South - Southern Embankment/dam crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - City of Comstock ring levee and associated roadway modifications is not required as part of Plan B.
- Cass County, North Dakota
 - 168th Avenue Southeast – Southern Embankment/dam crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - Cass County Highway 81 – Southern Embankment/dam crossing proposed as part of Plan B and the previously-proposed Project.
 - Cass County Highway 16 – Southern Embankment/dam crossing proposed as part of Plan B, but not as part of the previously-proposed Project. A portion of the roadway would be located in the upstream staging area for Plan B, but was not for the previously-proposed Project.

- Cass County Highway 17 – A portion of the roadway would be located in the upstream staging area for Plan B, but was not for the previously-proposed Project.
- Cass County Highways 16/17 – Requires re-alignment for Plan B to accommodate the Diversion Inlet Structure.

Within the benefited area, approximately 4.4 miles of roadway were identified for improvement in North Dakota at RS37 feet, with a maximum grade raise height of 1.5 feet. While in Minnesota, approximately 4.0 miles of roadway were identified to be impacted at RS37 feet with a maximum grade raise height of approximately 4 feet.

2.1.1.14

Project Operation

An Operation Plan is being prepared by the USACE in order to provide a summary of water control management activities associated with the Fargo-Moorhead Metropolitan Area Flood Risk Management Project. The Operation Plan was not complete at the time of this Draft SEIS publication. The Plan will relate to the hydraulic and hydrologic aspects of Plan B, and will identify actions that will be included in the Water Control Manual for the project prior to completion of the project. The water control management activities may be revised as detailed design proceeds, or through the Adaptive Management Monitoring Plan (AMMP) that would be included for Plan B.

A summary of project operations was included within the Hydrology and Hydraulics Report attachment of the 2018 permit application (Appendix C). As described in the project operations section:

Changes to the Southern Embankment alignment and the decision to use a 37-foot stage through town up through the 100-year event and a stage of 40 feet through town up through the 500-year event have resulted in modifications to the operation plan. Due to time constraints associated with the 2018 Environmental Assessment modeling, results presented in this Supplemental Environmental Assessment are based on an approximated operations plan that does not fully incorporate all of the necessary operation plan components. Therefore, it is likely that slightly different impacts than those reported will occur in future modeling that incorporates the full operations plan. The project operation plan described below is the intended full operation plan that will be incorporated into the hydraulic models prior to making any final determinations of pool levels and extents, real estate requirements, cultural impacts, control structure design, and Western Tieback and Eastern Tieback design.

During times of normal river flow (i.e., no flooding) and for all flood events where the stage at U.S. Geological Survey (USGS) Gage 05054000 - Red River of the North at Fargo, ND, would not exceed 37.0 feet (produced during a flow of 21,000 cfs): 1) the RRS and WRRS will remain completely open, and 2) the gates at the Diversion Inlet Control Structure will be essentially closed (local drainage ditch runoff will be allowed through the structure prior to the event). To determine if the stage would exceed 37.0 feet (flow of 21,000 cfs), the sum of the flows at USGS Gage 0505152130 (Red River of the North at Enloe, ND) and USGS Gage 05053000 (Wild Rice River near Abercrombie, ND) will be evaluated.

An analysis of historical floods indicates close to a 1:1 relationship between the sum of the Enloe gage and Abercrombie gage flows and the future flow at the Fargo gage, indicating that the combined flow at these two gages is a good predictor for the flows at the Fargo gage. Therefore, operation of the RRS and WRRS will only begin when the combined flow at Enloe/Abercrombie reach 21,000 cfs. It is noted that a flow of 21,000 cfs is approximately a 5% ACE event (20-year flood) at the Fargo gage, meaning that only flow events less frequent than the 5% ACE will require operations.

On the rising limb of a typical flood hydrograph, when the total flow at the Enloe/Abercrombie gages is 21,000 cfs, the total flow into town at the same point in time will likely be between 10,000 cfs and 15,000 cfs, depending on how quickly the flows at Enloe/Abercrombie are rising and how much flow is contributed by Wolverton Creek. Historically, the travel time for peak flows from Enloe/Abercrombie to Fargo is approximately two days. Beginning gate operations before the flows into the benefitted area exceed 21,000 cfs is necessary to store water during the rising limb of the hydrograph in order to minimize downstream stage impacts.

Gate operations begin by partially closing all gates at both the RRS and WRRS to restrict flow entering the benefitted area. Flows into the benefitted area are gradually reduced during this initial time period to meet the downstream stage impacts, resulting in storage of water upstream of the dam. Flows into the benefitted area will not be reduced by more than 2,000 cfs per day to ensure the rate of stage fall in the benefitted area does not exceed the natural fall rate, as a quick stage fall may impact bank stability.

Gate flow releases are based on an algorithm that consider the flows of six rivers (Red River, Wild Rice River, Wolverton Creek, Sheyenne River, Maple River, and Rush River) and the physical storage characteristics of the staging area. This algorithm considers the flows on each of the six rivers and operational limits in order to determine the appropriate flow releases through the three gated structures necessary to meet the stage impact requirements of the project.

An evacuation order would be issued for the F-M Urban Area if the pool approaches an elevation of 923.5 feet. To prevent the pool elevation from exceeding 923.5 feet, the Red River Control Structure and the Wild Rice River Control Structure gates would be opened to maintain a pool elevation of 923.5 feet and stages would rise above 40.0 feet at the Fargo gage resulting in flooding of the F-M Urban Area. There would be sufficient flow capacity at the gated structures and tieback embankments to keep the maximum pool level at or below 923.5 feet up through the PMF event.

After the flood peak has passed and the pool begins to be drawn down, the Red River Control Structure and the Wild Rice River Control Structure gate opening changes will be limited to ensure the rate of stage fall in the Staging Area is in line with the natural rate of stage fall. The operation plan limits the reduction in pool stage to no more than 2 feet per day, which is the historically-observed rate

2.1.1.15 Non-structural Project Features

There are several non-structural mitigation measures included in the Project to address impacts of increased flooding within the inundation area. These consist of fee acquisitions or relocations, construction of ring levees and the acquisition of flowage easements.

The non-structural features associated with Plan B are the same as those described for the previously-proposed Project except that different properties would be affected (discussed in detail in section 3.10) due to the alignment and staging area shift.

2.1.1.16 Recreation Features

The conceptual recreation plans for Plan B are the same as those described for the previously-proposed Project.

2.2 ALTERNATIVES

Minnesota Rules part 4410.3000, subpart 5, requires the scope of a SEIS to be limited to alternatives, impacts, and mitigation measures not addressed, or inadequately addressed, in the Final EIS. An SEIS also must include a description of how the changes in the proposed Project or new information may affect the potential significant environmental effects from the Project or the availability of prudent and feasible alternatives.

The alternatives section describes the process that was used to develop and evaluate potential alternatives for inclusion in the SEIS based on the Project Purpose and Need described in Chapter 1.

2.2.1 Alternatives Evaluation Summary

As outlined in Minnesota Rules 4410.2300, item G, EISs are required to include reasonable alternatives to the Project that could result in fewer environmental impacts while still achieving the Project's Purpose and Need. Project alternatives analyzed by the EIS include those such as alternative Project designs, technologies, magnitudes or locations, and can be dismissed from the EIS analysis if it doesn't meet the Project's Purpose and Need or if its environmental impacts are similar to others but the socioeconomic impacts are greater. The inclusion of Project Alternatives in an EIS offers decision-makers and the public options for implementing the Project and can illustrate the trade-offs between Project components and environmental or socioeconomic impacts. A no-action alternative is always included in this evaluation and considers existing conditions that would continue without the Project being constructed.

Many alternatives were submitted as part of the comment period during the SEIS Scoping Process, as well as during the 2016 EIS process. These submitted alternatives included a range of individual actions, as well as combinations of these individual actions. Some of these individual and combined actions were received during the 2016 EIS process and were subject to an Alternative Screening Process. Additional alternative actions and combinations of actions were submitted during the Scoping Process of the SEIS.

The Minnesota Department of Natural Resources (DNR) conducted an Alternative Screening Exercise to determine if previously-screened alternatives or new commenter-submitted alternatives should be fully evaluated in the Draft Supplemental EIS (DSEIS). Below is a summary of the alternative screening process. The full description of alternative screening is contained in Appendix B - 2018 SEIS alternative screening analysis.

2.2.1.1 Alternative Screening Approach

The alternatives screening analysis used by DNR in 2012 for the EIS scoping process, and conducted in 2015 for the alternatives received by commenters on the Draft EIS, is outlined in Appendix M: The Purpose & Need and Alternatives Rescreen Report of the 2016 Final EIS. At that time, DNR considered fully analyzing 29 alternatives in all. However, none of these were analyzed in the EIS because they either didn't demonstrate an ability to adequately meet the Proposer's Purpose and Need statement, or they did not provide socioeconomic benefits while reducing environmental impacts of the proposed Project. Both alternative screening analyses relied on hydrologic models using the Expert Opinion Elicitation Panel (EOEP) methodology.

Following the 2018 Governor's Task Force, it was determined that the Plan B should be based upon the hydrologic modeling using the updated Period of Record (POR) hydrology instead of the EOEP. This change means that results from previous alternative screening reports could possibly have been different if they had been based upon the POR hydrology. Therefore, the DNR decided to include the 29 previously-screened alternatives in the 2018 DSEIS Alternative Screening Exercise to ensure consistency of analysis.

In addition to the previously-screened 29 alternatives, during the DSEIS scoping period, DNR received three new alternatives. One of the three new alternatives was described in various ways by many commenters, and therefore was subsequently divided into two alternatives to ensure clarity of the analysis. In all, DNR considered for full analysis in the DSEIS the 29 previously-screened alternatives and 4 new alternatives for a total of 33 alternatives. Each of these alternatives and their respective identification numbers are listed in Appendix B. An alternative may be excluded from analysis in the SEIS if it would not meet the underlying need for or purpose of the project, it would likely not have any significant environmental benefit compared to the project as proposed, or another alternative, of any type, that will be analyzed in the EIS would likely have similar environmental benefits but substantially less adverse economic, employment, or sociological impacts.

The Purpose and Need statement (P&N) was developed by the Diversion Authority to meet the needs of the state environmental review process. The following P&N has not changed from the 2016 Final EIS and is not the same as those used in the FFREIS.

- The purpose of the Project is to reduce flood risk, flood damages, and flood protection costs related to flooding in the F-M Metropolitan area. To the extent technically and fiscally feasible, the Project will:
 1. Reduce flood risk potential associated with a long history of frequent flooding on local streams including the Red River, Sheyenne, Wild Rice (North Dakota), Maple, Rush and Lower Rush Rivers passing through or into the F-M metropolitan area,
 2. Qualify substantial portions of the F-M metropolitan area for 1-percent chance flood (i.e., 100-year flood) accreditation (i.e., meets the standard to

be shown on Flood Insurance Rate Maps as providing protection) by the Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program; and

3. Reduce flood risk for floods exceeding the 100-year flood or greater, given the importance of the F-M metropolitan area to the region and recent frequencies of potentially catastrophic flood events.

Because previous public comments received during the 2014-2016 EIS process have alleged that the EIS P&N was too narrow, DNR broadened the statement by using only the Federal Emergency Management Agency (FEMA) 100-year flood accreditation (accreditation) component for the Project P&N. DNR's reasoning was that FEMA accreditation is likely the most essential part of the need for the Project because it is the level of flood risk reduction that is typically sought by communities. To be consistent with the 2016 DNR alternatives screening process, this Alternatives Screening Exercise utilized the same methodology as outlined in the 2016 Final EIS Appendix M: The Purpose & Need and Alternatives Rescreen Report.

2.2.1.2 Alternative Screening Process/Methodology

Each alternative was assessed against each of the following questions in the order below.

1. Does the alternative fulfill the Purpose and Need? Do we believe the new alternative could receive FEMA accreditation (the critical component as explained above)? OR, if the alternative was previously-screened out, would the updated POR allow it to get FEMA accreditation?
2. Is the proposal a reasonable alternative to the proposed Project (i.e., it is not challenged by physical limitations, factors of time, cost, land acquisition, or political or regulatory issues?) (Minn. Rules 4410.2300, item G)?
3. Does the alternative have significant environmental benefit compared to the Project as proposed? b) If no, is it similar? (Minn. Rules 4410.2300, item G)?
4. Does the alternative have substantially less adverse socioeconomic impact over the Project? (Minn. Rules 4410.2300, item G)?

In order for an alternative to be included for potential further analysis, it must receive a "yes" to all five of the above questions.

- Questions 1-2 and 4: If the answer to a question was 'no', the alternative was determined not subject to further questions.
- For question 3, an alternative must receive a "yes" for either parts a) or b) of the question in order to advance to the question four.
- "N/A" is used in select instances (question 1) when the alternative has previously been included or is required by rule to be included and therefore does not need to pass the screening exercise (e.g., No Action Alternative).
- "Unavailable Info" was documented if the proposed new or suggested combination alternative described components for which DNR had no reliable data, and could not easily acquire this data within a reasonable amount of time, upon which to evaluate this proposed alternative.

2.2.1.3 Assumptions

2.2.1.3.1 Feasibility Assumptions

- **The Distributed Storage Alternative** (DSA, and other similarly-described upstream storage and/or retention options). As analyzed in the Draft EIS Appendix C and D, the DSA remains infeasible because it is challenged by time, cost, and regulatory issues. This applies to Alternatives 12, 15, 16, and 29.
- **Incremental Alternatives.** Alternative 18 recommended multiple actions that cumulatively could potentially meet flood risk goals. While it is theoretically possible to combine enough measures to achieve FEMA accreditation, at some point, because each measure contributes only incrementally to the overall accreditation, it becomes impractical and infeasible to assume the completion of the number and scope of projects and measures that would be needed to achieve the necessary flood risk reductions.
- **Feasibility of Mitigating Downstream Impacts.** In Alternative 3, while the alternative meets the 100-year accreditation and would have environmental benefits over the Project, it would also result in downstream impacts, potentially into Canada, that would require mitigation. Given the broad geographic distribution of downstream impacts and the significant amount of water that would require storage elsewhere on the landscape, it was determined that mitigating these potentially large impacts downstream was infeasible and to go unmitigated would not be allowed by Minnesota floodplain regulations.
- **Minnesota Permitting Feasibility.** Any alternative that would not offer benefits to the state that are commensurate with the impacts to the state would be unable to be permitted in Minnesota. This is because such an alternative wouldn't represent the least impactful solution in Minnesota (as required by Minnesota Law), and thus it would be infeasible.

2.2.1.3.2 Information Assumptions and Limitations

- When evaluating the environmental benefits of an alternative in Alternative Screening Exercise Question 3, a common criteria for consideration was impact acreage. However, the exact number of impacted acres in each screened and rescreened alternative was imprecise. Therefore, alternatives reaching this step in the process were screened based on existing information, including H&H modeling, and based on estimations of magnitude of potentially flooded areas using professional judgement.
 - For example, Alternatives 10, 14, 19 and 26 involve the transfer of flooding impacts between upstream and downstream locations. DNR used existing flood maps and existing flood modeling information associated with the Project to estimate acreages of flood reductions upstream and flood increases downstream.
- When evaluating socioeconomic benefits or impacts (DSEIS Alternative Screening Exercise Question 4), a common criteria was number of impacted structures. However, the numbers of structures impacted for each alternative was estimated and compared. Therefore, the alternative evaluation in Question 4 was based on professional judgement in assessing the potentially flooded areas. Where professional judgment was uncertain (i.e., could not definitively say that there would be lesser socioeconomic

impacts) the alternative was screened in with the expectation that more information would be generated in the DSEIS.

- Similar to the above example, while specific information related to flood increases and reductions was unavailable, DNR estimated that the net socioeconomic impacts downstream and upstream would be approximately equivalent or greater than the socioeconomic impacts of the Project for Alternatives 10, 14, and 19.
- When determining the basic description of the alternative provided by commenters (i.e., what components it included), some submissions were not descriptive enough to paint a clear picture of the specific actions and measures that the commenter intended to include. In those cases, DNR attempted to fill in the gaps, but in some cases, was unable to.
- During the DSEIS scoping comment period, many commenters requested inclusion of the commonly-referred-to “JPA alignment” or “Charlie Anderson’s alignment,” originally called “Alternative 30” for the Alternative Screening Exercise. This alternative has been discussed generally in the time before, during and after the Governor’s Task Force. In this time, there have been many renditions and variations of diversion channel and embankment alignments, making it unclear in SEIS scoping exactly which components were being requested for inclusion. The alternative generally included a dam/southern embankment alignment much closer to the existing Fargo-Moorhead urban area, and the components. Others discussed a change to the northwest portion of the diversion channel. Because of the lack of clarity, DNR decided organize this commenter-submitted alternative into two alternatives:
 - Alternative 30 includes a change to the northwest diversion channel alignment, as well as a change to the dam/Southern Embankment alignment.
 - Alternative 31 does not include the northwest diversion channel alignment, but retains the dam/Southern Embankment alignment described in Alternative 30.

2.2.1.4 SEIS Alternatives Screening Results

- Initial screening of alternatives in the DSEIS Alternative Screening Exercise determined that none of the previously-screened alternatives and three of the four commenter-submitted alternatives “passed”, so were excluded from further evaluation.
- One commenter-submitted alternative (Alternative 31) was unable to be screened based on available information. The DNR collected information about this alternative as part of DSEIS preparation and subsequently determined that although the alternative would have similar environmental benefits as Plan B, it would have greater socioeconomic impacts and was, therefore, excluded from further consideration.
- Appendix B provides a summary of the 33 alternatives screened as part of the SEIS. The summary includes DNR’s response to the question posed at each step in the screening process.
- In summary, none of the 29 previously-screened alternatives received a “yes” to all four questions posed. None of the four, new commenter-submitted alternatives received a “yes” to all four questions posed. Thus, DNR has determined that none of the alternatives identified require full evaluation in the DSEIS.

2.2.2 Project Alternatives Analyzed in the EIS

As a result of the 2018 SEIS alternative screening analysis (Appendix B), one alternative is included in this SEIS: the No Action Alternative (with Emergency Measures).

2.2.2.1 No Action Alternative (with Emergency Measures)

The DNR has determined that because the No Action Alternative does not include emergency measures, it is a situation that does not exist. In reality, there would never be a situation where the F-M area would be expected to flood and not utilize emergency measures to supplement their protection. Therefore, this SEIS will only carry forward the No Action Alternative (with Emergency Measures). Due to the change in hydrology methodologies discussed above (from EOEP to POR), where critical, this SEIS will provide additional and/or updated data regarding impacts from that described in the Final EIS. Otherwise, the descriptions in the 2016 Final EIS of the No Action Alternative (with Emergency Measures) and previously-described impacts would still apply. Inundation under the No Action Alternative (with Emergency Measures) is shown in Figure 8.

3.0 Affected Environment and Environmental Consequences

The Affected Environment and Environmental Consequences Chapter evaluates the following topics: Section 3.2 Hydrology and Hydraulics, Section 3.3 FEMA Regulations and the Conditional Letter of Map Revision (CLOMR) Process, Section 3.4 Wetlands, Section 3.5 Aquatic and Terrestrial Resources, Section 3.6 Cultural Resources, Section 3.7 Infrastructure , Section 3.8 Land Use Plans and Regulations, Section 3.9 Minnesota Dam Safety and Work in Public Waters Regulations and Permitting, and Section 3.10 Socioeconomics.

3.1 ENVIRONMENTAL EFFECTS THAT ARE SIMILAR BETWEEN THE PREVIOUS PROJECT AND PLAN B

The scope of the Supplemental EIS (SEIS) must be limited to impacts, alternatives and mitigation measures not addressed or inadequately addressed in the 2016 Final EIS (FEIS). The DNR has identified the following environmental consequences of Plan B that would be similar to what was analyzed in the 2016 Final EIS:

- Cold Weather Impacts on Aqueduct Function and Biota
- Cover Types
- Potential Environmental Hazards
- State-listed and Special Status Species
- Invasive Species

A description of the similarity for these impacts is provided below.

3.1.1 Cold Weather Impacts on Aqueduct Function and Biota

The environmental effect analysis in the 2016 Final EIS for cold weather impacts on aqueduct function and biota was limited to the proposed aqueducts on the Sheyenne and Maple Rivers. The location, design and operation of these aqueducts are same in Plan B as was proposed in the previous project. The environmental consequences and proposed mitigation measures for Plan B are adequately identified in the 2016 Final EIS.

3.1.2 Cover Types

The 2016 Final EIS identified that approximately 75% of the cover type changes was converting cropland to project components. The change in alignment and location of the dams and Southern Embankment would result in shifts to the specific values of various cover types, however these changes are not expected to substantially change the underlying finding that cropland cover type changes will be the dominant environmental consequences. Any material changes in wetlands, forest or brush/grassland are addressed in the Aquatic and Terrestrial Resources section of this Draft Supplement EIS (DSEIS).

3.1.3 Potential Environmental Hazards

The 2016 Final EIS evaluated potential environmental hazards from land disturbance and flood inundation through Phase 1 Environmental Site Assessment (ESA) reports prepared for the previously-proposed Project. These reports do not address the revised location of the dams and the Southern Embankment in Plan B. The potential environmental hazards identified in the 2016 Final EIS are typical to the types of land uses where Plan B is proposed. The land uses in the area of Plan B are similar to those of the previously-proposed Project and, as such, the potential environmental hazards are also expected to be similar.

3.1.4 State-listed and Special Status Species

The 2016 Final EIS evaluated environmental consequences to Lake Sturgeon, Burrowing Owl, Black Sandshell, Garita Skipper and Short-beaked Arrowhead through project impacts to habitat (cover types) that are utilized by the listed species. The 2016 Final EIS identified that potentially significant impacts to these species are unlikely. The changes proposed as part of Plan B does not materially change impacts to cover types and, thus, the material changes to state-listed species impacts is also not expected to materially change. The environmental consequences to state-listed species and special status species and proposed mitigation measures for them are adequately identified in the 2016 Final EIS.

3.1.5 Invasive Species

The 2016 Final EIS analyzed spread and introduction of invasive species by identifying known invasive species in the waterbodies and Project Area, as well as activities that could spread or introduce invasive species. Plan B would result in similar activities as the previously-proposed Project and could result in spread or introduction of the same invasive species that were identified in the 2016 Final EIS. The environmental consequences and proposed mitigation measures for Plan B are adequately identified in the 2016 Final EIS.

3.2 HYDROLOGY AND HYDRAULICS

Due to the nature of the Plan B (i.e., the Project), hydrologic and hydraulic (H and H) analysis is a key component for evaluation as it forms a basis for Project design. Hydrology refers to the rainfall and resulting runoff as it applies to flood events. It is used to estimate flood flow rates, typically through stream gage analysis, rainfall-runoff models, or a combination of the two. Hydraulics is the study of water flow. In floodplain management, hydraulics refers to the determination of the flood depth and area flooded. Hydraulics also encompasses the flow characteristics around and through control structures such as bridges, culverts, and weirs (IDNR 2002).

The USACE, along with the Diversion Authority and its consultants have completed Phase 9 H and H modeling for Plan B. The 2016 Final EIS used Phase 7 H and H modeling to analyze the environmental consequences of the previously-proposed Project. The major differences between the Phase 7 and Phase 9 H and H modeling are:

- Use of a calibrated HEC-HMS hydrologic model for the Red River watershed. This modeling method considers the runoff from the watershed during a specific rainfall event to help define flow into the hydraulic model.
- Use of the updated period of record (POR) for developing the hydrology (versus the Expert Opinion Elicitation Panel (EOEP) hydrology).

- Modification of the Phase 7 models based on the feedback from an Independent Technical Review and an Agency Technical Review of the hydrology and hydraulics to include: suggested modifications to bank station locations, storage and lateral structure connections, cross-section placement, reach lengths, and use of blocked obstruction. Suggestions were also made regarding completing a sensitivity analysis for weir coefficients, questioning the accuracy of culvert geometry in the storage area connections, and checking the overall storage in the model.
- Incorporation of the Plan B project changes such as locations of Project features and operations.

3.2.1 Affected Environment

The 2016 Final EIS accurately describes the affected environment of the Project Area. This includes a description of the geographic characteristics of the area and the large watershed draining through the Red River that contribute to the higher flood risk for the Fargo-Moorhead (F-M) area.

3.2.1.1 Hydrologic and Hydraulic Evaluation for Project Design

The 2016 Final EIS identified that official estimates vary for the 100-year flood flow and stage. Table 3-1 compares the discharge (cubic feet per second (cfs)) and stage (feet (ft)) for FEMA, EOEP (wet) and the POR estimates for various flood events.

Table 3-1 Peak Flow and Stage Data - USGS Gage 05054000 Red River at Fargo, ND

Event	Discharge (cfs) at USGS Gage at Fargo, ND	Stage (ft) at USGS Gage at Fargo, ND ¹
10-year FEMA	10,300	29.5
10-year POR	13,865	32.5
10-year USACE EOEP (Wet)	17,000	35.0
50-year FEMA	22,300	36.6
50-year POR	26,000	39.5
50-year USACE EOEP (Wet)	29,300	40.4
100-year FEMA	29,300	39.3
100-year POR	33,000	41.3
100-year USACE EOEP (Wet)	34,700	42.1
500-year FEMA	50,000	43.5
500-year POR	66,000	46.5
500-year USACE EOEP (Wet)	61,700	46.3

¹ Stages are dependent: 1) FEMA data are from the Clay County Flood Insurance Study, April 17, 2012; 2) USACE stages are from the current existing-condition-with-full-protection unsteady Hydrologic Engineering Center River Analysis System (HEC-RAS) model – Phase 7.0 Environmental Assessment (EA) results (2013); 3) Flood stage is 18 feet when minor flooding begins (National Weather Service).

It is important to note that both the EOEP and POR hydrology developed up to this point do not include flood events after 2009 (see Table 3-2). After Project completion, USACE would carry out subsequent hydrologic analyses based on updated flow-frequency analyses at critical locations along the Red River to certify the Project. USACE certification of the Project would rely upon the best available data, hydrologic methods and the most up-to-date guidance available at the time of certification. This implies that an extended period of record would likely be used which includes flood peaks observed post-2009.

Table 3-2 Historic Flood Events – USGS Gage 05054000 Red River at Fargo, ND

Event	Discharge (cfs) at USGS Gage at Fargo, ND	Stage (ft) at USGS Gage at Fargo, ND
1997 Historic	28,000	39.7
2006 Historic	19,900	37.1
2009 Historic	29,500	40.8
2010 Historic	21,200	37.0
2011 Historic	27,200	38.8

Source: USGS recorded data

3.2.1.1.1 Accuracy of Modeling Results and Available Information

This analysis is dependent on available information provided by the Diversion Authority and the USACE. The first step of the Quality Assurance/Quality Control (QA/QC) process begins with the Diversion Authority or USACE as they are the source of the technical data and information. Since information is being provided by professional engineers and scientists, it is reasonable to assume that the information that is transmitted and available has gone through a QA/QC process specific to the Project and meets the standard of care appropriate for this Project.

The model is based on a number of modeling decisions and assumptions; these assumptions can have a measurable impact on the results. To better understand the key assumptions as they relate to the Project and Project alternatives, an additional layer of review of the model was completed by a DNR Floodplain Action Hydrologist as part of the this Supplemental EIS (SEIS) process. The focus of this SDEIS review is on changes to the model since the previous review in the 2016 Final EIS. These changes include: incorporation of third party independent review comments, updated hydrology, and modifications of the Dam/Southern Embankment design.

Overall Model Review

This Red River HEC-RAS unsteady flow model(s) model extends from Abercrombie, North Dakota to Grand Forks, North Dakota and includes the main stem, major and minor tributaries, lateral inflow, and hundreds of interconnected storage areas. Inflows to the model were developed in the hydrologic modeling software HEC-HMS. This complex model was developed, calibrated, and refined over a period of several years. A detailed examination of the HEC-RAS model was not completed (e.g., checking specific cross sections or the stage-volume curves for individual storage areas).

Subsequent to the DNR model review for the 2016 Final EIS, two third party independent reviews of the model were completed (one by Barr Engineering and one by the USACE). These reviews included an in-depth examination of all model inputs, modeling techniques and results. As part of this current SEIS review, DNR staff verified that some of the more critical comments from the third party reviews had been addressed, such as the location of bank stations, overlapping cross-sections, and the use of blocked obstructions.

Project HEC-RAS Model Review

The key elements of the Project were incorporated into the HEC-RAS model, including the control structures on the Red River and Wild Rice River, the diversion channel and its inlet control structure, the aqueducts on the Sheyenne and Maple Rivers, and the connections with the North Dakota tributaries.

Features of the Southern Embankment and its associated elements changed after the 2016 Final EIS review. The HEC-RAS model was checked to make sure that it reflected the updated design elements.

Period of Record Hydrology

Prior to this submittal, inflow hydrology was previous based on suggestions from the EOEP. This method of estimated hydrology used a subset of the full POR to estimate peak flows. As part of this review, hydrology was updated to use the full POR (through 2009) as opposed to the subset of records recommended by the EOEP. Peak discharges using the entire POR were calculated for Hickson, Fargo, Halstad, and Grand Forks by the USACE prior to 2009. These values were used as the POR peak flows for this study. Ratios of flow rate between the EOEP and POR at the Hickson, Fargo, Halstad, and Grand Forks gages were used as multipliers to calculate the POR flows at the remaining gage locations.

Requested Sensitivity Analysis

An additional sensitivity analysis was requested by DNR for the flow rates into the city of Thompson. The POR peak flows were estimated at Thompson by using the ratios of the Fargo, Halstad, and Grand Forks gages. DNR staff suggested using only the Halstad and Grand Forks gages to estimate peak flows at Thompson that resulted in an increase of flows at that location. The sensitivity analysis was completed to determine how water surface elevations change with the increased flow rate during the 100-year event. The results of the sensitivity analysis show the model is not sensitive to slightly higher flow rates with the construction of the Plan B alternative, so it was not recommended that the modeled flows at the Thompson gage be increased.

Accuracy Assessment

Based on the USACE QA/QC procedure used for development and analysis of information for the Project, there is a reasonable level of confidence that the information included in this SEIS is valid and accurate. Overall, the extent and completeness of the H and H information available and provided for the Project is significant.

It is reasonable to conclude that the H and H models developed for the Project are adequate and appropriate to evaluate the Project. It is important to note this assessment is based on a general, high-level review of the HEC-RAS models and their boundary conditions, by qualified DNR hydrologists, along with review of available reports about the Project.

A brief summary and adequacy review of the H and H modeling analyses as currently completed for Plan B is provided below. It does not constitute a detailed review or

quality assurance of the H and H models. As the models are very complex, it is not practical to conduct an independent review of all associated elements. A discussion on review of information provided by the H and H models and other methods of analysis is also included.

The following are the considerations regarding the adequacy of H and H modeling as it relates to the SEIS and the appropriate level of review of available data:

- The level of detail and extent of the models completed for the Project are appropriate.
- The types of models and the methodology used are appropriate for the purpose of the analysis and use of results generated.
- The use of area-specific H and H models by Diversion Authority and local watershed districts for various localized analysis projects indicates independent review of the models.
- The calibration of the model to different datasets and different runoff conditions suggests that the level of detail and underlying assumptions are adequate and appropriate.

3.2.2 Environmental Consequences

The Project would affect flood flows and river stages on the Red River and its tributaries throughout the F-M area. These changes in flood flows and areas of flood inundation are the basis for identifying and analyzing environmental consequences. Red River peak flows were used to evaluate the majority of the impacts associated with the Project and are illustrated on the figures for the SEIS. Detailed discussions of H and H impacts from Project operation and the No Action Alternative (with Emergency Measures), are provided below.

3.2.2.1 Plan B

Operation of the Project would occur when it becomes known that a stage of 37.0 feet would be exceeded at the USGS gage in Fargo (the Fargo gage). At this stage, the flow through Fargo would be approximately 21,000 cfs. A flow of 21,000 cfs at the Fargo gage is approximately a 20-year flood (5-percent chance flood). When river flows at the Fargo gage are expected to be below 21,000 cfs the Red River Control Structure (RRS) and Wild Rice River Control Structure (WRRS) would remain completely open, and the gates at the Diversion Inlet Control Structure (DIS) would be essentially closed (local drainage ditch runoff will be allowed through the structure prior to the event). To determine if the stage would exceed 37.0 feet (flow of 21,000 cfs), the sum of the flows at USGS Gage 0505152130 (Red River of the North at Enloe, ND) and USGS Gage 05053000 (Wild Rice River near Abercrombie, ND) will be evaluated. An analysis of historical floods indicates close to a 1:1 relationship between the sum of the Enloe gage and Abercrombie gage flows and the future flow at the Fargo gage, indicating that the combined flow at these two gages is a good predictor for the flows at the Fargo gage. Therefore, operation of the RRS and WRRS would only begin when the combined flow at Enloe and Abercrombie reach 21,000 cfs.

