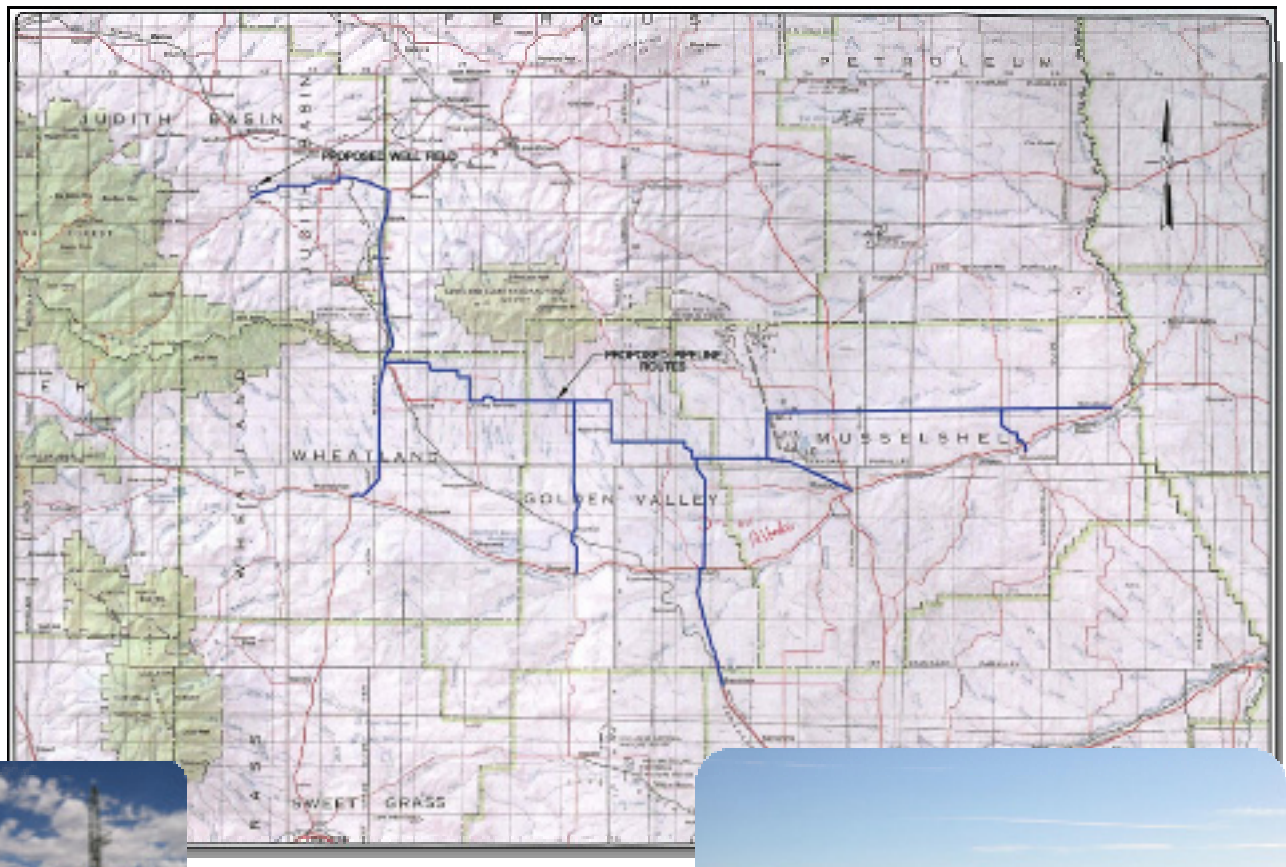
RECLAMATION

Managing Water in the West

Musselshell-Judith Rural Water System Appraisal Report



U.S. Department of the Interior
Bureau of Reclamation
Montana Area Office
Billings, Montana

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Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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INTRODUCTION AND BACKGROUND

This Musselshell-Judith Rural Water System (MJRWS) Appraisal Investigation was done by the Central Montana Regional Water Authority (CMRWA) with the intent of developing a rural water system to serve about 4,500 people in 15 incorporated and unincorporated towns in central Montana. The Appraisal Investigation submitted by CMRWA is intended to meet requirements of the *Rural Water Supply Act of 2006* (Act) and Interim Final Rule, 43 CFR Part 404 published in the *Federal Register* of November 17, 2008. It examines opportunities of providing towns in central Montana with a present and future source of high quality water at a capacity sufficient to satisfy the regional demand.

Authority

This Appraisal Report is being done under the authority of the Rural Water Supply Act (P.L. 109-451).

Purpose

This Appraisal Report has been prepared by the Montana Area Office of the Bureau of Reclamation as required under Title I Section 103 of the Act and Appraisal Criteria in CFR §404.2 "Appraisal Report". The purpose is for Reclamation (Regional Director, Great Plains Region) to determine whether it is appropriate to recommend that a Feasibility Study be conducted as described in the Act under §404.44, and §404.45. This determination is based on information contained in the *Musselshell-Judith Rural Water System Appraisal Investigation* (May 2010) provided to the Montana Area Office on May 5, 2010 and addendum received on June 29, 2010.

In addition this report provides a determination of the project's eligibility as defined in §404.2 "Rural Water Supply Project"; §404.6 "Who is eligible to participate in the program"; and §404.7 "What types of projects are eligible under the program". "Additional Required Content for Feasibility Studies" as described in Section IV D. 3 of the Funding Opportunity Announcement (FOA) No. R10SF80458 will also be addressed as part of this Appraisal Report.

