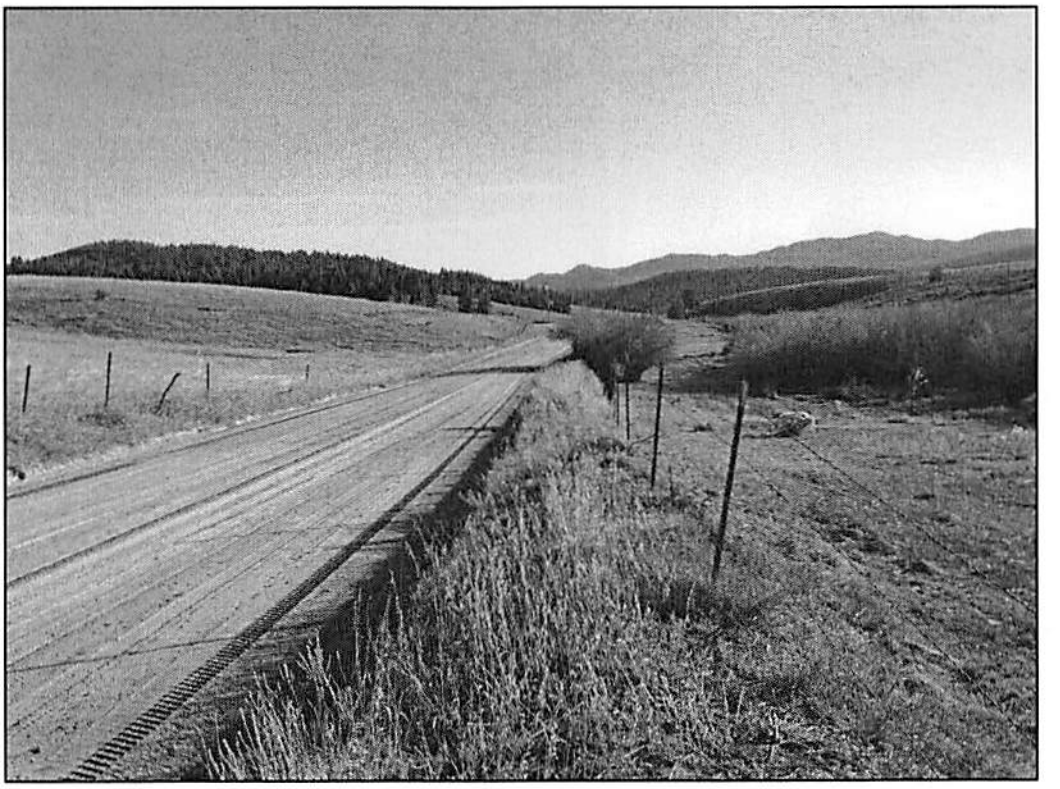
GROUNDWATER RESTORATION PLAN



Site for New Basin Creek Water Treatment Plant

Prepared for:
The Butte-Silver Bow
Water System

Prepared By:
The City and County of
Butte-Silver Bow

January 20, 2014

I hereby approve of this document, along with the associated response to comments document.

Governor Steve Bullock

10 March 2014
Date

GROUNDWATER RESTORATION PLAN
for the
BUTTE-SILVER BOW WATER SYSTEM
Public Comment Draft

Prepared for

MONTANA DEPARTMENT OF JUSTICE
NATURAL RESOURCE DAMAGE PROGRAM

Prepared by

THE CITY AND COUNTY OF BUTTE-SILVER BOW
Updated
January 20, 2014

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 Introduction and Executive Summary

This Groundwater Restoration Plan describes the various drinking water system improvements that Butte-Silver Bow City-County Government (BSB) will conduct with a $24.1-million allocation of Natural Resource Damage settlement funds and the analyses BSB used to decide on those improvements. It also provides the budget and schedule for the implementation. BSB developed this plan pursuant to the requirements of the Natural Resource Damage Program's (NRDP) *2011 Long Range Guidance Plan* and *2012 Upper Clark Fork River Basin Interim Restoration Process Plan*. As required in those documents, this Plan is based on the priorities set forth in BSB's locally approved current water system master plans. Specifically, this Plan is based on a 2013 update to a *2008 Water Master Plan*.[1] Also pursuant to NRDP requirements, this plan will be subject to public review for 30 days, consideration by the Upper Clark Fork River Basin (UCFRB) Remediation and Restoration Advisory Council and the Trustee Restoration Council, and a final approval decision by the Governor.