Gate operations would begin by partially closing all gates at both the RRS and WRRS to restrict flow entering the Benefitted Area. Flows into the Benefitted Area would be gradually reduced during this initial period to meet the downstream stage impacts, resulting in storage of water upstream of the dam. Flows into the Benefitted Area would not be reduced by more than 2,000

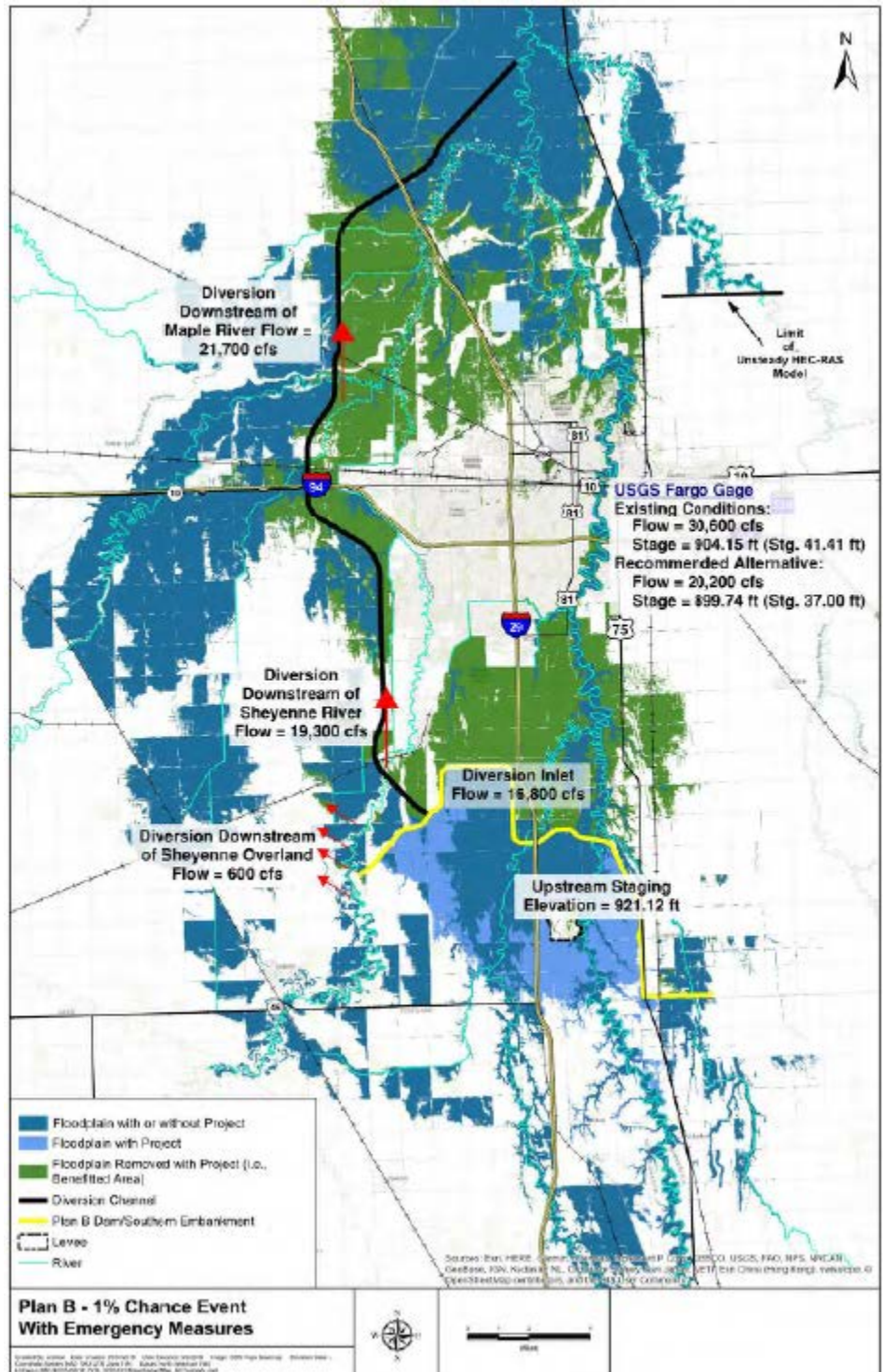
cfs per day to ensure the rate of stage fall in the Benefitted Area would not exceed the natural fall rate, as a quick stage fall may affect bank stability.

Gate flow releases are based on an algorithm that considers the flows of six rivers (Red River, Wild Rice River, Wolverton Creek, Sheyenne River, Maple River, and Rush River) and the physical storage characteristics of the staging area. This algorithm considers the flows on each of the six rivers and operational limits in order to determine the appropriate flow releases through the three gated structures necessary to meet the stage impact requirements of the Project. The portion of the algorithm that accounts for the flows and timing of the six rivers is based on a power law function in the form of $Q = aV^b$, where Q is the gate flow release, V is the storage volume, and a and b are user-defined coefficients. The user-defined coefficients are determined by simulating numerous synthetic and historic simulations and fitting the operated hydrographs to the existing condition hydrographs at a location downstream of the diversion outlet. A general description of operational targets based on combined Enloe/Abercrombie flows is divided into three main categories: 1) combined flows between 21,000 cfs and 39,000 cfs; 2) combined flows between 39,000 cfs and 64,000 cfs; and 3) combined flows are greater than 64,000 cfs.

When combined flows on the Red River and Wild Rice River are between 21,000 cfs and 39,000 cfs, approximately 21,000 cfs (37 feet at Fargo gage) would flow in the Red River through the benefitted area (Illustration 3-1).

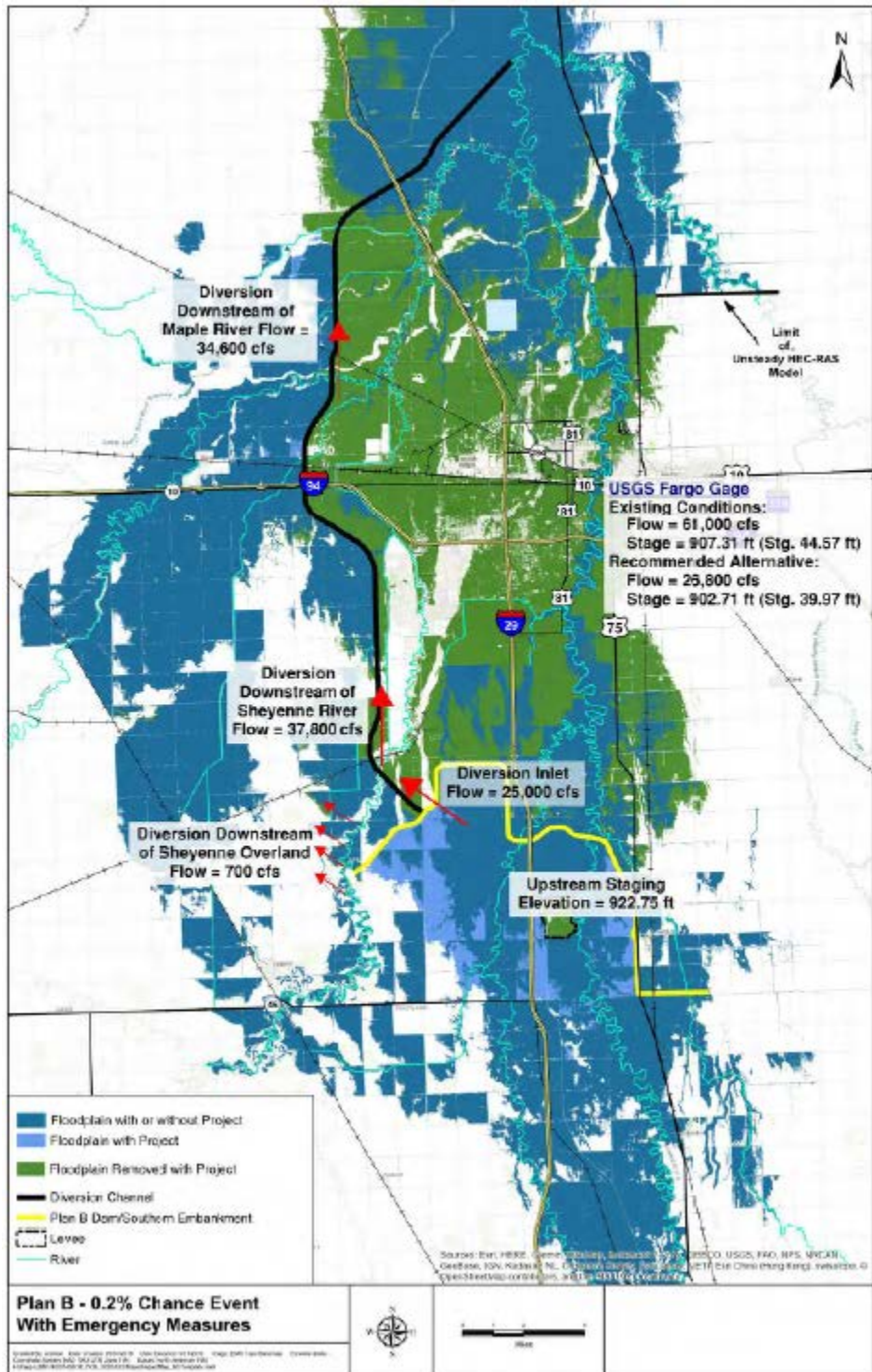
During the 21,000 cfs to 39,000 cfs operational range, a maximum of 20,000 cfs would be allowed through the DIS into the Diversion Channel. The gates on the DIS would be operated to limit flow increases to 2,000 cfs per hour. This operational limitation is intended to minimize potential for erosion within the diversion channel. The maximum surface water elevation in the staging area during this operational period, which includes the 100-year flood event, would be 921.0 feet (Illustration 3-2).

Illustration 3-2 Floodplain/Flow, Existing and with-Project F-M Area, 100-year (source: Appendix C)



When combined flows are between 39,000 cfs and 64,000 cfs, the target flows in the Red River through the Benefited Area would be between 21,000 cfs and 27,000 cfs (37.0 feet and 40.0 feet respectively at the Fargo gage). Flow through the DIS into the Diversion Channel would be between 20,000 cfs and 25,000 cfs. An unusually high-volume flood could require flows greater than 25,000 cfs into the Diversion Channel. This higher flow would maintain the 40.0 feet stage at the Fargo gage while not exceeding the 922.5 feet target for maximum surface water elevation in the staging area (Illustration 3-3).

Illustration 3-3 Floodplain/Flow, Existing and with-Project F-M Area, 500-year (source: Appendix C)



When combined flows are above 64,000 cfs the gate flow algorithm would no longer apply. The flow in the Red River through the Benefited Area would be maintained to limit river stage to 40.0 feet at the Fargo gage. Flow into the Diversion Channel could exceed 25,000 cfs to maintain the 40.0 feet at the Fargo gage and maintain a maximum surface water elevation in the staging area of 923.5 feet as long as possible. An evacuation order would be issued as the pool in the

staging area approaches 923.5. The RRS and WRRS gates would be opened to maintain the surface water elevation of 923.5 feet in the staging area, allowing flow in the Red River through the Benefited Area to exceed 40.0 feet at the Fargo gage.

After the flood peak has passed and the pool begins to be drawn down, RRS and WRRS gate opening changes would be limited to ensure the rate of stage fall in the staging area is no more than 2 feet per day, which is the historically-observed rate at USGS gage 05051522 – Red River of the North at Hickson, ND. This operational limitation is intended to limit stream bank instability and fish stranding within the staging area.

3.2.2.1.1 Diversion Channel

The 2016 Final EIS describes H and H environmental consequences of the diversion channel.

3.2.2.1.2 Upstream Inundation Area

Hydraulic changes in the staging area from Plan B would increase the area, duration and depth of floodwater inundation in the staging area. The actual areas, durations and depths of floodwater inundation would vary depending on the specific timing and severity of any flood event.

Figure 2 shows the areas under Plan B (100-year flood) operations that would either be removed from flooding, newly-inundated, or flooded with-or-without Plan B. The total inundation within the Project Area during the 100-year flood would be 123,954 acres; of which 12,049 acres lies on land that does not currently flood. Figure 9 shows estimates of inundation depths during Project operation and Figure 10 shows the duration of inundation during Project operation.

3.2.2.1.3 Eastern Tieback and Wolverton Creek

Plan B includes an Eastern Tieback levee that would cross Wolverton Creek approximately two miles south of the city of Comstock, Minnesota. A series of three, ten-foot by ten-foot box culverts within the levee would allow flow from Wolverton Creek to pass under the levee. The H and H Report (Appendix C) identifies a very small increase of 0.11 feet in water surface elevation for the 100-year event just upstream of the tieback levee. This small increase is observed until approximately three miles upstream.

3.2.2.1.4 Benefitted Area

The Benefitted Area would see a reduction or elimination of inundation during most flood events. Local drainage could result in some isolated inundation within the Benefitted Area. Plan B would protect 44,832 acres from inundation that would be flooded under existing conditions.

3.2.2.1.5 Downstream

Limiting Project operations to flood discharges above 21,000 cfs combined with maintaining a maximum water surface elevation of 923.5 in the staging area creates the

potential for increasing flood levels downstream of where the diversion channel empties into the Red River. Phase 9 H and H modeling shows the largest downstream increase during a 100-year event (1% chance) as 0.14 feet at Georgetown, Minnesota. At a 500-year event (0.2% chance) the largest downstream increase is 0.58 feet at Grand Forks, North Dakota.

3.2.2.2 No Action Alternative (with Emergency Measures)

A detailed discussion of the No Action Alternative (with Emergency Measures) is presented in Chapter 2, including a list of current and planned levees. Emergency measures, such as sandbags and other flood-fighting measures, are used to fill in the gaps between the levees that are constructed, or planned for construction, and provide flood risk reduction to the F-M urban area during low frequency events. The No Action Alternative (with Emergency Measures) essentially represents the conditions that are needed currently to protect the F-M urban area from flooding during a 100-year flood. Figure 8 shows the extent of emergency protection measures used to prevent flooding from the Red River and Wild Rice River in the F-M urban area. This figure also shows the flood extent under this alternative. As shown in Figure 8, the flow for the 100-year flood is maintained within the channel sections between the levees through the main stem of the Red River through the F-M urban area. The increased flood extents immediately upstream of the protected area are due to the surcharge in water surface elevation caused by the constriction of flow between the levees and emergency measures through the F-M urban area. This surcharge provides storage upstream of the levee which decreases peak flow rates through the F-M urban area.

3.2.3 Proposed Mitigation and Monitoring Measures

The Phase 9 unsteady HEC-RAS model was used during the evaluation of mitigation measures for the Project. Specific mitigation measures proposed for the Project are discussed in other sections of Chapter 3 for each resource topic. Evaluation of the proposed mitigation and monitoring is discussed in Chapter 6 for each resource topic, along with any additional recommended mitigation.

3.3 FEMA REGULATIONS AND THE CLOMR PROCESS

The Federal Emergency Management Agency (FEMA) recognizes the critical function of the floodplain as a natural resource, having environmental, economic, and social value, and therefore regulates development in the floodplain. The National Flood Insurance Program (NFIP), created by Congress in 1968 and governed by FEMA, is intended to mitigate future flood losses nationwide through community-enforced building and zoning ordinances and to provide access to federally-backed flood insurance protection for property owners.

The USACE has coordinated with FEMA and developed a FEMA/USACE Coordination Plan (Coordination Plan) that outlines floodplain management requirements for Plan B, including Conditional Letter of Map Revisions (CLOMR) requirements for floodplain map revisions and FEMA-related project mitigation. The Coordination Plan was updated in 2018 with a new Revision Reach map, and did not contain substantive changes. The Coordination Plan would be used to implement mitigation as it relates to FEMA CLOMR requirements in the Project Area and is included as Appendix E.

3.3.1 Affected Environment

There are a number of NFIP participating communities with Flood Insurance Rate Maps (FIRMs) affected by Plan B. Effective flood insurance study (FIS) Reports and FIRMs for all communities impacted by Plan B are available at the FEMA Map Service Center site at: <http://www.msc.fema.gov/>. FEMA has updated the FIRMs for the four affected counties and associated incorporated areas into their digital format with the exception of the unincorporated area in Cass County and Warren Township. The final digital maps are effective for Clay and Wilkin County, Minnesota and unincorporated areas; Richland County and unincorporated areas; and most of Cass County, North Dakota as noted above. The non-Federal sponsors have access to the FIS and FIRMs both effective and issued preliminary for their jurisdictions.

The updated FIS mapping shows no Special Flood Hazard Areas (SFHAs) in Comstock, Minnesota or Christine, North Dakota. Comstock and Barnes Township do not participate in the NFIP, but they have NFIP identification numbers (270079 and 380256, respectively) meaning they are eligible to join the voluntary NFIP if they choose.

3.3.1.1 Flood Hazard Areas

The NFIP requires FEMA to identify and map flood hazard areas as high, medium, and low flood risk. The SFHA is the high risk area defined as any land that would be inundated by a flood having a 1-percent chance (100-year flood) of occurring in a given year, where the NFIP's floodplain management regulations must be enforced, and where the mandatory purchase of flood insurance applies for federally-backed mortgages.

The regulatory floodway is an important designation on the FIRM. A floodway is the portion of the floodplain where development and filling (e.g., grading) is very restricted. The restrictions maintain a flow conveyance area that limits increases in flood stage to allowable tolerances. Typically, the floodway is the portion of the floodplain where the water is the deepest and fastest. Projects in the floodway must show there is no-rise in the Base Flood Elevation (BFE). The floodplain outside of the floodway is considered the flood fringe. Filling in the flood fringe is allowed but restricted. The allowable tolerance in North Dakota is one foot, which is the national standard. In Minnesota, it is 0.5 feet. Since the Red River lies on the border between the states of North Dakota and Minnesota, the allowable floodway surcharge (i.e., the difference in flood elevation before and after encroachment) for the Red River has been set at 0.75 feet (9 inches). In Minnesota, only structures accessory to open space uses (i.e., uninsurable structures) can be built in the floodway.

3.3.1.2 National Flood Insurance Program Map Revisions

NFIP maps can only be revised through the FEMA LOMR process, and therefore, the current NFIP maps, would be in effect until a LOMR is approved. A LOMR cannot be approved until after a project is completed. Proposed conditions are reviewed with a CLOMR which is the formal review and comment process FEMA uses to determine whether a proposed project complies with minimum NFIP standards. Upon approval, a CLOMR also describes eventual changes to the NFIP maps within the affected community if the project is completed as designed. CLOMRs are required for any project causing any increase in flood stage based on Hydrologic and Hydraulic (H and H) analyses (44 CFR 60.3(d) 4).

3.3.2 Environmental Consequences

3.3.2.1 Plan B

Results of the H and H modeling indicate that Plan B would result in increases in the BFE as well as other flood hazards, such as the 500-year flood elevations, at specific locations within the Project Area and the surrounding region. As a result of the increased flood risk within the SFHA and floodway, there are projected increases to insurable structures greater than 0.00 feet, which are outlined in Appendix F. Because Plan B would cause an increase in the SFHA and BFEs, a FEMA-approved CLOMR would be required.

After completion of a project, local sponsors would submit a LOMR request for Plan B based on the Project as-built and supporting technical data including updated H and H analysis and delineation of new floodplain boundaries and floodways. Affected structures cannot be removed from the SFHA until the LOMR or Physical Map Revision is final and effective.

3.3.2.2 No Action Alternative (with Emergency Measures)

Using the updated Period of Record (POR) hydrology results in negligible changes regarding FEMA/CLOMR processes; therefore, the description of the No Action Alternative (with Emergency Measures) included in the Final EIS would still apply (FEIS Section 3.2.2.2).

3.3.3 Proposed Mitigation and Monitoring Measures

Section 65.12 of the Code of Federal Regulations (CFR) requires communities to apply to FEMA for conditional approval (see 44 CFR Part 72 of the NFIP regulations) of actions which will cause increases in BFEs in excess of the limits.

In accordance with the NFIP, mitigation would be required for Plan B for structures that are subject to increases in BFEs greater than the tolerances set in 44 CFR 60.3(c) and (d) in which FEMA interprets this increase in BFE as any increase greater than 0.00 feet for areas newly inundated on the FIRM.

Based on the requirements in the NFIP regulations, appropriate mitigation would be determined through the CLOMR process. Because of the magnitude of Plan B, FEMA has discussed interpreting standards so that the CLOMR includes a list of properties that would be mitigated before Project completion but that the mitigation of those properties can be delayed until the Project affects the property flood risk.

The mitigation discussed within the Coordination Plan is defined primarily by the FEMA revision reach. The FEMA revision reach extent is defined by an effective tie-in for the 100-year flood at the upstream and downstream limits for each flooding source impacted by Plan B. This is obtained when the revised BFEs from the post-Project conditions model are within 0.5 feet of the pre-Project conditions model at both the upstream and downstream limits. Or, more simply put, the FEMA revision reach is defined by the Red River profile and limited to where Plan B would alter the river profile flood elevation by more than 0.5 feet. The current upstream and downstream limits of the FEMA revision reach is near model station 2673320 (about one mile south of Wolverton) and the outlet of the Diversion Channel, respectively. The staging area is located entirely within the FEMA revision reach. The actual FEMA revision reach would be determined once the Project design is finalized and updated H and H modeling becomes available; however, it isn't anticipated that the limits would change from where they currently are mapped.

Structure Mitigation

Mitigation for structures is proposed to be a combined effort between the USACE and the Diversion Authority. Impacts to structures in the Upstream Mitigation Area would be mitigated following the criteria outlined below. Figure 11 outlines the locations of the boundaries used to develop structure mitigation.

- The CLOMR-approved hydraulic model would be used to determine the flood water depth at the structure under a 100-year flood event under two scenarios: with Project and under existing conditions. For the purposes of structure mitigation, potential impacts are based on the total depth of flood water (existing flood impacts on structures plus additional impacts associated with Project operation) during a 100-year flood event.
- The CLOMR-approved hydraulic model would be used to determine the Operating Pool (Floodway, Zone 1) in the upstream mitigation area.
- Aerial photography of the upstream mitigation area would be taken before, during, and after flood events, and high-water marks would be surveyed to check and improve the hydraulic model for its use in the mitigation programs.

The potentially impacted structures have been classified into five categories according to the mitigation processes that will be applicable to them. These structures are identified by category and color on Figure 12 and outlined in Table 3-3.

1. Category 1 (red): Structures located within the floodway will be acquired via the typical acquisition process (Appendix F, see the Typical ND/MN Property Acquisition Process sections), and then removed from the floodway.
2. Category 2 (orange): Structures where the flood water depth at the structure is greater than or equal to two-feet, the structure will be acquired via the typical acquisition process (Appendix F, see the Typical ND/MN Property Acquisition Process sections), and then removed from the mitigation area.
3. Category 3 (yellow): Structures where the flood water depth at the structure is between 0.5 foot and two-feet, and outside the floodway and within the Revision Reach, the Diversion Authority would consider, with the property owner, non-structural measures for the structure as well as offer to acquire the structure via the typical acquisition process following an appraisal. Non-structural measures for residential structures may include elevation, ring levees, relocation, or acquisition. Non-structural measures for non-residential structures may include dry flood proofing, wet flood proofing, adjusting elevation, developing ring levees, relocation of the structure, and acquisition. Wells and septic systems serving residences that would remain would be modified to prevent impacts from flooding. Each of these structures would be considered on a case-by-case basis, in coordination with the property owner.
4. Category 4 (green): If the flood water depth at the structure is less than 0.5-feet, and if the structure is outside the floodway and within the Revision Reach, the Diversion Authority would field verify the structure elevation via a topographical survey to confirm the impacts. The field verification would result in the production of a FEMA Elevation Certificate. If the field verification confirms that the structure is impacted (for the purposes of structure mitigation, an impact is defined as any total depth greater than 0.01-feet during a 100-year flood event), the Diversion Authority, with the property owner, would consider non-structural measures for the structure as well as an offer to acquire the structure via the typical acquisition process following an appraisal. Non-structural measures for residential structures may include adjusting elevation, developing ring levees, relocation of structures, or acquisition. Non-structural measures for non-residential structures may include dry flood proofing, wet flood proofing, adjusting elevation,

developing ring levees, relocation of structures, and acquisition. Wells and septic systems serving residences that would remain would be modified to prevent impacts from flooding. Each of these structures would be considered on a case-by-case basis, in coordination with the property owner.

5. Category 5 (white): The USACE is required to perform a takings analysis on any properties with impacts resulting from the 100-year flood event, even if those impacts extend beyond the boundaries defined above. If the USACE takings analysis determines that mitigation would be required, the Diversion Authority would be responsible for performing the mitigation in accordance with the 2018 Property Rights Acquisition and Mitigation Plan.

Table 3-3 Structure Mitigation Matrix Proposed by USACE or Fargo-Moorhead Diversion Authority (FMDA) (more information on Zones 1 and 2 can be found in SEIS section 3.10) (Source: Appendix F)

Upstream Structure Mitigation Area	Mitigation Category 1 (Structures in Floodway)	Mitigation Category 2 (Total depth greater than 2-foot)	Mitigation Category 3 (Total depth between 2-feet and 0.5-feet)	Mitigation Category 4 (Total depth less than 0.5-feet)	Mitigation Category 5 (Outside Revision Reach)
USACE Zone 1	Structure Acquisition and Removal	Not Applicable	Not Applicable	Not Applicable	Not Applicable
USACE Zone 2	Not Applicable	Structure Acquisition and Removal	Mitigation via Non-structural Measures or Acquisition and Removal	Mitigation via Non-structural Measures or Acquisition and Removal	Not Applicable
Outside of USACE Zones	Not Applicable	<ul style="list-style-type: none"> • FMDA: Structure Acquisition and Removal • USACE: Not Applicable 	<ul style="list-style-type: none"> • FMDA: Non-structural Measures or Acquisition and Removal • USACE: Not Applicable 	<ul style="list-style-type: none"> • FMDA: Non-structural Measures or Acquisition and Removal • USACE: Not Applicable 	<ul style="list-style-type: none"> • FMDA: To be determined by USACE Takings Analysis • USACE: Takings Analysis

3.4 WETLANDS

“Wetland” is a general term that refers to land where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin, December 1979). The Clean Water Act (CWA) defines the term wetland as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Differences in soil, topography, climate, hydrology, and human disturbance, along with other factors, influence wetlands.

Wetlands that are determined to be Waters of the United States are regulated under Section 404 of the CWA. Potential impacts to these wetlands may require a Water Quality Certification per Section 401 of

the CWA. Wetlands within Minnesota are subject to regulation under the Minnesota Wetland Conservation Act (WCA) administered by the local governmental unit. All of these regulatory programs incorporate the concept of wetland mitigation sequencing that requires project proposers to first avoid wetlands, then minimize any unavoidable impacts, and lastly mitigate for what can't be avoided and minimized.

3.4.1 Affected Environment

The 2016 Final EIS identifies the setting and types of wetlands that are present in the area. Most notably, the majority of wetlands in the Project Area are isolated, seasonally flooded basins, often called prairie potholes (Eggers and Reed, 2011). Other wetland types present in the area (at much lower acreages) include shallow marsh, shrubb-carr and wet meadow (Eggers and Reed, 2011). There are also likely Type 1 forested wetlands associated with floodplain forests in the Project Area that are not accounted for in this section; however, these resources are addressed under Section 3.5 (Aquatic and Terrestrial Resources).

3.4.2 Environmental Consequences

The location of rivers, existing structures, and optimal project operation influence the Project route; therefore, route design options to completely avoid wetland impacts are not practicable at the scale necessary to meet the purpose of the proposed Project. Design constraints include natural river channels, transportation infrastructure, safety, economics, and property ownership issues. For these reasons, no alternative that totally avoids wetland impacts is practicable for the Project.

Direct wetland impacts would occur due to construction activity or indirectly due to changes in hydrology along rivers or through inundation during project operations. The evaluation of direct wetland impacts is related to the location of the wetland, with respect to the Project features footprint. Indirect wetland impacts are more difficult to identify, but would be a function of the change in hydrology and sensitivity of the wetlands. In most cases, indirect wetland impacts would result in changes to wetland type or changes to wetland extent.

3.4.2.1 Plan B

Direct impacts are those impacts that would include Project construction associated with permanent alteration of a wetland, which could include dredging, draining, filling and the excavation. Construction of Project components that would directly impact wetlands include: the Diversion Channel, excavated material berms, shallow drainage ditches outside the berms, embankments, and roads. The Project would have direct impacts from construction of control structures in Wolverton Creek, Red and Wild Rice Rivers; aqueducts in the Maple and Sheyenne River;; as well as the rerouting of the Lower Rush and Rush Rivers into the Diversion Channel. The City of Oxbow, Village of Hickson, and Bakke Subdivision (OHB) ring levee construction would also directly impact wetlands.

Wetland impacts from construction of the Diversion Channel and the OHB ring levee are described in the 2016 Final EIS. The relocation of the Dam/Southern Embankment and associated tieback levees has resulted in different wetland impacts for those features. Plan B would directly impact approximately 40 fewer wetland acres than the previously-proposed Project.

The Project footprint and the OHB ring levee is estimated to create 1,666 acres (Table 3-4) of direct impacts to wetlands. Table 3-5 compares and summarizes the total wetland impacts in the Project footprint and Dam/Southern Embankment by Eggers and Reed Classification. Small remnant wetlands may remain adjacent to the Project footprint but would likely be considered an indirect impact by changing the wetland type and, therefore, would require appropriate mitigation.

Table 3-4 Estimated Direct Wetland Impacts by Wetland Type

Wetland Type (Eggers and Reed)	Total project (acres)	Southern Embankment (acres)
Open water	<1	0.0
Seasonally flooded basin	1,426	155.6
Wet Meadow	155	71.4
Shallow Marsh	84	17.0
Shrub-Carr	0	0.0
Total Acres	1,666	244.0

Source: USACE 2009 Wetland Inventory

Table 3-5 Estimated Direct Wetland Impacts Associated with Tieback Embankment in Minnesota

Wetland Type	Embankment Impact (acres)
Open Water	0.0
Seasonally flooded basin	21.7
Wet Meadow	13.4
Shallow Marsh	4.4
Shrub-Carr	0.0
Total Acres	39.5

Source: USACE 2009 Wetland Inventory

In total, the USACE estimated that 124 acres of riparian and upland forest would be impacted by the Project. A portion of these forests could also be wetland. The forest area wetlands have not been delineated. Description of the existing environment, environmental consequences and mitigation of forested areas are address in Section 3.5 (Aquatic and Terrestrial Resources).

Indirect wetland impacts are considered those that result from the Project, but are not caused directly by construction of the Project footprint. Indirect impacts from the Project include changes in hydrology of wetlands, sedimentation occurring over time in the inundation area, and temporary flood inundation occurring due to Project operation.

Indirect wetland impacts could occur from changes in hydrology of wetlands as a result of existing drainage patterns being cut off by the Diversion Channel or the OHB ring levee construction as addressed in the 2016 Final EIS. Inundation of wetlands upstream of the Dam/Southern Embankment would occur from Plan B operation.

Isolated flooding of wetlands could also occur throughout the Project Area due to drainage and ephemeral streams being cut-off by Project features. This wetland inundation would not be limited to Project operations. Most of the wetlands in the Project Area are underlain with fine-textured soils, and therefore, wetland loss that might occur from cutting off drainage to wetlands is expected to be minor. Most wetlands outside the Project footprint rely on surface

water runoff and have relatively small catchment areas. Potential drainage impacts on wetlands outside the Project footprint and inundation area are unlikely since any such wetlands would be far enough away that a hydrologic connection would not exist.

Project operation may increase inundation of some wetlands in the Project Area compared to flood events occurring under existing conditions. In some areas, Project operation floodwater depths are estimated to be over five feet. The additional inundation from Project operation could result in changes to the existing vegetation communities; however, duration of inundation is anticipated to be temporary and, for most wetlands, to cause seasonal flooding similar to existing conditions. Flood duration, depth, and associated drainage or infiltration rate changes within the wetland basins could cause changes in wetland type over time through repeated killing of vegetation, sediment deposition, and in some locations, scour.

The National Wetlands Inventory (NWI) dataset was reviewed to approximate the potential indirect wetland impacts caused by new inundation within the Project Area (Table 3-6). NWI classifications were interpolated to Circular 39 wetland types for comparison. Field verification would be necessary to more accurately reflect existing acreages and types as well as confirm potential impacts. The majority of potential impacts would be to Type 5 shallow open water and shallow open water communities.