Project Sponsor

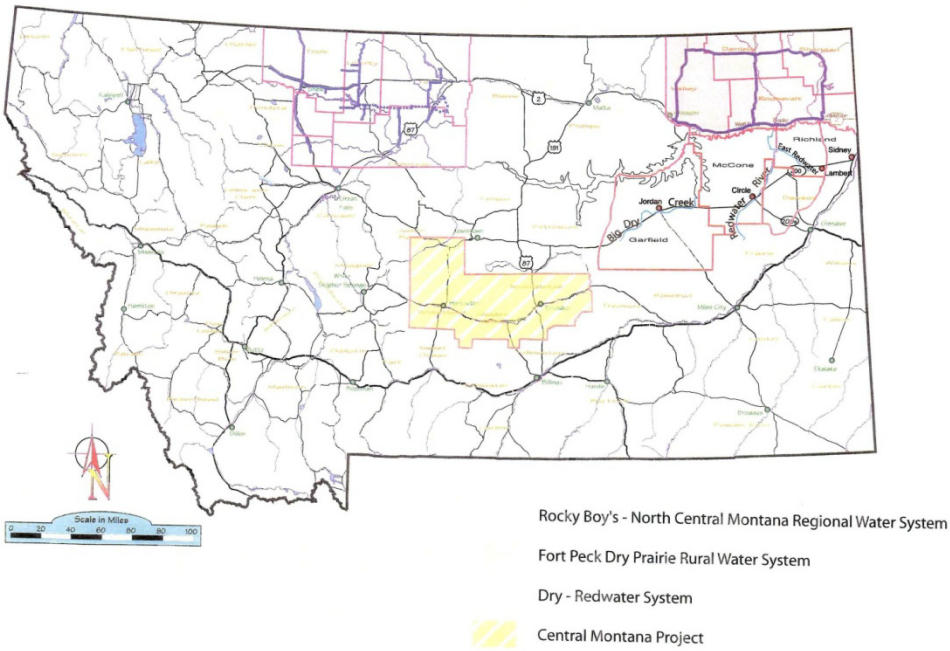
The CMRWA, formed by eight central Montana towns in 2004, is a legally created public water authority in the State of Montana. It is governed by a board

with members from Roundup, Hobson, Harlowton, Lavina, Broadview, Melstone, Ryegate, and Judith Gap.

Description of the Project Area

The sparsely-populated project area is bounded by the Judith River in the north and west, the Musselshell River in the south (see yellow shaded area in Figure 1). The dry continental climate in central Montana is characterized by short summers with cool to mild temperatures, and long winters with periods of cold weather. Rolling plains are dominated by several "island" mountain chains, the Little Belts in the west of the project area, the Big Snowies in the center, and the Little Snowies just to the east of them. Grasslands form the main wildlife habitat. Deer and antelope are common, with furbearers, game birds, waterfowl, and songbirds.

Figure 1: Area Map



In 2007, 4,457 people lived in the project area, which includes the larger towns of Harlowton and Roundup, and the smaller towns of Moore, Hobson, Utica, Buffalo, Straw, Judith Gap, Ryegate, Lavina, Melstone, and Musselshell. The mainstay of the area's economy is agriculture: widely-spaced farms and ranches dot the landscape. Crops are mainly dryland, consisting of wheat, barley, and oats. Livestock production within the project area consists of cattle and sheep.

Recreation also draws people to the project area. Deadmans Basin and Martinsdale reservoirs provide boating and fishing opportunities, and

campgrounds can be found at Crystal Lake in the Big Snowies.
Roundup in Musselshell County is experiencing some industrial growth. The Signal Peak Coal Mine, which opened in September 2009, is expected to produce 12.5 million tons of coal per year by the end of 2010. The coal supplies four power plants along Lake Erie and is being marketed to other power plants in the mid west.

Description of the Proposed Project

Towns in the project area are faced with low water quality, quantity, or both, in some cases. Currently, they operate their own municipal water systems or are served by individual wells. The Proposed Project will connect these towns to a main transmission line to a reliable water supply. The towns will still be required to manage their distribution systems; however, a central water source and main transmission lines (with some rural home connections) will be the responsibility of the CMRWA. A summary of these communities' existing water source, water quantity and quality, and infrastructure is provided in Table 1.

The Appraisal Investigation describes an Original Layout Alternative, a High Waterline Layout Alternative, and a No Action Alternative. The proposed project will be referenced herein as the Original Layout and the High Waterline Layout will be later referenced and further described in this report as the Preferred Alternative.

The Proposed Project would develop a field of five groundwater wells in the Utica, Montana, area to supply water for the rural water system. The Madison Aquifer, the water source, is deep underground; the test well at 3,700 feet is said to have only penetrated to the top of the aquifer. Total required source of supply capacity of the field would be 3,570 gallons per minute (gpm), which would allow for capacity equal to the maximum day demand with the largest well in the field (800 gpm) out of service as required by state law. The maximum day demand includes 15 percent for incidental stock watering and individual rural home sites. The wells would be laid on 1-acre pads. The well casings would vary from 20-inch diameter at the surface to 200 feet; 14-inch diameter from 200-2,000 feet (providing a chamber for a submersible well pump); and 8-inch from 2,000 to the production zone at 3,600-4,700 feet.