Section 2 of this Plan provides background on the *2008 Water System Master Plan* and the 2013 Update. Section 3 describes the various improvements that will be conducted pursuant to this Plan. This description identifies the schematic layout, requirements (operational, energy, permitting, and land), environmental considerations, constructability, costs, benefits and timelines associated with implementing the improvements. Section 4 provides the analysis of NRD legal criteria specified in the federal Superfund law for the proposed improvements**.** **Table 1-1** provides a summary of the various improvements proposed for funding under this Groundwater Restoration Plan and the budget for these features. **Figure 1-1** shows these proposed improvements and some of the other main existing features of the BSB drinking water system.

This is the second Groundwater Restoration Plan produced by BSB. The first plan was approved by the Governor in October 2012, for funding of $30.1 million in water system improvements. After reorganizing its water utility division in early 2013, and subsequently reevaluating the priorities identified in a 2012 Update to the *2008 Water System Master Plan*, BSB elected to proceed with only the Big Hole Transmission Line replacement portion of the 2012 Groundwater Restoration Plan for $6 million. That work is underway, pursuant to a completed contract with NRDP. The *2013 Master Plan Update* superseded the *2012 Master Plan Update*, and this second Groundwater Restoration Plan addresses the improvements to be made with the remaining $24.1 million of BSB's total $30.1 million funding allocation.

The *2013 Butte-Silver Bow Water System Master Plan Update* identified and prioritized improvements needed for the water system. The highest priority improvements in the Master Plan Update included a list of nine Phase One Improvements (1-A, 1-B, 1-C, 1-D, 1-E, 1-F, 1-G (a, b, and c), 1-H and 1-I). At least six of the highest priority improvements will be implemented by BSB under this Groundwater Restoration Plan and are summarized in **Table 1-1** with their associated costs. This table shows there is currently enough funding available to complete the first five improvements and approximately one-half of the water meter installation (1-F). However, if funds remain after the first five improvements have been completed, then those funds will be applied to the

[1] Water System Master Plan Update, prepared for the City and County of Butte-Silver Bow by Robert Peccia Associates and HDR Engineering, dated October 6, 2013 and approved by the BSB Council of Commissioners on October 16, 2013.

water meter project. If funds still remain after the water metering project has been completed, they will be applied toward the remaining Phase One improvements identified in the *2013 Master Plan Update* as summarized in **Table 3-2** presented in Section 3.0. This spending scenario assumes that a new storage tank will not be installed in conjunction with the construction of the new Basin Creek Water Treatment Plant (WTP). If the final design hydraulic analysis indicates that a treated water storage tank is required because pressurized flow through the WTP cannot be accomplished, contingency funds will be used to construct the tank.

Table 1-1 Phase One Improvements from *2013 Water System Master Plan Update* for Inclusion into BSB's Groundwater Restoration Plan

IMPROVEMENT		ESTIMATED CAPITAL COST
1-A	BASIN CREEK WTP	$ 20,000,000*
1-B	TELEMETRY AND CONTROLS	$466,725
1-C	CO_2 FEED AT BIG HOLE WTP	$181,729
1-D	VFD'S AND SOFT STARTS FOR HIGH SERVICE PUMPS AT BIG HOLE WTP	$274,850
1-E	BASIN CREEK TO COLORADO HILL PUMP STATION	$1,587,000
1-F	INSTALL WATER METERS**	$1,589,696
	Total	**$24,100,000**