Table 3-6 Estimate of Indirect Wetland Impacts from New Inundation During the 100-year Flood

Wetland Type	Minnesota Wetland Acres	North Dakota Wetland Acres	Total Acres
Type 1 (seasonally flooded)	12.4	41.4	53.8
Type 2 (fresh (wet) meadows)	0.0	0.0	0.0
Type 3 (shallow marsh)	7.2	120.6	127.8
Type 4 (deep marshes)	15.3	42.1	57.4
Type 5 (shallow open water)	3.6	0.0	3.6
Type 6 (shrub swamp)	0.0	1.7	1.7
Type 7 (wooded swamp)	8.6	0.2	8.8
Type 8 (bogs)	0.0	0.0	0.0
TOTAL ACRES	47.1	206.0	253.1

Source: NWI, Cowardin et al. 1979; US Fish and Wildlife Service

Portions of the area that would be inundated during Project operation have a history of row-cropping wetlands made feasible by using field drain tile. Existing agricultural activities result in a high potential for sediment transport due to loose, fine-textured surface soils exposed via plowing. The fine particles of soil in the Red River Basin tend to stay in suspension in the water column during floods except in areas where water velocity is significantly reduced. The greatest potential for sediment to cumulatively fill shallow wetlands would be near the Southern Embankment, where flood inundation would be the greatest and most frequent. Wetland types could change over time in the inundation area due to sediment deposition during Project operation. Wetlands downstream of structures may also be affected through increased velocities and resulting scour due to the structures. Without further hydrological aggradation and scour modeling, precise predictions of impacts are difficult to determine.

3.4.2.2 No Action Alternative (with Emergency Measures)

Under the No Action Alternative (with Emergency Measures) there would be no direct wetland impacts. Indirect wetland impacts from flood events would not change from the existing situation. Emergency measures would be used to reduce flooding in certain areas, which could alter the flow causing flooding or changes in other areas. Flooding that could occur would be temporary, and wetland impacts would occur slowly over a long period of time as part of flood dynamics and from other system influences.

3.4.3 Proposed Mitigation and Monitoring Measures

Wetland impacts due to construction of the Diversion Channel and the OHB levee would be addressed under Army Permit No. NWO-2013-1723-BIS and NWO-2014-0236-BIS, respectively. Again, these impacts have not changed from the 2016 Final EIS. Construction of the water control structures and the Southern Embankment for Plan B would require 244 acres of wetland impacts to be mitigated. The Project proposers have secured 17 of the 244 acres of wetland mitigation credit through the Ducks Unlimited in-Lieu Fee Program. Additional mitigation is also proposed from surplus wetland mitigation credits associated with wetland creation within the Diversion Channel. The majority of the wetland creation credits within the Diversion Channel are needed to mitigate wetland impacts from construction of the Diversion Channel. Any surplus wetland creation credits could be available for mitigation of other Project component wetland impacts. These potential surplus wetland creation credits would not be available for mitigation of wetlands in Minnesota under WCA because all of these credits are in North Dakota.

Under current WCA rules, mitigation would need to be located within a defined area in Minnesota and possibly of a defined wetland type, depending on whether mitigation banking is used or a Project-specific mitigation plan is developed. Currently, there are wetland bank options in Minnesota that would provide the necessary credits for Project impacts occurring in Minnesota. Preferred sites for wetland bank options are those that are within the bank service area local or near where the impacts would occur. Tieback embankment impacts that occur in Minnesota east of the Red River would be 39.5 acres as summarized in Table 3-5 and are proposed to be replaced per WCA. A determination of the specific wetlands within Minnesota that would require a wetland replacement plan has not been made. Some of the wetlands may be exempt from replacement under WCA. Wetland impacts may also be addressed as part of MPCA's 401 Water Quality Certification, if the USACE uses the traditional Section 404 permitting process for fill within waters of the United States.

It would be difficult, if not impossible, to monitor changes in wetland type and extent within the inundation area that result only from Project operations. Many of these wetlands would be inundated under existing conditions. Although Project operation would increase the depth and duration of the inundation of these wetlands, attributing any wetland change to this increased inundation is very subjective and difficult to separate from other impacts, such as flooding under existing conditions, and existing landscape stressors, such as agriculture and its associated drainage and erosion. The Project proposers have not identified any mitigation for indirect wetland impacts.

3.5 AQUATIC AND TERRESTRIAL RESOURCES

"Aquatic and Terrestrial Resources" is an environmental topic evaluated in the SEIS that combines three EIS sections from the 2016 Final EIS: 1) Fish passage and Biological Connectivity, 2) Wildlife and Wildlife Habitat and 3) Stream Stability.

3.5.1 Affected Environment

The 2016 Final EIS describes the landscape, rivers and streams, habitats and animal and plant species known to be present in the Project Area. A summary of the major features described includes:

- The landscape is dominated by cropland with a fair amount of wetlands.
- The primary rivers and streams in the Project Area include the Red River, Wild Rice River, Sheyenne River, Maple River, Lower Rush River, Rush River, and Wolverton Creek. These water courses are subject to riverbank slumping after flood events.
- A Qualitative Habitat Evaluation Index (QHEI) assessment and Index of Biological Integrity (IBI) assessment was completed by the Diversion Authority and USACE (URS, 2013) as part of the fisheries and macroinvertebrate inventory and assessment of streams in the Project Area. These assessments identified all the potentially affected streams as poor or very poor.
- Key habitats in the Project Area include prairie, wetland-non-forest, river-headwater to large, river-very large and forest-lowland deciduous.

The Natural Heritage Information System (NHIS) was reviewed in June 2018 to query if any additional known occurrence of state-listed species have been identified in the Project Area since the 2016 Final EIS. The NHIS review did not identify any additional known occurrences of state-listed species in the Project Area. The NHIS review did, however, identify a known occurrence of the rusty patched bumble bee (*Bombus affinis*), which is a federally-listed endangered species. The NHIS review also identified the presence of a Minnesota Biological Survey (MBS) Site of Moderate Biodiversity and “northern terrace forest”, which is a rare native plant community. This type of native plant community is vulnerable to extirpation in Minnesota and has been documented in multiple locations along the Red River in the vicinity of the proposed Project.

3.5.2 Environmental Consequences

Environmental consequences to aquatic and terrestrial resources would result from direct construction footprint impacts and indirect impacts from changes in hydrology and hydraulics. Changes in hydrology and hydraulics as well as floodplain extents could have effects on aquatic habitat, fish and macroinvertebrate populations and life cycles (e.g., migrations and spawning). Terrestrial habitat within the Project Area is somewhat limited given the extensive agricultural land use and urban development. There are no known prairie remnants within the Project Area, however the Project would result in direct and indirect impacts to floodplain forests (forest-lowland deciduous). Potential effects to non-forested wetlands are described in SEIS Section 3.4.

3.5.2.1 Plan B

Environmental consequences of Plan B that are potentially different than what was evaluated in the 2016 Final EIS are associated with changes to inundation and duration of Project operation and changes in the location of water control structures, Southern Embankment and tieback levees. Environmental consequences for construction of the Diversion Channel and OHB levee are not anticipated to be substantially different than what was identified in the 2016 Final EIS.

3.5.2.1.1 Construction

Footprint impacts would occur to rivers and streams from construction of water control structures and the tieback levees. The proposed locations of the Wild Rice River Control

Structure (WRRS) and the Red River Control Structure (RRS) are in the dry land adjacent to existing river segment. Following construction, the rivers would be diverted through a constructed channel through the control structures. The existing river segment would be abandoned or restored. Both WRRS and the RRS essentially remove a meander in the river on which they are constructed, resulting in a straightening of the river and removal of aquatic habitat. The RRS would measure approximately 400 feet long by 350 feet wide and remove 13 acres of aquatic habitat. The WRRS would measure approximately 450 feet long by 300 feet wide and remove 8 acres of aquatic habitat. Preliminary plan and profile drawings of the RRS and WRSS are in Figures 4 through 7.

The Eastern Tieback levee is proposed to cross Wolverton Creek using three 10-foot by 10-foot box culverts. Wolverton Creek would then be able to flow through the tieback levee into the Benefitted Area. The Wolverton Structure would measure approximately 85 feet long by 125 feet wide and remove one acre of aquatic habitat from the stream. A preliminary plan and profile drawing of the Wolverton Creek Structure is found in Figure 3.

Other impacts to aquatic habitat occur from the Sheyenne and Maple River Aqueducts, as well as the abandonment and redirect of the Lower Rush and Rush Rivers into the Diversion Channel. The aquatic habitat impact for the entire project footprint is 41.1 acres, including 19.1 acres of impact from the Sheyenne River and Maple River Aqueducts. For the Rush River and Lower Rush River, 2.1 and 3.4 miles, respectively, of river channel on each river would be abandoned from Project construction, as the flows from each river would be directed into the diversion channel. These impacts are all fully described in the 2016 Final EIS.

Construction of the above project features would also directly impact riparian vegetation that serves as both aquatic and terrestrial habitat for various plant and animal species at different life stages. This riparian area is also important foraging or nesting ground for various wildlife species such as waterfowl, turtles, and amphibians. The dominant riparian vegetation within the potentially impacted areas is floodplain forest. The importance of these forested floodplains is amplified due to the relatively scarce habitat available within the Project Area. Floodplain forest impacts from construction of the entire Project would result in the loss of 124 acres of floodplain forest.

3.5.2.1.2 Operation

Environmental consequences to the Sheyenne River, Maple River, Rush River and Lower Rush River from operation of aqueducts and the Diversion Channel are described in the 2016 Final EIS. The Project is proposed to operate only when flood discharges exceed 21,000 cfs, which would limit potential impacts to biological connectivity, but not eliminate them. Biological connectivity and fish passage could be impacted by the presence of the RRS, WRRS and Wolverton Creek structures, regardless of whether or not the Project is operating. Based off historical gage data, the Project would have operated five times since 1969 with an average duration of six days under Plan B compared to operating 10 times for an average of 6.8 days with the previously-proposed Project. Project operations would add an additional 10-14 days of increased velocity at the water control structures to allow drawdown of the staging area.

Project operation has the potential to alter velocities and depth on the Wild Rice and Red Rivers. This could lead to impacts on aquatic habitat, such as changes to the prevalence and location of deep or shallow pools. Sedimentation could occur in the inundation areas while scour is likely to occur in the downstream/benefitted areas. These changes in river depth and width associated with sedimentation and scour would likely result in impacts to aquatic habitat over time. Pools slowly fill with sediment, and banks and riffles may scour over time. Each of these river features provide habitat to fish, invertebrates, and other aquatic life.

Aquatic organism passage (i.e., the ability to migrate upstream or downstream) on rivers and tributaries is important to the overall health of an aquatic community. Aquatic organisms include macroinvertebrates, mussels, amphibians, fish and other aquatic species. A number of factors can affect aquatic organism passage. These factors can be naturally occurring, such as flow velocity or changes in stream stability; and human-caused, such as river impoundments, or dams and other structures acting as barriers (e.g., high velocities through culverts and perched culverts). The Project has the potential to disrupt aquatic organism passage through the construction of the diversion channel, associated control structures, and tieback embankment, as well as through modification of the natural hydrology of the Project Area by controlling water flow and staging water during flood events.

Aside from physical barriers such as dams, impacts to fish passage are generally a function of water velocity and distance fish need to travel. In the Red River Basin, velocities below 2 feet/second are sufficiently low that distance is typically not a concern for large river species. Stream velocities and the distance through the control structures and box culverts, whether the Project is operating or not, can be used to estimate potential impacts to connectivity. At the 10-year flood event, water velocity through the WRRS is estimated at 2.9 feet/second and water velocity through the RRS is estimated at less than 2 feet/second. The Wolverton Creek box culverts would have an estimated water velocity of 3.4 feet/second at a 10-year flood event. Based on this information, the WRRS and the Wolverton Creek box culverts could result in additional impediments to fish passage under certain conditions when the Project is not operating. Other features of the Project, such as the Maple and Sheyenne River Aqueducts, may also impact fish passage.

In addition to aquatic organism passage impacts from potentially increased velocities, the structures themselves have the potential to further limit fish passage by changing the physical environment within at each structure. Though the designs are not yet finalized, the WRRS and RRS will likely require a concrete bottom placed above the stream bed, which can limit passage, primarily affecting aquatic invertebrates. Other in-stream design components likely associated with these structures include rip-rap, baffles, and wing-walls, which have the potential to further limit passage by fish and other aquatic wildlife, such as turtles and amphibians, in the area.

The Project may also create stream instability through changes in hydrology and increased inundation, leading to riverbank slumping and bed scour at control structures.

The 2016 Final EIS provides additional detail about these potential environmental effects. Specific aspects of Plan B that were not addressed in the 2016 Final EIS include:

- the change to begin Project operation at 21,000 cfs (reducing frequency of operation from a 10-year event to a 20-year event),
- decreased rate of draining the inundation area as the flooding recedes,
- the Eastern Tieback levee interaction with Wolverton Creek, including the proposed use of box culverts for the creek to pass through the levee.

The changed frequency of operation with Plan B would lessen the potential for adverse effects associated with changes in hydrology. The decreased rate at which the inundation area is drained would lessen the potential for adverse effects associated with riverbank slumping. The changes to the Eastern Tieback levee and the box culverts for Wolverton Creek would increase the potential for adverse effects associated with bed scour at the culvert location.

3.5.2.2 No Action with Emergency Measures

Under the No Action Alternative (with Emergency Measures) aquatic habitat, aquatic organism passage, fish migration and fish mortality would remain similar to the existing conditions. This includes variable flow rates and other factors that influence aquatic habitat, fish passage and mortality in the Red River, Wild Rice River, Sheyenne River, Maple River, Rush River, Lower Rush River, and Wolverton Creek. Habitat within these rivers would continue to be influenced by the flooding patterns that currently occur and potentially contribute to channel scouring and/or siltation of aquatic habitat. There may be some localized impacts from the implementation of flood control measures. In most cases, emergency measures would include adding height to existing levees or adding temporary levees to protect additional areas. However, these actions are unlikely to be conducted directly within river channels and result in aquatic resource impacts. Emergency measures could also have incidental impact on terrestrial resources that are anticipated to be temporary and minor.

3.5.3 Proposed Mitigation

The USACE is proposing the use of an Adaptive Management and Mitigation Plan (AMMP, Appendix G) to address mitigation requirements for the Project. This plan is envisioned as a living document that would be updated as additional information on Project design and monitoring become available. The current version of the AMMP is provided as Appendix G. This document proposes to provide mitigation for impacts to aquatic habitat, forests and direct wetland impacts. Concerns about impacts to river geomorphology, indirect wetland impacts, biological connectivity and fish stranding are proposed to be addressed by monitoring Project impacts to determine if mitigation is warranted.

Potential mitigation options for aquatic habitat that are identified in the AMMP include:

- Restoration of the Bois de Sioux River
- Restoration of the Lower Otter Tail River
- Restoration of the Sheyenne River
- Drayton Dam Fish Passage
- Red River Fish Passage Retrofit
- Sheyenne River Fish Passage
- Other Fish Passage Projects (unspecified)

The restoration projects would improve river habitat by connecting oxbows and re-creating more natural riverine conditions in areas where the rivers have been channelized or otherwise degraded. The fish passage projects would construct rock rapids or make other modifications to existing dams and water control structures to improve fish and other aquatic organism passage through these features.

The AMMP identifies that approximately 253 acres of floodplain forest would need to be created to mitigate the 124 acres of floodplain forest removed. The increase in acres needed for mitigation is intended to account for the lengthy time period required to grow trees in newly-created floodplain forest. Non-forested wetland mitigation is addressed in SEIS Section 3.4.

There is some uncertainty about the degree of impact the Project would have on fish passage and biological connectivity. The main project feature that has been adjusted to address fish passage and biological connectivity is the frequency of operation. Limiting Project operation to flood events above the 20-year flood allows more natural hydrology through the Project Area for all flood events below the 20-year event. Preliminary concepts for design of the water control structures has included rock riffles or other features to increase roughness and decrease water flow velocities through the structures. Additionally, the three gates planned for both the RRS and WRRS are separated by abutments that can collect debris and increase velocities through the structures (until it can be removed), thus creating conditions that could reduce fish passage. The details and effectiveness of these features has not been developed.

DNR has identified concerns with the proposed mitigation. These concerns include:

- Feasibility of monitoring to capture Project-related indirect wetland impacts.
- Use of IBI as sole source of habitat quality assessment in mitigation calculations. IBI is utilized as an indicator of watershed habitat, not specific locations within a river reach.
- Potential for the RRS and WRRS cutting off meander bends and, therefore, shortening the river reaches.
- Proposed use of engineered channels that connect the river to the control structure as mitigation for aquatic habitat impacts. This habitat within engineered channels will likely have limited natural stream design and function.
- No proposed mitigation for biological connectivity and fish passage.
- Lack of identified triggers within monitoring results that would indicate adaptation is needed, and lack of potential actions that could be responsive to monitoring results.

The USACE has indicated a willingness to work collaboratively with various state, federal and local resource agencies and personnel to attempt to address DNR concerns. Supplemental EIS Chapter 6 includes DNR recommendations for revisions to the AMMP.

3.6 CULTURAL RESOURCES

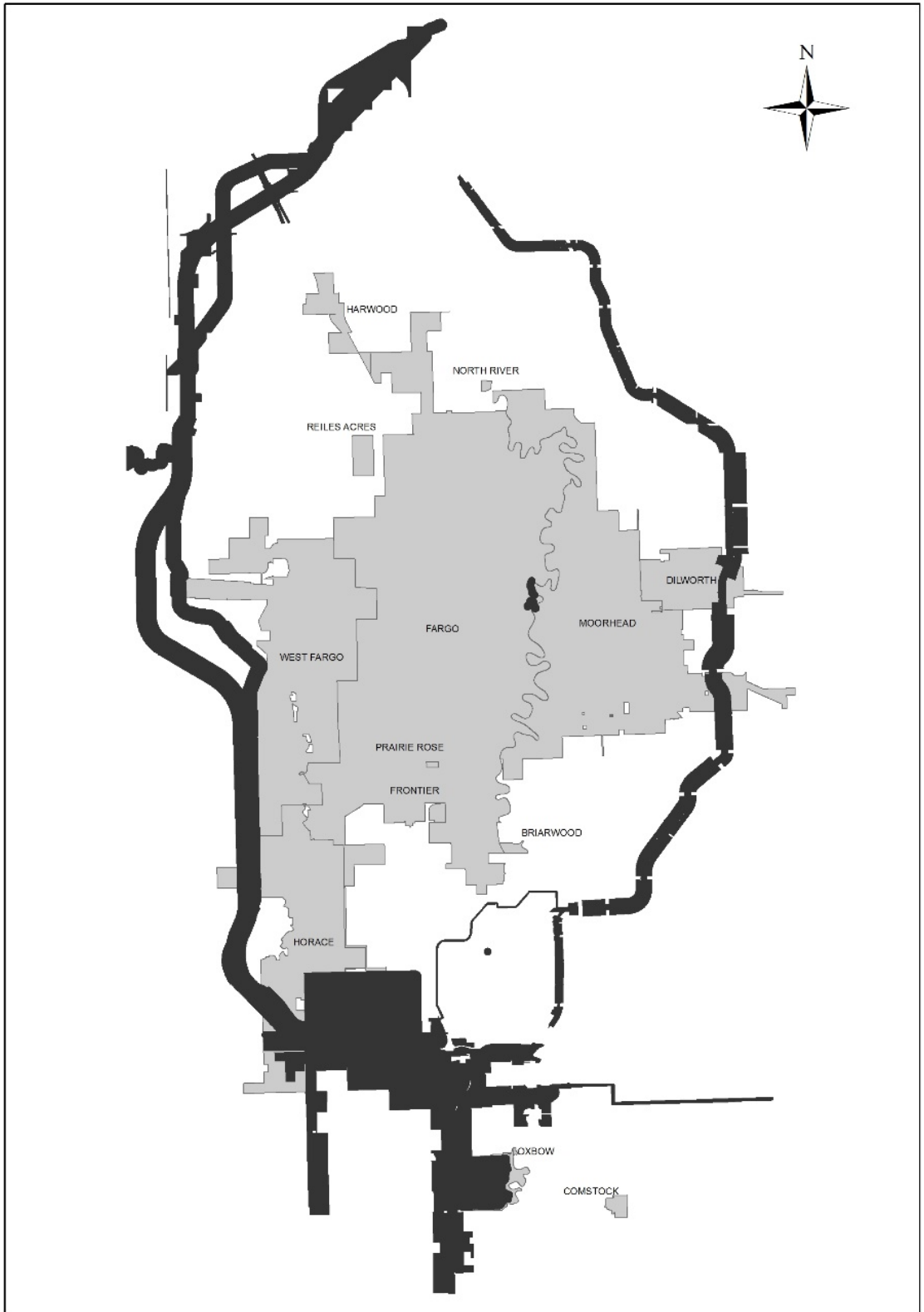
Cultural resources include a wide range of sites, structures and properties that may be historic, contain archaeological artifacts or indicate other resources related to past human activities. These resources may include sites such as those with existing observable evidence of past human activities, sites of religious or cultural significance that may have no observable evidence, historic structures and buildings, or properties associated with the certain cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the community's cultural identity, as well as natural resources inexorably linked to cultural beliefs and practices. This section will primarily

address these types of cultural resources. Although cemeteries are a cultural resource and are mentioned in this section, Section 3.10 (Socioeconomics) contains a more in-depth discussion of impacts to and proposed mitigation for cemeteries.

3.6.1 Affected Environment

The USACE has conducted Phase I and Phase II cultural resources surveys for various proposed alignments between 2009 and 2017. Nearly 33,400 acres have been the subject of Phase I survey to date. Cultural resources surveys have been completed for portions of Plan B and its staging area (Illustration 3-4). Previously surveyed areas present under Plan B include the former Storage Area #1, the Oxbow-Hickson-Bakke (OHB) ring levee and the Interstate 29 (I-29) road raise. The surveys have identified many cultural resource sites within the Plan B Project Area that may potentially be impacted both directly and indirectly by Plan B.

Illustration 3-4 Tracts surveyed for cultural resources, indicated in black, equal 33,385 acres. (Source: USACE, 2018)



Those portions within the Area of Potential Effect (APE) for direct and indirect impacts by the Plan B Project that were not included in previous surveys would need to be surveyed in order to document unidentified National Register of Historic Places (NRHP), NRHP-eligible, or NRHP-recommended sites that may be impacted. This additional information is also needed to determine appropriate mitigation for impacts. The USACE has indicated that the necessary additional cultural resource surveys are underway or would be completed prior to construction. Based on the currently-surveyed areas (Illustration 3-4), additional Phase I surveys for Plan B would be needed in the following areas:

1. The newly-aligned Western Tieback.
2. Portions of the Dam/Southern Embankment alignment, primarily in Minnesota.
3. Transportation corridors.
4. The newly-aligned Eastern Tieback, including the Wolverton Creek crossing.
5. The majority of the new staging area.
6. The APE for direct and indirect effects for the increased river stage to 37 feet through town.

All additional built environment surveys and any visual effects surveys would be required following delineation of the floodway and acquisition of right-of-entry for the relevant parcels. A shoreline survey would be required within the channels of the Wild Rice River, Red River of the North, and sections of Wolverton Creek to ascertain whether any cultural resources sites would be exposed by bank line erosion and to provide a baseline for comparison with Project effects. These surveys would also be performed following delineation of the floodway and acquisition of right-of-entry for the relevant parcels.

NRHP Criteria

To be eligible for the National Register of Historic Places, the site must meet one of the National Register criteria (National Park Service [NPS] 1995:3).

- Criterion A - under Criterion A, a site would be considered for NRHP nomination if it can be associated with an event that is significant to history.
- Criterion B - under Criterion B, a site would be considered eligible if it can be associated with the lives of significant persons in our past.
- Criterion C - under Criterion C, a site would be considered eligible if it:
 - embodies a distinctive characteristic of a type, period, or method of construction,
 - represents the work of a master,
 - possesses high artistic value, or
 - represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D - under Criterion D, a site would be considered eligible if it has yielded, or is likely to yield, information important to our understanding of history or prehistory.

Further, a Traditional Cultural Property (TCP) can be considered eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that are (a) rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community, (NPS 1998:1).

Finally, to be eligible for the National Register a site must also possess several, if not most, of the following aspects of integrity, such as location, design, setting, materials, workmanship, feeling, and association.

3.6.2 Environmental Consequences

Adverse effects on historic properties include, but are not limited to: physical destruction of or damage to all or part of a property; alteration of a property; removal of a property from its historical location; change of character of a property's use or physical features; introduction of visual or audible elements that diminish the integrity of a property's significant historic features; neglect of a property which causes its deterioration; and transfer, lease, or sale of property out of federal ownership or control without adequate restrictions or conditions to ensure long-term preservation.

3.6.2.1 Plan B

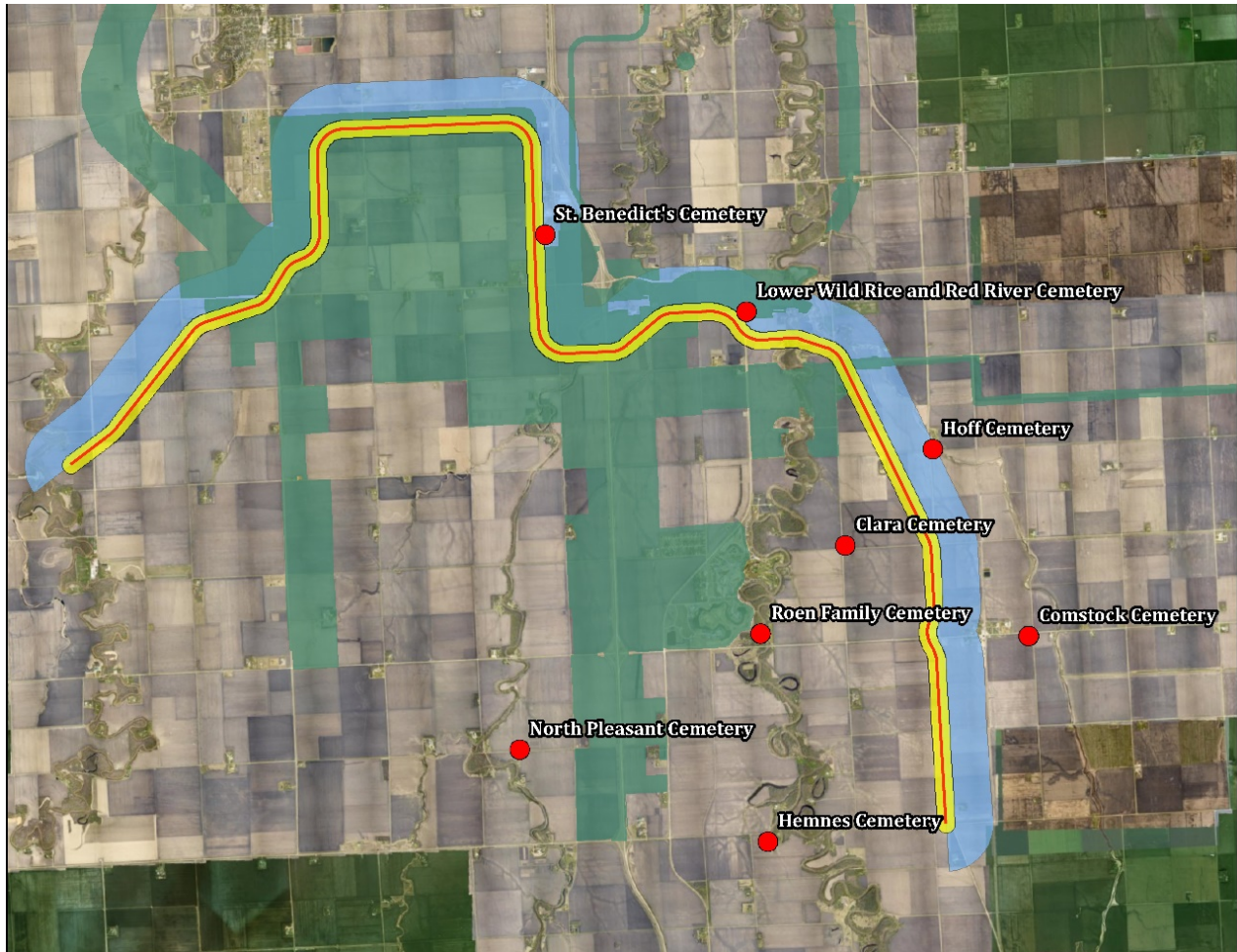
Potential impacts from Plan B could occur to NRHP properties and NRHP-eligible properties. The Section 106 process includes the assessment of adverse effects to historic properties (36 CFR, subpart B § 800.5). Direct impacts to cultural resources from construction of the Diversion Channel and the OHB Ring Levee for Plan B are anticipated to be similar to those described for the previously-proposed Project. The Plan B control structures, tieback embankments, and staging area are different from the previously-proposed Project, and therefore, the identified NRHP-eligible or recommended eligible sites would be different for these features. Some of the sites that were identified as located in the Benefited Area under the previously-proposed Project, might be potentially impacted under Plan B. Similarly, there might be some sites that are removed from impact with Plan B.

The following discussion on potentially-impacted sites for Plan B is not complete, but rather includes the known cultural resource sites identified as of May 2018. Future surveys would need to be conducted to fully consider Plan B impacts to NRHP-listed or eligible historic properties and determine avoidance, minimization or mitigation actions necessary. Plan B would be constructed in pieces, and would be surveyed and mitigated piece by piece prior to the start of construction.

3.6.2.1.1 Diversion Inlet Structure to Wild Rice River Structure

Survey of the direct APE for the section between the Diversion Inlet Control Structure (DIS) and the Wild Rice River Control Structure (WRRS) was largely completed in 2010 and is discussed in the USACE's 2011 FFREIS. Three National Register-eligible farmstead sites 32CS5158, 32CS5168, and 32CS5169, would require mitigation plans and Memoranda of Agreements (MOAs). Site 32CS5158 is a property that has been in the family for more than a century and contains an early 20th century barn eligible under criteria A and possibly C. Site 32CS5168, eligible under criterion A, was homesteaded in 1870 and has been in the family since that time. Site 32CS5169, eligible under criteria A and C includes an historic residential building with Queen Anne style elements circa 1900. Additionally, eligible site 32CS114, St. Benedict's Catholic Church and Cemetery, is located just inside the Benefited Area within the viewshed of the Plan B alignment (Illustration 3-5). Mitigation measures for viewshed impacts to the built environment by the Southern Embankment and hydraulic structures have yet to be defined. Structures located south of site 32CS5168 are addressed below as part of the staging area.

Illustration 3-5. Partial Plan B alignment with locations of previously surveyed cemeteries and viewshed buffer indicated in blue.



Source: USACE, 2018

3.6.2.1.2 Wild Rice River Structure to Red River Structure

Survey of approximately 50 percent of the direct APE for the section between the Wild Rice River Structure and the Red River Structure was completed in 2014 and 2015 as part of earlier investigations for the I-29 road raise. The approximately 350 acres that comprise the eastern half of this section, south of site 32CS2653, require Phase I survey for cultural resources. Three eligible sites are located within the benefitted area's half-mile viewshed, as defined by the amendment to the Programmatic Agreement (2013). The Lower Wild Rice and Red River Cemetery (32CS2653) would be avoided by Plan B, including the road raise of County Road 81, but it lies within the viewshed buffer. The 1953 pre-stressed concrete bridge at 124th Avenue SE and Cass County Road 16 over the Wild Rice River (32CS4678) and the southernmost extent of the Freeman Farmstead site 32CS5267 also are situated within the viewshed buffer. The Freeman Farmstead is a multi-structured early 1880s farmstead, originally belonging to Ole Olson who was part of the early Norwegian settlement in the area, eligible under criterion A.

3.6.2.1.3 Red River Structure to end of Eastern Tieback

Phase I survey of approximately 1,550 acres would be required in Minnesota along the section of the Plan B alignment between the Red River Structure and the end of the Eastern Tieback, including across Wolverton Creek. Archaeological and built environment resources investigations, including viewshed analyses, have not been undertaken throughout this part of the Project Area and would be required.

3.6.2.1.4 Diversion Inlet Structure to end of Western Tieback

Phase I survey of approximately 800 additional acres in Cass County, North Dakota would be required along the section of the Plan B alignment between the Diversion Inlet Structure and the end of the Western Tieback. Archaeological and built environment resources investigations, including viewshed analyses, have not been undertaken throughout this part of the Project and would be required.

