

Enclosure 1

Missouri Headwaters Basin Study

Plan of Study

Introduction

The Bureau of Reclamation (Reclamation) is partnering with the State of Montana Department of Natural Resources and Conservation to evaluate water supplies and water management issues in the Missouri River Headwaters in Montana. This Missouri Headwaters Basin Study (Basin Study) Plan of Study (POS) provides a description of the following:

1. Basin Study objectives, milestones, and tasks;
2. Roles and responsibilities of Basin Study partners;
3. Budget and schedule for completing the Basin Study;
4. Quality assurance measures; and
5. Plan to coordinate with stakeholders.

This Basin Study is being carried out under Reclamation's WaterSMART Program pursuant to the authority and mandates of the Secure Water Act (SW A), Subtitle F (P.L. 111-11). Under the SWA, Reclamation can partner with entities in the 17 Western U.S. states to: (1) evaluate projections of water supply and demand within a basin, including an assessment of the risks associated with climate change; (2) analyze how existing water and power infrastructure and operations will perform in the face of increasing demands; (3) develop adaptation and mitigation strategies to meet future demands; and (4) conduct trade-off analyses and make recommendations on strategies to secure future water supplies. This Basin Study will use existing data and build upon Reclamation's Impacts Assessment for the Upper Missouri River Basin (UMRB Impacts Assessment). It also will support and follow-up on Montana's updated State Water Plan that was submitted to the 2015 Montana Legislature. The State Water Plan lays out a path for managing Montana's Water resources over the next twenty years. It includes recommendations for DNRC to work with local water users and other government agencies to conduct a basin-wide physical water availability and water management assessment in the Upper Missouri Basin. This includes studies to assess and analyze how the basin's existing water and power operations and infrastructure will perform under different water supply scenarios, and to analyze the effectiveness of adaptation and mitigation strategies for meeting the challenges of supplying adequate water in the future.

Background and Need

This Basin Study encompasses the Missouri River basin (Basin) headwaters in Montana from the Continental Divide to the U.S. Highway 191 Fred Robinson Bridge over the Missouri River (at the United States Geological Survey (USGS) Missouri River at Landusky gauging station) and to the Montana State Highway 200 Bridge over the Musselshell River (at the (USGS) Musselshell River

at Mosby gauging station). Both stations are upstream of Ft. Peck Reservoir which is administered by the U.S. Army Corps of Engineers (Map 1). The drainage area of the basin to this point is about 50,000 square miles. In addition to the Missouri River main-stem, the larger tributary streams include the Gallatin, Jefferson, Madison, Beaverhead, Ruby, Big Hole, Dearborn, Smith, Sun, Teton, Marias, Judith and Musselshell Rivers.

Reclamation projects in the Basin include the five multi-purpose Pick-Sloan Missouri Basin Program (P-SMBP) Units: (1) *East Bench Unit*; (2) *Crow Creek Pump Unit* (3) *Canyon Ferry Unit* (4) *Helena Valley Unit* (5) *Lower Marias Unit*. These projects and features are summarized in Table 1. The Sun River Project was authorized before P-SMBP.

Table 1. Summary of U.S. Bureau of Reclamation projects in the Upper Missouri River Basin

Unit	Storage	Acres Irrigated	Hydropower
East Bench	Clark Canyon Reservoir: 257,000 acre-feet	61,700 acres	None at present; 4.7 MW proposed
Crow Creek Pump: Missouri River	NA	23,400 acres	NA
Canyon Ferry Reservoir	2,000,000 acre-feet	Makes possible the irrigation of 155,600 acres and supplements irrigation of 82,000 acres.	50 MW
Helena Valley	Helena Valley Reservoir supplied by Canyon Ferry Dam: 10,500 acre-feet	17,000 acres Also supplies M&I water for City of Helena	None
Sun River	Gibson Reservoir: 99,000 acre-feet Pishkun Reservoir: 46,000 acre-feet Willow Creek Reservoir: 34,000 acre-feet	95,000 acres	None at present; 15 MW proposed
Lower Marias	Tiber Reservoir: 925,000 acre-feet	127,000 acres originally planned; only about 3,000 acres have been developed	7.5 MW

An understanding of potential climate change impacts will be necessary in planning for the future operations of these projects. There have been substantial water shortages to irrigators on the East Bench Unit during drought, and adaptation strategies will be needed to lessen future impacts due in part to climate change, while still providing water to other contract irrigators and for instream fisheries needs. Canyon Ferry Reservoir may be the source of contract water for future development, but potential approaches for using Canyon Ferry releases to benefit endangered pallid sturgeon in the Missouri River downstream of Great Falls needs to be identified and evaluated before substantial increases in contracting by Reclamation can proceed. Water shortages are common for the Sun River project and options for achieving minimum flow targets in the Sun River, while not increasing water shortages to irrigators, need to be identified and evaluated. Tiber Reservoir also is a potential source of contract water for future development, and might also be a key component of plans to provide well-timed flow

releases for the endangered pallid sturgeon on the mainstem of the Missouri River system above Ft. Peck Reservoir.