* While the total cost for the Basin Creek WTP and related site development features is $29.85 million, $20 million is the portion of those costs that would be covered by the UCFRB Restoration Fund pursuant to this Groundwater Restoration Plan. The remaining $10 million will come from the BAO Restoration Fund pursuant to the 2012 Final BAO Restoration Plan. Of the $20 million covered under this Plan, $19.41 million will be for costs of the WTP and $0.59 million will be for plant site development costs, as further detailed in the Appendix to this document. WTP costs include 20% engineering and 25% contingency.

** Note total cost for installing all remaining water meters is $3.23 million

Figure 1-1 on the following page illustrates the location of all nine of the Phase One improvements identified in the *2013 Master Plan Update*. In **Figure 1-1**, various capital improvements are noted in blue, and the existing infrastructure is shown in grey.

1-B Upgrade Telemetry and Control System at Moulton WTP

Moulton Treatment Plant
Elev=6400
Butchertown Reservoir
Overflow Elev=6386

High Service Reservoir
Overflow Elev=6286

WTP

Main St. Pump Station
Elev=6206

PS

West Side Pump Station
Elev=5964

PS

West Side Tank
Overflow Elev=6002

1-G(b) New PRV at
Cobban and Massachusetts

Summit Valley to West Side Tank
Transmission Main

Summit Valley Pump Station
Elev=5440

PS

1-I Complete replacement of Big Hole
Transmission Pipeline using BSB
Public Works Department Personnel

I-90

Colorado Hill Tank
Overflow Elev=5869

1-G(a) New
12" Main
under I-15/90

1-G(c) New PRV at
Lexington and Rowe

From Big
Hole WTP

South Side Tank
(Abandoned)
Approx. Elev=5780

1-H Replace Timber Butte Transmission Main

1-E Basin Creek to Colorado Hill
Pump Station

Waterline Rd

PS

Harrison Ave

OTHER RECOMMENDED PHASE ONE IMPROVEMENTS:

1. 1-C INSTALL NEW PERMANENT CARBON DIOXIDE FEED SYSTEM AT BIG HOLE WATER TREATMENT PLANT FOR OPTIMIZING REMOVAL OF TOC'S FROM BIG HOLE SUPPLY.

2. 1-B UPGRADE TELEMETRY AND CONTROL SYSTEM AT BIG HOLE WATER TREATMENT PLANT.

3. 1-D INSTALL TWO VARIABLE FREQUENCY DRIVES AND THREE SOFT START SYSTEMS ON THE HIGH SERVICE PUMPS AT BIG HOLE WATER TREATMENT PLANT.

4. 1-F INSTALL WATER METERS ON REMAINING UNMETERED SERVICE CONNECTIONS IN THE DISTRIBUTION SYSTEM.

Basin Creek PRV
Elev=5610

Legend

- WTP — Water Treatment Plant
- PS — Pump Station
- New Water Main
- Pressure Reducing Valve Vault

Notes:

New components described by blue lettering.

Existing components described by black lettering.

1-A New Basin Creek Water
Treatment Plant

WTP

N

Butte - Silver Bow Water

Recommended Phase One Improvements
Figure 1-1

2.0 Background

This background section summarizes the history of BSB's acquisition and management of its drinking water system, past improvements, and BSB's master planning process. It also focuses on the changes that have occurred since completion of BSB's *2008 Water System Master Plan* and the 2013 Update.

It has long been recognized that the deposition of wastes in the city of Butte from mining and mineral-processing operations has resulted in injury to groundwater resources and the surface water of Silver Bow Creek. Injury to groundwater has been demonstrated by the occurrence of concentrations of heavy metals (including cadmium, zinc, iron, lead, copper, arsenic, mercury and sulfate) that exceed drinking water standards in the alluvial and bedrock aquifers.