3.6.2.1.5 Plan B Staging Area

Cultural resources survey of portions of the staging area began in 2010. The previously-proposed Project's connecting channel alignment component was surveyed between 2010 and 2012 and covered areas between County Road 17 and I-29. Phase I surveys and geoarchaeological deep testing investigations for the OHB Ring Levee were completed in 2013. Additional surveys were conducted in 2014 and 2015 for the revised southern alignment and I-29 road raise. Six cemeteries located in the staging area were surveyed in 2014: three in North Dakota and three in Minnesota. A seventh cemetery, also surveyed in 2014 and located at Comstock (CY-HCR-008), lies east of and outside the staging area.

Within these previously-surveyed areas are a number of historic properties. Two of the cemeteries, Clara (CY-HCR-007), in Minnesota, and Hemnes (32RI1877), in North Dakota, are National Register-eligible (Figure 13). The Clara cemetery is eligible under criteria A for its association with the themes of rural settlement and religion. The Hemnes cemetery is eligible under criteria A for its association with the themes of rural settlement and religion, B for its relationships with local historically significant individuals, and D for its potential to yield data important to the understanding of local and regional history. A cemetery mitigation plan was prepared in 2014. The remaining cemeteries shown on Figure 13 are ineligible for listing in the National Register.

Within the previously-surveyed areas described above, there are two farmstead properties along the Wild Rice River that require mitigation plans or further investigation. The Ramstad Farmstead (32CS5109) has a number of structures that illustrate, under criterion A, the connection to local agricultural practices. Site 32CS5098, also located on property associated with the Ramstad farmstead, is reported as the location of a former log cabin structure, and requires additional field verification.

Built environment surveys and visual effects surveys would be required for the floodway. A limited shoreline survey would be conducted within the channels of the Wild Rice River, Red River of the North, and sections of Wolverton Creek to ascertain whether cultural resources sites are exposed by bank line erosion. These surveys would be performed following delineation of the floodway and acquisition of right-of-entry for the relevant parcels.

3.6.2.1.6 In-town

Project design changes for the increased river stage to 37' through Fargo-Moorhead would require an additional survey for an adjusted APE for direct effects, and possibly for indirect effects if additional levee and floodwall protection is added to Plan B. These surveys would be required following delineation of the floodway and acquisition of right-of-entry for the relevant parcels.

3.6.2.2 No Action Alternatives (with Emergency Measures)

Conditions for the No Action Alternative (with Emergency Measures) are not anticipated to change significantly from those described in the 2016 Final EIS. Changing the hydrologic and hydraulic modeling from the Expert Opinion Elicitation Panel (EOEP) to the updated Period of Record (POR) may require an additional survey for an adjusted APE for direct effects, and possibly for indirect effects if additional levee and floodwall protection is added to the Project. These surveys would be required following delineation of the floodway and acquisition of right-of-entry for the relevant parcels.

3.6.3 Proposed Mitigation and Monitoring Measures

The description of the USACE's compliance with Section 106 of the NHPA and the Programmatic Agreement has not changed and is described in the 2016 Final EIS. Proposed cemetery mitigation has changed since the 2016 Final EIS and is discussed in detail in Socioeconomics section 3.10.

3.7 INFRASTRUCTURE

This section describes Plan B infrastructure related to roads, bridges, railroads and drainage within the Project Area and the potential impacts from construction and operation of the proposed Project. The No Action Alternative (with Emergency Measures) is also discussed, along with proposed mitigation and monitoring.

The Diversion Authority prepared a FM Diversion Plan B Transportation Master Plan (Transportation Plan, Appendix D) that evaluates impacts to the existing transportation network to account for modifications within the Dam/Southern Embankment. The Transportation Plan includes key roads that would be raised within the staging area and areas that will be inundated during Project operation. The purpose of the Transportation Plan is to account for the major changes to transportation features with Plan B as compared to existing conditions.

3.7.1 Affected Environment

The Project Area has an established transportation system serving both rural and urban needs, and includes interstate highways, state highways, county roads, and township roads. The Project Area also has a number of railways and drainage ditches. The 2016 Final EIS identifies these major road, bridge, railway and drainage features. DNR is unaware of any major additions to these infrastructure categories.

3.7.2 Environmental Consequences

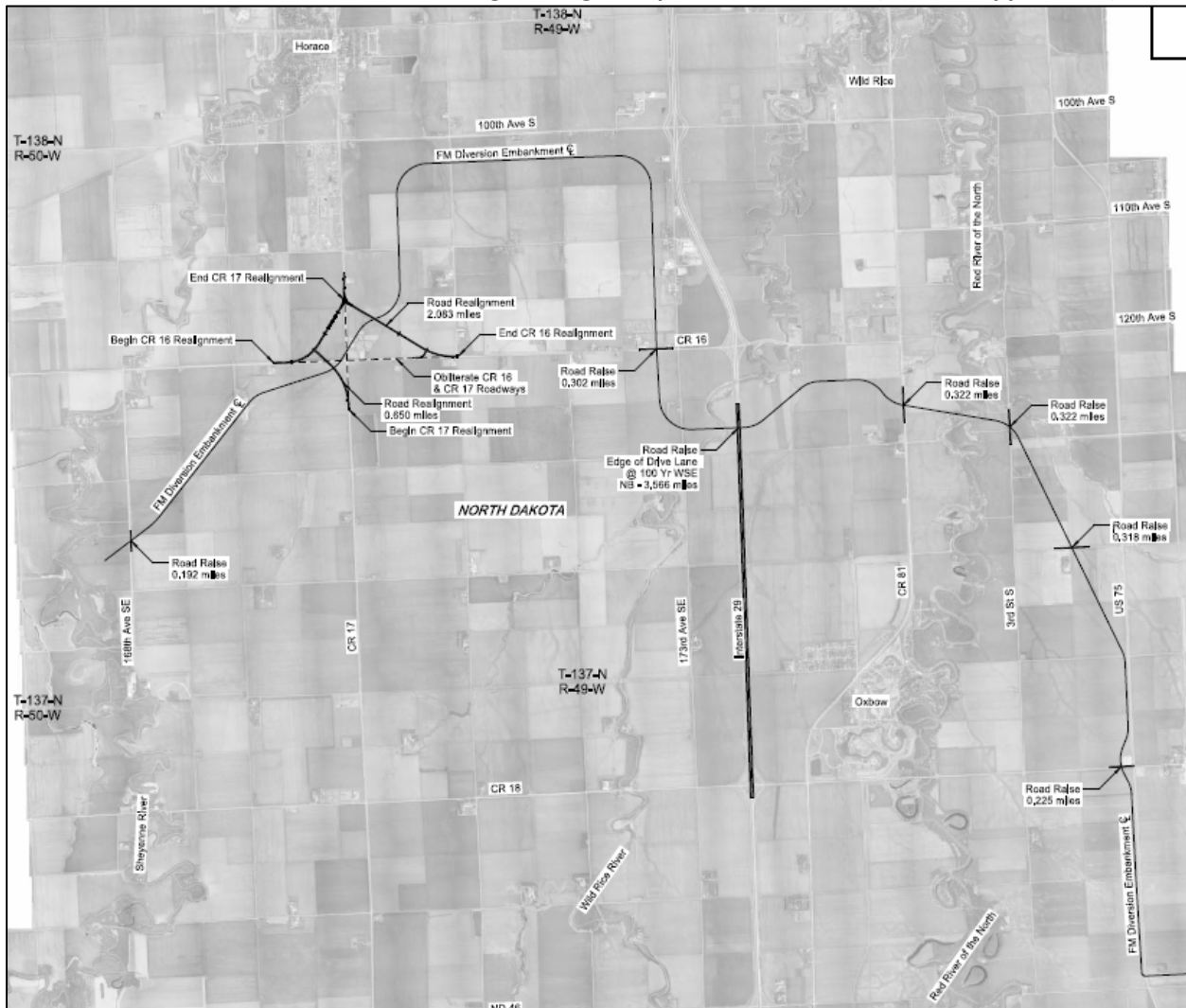
To the extent that Plan B changes impacts to highways, county roads, township roads, bridges, ditches, railroads, and water treatment facilities, potential impacts are described here.

3.7.2.1 Plan B

3.7.2.1.1 Roads and Bridges

Plan B would result in the modification of traffic patterns for local residences and farmsteads that are close to the Dam/Southern Embankment alignment, and would affect connectivity and accessibility to various locations and properties in the Project Area. As a part of Plan B, key roads will be raised within the staging area. Additional roads will be raised where they cross the Dam/Southern Embankment. Portions of the remaining roads within the staging areas will be inundated during Project operation. A general overview of road and bridge impacts is below in Illustration 3-6. Full details about road impacts, including costs, can be found in Appendix D.

Illustration 3-6 Overview of Road and Bridge Changes required with Plan B. (Source: Appendix D)



As part of Plan B, key roads, including Interstate 29 (I-29) would be raised within the staging area. Additional roads, including 3rd Street South, 140th Avenue South and 160th Avenue South in Clay County, Minnesota and 168th Avenue Southeast, Cass County Highway 81 and Cass County Highways 16/17 in Cass County, North Dakota would be raised where they cross the Dam/Southern Embankment, but the remaining portions of these roads would not be raised.

Portions of the remaining roads within the staging area would be inundated for a period of time during Project operation. With Plan B, no grade raises are required or planned for U.S. Highway 75 nor the Burlington Northern Santa Fe (BNSF) Moorhead Subdivision rail line. After completion of the Project, all parcels of land would continue to have direct access off of an adjacent road. The following are major transportation feature changes associated with Plan B when compared to the previously-proposed Project:

- Interstate 29 – Slight reduction in the amount of grade raise with Plan B.
- U.S. Highway 75 – No grade raise needed with Plan B.
- Clay County, Minnesota:
 - Clay County Highway 7 – No Dam/Southern Embankment crossing required with Plan B.
 - Clay County Highway 61 – No Dam/Southern Embankment crossing required with Plan B.
 - 3rd Street South – Dam/Southern Embankment crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - 140th Avenue South - Dam/Southern Embankment crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - 160th Avenue South - Dam/Southern Embankment crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - City of Comstock ring levee and associated roadway modifications is not required as part of Plan B.
- Cass County, North Dakota
 - 168th Avenue Southeast – Dam/Southern Embankment crossing proposed as part of Plan B, but not as part of previously-proposed Project.
 - Cass County Highway 81 – Dam/Southern Embankment crossing proposed as part of Plan B and the previously-proposed Project.
 - Cass County Highway 16 – Dam/Southern Embankment crossing proposed as part of Plan B, but not as part of the previously-proposed Project. A portion of the roadway would be located in the upstream staging area for Plan B, but was not for the previously-proposed Project.
 - Cass County Highway 17 – A portion of the roadway would be located in the upstream staging area for Plan B, but was not for the previously-proposed Project.
 - Cass County Highways 16/17 – Requires re-alignment for Plan B to accommodate the Diversion Inlet Structure (DIS).

No changes are proposed to the OHB Levee design, so the description of infrastructure impacts described for the OHB Levee under the previously-proposed Project in the 2016 Final EIS would also apply to Plan B.

Within the Benefited Area, approximately 4.4 miles of roadway were identified for improvement in North Dakota at river stage (RS) of 37 feet, with a maximum grade raise height of 1.5 feet. While in Minnesota, approximately 4.0 miles of roadway were identified to be impacted at RS37 feet with a maximum grade raise height of approximately 4 feet.

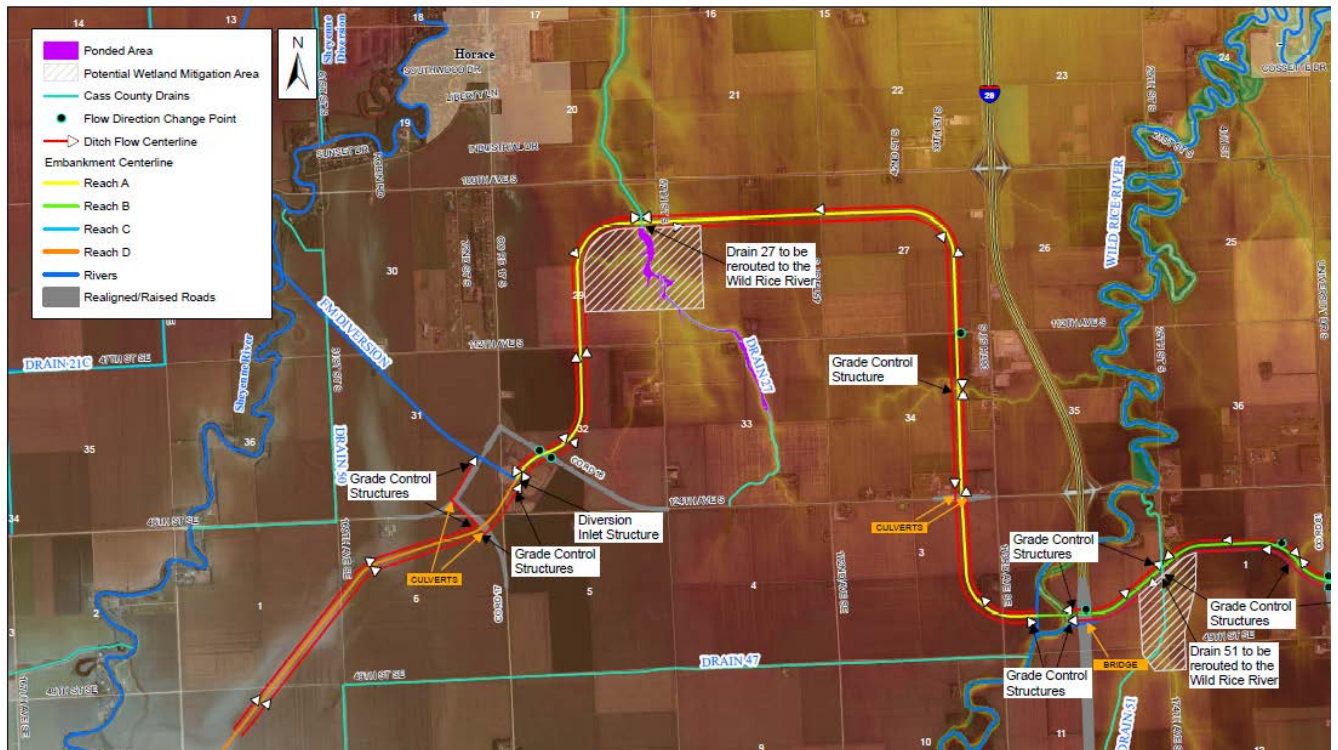
3.7.2.1.2 Railroads

Under Plan B, no grade raise is needed to the BNSF Moorhead Subdivision Rail Line.

3.7.2.1.3 Drainage

On the North Dakota side, Cass County Drain 47 would no longer be intersected by the Dam/Southern Embankment, and would not require a realignment of the channel, compared to the previously-proposed Project. However, Cass County Drain 27 would be intersected by the Dam/Southern Embankment. The portion of Drain 27 south of the Dam/Southern Embankment would no longer flow north through the City of Fargo, but would, instead, flow east and south parallel with the Dam/Southern Embankment and outlet just south of the Wild Rice River Control Structure (WRRS). Preliminary profile figures of the drainage ditches appear to indicate that Drain 51 between the Red River and the Wild Rice River, adjacent to 174th Ave, might be impacted by the Dam/Southern Embankment and rerouted to the Wild Rice River. These areas are identified in Illustration 3-7, below.

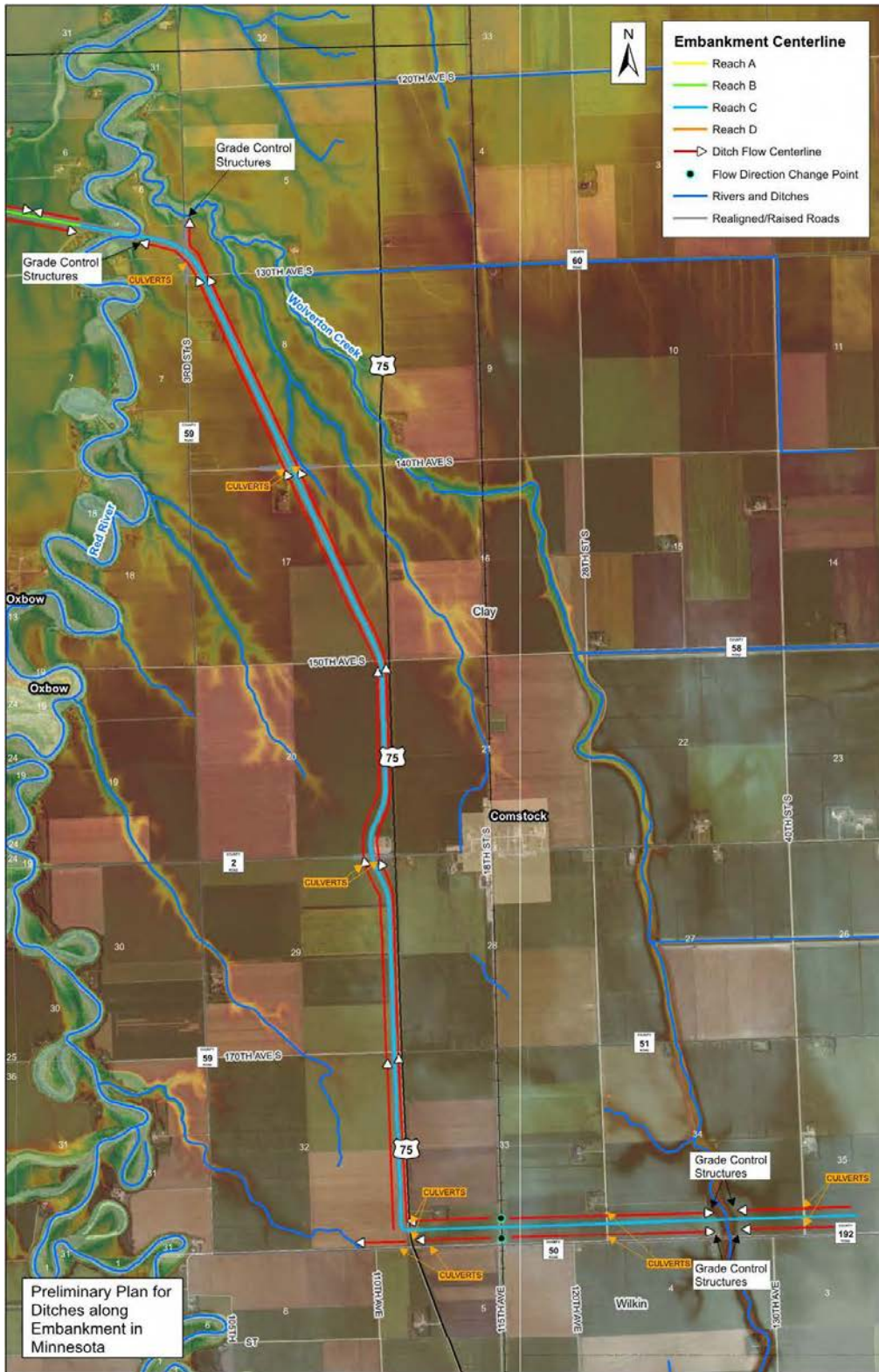
Illustration 3-7 Preliminary Plan for Ditches along Embankment, North Dakota, Plan B. (Source: Appendix D).



On the Minnesota side, the Dam/Southern Embankment has been realigned such that it follows relatively high ground from the Red River to Highway 75. Then, it extends south to a location that is approximately 500 feet north of the Clay/Wilkin County line, at which point the Eastern Tieback extends east across Wolverton Creek to a location of high ground. This new alignment eliminates the need for many local drainage pattern changes. New box culverts through Wolverton Creek would allow flows to continue through the tieback (more information on impacts to Wolverton Creek can be found in Section 3.2—Hydrology and Hydraulics). All other creek tributaries would naturally drain away from the proposed alignment without the need for reshaping or reconstruction (except in cases where local drainages intersect the Dam/Southern Embankment and local drainage would be picked up by the parallel local drainage ditches that are proposed to be constructed adjacent to the dam/southern embankment and conveyed). A

local ditch would be constructed on either side of the Eastern Tieback to drain local water to Wolverton Creek. All water adjacent to the Dam/Southern Embankment would flow in a local drainage ditch parallel to the Dam/Southern Embankment toward the Red River and Wild Rice River. These areas are identified in Illustration 3-8, below.

Illustration 3-8 Preliminary Plan for Ditches along Embankment, Minnesota, Plan B. (Source: Appendix D)



3.7.2.1.4 Water Treatment Facilities

Under Plan B, the Comstock, Minnesota sewage lagoons are not anticipated to be impacted. However, the existing water treatment plant located near St. Benedict's would be on the wet

side of the proposed Southern Embankment, which would require removal of the water treatment plant and mitigation of the impacts to the Cass Rural Water Users District (CRWUD).

3.7.2.2 No Action Alternative (with Emergency Measures)

The No Action Alternative (with Emergency Measures) would result in numerous highway and railroad bridge closures and the airport closure during flood events. The cities of Fargo and Moorhead each have ongoing and future flood damage reduction (FDR) projects. These projects provide benefit in reducing the potential for flooding in Fargo and Moorhead, and therefore, also reduce the potential magnitude of impact on infrastructure and public services. Emergency measures, such as sandbagging and temporary levees, would be constructed where gaps in FDR project protection exist to tie into existing levees. A temporary levee may be constructed across a roadway, which would disrupt traffic flow in that area. Emergency measures could also be targeted toward specific infrastructure, such as a water treatment plant, as needed to reduce flood risk. Emergency measures also includes floodwall closures.

Predicting whether the emergency measures would be effective enough to avoid impacts to public infrastructure and public services is dependent on each flooding event. Emergency measures have been effective in the past when there has been enough lead time to prepare for flooding. However, there is a risk of the temporary structures failing, which would result in significant flooding in certain areas and potentially significant impacts to infrastructure and delivery of public services.

3.7.3 Proposed Mitigation and Monitoring Measures

3.7.3.1 Roads and Bridges

Construction of road and rail bridges over the diversion channel would be completed to mitigate transportation connectivity impacts. Interstate 29 would be raised in the staging area to prevent inundation during Project operation. Small portions of Cass County Highways 81 and 18 would be raised to maintain access inside the OHB Levee. All other roads in the staging area would be allowed to flood under Project operation. Other roadway changes would be implemented per the Transportation Plan (Appendix D).

Operation of the Project and upstream inundation may cause some damage to public lands, including township and county roads. For these potential impacts, the Diversion Authority proposes a post-operation public lands repair and clean-up plan, which is described in detail in the Land Use Plans and Regulations section (Section 3.8.3) as well as in Appendix F. This plan would allow local government entities (townships, water boards, etc.) to contract for the repair and clean-up work on the public lands, and then submit for reimbursement to the Diversion Authority.

3.7.3.2 Railroads

Improvements and/or modifications to the rail lines were not evaluated in the Plan B Transportation Plans. Any improvements and/or modifications to the railroads would need to be coordinated with BNSF and the Red River Valley & Western Railroad.

3.7.3.3 Drainage

The Dam/Southern Embankment severs existing drainage paths and the embankment itself will produce runoff. The general drainage mitigation strategy along the embankment include pool-side and dry-side ditches that will flow toward the Red River or Wolverton Creek in Minnesota and toward various low points in North Dakota. Ditch slope and cross-section configuration will be similar to those typically used by local water resource districts except that the size of the pool-side ditch may be larger than what is necessary for local drainage in order to provide material for the embankment. The longitudinal slope of ditches will generally be 0.05 percent, although slightly flatter and steeper slopes may be used to satisfy cut/fill needs. The bottom and side slopes of ditches will be conducive to future maintenance. In general, vegetation will suffice for erosion control, although riprap is expected to be installed at culverts, grade control structures, and other locations where erosion potential is increased.

Operation of the Project and the upstream inundation area may cause some damage to drainage ditches and parks, as well as the accumulation of debris (logs, straw, trash, etc.). For these potential impacts, the Diversion Authority proposes a post-operation public lands repair and clean-up plan, which is described in detail in the Land Use Plans and Regulations section (Section 3.8.3) as well as in Appendix F. This plan would allow local government entities (townships, water boards, etc.) to contract for the repair and clean-up work on the public lands, and then submit for reimbursement to the Diversion Authority.

3.7.3.4 Water Treatment Facilities

As noted above in Section 3.7.2.1.5, there is a Cass County water treatment plant that would require removal under Plan B. The Diversion Authority, along with the City of Fargo, proposes to work with the Cass Rural Water Users District (CRWUD) to develop a regional water system solution that would provide water service to all CRWUD customers and maintain the financial position of the utility. The regional water system solution may require construction of a new CRWUD water treatment plant, or it may involve connecting the distribution systems, providing discounted wholesale water, or cost-share for future CRWUD infrastructure requirements. The cost estimate for the Project includes costs for this mitigation requirement.

3.8 LAND USE PLANS AND REGULATIONS

Plan B would affect a number of local government units (LGUs) including counties, townships, cities, and watershed management organizations. Some of the LGUs have planning and zoning authority within the project area. LGUs that do not have regulatory authority rely on other LGUs, such as the county, to regulate land uses and zoning. This section describes relevant information from county and city land use plans, regulations, and other flood damage reduction plans in the Project Area. Operation and/or construction activities that would affect the LGU would potentially require permits.

3.8.1 Affected Environment

The USACE and Diversion Authority continue to coordinate with Cass County (ND), Clay County (MN), City of Fargo (ND), City of Moorhead (MN) and Cass County (ND) Joint Water Resources District. Many affected counties, townships, municipalities, and watershed management organizations remain the same for Plan B. The 2016 Final EIS describes the potentially affected LGUs and their respective land use authorities and plans.

3.8.2 Environmental Consequences

Please refer to the 2016 Final EIS section 3.14 regarding current plans and zoning ordinances for each of the LGUs in the Project Area that could be affected by flooding and/or Plan B. An evaluation of current and future plans for growth and regulations in place to manage flood risk through land use and floodplain ordinances were included in the evaluation as well as potential challenges to the plans and zoning ordinances.

3.8.2.1 Plan B

Plan B would affect a number of LGUs within the Project Area. Local Government Units in the area of the Plan B Dam/Southern Embankment and inundation area would have different Project features, as well as different degrees of inundation and/or flood protection, than was described in the 2016 Final EIS.

The DNR contacted via email counties and watershed/resource organizations in the Project Area to collect information about how Plan B would interact with land use plans and regulations. The entities contacted included Cass County, Clay County, Wilkin County, Richland County, Cass County Joint Water Resource District, and Buffalo Red River Watershed District. The cities of Fargo and Moorhead were also contacted due to their central involvement in the Project. Pleasant Township was also contacted due to a potential land use regulation conflict that was identified as part of the 2016 Final EIS. Below is summary of the questions DNR posed to the LGUs and their responses.

Questions sent to LGUs potentially impacted by Plan B

1. With what, if any, land use regulations would the Project need to comply? Please list the specific ordinances and supply any supporting references (e.g., CUP, grading permit, etc.)
2. What criteria would you consider when making a permitting decision on the above authority?
3. Do you have any concerns about the Project's compatibility with your comprehensive plan and related land use ordinances (floodplain, shoreland)?
4. What additional information might you need to inform your permitting decisions?

Response: Cass County

The County has authority over the subdivision of land and access permitting along county roads. All other zoning and permitting authority is governed by individual townships within Cass County. Zoning and flood plain ordinances are considered when permitting, with each project proposal.

Development within the special flood hazard area must comply with the Flood Damage Prevention Ordinance 1998-2.

Response: Cass County Joint Water Resource District

Responses apply to following Water Resource Districts (WRD) in Cass County, ND:

- Cass County Joint WRD
- Southeast Cass WRD
- Maple River WRD
- North Cass WRD

- Rush River WRD

1. The Water Resource Districts (“WRDs”) have jurisdiction over surface drainage to the extent a project seeks to drain a watershed area of 80 acres, under N.D. Cent. Code § 61-32-03. To the extent the project will result in surface drainage of any watershed or combination of watersheds of 80 acres or more, the project sponsors will have to apply for a surface drainage application under Section 61-32-03.

With regard to dam/dike permits, the State Engineer’s Office (“OSE”) reviews and approves those applications under N.D. Cent. Code § 61-16.1-38. OSE forwards all dam and dike applications to the WRDs for review and comment, but the WRDs do not have authority to approve or deny dam or dike applications. The WRDs support the project and the vital flood protection the project will provide; in the event the project requires additional permitting from OSE, the WRDs will submit comments to OSE in support of the project.

2. With regard to any drainage permitting, Section 61-32-03 and Chapter 89-02-01 of the North Dakota Administrative Code would require the WRDs to analyze and determine what, if any, flowage easements the project sponsors would have to obtain as a condition to any approval of any surface drainage permits.
3. The WRDs do not have any concerns and, in fact, the project would provide crucial flood protection to a substantial amount of property within the WRDs’ jurisdictional boundaries
4. The WRDs have access to project design information and other data the WRDs would access in the event the project sponsors submit any permit applications to the WRDs.

Response: City of Fargo

1. The City’s land use regulations are codified within the Land Development Code (LDC), which is Chapter 20 of the Fargo Municipal Code. Permanent flood protection is a use permitted by right in all zoning districts. Earthwork activities adjacent to rivers are reviewed against the City’s Watercourse Setback Ordinance (Section 20-0508 of the LDC), however permanent flood protection projects are exempt from this ordinance.
(https://library.municode.com/nd/fargo/codes/code_of_ordinances?nodeId=CH20LADECO)

Applicable structures associated with the project would be reviewed and permitted in accordance with the International Building Code (2015 IBC).
(https://library.municode.com/nd/fargo/codes/code_of_ordinances?nodeId=CH21INBUCO).

Additionally, development within the Special Flood Hazard Area must comply with City of Fargo Flood Plain Management ordinance, which is Article 21-06 of the Fargo Municipal Code.
(https://library.municode.com/nd/fargo/codes/code_of_ordinances?nodeId=CH21INBUCO_ART21-06FLPLMA)

2. The land use associated with the project is permitted by right, therefore no land use permits would be required.

Building permits for structures would be reviewed for conformance with the applicable requirements of the 2015 IBC.

(https://library.municode.com/nd/fargo/codes/code_of_ordinances?nodeId=CH21INBUCO)

Permits for development within the Special Flood Hazard Area would be reviewed for conformance with the applicable requirements of the City's Flood Plain Management ordinance.

(https://library.municode.com/nd/fargo/codes/code_of_ordinances?nodeId=CH21INBUCO_ART21-06FLPLMA)

3. The City of Fargo has no concerns about the project's compatibility with the comprehensive plan or related ordinances. The project is consistent with the City's Comprehensive plan, land use ordinances and is consistent with existing flood protection infrastructure. Establishing permanent flood protection for the City is the top ranked priority of the City's Go2030 Comprehensive Plan (http://download.cityoffargo.com/0/go2030_comprehensive_plan_-_final.pdf) Additionally, permanent flood protection projects are permitted by right in all zoning districts and are exempt from the City's Watercourse Setback ordinance (See §20-0508.C.7 of the LDC).
4. The land use associated with the project is permitted by right, therefore no land use permits would be required.

Any work requiring permitting in accordance with the 2015 IBC or City's Flood Plain Management ordinance will need to be submitted for review. A permit application would need to be submitted with all plans, specifications, and supporting documentation. Plans will be reviewed and approved prior to any work involved and permits written as required.

