Fargo-Moorhead Metropolitan Flood Risk Management Feasibility Report & Environmental Impact Statement

PA10 Class

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13 September 2010

US Army Corps of Engineers
BUILDING STRONG®
Planning Associates District

Purpose of CWRB Briefing

- Provide an overview of the Fargo-Moorhead Metropolitan Flood Risk Management Project;
- Obtain approval to proceed with release of the Fargo-Moorhead Project Feasibility Report and Environmental Impact Statement (EIS) for State and Agency review;
- Answer questions and address comments;
- Discuss the next steps in the approval process towards a Chief's Report

Agenda

- Commanders Presentation
  - Introduction – Julie Watkins
  - Plan Formulation – David Schulenberg
  - Alternative Comparison – Raymond Wimbrough
  - Recommended Plan – Steve Fischer
  - Other Project Details – Durund Elzey
- Sponsor Presentation – Melissa Montag
- MSC Presentation – Charissa Kelly
- OWPR Presentation – Kelly Baerwaldt

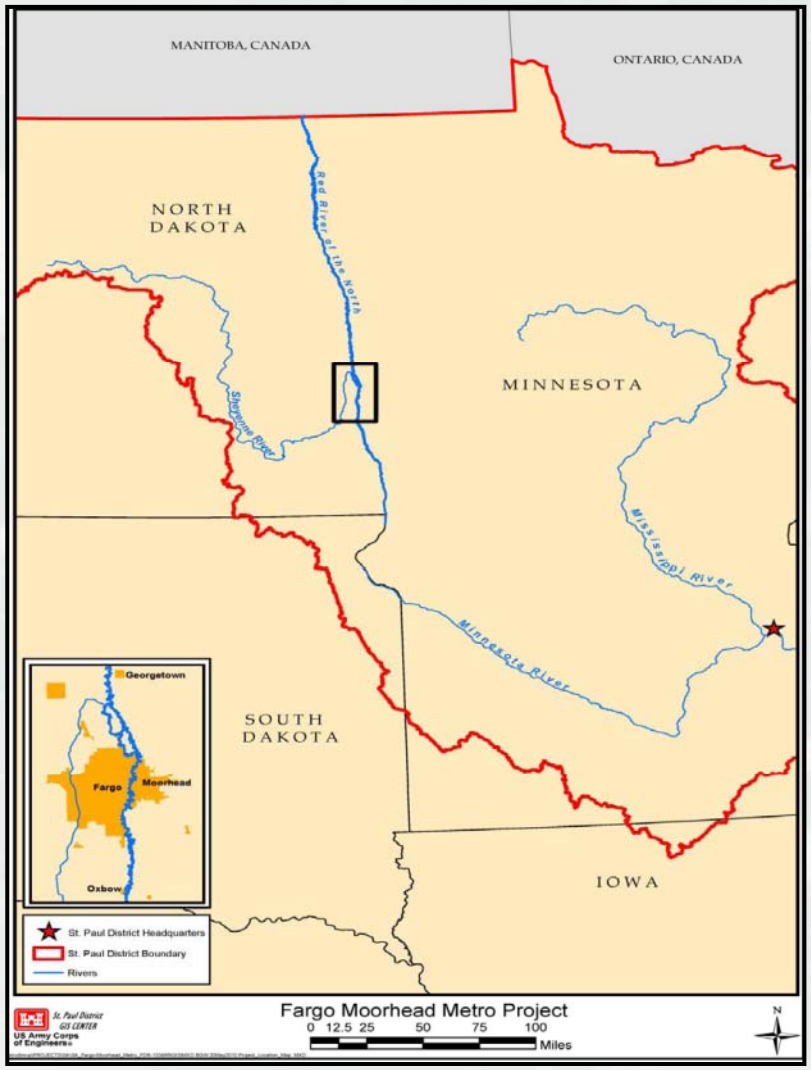
Presentation Topics

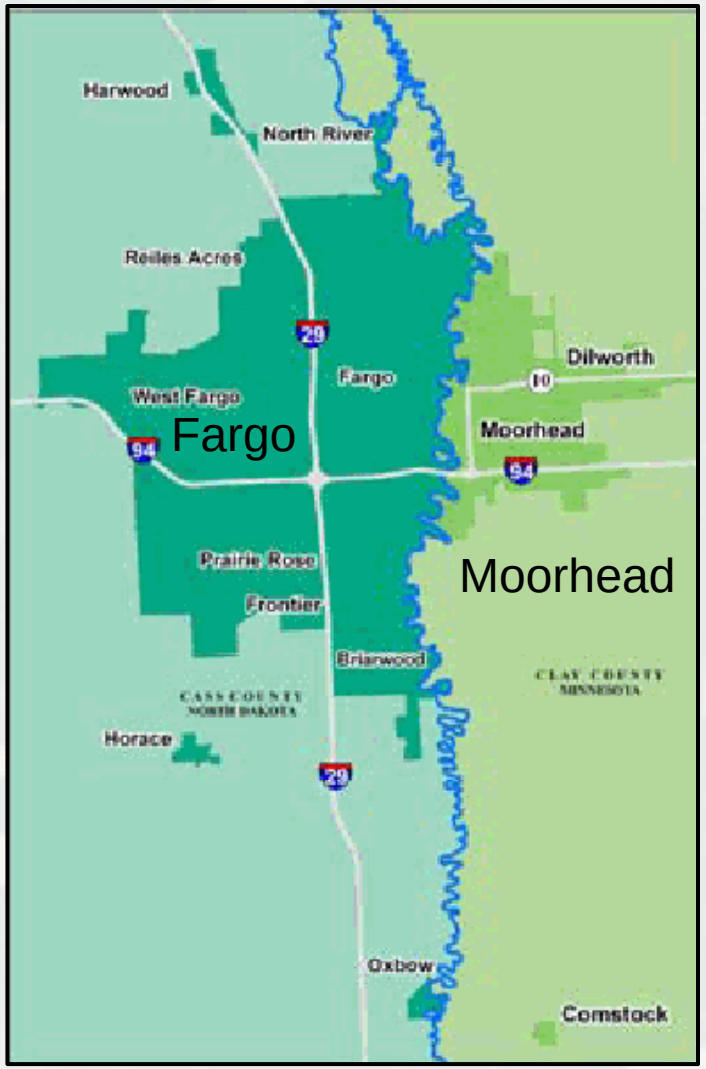
- History of Flooding in the Project Area
- Current Conditions and Challenges
- Plan Formulation
- Recommended Plan and Costs
- Other Project Details:
  - Risk and Uncertainty
  - Public Involvement
  - Peer Review
  - Campaign Plan

