SECTION 7.0
PROJECT FEASIBILITY, ENGINEER'S RECOMMENDATION AND DESIGN ISSUES NEEDING RESOLUTION

7.1 PROJECT FEASIBILITY

The determination of project feasibility is based upon several criteria established by the Project Engineer in consultation with the UMRWD and the BVFMTF. These criteria include:

- The ability to attain the design goals as presented in Section 2.1, Project Design Goals of this report;
- An understanding of the perceived magnitude of the potential environmental impacts and the likelihood of obtaining the necessary regulatory approvals and permits;
- The perceived constructability of the project;
- Cost; and
- The ability of the owner to operate and maintain the project as designed.

Based upon the information presented within this report, it is the opinion of the Project Engineer that all Little Minnesota River floodways are capable of solving the river flooding problem within Browns Valley. Flood protection accomplished through engineering improvements within the Toelle Coulee are also considered feasible. Some mitigation for potential adverse environmental impact is anticipated. The amount of mitigation is yet to be determined through the completion of additional field studies and consultation with the various regulatory agencies. The UMRWD anticipate owning and operating the project on behalf of the City of Browns Valley. The UMRWD currently operates the Big Stone Lake dam and has a history of successful project operation. The Project Engineer believes based upon current information constructability issues for the Browns Valley Flood Mitigation Project is manageable.

7.2 ENGINEER'S RECOMMENDATION

Considerable technical analyses have been completed to evaluate the various floodway alternatives for the Little Minnesota River and Toelle Coulee and to select an acceptable alternative. This section presents the rationale for the Engineer's recommendation.

7.2.1 Little Minnesota River Floodway

Several Little Minnesota floodway alternatives (i.e., defined as Alternative CS4) are capable of removing the part of the City from the 100-year floodplain, as identified as a goal within Section 2.1, Project Design Goals, of this report. Toelle Coulee is another flooding source to part of the City. The various floodway alternatives have advantages and disadvantages.

Alternative CS4 (Little Minnesota River), Option 1 is less costly than Option 2 and Option 3, assuming the same type of floodway inlet. Option 1 lacks the ability to directly address flooding that may originate within Lake Traverse and move south toward Browns Valley (a concern raised by the BVFMTF). Technical analysis indicates that an elevation with a 250 year return period is needed within Lake Traverse, for water to flow south and cross TH 28 and reach Browns Valley. (Note: stop log rails could be added into the box culverts under TH 28. Stop logs could then be inserted into the box culverts if a flood from Lake Traverse to the south is eminent).

Option 1 is only indirectly capable of addressing flooding originating from Lake Traverse, but since coincident flood flows from the Little Minnesota River will be diverted downstream and the maximum capacity through Browns Valley limited to about 500 cfs, some capacity in the Little Minnesota River will be available for unforeseen events. The bankfull channel capacity within the City approaches 1,200 cfs. Therefore, some channel capacity would remain for moving water flowing south from Lake Traverse toward Browns Valley through the City. Because the occurrence of flooding from Lake Traverse south occurs infrequently (in fact this flood mechanism has only been documented once since construction of the Lake Traverse Project), the Project Engineer feels the selection of another Option (i.e., Option 2 or 3) ***solely*** to address this flood mechanism is unwarranted.

One of the largest potential environmental concerns is modifying the low flow regime through the City of Browns Valley, which is a function of the type of inlet and floodway alignment. The "passive" inlet will reduce low flows through Browns Valley. The "active" or gated inlet could be operated to pass the desired amount of flow through the Little Minnesota River for ecologic and geomorphic purposes (e.g., 2-year through 5-year flows), while also providing very good flood protection when needed. An active inlet within the Little Minnesota

River would be subject to blockage by debris and ice. Modifying the low flow regime is likely to result in some additional sediment accumulation, some reduction in aquatic habitat and the need for periodic maintenance to remove sediment and accumulated vegetation (Note: some maintenance is also expected with a gated inlet). The active (gated) inlet has more potential operational issues. An active inlet within the Little Minnesota River would be subject to blockage by debris and ice so maintenance will be required. Someone must be present at the time of the flood to operate the gates and divert flows from the Little Minnesota River, downstream through the floodway. Flooding within Browns Valley occurs rapidly, sometimes with little warning. Human intervention is not needed for the operation of a passive inlet. The passive floodway represents the concept with the least potential for operational issues.

