

2012

MISSOURI RIVER BED DEGRADATION
FEASIBILITY STUDY—REPORT SYNOPSIS



KANSAS CITY DISTRICT

PLANNING CHARENTE NOVEMBER 5-9 2012

10/15/2012

Missouri River Bed Degradation Feasibility Study

Report Synopsis

October 9, 2012

The Report Synopsis has been prepared by the Project Delivery Team (PDT). The Report Synopsis is one of the SMART planning tools and is designed to help the PDT focus on the foundations of the study through the development of specific documents. This synopsis provides key information to the vertical team in preparation for the upcoming re-scoping charette. The document list for the synopsis has been expanded from the original “7 Pieces of Paper” to now also include three additional documents; Study Background, Map of Study Area, and Six-step Planning Process. Documents included in this synopsis are as listed below:

Study Background

Map of Study Area

Six-Step Planning Process

Problems and Opportunities

Objectives and Constraints

Evaluation Criteria

Key Uncertainties

Without-Project Condition

Measures Screened

Formulated Plans Under Consideration

Study Background

STATUS: The study has completed Planning Step 1, Identify Problems and Opportunities/Objectives and Constraints and is now working on Planning Step 2, Inventory and Forecast Conditions (Existing and Future without Project).

AUTHORITY: The study is authorized by Section 216 of Public Law 91-611, Flood Control Act of 1970, which reads:

The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significant changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.

STUDY DESCRIPTION: The study area is located on the lower Missouri River, from River Mile (RM) 498 at Rulo, Nebraska, to the mouth, located north of St. Louis, Missouri. The Missouri River bisects a two-state area. Major cities affected in Missouri are St. Joseph, Kansas City, and Jefferson City. In Kansas, Kansas City and smaller communities adjacent to the Missouri River are affected. The study area also includes tributary rivers and streams where direct influence or effects between the tributary and the Missouri River are evident. Federal projects within the study area include the Missouri River Bank Stabilization and Navigation Project (BSNP) and the associated BSNP Fish and Wildlife Mitigation Project. In addition, there are significant federal Flood Risk Management Infrastructure (Levees and Floodwalls) located throughout the study area.

STUDY HISTORY:

- Reconnaissance Study - 905 (b) Analysis: Completed August, 2009
- Feasibility Cost Share Agreement (FCSA): Signed November, 2010
- Project Management Plan: September, 2011

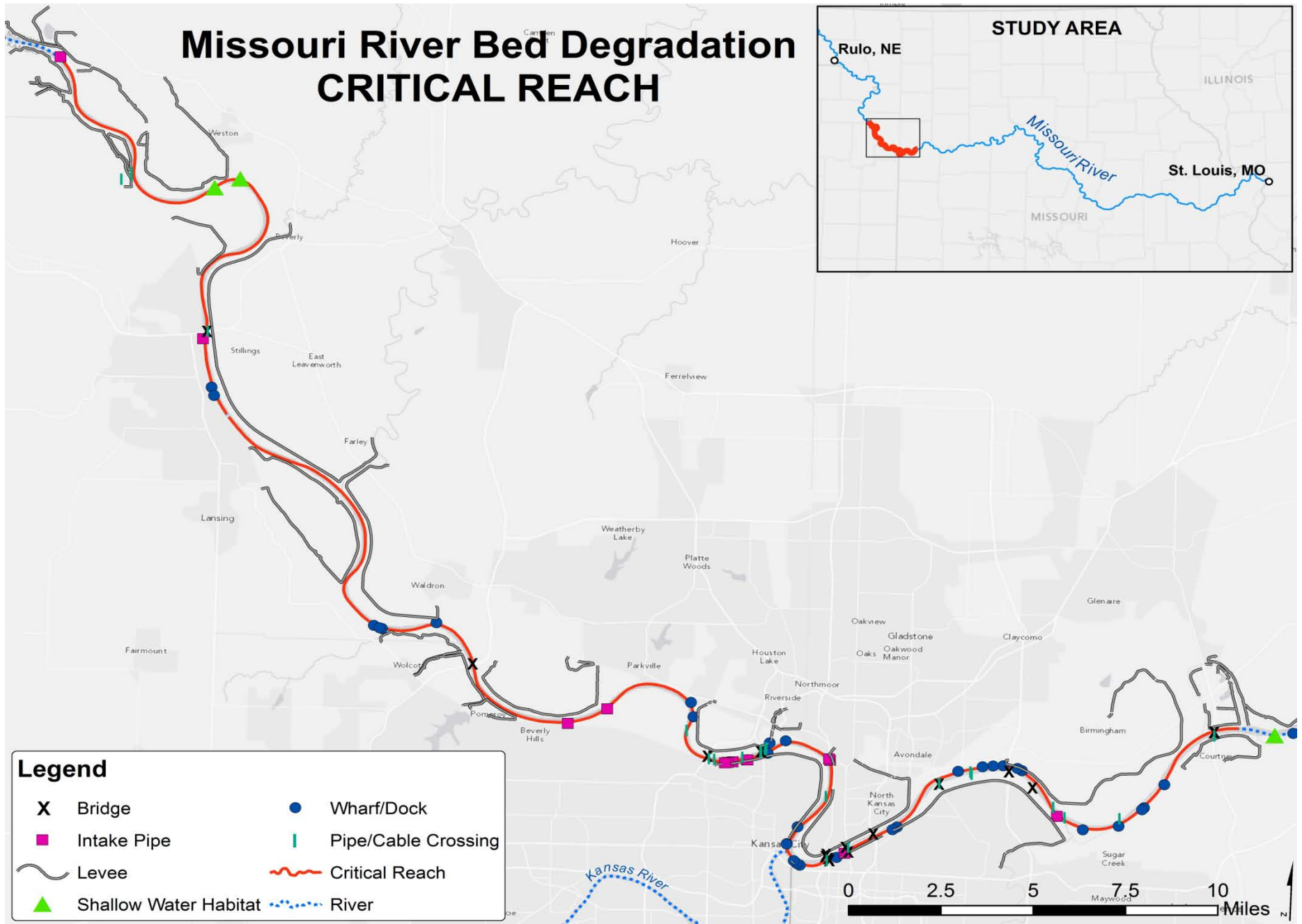
STUDY COST (as negotiated in FCSA): Total Project Cost estimated at \$6.8M. Obligation to date - \$1.7M.