(<http://fargond.gov/city-government/departments/inspections/commercial-building-permits-fees/required-plans-documents>)

Response: City of Moorhead

1. The City of Moorhead's regulatory authority is floodplain and stormwater permitting for levees that will be incorporated into the diversion project and which are within Moorhead city limits. This includes any flood mitigation infrastructure, including but not limited to levees, constructed within City limits as required to facilitate a 100-year flood stage of 37 feet.
2. The floodplain permitting process for levees constructed within City limits will be regulated by the City Code (Flood Fringe (FF) and Floodway (FW) standards). As required by the City Code, conditional use permits (CUP) will be used, if required. (http://www.sterlingcodifiers.com/codebook/index.php?book_id=530&chapter_id=31121)
3. The project is compatible with the City's long-term flood mitigation goals outlined within the 2009 City of Moorhead Comprehensive Plan Addendum. (<http://www.ci.moorhead.mn.us/home/showdocument?id=134> (See Strategic Initiative #3 starting on page 94))
4. Permitting will be consistent with Floodplain Ordinance standards and the related

Floodplain Development Permit Application.
<http://www.ci.moorhead.mn.us/departments/engineering/floodplain-information/floodplain-permits>

Response: Pleasant Township

No Reply

Response: Buffalo Red River Watershed District

1. Districts, govern all that we do. We are required by law to have a “Watershed Management Plan”, to provide “a narrative description of existing water and water-related problems with the watershed district, possible solutions to the problems, and the general objectives of the watershed district. The watershed management plan must also conform closely with watershed management plan guidelines as adopted and amended from time to time by the Board of Water and Soil Resources.” Our last plan was adopted on June 23, 2010, and is available for review on our website at www.brrw.org, under “Resources”. We are just starting the process to replace this plan for the new One Watershed, One Plan (1W1P), which is scheduled to be completed by the end of December, 2019. We also adhere to the goals and principles of the Mediation Agreement, adopted on December 9, 1998 – copy again attached. Since May 21, 1979, the Buffalo-Red River Watershed District (BRRWD) has had Rules regarding certain activities that can effect water. See attached. The BRRWD is in the process of adopting new Rules – also see attached, with plans to have the new Rules adopted by September 1, 2018. These Rules require permit applications for particular works, including tie back levees, etc., associated with the F-M Diversion.
2. Probably the biggest thing we look at when evaluating permit requests, are the project’s potential impacts to others. To a point, if we identify that a particular request has the potential to directly impact a neighboring landowner, we send that party a “notification” form, alerting them of the proposed project, and asking for their input in that regard. We also heavily rely on the expertise of our consulting Engineer, Erik S. Jones, Houston Engineering, Inc. (HEI) to research all applications, determine if projects are sound, have the proper design, review of impacts to neighboring properties, etc.
3. Probably our biggest concern is that people/project developers have to understand that water projects in general can and are “controversial” and take considerable time to materialize/develop. All ideas/concepts have to be thoroughly reviewed/vetted with all affected parties, including landowners. Project design/designers have to be flexible to incorporate other’s concerns/ideas. By working together, most of the time, you end up with a “better” project in the end. A project that gets shoved down someone’s throat just “because” in my opinion never works.
4. The BRRWD in my opinion will not be issuing any permits until all of the above referenced concerns/rules/planning goals have been met. To date, we’ve never been told the impacts, etc., of any tie-back levees, etc. All their planning to date, shows a “red box” where the water will be stored, and we know that water won’t stay in that “box” because of elevations. Inlet channels in the storage area, culvert sizes, locations, will all have to be designed/reviewed. Impacts to others from a levee breach situation has to be considered

for all neighboring properties. Seems to me, they still have a lot of work to do before they should expect to get any permits.

Response: Richland County

No Reply

Response: Wilkin County

I believe that all your questions can be answered by reviewing the Wilkin County Zoning/Land Use Ordinances located on the Wilkin county website.

https://www.co.wilkin.mn.us/index.asp?SEC=F63335D0-DC64-4B80-8C15-5983BC6D1718&DE=EFE3B1EF-6832-48D2-8249-B0AE33EFEC13&Type=B_BASIC

3.8.2.2 No Action Alternative (with Emergency Measures)

Land use plans and zoning ordinances would continue to be in place in the Project Area. These plans and regulations would be revised over time to reflect growth trends and future needs of each community, including regulation of floodplain development. Watershed management organizations would continue planning and implementing projects. Plans for emergency measures would be revised, as needed, over time and implemented during periods of flooding in the Project Area.

3.8.3 Proposed Mitigation and Monitoring Measures

Along with any mitigation required by permitting, the Diversion Authority has prepared a Property Rights Acquisition and Mitigation Plan (PRAM, Appendix F). The PRAM includes a section on compensation for damages through an operations and maintenance (O&M) funding program. The program will be funded using sales tax revenues and/or a maintenance district.

3.8.3.1 Funding

The Diversion Authority ensures that all of the mitigation costs outlined in the Mitigation Plan would be eligible for funding through the Operation and Maintenance (O&M) Funding Program. The O&M Funding Program would also provide a mechanism for funding unforeseen mitigation needs that may arise due to Project operation.

Operation and Maintenance, including transportation elements of Plan B, would utilize three main sources of finance. This would include excess sales and use taxes. Any excess revenues of the County Sales Tax, the City Flood Control Tax, the City Infrastructure Tax or any Additional Sales and Use Tax remaining after payment of debt obligations issued for the capital costs of the Project, may be used by operations and maintenance.

Another source of revenue is a maintenance district created in FM Flood Risk Management District No. 1. The CCJWRD can levy special assessments within the district for maintenance costs (the "Maintenance Levy"). North Dakota law bases property assessment for a Maintenance Levy upon the value of the property deemed benefiting from the project. Additional detail are located in Appendix F.

The third source of revenue would be a Storm Water Maintenance Fee levied and collected monthly by the City of Moorhead, Minnesota. The City of Moorhead has agreed to levy, collect, and remit a portion of its storm water maintenance fee for the O&M of the Project.

3.8.3.2 Debris Clean-Up of Public Property

The Diversion Authority recognizes that public lands, such as township and county roads, drainage ditches, cemeteries, parks, etc., may experience damages and debris accumulation associated with the operation of by Plan B. As such, the Diversion Authority developed a post-operation debris clean-up plan (the Plan, part of Appendix F). The Plan is specific to clean-up of debris in the upstream mitigation area. The plan would allow LGUs to contract for the repair and clean-up work on the public lands, and submit for reimbursement to the Diversion Authority. As noted in Appendix F:

- The Plan will pattern the approach that the Federal Emergency Management Agency (FEMA) uses for post-disaster damage assessment and reimbursements.
- The Diversion Authority will declare the Project operated.
- The Diversion Authority will define the boundary of the upstream mitigation area based on the actual flood event.
- The Diversion Authority will notify public entities of eligible areas and request that the public entity identify any damage that may have been caused by the Project operation, including debris removal.
- The Diversion Authority will send a representative to meet with the public entities to verify damage on a site by site basis.
- The public entities shall solicit quotes (in conformance with procurement, legal, and regulatory requirements) for the repairs or clean-up work at each site, and submit the quotes for each site to the Diversion Authority for review.
- The Diversion Authority shall review the quotes for reasonableness, and either approve, request additional details, or deny the quote.
- The Diversion Authority will confirm the work was completed in accordance with the quote, and then reimburse the public entity.
- The Diversion Authority will also consider reimbursement of emergency repairs that may be needed in advance of following this process.

3.8.3.3 Potential Permits Needed

Construction and operation of Plan B would affect multiple LGUs. Project construction may require permits and LGU approval including conditional use permits (CUPs). Additionally, the impact of the Project on the existing floodplain may require LGU review of current floodplain ordinances and maps. Zoning amendments may be considered by the LGUs prior to Project operation and impacts may be monitored and quantified.

Based on the information received during the scoping comment period and contained in the 2016 Final EIS, it appears that Plan B may have direct conflict with Pleasant Township's floodplain ordinance, which is more restrictive than the state standard. If Plan B conflicts with the Township's

ordinance, a permit or variance would be required. Compared to the previously-proposed Project, Plan B might be in greater compliance with Wilkin County’s surface water impoundment policy, which limits impoundments to 640 acres (Plan B would potentially add 409 acres of new inundation in Wilkin County). The Buffalo-Red River Watershed District also appears to require approval before construction.

Table 3-7 provides a summary of permits and possible approvals that may be needed for Project construction and operation. These permits and approvals have the potential to include mitigation by requiring avoidance or minimization. Prior to Project implementation, the non-Federal sponsors are required to comply with all applicable federal and state laws and regulations (USACE 2011b). The USACE has indicated regulations would be followed as required by federal law, and that they would continue to work with state and LGUs during Project implementation.

Table 3-7 Local Government Permitting and Approvals That May Be Needed for Project Construction or Operation

	Project Construction Footprint – North Dakota	
Permitting Authority	Potential Permits	Notes
North Dakota		
Cass County, North Dakota	Zoning amendment (potential)	A zoning amendment may be required due to possible changes to existing floodplain.
Harwood Township, North Dakota	Building permit	-
	Floodplain permit	-
Mapleton Township, North Dakota	Conditional Use permit and Site Approval	Conditional Use Permit (CUP) may be needed due to severed roads during Project construction.
Pleasant Township, North Dakota	Conditional Use permit and Site Approval	CUP may be needed due to severed roads during Project construction.
Warren Township, North Dakota	Site Approval for General Ground Excavation with Conditional Use Permit	CUP may be needed due to severed roads during Project construction.
City of Argusville, North Dakota	Conditional Use permit and Site Approval	-
City of Horace, North Dakota	Conditional Use permit and Site Approval	CUP may be needed due to severed roads during Project construction.
City of Fargo, North Dakota	Floodplain Permit	-
	Stormwater Permit	-
City of West Fargo, North Dakota	Conditional Use permit	CUP may be needed due to severed roads during Project construction.
Cass County Joint Water Resource District, North Dakota	Subsurface Drain/Application to Drain	-
	Application to Drain	-
Project Construction Footprint – Minnesota		

Project Construction Footprint – North Dakota		
Permitting Authority	Potential Permits	Notes
Clay County, Minnesota	Floodplain permit	-
City of Moorhead, Minnesota	Floodplain Permit	-
	Stormwater Permit	-
Buffalo-Red River Watershed District, Minnesota	Construction/Floodplain Approval	Permit may be needed per Rules Section 8
Two Rivers Water Resource District, Minnesota	Two Rivers Water Resource District Application	Drayton Dam mitigation project
Project Staging Area and FEMA Revision Reach		
Permitting Authority	Permit Needed	Conditions, if applicable & Comments
North Dakota		
Permits may be required depending on impacts observed during Project operation and depending on the applicability. At this time, some local governments are unsure whether or not certain permits would be required as the actual impact of Project operation is uncertain.		
Minnesota		
Buffalo-Red River Watershed District	Construction/Floodplain Approval	-
Permits may be required depending on impacts observed during Project operation and depending on the applicability. At this time, some local governments are unsure whether or not certain permits would be required as the actual impact of Project operation is uncertain.		

Source: Wenck, 2014/2015

3.9 MINNESOTA DAM SAFETY AND PUBLIC WATERS REGULATIONS AND PERMITTING

This section summarizes the regulatory framework for dam safety and the dam safety permit and work in public waters under Minnesota Statutes and Rules and the regulatory implications to Plan B, as applicable. The DNR received a permit application for Plan B on March 16, 2018. Minnesota Rules, part 4410.3100, subpart 2a, does allow for concurrent review of draft permits prior to completion of environmental review.

Although the 2018 permit application review and environmental review for Plan B are occurring concurrently, they are separate programs and processes. In general, environmental review gathers and analyzes environmental and socioeconomic information on a proposed project and summarizes potential impacts and proposed mitigations in an EIS. The information in the EIS should be complete and relevant enough to inform permit decisions; both by DNR and any other permitting authorities. Decisions to approve or deny a permit application are not made in an EIS. A decision to approve a project (i.e., grant a permit) cannot occur until after the EIS is deemed adequate (by way of publishing an Adequacy Decision document).

3.9.1 DNR Dam Safety and Work in Public Waters Permitting Process and Permit Decision Criteria

The proposed Class I dam on the Red River is proposed upstream of the F-M urban area and would require a Minnesota Dam Safety and Work in Public Waters permit. The Eastern Tieback alignment would run near the border of Cass and Wilkin County, Minnesota, crossing Wolverton Creek, and tying into high ground at the maximum pool elevation (923.5 feet). The Wolverton Creek crossing is proposed to include three ten-foot by 10-foot box culverts and would also require a Minnesota Work in Public Waters permit.

For Plan B, the work in public waters permit, including permit requirements and provisions; would likely be captured under a permit combined with the dam safety permit requirements and provisions; herein referred to as the DNR combined permit or the 2018 permit application, when applicable. Denial or issuance of the DNR combined permit would extend to both. Minnesota Rules, part 6115.0240 identifies application requirements for work in public waters.

3.9.1.1 Dam Safety

The specific rules governing the Minnesota Dam Safety Program (the Program) are defined in Minnesota Rules, parts 6115.0300 through 6115.0520. Minnesota Rules, part 6115.0410 details the documents necessary for the dam safety permit application process. The permitting process requires the submittal of a permit application including a preliminary report. Following acceptance and agreement by the DNR of the preliminary report, a final design report along with plans and specifications must be submitted for approval (see Minnesota Rules, part 6115.0410 for more details on required submittal documents). The DNR has posted on its website many of the documents submitted with the permit application (see https://www.dnr.state.mn.us/input/environmentalreview/fm_flood_risk/index.html).

State rules require that a professional engineer registered in the state of Minnesota (or engineers who are employees of the U.S. per Minnesota Statute 3.26.13) who is proficient in dam engineering, prepare the engineering documents, plans, and specifications; inspect the construction; and establish operation and maintenance procedures for the structure(s). Application materials provided by the Diversion Authority would be required to meet this requirement.

3.9.1.2 Public Waters

The specific rules governing work in Minnesota public waters are defined in Minnesota Rules, parts 6115.0150 through 6115.0280. Minnesota Rules, part 6115.0240 details the information required for the public waters permit application. The permitting process requires the submittal of a permit application.

In evaluating work in public waters permit applications, it is the permit reviewer's job to ensure that all appropriate rules and statutes are considered. The application and proposed project must be consistent with Minnesota Statute 103G, 103F, and Rules 6115. Minnesota Rule 6115.0410, and Statute 103G specifically outlines information requirements for each application.

Specifically, Minnesota Rules 6115.0220, subpart. 5, requires that proposed projects must be consistent with applicable floodplain management standards and ordinances. Minnesota Statute, section 103F.105 states that the policy of this state is to reduce flood damages through floodplain management, stressing nonstructural measures such as floodplain zoning and

floodproofing, flood warning practices, and other indemnification programs that reduce public liability and expense for flood damages.

Further, a landowner is entitled to have the water or lack of water preserved in its natural state and at its accustomed level, or absence. If a project would change the water level on the land during project operation, the owner of the project is required to acquire property interests for all properties up to the water surface elevation at the maximum capacity of the dam. Minnesota Rules 6115.0240, subpart 2a, states, "a governmental agency, public utility, or corporation authorized by law to conduct the project may apply if the property rights acquired or to be acquired are fully described in the application."

Minnesota Rules 6115.0250, Subpart 1a, states that the commissioner may not issue a permit that causes pollution, impairment, or destruction of the air, water, land, or other natural resources so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the public health, safety, and welfare. If the commissioner determines that a major change in public waters is justified and can be authorized under public water rules 4, the permit must include provisions to compensate for the detrimental aspects of the change.

Minnesota Rules 6115.0250, subpart 2, requires coordination with other agencies. It states, "Nothing in these standards is intended to supersede or rescind the laws, rules, regulations, standards, and criteria of other federal, state, regional, or local governmental subdivisions with the authority to regulate work in the beds or on the shorelands of public waters. The issuance of a permit shall not confer upon an applicant the approval of any other unit of government for the proposed project. The department shall coordinate the review with other units of government having jurisdiction in such matters."

3.9.1.3 Permit Approval or Denial

The approval or denial of a permit is based on the potential hazards to health, safety, and welfare of the public and the environment including probable future development of the area downstream or upstream of the dam. For a Class I dam, the DNR must determine the proposal is adequate and shows a "lack of other suitable feasible and practical alternative sites, and economic hardship which would have major adverse effect on population and socioeconomic base of the area affected" (Minnesota Rules, part 6115.0410 subpart 8).

A public-waters-work permit may be issued only "if the project will involve a minimum encroachment, change, or damage to the environment, particularly the ecology of the waterway." And "If a major change in the resource is justified, public-waters-work permits must include provisions to compensate for the detrimental aspects of the change." (MN Statute 103G.245)

The proposal must adequately identify the need in terms of quantifiable benefits; the structural integrity of the dam and associated features under all conditions of construction and operation; discharge and storage capacity of handling the design flood; and compliance with prudent, current environmental practice throughout its existence. Minnesota Rules lists some of the general criteria that must be met for a work in public waters permit to be granted; however it should be noted that other rules, statutes, or requirements may apply.

Other considerations for permit approval or denial include Minnesota Statutes 116D.04 subdivision 6 and Minnesota Statutes 103G.245 and 103G.315. Minnesota Statutes 116D.04 subdivision 6 reads that a permit cannot be granted where the "...action or permit has caused or is likely to cause pollution, impairment, or destruction of the air, water, land or other natural resources located within the state, so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the public health, safety, and welfare and the state's paramount concern for the protection of its air, water, land and other natural resources from pollution, impairment, or destruction. Economic considerations alone shall not justify such conduct."

Minnesota Statute 103G.315 states "if the commissioner concludes that the plans of the applicant are reasonable, practical, and will adequately protect public safety and promote the public welfare, the commissioner shall grant the permit".

If a project is permitted, dam safety and work in public water work permits may have provisions, or conditions of the permit, required by the applicant to follow and monitor. Example conditions of the permit may include construction and operational restrictions, inspection schedules, construction and operational reports, operation and maintenance plans, as well as required mitigation including adaptive management.

3.9.2 Affected Environment

Minnesota public water and dam safety permits pertain to waterbodies in Minnesota including the Red River and Wolverton Creek. The dam safety permit also permits the earthen embankment associated with the dam.

3.9.3 Environmental Consequences

Plan B must be designed to provide the appropriate measures and factors of safety to meet the requirements of the DNR dam safety and public water rules. Failure of the embankments, control structures or its components due to inadequate design, improper operation, inadequate maintenance, or unusually larger flood events that exceed the design capacity could allow flood water into the protected area, north of the dam. The effects of failure could be catastrophic, causing loss of life and significant property damages, depending on the magnitude and timing of the flood increases. The public works permit ensures reasonable use of public waters with minimization and mitigation of both direct and indirect impacts to water recreation, navigation, and wildlife. The DNR combined permit application review and decision process helps provide assurances and safeguards from these types of impacts from occurring.

Dam Breach Analysis

Summary

The USACE completed a first-level dam breach analysis for the Diversion Authority's 2018 permit application. The dam breach analysis provides an idea of what risk could occur as a result of structure (e.g., levee, dam) failure under both the No Action Alternative (with Emergency Measures) and Plan B conditions. The analysis models hypothetical breaches of the Dam/Southern Embankment during flooding conditions to find out how high and far the water would rise downstream of the dam. The analysis contains maps that show the affected area and current and future projected populations that may be impacted by a dam breach which would be used in the development of an emergency action plan and for consideration in future land use development planning. A second-level, formal dam breach

analysis would be conducted by the USACE at a later time as part of the Emergency Action Plan development. The hydraulic models and breach parameters employed for the formal USCAE dam breach analysis will be the same or very similar to those reported in this first-level analysis.

Analysis Criteria

The State of Minnesota criteria for evaluating the danger to loss of life from a potential dam breach of this project are the depth of flow (D) and velocity of flow (V) from a dam breach. A rule of thumb sometimes used is that lives are at risk if the depth of flow times the velocity of flow is greater than 7 ft²/second. Deep, slow moving water (3.5 feet of water moving at 2 feet per second) would have a similar risk as shallower, faster moving water (2 feet of water moving at 3.5 feet per second). In general, a D*V value less than 7 ft²/sec is considered “wet, but safe”, meaning that structures and land would get wet and people would likely survive being subjected to the flood to safety. Areas with a D*V greater than 7 ft²/sec are at an elevated risk, meaning that people would have a very difficult time evacuating or walking. Other factors used to assess the danger from a dam breach include the depth of water, available time to evacuate, and the area inundated.

Analysis Setup and Boundaries

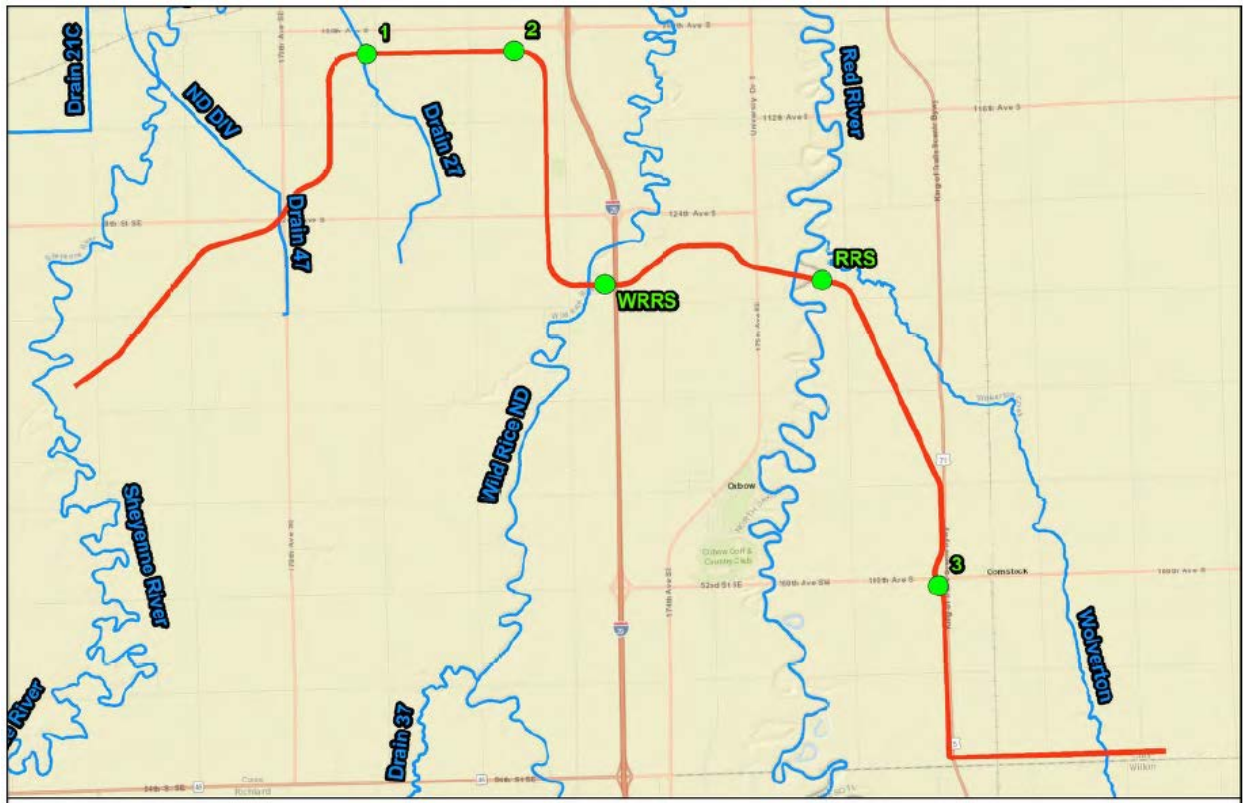
Both existing and proposed conditions were evaluated as part of the dam breach analysis. All levees and emergency measure installations surrounding the F-M urban area were assumed to be constructed. The extent of the model encompassed the population centers of Fargo, West Fargo, Horace, Oxbow, North Dakota; and Moorhead, Comstock and Oakport, Minnesota. Two events were assessed in the analysis: the 100-year flood event, and the 90,000 cubic-feet-per-second (cfs) peak inflow event, which is slightly smaller than the half-probable-maximum-flood (1/2 PMF) event, or roughly the 1,000-year flood.

Breach Locations

Five locations along the dam embankment were identified as locations where breaches should be evaluated (see Illustration 3-9, below). DNR Dam Safety and Floodplain experts approved these locations before the analysis was conducted.

- Location 1 is located at a low spot along Cass County Drain 27.
- Location 2 is considered a representative location for a majority of the dam, as it is located along relatively flat ground.
- Location 3 is located along the eastern edge of the Plan B embankment and was selected due to its proximity to Comstock, MN.
- Location 4 and 5: Additional breaches were simulated at the existing channel locations next to the Wild Rice River Structure (WRRS) and the Red River Structure (RRS).
- To assess whether a breach of the Fargo levee resulted in significantly different depths and velocities within the levee-protected area of Fargo, additional scenarios were evaluated in which the Fargo levee was breached. The Fargo levee breach location was selected based on the hydraulic loading of the levee as well as the high density of residential structures located immediately downstream of the levee breach location.

Illustration 3-9 Locations Evaluated in the Dam Breach Analysis. (Source: Appendix H)



Analysis Results

The sections below describe high level results of the dam breach analysis as they apply to the No Action Alternative (with Emergency Measures) and Plan B. The full dam breach analysis is included as Appendix H.

3.9.3.1 Plan B

In general, Plan B design, construction, and operation would be related to those proposed for the previous Project, including the construction of an embankment system and control structures.

Related to Minnesota permitting, critical Plan B components, locations and operation differences from the previously-proposed Project include the following:

- Dam/Southern Embankment alignment: Plan B contains a longer dam between the Diversion Inlet Control Structure (DIS) and the Red River Control Structure (RRS). In general, a longer dam implies greater potential risk. The shift in alignment also moves the dam closer to Fargo.
- Embankment in Minnesota: The Dam/Southern Embankment in Minnesota was realigned to follow a southeasterly direction from the RRS. With a realigned embankment, the City of Comstock, Minnesota, would be on the dry side of the dam and would not require a community ring levee.
- Wolverton Creek Crossing: The Eastern Tieback requires crossing Wolverton Creek using three 10-foot by 10-foot box culverts.
- Flows through Town: More flow through town means the project would store water less frequently and at a lower elevation. A maximum stage of 37.0 feet would be maintained

at the Fargo gage until the upstream staging elevation would reach 921.0 feet, which is anticipated to occur with the 100-year flood.

Since the 2016 permit application, additional and updated studies have been received by DNR to satisfy the necessary requirements for the DNR combined permit, including a dam breach analysis (Appendix H). The draft Operating Plan is part of the Hydrology and Hydraulics attachment of the permit application (Appendix C). Some additional and updated studies would still be required. This includes development of a complete Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Plan Manual that would be completed once project designs are finalized.

The components evaluated to-date by the Diversion Authority and or the USACE includes the river control structures and some of the embankment system. The Plan B permit application received on March 16, 2018 included the following information:

- Project component maps, plans, and illustrations;
- Maps of project area features (e.g., historical properties, transportation, utilities, and survey locations)
- Subsurface conditions report, including geology and geotechnical information
- Hydrology and hydraulic modeling;
- Construction schedule
- Property acquisition plan
- Mitigation plan
- Preliminary Cost Estimate
- Operation Plan
- Plans and specifications for the diversion inlet control structure
- Draft plans and specifications for the Wild Rice River control structure

3.9.3.1.1 Work in Public Waters Permit

Under the 100-year flood, Plan B removes approximately 43,997 acres of natural floodplain (i.e., the Benefited Area); about 34,860 acres of which (or 80%) from North Dakota and about 9,137 acres of which (or 20%) from Minnesota.

Along with evaluating potential environmental consequences due to the RRS and Wolverton Creek crossing, Minnesota Rules and Statutes require that the DNR consider how a proposed project may or may not be consistent with applicable federal, state and local water and land management plans and programs. To assist with this consideration, it is standard practice for the DNR to send Public Water Work permit applications to potentially-affected state and local governmental units for a 30-day review. This is typically conducted through an automated, web-based distribution using the Minnesota Permitting and Review System (MPARS) application. North Dakota entities typically would not have access to this Minnesota-based online application; therefore, potentially-affected RGUs in North Dakota received a special review request from the DNR to access the MPARS application. A formal, 30-day permit application review was sent on June 5, 2018 and ended on July 6, 2018.

The DNR requested review from the following RGUs:

Minnesota

- Buffalo-Red River Watershed District
- Board of Water and Soil Resources – Detroit Lakes
- City of Comstock
- City of Moorhead
- City of Dilworth
- City of Wolverton
- Clay County
- Clay County Soil and Water Conservation District
- Clay County Army Corps of Engineers
- Kurtz Township
- MN Department of Natural Resources Fisheries – Detroit Lakes
- MN Department of Natural Resources Wildlife – Fergus Falls
- MN Department of Natural Resources Ecology – Northwest Region
- MN Department of Natural Resources Nongame – Northwest Region
- MN Department of Transportation - Detroit Lakes
- MN Pollution Control Agency – Northwest Region
- Moorhead Township
- Wilkin County
- Wilkin County Soil and Water Conservation District

North Dakota

- Cass County
- Cass County Joint Water Resources
- Cass County Soil and Water Conservation District
- City of Argusville
- City of Fargo
- City of Horace
- City of Oxbow
- City of West Fargo
- Harwood Township
- Mapleton Township
- North Dakota Department of Health – Watershed Management
- North Dakota Department of Transportation - Fargo
- North Dakota Game and Fish Department
- Pleasant Township
- Richland County Water Resource District
- Richland County Soil & Water Conservation District
- Warren Township

The DNR received six responses on the request for comment of the 2018 permit application. Brief summaries of those responses (related to permitability) are below:

Buffalo-Red River Watershed District (BRRWD)

- Concerned that details about project design have not been completely formulated; making determining project impacts difficult.

- Concerned about the Eastern Tieback levee crossing Wolverton Creek and the impacts on the Wolverton Creek Restoration and Sediment Reduction Project.
- States that the Diversion Authority has not obtained required easements from affected landowners to warrant receiving a permit at this time.
- Concerned about a dam breach.

Minnesota Department of Natural Resources Fisheries – Detroit Lakes

- Project continues to be a barrier to fish passage on Red River.
- Conflicts with several state and provincial management plans.
- Mitigation should include Drayton Dam, and should occur before or concurrent with construction of project.
- A final operation plan should be required prior to construction.
- Needs more detail for monitoring and adaptive management.

Minnesota Department of Natural Resources Ecology – Northwest Region

- Wolverton Creek should be avoided. Box culverts currently undersized and misaligned, needs a low-flow culvert, needs better figures and tables, must comply with Minnesota Department of Transportation (MNDOT) bridge and culvert general permit standards.
- Red River structure - consider a low-flow culvert, needs better figures and tables and velocity data for non-operation events.
- Needs justification for the “dry construction” technique on the Red River structure.
- Concerned about attracting additional development within the currently undeveloped lands in the benefitted area and the life, health, and safety issues for an additional population should the levee and structures fail.
- Mitigation needs further information on the following topics:
 - Non-forested wetland mitigation – Using the diversion channel as mitigation for impacts to the Rush/Lower Rush may limit access by wildlife.
 - Forested Mitigation – Rather than seeding tree species that already spread on their own, we recommend planting bare root tree seedlings to supplement wind-blown species and that are consistent with MN Native Plant Communities.
 - Aquatic Mitigation –Wolverton Creek Crossing and effects/indirect effects on culverts, newly constructed channels are counted as mitigation and need to be evaluated, geomorphology impacts need to be mitigated (not monitored), aquatic organism stranding in staging area is a concern.

Minnesota Department of Natural Resources Nongame– Northwest Region

- More details needed on structures and structure openings, associated rip-rap, baffles, and wing walls to determine potential hazards and blockage of migration to species such as turtles and amphibians along riparian corridors. Low flow channels would help alleviate these concerns.
- Flashy flows along the diversion channel will limit the use of the channel by wildlife, and also promote invasive species. With high flow events the

vegetation will scour and be killed/removed and what will return will likely be cattail and reed canary, which would not be much of a benefit for wildlife.

- If the channel was created in such a way that braided features developed through time where there were deeper and shallower areas that hold water, it is possible that good quality habitat will be created. Additionally, if water were allowed through this area on a somewhat regular basis, then perhaps some riparian/oxbow habitats would be formed. Several complimentary things may be done to facilitate the use of constructed channels by wildlife species.

Richland County Water Resource District

- Believes the project runs counter to state, national and local flood control policies.
- Not enough detail has been provided regarding upstream community impacts.
- The Permit Applicant has failed to establish that there is a “lack of other suitable feasible site[s]” as required by Minn. R. 6115.0410, subpart 8A. (2015).
- The proposed Project does not preserve or rely on natural floodplain storage and is inconsistent with the underlying intent of E.O. 11988 and E.O. 13690.
- It is the policy of the State to reduce flood damage first through floodplain management and nonstructural measures such as floodplain zoning, flood proofing, and flood warnings.
- Violation of Regional Regulatory requirements: Section 5 of the BRRWD Rules provides: “Surface water shall not be artificially removed from the upper land to and across lower land without adequate provision being made on the lower land for its passage, nor shall the natural flow of surface water be obstructed so as to cause an overflow onto the property of others.”
- Inconsistency with Federal, State and Local requirements.

Wilkin County (Wilkin County and the Richland/Wilkin Joint Powers Authority (JPA))

- Plan B, like the previous submission is not the least impact solution.
- Plan B removes too much natural floodplain.
- No effort has been made by Diversion Authority to initiate permit reviews in the local and regional permitting authorities.
- The Permit Applicant has failed to establish that there is a “lack of other suitable feasible site[s]” as required by Minn. R. 6115.0410, subpart 8A. (2015).
- The proposed Project does not preserve or rely on natural floodplain storage and is inconsistent with the underlying intent of E.O. 11988 and E.O. 13690.
- It is the policy of the State to reduce flood damage first through floodplain management and nonstructural measures such as floodplain zoning, flood proofing, and flood warnings.
- Violation of Regional Regulatory requirements: Section 5 of the BRRWD Rules provides: “Surface water shall not be artificially removed from the upper land to and across lower land without adequate provision being made on the lower land for its passage, nor shall the natural flow of surface water be obstructed so as to cause an overflow onto the property of others.”
- JPA is also concerned that inadequate information has been supplied regarding the Diversion Authority’s plans respecting the Wolverton Creek area.