Option 3, although more costly, has several potential advantages over Options 1 and 2 and is consistent with the direction and goals established by the BVFMTF. Specifically, because of the location of the floodway opening, Option 3 is able to control the amount of water flowing north toward Lake Traverse; i.e., the historic flow distribution can in part be replicated by construction of a positive hydraulic control. By placing an active inlet at the floodway opening, during non-flood periods the gates can be closed avoiding modification of low and moderate discharges into Browns Valley. By placing an active inlet in the river, during non-flood periods the gates can be opened avoiding modification of low and moderate discharges into Browns Valley. Similarly, during a flood the gates can be closed and head increased for force more water into the floodway.

Should ice or debris occur downstream of the floodway opening, the flow distribution into the floodway and to Lake Traverse are equally affected, because the openings are essentially co-located on opposite sides of the Little Minnesota River. The floodway opening for Option 3 is located sufficiently west, to reasonably ensure flood flows from the Little Minnesota River actually enter the floodway. A critical concern of Option 2 is the location of the floodway inlet. The inlet is located a considerable distance east toward Browns Valley. The capacity of the Little Minnesota River upstream of the inlet is insufficient to carry the floodway design discharge, either requiring a channel improvement or some other means to ensure the flood flows reach the floodway inlet. Ice and debris forming upstream of the floodway opening will result in

water leaving the banks of the Little Minnesota River, with little to no means of controlling the rate or direction of these flows.

Option 3 (passive or active) is the only option consistent with the design goals established by the BVFMTF. Based upon our analysis Option 3 (passive-with leaf gates) is recommended (Opinion of Probable Cost of $7.3 million), with the following caveats:

- Provided local operation of a gated structure can be ensured then Option 3 (active) is recommended (Opinion of Probable Cost of $6.9 million).
- Should the Board of Managers concur with the Engineer's perspective (and based upon input received during the hearing and comments provided by the agencies through the Director's reports) that the potential increase in stage within Big Stone Lake is "manageable" **and** local operation of a gated structure can be ensured then Option 1A (active) (Opinion of Probable Cost of $5.6 million) is recommended (rather than Option 3).
- Should the Board of Managers concur with the Engineer's perspective (and based upon input received during the hearing and comments provided by the agencies through the Director's reports) that the potential increase in stage within Big Stone Lake is "manageable" **and** should the natural resource agencies review of the project and those agencies responsible for permitting (e.g., the U.S. Army Corps of Engineers) indicate that the reduction in aquatic and geomorphic flow within the Little Minnesota River through Browns Valley resulting from the use of a passive inlet is acceptable then Option 1A (passive, no leaf gates) (Opinion of Probable Cost of $4.9 million) is recommended.

The decision is essentially a policy decision specific to the importance of maintaining the historic flow split to Lake Traverse and provided for aquatic and geomorphic flows within the Little Minnesota River through Browns Valley.

7.2.2 Toelle Coulee

The flooding from Toelle Coulee is in part a direct consequence of the previous construction of Traverse CR 2. A low spot within the west road ditch of Traverse CR 2 along

Toelle Coulee, presumably a consequence of using material to construct the road, provides for an opportunity for floodwater to overflow into the City of Browns Valley. Because culverts placed through the Traverse CR 2 embankment at the coulee are insufficient to pass the 100-year flood, these large flood events may no longer follow Toelle Coulee, but overflow into the City. Simply closing this low spot seems an obvious solution. However, the Traverse CR 2 embankment is not designed as a dam nor are features typical of a dam (e.g., emergency spillway) present.