SPONSOR: Mid-America Regional Council (MARC) - A regional planning agency that facilitates engagement and funding by a stakeholder group comprised of 17 entities representing a wide range of interests; including water supply, transportation (rail and highway), levee districts, commercial dredging, city, county, and state governments.

SCHEDULED LEGACY MILESTONES: (AS REFLECTED IN CURRENT SCHEDULE)

Feasibility Scoping Meeting – Nov 2013
Alternative Formulation Briefing – December 2015
Civil Works Review Board – January 2017

Missouri River Bed Degradation CRITICAL REACH

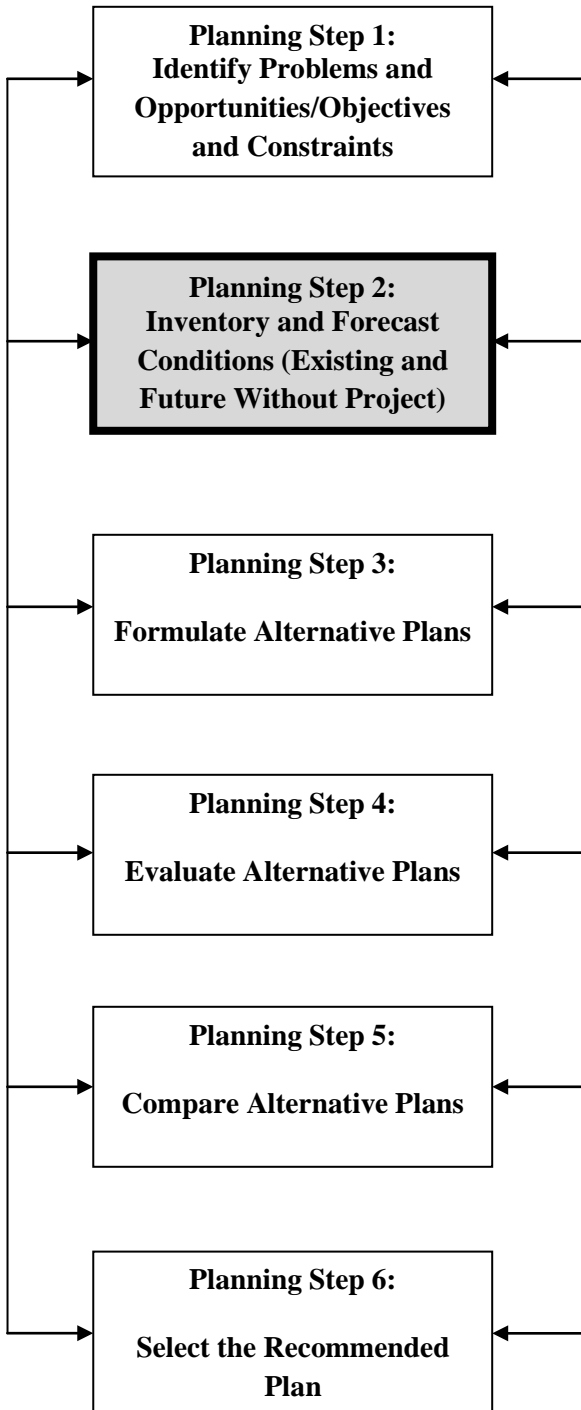


Legend

X	Bridge	●	Wharf/Dock
■	Intake Pipe		Pipe/Cable Crossing
—	Levee	—	Critical Reach
▲	Shallow Water Habitat	⋯	River



Six Step Planning Process



The study is currently in the Inventory and Forecast phase (Step 2) of the planning process as outlined in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983)*. Step 1: Specification of Problems and Opportunities has been completed by the study team, which is currently developing without-project conditions.

An inventory of at-risk infrastructure and habitats is currently being conducted and is near completion. The following ongoing analyses are in various stages of execution, which will be used to forecast without and with-project conditions:

- Mobile Bed Model, which forecasts bed elevations and associated river stages, has been built and calibrated. Engineers are currently assembling future conditions for use in the model;
- Levee Assessments for under seepage and stability are completed for existing conditions and for initial sensitivity assessments of various future conditions;
- Assessment of design, repair history, and current conditions of the Bank Stabilization and Navigation Project (BSNP) is under peer review;
- Assessments of infrastructure other than levees (Bridges and Water/Intakes) is underway;
- USGS regional ground water model, which forecasts ground water conditions at various bed elevations and associated river stages, has been calibrated for existing conditions. The model will be utilized for assessment of impacts under future conditions;
- Economic Damages Framework is being developed for future costs of operations, maintenance, repair, and replacement for at risk infrastructure;
- Draft Environmental Baseline Study of affected environment with gap analysis is under review; and
- Stakeholder engagement with project development occurs at monthly meetings. Public scoping and agency scoping has not been conducted.

Problems and Opportunities