The Bottom Line

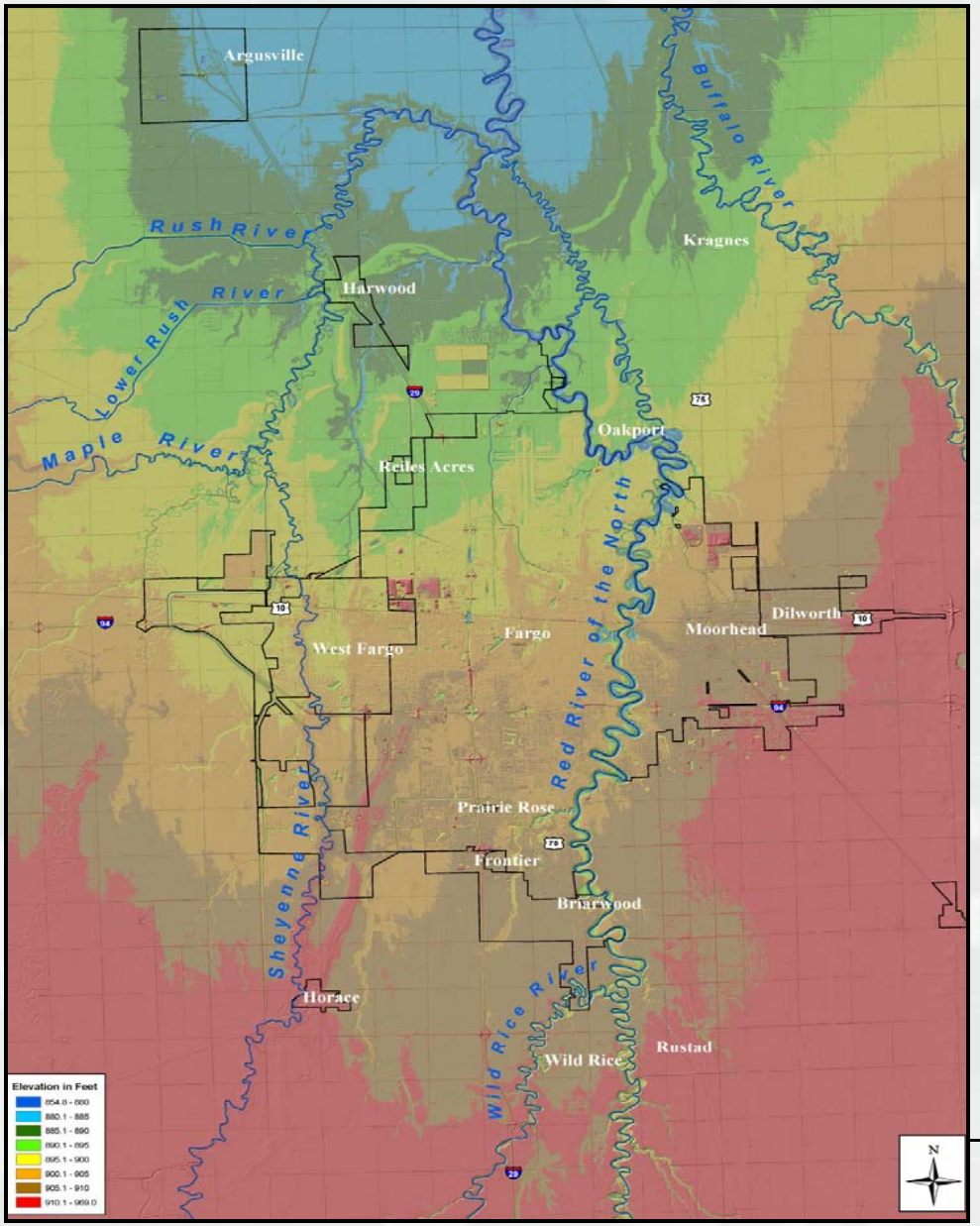
The Fargo-Moorhead Flood Risk Management Project is needed to reduce the risk of catastrophic flooding and loss of life.

Project Location





Red River of the North Basin



- Drainage area of 6,800 square miles
- Flows 453 miles north to Lake Winnipeg, Canada
- Also includes the following rivers:
  - Wild Rice
  - Sheyenne
  - Maple
  - Rush
  - Buffalo

Damages and Risk of Flooding

- Current annual flood damages in Fargo-Moorhead Metro Area are estimated at over $187 million
- Red River of the North has exceeded flood stage of 18 feet in 47 of past 108 years
- Flood stage has been exceeded

EVERY YEAR FROM 1993 THROUGH 2010

Future Without Project Condition

- The Metropolitan region will continue to be subject to flooding and will rely on emergency responses
  - High risk of failure and significant cost of emergency response
- Continued development expected in the Fargo-Moorhead Metropolitan region
- Future expected annual damages is greater than $195M

Project Delivery Team

- Lead Agency: U.S. Army Corps of Engineers
  - St. Paul District Staff
  - Non-structural Flood-Proofing Committee
  - Regional Integration Team
  - Mississippi Valley Division
  - Headquarters
- Non-Federal Sponsors:
  - City of Fargo, North Dakota
  - City of Moorhead, Minnesota
- Federal, State and Local Agencies

Plan Formulation

Objectives

- Reduce flood risk and flood damages in the Fargo-Moorhead metropolitan area
- Provide recreational opportunities in conjunction with other project features

Constraints

- Avoid increasing peak Red River flood stages
- Comply with the Boundary Waters Treaty of 1909 and other pertinent international agreements.
- Avoid negatively impacting the Buffalo Aquifer in MN.
- Minimize loss of floodplain in accordance with Executive Order 11988, Floodplain Management

Nature of FRM
Non-Structural Measures

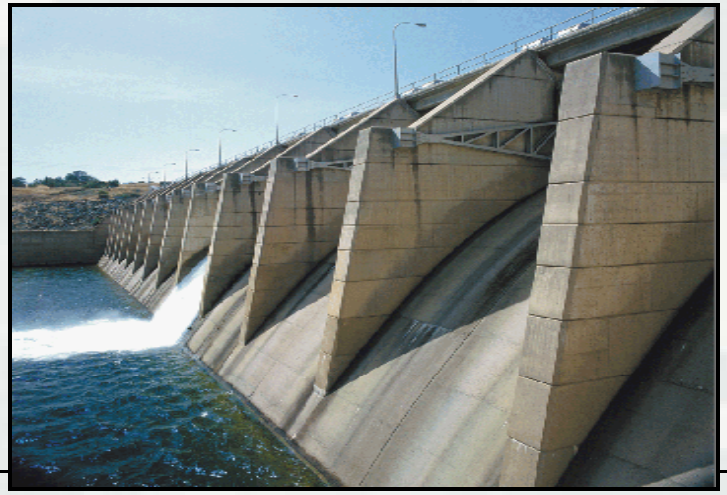
- Buyouts, relocations, flood proofing, elevating, etc.
- Ineffective as stand-alone alternatives due to cost, socio-economic effects acceptability
- Could be in combination with Structural measures to gain incremental increases in project performance