3.9.3.1.2 Dam Safety Permit Review and Environmental Review – Public Input

The most fundamental dam safety permit requirements focus on public safety. That is because the purpose of the Dam Safety Program is to safeguard against risk of failure and to ensure that dams are safe. It should be clarified that “risk” is the probability of failure times the consequences of failure.

Unlike environmental review, the dam safety permit application process does not typically include a public review component nor does it necessarily involve or include access to all decision makers. A public hearing on a permit application could occur, though the hearing is typically waived per Minnesota Statute, section 103G3.11, subdivision 4. For projects that require an environmental review, such as this one, the environmental review process offers an opportunity for the public and other interested parties to participate through public review and comment periods.

3.9.3.1.3 Dam Breach Analysis—Plan B

The dam breach analysis methodology, criteria and inputs are summarized above in Draft SEIS Section 3.9.3. This subsection provides a high-level summary of the dam breach analysis results for Plan B. The full dam breach analysis, including maps, is included as Appendix H.

- The 90,000 cfs Event (with breach) would completely flood the area between Plan B Southern Embankment and the Fargo Levee. This event would overtop the Fargo Levee, leaving conditions in the Project Area in the same flood scenario as would be experienced with the No Action Alternative (with Emergency Measures).
- The 90,000 cfs Event (without breach) would benefit the F-M urban area.
- A breach at Location 1 during the 90,000 cfs Event would flood a portion of eastern Horace in a range of 0-2 feet.
- Because Location 2 is a typical section of the dam, the results of a failure of the dam at this location represent what might occur at most areas along the embankment. A breach at Location 2 showed a $D*V$ zone greater than 7 ft²/sec for about ¼ mile downstream of the embankment.
- The depth of water behind the dam at Location 3 during the 90,000 cfs Event (with breach) would range from 2-6 feet. A breach at this location is not likely to impact Comstock, which is approximately ½-mile east of the dam (Table 3-8, below).
- During a 90,000 cfs event, a breach at Location 3 would not cause the Fargo levees to be overtopped. All other breach locations would result in overtopping of the Fargo Levees during the 90,000 cfs flood event.
- The dam breach with the greatest flooding extent during the 90,000 cfs Event would be at the RRS. Under this scenario, flooding in the F-M urban area would be approximately the same as the No Action Alternative (with Emergency Measures).
- During a 100-year dam breach (i.e., 34,700 cfs) at the RRS, the Fargo Levee would overtop, and the majority of the F-M urban area would see flood depths of 0-6 feet and $D*V$ of less than 7ft²/sec. Under this scenario, flooding in the F-M urban area would be worse than the No Action Alternative (with Emergency Measures). In other words, during a 100-year event, Fargo would end up in a worse situation if Plan B were built and breached than if the Fargo levees were to breach. However, the Fargo levees are more likely to breach than is Plan B, as designed.

- The dam/Southern Embankment, Eastern Tieback, and Western Tieback would be constructed of a clay, which has a very slow erosion rate. As such, a dam breach would likely occur very slowly over time (i.e., getting bigger and bigger over time), allowing an evacuation notice in the range of 10-100 hours, based on breach location (see Table 3-9, below).

Table 3-8 Summary of D*V Values for Populated Areas near Dam Alignment during 90,000 cfs Event

Populated Area	Are D*V values greater than 7 ft ² /s at any property within the populated area for any of the breaches simulated?
Comstock, MN	No
Rustad, MN	No
St. Benedict, ND	While none of the breach scenarios resulted in D*V values greater than 7 ft ² /s in St. Benedict, it is assumed that because most of the properties within St. Benedict are located within 0.25 miles of the embankment, D*V values would be greater than 7 ft ² /s at these properties.
Wild Rice, ND	No
Horace, ND	No

Table 3-9 Time Difference Between Dam Breach and Fargo Levee Overtopping for 90,000 cfs Event Under Proposed Conditions Dam

Breach Location	Time Difference Between Dam Breach and Fargo Levee Overtopping (hours)
Breach Location 1	71 hours
Breach Location 2	100 hours
Breach Location 3	Levee not Overtopped
Breach Location at WRRS	39 hours
Breach Location at RRS	10 hours

3.9.3.1.4 Water Control Manual; Draft Operation Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Plan; and Operation Plan

An Operation Plan is being prepared by the USACE in order to provide a summary of water control management activities associated with the Project. The Operation Plan was not complete at the time of this Draft SEIS publication. The Operation Plan will relate to the hydraulic and hydrologic aspects of Plan B, and will identify actions that will be included in the Water Control Manual for the project prior to completion of the project. The water control management activities may be revised as detailed design proceeds, or through the Adaptive Management Monitoring Plan (AMMP) that would be included for Plan B.

A summary of project operations was included within the Hydrology and Hydraulics Report (Appendix C) attachment of the 2018 permit application as well as summarized in SEIS section 2.1.1.14.

The Water Control Manual is required by USACE regulation ER 1110-2-240, "Water Control Management." As stated in the regulation:

"Water control plans include coordinated regulation schedules for project/system regulation and such additional provisions as may be

required to collect, analyze and disseminate basic data, prepare detailed operating instructions, assure project safety and carry out regulation of projects in an appropriate manner.”

The Water Control Manual is developed in accordance with DIVR 1110-2-240 “Preparation of Water Control Plans & Manuals” and ER 1110-2-8156 “Preparation of Water Control Manuals”.

Operation and maintenance activities not directly related to the water control management activities will be included in an Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Manual, which would be considered complete at the end of construction of the entire project. The OMRR&R Manual is required by Corps regulation ER 1110-2-401, “Operation, Maintenance, Repair, Replacement and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors.” A typical manual includes the following sections and appendices:

- Section 1. General
- Section 2. Authorization
- Section 3. Location
- Section 4. Pertinent Information
- Section 5. Construction History
- Section 6. Project Performance
- Section 7. Project Cooperation Agreement
- Section 8. Operation
- Section 9. Emergency Operations
- Section 10. Maintenance and Inspection
- Section 11. Surveillance
- Section 12. Repair, Replacement, and Rehabilitation
- Section 13. Notification of Distress
- Appendix A. As-Built Information
- Appendix B. Project Cooperation Agreement

The USACE provides that a large, complex project such as proposed would also typically have interim manuals developed for each large feature of the overall project (such as for the DIS) as the feature is constructed and turned over to the non-federal sponsors for operation and maintenance purposes. These manuals would be prepared during construction of the feature, with the final interim manual completed after completion of construction. This is necessary since the manuals include as-built information such as construction history, as-built drawings and shop drawings.

3.9.3.2 No Action Alternative (with Emergency Measures)

Under the No Action Alternative (with Emergency Measures), the F-M urban area would rely on levees for flood protection. Flooding would continue in other parts of the Project Area. A Class I dam on the Red River and Wild Rice River would not be constructed. Potential flood risk reduction from Plan B would not be realized.

Sandbagging, temporary levees and floodwall closures would continue along the Red River through the F-M urban area. Sandbagging and temporary levees, although providing some level of protection

from flood waters, may increase the risk to human health and safety due to the increased likelihood of failure of emergency measures.

3.9.3.2.1 Levee Breach Analysis—No Action Alternative (with Emergency Measures)

The dam breach analysis methodology, criteria and inputs are summarized above in Draft SEIS Section 3.7.3. This subsection provides a high-level summary of the dam breach analysis results for the No Action Alternative (with Emergency Measures). The full dam breach analysis, including maps, is included as Appendix H.

- Under a 90,000 cfs Event, the Fargo Levees would overtop and the majority of Fargo would flood.
- Under a 100-year flood (34,700 cfs), the Fargo Levees would not overtop and the majority of the F-M urban area would be protected.
- Under a 90,000 cfs event (with levee breach) there would be dangerous depths and velocities approximately 200 feet downstream.
- Under a 100-year flood (34,700 cfs) with levee breach, the majority of downstream flooding would be 0-2 feet and located in Fargo.

3.9.4 Proposed Mitigation and Monitoring Measures

There are no specific dam-safety- or public-waters-related mitigation or monitoring measures proposed. Proposed mitigation and monitoring proposals and recommendations are detailed under each topic area within Chapters 3, 5, and 6; and Appendix F this Draft SEIS. The DNR combined permit may require – through permit conditions - additional mitigation above and beyond that which is proposed or may require plans already in place to address impacts that may occur.

As stated above, a permit application was received by the DNR on March 16, 2018. Information presented within this DSEIS and associated environmental review documents was included with that submittal and will continue to be used as a guide as part of the decision process, along with any other addition documents or details necessary by DNR permitting staff. The 2018 permit application is currently undergoing a review, which includes a thorough review by DNR staff and other technical agencies, local government, or organization staff as deemed necessary. Additional discussions would occur between the USACE, Diversion Authority, their representatives, and DNR permitting staff to assess the dam safety and work in public waters permit requirements specific to this project. As discussed above, a permit cannot be granted until the Final SEIS is deemed adequate (Minnesota Rules, part 4410.3100, subpart 1).

3.10 SOCIOECONOMICS

This section includes an evaluation of impacts to structures, lands, cemeteries and organic farms. It also includes a discussion of proportional impacts between the two states impacted by the Project, the benefited/unbenefited area, and the concept of flood risk transfer. Information here focuses on the areas that would be affected most by Plan B, which are the rural areas located south of the Dam/Southern Embankment within and adjacent to the staging area.

This section does not include a reevaluation of the cost-benefit analysis that was conducted in the 2016 Final EIS. The USACE has also indicated that an updated cost-benefit analysis is not required at this time for Plan B.

This section also does not include a reevaluation of the regional economic impact nor demographic analysis. The changes proposed with Plan B should not result in significantly different regional socioeconomic or demographic benefits or impacts. The regional economic and demographic analyses that were completed for the previously-proposed Project in the 2016 Final EIS still apply to Plan B and the No Action Alternative (with Emergency Measures). The model that was used for the socioeconomic analysis was not set up to produce benefits/impacts by an individual community. In addition, inputs were only available at the county level, and no community-specific input information is available. It is standard practice to conduct regional impact analyses at this level and not specific to individual communities.

3.10.1 Affected Environment

Plan B does not significantly change the major socioeconomic trends (demographics, employment and income, housing, and fiscal resources) for the four counties that comprise the project area: Cass and Richland County, North Dakota; and Clay and Wilkin County, Minnesota. The evaluation in the 2016 Final EIS section 3.15.1 would still apply to Plan B.

Changes to the Dam/Southern Embankment and the Eastern and Western Tieback would change the number and extent of impacted structures, parcels and cemeteries near those features, as well as the geographic extent of impacts between Minnesota and North Dakota and the upstream mitigation area. Plan B also allows more flows through town, which would slightly change the extent of impacts in the Benefited Area. Details on these potential impacts are described below in the Environmental Consequences section.

3.10.2 Environmental Consequences

This subsection evaluates the impacts and benefits of Plan B that are different from what was proposed in the 2016 Final EIS.

For structure and parcel counts provided below in sections 3.10.2.1.1 and 3.10.2.2.1, the DNR completed an ArcGIS analysis in order to obtain individual structure and/or structure parcel data specifically for the upstream inundation area (i.e., Unbenefited Area) as this is the area that would experience the majority of the negative effects resulting from Plan B. The structure analysis was completed to provide a more detailed assessment of structures within the Unbenefited Area that currently experience flood impact under Plan B and the No Action Alternative (with Emergency Measures).

Structure data was obtained from the USACE and included point location and structure type (residential or non-residential) that was completed through a GIS desktop exercise in 2017. Residential structures were defined as structures that were used as living spaces (e.g., apartment complexes, townhomes, and single family homes). Non-residential structures are all other structure types including garages, barns, sheds, pole-sheds, and commercial structures. The inundation area was modeled for Plan B and the No Action Alternative (with Emergency Measures) at four different flooding events—20-, 50-, 100-, and 500-year floods. Structures were “counted” where a flood impact was observed. Impact was defined for this analysis as a flood level greater than zero measured at the structure location. County parcel data obtained from the respective counties (Clay and Wilkin Counties, Minnesota; and Cass and Richland

Counties, North Dakota) were then layered with the USACE structure inventory data and inundation areas modeled for scenario and flood events.

3.10.2.1 Plan B

3.10.2.1.1 Impacts to Structures and Parcels

Compared to the previously-proposed Project, Plan B would reduce the frequency of induced flooding in the upstream mitigation areas with the changes made to allow 37-feet of floodwaters to pass through the Red River between Fargo and Moorhead before the Project would be allowed to operate. This change reduces the frequency of Project operation from the 10-year return frequency to the 20-year return frequency, or once in 10 years to once in 20-years, on average.

The DNR completed an ArcGIS analysis in order to obtain individual structure and/or structure parcel data specifically for the upstream inundation area (i.e., Unbenefited Area). Impact was defined for this analysis as a flood level greater than zero measured at the structure location. The results are presented in Table 3-10 and Table 3-11 by county, parcel, structure type, and flood event. Figure 14 depicts potentially impacted structures under Plan B for the 100-year flood. Figure 15 depicts potentially impacted parcels under Plan B for the 100-year flood.

Table 3-10 Plan B: Number and Type of Structures Impacted under 20-year, 50-year, 100-year, and 500-year Floods within the Upstream Inundation Area

Return Period: Scenario	20-year Flood	50-year Flood	100-year Flood	500-year Flood
Cass County Non-Residential	92	346	400	522
Cass County Residential	4	51	61	72
Richland County Non-Residential	5	27	55	305
Richland County Residential	0	0	3	59
Total Non-Residential -North Dakota	97	373	455	827
Total Residential – North Dakota	4	51	64	131
Clay County Non-Residential	7	80	125	221
Clay County Residential	0	9	11	15
Wilkin County Non-Residential	9	21	41	172
Wilkin County Residential	0	0	2	49
Total Non-Residential -Minnesota	16	101	166	393
Total Residential - Minnesota	0	9	13	64
Total Non- Residential Structures	113	474	621	1220
Total Residential Structures	4	60	77	195
Total Structures	117	534	698	1415

Source: DNR, 2018; HMG, 2017

Notes:

- Structures included within the analysis are those found within the counties identified and limited to the upstream inundation area.
- Impact is not defined by a set flood depth. If a structure is impacted by water by any extent, it is considered an impact.
- Structures impacted are not differentiated by currently inundated and newly inundated structures.
- GIS structure data obtained and provided by the USACE through a GIS desktop analysis.
- Non-residential includes all other structures that are not used for residential purposes, including commercial structures.
- Structure numbers and type should not be compared to those represented in the Final EIS. Methods and data sources applied were different.

Table 3-11 Plan B: Number of Parcels Impacted under 20-year, 50-year, 100-year, and 500-year Floods within the Upstream Inundation Area

Return Period: Scenario	20-year Flood: Plan B	50-year Flood: Plan B	100-year Flood: Plan B	500-year Flood: Plan B
Cass County	143	173	173	192
Richland County	61	91	111	179
Total Parcels -North Dakota	204	264	284	371
Clay County	51	55	59	78
Wilkin County	48	50	62	126
Total Parcels -Minnesota	99	105	121	204
Total Parcels	303	369	405	575

Source: DNR, 2018

Notes:

- Structures used for determining parcel inclusion are those found within the counties identified and limited to the upstream inundation area.
- Impact is not defined by a set flood depth. If a structure is impacted by water by any extent, it is considered an impact.
- Parcels impacted are not differentiated by currently inundated and newly inundated parcels.
- Parcels included in counts were those found to contain impacted structures. Undeveloped land was not included in this analysis.
- Structures used in analysis were identified and provided by the USACE through a GIS desktop analysis, 2017.

3.10.2.1.2 Effects on Cemeteries

Under Plan B, there are five cemeteries upstream of the Dam/Southern Embankment that may experience additional flood depths (ranging from 0.3 feet to 6.3 feet) due to operation of Plan B in a 100-year flood. The potentially-impacted cemeteries are Clara Cemetery, Roen Family Cemetery, North Pleasant Cemetery, Eagle Valley Evangelical Cemetery, and Wolverton Cemetery.

Four cemeteries (Comstock, Hemnes, South Pleasant and South Pleasant Church) would experience no change in anticipated flood depth, and three cemeteries (Hoff, Lower Wild Rice and Red River, and St. Benedict’s) would experience reduced inundation due to operation of Plan B in a 100-year flood.

Under the previously-proposed Project, there were 11 potentially impacted cemeteries upstream of the Diversion Project (a total of 12, including St. Benedicts Church described under the Northern Alignment Alternative). Figure 13 indicates the locations of the upstream

cemeteries, and indicates which cemeteries would be impacted, benefitted or experience no change.

Compared to the previously-proposed Project, Plan B would reduce the depth, duration, and frequency of the potential impacts to most upstream cemeteries that remain potentially impacted. The frequency of induced flooding in the upstream mitigation area is expected to be reduced with the changes made to allow 37-feet of floodwaters to pass through the Red River between Fargo and Moorhead before the Project would be allowed to operate. This change reduces the frequency of operation from the 10-year return frequency to the 20-year return frequency, or once in 10 years to once in 20-years, on average. The elevations, existing water depths, Plan B water depths, and the additional depths for the upstream cemeteries, including St. Benedicts, are presented for Plan B in Table 3-12.

Table 3-12 Upstream Mitigation Area Cemetery Impacts, 100-year Flood, Plan B

Cemetery	Approx. Lowest Site Elevation	Existing Peak Elevation	Existing Total Depth (feet)	Plan B Peak Water Surface Elevation	Plan B Total Depth (feet)	Depth Difference (feet)
Clara	915.0	914.5	0.0	921.3	6.3	6.3
Comstock	922.0	921.0	0.0	920.9	0.0	0.0
Eagle Valley	924.0	924.2	0.2	925.2	1.2	1.0
Hemnes	922.0	918.3	0.0	922.0	0.0	0.0
Hoff	908.0	913.8	5.8	911.9	3.9	-1.9
Lower Wild Rice and Red River	908.0	913.1	5.1	910.9	2.9	-2.2
North Pleasant	921.0	920.2	0.0	921.3	0.3	0.3
Roen Family	917.0	916.4	0.0	921.6	4.6	4.6
South Pleasant	923.0	924.4	1.4	924.4	1.4	0.0
South Pleasant Church	927.0	927.3	0.3	927.3	0.3	0.0
St. Benedict's	909.0	911.8	2.8	909.7	0.7	-2.1
Wolverton	923.0	925.6	2.6	926.3	3.3	0.7

Source: HMG, 2018

Non-inundation Impacts to Cemeteries

There are two cemeteries that, although would be benefitted by Plan B, might experience viewshed buffer impacts due to their proximity to the Plan B Southern Embankment. Those cemeteries with potential viewshed buffer impacts include: St. Benedict's Cemetery and the Lower Wild Rice and Red River Cemetery. A discussion of potential viewshed impacts and an illustration of viewshed buffers are included in Section 3.6.2 (Cultural Resources; Illustration 3-5).

3.10.2.1.3 Agricultural Impacts

Compared to the previously-proposed Project, Plan B would reduce the frequency of induced flooding in the upstream mitigation with the changes made to allow 37-feet of floodwaters to pass through the Red River between Fargo and Moorhead before it would be allowed to operate.

Plan B impacts related to organic farms would result in different impacts compared to the previously-proposed Project. Table 3-13 provides a rough estimate of identified organic farm acres benefited or impacted at the 100-year event. Figure 16 depicts the areas of organic farm flood inundation associated with the operation of Plan B during the 100-year flood.

Table 3-13 Organic Farm Impacted Acreage for 100-Year Flood Event

Farm		Acres within No Action (with Emergency Measures)	Acres Removed from Impact with Plan B	Acres Impacted with or without Plan B	Acres newly-impacted with Plan B
Farm 1: 998 acres	<i>Flooded</i>	78		62	55
	<i>Non-flooded</i>	920	16		
Farm 2: 1,330 acres	<i>Flooded</i>	387		368	0
	<i>Non-flooded</i>	943	19		
Farm 3: 835 acres	<i>Flooded</i>	29		29	0
	<i>Non-flooded</i>	806	0		
Farm 4: 1,208 acres	<i>Flooded</i>	22		15	16
	<i>Non-flooded</i>	1186	7		
TOTAL: 4,371 acres	<i>Flooded</i>	516		474	71
	<i>Non-flooded</i>	3855	43		

Source: Wenck, 2015; USACE 2017

Notes:

- Total acres for each farm are based on the total acreage in the parcel, not the total acres that are actually farmed. Acreages were rounded to the near acre. Totals and percentages provided are rough estimates based on rounded acreage.
- Flooded and Non-flooded conditions are based on the USACE POR elevations modeled for the 100-year flood. Flood indicates the estimated acreage that is anticipated to be inundated during the 100-year. Non-flood indicates the estimated acreage that is anticipated to not be inundated during the 100-year flood.
- Plan B 100-year flood refers to the additional area that would flood for the 100-year flood (using POR) during operation.
- Total farm acreage is based on total parcel acreage for the PIDs provided by the farmers, which includes their reported organic farm acreage.
- In all cases the organic farm acreage reported by the farmer is less than the total parcel acreage associated with the farmed PIDs. ArcGIS was used to map and evaluate the organic farm acreage using the available PIDs data. Surveys and delineations of actual organic farm acreage were not available, and therefore, the PID information was the best available information at the time of EIS publication.

3.10.2.1.4 Geographic Extent Impacts: Minnesota and North Dakota, Benefited and Unbenefited Areas

Modifications to the Eastern Tieback, Western Tieback and Dam/Southern Embankment alignment for Plan B result in different flood damages for each state as those described for the previously-proposed Project.

Under Plan B, Minnesota would experience fewer acres of new inundation compared to the previously-proposed Project, particularly in the area east of Highway 75. Comstock, Minnesota, would now be on the dry side of the dam and would not require a community ring levee.

North Dakota would experience greater new inundation compared to the previously-proposed Project, particularly in the area west of St. Benedict’s Church/southeast of Horace and west of North Dakota County Road 17.

The Plan B proportion of new flood impacts would be closer to what is experienced for each state under the No Action Alternative (with Emergency Measures). For the 100-year flood, Minnesota would experience approximately 27% of the inundation impact, and North Dakota would experience approximately 73%. For the same flood event, Minnesota would experience 17% of the benefit (i.e., protection) of Plan B, and North Dakota would experience about 83% of the benefit. In other words, Minnesota ends up with slightly more impacts than benefits under the 100-year flood scenario with the Plan B proposal. Table 3-14, below, outlines the 100-year anticipated floodplain impacts and benefits within the Project Area for Plan B by state and county. This table includes total inundation and does not account for acres that may be newly-inundated or have current flooding. It also doesn’t report total number of acres that are currently flooded and that may experience increased depth or duration of inundation under Project operation.

Table 3-14 Plan B, 100-year flood, Total Acres Impacted and/or Protected in the Project Area

<i>Area Inundated or Benefited</i>	<i>Number of Acres</i>
Total Inundated Acres in Project Area	123,954 acres
Minnesota Total Inundation	33,545 acres (27%)
Wilkin County Total Inundation	3,599 acres
Clay County Inundation Impacts	29,946 acres
North Dakota Total Inundation	90,409 acres (73%)
Richland County Inundation Impacts	8,697 acres
Cass County Inundation Impacts	81,712 acres
Total Acres Removed from Flooding in Project Area	56,882 acres
Minnesota Removed from Flooding	9,635 acres (17%)
Wilkin County Removed from Flooding	5 acres
Clay County Removed from Flooding	9,630 acres
North Dakota Removed from Flooding	47,247 acres (83%)

<i>Area Inundated or Benefited</i>	<i>Number of Acres</i>
Richland County Removed from Flooding	4 acres
Cass County Removed from Flooding	47,243 acres

Source: HMG, 2018

Note:

- Total inundation includes new inundation, existing inundation and removed inundation.

The above table notes a total of 3,599 acres of total impact in Wilkin County, of which 409 is newly-inundated. Similarly, Richland County notes 8,697 acres of total potential impact, of which 576 is newly-inundated.

3.10.2.2 No Action Alternative (with Emergency Measures)

The No Action Alternative (with Emergency Measures) includes the potential flood risk reduction impact of existing and currently funded permanent projects such as levee construction and property buyouts. This alternative also assumes that emergency measures similar to those that have been historically implemented in the project area would continue to be implemented as necessary due to flooding.

3.10.2.2.1 Impacts to Structures and Parcels

The DNR completed an ArcGIS analysis in order to obtain individual structure and/or structure parcel data specifically for the upstream inundation area (i.e., Unbenefited Area). Impact was defined for this analysis as a flood level greater than zero measured at the structure location. The results are presented in Table 3-15 and Table 3-16 by county, parcel, structure type, and flood event.

Table 3-15 Number and Type of Structures Impacted under the No Action Alternative (with Emergency Measures) at 20-year, 50-year, 100-year, and 500-year Floods within the Upstream Inundation Area

Return Period: Scenario	20-year Flood	50-year Flood	100-year Flood	500-year Flood
Cass County Non-Residential	98	271	343	459
Cass County Residential	5	22	29	79
Richland County Non-Residential	5	22	40	296
Richland County Residential	0	0	1	56
Total Non-Residential -North Dakota	103	293	383	755
Total Residential – North Dakota	5	22	30	135
Clay County Non-Residential	9	49	91	215
Clay County Residential	0	3	4	16
Wilkin County Non-Residential	9	13	30	168
Wilkin County Residential	0	0	1	47
Total Non-Residential -Minnesota	18	62	121	383
Total Residential - Minnesota	0	3	5	63
Total Non- Residential Structures	121	355	504	1138
Total Residential Structures	5	25	35	198
Total Structures	126	380	539	1336

Source: DNR, 2018; HMG 2017

Notes:

- Structures included within the analysis are those found within the counties identified and limited to the upstream inundation area.
- Impact is not defined by a set flood depth. If a structure is impacted by water by any extent, it is considered an impact.
- GIS structure data obtained and provided by the USACE through a 2017 GIS desktop analysis.
- Non-residential includes all other structures that are not used for residential purposes, including commercial structures.
- Structure numbers and type should not be compared to those represented in the Final EIS. Methods and data sources applied were different.

Table 3-16 Number of Parcels Impacted under the No Action Alternative (with Emergency Measures) at 20-year, 50-year, 100-year, and 500-year Floods within the Upstream Inundation Area

Return Period: Scenario	20-year Flood: Base No Action Alt.	50-year Flood: Base No Action Alt.	100-year Flood: Base No Action Alt.	500-year Flood: Base No Action Alt.
Cass County	147	185	186	190
Richland County	61	78	97	175
Total Parcels -North Dakota	208	263	283	365
Clay County	50	62	72	101
Wilkin County	48	50	56	126
Total Parcels -Minnesota	98	112	128	227
Total Parcels	306	375	411	592

Source: DNR, 2018

Notes:

- Structures used for determining parcel inclusion are those found within the counties identified and limited to the upstream inundation area.
- Impact is not defined by a set flood depth. If a structure is impacted by water by any extent, it is considered an impact.
- Parcels included in counts were those found to contain impacted structures. Undeveloped land was not included in this analysis.
- Structures used in analysis were identified and provided by the USACE through a GIS desktop analysis.

3.10.2.2.2 Effects on Cemeteries

Under the No Action Alternative (with Emergency Measures), impacts to cemeteries would be similar to those described in the 2016 Final EIS. However, additional cemeteries may be impacted under the No Action Alternative (with Emergency Measures) due to use of the updated Period of Record hydrology in this SEIS. Table 3-17, below, outlines existing inundation depth for each of the 12 cemeteries identified in the 2016 Final EIS near the Upstream Mitigation Area.

Table 3-17 Upstream Mitigation Area Cemetery Impacts, 100-year Flood, No Action Alternative (with Emergency Measures)

Cemetery	Approximate Lowest Site Elevation	Existing Peak Elevation	Existing Total Depth (feet)
Clara	915.0	914.5	0.0
Comstock	922.0	921.0	0.0
Eagle Valley	924.0	924.2	0.2
Hemnes	922.0	918.3	0.0
Hoff	908.0	913.8	5.8
Lower Wild Rice and Red River	908.0	913.1	5.1
North Pleasant	921.0	920.2	0.0
Roen Family	917.0	916.4	0.0
South Pleasant	923.0	924.4	1.4
South Pleasant Church	927.0	927.3	0.3
St. Benedict's	909.0	911.8	2.8
Wolverton	923.0	925.6	2.6

3.10.2.2.3 Agricultural Impacts

Under the No Action Alternative (with Emergency Measures), impacts to agriculture would be similar to those described for the previously-proposed Project in the 2016 Final EIS. However, additional acres of agricultural land may be impacted under the No Action Alternative (with Emergency Measures) due to use of the updated Period of Record hydrology. Table 3-18 provides a rough estimate of identified organic farm acres that experience varying degrees of flooding at the 100-year event under the No Action Alternative (with Emergency Measures).

Table 3-18 Organic Farm Acreage By 100-Year Flood Event for Plan B

Farm		Acres within No Action (with Emergency Measures)	Acres Removed from Impact with Plan B	Acres Impacted with or without Plan B	Acres newly-impacted with Plan B
Farm 1: 998 acres	<i>Flooded</i>	78		62	55
	<i>Non-flooded</i>	920	16		
Farm 2: 1,330 acres	<i>Flooded</i>	387		368	0
	<i>Non-flooded</i>	943	19		
Farm 3: 835 acres	<i>Flooded</i>	29		29	0
	<i>Non-flooded</i>	806	0		
Farm 4: 1,208 acres	<i>Flooded</i>	22		15	16
	<i>Non-flooded</i>	1186	7		
TOTAL: 4,371 acres	<i>Flooded</i>	516		474	71
	<i>Non-flooded</i>	3855	43		

Source: Wenck, 2015; USACE 2017

Notes:

- Total acres for each farm are based on the total acreage in the parcel, not the total acres that are actually farmed. Acreages were rounded to the near acre. Totals and percentages provided are rough estimates based on rounded acreage.
- Flooded and Non-flooded conditions are based on the USACE POR elevations modeled for the 100-year flood. Flood indicates the estimated acreage that is anticipated to be inundated during the 100-year. Non-flood indicates the estimated acreage that is anticipated to not be inundated during the 100-year flood.
- Plan B 100-year flood refers to the additional area that would flood for the 100-year flood (using POR) during operation.
- Total farm acreage is based on total parcel acreage for the PIDs provided by the farmers, which includes their reported organic farm acreage.
- In all cases the organic farm acreage reported by the farmer is less than the total parcel acreage associated with the farmed PIDs. ArcGIS was used to map and evaluate the organic farm acreage using the available PIDs data. Surveys and delineations of actual organic farm acreage were not available, and therefore, the PID information was the best available information at the time of EIS publication.

3.10.2.2.4 Geographic Extent Social and Economic Impacts: Minnesota and North Dakota, Benefited and Unbenefited Areas

Minnesota and North Dakota

Under the No Action Alternative (with Emergency Measures), the flooding conditions in Minnesota and North Dakota would remain the same and would not be influenced by a large-scale flood control project. Flood damages and the social and economic effects resulting from large flood events would continue as would flood-fighting efforts.

Total inundation in the project area under the No Action Alternative (with Emergency Measures) at the 100-year flood event is approximately 168,786 acres. Of that total inundation, Minnesota experiences 39,503 acres of inundation (or approximately 23%), and North Dakota experiences approximately 129,282 acres of inundation (or approximately 77%).

Benefited and Unbenefited Areas

Under the No Action Alternative (with Emergency Measures), there are areas within the F-M urban area that are protected by permanent levees and floodwalls, plus implementation of temporary levees and floodwalls, floodwall closures and sandbagging, which would reduce the

flood inundation in the F-M urban area. In general, implementation of emergency measures could protect the F-M urban area to at least a 50-year flood. However, there is high risk involved with relying on temporary measures for protection, which could result in catastrophic failure.

Areas outside of the F-M urban area are considered Unbenefited. These areas are primarily rural where permanent and emergency measures have limited use. Small communities may implement flood-fighting measures depending on the flood, as well as some individual property owners may implement some measures to protect their homes or other property. Depending on the magnitude of the flood, the Unbenefited Areas would be impacted by flood inundation, which would cause damage to property, potential income loss, and effects on the emotional and physical well-being of individuals, families, and communities. During flood events, many communities and rural properties located within the Unbenefited Area would be flooded by the Red River and its tributaries.