Early in the design process construction of a floodway seemed most promising. Technical analysis however, showed that constructing a floodway would require considerable increase in culvert capacities through Traverse CR 2 and TH 28 and that excavation downstream from TH 28 would likely be difficult to permit. Additional potential solutions were evaluated including Toelle Coulee Levee West and Toelle Coulee Levee East. Each of these solutions has similar Opinion of Probable Costs. Because restoring the CSAH 2 crossing capacity appears more practical than maintaining the overflow to Browns Valley, future maintenance costs are expected to be lower (i.e. all flows are kept in a single channel), and because the solution is less visually impacting, Toelle Coulee East ($1.1 million) is recommended.

7.2.3 Additional Recommendations

The following additional recommendations are provided to the Board of Managers for consideration:

- Gage operation at the Peever, South Dakota U.S. Geological survey gage should occur in perpetuity and an early flood warning system implemented at the gage as a component of this project. A cooperative agreement should be established between the U.S. Geological Survey, the Minnesota DNR, the State of South Dakota, the National Weather Service and the UMRWD for the operation of the gage and the early warning system. The Managers should explore working with the National Weather Services to integrate the early warning system into their current operations;
- Include a Supervisory Control and Data Acquisition (SCADA) system linked to the early warning system. The SCADA system should include remote operation of the gates and include a video camera to remotely observe gate position;

- Prior to proceeding with the development of construction plans complete additional consultation with the regulatory and permitting agencies to better define the level of concern associated with flows through the City of Browns Valley and issues specific to Big Stone Lake. Based upon this consultation and the levels of concern, select the option for the Little Minnesota River based upon the guidance provided within Section 7.2.1, Little Minnesota River Floodway;
- Submit the Engineer's Report to the Minnesota DNR and BWSR to obtain comments; and
- Hold a public hearing in accordance with Minnesota Statute to obtain input on the Preliminary Engineer's Report.

These recommendations are provided to the Board of Managers, realizing that the Board of Managers has the discretion to accept, modify, or delete any or all of these recommendations in accordance with their responsibilities under Watershed District Law.

Following action by the Board of Managers (assuming approval) we anticipate the following additional activities necessary for construction:

- Complete the geotechnical analyses necessary for completion of project design;
- Continue discussions with land owners and obtain options for easements and land acquisition necessary for project completion;
- Complete additional environmental field work needed to obtain regulatory approvals. Specifically, complete wetland delineation, impact and mitigation report, and a cultural resource survey. These documents will be required to obtain the necessary permits prior to construction;
- Complete an Environmental Assessment Worksheet for the project;
- Complete and submit permit applications for the project;
- Secure adequate funding based upon the Opinion of Probable Cost developed by the Project Engineer;
- Refer the project to Legal Counsel for review, to ensure an absence of legal issues associated with land acquisition or other project related activities;
- Proceed with the preparation of construction plans and specifications;

- Following final design, complete and submit a Conditional Letter of Map Revision to remove land within the City from the FEMA 100-year floodplain; and
- Complete the bid process, select a contractor and proceed to construction.

7.3 DESIGN ISSUES NEEDING RESOLUTION

The recommendations provided by the Engineer are subject to limitations imposed by the information currently available. As more information is developed and the project proceeds toward the preparation of construction plans, these design issues will become resolved and the Opinion of Probable Cost refined.

The primary design issues potentially affecting the Engineer's recommendation (and the Opinion of Probable Cost) are the structural suitability of the soils and the presence of groundwater which may pose challenges during construction. These issues are currently addressed by the Engineer within the Opinion of Probable Cost by including a contingency. The resolution of these issues is expected subsequent to the completion of this report, as geotechnical analyses of the soils are completed and environmental issues associated with the various floodway inlet options for the Little Minnesota River resolved. Environmental mitigation costs vary widely, and are included as a line item within the Opinion of Probable Cost.