Problem Statement: Bed degradation in the Missouri River and tributaries impacts critical federal, municipal, and private infrastructure. Lower bed elevation (and the associated river profiles) and low flow stages impose substantial costs on infrastructure owners and operators and affect floodplain ecosystem functionality. Within the study area, located from Rulo, NE to the mouth in St. Louis, MO the bed degradation has been characterized into categories of no-bed change, significant, severe, and critical, based on the drop in the low flow water surface profiles (1990-2009). Based on this characterization the Kansas City Reach (RM 357 to RM 410) was designated as being critical and severe and is the focus of the analysis.

In-water and stream bank infrastructure are affected by lower river profiles and stages, which result from bed degradation. Lower river bed elevations impact the structural stability of in-water and stream bank infrastructure. Infrastructure, such as bridges, utility crossings, and flood risk management structures, has been modified to maintain structural integrity with a lower river bed. Lower river stages impact the effectiveness of water intakes, some of which have been modified to operate at lower water surface elevations. Lower river stages reduce groundwater elevations, which impacts alluvial well-field water supply production. Shallow water riverine habitats and floodplain wetlands are also impacted by lower water elevations. In addition, reduced water surface elevations on the lower Missouri River also cause bed degradation on tributaries, creating similar effects to tributary in-water and stream bank infrastructure and habitats.

Bed degradation is projected to continue into the future, further lowering Missouri River and tributary bed profiles and river stages. The characterization of the degradation reaches throughout the study region may change due to the impacts from the recent flood of 2011. Post flood information is still being processed.

Opportunity Statement: The study investigates opportunities on the main stem and tributaries to:

- Improve federal flood risk management, water supply, and navigation project operations, effectiveness, and efficiencies;
- Provide ancillary benefits to commercial, industrial, and municipal users of river resources;
- Bring the Missouri River and tributaries into a more stable balance with current and projected future conditions;
- Enhance water supply reliability during low flow conditions;
- Enhance and/or sustain ecosystem functions and services; and
- Reduce the risk of failure for in-water and stream bank structures.