Water would be distributed from the well field by a branch type system of pipelines, booster pump stations, and storage tanks (see Figure 2). Pipeline sizes would steadily decrease as more towns were passed and the ground elevation dropped. The main line would be composed of 20-inch high pressure pipe from Utica through Hobson, paralleling U.S. Highway 191 (after a 9-mile jog eastwards to tie into the town of Moore) down to a water storage tank southwest of Judith Gap. From the Judith Gap storage tank, water would run south in a 10-inch pipeline to Harlowton. A booster station at Judith Gap would pump water

eastwards through a 16-inch pipeline about 30 miles long, where the pipeline

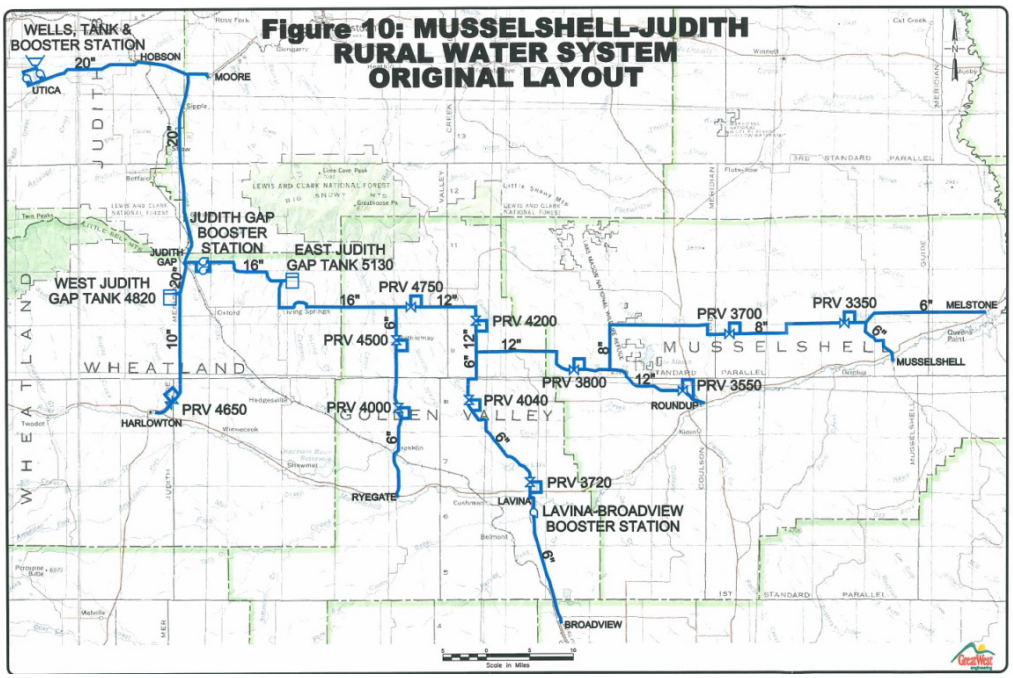
Table 1: Summary of Existing Communities				
Town	**Water Source**	**Water Quantity**	**Water Quality**	**Infrastructure**
Roundup	2 Groundwater Wells	- Wells yield 1,150 gpm - 2 1 million gallon storage tanks	- Satisfies Primary Standards -TDS, iron manganese, sulfate exceed Secondary Standards	- Clearwell caisson from abandoned infiltration gallery - Half of the distribution system is composed of 100 year cast iron mains, 6 leaks occur per year
Harlowton	3 Groundwater Wells	-Wells produce 1,130 gpm. - 500,000 gallon reservoir tank	-Satisfies Primary Standards. -The City's wells contain concentrations of iron, manganese, sulfate, and TDS.	- Built in 1930's of PVC, cast iron, AC pipes -Leaks occur 5 times a year -City is replacing the water tank
Broadview	2 groundwater wells	-The produce 36 gpm - 21,000 gallons water tank.	- Meet Primary Standards. -Aesthetic quality is very poor, high TDS content	-Newer PVC distribution -Tank is 15 years old, good condition - Wells corrode, OM&R high
Melstone	- Intake at Musselshell River - 1 groundwater well	-Groundwater well has a yield of 18 gpm - 180,000 gallon steel tank	-After treatment, river water meets all standards -Well satisfies Primary Standards, but high TDS, iron, sulfate that exceed Secondary Standards	-Well completed in 2003, plus 2 additional wells -Treatment plant is out-dated -Nearly all PVC piping was replaced in 1988
Judith Gap	Groundwater well	-Well produce 200 gpm - 50,000 gallons steel reservoir	-Water quality meets all Primary Standards. - High concentrations of iron and manganese	-1986 town completed system improvements -Distribution system is cast iron, PVC, polyethylene
Ryegate	-Riverbank infiltration gallery -Backup groundwater well	-Well produces 16 gpm - Infiltration gallery produces 89 gpm - 144,000 gallon reservoir	-Meets Primary Standards. -High concentrations of TDS and sulfate	-Distribution system is cast iron and PVC -1920 storage tank, fair condition

Musselshell	2 groundwater wells	-Wells yield 35 gpm -1,000 gallons steel tank	-Wells meet Primary Standards -A moderate concentration of DEHA -Double concentration for sulfates, Secondary Standard	- Distribution is PVC
Lavina	- Private groundwater wells	-High levels of TDS, sulfates, nitrates	-Water quality is exceedingly poor	-No central distribution system exists
Hobson	-Fill station that is replenished by a groundwater well	- Well yields 10 gpm -10,300 gallon Water Storage Tank	-Meets most Primary Standards, some violations of nitrates -Contains moderate levels of TDS and iron	-No infrastructure exists other than the Fill Station and the transient and non-transient systems
Moore	- Groundwater well	-Well yields 200 gpm -Clearwell is 65,000 gallon -55,000 gallon tank.	-Moderately high concentration of Radium 226 has been detected which is over half the Primary Standard	-Distribution system was upgraded to PVC pipe.

would be reduced to 12-inch diameter to the town of Roundup. Six-inch lines branching off this main line would serve Ryegate, Lavina, and Broadview.