State-owned dams/reservoirs in the study area provide substantial irrigation supplies and at one location, the dam produces hydropower. The dams/reservoirs are Ruby (36,600 acre-feet), North Fork of Smith River (11,400 acre-feet), Nilan (10,100 acre-feet), and Willow Creek (17,700 acre-feet), and the Toston Dam/Hydropower Plant on the Missouri River (10 MW). NorthWestern Energy owns and operates one storage and eight hydroelectric projects in the basin including Hebgen Lake (386,000 acre-feet, Madison River), Madison Dam (9 MW, Madison River), and Hauser (19 MW), Holter (48 MW), Black Eagle (21 MW), Cochrane (64 MW), Rainbow (60 MW), Ryan (60 MW) and Morony (48 MW) Dams (Missouri River between Canyon Ferry and Great Falls).

Red Rock Lake National Wildlife Refuge in the upper headwaters above a privately owned reservoir (Lima Dam and Reservoir 84,050 acre-feet capacity) and Charles M. Russell National Wildlife Refuge (CMRNWR) spanning the Fred Robinson Bridge are managed by the U.S. Fish and Wildlife Service (USFWS). The U.S. Bureau of Land Management (BLM) manages the Upper Missouri Wild and Scenic River that begins at Fort Benton and runs 149 miles downstream to the Fred Robinson Bridge. The BLM also manages the Upper Missouri River Breaks National Monument which generally parallels the Wild and Scenic River from Ft. Benton downstream to approximately Arrow Creek where the monument widens from 6 to 16 miles on each side of the Missouri River until it reaches CMRNWR.

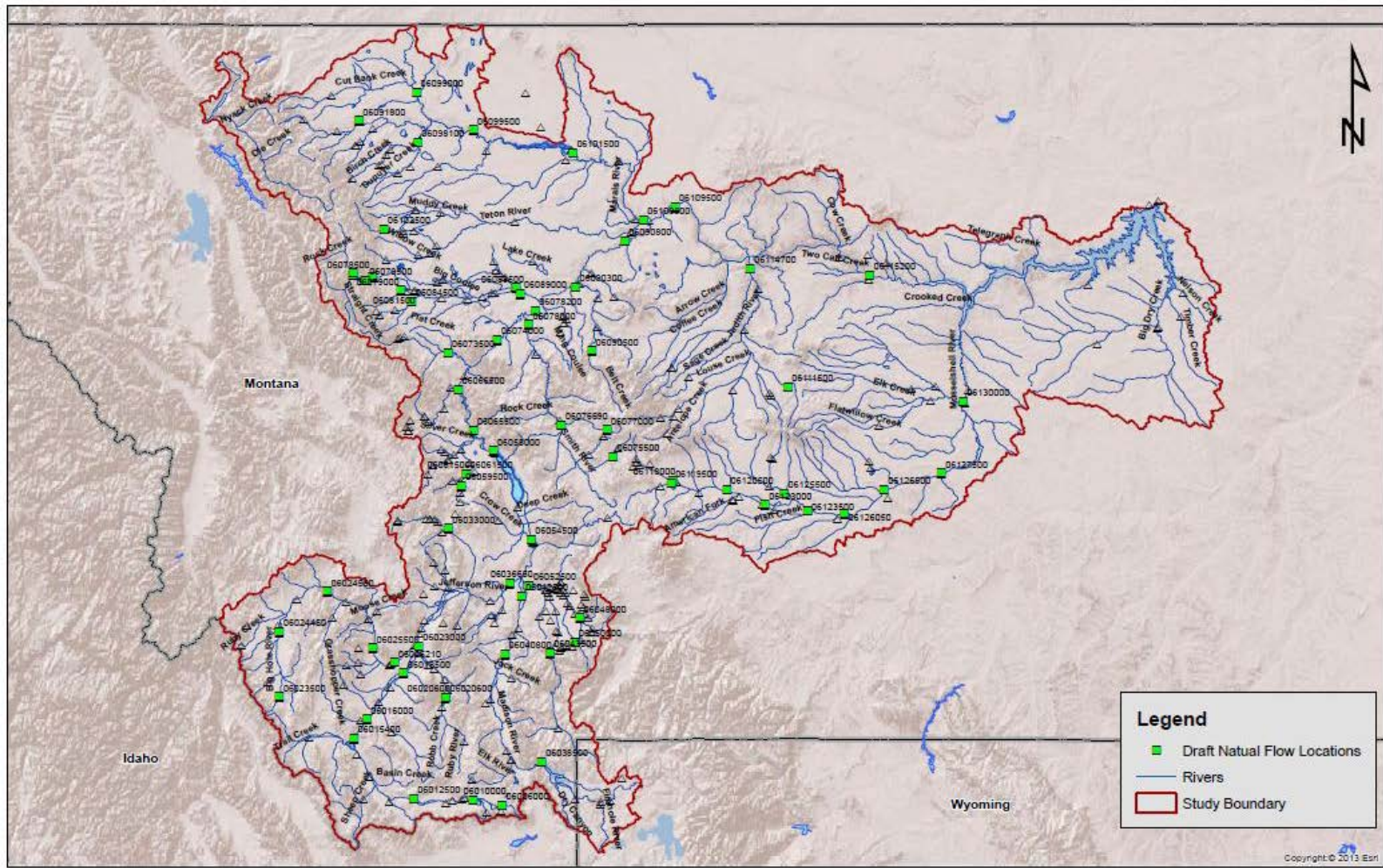
Indian Tribes on the Blackfeet Reservations, the Rocky Boys Reservation and the Fort Belknap Reservation have a significant stake in the Basin Study, especially at Tiber Dam/Lake Elwell. That facility has been and is likely to continue to be an important component of reserved water rights settlements.