3.10.3 Proposed Mitigation and Monitoring Measures

Below is an overview of proposed mitigation for impacts to structures, land, cemeteries and organic farms. Proposed mitigation for other potential impacts, such as flood debris, excess property, historic properties, the OHB Levee, in-town levee mitigation projects, medical hardship, and funding can be found in the 2018 Property Rights Acquisition and Mitigation Plan (PRAM, Appendix F).

3.10.3.1 Terms, Definitions and Boundaries

The proposed structure and land mitigations are based on anticipated flood depths and locations using the 100-year flood event, and fall into different boundaries, zones and categories (see Figures 11 and 12). In some cases, these areas and categories have new names from what was described in the 2016 Final EIS. This subsection describes the new boundaries, zones and categories and, where appropriate, identifies a previously-known name for the boundary. Most of these boundaries are also described in the 2018 USACE/FEMA Coordination Plan (Appendix E) and/or the PRAM (Appendix F).

3.10.3.1.1 Upstream Mitigation Area (new term)

The upstream mitigation area is a new term used to refer to areas where planned mitigation is proposed at varying levels based on location and inundation depth. It is defined using two areas: (1) Revision Reach Area and (2) Property Rights Area.

3.10.3.1.2 Revision Reach Area (same as described in the 2016 Final EIS)

The Revision Reach Area is defined as part of the Conditional Letter of Map Revision (CLOMR) that will be developed following the 2018 USACE/FEMA Coordination Plan. In general, the Revision Reach Area is where the 100-year floodplain will be revised as a result of the Project. The Revision Reach is developed in coordination with FEMA. The Coordination Plan defines the revision reach for the CLOMR as follows:

“The extent of the revision is defined by an effective tie-in at the upstream and downstream limits for each flooding source. An effective tie-in is obtained when the revised base flood elevations from the post-project conditions model are within 0.5 feet of the pre-project conditions model at both the upstream and downstream limits.”

Currently, the Revision Reach is defined using existing property boundaries. When obtaining the actual flowage easements, the actual easement would be defined by describing by survey the actual inundation on the parcel. The Revision Reach will be finalized as part of the CLOMR.

3.10.3.1.3 Property Rights Area (new boundary)

The Property Rights Area is defined by using the probable maximum flood (i.e., the maximum elevation of the spillway, which is expected to be no higher than 923.5 feet (NAV88)). Currently, the boundary of the Property Rights Area is extended beyond the 923.5-foot contour to the existing parcel boundaries. The Property Rights Area will be finalized based on the final design of the Project, and the final boundary could be defined by describing by survey the actual contour on the parcel. All land within this boundary will receive a flowage easement, the value of which will be based on appraisal. Information on the easement value and appraisal is provided below in subsection 3.10.3.6 (Flowage Easement Value).

As part of the permitting process for the Project, the North Dakota State Water Commission (NDSWC) and DNR have indicated the following requirements:

- NDSWC – Permit to Construct or Modify: “Evidence establishing a property right for all lands affected as a result of the final design elevation of the Limited Service Spillway”. It is expected that the Limited Service Spillway will be constructed at elevation no greater than 923.5 feet (NAVD88). As such, for the purposes of this Mitigation Plan, a maximum elevation of 923.5 feet is used to define the area where the NDSWC will require the Diversion Authority to obtain property rights in North Dakota.
- DNR – Public Waters Work and Dam Safety: “Minnesota will require property rights up to the water surface elevation at the maximum capacity of the dam...”
NOTE: Based on hydraulic modeling and preliminary design for the new Project, the water surface elevation at the maximum capacity of the dam is expected to be 923.5 feet (NAVD88).

3.10.3.1.4 Flowage Easement (same as defined in the 2016 Final EIS)

A flowage easement provides the legal ability to inundate property as part of the operation of the Project. The value of a flowage easement on an individual property would be determined by appraisal. Factors that would be considered are depth, duration, frequency of additional flooding, and the highest and best use of the property. USACE policy defines a flowage easement as a one-time payment made at the time that the easement is acquired. Information on the easement value and appraisal is provided below in subsection 3.10.3.6 (Flowage Easement Value).

3.10.3.1.5 Zone 1 and Zone 2 (i.e., Staging Area)

Zone 1 and Zone 2 comprise the area formerly known as the staging area. These areas will be used to define the federal requirements for land mitigation. The USACE would impose use and development limitations on lands where Project impacts produce more than 1 foot of stage for either the 100-year or the 500-year flood event. Zone 1 is a more restrictive inner area, while Zone 2 is a less restrictive outer area. The specific requirements to be imposed on Zone 1 and Zone 2 are as follows:

Zone 1

- Most restrictive zone.
- Defines the operating pool extents required to ensure the operation of the Project as planned, which includes minimizing downstream impacts.
- Provides sufficient volume to operate the Project as planned up to the 500-year event.
- Limited to Cass and Clay Counties as much as possible, except for corridors along the Red River and Wild Rice River in Richland County and Wilkin County.
- Development would not be allowed.
- Placement of fill would not be allowed (e.g., roads/driveways cannot be raised).
- Flowage easements would be acquired.
- Will be mapped as floodway.

Zone 2

- Less restrictive zone.
- Portion of the staging area outside of Zone 1.
- Limited placement of fill would be allowed, within the terms and conditions of the flowage easement.
- Development would be allowed, but structures must be constructed at least 1-foot higher than the elevation of the maximum pool elevation or above the 500-year water surface elevation (for planning purposes, this is currently 923.5).
- Flowage easements would be acquired.
- Will be mapped as floodplain.

3.10.3.1.6 Floodway (not new term, but not previously defined)

The floodway is the portion of the staging area that is required to mitigate downstream impacts from the Project. According to FEMA, a “Regulatory Floodway” means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

3.10.3.1.7 Floodplain (same as defined in the 2016 Final EIS)

Floodplain is any land area susceptible to being inundated by flood waters from any source.

3.10.3.1.8 Operating Pool (not new term, but not previously defined)

The Operating Pool is required to ensure the operation of the Project as planned, which includes minimizing downstream impacts. The Operating Pool provides sufficient volume to operate the Project as planned up to the 500-year event without increasing pool levels above the maximum pool levels that occur during the Probable-Maximum Flood (PMF) inflow design event.

3.10.3.1.9 Taking (same as defined in the 2016 Final EIS)

The Fifth Amendment of the U.S. Constitution prohibits the federal government from taking property for a public purpose without first paying the landowner just compensation for the taking of his or her property. The Fourteenth Amendment of the U.S. Constitution makes the Fifth Amendment takings requirement applicable to the individual states. In addition, Article I § 13 of the Minnesota Constitution expressly

provides: “Private property shall not be taken, destroyed or damaged for public use without just compensation therefor, first paid or secured.” The North Dakota Constitution also contains a taking provision which provides in part that “private property shall not be taken or damaged for public use without just compensation having been first made. . .” *North Dakota Constitution*, Art. I § 16. Thus, neither a Minnesota governmental unit nor a governmental unit in North Dakota can acquire property for the Project without meeting the takings requirements of both the U.S. Constitution and their individual state constitutions.

The USACE would perform an analysis to determine if a taking has occurred on a case-by-case-basis for any land with additional impacts caused by the Project outside of the Property Rights Area. This analysis would be used to define any additional mitigation needs. Flowage easements would be obtained where the USACE analysis determines that an impact rises to the level of a taking under the Fifth Amendment of the U.S. Constitution. The USACE would also perform an analysis to determine if there is a taking for all structures impacted by the Project that are located outside of the Revision Reach. The USACE would determine mitigation needs on a case-by-case basis through the takings process.

3.10.3.2 Structure Mitigation

Mitigation for structures is proposed to be a combined effort between the USACE and the Diversion Authority. Impacts to structures in the Upstream Mitigation Area would be mitigated following the criteria outlined below.

- The CLOMR-approved hydraulic model would be used to determine the flood water depth at the structure under a 100-year flood event with Project and under existing conditions. For the purposes of structure mitigation, potential impacts are based on the total depth of flood water (existing plus additional) during a 100-year flood event.
- The CLOMR-approved hydraulic model would be used to determine the Operating Pool (Floodway, Zone 1) in the Upstream Mitigation Area.
- Aerial photography of the upstream mitigation area would be taken before, during, and after flood events, and high-water marks would be surveyed to check and improve the hydraulic model for its use in the mitigation programs.

The potentially impacted structures under Plan B have been classified into five mitigation categories. These structures are identified by category and color on Figure 12 and listed in Table 3-19.

1. Category 1 (red): If the structure is located within the floodway, it will be acquired via the typical acquisition process (Appendix F, see the Typical ND/MN Property Acquisition Process sections), and then removed from the floodway.
2. Category 2 (orange): If the flood water depth at the structure is greater than or equal to two-feet, the structure will be acquired via the typical acquisition process (Appendix F, see the Typical ND/MN Property Acquisition Process sections), and then removed from the mitigation area.
3. Category 3 (yellow): If the flood water depth at the structure is between 0.5 foot and two-feet, and if the structure is outside the floodway and within the Revision Reach, the Diversion Authority will consider, with the property owner, non-structural measures for the structure as well as offer to acquire the structure via the typical acquisition process following an appraisal.

Non-structural measures for residential structures may include elevation, ring levees, relocation, or acquisition. Non-structural measures for non-residential structures may include dry flood proofing, wet flood proofing, elevation, ring levees, relocation, and acquisition. Wells and septic systems serving residences that will remain will be modified to prevent impacts from flooding. Each of these structures will be considered on a case-by-case basis, in coordination with the property owner.

4. Category 4 (green): If the flood water depth at the structure is less than 0.5-feet, and if the structure is outside the floodway and within the Revision Reach, the Diversion Authority will field verify the structure elevation via a topographical survey to confirm the impacts. The field verification will result in the production of a FEMA Elevation Certificate. If the field verification confirms that the structure is impacted (for the purposes of structure mitigation, an impact is defined as any total depth greater than 0.01-feet during a 100-year flood event), the Diversion Authority, with the property owner, will consider non-structural measures for the structure as well as offer to acquire the structure via the typical acquisition process following an appraisal. Non-structural measures for residential structures may include elevation, ring levees, relocation, or acquisition. Non-structural measures for non-residential structures may include dry flood proofing, wet flood proofing, elevation, ring levees, relocation, and acquisition. Wells and septic systems serving residences that will remain will be modified to prevent impacts from flooding. Each of these structures will be considered on a case-by-case basis, in coordination with the property owner.
5. Category 5 (white): The USACE is required to perform a takings analysis on any properties with impacts resulting from the 100-year flood event, even if those impacts extend beyond the boundaries defined above. If the USACE takings analysis determines that mitigation would be required, the Diversion Authority would be responsible for performing the mitigation in accordance with the 2018 Property Rights Acquisition and Mitigation Plan.

Table 3-19 Structure Mitigation Matrix Proposed by USACE or Fargo-Moorhead Diversion Authority (FMDA)

Upstream Structure Mitigation Area	Mitigation Category 1 (Structures in Floodway)	Mitigation Category 2 (Total depth greater than 2-foot)	Mitigation Category 3 (Total depth between 2-feet and 0.5-feet)	Mitigation Category 4 (Total depth less than 0.5-feet)	Mitigation Category 5 (Outside Revision Reach)
USACE Zone 1	Structure Acquisition and Removal	Not Applicable	Not Applicable	Not Applicable	Not Applicable
USACE Zone 2	Not Applicable	Structure Acquisition and Removal	Mitigation via Non-structural Measures or Acquisition and Removal	Mitigation via Non-structural Measures or Acquisition and Removal	Not Applicable
Outside of USACE Zones	Not Applicable	<ul style="list-style-type: none"> FMDA: Structure Acquisition and Removal USACE: Not Applicable 	<ul style="list-style-type: none"> FMDA: Non-structural Measures or Acquisition and Removal USACE: Not Applicable 	<ul style="list-style-type: none"> FMDA: Non-structural Measures or Acquisition and Removal USACE: Not Applicable 	<ul style="list-style-type: none"> FMDA: To be determined by USACE Takings Analysis USACE: Takings Analysis

3.10.3.3 Land Mitigation

Mitigation for land is proposed to be a combined effort between the USACE and the Diversion Authority. All land within the Property Rights Area (up to the Probable Maximum Flood elevation of 923.5) will receive a flowage easement. Easement values will vary based on appraisal (more information on easement value is described below in section 3.10.3.6). Full details on land mitigation can be found in the PRAM Plan (Appendix F). Impacts to land in the upstream mitigation area will be mitigated following the criteria outlined below.

- The CLOMR-approved hydraulic model will be used to define the ‘existing’ and ‘with-project’ flood water depths and durations within the upstream mitigation area.
- The CLOMR-approved hydraulic model will be used to determine the Operating Pool (Floodway, Zone 1) in the upstream mitigation area.

The boundaries for land mitigation are identified in Figure 11 and listed in Table 3-20. Flowage easement conditions, restrictions, and value would vary as follows:

- Properties within the Operating Pool (Floodway, Zone 1): This is a Federal requirement, and the flowage easement in this area will restrict all development. The Operating Pool (Floodway, Zone 1) is the area required for Project operation to mitigate downstream impacts. This area will be mapped as Floodway.
- Properties within the Revision Reach Area, but outside of the Floodway: As noted above, the Revision Reach is defined through coordination with FEMA. Flowage easements in this area will require that structures be constructed at least 1-foot higher than the elevation of the maximum pool elevation controlled by the Limited Service Spillway, which is expected to be no greater than 923.5 feet (NAV88), or above the 500-year water surface elevation, whichever is higher.

- Properties outside the Revision Reach, but within the Property Rights Area, which includes properties with an elevation less than the elevation of the maximum pool elevation controlled by the Limited Service Spillway, which is expected to be no greater than 923.5 feet (NAV88): Flowage easements in this area will require that structures be constructed at least 1-foot higher than the elevation of the maximum pool elevation controlled by the Limited Service Spillway, which is expected to be no greater than 923.5 feet (NAV88), or above the 500-year water surface elevation, whichever is higher.
- The southern end of the flowage easement boundary along existing river channels: will be limited to where the 923.5-foot elevation meets the existing 100-year flood elevation. This boundary will be used so the Diversion Authority is not obligated to obtain property rights within the existing river channels.

Table 3-20 Land Mitigation Matrix Proposed by USACE or Fargo-Moorhead Diversion Authority (FMDA)

Upstream Land Mitigation Area	Land Inside Revision Reach and within Floodway	Land Inside Revision Reach but Outside Floodway	Land Inside Property Rights Area but Outside Revision Reach	Land Outside Property Rights Area and Revision Reach
USACE Zone 1	Flowage Easement	Not Applicable	Not Applicable	Not Applicable
USACE Zone 2	Not Applicable	Flowage Easement	Flowage Easement	Not Applicable
Outside of USACE Zones	Not Applicable	<ul style="list-style-type: none"> • FMDA: Flowage Easement • USACE: Not Applicable 	<ul style="list-style-type: none"> • FMDA: Flowage Easement • USACE: Not Applicable 	<ul style="list-style-type: none"> • FMDA: Dispute Resolution Board • USACE: Not Applicable

Outside of flowage easement compensation for property owners that experience impacts caused by Plan B, the Diversion Authority developed a post-operation debris (e.g., logs, straw, trash), private land clean-up plan. This plan is specific to clean-up of debris in the upstream mitigation area from operation of the Plan B Project. As described in Appendix F:

- The plan will pattern the “clean-up week” approach used throughout the metro area.
- The Diversion Authority will declare the Project operated.
- The Diversion Authority will define the boundary of the upstream mitigation area based on the actual flood event.
- The Diversion Authority will notify affected property owners in the area eligible via posting of a map on the Project website ([FM Area Diversion Project Website \(www.fmdiversion.com\)](http://www.fmdiversion.com)) for clean-up assistance and provide direction on clean-up procedures.
- The Diversion Authority will solicit quotes from contractors for clean-up of flood debris in the upstream mitigation area.
- Upon receipt of quotes, the Diversion Authority will retain one or more contractors to conduct the flood debris clean-up operations in the upstream mitigation area.

- Property owners will be responsible for moving debris to established field entrances or access points that the contractors can access without impacting farm operations.
- Contractors will only enter upon established field entrances or access points to pick up the debris.
- After each occurrence, property owners could voluntarily sign a “right of entry” to allow the contractors to enter and access other portions of their private property.
- Eligible debris for pick-up will be limited to debris caused by the flood event.
- The contractors will be responsible for ultimate disposal of the debris.

3.10.3.4 Cemetery Mitigation

Mitigation for cemeteries is proposed to be a combined effort between the USACE and the Diversion Authority. Full details on each impacted cemetery can be found in the PRAM Plan (Appendix F). As described above in section 3.10.2.2.2, there are five cemeteries in the upstream mitigation area that are anticipated to have impacts with Plan B. Proposed mitigation for these cemeteries is outlined below in Table 3-21 and descriptions of these mitigations follows. If a cemetery in the project area is not listed in Table 3-21, it is not anticipated to receive new inundation impacts for the 100-year flood.

Table 3-21 Proposed Cemetery Mitigation for Inundation Under Plan B, 100-year flood.

Cemetery	Would it Receive a Diversion Authority Flowage Easement?	Would it be eligible for the Repair and Debris Clean-up Program?	Is it NRHP Eligible?	Potential Mitigation Alternatives (Note: There is no uniform solution for all cemeteries. The Diversion Authority will meet with each cemetery representative to discuss the technically feasible options for each specific location.)
Clara	Yes	Yes	Yes	Berm, Offsite Access, Debris Fence, Anchoring Headstones, Elevating Low Areas
Eagle Valley	Yes	Yes	No	Berm, Offsite Access, Debris Fence, Anchoring Headstones, Elevating Low Areas
North Pleasant	Yes	Yes	No	Berm, Offsite Access, Debris Fence, Anchoring Headstones, Elevating Low Areas
Roen Family	Yes	Yes	No	Berm, Offsite Access, Debris Fence, Anchoring Headstones, Elevating Low Areas
Wolverton	Yes	Yes	No	Berm, Offsite Access, Debris Fence, Anchoring Headstones, Elevating Low Areas

3.10.3.4.1 Federal Mitigation Plan and Requirements

The USACE completed a Draft Cemetery Mitigation Plan for the potentially impacted cemeteries in June 2015 that more fully evaluated impacts under the previously-proposed Project, proposed mitigation, and potential mitigation impacts. The 2015 Draft Cemetery Mitigation Plan is available online at:

<https://fmdiversion.com/pdf/150601%20FMM%20Draft%20Cemetery%20Mitigation%20Plan.pdf>. The Draft Cemetery Mitigation has not been updated since the 2016 Final EIS; thus, the description of those measures in the 2016 Final EIS remains the same. For the cemeteries which may be impacted by operation and which occur within Zones 1 or 2 (i.e., staging area), required federal mitigation would be satisfied by establishing flowage easements. There are no federal mitigation requirements for the other potentially-impacted cemeteries located outside the staging area.

The USACE has stated that impacts to cemeteries are not considered a taking. The previously-completed cemetery studies can be found online at www.fmdiversion.com/studies-technical-documents/. Their analysis will be amended with data from the Plan B configuration.

3.10.3.4.2 Diversion Authority Flowage Easements

Additional mitigation for impacts to cemeteries has been proposed by the Diversion Authority and extends beyond the federal easement limits. For cemeteries within the Property Rights Area and outside of Zones 1 and 2, the Diversion Authority has committed to obtaining flowage easements.

3.10.3.4.3 Clean-Up Assistance

The Diversion Authority proposes to adopt a post-operation repair and debris clean-up program and ensure the cemeteries within the Property Rights Area are eligible to take part in the repair and clean-up assistance program. The program would accommodate collection of debris that accumulates on the cemetery sites, and also provides for reimbursement of repair costs that may be necessary to correct physical damage to the cemetery caused by operation of the Project. Details on this program are outlined in the public lands repair and debris clean-up section in the PRAM Plan (Appendix F).

3.10.3.4.4 National Register of Historic Places

For the cemeteries that are eligible to be listed on the National Register of Historic Places (NRHP) and are potentially-impacted by Plan B under the 100-year flood (this includes the Clara Cemetery and any additional cemetery that may be identified on the NRHP), USACE and the Diversion Authority propose to work with each respective State Historic Preservation Office (SHPO) to assure compliance with Section 106 and 36 C.F.R. 800 prior to operation of the Project.

3.10.3.4.5 Cemetery Mitigation Alternatives

In addition to the flowage easements and clean-up assistance, the Diversion Authority proposes to meet with a representative from each cemetery to discuss technically-feasible options for each location. These meetings would be conducted in conjunction with the Local Cemetery Mitigation Team comprised of representatives from entities in Minnesota and North Dakota. The Federal Cemetery Mitigation Plan that was completed in 2015 included a table of mitigation alternatives for each of the impacted sites. The

mitigation alternatives included: berms, offsite access, debris fencing, anchoring of headstones, and raising the elevation of the land itself.

It should be noted that the federal study identified a number of cost-prohibitive actions, technical aspects and potentially-adverse effects on historic integrity that may make one or more of the mitigation alternatives infeasible to be utilized on some sites. Thus, the Diversion Authority has indicated that the approach to cemetery mitigation will be site-specific, since each site provides a unique situation and must be handled individually. In addition, the information and feasible options for each site may also vary, and the Diversion Authority will respect both when developing the appropriate mitigation for each cemetery. Consideration for impacts associated with floods larger than the 100-year flood event will be made when developing final mitigation decisions. Those considerations should include adequate design, technical feasibility, and cost.

3.10.3.5 Organic Farm Mitigation

The PRAM Plan (Appendix F) outlines proposed mitigation for traditional and organic agricultural lands. For traditional farmland in the upstream mitigation area, the Project will need to obtain a flowage easement on the property. For organic farmland, there is a chance that flooding could result in loss of organic certification, which requires three to five years to establish. To address these organic farm impacts, the Diversion Authority has developed an Organic Farmland Acquisition Plan.

Organic Farmland Acquisition Plan

The Diversion Authority proposes offering early acquisition of organic farmlands in the upstream mitigation area so that the organic farmers would have the opportunity to establish organic certification on new lands outside of the upstream mitigation area well in advance of Project operations. Upon acquisition of existing organic farmland, the Diversion Authority would enter into a rental agreement with the current organic farm operator to rent the existing organic farmland during the timeframe in which the organic certification is being established on new lands, which is typically three to five years.

As described above in section 3.10.2.2, there are four organic farming operations within the vicinity of the upstream mitigation area of the Project, two of which will be newly-inundated under Plan B.

If desired by the organic farmland property owner, the Diversion Authority would initiate the Organic Farmland Acquisition process by ordering an appraisal of the property. The appraisal would be prepared following state and federal rules for valuing property rights, and the appraisal would establish the minimum value for acquiring the property in fee title. Representatives from the Diversion Authority would present the appraisal and initial purchase offer to the property owner for consideration and to begin negotiations. The purchase agreement would be structured to allow a 1031 type tax exchange transaction.

The Diversion Authority would attach a flowage easement to the property upon acquisition. The Diversion Authority would engage its farmland management firm to develop a farmland rental agreement with the organic producer. Ultimately, after allowing sufficient time for the organic producer to establish new organic certified farmland, the Diversion Authority would conduct a public sale of the property.

If the organic farmland owner declines to participate in this program, the typical land mitigation approach would be used for the organic farmlands.

3.10.3.6 Flowage Easement Value

The Diversion Authority is currently creating a Flowage Easement Valuation Study that will help gather data for establishing flowage easement values. Establishing appropriate values for flowage easements depends on the final configuration of the Project, which includes defining the exact location of the Upstream Mitigation Area, further detailed technical analysis, hydraulic modeling, and permitting. The Diversion Authority commissioned Phase 1 of a customized flowage easements valuation study in December 2017. Phase 1 of the flowage easement valuation study is a research and development effort with an expected delivery date of August 31, 2018.

Phase 1 of the Flowage Easement Valuation Study includes researching land sales in the Red River Valley and from other markets across the country. The research of land sales includes finding sales of land with and without flood risk so that a “matched pairs” analysis can be conducted to determine the extent that flooding risk changes the value of the sale. In addition, due to the amount of data and the numerous variables that impact land values, a computer model will be created to assist the appraisal team to isolate market factors that cause a differentiation of value. The computer model will also incorporate hydrological data from various flood events and agronomic data such as seasonal planting times.

The Phase 1 study is being conducted prior to final definition of the Project location, boundaries, and operation of the Property Rights Area. Phase 1 of the study was commissioned to proceed in a parallel timeframe to the development of Project refinements and permitting reviews. Future phases of the Flowage Easements Valuation Study are expected to incorporate the final hydraulic modeling and design of the Project, and will allow the Diversion Authority to provide an easement valuation unique to each parcel. It is expected that future phases will be commissioned if Plan B is confirmed.

4.0 Cumulative Potential Effects

4.1 CUMULATIVE POTENTIAL EFFECTS: PLAN B UPDATES

Cumulative potential effects (CPE) are environmental or social effects that result from the proposed project in conjunction with other projects in a given area. The effects from any one project may be small; however, the aggregated effects from all the projects together may be significant. (Minn. R. 4410.0200, subpart 11a.) This chapter builds off the CPE analysis that was conducted as part of the 2016 Final EIS. The extent of the CPE update is an evaluation of reasonably foreseeable projects that could potentially have environmental interactions with the proposed Project and descriptions of CPE that have changed due to identification of different reasonably foreseeable projects. Portions of the 2016 Final EIS that do not require updates include:

- Differences between state and federal CPE requirements
- Minnesota CPE analysis methodology
- Environmental Resource Categories that are analyzed for CPE
 - Aquatic Habitat
 - Wildlife Resources
 - Fish Passage/Biological Connectivity
 - Cultural Resources
 - Socioeconomics
 - Stream Stability
 - Hydrology and Hydraulics
 - Wetlands

4.1.1 Proposed Reasonably Foreseeable Projects

The 2016 Final EIS identified five reasonably foreseeable projects as part of the CPE evaluation:

- Wolverton Creek Restoration and Sediment Reduction Project.
- Manston Slough Wildlife Pool Management.
- Cass County Drain 21 Improvements.
- Cass County Drain 45 Improvements.
- Cass County Drain 30 Channel Improvements.

The Wolverton Creek Restoration and Sediment Reduction Project is the only reasonably foreseeable project identified in the 2016 Final EIS that has not been completed. For this Supplemental EIS, the other four projects will not be included for evaluation of CPE, as these projects now represent the existing environment.

The Diversion Authority reached out to other jurisdictions within the Project Area to identify if there are any new reasonably foreseeable projects that need to be included for this updated CPE. This effort only identified one reasonably foreseeable project by the Buffalo-Red River Watershed District (BRRWD). The BRRWD has received an improvement petition for Clay-Wilkin Judicial Ditch (J.D.) No. 1. The improvement would begin at the outlet of the main ditch into Wolverton Creek in Section 27 of Holy Cross Township and proceed upstream for approximately 3.2 miles ending in Section 30 of Alliance Township. It is anticipated that this project could be built in 2019.

The lack of reasonably foreseeable projects identified by this effort could be the result of local engineering staff or others contacted not fully understanding how environmental effects from a different types of projects can interact.

DNR determined that planned projects within the cities of Fargo and Moorhead to address flood risk constitute reasonably foreseeable projects subject to cumulative potential effects analysis.

Table 4-1 Reasonably Foreseeable Projects

Reasonably Foreseeable Project	Project Location	Applicable Environmental Impact Category
Wolverton Creek Restoration and Sediment Reduction Project	Holy Cross Township, Clay County; and Wolverton Township, Roberts Township, and Mitchell Township, Wilkin County	Hydrology Stream Stability Wetlands Fish Passage Wildlife Resources Cultural Resources
J.D. No. 1 Improvements	Holy Cross and Alliance Townships, Clay County	Hydrology Stream Stability Wetlands Socioeconomic
In-town Flood Risk Reduction Projects	Cities of Fargo and Moorhead	Hydrology Socioeconomics

Source: Diversion Authority

4.1.1.1 Wolverton Creek Restoration and Sediment Reduction Project

Wolverton Creek is the outlet for numerous ditch systems and drainage systems that contributes to high sediment loading and increased turbidity in the Red River. The BRRWD, with cooperation from Clay and Wilkin County Soil and Water Conservation Districts and Minnesota Board of Water and Soil Resources (BWSR), has been planning and developing the Wolverton Creek Restoration and Sediment Reduction project (Wolverton Project) over the past several years.

The intent of the Wolverton Project to is to reduce erosion and sedimentation along the portions of the restored stream channel and areas downstream. The Wolverton project would be a restoration of Wolverton Creek from United States (U.S.) Highway 75 upstream to the east boundary of Section 17, Township 135 North, Range 47 West (Mitchell Township), Wilkin County. The Wolverton project includes channel restoration to stabilize slopes and establish vegetation, side inlet sediment controls on gullies and ditches, buffer strips, channel grade control, and instituting conservation tillage programs, all to reduce erosion and sedimentation.

The BRRWD received the work in public waters permit from the DNR early in 2015 and expected to start construction in 2018.

4.1.1.2 J.D. No. 1 Improvement Project

The petition received by the BRRWD identifies the location and need for the J.D. No. 1 Improvement Project. The proposed drainage improvement would be for that portion of the main ditch located in Sections 25, 26 and 27, Holy Cross Township, Clay County, T137N, R40W, and the West ½ of Section 30, Alliance Township, Clay County, T137N, R47W. The proposed improvement would be approximately 16,833 feet beginning at Wolverton Creek and continuing upstream (within the ditch) to the east where the main drain meets with Branch No. 1 of Clay-Wilkin J.D. No. 1

4.1.1.3 In-town Flood Risk Reduction Projects

The Diversion Authority has identified the following flood risk reduction projects that are planned, but not constructed:

Fargo

- Drain 27 inlet culvert replacement
- North Side Protection – Drain 10
- Royal Oaks Levee
- Elm Circle
- Riverwood
- Woodcrest
- Oak Grove
- 1-29 Ditch
- Oakcreek, Copperfield Court
- Belmont
- Harwood, Hackberry, River Drive gaps
- 64th Ave Borrow Pit/Bison Meadows
- Rosewood
- Estimated \$46,000,000 in Stormwater Lift Station Improvements

Moorhead

- North Moorhead
- Moorhead Center mall Sanitary Lift Station #2
- 1st Avenue North Levee
- Riverview Circle
- Estimated \$48,000,000 in Stormwater Lift Station Improvements

4.2 CUMULATIVE POTENTIAL EFFECTS

The 2016 Final EIS included the following environmental impact categories for the CPE evaluation:

- Fish Passage and Biological Connectivity
- Cultural Resources
- Socioeconomics
- Stream Stability

- Wildlife Resources
- Hydrology and Hydraulics
- Wetlands

These environmental impact categories represent environmental effects from the proposed Project that may have interacted with environmental effects from the five reasonably foreseeable projects identified in the 2016 Final EIS. The interaction of CPE between the previously-proposed Project and the Wolverton Creek Restoration project is different than the interaction of CPE between Plan B and the Wolverton Creek. The previously-proposed Project had the Red River Control Structure (RRS) downstream of the confluence of Wolverton Creek and the Red River. This would have resulted in portions of the Wolverton Creek being inundated during Project operations. Plan B proposes the RRS upstream of the Red River/Wolverton Creek confluence and the Project also includes an Eastern Tieback levee from the RRS that would prevent Red River flood water from flowing overland into the bottom several miles of Wolverton Creek. The Eastern Tieback levee also intersects Wolverton Creek where three box culverts are proposed to allow flows from Wolverton Creek to enter the benefitted area.

The change in proposed Project interaction with the Wolverton Project and the addition of J.D. No. 1 Improvement Project require another assessment of environmental impact categories from Plan B that could interact with these two reasonably foreseeable projects. The nature of these water resource restoration and drainage improvement projects would likely have environmental effects associated with fish passage and biological connectivity, stream stability, wildlife resources, hydrology and hydraulics, and wetlands. For this SEIS, the environmental categories of fish passage and biological connectivity, stream stability and wildlife resources have been combined into one category called Aquatic and Terrestrial Resources.

The Wild Rice River Control Structure (WRRS) and the Wolverton Creek box culverts creates a cumulative potential effect to fish passage and biological connectivity for these water courses. As identified in Chapter 3, the estimated velocities through these structures at flood events below 21,000 cfs have the potential to limit or prevent upstream passage. There are also existing road crossings near the proposed structure that have increased velocities, which would be estimated to increase after Project construction. An approximate 8,000 foot section of the Wild Rice River would have the I-29 crossing, the WRRS and the Section 10/11 township road crossing all with estimated water velocities over 2.5 ft/second during a 10-year flood event. An approximate 10,000 foot section of Wolverton Creek would have the 170th Avenue crossing, Wolverton box culverts (Eastern Tieback Levee) and 180th Avenue crossing all with estimated water velocities over 3 ft/second during a 10-year flood event. The combined effect of these features could create multiple difficulties for fish passage and biological connectivity for each of these water courses.