Nature of FRM

Structural Measures

Increase Conveyance

Flood Barriers



Flood Storage

Types of Structural Measures

Flood Barriers

- Less cost effective in providing high levels of risk reduction
- Not implementable, levees cannot be certified to contain floods larger than 1% event (30,000 cfs)
- Socio-economic impacts due to need for removal of over 1,000 structures

Types of Structural Measures

Flood Storage

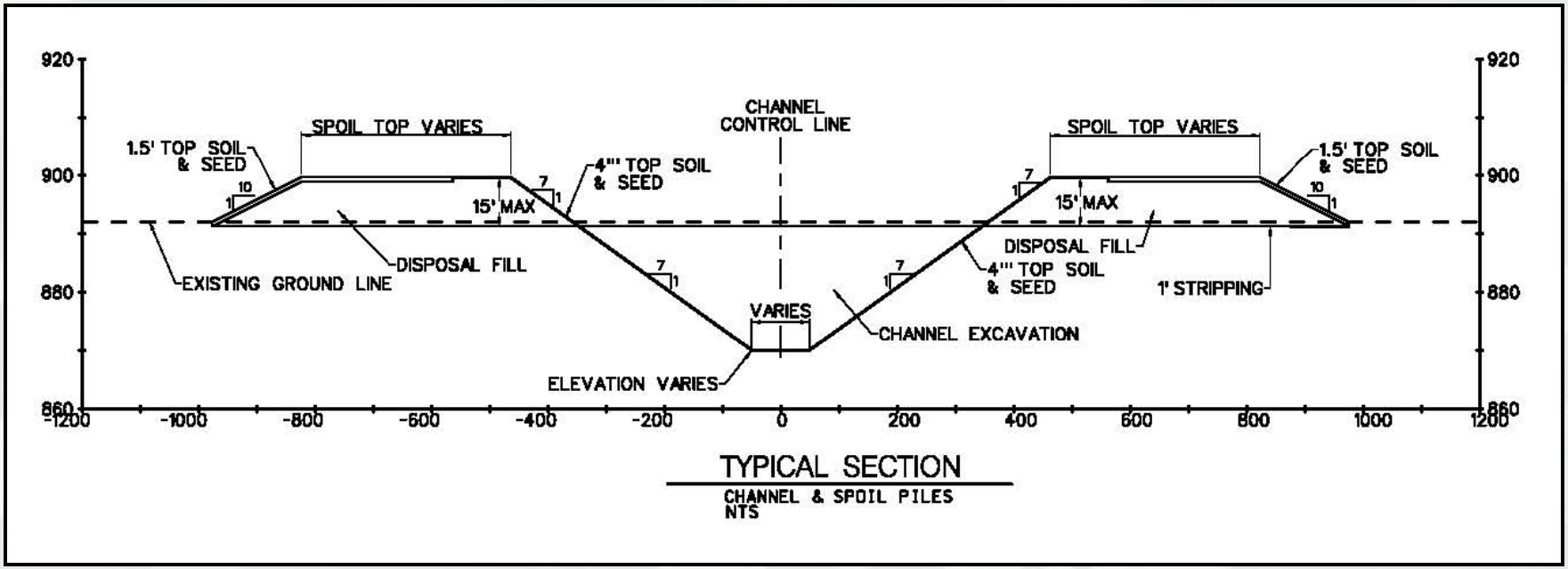
- Less cost effective in providing high levels of risk reduction
- Flat topography in the area would necessitate a massive footprint
- Pool assumed to be 40,000 acres at depth of 10-feet would provide stage reductions of less than 1.6 feet

Types of Structural Measures

Increase Conveyance

- Measures included underground tunnels, highway viaduct, channel improvements, and diversion channels
- Diversion channels were most cost effective in providing high levels of risk reduction
  - Acceptable, would not produce unacceptable socio-economic impacts
  - Implementable, construction of diversion channels would be technically feasible