There are a variety of environmental issues and interests, and species of special concern in the upper Missouri River Basin, such as the pallid sturgeon which was listed as Endangered in 1990 under the Endangered Species Act. Pallid sturgeon are large, long-lived benthic fish native to the Mississippi River drainage and are found as far upstream in the Missouri River as the Marias River confluence near Ft. Benton. They now exist in isolated populations segmented by large dams. It is important to understand that proposed adaptation and mitigation measures or other actions that may be proposed by the Basin Study partners can not jeopardize the continued existence of pallid sturgeon.

Fluvial arctic grayling (grayling) inhabit the Big Hole River drainage in the Missouri River headwaters. Grayling are a species that likely would be sensitive to changing climate and to changing flow patterns, and this Basin Study could provide information that would be useful to future grayling conservation efforts throughout the Basin.

Lastly, recreation is an important resource in the Basin. The study area enjoys significant flat water-related visitation at nearly all Federal and State reservoirs, at the plentiful rivers and streams, and at a variety of Montana State Parks. Significant upland opportunities also exist throughout the Basin.

The study area map on the following page shows the general hydrographic features of the study area and potential node locations of a hydrology model (RiverWare).



Basin Study Objectives

The objectives of the Missouri Headwaters Basin Study are to:

- 1) Project future water supply and demand within the Basin, and water supply risks relating to climate change.
- 2) Leverage river system management model developed as part of the UMRB Impacts Assessment for simulation of system operations under present and future conditions;
- 3) Possibly integrating groundwater modeling into the river system management model for alluvial aquifers in high-demand areas, such as the Gallatin and Beaverhead valleys.
- 4) Through the river system management model, analyze the water and power infrastructure performance and operations under climate change and future growth scenarios.
- 5) Model adaptive management strategies for the Basin, and running and compiling the results for these adaptive management strategies.
- 6) Conduct a trade-off analysis of the identified strategies and develop findings and recommendations.
- 7) Conduct outreach to involve stakeholders for the development of the alternative adaptation measures and trade-off analysis.

Basin Study Tasks

The completion date for the Basin Study will be September 30, 2017. Leading up to the Basin Study, and being conducted concurrently, will be the UMRB Impacts Assessment. Below are the nine major tasks that have been identified. The UMRB Impact Assessment phase of the project encompasses Task 1 through Task 4. The focus will then shift to the Basin Study with Task 5.

Task 1: Basin Study Kick-Off and Historic Data Collection

Task 2: Climate Change and Future Water Supply Analysis

Task 3: River System Management Model Development and Calibration

Task 4: System Reliability and Impact Analysis

Task 5: Identification of Adaptation Strategies; Public Outreach

Task 6: Modeling of Adaptation Strategies

Task 7: Trade-Off Analysis and Recommendations

Task 8: Draft Report Compilation and Review

Task 9: Finalize Report

Task 1: Basin Study Kick-Off and Historic Data Collection

This task will include developing the scope of the project and agreeing on schedules, budgeting, and roles and responsibilities for achieving Basin Study objectives. The synchronization between the Impacts Assessment and Basin Study also will be planned. Subtasks will include the following:

- *Hold kick-off meeting with Basin Study partners*
- *Prepare a Memorandum of Agreement (MOA):* This will be signed by the Basin Study partners and stipulate the terms and conditions for conducting the study.
- *Prepare a detailed POS:* The POS will outline tasks, schedules, and budget for conducting the Basin Study.
- *Decide on accounting nodes for the future climate and river system management modeling efforts, and compile available historic streamflow data for these locations*