Finally, an 8-inch, then a 6-inch diameter pipe would deliver water to Musselshell and Melstone, further to the east in the project area.

Figure 2: Original Layout



Water storage would be limited to that required for ease of operations, and fire flow wouldn't be provided through system storage. Peak demands in the smaller town, however, like Buffalo and Straw could be easily met by the system storage; larger towns already have water storage tanks and would be required to ensure these were adequate to meet peak momentary demands and fire demands.

Pipe 12-inches or less could be HDPE or PVC (ASTM or irrigation pipe, not AWWA C:900 due to costs). Mostly PVC was used for 10-inch and 12-inch diameter pipe in the cost estimates. It was considered necessary to use ductile iron pipe (DIP) or steel pipe when pressures exceeded 200 pounds-per-square-inch. Pipe larger than 12-inches would be PVC per AWWA C:905 or DIP of the necessary class, or steel pipe with wall thickness calculated based on AWWA design criteria and including a surge allowance.

Cost of the proposed project would be $139,937,000. Detailed tables showing all pipeline segments along with maximum pressures for all conditions are included in Appendix D of the Appraisal Investigation, along with cost of the pipe per foot

for segment based on diameter and pressure. Appendix E contains sizing of booster stations and storage tanks.

RURAL WATER ELIGIBILITY

Rural Water Program Eligibility

CMRWA, as a non-federal project sponsor, is eligible for the Rural Water Program under Rule §404.7. They qualify under item (a) as they are a state or political subdivision of the state, specifically a regional authority. The Montana Secretary of State certified Central Montana Regional Water Authority as a water Authority on May 2, 2005 (filing ID No. D143702-616178). The authority is under the Regional Water and Wastewater Authority Act, Montana Codes Annotated 75-6-301 through 75-6-329.

The project is eligible under Rule § 404.6. The proposed project is located in a Reclamation state and meets the definition of a Rural Water Supply Project (§404.2). The project proposes to construct a new rural water supply, infrastructure, and facilities to serve a population of about 4,500 inhabitants, including dispersed home sites, rural areas with domestic, municipal, and industrial water, with incidental noncommercial livestock watering and noncommercial irrigation of vegetation. The project doesn't propose any major impoundment structures or a water demand for commercial irrigation.

Eligibility to Be Reviewed under the Program

In addition to Rural Water Program eligibility requirements listed above, Reclamation is required to determine if the *Prioritization Criteria* referred to in §404.13 has been addressed in CMRWA's Appraisal Investigation. Table 2 summarizes the applicant's statements that the Prioritization Criteria has been addressed.

Table 2: Summary of Prioritization Criteria (§404.13)

Priority	Citation	Summary of Applicant Statements
Urgent need:	Rule § 404.13 (a) FOA V.A.2.1	The Appraisal Investigation states most towns in the project depend on various groundwater aquifers to supply needs, though Ryegate and Melstone supplement groundwater with surface water from the Musselshell River. The preferred alternative in the Investigation states the MJRWS project will alleviate and supply these communities with a good water source.

(a) Water supply	Rule § 404.13 (a) FOA V.A.2.1	The present municipal water supply barely meets the needs of Melstone, Hobson, and Lavina, and would be unable to meet the needs of Ryegate during severe drought. The project is planned for a 50 year period and is planned to supply the communities with a reliable water source.
(b) Violations of drinking water standards	Rule § 404.13 (a) FOA V.A.2.1	According to the Appraisal Investigation, samples of groundwater sometimes exceed the *Primary Drinking Water Standards* (those that affect public health) for total dissolved solids in Lavina and nitrates in Hobson, and *Secondary Drinking Water Standards* (those affecting taste and smell of the water and its effect on fixtures) for total dissolved solids and sulfates in most of the towns. See Table 1 for a summary of existing drinking water violations.
(c) Inadequacies in infrastructure	Rule § 404.13 (a) FOA V.A.2.1	Towns treat municipal supplies with chlorine gas or hypochlorite solution, according to the Appraisal Investigation, except for Musselshell, Lavina, Hobson, and Moore which do not treat water at all. Roundup relies on two wells drilled into an abandoned mine shaft, using a caisson from the mine's infiltration gallery as a clearwell. Harlowton's wells corrode quickly because of the characteristics of the water. There are no central water distribution systems in Lavina or Hobson, which must depend on individual, shallow wells for water. See Table 1 for summary of the status of the existing community's infrastructure.
Regional or watershed perspective	FOA V.A.2.2 Rule § 404.13 (b)	The proposed project area includes all or parts of six large Montana counties servicing up to 4,500 people when built out. It fills a large gap of central Montana, north of the Yellowstone River. The MJRWS project is designed to serve approximately 15 communities and dispersed rural home sites through 300 miles of pipeline.
Financial need	Rule § 404.13 (c) FOA V.A.2.4	Financial need is discussed in Section 4.5 and 4.6 of the Appraisal Investigation. Median household income ranges from a low of $16,979/yr in Judith Gap (Judith Basin County) to a high of $31,250/yr in Melstone (Musselshell County), with a median income for the major communities in the region of $25,487/yr, or approximately 49% of the national average ($52,029).
Unique qualifications	Rule § 404.13 (d) FOA V.A.2.4	The project sponsors are proposing this project be funded and constructed under Reclamation's Rural Water Program. The proposed project would serve a vast arid region in one of Reclamation's 17 western states and is similar in scope to a rural water project north of the proposed project area that was planned, designed, and is being constructed with Reclamation technical oversight and funding.
Applicable legal requirements	Rule § 404.13 (e) FOA V.A.2.4	The proposed project would help assure the towns of Roundup, Harlowton, Broadview, Melstone, Judith Gap, Ryegate, Musselshell, Hobson, and Moore with

