2.2.11.3 Advanced replacement, flood proofing cost savings, and transportation benefits have not been included but are anticipated to be relatively low.

2.2.11.4 Impacts to historical properties have not been fully assessed, the costs for this are anticipated to be high.

2.2.11.5 Environmental mitigation costs have not been included, these costs are anticipated to be low.

2.3 DIVERSION CHANNELS

2.3.1 Alternative Description

This alternative would involve diversion channels to route flood flows around the metropolitan area, thus reducing stages in the natural channel through town. A control structure would be required on the Red River to divert flows into the diversion channel and drop structures would be necessary to allow local drainage to enter the diversion channel. Tie-back levees at the southern limits of the project would be necessary to tie into high ground. No tie-back levees at the north end of the project would be necessary.

Nine separate diversion plans were analyzed during the initial screening, including a total of four separate alignments, two in Minnesota and two in North Dakota, and various capacities. The Red River control structure allows for the maximum benefit for a given diversion channel capacity by reducing water surface elevations immediately downstream of the structure. Additionally, the control structure allows the water surface elevation upstream of the project to remain at a near natural elevation to prevent erosion-causing velocities in the Red River at the upstream end of the project. Because of the Wild Rice River's proximity to the Red at the south end of the project, three of the four alignments also include control structures on the Wild Rice River. The North Dakota alignments would require additional hydraulic structures where the diversion alignments cross the Wild Rice, Sheyenne, Maple and Rush Rivers.

The Minnesota short alignment is approximately 25 miles long, starting near the confluence of the Wild Rice and Red Rivers and ending near the confluence of Sheyenne and Red Rivers. Three separate diversion capacities were analyzed for the Minnesota alignments including 25,000, 35,000, and 45,000 cubic feet per second (cfs). The channel configuration should have a maximum depth of approximately 30 feet due to geotechnical concerns, and channel bottom widths ranged from 250 to 500 feet. The Minnesota short alignment includes 20 highway bridges and 4 railroad bridges. The flow split between the diversion channel and the Red River would be controlled by a combination of a control structure on the Red River at the south end of the project and a weir at the entrance to the diversion channel.

The Minnesota long alignment started approximately 3 miles south of the confluence of the Red and Wild Rice Rivers and would end at the Red River near the confluence of the Red and Sheyenne Rivers. The alignment would be approximately 29 miles long. Because this alignment begins south of the confluence of the Red and Wild Rice Rivers, an extension of the diversion channel would be required between the Red and Wild Rice Rivers. The tie-back levee would be required to extend west from the Wild Rice control structure to higher ground.

The North Dakota west alignment would start approximately 4 miles south of the confluence of the Red and Wild Rice Rivers and extended west and north around the cities of Horace, Fargo, West Fargo, and Harwood and would end at the Red River north of the confluence of the Red and Sheyenne Rivers near the city of Georgetown, Minnesota. The alignment would be approximately 35 miles long. The North Dakota east alignment generally followed the North Dakota west alignment except that, after crossing the Sheyenne River, it would use the existing Horace to West Fargo Sheyenne River Diversion

corridor between Horace and I-94. The North Dakota east alignment would be approximately 36 miles long.

The North Dakota alignments would require an extension of the diversion channel between the Red and Wild Rice Rivers which would begin south of the confluence of the Red and Wild Rice Rivers, like the Minnesota long alignment. The tie-back levee associated with these alternatives would extend east from the Red River control structure to high ground. The North Dakota west alignment was analyzed for 35,000 and 45,000 cfs, and the North Dakota east alignment was analyzed for 35,000 cfs. The channel configuration for each event was largely determined based on the minimum excavation quantity for a given capacity rather than by the maximum recommended excavation depth as was used for the Minnesota alignments. The channel bottom width for both capacities would be 100 feet, and the maximum depth would be approximately 32 feet. The North Dakota alignments would include 18 highway bridges and 4 railroad bridges. A combination of control structures on the Red and Wild Rice Rivers at the south end of the project, along with a weir at the entrance to the diversion channel, would control the flow split between the Red and Wild Rice River channels and the diversion channel. This alignment would cross several rivers, including the Sheyenne, Maple, Lower Rush, and Upper Rush. Hydraulic structures would be necessary at the point where the diversion channel crosses these rivers. The purpose of these hydraulic structures would be to allow some base flow to continue down the various rivers while diverting excess water during flood events to the diversion channel. This would result in added flood protection along all of the affected tributaries downstream of the crossing.

2.3.2 Effectiveness

Diversion channels would be very effective in reducing flood risk in the Fargo-Moorhead Metropolitan Area. The smallest diversion considered in the screening exercise (25,000-cfs capacity) would reduce a 0.2-percent chance event to approximately the 1-percent chance stages through town, and a 1-percent chance event would be reduced to less than 10-percent chance stages. The communities begin emergency measures between the 15 and 20-year events meaning that a diversion would nearly eliminate the need for emergency measures during smaller, more frequent floods, but flood fighting would still be needed for events approximately 1-percent chance or larger. Larger diversion alternatives could nearly eliminate the need for flood fighting except for the extremely rare and large events. This alternative is highly effective.

2.3.3 Environmental Effects

This alternative would have moderately positive impacts.

2.3.3.1 Natural Resources

There is a potential for adverse effects on aquatic habitat from the structures necessary on the Red River and the tributaries. Those structures could impact fish passage which could result in adverse effects on fish populations in the Red River. Agencies have identified that fish passage would have to be a key design criterion. Sedimentation in the diversion channel or on the Red River could be a potential issue resulting in adverse effects to aquatic habitat and the river ecology.

The diversion channels could have potential adverse effects on the aquatic resources caused by impacts to fish passage and fish trapping. The alternative would be designed to ensure that impacts to aquatic habitat would be minimized to the greatest extent possible and that the overall impact to the resource would be less than significant. Wetlands along the alignment would be intercepted by the channel and removed or drained, and the channel would impact the depth of groundwater near the channel. The channel would be