Task 2: Climate Change and Future Water Supply Analysis

As part of the UMRB Impacts Assessment, Reclamation will evaluate projected future climate and runoff conditions for the Upper Missouri River Basin. The climate change analysis will involve development of climate change scenarios for the basin (including future precipitation and temperature) that bracket the range of possible climate futures. The future temperature and precipitation scenarios will serve as input to the Variable Infiltration Capacity (VIC) hydrology model, which will simulate runoff and other water balance variables at selected locations in the basin. The output from the VIC model will be the flow input data to a RiverWare river system management model, which will be used to simulate Reclamation's and others' infrastructure and operations in the basin, and to evaluate potential impacts to these operations. Modeling for the UMRB Impacts Assessment and Basin Study will be done at daily time-step for using the 1950-1999 period to define the historical reference period. Future scenarios will be summarized for 30-year periods centered on 2025, 2055, and 2085, consistent with Reclamation's West-Wide Climate Risk Assessment (WWCRA). Additional climate change scenarios may be provided that incorporate climate and/or streamflow reconstructions from analysis of paleo records. These scenarios would be in addition to those developed based on climate projections from general circulation models (GCMs). Reclamation will take the lead on the climate change and future water supply effort, with DNRC participation to understand the process and to offer input during the VIC model calibration. Subtasks will include the following:

- *Develop spatially down-scaled precipitation and temperature data for the basin:* Reclamation already has collaborated with federal and nonfederal entities to develop downscaled (1/8° spatial grid) precipitation and temperature data for the western United States as part of its WWCRA. The archives contain climate data for a broad range of climate projections created by the application of different GCMs to distinct future scenarios for greenhouse gas emissions pathways and assumed initial conditions for global climate. The basis of the climate change input data for the UMRB Impacts Assessment and Basin Study are downscaled World Climate Research Programme's Coupled Model

Intercomparison Project (CMIP) 3 and CMIP5 climate projections. Both CMIP3 and CMIP5 climate projections (309 projections in total) will be used to develop the 5 ensemble future climate scenarios for each of three future periods, centered on 2025, 2055, and 2085. The ensemble hybrid-delta period-change approach will be used to develop climate change scenarios.

- *Develop future water supply data for the basin:* The temperature and precipitation scenarios will be used with the Variable Infiltration Capacity (VIC) hydrology model by Reclamation to simulate runoff, at a 1/8° spatial grid, for the potential future climate scenarios. Runoff will be simulated for each of the accounting nodes identified in Task 1. The VIC runoff model may be calibrated at select locations as part of the UMRB Impacts Assessment by making adjustment to input parameters so that simulated natural flow corresponds more closely to the historical reconstructed natural flow, which have been quantified for numerous sites within the study area through previous modeling studies.
- *Develop historical and future water supply data for the basin based on paleo analysis:* Additional scenarios of historical and future climate and/or streamflow may be developed using analysis of the paleo record, which predominantly includes tree ring data. The U.S.G.S. will coordinate with Reclamation to provide any scenarios based on paleo information as part of the UMRB Impacts Assessment.

Task 3: River System Management Model Development and Calibration

Reclamation will take the lead in developing a RiverWare daily time-step river system management model of the Basin as part of the UMRB Impacts Assessment. DNRC will contribute to this effort by refining its existing Musselshell River model to a daily time-step, for incorporation into the model for the entire basin, and by assisting with the development of other sub-basin model components for the UMRB RiverWare management model. Model parameter information and input data development will be part of this task. Subtasks will include the following:

- *Develop the historic evapotranspiration, net irrigation requirements, and reservoir evaporation data that will be used as input to the river system management model:* This will include data on crop coefficients, irrigated acreages, and effective precipitation. Reclamation already has generated much of this data need to model irrigation water use in the Basin but will refine the information as needed.
- *Develop revised water demands for future climate Scenarios:* Potential evapotranspiration for future climate scenarios will be determined and irrigation input files to the RiverWare management model will be modified for modeling the future climate scenarios.
- *Compile other necessary input data for the model:* Other input files required for modeling irrigation will be developed including canal capacities, irrigation

efficiencies, irrecoverable losses and return flow factors. Model input files for municipal water uses and consumption will be developed by DNRC. Reservoir data input files, such as area-capacity tables, and outlet and spillway capacity tables will be compiled. Other input data files that will need developed for the model include information needed to compute hydropower production, and information on minimum and target instream flows below reservoirs.

- *Develop a river system management model for the Upper Missouri Basin:* Reclamation will be developing a river system management model of the Missouri River headwaters with the RiverWare software as part of its UMRB Impacts Assessment. This will include developing rules to model reservoir operations, hydropower, and municipal and irrigation water use in the basin. The model will run on a daily time-step, for the historical reference period as well as future climate change scenarios.
- *Modify the monthly time-step RiverWare management model of the Musselshell River watershed portion of the Basin to a daily time-step for the Impacts Assessment and Basin Study:* DNRC will update its monthly time-step model of the Musselshell system to a daily time-step. The updated model will then be incorporated into the full Upper Missouri River basin model.
- *Review and refine overall integrated operations of the Upper Missouri River system:* This task will be to review and test the RiverWare management model to ensure that the various components of the model are correctly integrated so that it simulates the Upper Missouri River system as a whole. This will include the ability to simulate current arrangements that optimize system hydropower production, flood control operations, and coordinated reservoir releases for endangered species.
- *River system management model calibration:* The river system management model will be calibrated to suitably simulate historic “baseline” conditions for the 1950-2014 period. This will include calibrating to historic gaged streamflow data, reservoir contents, and irrigation diversions, where data are available. The baseline conditions model runs will use the current level of irrigation development, crop mixes, irrigation efficiencies and crop irrigation requirements, and current operation procedures for the reservoirs.
- *Incorporate groundwater modeling:* Montana is actively studying the interactions of surface and ground waters in high demand areas of the Missouri River headwaters, such as the Gallatin and Beaverhead valleys. Detailed evaluations of groundwater resources for at least portions of these valleys are available through research investigations by the Montana Bureau of Mines and Geology as part of its Ground Water Investigation Program (GWIP). Groundwater flow models developed using the U.S.G.S. finite difference model MODFLOW also are being developed for these alluvial aquifer systems. These models, or elements of them, could be incorporated into the Upper Missouri RiverWare management