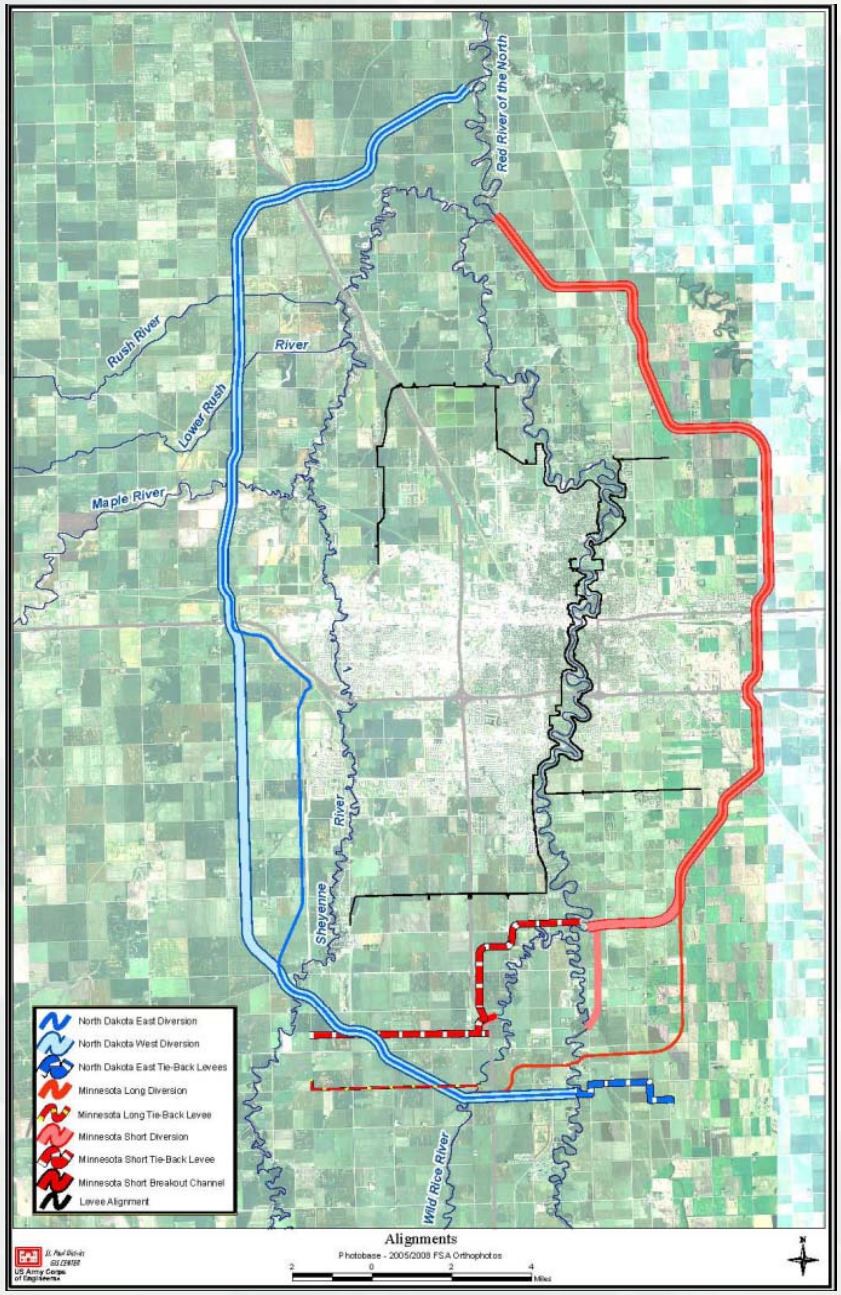
Typical Diversion Channel



Alternative Comparison

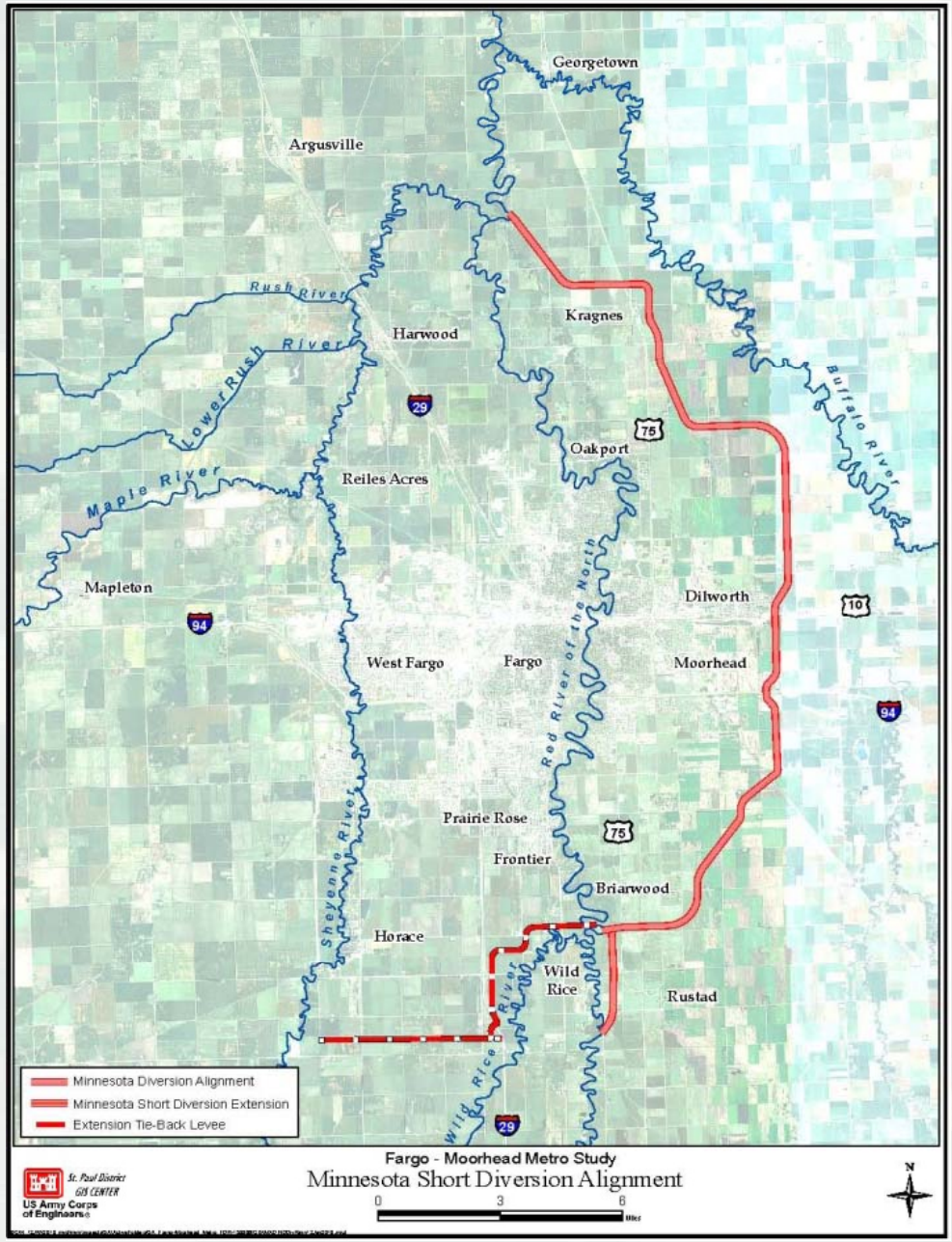
Initial Array of Alternatives

- Determine size and location of flood risk measures (Diversion Channel)
- Included four series of alternatives:
  - MN Short
  - MN Long
  - ND East
  - ND West
- Traditional analysis of 1% chance event with flows of 30,000 cubic feet per second (cfs).