		a quality water supply that would meet the standards of the *Safe Drinking Water Act (SDWA)*. The towns are in jeopardy because their municipal water supplies will be in violation of the SDWS.
Indian water supply	Rule § 404.13 (f) FOA V.A.2.3	There are no Tribal lands included within the boundaries of the proposed service area, therefore it is not anticipated that Indian Tribes will be directly served by the MJRWS
Program overlap	Rule § 404.13 (g) FOA V.A.2.5	Programs in Montana have been established to assist rural communities develop rural water systems in cooperation with Federal programs. Reclamation's Rural Water Program is the only source of comprehensive funding sufficient to fully fund planning and construction of the entire project. The project has received funding from the State of Montana in the amount of $1.6 million; however, this level of funding is insufficient for construction of the project.
State and Local Priorities	Rule § 404.13 (h) FOA V.A.2.6	The CMRWA has received approximately $1.6 million in supportive funding to administer and complete various aspects of the MJRWS from the State of Montana, Department of Natural Resource and Conservation. Numerous letters of support from local communities also state this project as a priority.
Innovation	Rule § 404.13 (i) FOA IV.D.2 b. (3)	The CMRWA is proposing a majority gravity flow system and only 1-3 pumping stations may be required. This is unique compared to other rural water systems that have numerous pumping requirements. The OM&R duties would be centralized with one entity for the project. Innovative energy sources such as pressure reducing valves may be used within the project. These valves can produce mechanical energy which translates into electricity.
Other	Rule § 404.13 (j)	N/A

Reclamation's Determination Whether It Is Appropriate to Recommend Continuing to a Feasibility Study

Below are the criteria contained in Rule Section §404.44 that will be applied to determine whether at least one of the alternatives identified is appropriate for further analysis through a Feasibility Study or whether the investigation should be terminated without conducting a Feasibility Study.

Reasonable Range:

A reasonable range of alternatives (structural and non-structural) has been formulated and evaluated (Rule § 404.44 [a]).

The Appraisal Investigation evaluated the Preferred Alternative in detail and described other alternatives considered in lesser detail. The No Action Alternative was also described.

The Kootenai and Ellis aquifers were considered as water sources instead of the Madison Aquifer, but they didn't have the production capability, quality, or exclusivity of the Madison (Appraisal Investigation, p.39). The Madison Aquifer is only lightly used, so getting a water right to the aquifer should be eased. The sponsor found the surface water supply from the Musselshell or Judith Rivers in the project area to be inadequate for their needs, and it would require costly water treatment unlike the supply from the Madison Aquifer.

Different arrangements of wells in the well field were also examined in the Appraisal Investigation.

The No Action Alternative was described as that the towns in the project area would continue to produce municipal water as they do at present. Water would continue to be of poor quality and in a few cases, insufficient volume, especially during drought years. Towns dependent on the Musselshell River for part of their water supply would be particularly vulnerable as it is listed by the Montana Department of Environment Quality as impaired because of total dissolved solids, among other reasons (Appraisal Investigation, p. 75). Towns would continue to pay high costs for water treatment.

At Least One Viable Alternative:

The recommendation for further study of one or more alternatives is clearly supported by the analysis in the appraisal investigation (Rule § 404.44 [b]).

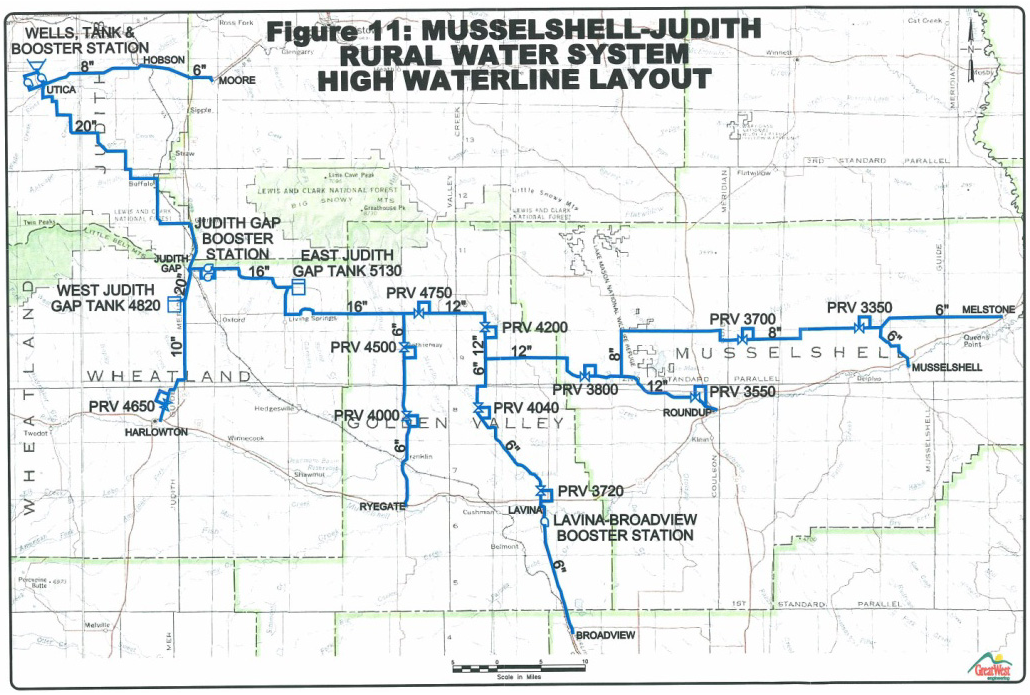
The Preferred Alternative is called the High Waterline Layout Alternative in the Appraisal Investigation. The water source in this alternative would be the same well field of five groundwater wells in the Utica area pumping from the Madison Aquifer as described in "Description of the Proposed Project" above.