model to assess groundwater and surface water as a unified resource. DNRC would take the lead on this aspect of the Basin Study.

- *Evaluate potential stream temperature changes:* To qualitatively evaluate the effects of stream temperature on fish species, historical simulated climate and flows will be correlated with available historical measurements of stream temperature within the study area. Projected stream temperature will be qualitatively evaluated by using a reference approach in which analogs of historical climate, flow, and associated stream temperatures will be used to estimate projected stream temperatures

Task 4: System Reliability and Impacts Analysis

The river system management model and future climate input data will be used to evaluate potential impacts to Reclamation's and others' operations and activities, based on rules that simulate current operating requirements, policies, and regulations. The ability of the system to provide existing levels of benefits--under climate change and growth scenarios--for irrigation, recreation, flood control, ecological resources, and hydropower generation will be assessed. Reclamation will take the lead on this task. Subtasks will include the following:

- *Modeling future climate scenarios:* Following calibration, the model will be run using the hydrologic and water use input files for the future climate scenarios. Future scenarios may include both GCM-based scenarios and paleo-based scenarios. The output for the future scenarios will then be compared to that for baseline conditions. Based on this comparison and analysis, any increases in water shortages or new operational challenges will be identified.
- *Hydropower:* The model will be used to simulate hydropower production at all major facilities in the basin under future conditions considering current operational constraints at Canyon Ferry Dam.
- *Irrigation:* Water needed for irrigation under projected future climate and growth scenarios will be simulated for future conditions and compared to historic needs. Changes in future flow rates and timing and consumptive-use demands could have effects on reservoir levels and associated recreational benefits, and these will be evaluated, as will potential impacts to ecological resources.
- *Flood Control:* The ability to provide current levels of flood control, under a changing climate, will be evaluated for multi-purpose reservoirs such as Clark Canyon, Canyon Ferry and Tiber reservoirs.
- *Fish and Wildlife:* Agreements exist to maintain minimum flow rates in a number of river reaches. The model will be used to evaluate the ability to maintain these flow rates under future conditions. The pallid sturgeon inhabits the Missouri River between the mouth of the Marias River and Fort Peck Reservoir and was listed as endangered by the USFWS in 1990. Reclamation is working with the USFWS and other agencies to investigate higher releases from Tiber and Canyon

Ferry reservoirs to benefit pallid sturgeon migration and recruitment in the upper Missouri River. The potential to provide releases for pallid sturgeon also will be assessed. The UMRB Impacts Assessment will also explore the capabilities of the RiverWare management model to simulate stream temperature, using available historical measurements for validation.

- Future demands also will take into account increases in municipal demands due to projected population growth. DNRC will take the lead in developing these future demand projections.

Task 5: Identification of Adaptation Strategies; Public Outreach

Simulating the system under existing operations and with the existing infrastructure will provide a no action scenario baseline to which adaptation strategies can be compared. Adaptation strategies will be developed to address projected future imbalances between supply and demand. These strategies could include operational changes, modifications or replacements to existing facilities, and improved water management. Public outreach and participation will be important in identifying and developing the adaptation strategies. DNRC will take the lead on this task. Subtasks will include the following:

- *Identify constraints and objectives:* Determine the objectives of the adaptation strategies and identify what operational and infrastructure constraints there might be.
- *Formulate viable options for further analysis:* This will include, but not limited to, operational modifications, infrastructure improvements, potential new infrastructure, and management improvements.
- *Public Outreach:* An important component of the Basin Study will be working with stakeholders to develop adaptation strategies that can be simulated with the RiverWare management model. Through its State Water Planning activities in the Missouri River Headwaters, DNRC has developed a citizens' Upper Missouri River Basin Advisory Council and would work with the council, along with Watershed Groups, Conservation Districts and others to expand diverse stakeholder participation in the Basin Study. Meetings will be held to engage the public in the development of adaptive strategies and identification of operational constraints. DNRC will take the lead in engaging stakeholders and incorporating their input throughout the Basin Study, although Reclamation will be responsible for outreach to the Tribes on the Blackfeet, Rocky Boys, and Ft. Belknap Reservations.