The federal interest in this project is the potential contribution to National Economic Development, which would result from avoiding future damages due to the impacts of bed degradation in the lower Missouri River main stem and tributaries. Future damages include repair and replacement costs for at-risk-infrastructure, which is owned and maintained by federal, state, and local governments, and by private entities. In addition, bed degradation increases BSNP maintenance and operations costs and impacts Missouri River main stem dam project operation (*e.g.* discretionary releases for downstream municipal water supply).

Objectives and Constraints

Study Objectives¹: The objective of the study is to identify a plan which contributes to national economic development by:

- Reducing future repair and replacement costs for in-water and stream bank infrastructure;
- Reducing future operations and maintenance costs for in-water and stream bank infrastructure, flood plain habitats, and shallow water habitats;
- Reduce the negative environmental impacts of bed degradation in the main stem Missouri River and tributaries;
- Improve infrastructure reliability and reduce risk of failure; and
- Reverse bed degradation (bed aggradation) where beneficial.

Categories of at-risk infrastructure along the 53 river miles identified for detailed investigation in this analysis include:

- BSNP bank stabilization component (federal);
- Power utility water intakes (multiple public utilities);
- Pipelines (multiple private owners);
- Levees (multiple federal and local projects);
- Roadway bridges (multiple public agencies);
- Railway bridges (multiple private owners);
- Municipal water supply (multiple public agencies); and
- Critical shallow water habitat (federally implemented).

The study objectives may change with future public scoping and National Environmental Policy Act (NEPA) considerations.

Study Constraints²:

- Do not implement measures which would impact the Missouri River System's ability to meet all authorized project purposes (flood control, navigation, water supply, recreation, hydropower, fish and wildlife, and irrigation);
- Do not implement measures which would require system operations that are inconsistent with the Master Manual; and
- Do not reduce habitat area required by the 2000 Biological Opinion (BiOp) as amended (2003).

¹ "An objective is a statement of the intended purpose of the planning process; it is a statement of what an alternative plan should try to achieve" Charlie Yoe and Kenneth Orth, 1996. Planning Manual. IWR Report 96-R-21 (page 79).

² "Planning objectives are the things we want to accomplish with a plan...In contrast, study specific planning constraints are things we want to avoid doing" Ibid. (page 80).

EVALUATION CRITERIA

Objectives		Metric
1	Reduce future repair and replacement costs for in-water and stream bank infrastructure.	Difference between without and with-project projected average annual equivalent value of repair and replacement costs.
2	Reduce future operations and maintenance costs for in-water and stream bank infrastructure, flood plain habitats, and shallow water habitats.	Difference between without and with-project projected average annual equivalent value of operations and maintenance costs.
3	Reduce the negative environmental impacts of bed degradation in the main stem Missouri River and tributaries.	Projected acres of suitable habitat: Note that same metric will be used to ensure compliance with Constraint #3 (Biop constraint)
4	Improve infrastructure reliability and reduce risk of failure.	Probability of levee failure modeling results, first year critical bed elevation and associated profile results from Mobile Bed Model, first year low flow critical water level elevation results from Mobile Bed Model.
5	Reverse bed degradation (bed aggradation) where beneficial.	Projected bed elevations (and associated river profiles).
Constraints		Metric
1	Do not implement measures which would impact the Missouri River System's ability to meet all authorized project purposes	Proposed changes to release schedules (CFS)
2	Do not implement measures which would require system operations that are inconsistent with the Master Manual	Proposed changes to release schedules (CFS)
3	Do not reduce habitat area required by the 2000 Biological Opinion as amended (2003)	Projected acres of suitable habitat

COMPARISON CRITERIA

•	Objectives 1, 2, and 4 can be combined into a single dollar value
•	Habitat acres (Objective 3) can be combined into a single value, which assumes that all habitat types are weighted equally
•	More aggradation (Objective 5) is better than halting degradation, but only to the extent that the incremental addition to aggradation generates incremental increases in economic and environmental benefits
•	Note that improved reliability and risk reduction (Objective 4) may also be applied as a threshold criterion for preliminary screening (e.g. a plan may be advanced for detailed analysis only if reliability is improved).

SELECTION CRITERIA

Use a hierarchy of objectives, such as
Dollar value is the primary objective;
habitat acres is the secondary objective; and
total aggradation is the tertiary objective.
—Under the hierarchical scenario, the alternative plan with the highest dollar value (net benefits) would be the selected plan. If there were two plans with the same dollar value, then (out of those two plans) the plan with the most habitat acres would be selected, and so on.