Water would be distributed from the well field by a system of pipelines, booster pump stations, and storage tanks, as well, but with a different layout than the Proposed Project (see Figure 3). The main line would again be 20-inch high pressure pipe from Utica, but the route would run through Buffalo and down to

the storage tank southwest of Judith Gap. An 8-inch diameter pipeline east from Utica would serve Hobson and, after being reduced to 6-inch diameter, the town of Moore.

From the Judith Gap storage tank, water would again run south in a 10-inch pipeline to Harlowton. The booster station at Judith Gap would pump water eastwards through a 16-inch pipeline about 30 miles long, where the pipeline would be reduced to 12-inch diameter to the town of Roundup. Six-inch diameter lines branching off the main line would serve Ryegate, Lavina, and Broadview, as with the Proposed Project. An 8-inch, then 6-inch diameter pipe would also deliver water to Musselshell and Melstone.

Figure 3: High Waterline Layout



Pressure reducing valves would also be required to reduce pressure in the pipeline as elevations steadily dropped from Judith Gap area to the outer towns. The single small booster station would be required between Lavina and Broadview due to a steep increase in elevation between these two. Water storage would be limited to that required for operations; fire flows and peak momentary demands in the larger towns would be met by their existing water storage tanks.

Costs of the Preferred Alternative would be $125,771,000. Types of pipe would be as described for the Proposed Project. Costs for the Preferred Alternative were developed as with the Proposed Project.

Criteria for Each Alternative Considered:

As stated in section §404.44 (c), Reclamation is asked to determine for each alternative considered in the Appraisal Investigation whether the alternative:

(1) Identifies viable water supplies and water rights sufficient to supply the proposed project area; –
The hydrogeologic analyses conclude that the Madison Aquifer in the project area will likely provide a sustainable, high quality drinking water source that will produce sufficient water quantity to serve regional demands. These conclusions were confirmed by a test well near Utica. It can be anticipated that because of the significant depth required to fully penetrate the aquifer, it is underutilized in this region. Therefore, water rights permitting for the project should be easier to obtain than for surface water sources or shallower aquifers available in the region. This is validated by the fact that the CMRWA has obtained a water right for 300 gpm out of a total need of 3,570 gpm for the project.

As part of the 300 gpm water right, CMRWA entered into a memorandum of understanding (MOU) with the Montana Fish, Wildlife, and Parks (FWP) to monitor potential impacts to surrounding springs and surface water in the area from the wells developed in the Madison Aquifer near Utica. The MOU ensures that the water will be controlled so that the water right of prior appropriator will be satisfied or other measures will be taken to prevent adverse affects to the water rights of prior appropriators.

Other practicable water sources were identified including surface water from the Musselshell River or Judith River, but were determined to be inadequate because of higher surface water treatment. Ground water supplies, such as the Kootenai and Ellis aquifers, lower quality waters, non-potable waters were ruled out as a reliable supply due to limited volume, and poor water quality,.

(2) Has a positive effect on public health and safety; –
Many of the communities within the project area currently have problems with inadequate water quantity, poor water quality, or both. The community of Hobson has several transient non-community public water systems that utilize groundwater. This aquifer contains high levels of nitrates which have resulted in violations for exceeding the maximum contaminant level (MCL) of the primary drinking water standard identified in the Safe Drinking Water Act (SDWA). The town of Lavina also has recorded high levels of nitrates. Many of the communities in the project area exceed the SDWA's secondary MCL for iron, manganese, sulfate, pH, and total dissolved solids. The inadequate supplies of water in several communities result from water shortages caused by drought (town of Melstone and Ryegate along the Musselshell River) or in the inability of existing infrastructure to supply a sufficient municipal demand (Lavina does not

have a community water system and Broadview's wells cannot meet the average daily demand). The entire project area will benefit from the MJRWS by providing a reliable water source and promote a better quality of life as it relates to health and safety.

(3) Will meet present and future water demands; –
Hydrogeologic analyses conclude that the Madison Aquifer in the project area will likely provide a sustainable drinking water source for the MJRWS. Pump testing of the CMRWA's test well, CMRWA No. 1, have confirmed that the Madison is capable of producing an adequate supply of water for the proposed project area through the 50-year planning period.