Initial Array of Alternatives

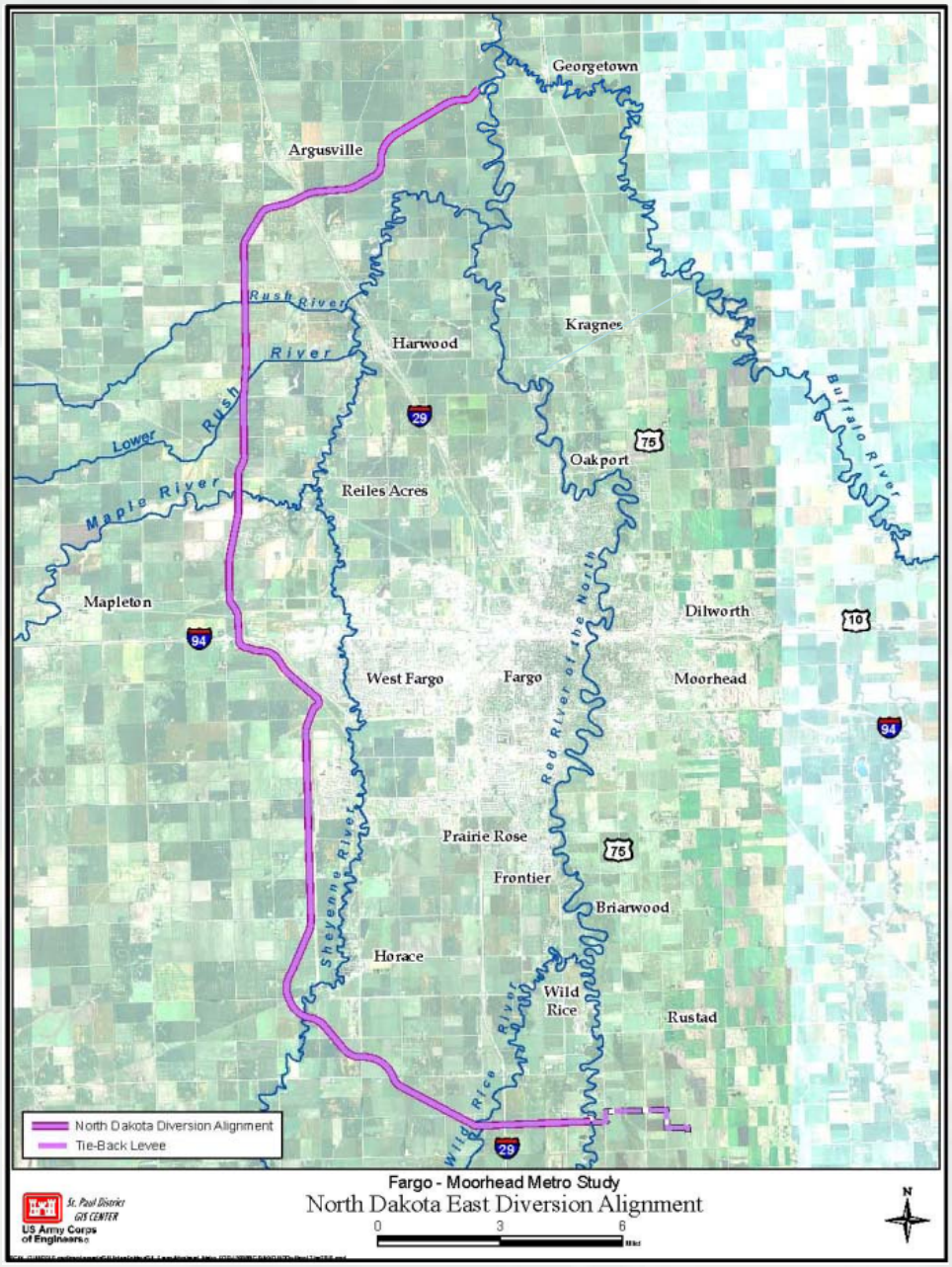
- Minnesota Alignments
  - MN Short
  - MN Long
- North Dakota Alignments
  - ND East
  - ND West



MN Short Alignment

- MN Short Alignment outperformed MN Long & both ND Alternatives
- Likely NER plan

Alternative	BCR
MN Short 25K	1.22
MN Long 25K	1.10
MN Short 45K	1.04
MN Long 45K	0.89



ND East Alignment

- ND East Alignment outperformed ND West
- Retained because ND Alignment was preferred by non-Federal sponsor
- Additional categories may increase benefits

Final Array of Alternatives

Design Optimization

- Red River control structure added.
- Tributary structures improved to reduce costs.
- Structures modified for fish passage.

Refined Benefits

- Transportation benefits calculated.
- Future development cost avoidance.
- Flood damage reduction benefits on Sheyenne River and tributaries.

Final Array Economic Analysis

	Minnesota Short Alignment						ND East Alignment	
Alternative	10K	15K	20K	25K	30K	35K	30K	35K
Cost (Millions)	$730	$800	$871	$980	$1,050	$1,143	$1,231	$1,295
Average Annual Net Benefit	$1.3	$11.4	$16.2	$15.5	$15.1	$12.2	$13.3	$11.7
Benefit-Cost Ratio	1.03	1.28	1.41	1.36	1.33	1.26	1.26	1.22

2009 Flood of Record

and Assessment of Climate Variability

Hydraulic Model

- Model was recalibrated to include 2009 flood event.
- Average damages went from $77M to $104M.
- Net benefits between alternatives different by as much as 5%.

Hydrologic Assumptions

- Revised traditional analysis and the nontraditional Climate Change Expert Opinion Elicitation Panel analysis resulted in higher flows for all frequencies
- Approach by Expert Panel used as results better represented actual conditions in Red River Basin

Shift in Net Benefits

Alternatives	Initial Array	Final Array
MN 10K	$1.3	-------
MN 15K	$11.4	-------
MN 20K	$16.2	$87.0
MN 25K	$15.5	$98.8
MN 30K	$15.1	$101.7
MN 35K	$12.2	$104.9
MN 40K	-------	$105.6
MN 45 K	-------	$104.9
ND 30K	$13.3	-------
ND 35K	$11.7	$95.4

National Economic Development Plan

Revised Final Array Economic Analysis

	Minnesota Short Alignment						ND East Alignment
Alternative	20K	25K	30K	35K	40K	45K	**35K**
Cost (Millions)	$1,032	$1,121	$1,194	$1,286	$1,367	$1,450	**$1,462**
Average Annual Benefit	$140.0	$156.4	$163.1	$171.0	$175.9	$179.5	**$171.1**
Total Annual Net Benefit	$87.0	$98.8	$101.7	$104.9	$105.6	$104.9	**$95.4**
Benefit-Cost Ratio	2.64	2.71	2.66	2.59	2.50	2.41	**2.26**

National Economic Development Plan (NED)
Locally Preferred Plan (LPP)
Federally Comparable Plan (FCP)