4.2.1 Aquatic and Terrestrial Resources

Plan B would have long term impacts to aquatic habitat, stream stability, fish passage and biological connectivity. The Wolverton Project may have short, negative impacts to these same resources during project construction, however the timing of the Wolverton Project is such that all construction would be complete before any Plan B impacts begin. After construction, it is anticipated that the Wolverton Project would be beneficial to aquatic habitat, stream stability, fish passage and biological connectivity. As such, it is unlikely these benefits would combine with Plan B impacts to either exacerbate or alleviate impacts. The portions of the Wolverton Project upstream of the Eastern Tieback Levee could receive additional flood inundation during project operations, which would result in additional sedimentation within Wolverton Creek. The placement of the Plan B box culverts in Wolverton Creek could undermine

some of the aquatic habitat, stream stability, fish passage and biological connectivity benefits of the Wolverton Project.

The J.D. No. 1 Improvement Project is not anticipated to result in direct impacts to aquatic habitat, stream stability, fish passage or biological connectivity.

4.2.2 Hydrology and Hydraulics

Plan B operations would significantly change the hydrology and hydraulics of flood events in the Project Area. The Wolverton Project is not anticipated to result in any changes to hydraulics or hydrology during flood events when Plan B would operate. Smaller flood events may see a change in hydrology because the Wolverton Project would create additional riparian buffers and other features to slow the discharge of water to Wolverton Creek. The J.D. No.1 Improvement Project would expand drainage from its stretch of the landscape into Wolverton Creek. This could change hydrology in Wolverton Creek. The degree of change would not likely be significant, especially when compared to the degree of change that would occur during Plan B operation. The J.D. No. 1 Improvement Project could result in additional water entering the Plan B Benefitted Area during project operation. The In-town Flood Risk Reduction Projects include construction or enhancement of levees that would affect the hydraulics of floodwaters through town. For purposes of this Supplemental EIS, those areas were assumed to have emergency measures in place, so the hydraulics analyzed are not materially different than would be the case with these in-town projects in place.

4.2.3 Wetlands

Plan B would result in a direct impact to thousands of acres of wetland and potential additional indirect wetland impacts due to inundation from project operation. The Wolverton Project is not anticipated to have negative long-term wetland impacts. The J.D. No. 1 Improvement Project could result in direct and indirect wetland impacts from construction and draining of wetlands near its project area. The potential wetland impact from the J.D. No. 1 Improvement Project would be very small compared to the Plan B wetland impacts. It is not anticipated that wetland impacts from the combined Plan B and J.D. No. 1 Improvement Project would be any more exacerbated than the Plan B impacts alone.

4.2.4 Socioeconomics

In-town Flood Risk Reduction Projects would involve land acquisition to allow a flood stage of 37 feet through town. One hundred-eleven (111) properties would need to be acquired within the Cities of Fargo and Moorhead. These landowners would receive fair-market value for their property, but there could be some limited economic impact depending on the existing use of the property. The social impact of losing property is probably the larger portion of the impact for these projects.

4.3 SUMMARY

The size, scale and magnitude of Plan B is such that environmental impacts from other reasonably foreseeable projects are minor in comparison. The addition of environmental effects from other projects combining with Plan B effects results in minor potential increases to the resources being affected. No potentially affected resources were identified as being particularly susceptible to the minor additional environmental effects from the other identified projects combining with Plan B effects.

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5.0 Comparison of Alternatives

This chapter compares the impacts and/or benefits of the No Action Alternative (with Emergency Measures) to the previously-proposed Project and Plan B. These three alternatives were selected to provide a more consolidated description of differences between current conditions (i.e., the No Action Alternative (with Emergency Measures)), the previously-proposed Project and Plan B. More importantly, these three alternatives were selected to assist with the 2018 permit application decision.

The DNR is not required to name a “preferred alternative” in this document. Rather, the purpose of environmental review is to provide information to the public and units of government on the environmental impacts of a project before approvals or necessary permits can be issued. After projects are completed, unanticipated environmental impacts can be costly to undo, and environmentally-sensitive areas can be impossible to restore. Environmental review creates the opportunity to anticipate and correct these problems before projects are built (EQB, 2015). While the EIS must be used as a guide, the summary information presented in this chapter will add utility to the document as a guide in issuing, amending, and denying permits and carrying out other governmental responsibilities to avoid or minimize adverse environmental effects and to restore and enhance environmental quality.

The Comparison of Alternatives (Table 5-1) also serves the purposes of Minnesota Statutes 2008, section 116D.04, subdivision 6 that states:

“Subdivision 6. Prohibitions. No state action significantly affecting the quality of the environment shall be allowed, nor shall any permit for natural resources management and development be granted, where such action or permit has caused or is likely to cause pollution, impairment, or destruction of the air, water, land or other natural resources located within the state, so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the public health, safety, and welfare and the state's paramount concern for the protection of its air, water, land and other natural resources from pollution, impairment, or destruction. Economic considerations alone shall not justify such conduct.”

Permitting authorities can use Table 5-1 to get a general sense of which alternative poses fewer environmental consequences and greater social and/or economic benefit. Details of bulleted items in Table 5-1 can be referenced and reviewed in Chapter 3 (both the FEIS and DSEIS) under the respective topic subsection (Chapter 3 subsections listed under each topic name in the table). When weighing information, Minnesota Statute directs that economic considerations alone shall not be used a basis to deny or grant a permit. Similarly, environmental impacts should be taken in context when making the judgment of which alternative to permit. When considering permit conditions, permittees should also reference Chapter 6—Effectiveness of Proposed Mitigation Measures, which identifies additional proposed mitigation measures that could reasonably eliminate or minimize environmental impacts of Plan B.

5.1 COMPARISON NOTE

Table 5-1 presents data using two different hydrologic models. A SEIS is intended to supplement data included in a previous Final EIS, so the data presented below for the previously-proposed Project presents impact numbers obtained from the 2016 Final EIS, which relied on the Expert Opinion Elicitation Panel (EOEP) hydrology. Data presented for the No Action Alternative (with Emergency Measures) and Plan B relied on the updated Period of Record (POR) hydrology. Using the POR hydrology is a lower 100-year event that what was used to evaluate the previously-proposed Project in the 2016 Final EIS.

Since the 2016 permit application for the previously-proposed Project was denied, DNR determined those impacts did not require updating. Thus, comparisons of impacts should be understood as estimated and be used as a general guide only. For the purposes of the pending 2018 permit application decision, DNR would only compare Plan B to other reasonable alternatives, which given the lack of other reasonable alternatives (see Chapter 2 and Appendix B for reasoning), would be the No Action Alternative (with Emergency Measures). The previously-proposed Project is not evaluated in this SEIS and only included for informational purposes.

Table 5-1 Summary of Environmental and Socioeconomic Effects for previously-proposed Project, Plan B and No Action Alternative (with Emergency Measures)

Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
Hydrology and Hydraulics (see Section 3.2)	<ul style="list-style-type: none"> • 118,513 total inundated acres in Project Area (includes base flooding). • 20,461 acres newly-inundated in Project Area, 100-year flood. • 72,924 acres protected from inundation in Project Area. • Flows through town to River Stage (RS)35. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project, with the following differences: <ul style="list-style-type: none"> ○ 123,954 total inundated acres in Project Acres (includes base flooding). ○ 12,049 acres newly-induced in Project Area (3,534 acres in MN and 8,183 acres in ND). ○ 56,882 acres protected from inundation in Project Area. ○ (3) 10’x10’ box culverts crossing Wolverton Creek. ○ Increased flows through town from RS35 to RS37. 	<ul style="list-style-type: none"> • 168,786 total acres inundated in Project Area. • No new dams, aqueducts, channel abandonments, or box culverts. • No flood risk transfer.
FEMA Regulations and the CLOMR Process (see Section 3.3)	<ul style="list-style-type: none"> • Areal extent of 100-year flood inundation required for Project operation in the staging area would be mapped as floodway. Any additional flood inundation area beyond the staging area but within the FEMA revision reach would be mapped as floodplain. • A FEMA-approved Conditional Letter of Map Revision (CLOMR) would be required. • After Project completion, a Letter of Map Revision (LOMR) would be submitted. 	<ul style="list-style-type: none"> • Same as under Proposed Project, with the following difference: <ul style="list-style-type: none"> • Comstock would not need their maps revised. 	<ul style="list-style-type: none"> • No Existing FEMA mapped flood risk would apply. Additional flood damage reduction projects or flood assessments could result in FEMA map revisions.

Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
<p>Wetlands (see Section 3.4)</p>	<ul style="list-style-type: none"> • 1,820 wetland acres directly impacted from diversion channel, connecting channel, excavated material berms, shallow drainage ditches outside berms, tieback embankments, roads, control structures, and OHB ring levee (1,820 acres; mostly seasonally flooded basin types). • Direct Wetland Impact from Comstock Levee (estimated to be less than 5 acres). • Direct wetland impact from Drayton Dam Mitigation Project (0.5 acres). • Indirect and temporary impacts to 151 (estimated) acres in inundated areas. • Indirect impact by changing wetland function/type from Rush/Lower Rush River bisect. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project, with the following differences: <ul style="list-style-type: none"> • 1,718 acres of direct wetland impact (a total of 38 acre reduction). • The estimate for wetland impact from the diversion channel was reduced by 2 acres due to a change in the method of calculation. • Wetland impacts from Dam/Southern Embankment 244 acres (about 36 acres reduction). • Indirect wetland impact of 253 acres (about 100 more; difference may be influenced by different methodology for estimation). • Forest impacts and mitigation have been removed from wetlands impact and mitigation. Addressed separately. • No Comstock Ring Levee needed, therefore, those acres would not be impacted. • Impacts from Drayton Dam are uncertain, as that piece of mitigation is not committed. 	<ul style="list-style-type: none"> • Emergency measures could result in some indirect wetland impact from additional inundation.

Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
Aquatic and Terrestrial Resources (see Section 3.5)	<ul style="list-style-type: none"> • Inundation Area: direct impact by increased depth and duration of flooding. Increased duration could reduce soil bank strength and be more prone to collapse. Increased sedimentation would occur incrementally over decades. If flood inundation extends into the growing season, plants are likely to be stressed, which could make them susceptible to disease and insect infestations. • Rush/Lower Rush Rivers: potential aggradation from sediment in abandoned river sections. • Control Structures: Increases potential for bed and channel scour. • Aquatic Habitat Impact: 37.4 acres. • Direct loss of river channel to Rush and Lower Rush Rivers: 2.3 and 2.7 miles, respectively. • Direct impact: 62 acres forest. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project, with the following differences: <ul style="list-style-type: none"> • Limiting operation to flows above 21,000 cfs reduces potential for stream stability impacts. • Limiting operation to flows above 21,000 cfs reduces potential fish passage impacts due to hydrology alteration. • Three Wolverton box culverts increase potential impact to biological connectivity due to high velocities. • Aquatic Habitat Impact increases to 44.1 acres. • Direct impact to forests increases to 124 acres. 	<ul style="list-style-type: none"> • Aquatic and Terrestrial Resources would remain similar to existing conditions.
Cultural Resources (see Section 3.6)	<ul style="list-style-type: none"> • Upstream Inundation Area—11 cemeteries with varying level of impact. 	<ul style="list-style-type: none"> • Upstream Inundation Area—5 cemeteries with varying level of impact. • The extent of inundation would result in different impacts. 	<ul style="list-style-type: none"> • Upstream Inundation Area—7 cemeteries with varying level of impact.

Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
Infrastructure (see Section 3.7)	<ul style="list-style-type: none"> • Impacts to infrastructure include severed roadways by the diversion channel, roadway alterations, reconstruction, and rerouting, and raised roadways to higher elevations to provide access during flooding, as well as potential detours and rerouting of existing service routes. • The North Dakota Western would impact four roads. • The tieback embankment in Minnesota would impact five roads. • Traffic patterns, primarily within the staging area, would permanently change. • Interstate Highway 29 and United States (U.S.) Highway 75 would be elevated to maintain traffic routes during high flows while in operation. The BNSF Moorhead Subdivision Rail Line would also be raised to a higher elevation. Except for OHB and Comstock ring levee access roads, all other roadways in the inundation areas would be allowed to flood. • Flood impacts to BNSF mainline operations through the Benefited Area would be minimized. • OHB Levee construction would impact Cass County Highway 81, Cass County road 18, and Cass County Highway 25. • Comstock Levee would require Clay County Highway 2 to be raised to a higher elevation. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project, with the following differences: <ul style="list-style-type: none"> ○ Comstock Ring Levee is not required, thus no impact to Clay County Highway 2. ○ U.S. Highway 75 would not need to be raised. ○ BNSF Railroad would not need to be raised. ○ 6 additional roads would be impacted in Clay and Cass Counties. ○ Cass Rural Water Users District water treatment plant (near St. Benedict's) would be impacted. 	<ul style="list-style-type: none"> • Infrastructure impacts would remain similar to existing conditions.

Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
Land Use Plans and Regulations (see Section 3.8)	<ul style="list-style-type: none"> • Under Project conditions, upstream flooding would discourage development in inundated areas. • The Project may not be consistent with Comprehensive Plan goals to facilitate traffic movement for the Townships of Mapleton, Pleasant or Warren. • The Project may not be consistent with Pleasant Township’s zoning ordinance to “protect public health, safety, morals, comfort, convenience, prosperity and general welfare.” • The Project may not be consistent with Holy Cross Township’s interim ordinance establishing a moratorium on water impoundment projects. • Project construction and operation may require various LGU approvals, Conditional Use Permits, review of floodplain maps, and zoning amendments. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project, with the following differences: <ul style="list-style-type: none"> ○ Less inundation impact to potential land uses in Richland and Wilkin Counties. ○ Reduced protection of undeveloped floodplain in the benefitted area. 	<ul style="list-style-type: none"> • Land uses proposed would need to comply with existing floodplain regulations.
Minnesota Dam Safety and Work in Public Waters Regulations and Permitting (see Section 3.9)	<ul style="list-style-type: none"> • Dam Safety and Work in Public Waters permits required. 	<ul style="list-style-type: none"> • Similar to previously-proposed Project impacts, with the following differences: <ul style="list-style-type: none"> • Wolverton Creek box culverts would be included in the permit decision. • Potential Dam breach would affect different areas. 	<ul style="list-style-type: none"> • No high hazard dam. No permits required.

<p>Socioeconomics (see Section 3.10)</p>	<ul style="list-style-type: none"> • Estimated cost \$1.79 billion. • 828 Damaged Structures, 100-year: 511 (62%) in ND and 317 (38%) in MN. • 230 parcels impacted, 100-year: 163 (71%) in ND and 67 (19%) in MN. • Estimated average residual annual damage: \$10 million, a reduction over Base No Action in ND and MN of 84% and 38%, respectively. • Estimated Cost of Land Acquisition and Damages: \$265,022,680. • Average annual disruption cost from loss of building function to ND and MN are \$1 million and \$0 million, respectively. • Average annual relocation costs to ND and MN are \$8 and \$1 million, respectively. • Flood insurance costs reduced by 17,714 structures in F-M urban area. • Average annual business losses in ND and MN are \$183 million and \$18 million, respectively. • Social disruptions in the upstream inundation area. • Potentially reduced tax revenue, student populations and property tax base in upstream inundation areas. • Buyouts, relocations and non-structural measures could cause stress for those residents. • Property owners in inundated areas could experience loss of income and property value. • Temporary construction disruptions for residents behind community ring levees (e.g., OHB ring levee). • Indirect impact to residents regarding perception of living behind a community levee. • Due to the additional flood risk of the Project, Comstock residents would be expected to experience higher levels of stress and anxiety than they do under the baseline condition. • Flooding could reduce the economic vitality of Comstock as businesses might relocate to other areas not prone to flooding. 	<ul style="list-style-type: none"> ○ Similar to previously-proposed Project impacts, with the following differences: <ul style="list-style-type: none"> ○ Economic and costs were not reevaluated for Plan B. ○ 698 Damaged Structures, 100-year: 519 (74%) in ND and 179 (26%) in MN. ○ 405 parcels impacted, 100-year: 284 (70%) in ND and 121 (30%) in MN. ○ Approximately 474 acres of inundation to organic farms (between 2 organic farms; represents about 11% of the total organic farm acreage) impacted by Project. ○ Comstock would not need a ring levee. ○ Under a 100-year event for Plan B, Minnesota experiences 27% of the inundation and North Dakota experiences 73%. 	<ul style="list-style-type: none"> • 539 Damaged Structures, 100-year: 413 (77%) in ND and 126 (23%) in MN. • 411 parcels impacted, 100-year: 283 (69%) in ND and 128 (31%) in MN. • 516 acres of inundated organic farmland (represents about 12% of the total organic farm acreage) • Under a 100-year event, Minnesota experiences 23% of the inundation and North Dakota experiences 77%.
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Topic	Previously-proposed Project (based on EOEP hydrology, 100-year flood, unless otherwise noted)	Plan B (based on POR hydrology, 100-year flood, unless otherwise noted)	No Action Alternative (with Emergency Measures) (based on POR hydrology, 100-year flood)
	<ul style="list-style-type: none"> • The Comstock ring levee may restrict future development due to the increased flood risk in and around the area. Fiscal requirements and resources of school districts would be both positively and negatively affected by the Project. • Construction and operation could impact drinking water wells. • Construction and operation could impact newly inundated septic systems with a modification cost of \$15-20,000 each (residential). • Construction of new insurable structures in FEMA Revision Reach would be limited. • Existing farm buildings in staging area and FEMA Revision Reach would not be compatible with flooding. • Potential for grain and livestock feed spoilage in inundated areas. • Approximately 2,200 acres of inundation to organic farms (between 4 organic farms; about 50% overall organic farm land) impacted by Project. • Construction and operation would reduce stress and threats to life/safety associated with flood fighting in protected and mitigated areas. • MN is affected socially and economically by flooding in Fargo (loss of employment or income). • Operation and maintenance of the Project is expected to provide employment opportunities. 		

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6.0 Proposed and Recommended Mitigation and Monitoring

Minnesota Rules, part 4410.2300 states that the Environmental Impact Statement (EIS) must include mitigation measures that could reasonably eliminate or minimize any adverse environmental, economic, employment, or socioeconomic effects of the Project. The mitigation and monitoring proposed by the USACE and Diversion Authority was evaluated in the Diversion Authority's 2016 permit application. The findings of fact for the 2016 permit application identified insufficient mitigation as a reason, among others, for the permit application denial. The 2018 permit application proposes different mitigation and monitoring (see Appendices F and G). Proposed mitigation would be a combination of USACE and Diversion Authority responsibilities. The environmental mitigation and monitoring is located within the USACE's Adaptive Management and Monitoring Plan (Appendix G). Other proposed mitigation can be found in the Diversion Authority's Property Rights Acquisition and Mitigation Plan (Appendix F).

This chapter includes a description of major differences between the 2016 and 2018 Mitigation and Monitoring plans and proposals, and an evaluation of updated mitigation and monitoring sufficiency. Where needed, additional mitigation and monitoring measures were developed by technical and subject matter experts and are provided for consideration by the Diversion Authority, USACE and regulators. This comparison can help regulators determine if previous concerns about mitigation sufficiency have been addressed with the new proposals.

Table 6-1, below, organized by impact area, summarizes the major differences between the 2016 and 2018 Mitigation and Monitoring plans and proposals and provided recommended additional mitigation and monitoring identified during the development of this EIS.

Table 6-1 Mitigation and Monitoring; Major Differences Between the 2016 and 2018 Proposals, and SEIS Recommendations

Impact	2016 Proposed Mitigation and Monitoring	2018 Proposed Mitigation or Monitoring	SEIS Recommended Mitigation and Monitoring
Structure Impacts up to 100-year	Based on depth and location: acquisition, relocation, or evaluated for non-structural measures.	No Change.	No additional recommendations or requirements at this time.
Structure Impacts greater than 100-year	The FEMA/USACE Coordination Plan did not address mitigation above the 100-year flood event	The Diversion Authority proposes to obtain property rights up to the maximum pool elevation (i.e., above the 100-year). (PRAM Plan, Appendix F)	Rights or interests would need to be acquired prior to impactful activities.
Land Impacts greater than 100-year	The FEMA/USACE Coordination Plan did not address mitigation above the 100-year flood event.	The Diversion Authority proposes to obtain property rights up to the maximum pool elevation (i.e., above the 100-year). (PRAM Plan, Appendix F)	Rights or interests would need to be acquired prior to impactful activities.
Land Impacts up to 100-year	The FEMA/USACE Coordination Plan did not address mitigation above the 100-year flood event. EIS Recommendations at the time included providing supplemental crop insurance, providing private land debris clean-up assistance, early-buy out options, and considering "loss of going concerns".	The 2018 Plan includes a supplemental crop insurance plan, provides for private land debris clean-up assistance, and includes early buy-out options. (PRAM Plan, Appendix F)	Flowage easements must consider "Going Concerns" for Minnesota businesses per Minnesota Constitution.
Organic Farms	In the 2016 Plan, the FEMA/USACE Coordination Plan proposed flowage easements.	The 2018 Plan includes an Organic Farm Acquisition Program. (PRAM Plan, Appendix F)	No additional recommendations or requirements at this time.

Impact	2016 Proposed Mitigation and Monitoring	2018 Proposed Mitigation or Monitoring	SEIS Recommended Mitigation and Monitoring
Cemeteries	The 2016 Plan did not commit to proposed cemetery mitigation measures beyond federal requirements for flowage easements in the staging area.	The 2018 Plan extends flowage easements to cemeteries outside the staging area and within the property rights area. The Diversion Authority will also provide post-operation clean-up assistance for cemeteries, and pending future discussions, would commit to additional non-structural measures. (PRAM Plan, Appendix F)	No additional recommendations or requirements at this time.
Aquatic Habitat	The 2016 Plan proposed stream restoration and construction of habitat features in constructed channels.	The 2018 Plan identified potential mitigation options including restoration of Bois de Sioux River, Lower Otter Tail River, or Sheyenne River. Various fish passage project and habitat features in constructed channels. (AMMP, Appendix G)	More robust assessment of habitat impacted to ensure mitigation is suitable. Adopt an alternative method to guide stream habitat mitigation that does not rely upon site specific IBI scores.
Stream Stability	The 2016 Plan relied heavily on stream monitoring and conceptual mitigations (but did not commit). EIS recommendations at the time strongly encouraged more detail and committed language.	The 2018 Plan has not materially changed due to project operations being limited to flood event discharges over 21,000 cfs, which will help reduce stream stability impacts. (AMMP, Appendix G).	AMMP needs more detail on triggers for action based on monitoring results and identification of adaptations that could be implemented.

Impact	2016 Proposed Mitigation and Monitoring	2018 Proposed Mitigation or Monitoring	SEIS Recommended Mitigation and Monitoring
Wetland Impacts	The 2016 Plan called for 2:1 ratio for floodplain forest impacts. There was no proposed mitigation or monitoring for indirect wetland impacts. EIS recommendations at the time called for a more robust wetland monitoring.	The 2018 Plan proposes mitigation of direct impacts from diversion channel OHB levee as required by permit approvals and wetland bank mitigation for direct impacts from the Southern Embankment. Monitoring proposed for wetlands indirectly impacted by inundation. (AMMP, Appendix G)	Identify wetlands most likely to be impacted by increased inundation and develop mitigation for acreages and functions of that subset of wetlands.
Fish Passage and Biological Connectivity	The 2016 plan included monitoring fish, macroinvertebrates, and habitat. Mitigation included removal of the Wild Rice River dam, constructing Drayton Dam fish passage, and creating a sinuous channel in the diversion. EIS recommendations at the time called for greater and more robust monitoring, construction avoidance periods, and considering ways to operate less.	The 2018 Plan removes all of the previous-proposed mitigation for biological connectivity, including Drayton dam fish passage project (due to project operations being limited to flood discharges over 21,000 cfs). This mitigation was replaced with monitoring. (AMMP, Appendix G)	Maintain Drayton Dam fish passage to mitigate all impacts to fish passage and biological connectivity. Drayton Dam modification should occur prior to or at a minimum concurrent with the Red River Control Structure construction.
Public and Private Land Debris	The 2016 Plan did not provide mitigation for post-operation debris clean-up on private or public lands (e.g., roads, culverts, ditches)	The Diversion Authority proposes a Debris Clean-up and Repair program for public lands, which allows for reimbursement of clean-up costs. Private land clean-up would include pick-up, but not reimbursement. (PRAM Plan, Appendix F)	No additional recommendations or requirements at this time.

Impact	2016 Proposed Mitigation and Monitoring	2018 Proposed Mitigation or Monitoring	SEIS Recommended Mitigation and Monitoring
Permits and Regulations	The USACE has indicated regulations would be followed as required by federal law, and would continue to work with state and local entities for Project implementation. EIS recommendations at the time included "no build zones" downstream of the dam.	No Change.	Enhanced land use controls (e.g., "no build zones") downstream of the dam in the benefited area (e.g., the hydrologic shadow of the dam).

7.0 Consultation and Coordination

7.1 COORDINATION

State and federal agencies have participated in the preparation of the Draft Supplemental Environmental Impact Statement (Draft SEIS). The Minnesota Environmental Policy Act (MEPA) governs the process for evaluating potential environmental and socioeconomic impacts, and mitigation options, proposed for Plan B and its alternatives. Agency representatives relied on MEPA for developing the scope for the Draft SEIS. Following is a description of the core agencies involved.

7.1.1 Minnesota Department of Natural Resources

Staff in the DNR Divisions of Ecological and Water Resources and Fish and Wildlife were involved with the preparation of the Draft SEIS. DNR Division of Ecological and Water Resources provided project management support for the Draft SEIS process which included review and approval of work plans, analyses, impact assessments, and technical reports/memoranda.

7.1.2 Diversion Authority

The Project Proposer is the Flood Diversion Board of Authority (Diversion Authority). The Diversion Authority and its members worked with the USACE on the Fargo-Moorhead Metropolitan Flood Risk Management Plan B. The Diversion Authority, as the Project Proposer, provided data and information used in this Draft SEIS.

7.1.3 United States Army Corps of Engineers

The USACE is working with the Diversion Authority to design and construct Plan B. USACE is also a collaborative partner with DNR in the implementation of MEPA in addition to acting as the lead agency in implementing NEPA requirements for the Project. The USACE assisted in gathering information used in this Draft SEIS.

7.2 PUBLIC INVOLVEMENT

The SEIS scoping process included public notifications and opportunities for the public to learn about and comment on the Plan B Project. On May 21, 2018, the DNR published the SEIS Preparation Notice in the *EQB Monitor*, initiating a 20-day public comment period, the purpose for which was identifying potentially significant environmental effects and determining what issues and alternatives to address in the SEIS. The comment period ended on June 11, 2018. Comments received were considered when making revisions to the issues identified in the Preparation Notice for evaluation of the Draft SEIS.

The Draft SEIS was published and circulated in accordance with the rules and requirements of Minnesota Rules Chapter 4410. The Draft SEIS was distributed to allow for a 30-day public comment period. Written comments are accepted during the public comment period. A public information meeting will be held to present information on the Draft SEIS, answer questions, and provide a forum for public comments. Comments received will be considered in assessing the impacts of Plan B and potential mitigation actions for the Final SEIS. Comments received during this period will be responded to and included in the Final SEIS.

8.0 List of Preparers

Table 8-1 List of Preparers

8.1 DEPARTMENT OF NATURAL RESOURCES

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Jason Boyle	State Dam Safety Engineer B.S. University of North Dakota, Civil Engineering; Master of Engineering University of North Dakota, Environmental/Water Resources 18 years of experience
Randall Doneen	Environmental Review Unit Supervisor B.S. Environmental Biology, Humboldt State University 25 years of experience
Kate Fairman	Environmental Review Planning Director B.S. University of Minnesota—Twin Cities in Environmental Science, Emphasis in Soil and Wetland Sciences M.P.A. Minnesota State University – Mankato 11 years environmental permitting and planning experience
Kelsey Forward	Floodplain Hydrologist B.S. North Dakota State University, Geology; M.S. University of North Dakota, Geology; Graduate Certificate University of North Dakota, Geographic Information Science 5 years of experience
Neil Haugerud	River Ecologist B.A. Gustavus Adolphus College, Biology; M.S. South Dakota State University, Wildlife and Fisheries Sciences 12 years of experience
Suzanne Jiwani	Floodplain Mapping Engineer B.S. University of Minnesota, Twin Cities, Civil Engineering; M.S. Colorado State University, Fort Collins, Civil Engineering (Water Resource Engineering) 42 years of experience
Lisa Joyal	Endangered Species Review Coordinator B.S. University of Montana, Wildlife Biology; B.S. University Montana, Zoology; M.S. University of Maine, Orono, Wildlife Ecology 18 years of experience

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Cynthia Novak-Krebs	Environmental Review Intermediate Planner University of Wisconsin-Madison: B.S. Community and Environmental Sociology; M.S. Water Resources Management; M.S. Urban and Regional Planning 1 year environmental review experience
Mary Presnail	Floodplain Hydrologist B.S. University of Minnesota, Environmental Science Policy and Management; M.S. University of Minnesota, Natural Resource Science and Management 6 years of experience
Jaimé Thibodeaux	Environmental Assessment Ecologist B.S. University of Wisconsin-Madison, Wildlife Ecology M.S. Bemidji State University, Biology 15 years of experience
Jill Townley	Project Manager B.E.D. University of Minnesota—Twin Cities, Landscape Architecture; M.U.R.P University of Minnesota—Humphrey Institute, Urban and Regional Planning (Environmental Planning) 12 years of experience
Rita Weaver	Floodplain Action Hydrologist B.C.E., University of Minnesota – Twin Cities, Civil Engineering Certified Floodplain Manager (CFM) 16 years of experience
Jamison Wendel	Red River Fisheries Biologist B.S. North Dakota State University; M.S. University of North Dakota 16 years of experience

8.2 U.S. ARMY CORPS OF ENGINEERS

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Aaron W. Buesing	Hydraulic Engineer B.S. and post-graduate study University of Minnesota, Civil Engineering 27 years of experience
Kevin Denn	Hydraulic Engineer B.S. University of Wisconsin Platteville, Civil Engineering M.S. University of Iowa, Civil & Environmental Engineering 9 years of experience

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Elliott L. Stefanik	Biologist, Chief Environmental Planning Section B.S. University of Wisconsin Platteville, Biology (emphasis in Field Biology); M.S. University of Wisconsin La Crosse, Biology (emphasis in Fisheries) 21 years professional experience
Craig Evans	Planner, Chief Plan Formulation Section B.C.E. University of MN, Twin Cities, Civil Engineering; M.A. Hamline University, Public Administration 28 years professional experience
Derek Ingvalson	Biologist B.S. University of Minnesota – Duluth, Biology; M.S. University of Minnesota, Natural Resources Science and Management 9 years of experience
Rebecca Seal-Soileau	Geologist B.S. University of Minnesota – Institute of Technology, Physics; PhD University of Minnesota, Geology: 26 years of experience
Susan Malin-Boyce	Archaeologist, Environmental Planning Section B.A. Mary Washington College, M.A., M.Phil., Ph.D. New York University, Anthropology, 31 years professional experience
Terry Williams	Program Manager/Chief of Project Management Branch A B. S University of North Dakota, Civil Engineering 32 years of experience

Diversion Authority

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Nathan Boerboom	Division Engineer City of Fargo B.S. North Dakota State University, Civil Engineering 14 years of experience
Erik Nelson	GIS Analyst II Houston Moore Group B.S. University of North Dakota, Geography/GIS 10 years of experience

Name	Environmental Impact Statement (EIS) Role/Area of Expertise and Qualifications
Lyndon Pease	Senior Project Manager Houston Moore Group B.S. South Dakota School of Mines and Technology , Civil Engineering M.S. North Dakota State University, Civil Engineering 11 years of experience
Gregg Thielman	Senior Project Manager Houston Moore Group B.S. North Dakota State University, Civil Engineering 28 years of experience
Greg Thompson	Project Manager Houston Moore Group B.S. North Dakota State University, Civil Engineering 15 years of experience
Kyle Volk	GIS Group Leader Houston Moore Group B.S. North Dakota State University, Civil Engineering 13 years of experience
Robert Zimmerman	City Engineer City of Moorhead B.S. North Dakota State University, Civil Engineering M.S. North Dakota State University, Civil Engineering Ph.D. North Dakota State University, Engineering 29 years of experience
Eric Dodds	Program Manager Advanced Engineering and Environmental Services, Inc. (AE2S) B.S. Civil Engineering, North Dakota State University M.S. Civil Engineering, North Dakota State University 17 years of experience

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