The projected growth of the MJRWS is estimated at 7,500 equivalent population in year 2062. The population projections are reasonably consistent with other engineering studies and county growth analysis conducted within the MJRWS area. Other attributes related to growth are economic factors based upon the increase of wind energy and coal mining, as well as being in proximity to the city of Billings.

The projected water demands were formulated based upon the usage rates from the town of Roundup as other towns did not have the required data available or did not exist. The average day demand and peaking factors are comparable to other towns and communities around Montana.

(4) Provides environmental benefits, including source water protection;–
The preferred water supply alternative consists of multiple deep groundwater wells that penetrate the confined Madison Aquifer. As a result the environmental benefits may include elimination of existing surface water and groundwater diversions currently used by the communities for their water supplies. For example, the community of Melstone's source water is diverted from the Musselshell River and has a conventional treatment plant. By eliminating this diversion, benefits would include an increase in aquatic habitat connectivity and remove the possibility of entraining fish and other aquatic organisms. Other benefits include minimal treatment, only chlorination and low susceptibility to potential water source contamination. Additionally, the surface water remaining in the river would provide watershed users with increased management opportunities to improve watershed health.

Other environmental aspects noted during the review of the MJRWS Appraisal Investigation, which need to be addressed in the National Environmental Policy Act document in a Feasibility Study, is a discussion on impacts of climate change on water sources, impacts to the Madison Aquifer and inventory of the nearby springs, and impacts to wetlands.

(5) Applies a regional or watershed approach; –
The MJRWS project is designed to serve approximately 15 communities and dispersed rural home sites. These communities are active participants in the

project as well as Federal and State representatives and strive to work together to meet the needs of this large service area. The service area includes a large portion of the Musselshell watershed as well as a portion of the Judith basin. The project will require nearly 300 miles of piping to serve the CMRWA members.

(6) Implements an integrated water resources management approach; –
The CMRWA is proposing a rural water system that takes advantage of an economy of scale by utilizing one reliable source water well field system that has minimal water treatment requirements. The project well field enhances the optimization of water supply within the basin as the Madison Aquifer is not highly utilized due to its groundwater depth. The project is projected to manage demand for the region and the water will be distributed to meet to participating communities' demands at established prices established by CMRWA (comprised of community representatives). Operation, maintenance, and replacement duties will be centralized into one entity for the region.

(7) Enhances water management flexibility, including providing for local control and encouraging participation in water banking and markets; –
Each individual community delivering drinking water is accountable for complying with SDWA standards, which include testing requirements, and is responsible for operations and maintaining their wells or intake sites and distribution pipelines. The MJRWS will eliminate the need for individual source water and will therefore eliminate the burden to test, operate, and maintain the source water and associated infrastructure. After the implementation of the MJRWS, the communities will continue to be responsible for operating, maintaining, repairing, and monitoring usage of the local distribution pipelines. This will allow for regional and local water management flexibility and control of the system. Close interaction with the communities will be warranted in order to operate the system efficiently and effectively. We do not anticipate that water banking and markets will have a role in this project.

(8) Promotes long term protection of water supplies; –
The Madison Aquifer will likely provide a sustainable quality drinking water source for the MJRWS. The test well at the Utica site shows evidence that the entire well field area can support the needs of the communities. Water testing as well as additional test wells are planned to continue into the future to ensure this well field area is a protected source and can be further addressed in the Feasibility Study. The testing completed to date has indicated that water drawn from the Madison Aquifer will require only chlorination before being distributed throughout the region.

Communities served by the MRJWS that currently depend on drought sensitive surface water resources or wells within the region will no longer be reliant on these questionable supplies. Rural users that currently haul water or rely on inadequate or poor quality groundwater wells will be provided with a reliable drinking water source.

(9) Includes preliminary cost estimates that are reasonable and supported; –
The CMRWA cost estimates were developed using bid tabulations and conversations with drilling companies and pipe suppliers. Older data was indexed using both Engineering News Magazine Construction Cost Index and the Bureau of Reclamation Construction Cost Trends.

An independent appraisal level estimate for the Original Layout was prepared by staff from Reclamations Technical Service Center, Denver, Colorado, and identified a several items that potentially represent a significant increase in project costs listed below.

1) It appeared that some of the pipeline unit prices may be low. Increasing some of the pipeline unit prices may increase the total construction costs by approximately $9.6 million.
2) It appeared that some of the unit prices for the well field and pumps may be low. Increasing some of those unit prices may increase the total construction costs by approximately $.22 million.
3) Escalation during construction should be considered and added as appropriate and could increase the total construction costs by $4.2 to $12.9 million.
4) Design Contingencies should be increased from 10% to 15% which could increase the total construction costs by approximately $7 million.
5) Construction Contingencies should be increased from 20% to 25% based on construction unknowns, such as geological data, at this early appraisal stage. This would increase the total construction costs by approximately $7 million.

Combined, these estimated additional costs add up to around $28 to $36 million or about 20-25 % of the estimated Total Construction Cost of project. It should be noted that about half of the addition cost is attributed to escalation, otherwise known as interest during construction. This is a very real problem for rural water projects, which may take decades to complete. However, Congress has traditionally recognized and addressed this issue by incorporating construction indexing provisions in the project authorization.