Task 6: Modeling of Adaptation Strategies

Once potential adaptation strategies are identified for addressing the imbalances between supply and demand, alternatives will be developed and simulated with the river system management model. Simulating the system under existing operations and with the existing infrastructure for various alternatives will provide a no action scenario baseline to which

adaptation strategies can be compared. DNRC will lead this effort. Subtasks will include the following:

- *Develop alternative scenarios to simulate potential adaptation strategies:* These options could include structural measures, such as more efficient irrigation systems, increasing reservoir storage, and system capacity improvements. The alternatives also could include operational changes for reservoirs and canals, or changes in water sharing arrangements during times of shortage. The alternatives might also include adaptation strategies that mitigate potential changes in stream temperatures.
- *Develop new rules for the RiverWare management model to simulate the adaptation strategies:* Simulating physical changes in the infrastructure or modified operational strategies will require the development of new rules for the RiverWare management model.
- *Review model results to determine if objectives have been met:* If objectives have not been met, redefine strategies and rerun model to achieve objectives.

Task 7: Trade-Off Analysis and Recommendations

A trade-off analysis will be used to compare the potential costs and benefits of the adaptation strategies. For instance, new infrastructure might have the potential to provide substantial benefits to some water uses but might have significant environmental or other costs. The trade-off analysis will include all alternatives and encompass all identifiable benefits, costs, and risks. Because the trade-off analysis will be qualitative, stakeholder input will be an important component. The trade-off analysis will include a summary of findings and recommendations.

Task 8: Draft Report Compilation and Review

This task will include compiling the draft report and soliciting review and comments from Basin Study partners and stakeholders. Subtasks will include the following:

- *Disseminate draft Basin Study report to Reclamation's Great Plains Regional Office for policy review:* Concurrently transmit draft Basin Study report to DNRC for review and comment.
- *Incorporate comments and disseminate draft Basin Study report to agencies and stakeholders for review and comment;*
- *Incorporate agency/stakeholder comments and disseminate draft Basin Study report back to study partners for final review and comment;*
- *Transmit revised final draft Basin Study report to Reclamation's Great Plains Regional Office for policy review;*
- *Incorporate comments and transmit final draft Basin Study report to Reclamation's Policy and Administration Office for final policy review and approval.*

Task 9: Finalize Report

Under this task, the report will be finalized and disseminated to the public. Subtasks will include the following:

- *Finish incorporating all comments into draft report and finalize all graphics and report formatting;*
- *Disseminate electronic and hard copies of the final report to Basin Study partners, agencies, and stakeholders.*

Schedule

Task	Duration Months	2014	2015				2016				2017		
		Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul
1. Basin Study Kick-Off and Historic Data Collection	6												
2. Climate Change and Future Water Supply Analysis	6												
3. River System Management Model Development and Calibration	6												
4. System Reliability and Impact Analysis	6												
5. Identification of Adaptation Strategies; Public Outreach	18												
6. Modeling of Adaptation Strategies	6												
7. Trade-Off Analysis and Recommendations	6												
8. Draft Report Compilation and Review	3												
9. Finalize Report	3												

Budget

Most of Reclamations costs during Tasks 1 through 4 will be funded through its UMRB Impacts Assessment budget. The Reclamation costs in the budget table below associated with these tasks are for administration and coordination with DNRC during the Impact Assessment phase, and for integrating the Musselshell River basin model, developed by DNRC, into the complete model for the Upper Missouri River system. During the Impacts Assessment phase (Tasks 1 through 4) DNRC will coordinate with and assist Reclamation, and develop the Musselshell River basin portions of the Upper Missouri basin RiverWare management model.

Budget Table

Task	Task Cost	Reclamation	DNRC
1. Basin Study Kick-Off and Historic Data Collection	\$20,000	\$10,000	\$30,000
2. Climate Change and Future Water Supply Analysis	\$20,000	\$10,000	\$20,000
3. River System Management Model Development and Calibration	\$60,000	\$10,000	\$140,000
4. System Reliability and Impact Analysis	\$10,000		\$20,000
5. Identification of Adaptation Strategies; Public Outreach	\$200,000	\$80,000	\$80,000
6. Modeling of Adaptation Strategies	\$400,000	\$200,000	\$110,000
7. Trade-Off Analysis and Recommendations	\$80,000	\$50,000	\$30,000
8. Draft Report Compilation and Review	\$60,000	\$40,000	\$20,000
9. Finalize Report	\$20,000	\$15,000	\$5,000
Totals	\$870,000	\$415,000	\$455,000

Basin Study Management

This Basin Study will be managed jointly by Reclamation's Montana Area Office (MTAO) and DNRC's Helena Water Resources Division Main Office. The following individuals will be responsible for Basin Study management on behalf of Reclamation and DNRC.