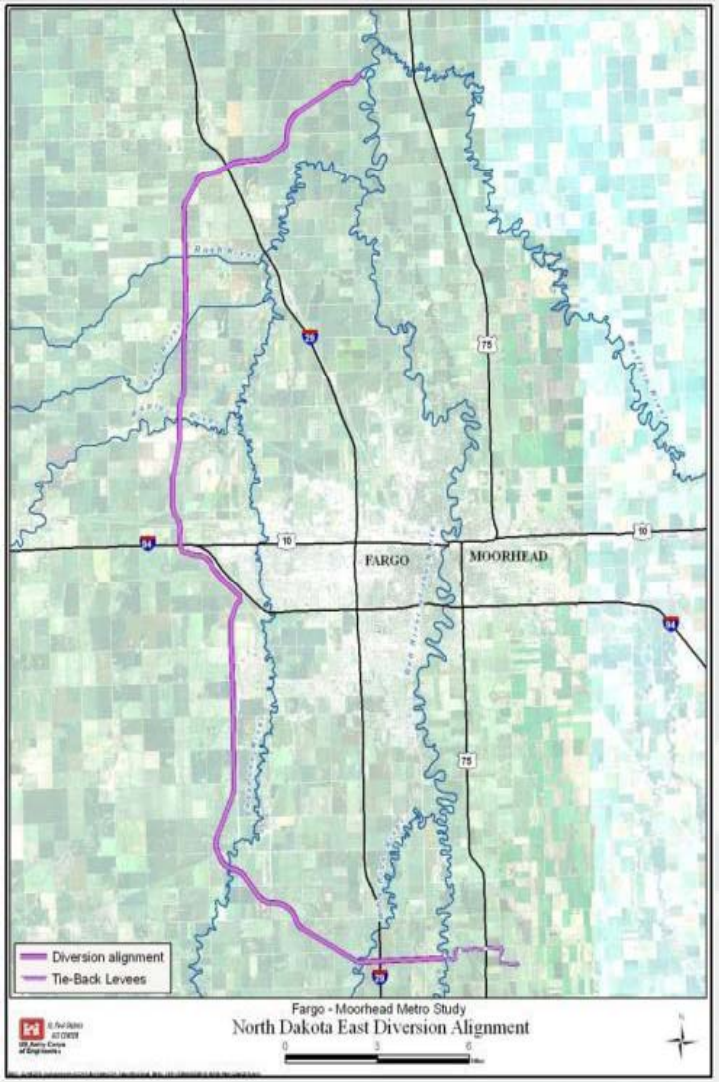
NED vs. FCP vs. LPP

	NED MN 40K	FCP MN 35K	LPP ND 35K
Average Annual Benefit	$175.9	$171.0	$171.1
Total Annual Net Benefit	$105.6	$104.9	$95.4
Benefit-Cost Ratio	2.50	2.59	2.26

Recommended Plan

Recommended Plan

ASA-CW approved LPP as Recommended Plan on 28 April 2010



LPP – North Dakota 35K

- $1.45B Cost is fully funded plus contingency
- 36-mile diversion channel and structures
  - Includes all 5 local river systems
- Channel width 100’ - 300’ with max depth of 29’
- Construction footprint of 6,560 acres
  - 18 Highway and 4 Railroad Bridges
  - 9 water control structures
- Annual net flood risk management benefits of $95M

Advantages of the Plan

- The LPP achieves objectives of the Feasibility Study:
  - Significantly reduces flood frequency on approximately 80 square miles currently located in the 1-percent chance event floodplain.
  - Reduces flood risk from all of the rivers in the North Dakota portion of the study area
  - Provides benefits to a larger area and protects a larger number of people than the NED plan
  - Significantly reduces the expected loss of life and allows the communities time to react in emergencies
  - Significantly reduces the risk of catastrophic damage for very large events
- Is more robust solution than other plans considering the potential for future flood flows and frequencies to be larger than reflected in the historic record.

Advantages of the Plan - 2

- It is an integrated, sustainable, water resource solution that was developed through a collaborative process.
- Strong sponsor and agency support
  - Result of communication efforts, Resource PDT engagement, and Panel of Experts
- Complies with Executive Order 11988 on Flood Plain Management
  - By significantly reducing flood damages and flood risk,
  - By improving public safety, and
  - By removing much of the Fargo-Moorhead area from the regulatory floodplain.
  - Many Non-Structural measures have already been implemented in newer developments within the study area.
- Important to note … none of the plans completely eliminate the risk of future flooding

Cost Sharing

Item	Federal Cost	Non-Federal Cost	Total
Planning, Engineering and Design (PED)	$110,972	$14,108	$125,080
Construction Management	$51,787	$6,584	$58,371
Lands, Easements, Relocations & Right-of-ways (LERR&R)	$149,397	$143,332	$292,729
Construction (Flood Risk Management)	$590,418	--------	$590,418
Recreation	$17,121	$17,121	$34,242
Total Project Cost (65:35 rate)	$710,410	$390,429	$1,100,839
Operations, Maintenance, Repair, Rehabilitation & Replacement (OMRR&R)	--------	$3,318	$3,318

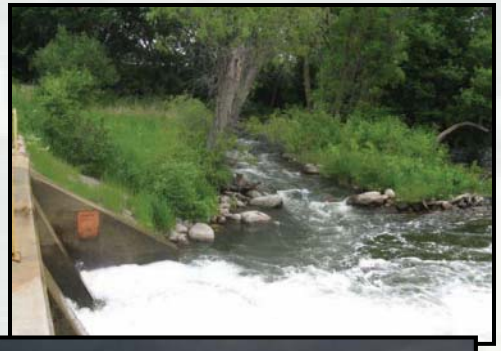
Note: All costs are in 1,000s

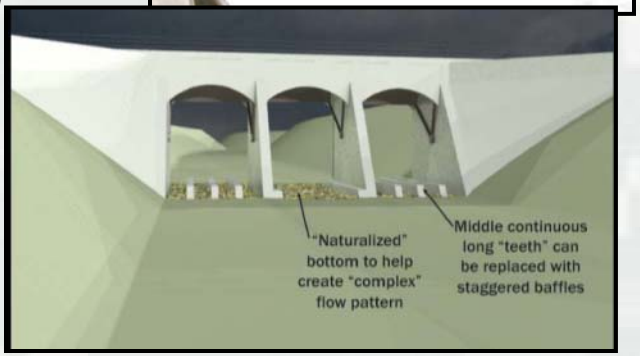
Recreation Plan

- Recreation features are economically justified with average annual net benefits of $5.3M and an incremental benefit/cost ratio of 2.88
- Will add social and economic benefits in the metropolitan area
- Plan will include
  - 48 miles of multipurpose trails
  - 18 miles of trails for horseback riding and snowmobiling
  - 3 picnicking areas at trail heads, and 24 sites along the trails with benches, trash receptacles and interpretive signage wildlife viewing stations
- Total cost of $34.2M (3% of Total Project Costs)

Mitigation

- Impacts
  - Wetlands – 71.5 acres directly / 193 acres indirectly
  - Riparian Forests – 138 ac directly
  - Rivers & Structures – fish passage
- Total mitigation cost - $37.3M (3.4% of total cost)
  - $18.0M – Fish passage
  - $14.6M - Stream re-meandering
  - $4.7M – stream buffer restoration
  - Real Estate cost is $1.8M
- Adaptive Management approach and monitoring
  - Pre- and Post- construction surveys for impacts
- Mitigation to occur concurrent to construction activities