The CMRWA hydraulic model used irrigation pipe for pipelines under a 12 inch diameter and a pressure class of 200 pounds per square inch. This is not typically used for municipal water supply projects and should be updated to reflect appropriate pipe material in the Feasibility Study. The hydraulic model did not include a network diagram, profiles, junction pressures, and other labels that would be beneficial to the model, but not required at the appraisal level study. This can also be addressed in a Feasibility Study. Since CMRWA's cost estimate used irrigation pipe costs that is not typical, this may address the cost discrepancy between the CMRWA and TSC cost estimates.

Another large piece of the additional costs are for contingency items where industry practices and Reclamation practices traditionally differ. Reclamation contingency costs will be applied should the project continue to Feasibility.

The CMRWA estimate includes a 5% allowance for procurement strategies, which may be reasonable assuming the contract is a Request for Proposal and not a sealed bid. This item is not typically included in a Reclamation estimate and adds about $4 million to the total construction cost.

The engineering estimates for the operation, maintenance, and replacement costs were reviewed and appear to be reasonable. However, more detail on estimates for the number of pipeline repairs, power requirements, and replacements costs may be needed.

Conclusion: The CMRWA appears to have developed a fundamentally sound design and cost estimate for their proposed alternative. Discrepancies remain between the CMRWA and Reclamation regarding how escalating factors will be applied to the project to arrive at an appraisal level estimated total construction cost. Should the project move forward to feasibility, these discrepancies will be addressed.

(10) Is cost-effective and generates national net economic benefits as required under the Principles and Guidelines; –

Alternatives are presented for No Action (without the project) and two pipeline route scenarios. There is also discussion of construction and operation of reverse osmosis plants in each of the communities. The two pipeline alternatives provide essentially the same water supply service and therefore the same benefits. No Action doesn't address the water supply problems experienced in Melstone and Broadview and does not address water quality problems experienced in several communities. The reverse osmosis alternative addresses water quality but does not address water supply shortages. Therefore, only the two pipeline alternatives meet water supply needs and produce water supply benefits. The High Waterline Layout route has lower capital costs than the Original Pipeline Layout route, but slightly higher OM&R costs. It appears that, overall, the High Waterline Layout route would be slightly less expensive and would therefore have slightly greater benefit. However, both pipeline alternatives provide measurable benefits to the region through improved water quality, reduction of water shortages, and improved water distribution.

(11) For each alternative proposed for further evaluation in a feasibility study, whether the project sponsor has the capability to pay 100 percent of the costs associated with the operation and maintenance, and replacement of the facilities constructed or developed; –

The estimated annual operation, maintenance, and replacement cost of the High Waterline Layout is estimated to be $661,000. The median household income in the study area was estimated to range from $16,969 to $30,179. The proposed

water rates with the project are estimated to range from $65.60 per month to $109.60 per month. These rates translate into water bills as a percentage of median household income ranging from 3.5% to 4.6%. The U.S. Environmental Protection Agency has used a water affordability threshold of 2.5% of median household income in the past. The proposed water rates exceed this threshold. However, current cost of water considering all expenses needed to deal with water quality problems, in addition to the amount billed for water, ranges from 2.5% to 5.7% of median household income. The percentages with the project are within the current percentages. Therefore, this indicates the water users in the study area are capable of paying the projected OM&R costs plus at least a portion of the capital costs.

(12) Other factors that Reclamation deems appropriate.
See "Other Investigation Requirements" section below.

Other Investigation Requirements

The administration has requested that other investigation requirements be addressed in this program as provided for in Rule § 404.44 12 and outlined in the Funding Opportunity Agreement (FOA) Section IV.D.1. Reclamation's findings for these other requirements are summarized in Table 3 below.

Table 3: Reclamation's Findings for Other Investigation Requirements

Administration Program Requirements	Citation	Reclamation's Findings
Minimize or reduce energy use	FOA IV.D.1(1)	(1) This program will: (a) Eliminate the need for numerous individual and community wells and their associated pumping energy use (b) Incorporate equipment or system components with higher energy efficiency
Minimize or reduce water consumption	FOA IV.D.1(2)	The MJRWS will be equipped with a metering system to promote water conservation. A detailed water conservation plan can be developed during feasibility.
Use renewable energy	FOA IV.D.1(2)	Pressure reducing valves may be used within the project. These valves can produce mechanical energy which translates into electricity.

Provide environmental benefits	FOA IV.D.1(3)	See response in under Alternative Evaluation (4).
Reduce impacts to critical habitat for Federally-listed threatened or endangered species	FOA IV.D.1(3)	The project will implement measures to avoid any impacts to critical habitats and provide mitigation in the event impacts cannot be avoided.
Provides innovative technologies	FOA IV.D.1(4)	The project is an innovative approach as it utilizes groundwater rather than surface water utilized by most other regional water systems. This results in significantly lower operations and maintenance costs because disinfection is the only treatment required. The project is also unique in that most of the system will be served by gravity once the water is pumped to the high point for delivery to the system users. It is anticipated only 1-3 pump stations would be required.
Provides creative administrative or cooperative solutions. Rule §404.13 (i)	FOA IV.D.1(4)	Administration of the proposed project will be centralized to take advantage of economy of scale. The proposed project is being promoted through a cooperative effort of towns, conservation districts and counties in the service area.

RECLAMATION'S FINDINGS

It is the finding of this evaluation that it is appropriate to proceed to a Feasibility Study based on review of the Appraisal Investigation and supporting material submitted by CMRWA and application of the criteria set forth in §404.44 as discussed above.

As discussed in this Appraisal Report, specific issues will need to be addressed during the Feasibility Study.