Bureau of Reclamation

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Administrative Record: Basin Study managers from Reclamation and DNRC will be responsible for maintaining the administrative record of all electronic and paper documents that substantively relate to completion of this Basin Study. Copies of the administrative record will be provided to both Reclamation and DNRC upon request and at the end of the Basin Study.

Basin Study Team

The project team will provide the necessary skills and expertise to meet Basin Study objectives. The team will complete the tasks related to the Basin Study and be responsible for ongoing quality assurance. A list of team members is provided in Attachment I.

Partner Coordination and Meetings

Basin Study partners will communicate regularly through email and semi-monthly conference calls. Face to face meetings with the Basin Study partner(s) are tentatively scheduled at the following milestones listed below:

Partner Meeting 1: The first meeting already has been held by Basin Study partners to kick-off the study and discuss study objectives, the scope of work, and model node locations.

Meeting Date: July 22 and 23, 2014

Partner Meeting 2: A meeting was held by Basin Study partners to discuss the results of the climate change and future water supply analysis. The next step, development of the RiverWare management model for the basin, also was discussed along with the conversion of the DNRC

Musselshell basin model to a daily time-step. Input from a technical meeting the previous day, with agencies and other stakeholders, was reviewed.

Meeting Date: July 10, 2015

Partner Meeting 3: The Basin Study partners met to discuss the water supply and water demand assessments, the RiverWare management model, and approaches to incorporate paleo-informed analyses into the Impact Assessment and Basin Study. Discussions on the RiverWare management model included modeling subbasins, calibration, and validation. Strategies for running the model to conduct the system reliability and impact analysis also were discussed.

Meeting Date: December 3, 2015

Partner Meeting 4: The Basin Study partners met to discuss the water supply and demand assessment results, the paleo-hydrology analysis, and development of the RiverWare management model. The partners also discussed contracted support from CADSWES (Center of Advanced Decision Support for Water and Environmental Systems) for the RiverWare management model review and support.

Meeting Date: March 3 and 4, 2016

Partner Meeting 5: The Basin Study partners met to discuss the development of the RiverWare management model and the results of the CADWES model review. A strategy for completing the RiverWare management model was discussed. The partners were updated on the USGS's paleo-hydrology work, and a schedule for completing the Impact Assessment was discussed. The second day included a site visit to the Beaverhead River watershed and Clark Canyon Reservoir, and a meeting in Dillon with a representative from the East Bench Irrigation District and a representative from the Montana Department of Fish, Wildlife and Parks.

Meeting Date: July 16-17, 2016

Partner Meeting6: The Basin Study partners will meet to discuss the results of the system reliability and impact analysis and the upcoming draft Impact Assessment report. The transition to working on Basin Study tasks also will be discussed, with focus on potential adaptation strategies and planning for agency, and public and stakeholder meetings.

Target Date: September 29, 2016

Partner Meeting7: This meeting will be held to further develop the adaptation strategies based on the input from the public and agency meetings. The Basin Study partners also will develop an approach for developing alternatives, which reflect the adaptation strategies, to model with the RiverWare management model.

Target Date: December, 2016

Partner Meeting 8: A meeting of the Basin Study partners will be held to review the results of the adaptation strategy modeling and to discuss how to use the trade off analysis to compare the alternatives.

Target Date: March, 2017

Partner Meeting 9: The Basin Study partners will meet to discuss strategies for compiling the draft and final reports for the Basin Study.

Target Date: June, 2017

Agency Coordination

Agency coordination meetings will be held to solicit input, expertise, and data requests from agencies with jurisdiction or that have relevant activities in the study area. The following are agencies that will be consulted with during the Basin Study:

- Montana Department of Fish, Wildlife and Parks
- Montana Department of Environmental Quality
- Montana Bureau of Mines and Geology
- U.S. Fish and Wildlife Service
- U.S. Bureau of Land Management
- U.S. Geological Survey
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Army Corps of Engineers
- U.S. Bureau of Indian Affairs
- Blackfeet Environmental Office
- Chippewa Cree Tribe of Rock Boy Montana
- Tribes of the Fort Belknap Indian Reservation

Agency Coordination Meetings

Meetings will be held at key milestones to solicit input from the agencies. Basin Study partners will be responsible for notifying the agencies of the meetings. The following two agency meetings are tentatively planned:

Agency Meeting 1: A technical meeting was held with agencies, universities, and stakeholder groups to discuss the Impact Assessment and Basin Study that would follow, and to discuss related activities by other groups in the basin. The study methodologies were presented, and opportunities for collaboration were discussed.

Meeting Date: July 9, 2015

Agency Meeting 2: A meeting will be held with the agencies, universities and key stakeholders to discuss the results of the Impact Assessment and the Basin Study plan, and to solicit input on adaptation strategies. Watershed groups and conservation district staff, who have expressed interest in the Basin Study, also will be invited along with watershed drought coordinators.

Target Date: December 1, 2016

Agency Meeting 2: The agencies, universities and key stakeholder groups will again be consulted to review the results of the modeling of alternative adaptation strategies and to solicit their input on the trade-off analysis and the draft Basin Study report.