ADDITIONAL SELECTION CRITERIA: May be used for preliminary screening or detailed analysis

•	P&G Criteria: Effectiveness, Efficiency, Completeness, Acceptability;	•	Reduce loss of life; and
•	Remaining P&G accounts: Regional Economic Development (RED) and Social Effects;	•	Improve public safety.
•	Constructability;		

KEY UNCERTAINTIES: WHAT AREAS OF UNCERTAINTY DO YOU EXPECT TO IMPACT YOUR PLANNING DECISION?**Existing Condition Uncertainty****Responsibility for causes of historical degradation**

- Responsibility information would not be available to support cost share decision making
- Determining responsibility would be expensive, time consuming, and potentially challenging to constraints
- Responsibility determination would not affect study recommendation

Without and With-Project Uncertainty**Projected bed degradation (mobile bed model output)--River profiles and stages (over and/or under estimate)**

- Over and/or under estimation of river profiles and stages would lead to over or underestimation of risks and benefits
- Sensitivity analyses may be conducted to assess impacts on study recommendation

Projected bed degradation (mobile bed model output)—timing of physical impacts (high and low flow events)

- Incorrectly projecting the timing of bed degradation would cause over or under estimation of project benefits
- Sensitivity analyses may be conducted to assess impacts on study recommendation

Projected bed degradation – relation between main stem and tributaries

- The relationship between main stem bed degradation and tributary bed degradation is not quantified
- Professional judgment will be a major factor in projecting tributary bed degradation
- Over/under estimation of tributary bed degradation will cause over/under estimation of risks and benefits
- Sensitivity analyses may be conducted to assess impacts on study recommendation

Critical bed elevations for in-water and stream bank infrastructure

- Estimates of critical bed elevations will be required for infrastructure that does not have supporting engineering data
- Incorrect critical bed elevation estimates will cause an over/under estimation of risks and benefits
- Sensitivity analyses may be conducted to assess impacts on study recommendation

Future OMR&R costs

- Future OMR&R costs will be based on a combination of historical costs and professional judgment
- Incorrect future OMR&R costs estimates will cause an over/under estimation of benefits
- Sensitivity analyses may be conducted to assess impacts on study recommendation

Regulatory decisions uncertainty

- Concerning quantity of commercial dredging (Section 404 permit)
- Section 401 State Water Quality Certification for chute construction (floodplain connections)

USACE Planning decision uncertainty

- Upper basin water supply decisions (reallocation study)
- Cottonwood management plan implementation

Regional Economic Impact effects on acceptability

- Potential impacts to dredging, construction, and navigation industries

Navigation industry engagement

- Potential response to BSNP operational changes
- Navigation industry as a whole is currently not involved with the study

Without-Project Condition

The without-project condition is currently under development and is not fully formulated. Major components of the without-project condition include:

- Continued operation and maintenance of the BSNP at current levels;
- Continuation of commercial sand and gravel dredging activities (level of dredging to be determined);
- Continued compliance with the 2000 BiOp as amended in 2003;
- Continued Missouri River bed degradation: Mobile Bed Model projects without-project future bed elevations, river profiles, and river stages;
- Continued tributary bed degradation: Without-project future bed elevations, river profiles, and river stages in the tributaries will be projected from Missouri River Mobile Bed output;
- Infrastructure will continue to be at risk and require repairs and replacement: Without-project damages will be projected from Mobile Bed Model output and economic model. Without-project levee reliability will be projected from levee underseepage and stability analyses; and
- Wetland and shallow water habitats will be affected by lower river stages: Mobile Bed Model output, USGS regional ground water model, and mapping of existing habitats will be used to project at-risk habitats.

Measures Screened

Measures have not been formulated, however; the district has operated the BSNP for decades, which provides substantial insight into the development of measures. Measures may be screened by the Mobile Bed Model, which is capable of projecting the effects on Missouri River bed degradation resulting from changes in the following factors:

- Sediment volume;
- Dredging;
- Roughness;
- Cross-sectional geometry; and
- Bed stabilization.

A decision needs to be made concerning the level of detail required to perform screening of measures during plan formulation. More detailed analyses may be required for the evaluation of alternative plans. Additional model development may be required for the analysis of specific alternatives.

Formulated Plans Under Consideration

There are no formulated plans under consideration at the time.