Other Project Details

Other Project Details

- Public Involvement & Issues
- Risk & Uncertainty
- Agency Technical Review (ATR)
- Independent External Peer Review (IEPR)
- Environmental Operating Procedures (EOP)
- Campaign Plan
- Watershed Approach
- Project Timeline
- Lessons Learned

Public Involvement

- Public & Agency Meeting
  - 5 Scoping Meetings; average attendance 78 people
  - 12 Public Meetings; average attendance 258 people
  - 15 Working Group Meetings
  - 9 Resource Agency Team Meetings
    - 18 agencies were actively engaged within the team
    - Team was comprised of federal, state, and local agencies

- Agency Concerns
  - Loss of habitat
  - Fish Passage
  - Increased flows downstream

Risk & Uncertainty

- Cost & Schedule Risk assessment –
  - Resulted in 34 – 36% contingencies (greater than the standard 25%)
  - 70% of the risk addressed in the contingency increase is due to uncertain funding streams

- Climate Variability
  - Utilized a panel of expert in hydrology and climate change
  - Panel noted a “dry” and “wet” period in the hydrologic record and revised the flow frequency curves to reflect this pattern in future conditions
  - Resulted in a modified 1% chance flow event

Agency Technical Review (ATR)

- ATR lead by Omaha District
- FSM
  - 106 Comments
  - Completed 16 March 2009
- AFB
  - 136 comments; 28 critical
  - Completed 16 February 2010
- All review comments were resolved and closed
- Cost Estimates have been certified by Walla Walla Cost Engineering DX in accordance with
  - ECB No. 2007-17 (September 2007)
  - "Cost & Schedule Risk Analysis Guidance" (May 2009)

Agency Technical Review (ATR)

- Key FSM/AFB Comments
  - Geotechnical analyses
  - Economic analyses
  - H&H analyses
  - Cost engineering
  - Multiple future without conditions

- Final resolution of all comments was accomplished as follows:
  - Substantially revised the Hydrology, Hydraulics, and Economics appendices including running new H&H models
  - Updated Cost Appendix to reflect latest information obtain from the models
  - Performed an additional backcheck of the draft and/or final versions of the Feasibility Report as they become available

Independent External Peer Review (IEPR)

- IEPR managed by FRMPCX and conducted by Battelle
- IEPR completed 6 July 2010
- 23 comments generated (21 concurred, 2 non-concurred)
- Classification of comments by the IEPR team
  - 7 – High Significance
  - 13 – Medium Significance
  - 3 – Low Significance

Independent External Peer Review (IEPR)

- Key issues identified in comments
  - Geotechnical Analyses
  - Hydraulic and Hydrodynamic Modeling
  - Channel Configuration
  - Acceptability
  - Flood Fight Cost
  - Non-Structural Cost
  - Growth expansion in economic analysis
  - Performance of future flood risk reduction measures

Environmental Operating Principles (EOP)

- ***Strive to achieve environmental sustainability*** – achieved by incorporating features to facilitate fish passage, minimize impacts to geomorphology and other environmental impacts

- ***Proactively consider environmental consequences*** – Coordinated with resource agencies to identify appropriate measures to be included in project and mitigation design

- ***Seek balance and synergy among human development activities and natural systems*** - Recommended plan reduces flooding risk for the metropolitan area while minimizing impacts to the natural environment

- ***Accept corporate responsibility and accountability*** – The recommended plan is consistent with all laws and policies; the non-federal sponsor accepts the responsibility to operate and maintain the project in accordance with all applicable laws and policies

Environmental Operating Principles (EOP)

- ***Appropriate ways and means to assess cumulative impacts to the environment*** – Accomplished through the use of engineering models, environmental surveys, and discussions in the Resource Agency Team

- ***Appropriate mitigation –*** the recommended plan has evolved to address as many concerns as possible and minimize impacts to the environment ; all unavoidable impacts will be mitigated

- ***Integrated scientific knowledge base*** – has been increased by detailed modeling and surveys required for the study area

- ***Individuals and groups interested in Corps activities; listen to them actively, and respectfully*** – during the study process an extensive public involvement and outreach plan was implemented ; as a result extensive comments were generated and incorporated into the study

Campaign Plan

- **Project delivers enduring, sustainable and essential water resource solutions through collaboration with partners and stakeholders**
  - **Objective 2a –** Deliver integrated, sustainable, water resources solutions
  - **Objective 2b –** Implement collaborative approaches to effectively solve water resource
  - **Objective 4c –** Use of integrated, systemic approach to planning
- **Planning effort has built and is cultivating a competent, disciplined, and resilient team equipped to deliver high quality solutions**
  - **Objective 4a –** Identify, develop, maintain, and strengthen technical competencies in selected Communities of Practice (CoP)
  - **Objective 4b –** Communicate strategically and transparently
  - **Objective 4c –** Standardization of reports and business processes

Watershed Approach

- The recommended plan addresses flooding from the Red River of the North and five of its tributaries

- Significant portions of two counties in two states will receive benefits from the project upon implementation

- Although no formal agreements were executed, all of the agencies were active participants in a collaborative planning process

Project Timeline

- Reconnaissance – September 2008
- FSM – May 2009
- AFB – April 2010
- CWRB – September 2010
- Chief's Report – November 2010

Summary & Recommendation

Project Summary

- Project formulated using a systems approach between states and municipalities
- Provides a level of risk reduction in excess of the 1-percent chance event for majority of the region
- Overall Benefit/Cost ratio of over 2.27:1
- No significant environmental impacts
- Project has broad public & agency support

Recommendation

The Civil Works Review Board approves the Fargo-Moorhead Feasibility Report and Environmental Impact Statement and the St. Paul District be approved to initiate State and Agency Review

Fargo-Moorhead Metropolitan Flood Risk Management Feasibility Report & EIS

Mississippi Valley Division Position

Charissa Kelly

CESWF-Planning

13 September 2010

Rationale for MVD Support

- Concur with District Commander's findings and recommendations
- Report complies with all applicable policies and laws
- Plan supported by sponsors and congressional delegation
- Project Supports Strategic Campaign Goals 2 and 4

Rationale for MVD Support

- Report informs partners and public of risk and uncertainty
- Recommended project is technically sound, environmentally acceptable, and economically feasible

Certification of Legal & Policy Compliance

- Legal review of draft Feasibility Report by District Counsel
- Technical and Policy Compliance
  - ATR certification complete with all ATR comments resolved
  - All policy compliance issues have been addressed
  - IEPR comments received 6 July

Quality Assurance

- Centers of Expertise Involvement
  - FRM-PCX
  - ECO-PCX
  - Cost DX
- ERDC

Quality Assurance

Agency Technical Review, Division and HQ Policy Reviews, and IEPR:

Agency Technical Review	March 2009
Feasibility Scoping Meeting	May 2009
Agency Technical Review	February 2010
Alternative Formulation Briefing	April 2010
Draft Feasibility Report and EIS	May 2010
IEPR	July 2010

MVD Recommendation

- Approve Final Report
- Release for State and Agency Review
- Complete Chief's Report
- Anticipated favorable response to draft Chief's Report and NEPA review

Office of Water Project Review

Significant Policy Review Concerns

Kelly Baerwaldt

Chief, OWPR

13 Sept 2010

Areas of Policy Concern

- Without Project Condition
- Screening of Measures and Alternatives
- NED Plan
- Downstream Effects
- Mitigation

Without Project Condition

Concern:

- **Flood fighting**: No credit taken for its success; costs or how they may vary in different events (emergency actions) not evident in report
- **Base year**: No clear statement of what the assumed base year is for the analyses. This defines the start of the 50-year period of analysis and should be discussed in this section; critical to forecasting FWOP conditions and comparison of alternative effects over time.
- **Period of analysis**: MN diversion plans could be implemented after 6.5 years of construction and the ND diversion plans would require 8.5 years: not a comparable period of analysis.

Resolution:

- **Flood fighting**: More information be provided to understand emergency costs incurred and how they translate into benefits. Emergency costs should be specifically addressed this section as a basis for impact assessment under the with-project conditions.
- **Base year**: MVP work with OWPR to ensure analysis is correct; benefits will be adjusted appropriately. Prepare a detailed schedule for both the NED plan and the LPP.
- **Period of analysis**: ND plans should be shifted to the same timeframe as those in MN using the appropriate economic factors. This may make the ND plans more competitive, since the construction costs would be discounted for comparison.

Screening of Measures and Alternatives

Concern:

- **Screening of Management Measures**: Appendix O does not adequately discuss how management measures were screened, retained, and/or combined into alternatives. Additionally, the management measures that are listed in Section 1.6 seem to be different than the management measures that are evaluated in Section 2.4.
- **Screening of Alternatives**: Reasons for why the particular Alternative Screening Criteria were chosen and how they were measured and quantified in comparing alternatives is not clearly explained. Difficult to determine why these screening criteria were uniquely used and if they have individual weighting separate from criteria such as completeness, effectiveness, efficiency and acceptability.

Resolution:

- **Screening of Management Measures**: The document needs to more fully document the screening process. The details surrounding the alternative selection/screening process should be presented in the main report in addition to Appendix O. A table should be provided that demonstrates the rationale used to evaluate the management measures.
- **Screening of Alternatives**: Add an explanation of the criteria used, why they were selected, and how this fits in with the prescribed methods of evaluation in ER 1105-2-100.

NED Plan

Concern:

- MN20K diversion plan is designated as NED plan in the text, however it is noted that with reanalysis of hydrology the NED plan designation may change. NED plan should be established per 2-3.f.(1) of ER 1105-2-100 prior to release of the draft report; NED plan forms the basis for cost sharing when a larger LPP is proposed for recommendation.
- NED plan and LPP must be presented at the same (feasibility) level of detail to compare the plans in the report.
- Need to discuss how the new hydrology affects the screening analysis and verify that the screening based on the traditional analyses is still valid.

Resolution:

- The NED plan should be incorporated into the report. Information will be included in the main report indicating why the changes do not impact the results of the screening, and actually strengthen it.

Downstream Effects

Concern:

- Section 3.5.3.4.2 indicates the diversion plans would all have downstream effects that have not been analyzed except for the MN35K and ND35K diversion plans to identify maximum extent. This section states additional analyses will be conducted for only the LPP and NED Plans. It is unclear how significant the differences might be between various scale plans and whether there is potential for these considerations to affect the NED plan designation. Clarification is needed as to the effects of the induced flooding on the detailed alternative plan formulation and NED plan designation.

Resolution:

- The NED and LPP plans will be updated based on the new H&H analysis. The PDT will complete an economic analysis of the downstream impacts based on the future without project condition.

Mitigation Concerns

Use of ratios:

- Several sections state mitigation acreage ratios of 2:1 would be used for wetlands, geomorphic/fisheries and riparian impacts. This is inconsistent with paragraph C-3(d)(5) of ER 1105-2-100, which states habitat-based evaluation methodologies shall be used to describe and evaluate ecological resources and impacts associated with alternative plans.

CE/ICA needed:

- Neither the report nor the Environmental App. F contains a CE/ICA for the mitigation plan.

Mitigation performance standards, monitoring and adaptive management:

- The report should include mitigation performance standards, mitigation monitoring costs and duration, and an adaptive management plan.

Refinement of Mitigation Plan:

- The report indicates mitigation was developed based on existing data to assess potential impacts and no detailed studies, analyses, or modeling was performed.

Consideration of mitigation banks:

- No consideration to mitigation banks is given.

Mitigation Resolution

Mitigation Plan:

- The mitigation portion of the report will be updated and better defined to ensure that it is policy compliant. It is acknowledged that ER1105-2-100 requires specific habitat evaluation, including CE/ICA of mitigation actions. An appropriate level of detail is needed to evaluate the project impacts through the period of analysis and mitigation requirements should be identified based on an average annual habitat value as a basis for CE/ICA analyses.

Mitigation performance standards, monitoring and adaptive management:

- The final report will include draft performance standards and monitoring plans for mitigation, and contingency measures and adaptive management (including monitoring) to implement if original project is not effective.

Consideration of mitigation banks:

- Mitigation banks will be considered and information will be included in the final report.

OWPR Recommendation

Approve release of the Feasibility Report/Environmental Impact Statement for State and Agency Review

Discussion

Questions ?

Lessons Learned - MVP

- Early and frequent engagement of the vertical team and review team is essential to maintaining project schedule
- Identify key policy issues early in the study process
- Institute a central consistency management function
- Integrated FS/EIS ensures consistency
- Utilize industry expert where needed to address major concerns or unknowns
- Incorporation of comments from PA2010 has significantly improved the draft Feasibility Report

Lessons Learned - MVD

- Vertical team, sponsor, and public involvement are absolutely critical for the success of an expedited study
- Getting the vertical team on site early in the study helped with their understanding of the key problems/issues to be addressed
- Early identification and resolution of potential policy issues with the vertical team minimized delays later in the study
- Writing the report throughout the formulation process made draft report preparation less difficult and allowed for early buy-in by the vertical team
- Data collection for key issues like mitigation cannot be delayed until late in the study without the potential for delays
- There may be cases where climate variability is a key consideration for decision makers