Target Date: April, 2017

Stakeholder and Public Involvement

Stakeholder and general public input will be important in identifying adaptation strategies and in conducting the trade-off analysis. The following list includes but is not limited to some of the stakeholder groups who will be consulted during the Basin Study:

- Greenfields Irrigation District
- Trout Unlimited
- Helena Valley Irrigation District
- Fort Shaw Irrigation District
- Upper Basin Pallid Sturgeon Working Group
- Friends of the Missouri Breaks Monument
- Teton Cooperative Reservoir Company
- Ruby Conservation District and Watershed Council
- Gallatin Task Force
- Broadwater Conservation District
- Pondera County Canal and Reservoir Company
- Beaverhead Conservation District and Watershed Committee
- Lower Musselshell Conservation District
- Musselshell Watershed Coalition
- The Nature Conservancy & Centennial Valley Association
- Teton Conservation District
- Madison Conservation District
- Sun River Watershed Group
- Big Hole Watershed Committee
- Jefferson River Watershed Council
- Greater Gallatin Watershed Council
- Gallatin Conservation District
- Choteau Conservation District
- Cascade Conservation District
- City governments throughout the basin

A mailing list of stakeholders will be compiled so they can be contacted when scheduling stakeholder meetings and for Basin Study updates.

The Basin Study will be complimentary to and build upon DNRC's state water planning activities. Through its ongoing planning activities in the Missouri River Headwaters, DNRC will work with Watershed Groups, Conservation Districts and others to expand diverse stakeholder and public participation in the Basin Study. This will include meetings facilitated by the Watershed Groups and Conservation District that are open to all stakeholders and the general public.

Stakeholder Coordination Meetings

Meetings will be held following key milestones to solicit input from stakeholder and the public. Basin Study partners will be responsible for notifying the stakeholders and public of the meetings through mail, e-mail, telephone, news releases, and websites, as appropriate. Meetings with stakeholder groups will be scheduled for the following milestones listed below:

Impact Assessment Completion and Adaptation Strategies: Following the December 1, 2016 meetings with key agencies, universities and representatives of stakeholder groups, a series of meetings will be held at the local level to discuss the results of the Impact Assessment and to solicit input on adaptation strategies for the Basin Study. These meetings will be scheduled by DNRC with the assistance of the local watershed groups, conservation districts, and drought coordinators. Where possible, the meetings will be scheduled in conjunction with regular watershed group, conservation district or other stakeholder groups meetings. Public participation will be encouraged. Between five and ten meetings throughout the basin are anticipated.

Target Date: January-February, 2017

Modeling of Adaptation Strategies and Trade-off Analysis: A second set of stakeholder group meetings will be scheduled to introduce the results of the modeling of alternative adaptation strategies, and to solicit public input on the findings to date and the trade-off analysis. The first draft of the report also will be presented at this meeting for public and stakeholder input. Between five and ten meetings are anticipated.

Target Date: June, 2017

Website Development

Reclamation will provide press releases and links to the plan of study and a Basin Study fact sheet on its Montana Area Office website at: <http://www.usbr.gov/gp/mtao/>. A link to the study fact sheet also will be provided on Reclamation's WaterSMART Basin Studies website at: <http://www.usbr.gov/WaterSMART/lbsp/studies.html>. DNRC will provide links to the plan of study and fact sheet on its website at: <http://dnrc.mt.gov/>.

Attachment 1 – Study Team and Technical Review

Name	Office	Title	Role
Project Management			
Gerald Benock	Reclamation MTAO	Supervisory Civil Engineer	Reclamation Team Lead
Paul Azevedo	DNRC Water Management Bureau	Bureau Chief	DNRC Team Lead
Technical Team			
Marketa McGuire	Reclamation Denver TSC	Hydrologic Civil Engineer	TSC Lead Modeler
Subhrendu Gangopadhyay	Reclamation Denver TSC	Supervisory Civil Engineer	TSC Team Lead
Patrick Erger	Reclamation GPRO	Supervisory Hydrologist	GPRO Team Lead
Stephanie Micek	Reclamation MTAO	Civil Engineer (Hydrologic)	MTAO support – Facilities Operations
Jordan Lanini	Reclamation GPRO	Civil Engineer Hydrologic	GPRO support – Modeling
David Trimpe	Reclamation GPRO	Environmental Specialist	GPRO support - Environmental
Larry Dolan	DNRC Helena	Hydrologist	DNRC technical lead
James Heffner	DNRC Helena	Hydrologist	Modeling
Russ Gates	DNRC Helena RO	Hydrologist	Hydrologic data and analysis
Russell Levens	DNRC Helena	Hydrologist	Groundwater
Attila Fohnagy	DNRC Helena	Hydrologist	Groundwater
Ann Schwend	DNRC Helena	Water Conservation Specialist	Public outreach, adaptation strategies
Technical Review Team			