In turn, surface water and streambed contamination to Silver Bow Creek has resulted from the discharge of contaminated surface runoff. In the past, surface runoff from storms and snowmelt carried hazardous substances from hundreds of dispersed waste source sites to Silver Bow Creek through surface drainages and the Butte storm water collection system.

The loss of this groundwater and surface water source has required the citizens of Butte to assume responsibility for a vast and extensive water supply, treatment and distribution system that relies upon raw water supplies a considerable distance from the customer base. Moreover, the infrastructure for this system was put in place nearly a century ago and is in dire need of replacement and upgrades.

For over a century the Butte water supply systems were owned and managed by private corporations whose primary objective was to supply water to the burgeoning mining industry. Drinking water supply and safety was a secondary concern. In the early 1990's, the water supply and distribution systems came under public ownership as part of the consolidated City and County of Butte-Silver Bow. Immediate improvements were completed in the mid 1990's to mitigate the "boil" order and associated health problems the citizens of Butte were experiencing.

Over the past two decades the BSB Water Utilities Division has been responsible for operating the water system as an enterprise account. Capital improvements have been financed both by external sources such as the NRDP and from capital reserves supported by the rate payers. *To date, approximately $35.5 million has been invested by NRDP and $44.5 million by rate payers. A significant amount of capital investment yet remains to restore this water system.*

The Butte water system is a very complex water system given the pumping from remote distances, blending of water supplies, challenging source water quality, and deteriorating infrastructure dating back to early mining days. BSB's domestic water system is comprised of the surface water resources of the Big Hole River (including South Fork Reservoir), Basin Creek and Moulton Watersheds. Surface WTP's provide treatment for the Moulton and Big Hole supplies, while Basin Creek has historically operated under a filtration waiver with only chlorine disinfection. These sources are pumped and/or flow by gravity for great distances to storage tanks located at various

locations within Butte. From these storage tanks, distribution systems consisting of nine different pressure zones controlled by pumps, tanks, and pressure reducing valves provide domestic water supply and fire protection to approximately 12,800 residential and commercial customers. In addition to these inherent challenges, new Federal Safe Drinking Water Act regulations continue to ramp into effect and are now immediately impacting the compliance status of the Butte Water System.

In 2008, BSB completed a Water Master Plan that provided a description of the existing BSB water system and identified many of the deficiencies and critical elements that needed replaced. Since completion of the *2008 Water Master Plan* there have been a number of occurrences and changes made to the system that necessitated modifications to the course outlined in the Master Plan as discussed below.

Major Deficiencies Identified in the *2008 Master Plan*

Major issues and problems that were identified in the *2008 Master Plan* included the following:

Potential to Exceed EPA's Stage 2 Disinfectant and Disinfection Byproducts Rule

When the *2008 Master Plan* was written, requirements of the Stage 1 Disinfectant and Disinfection Byproducts Rule (Stage 1 Rule) were in effect and Butte was in compliance with the Stage 1 Rule. This rule regulates the concentrations of the four trihalomethanes (THM) and five haloacetic acids (HAA5), which are carcinogens. These compounds are disinfection byproducts that are formed when chlorine, which is used as a disinfectant in the water supply, combines with dissolved organic matter in the water.

The concentrations of these compounds must not exceed 80 ug/l for THM's and 60 ug/l for HAA5's based on an annual average of all samples taken quarterly in the distribution system. In 2008, there had not been any violations of the Stage 1 Rule. However it appeared that the system's three water supplies (Moulton, Big Hole, and Basin Creek) were in danger of violating the requirements of the new Stage 2 Disinfectant and Disinfection Byproducts Rule (Stage 2 Rule), based on the preliminary distribution system sampling program that was initiated by BSB as a requirement of the Stage 2 Rule. It appeared that all three sources had the potential of violating the HAA5 maximum contaminant level (MCL) of 60 ug/l.

The Stage 2 Rule has more stringent sampling requirements than the Stage 1 Rule; locational running annual averages of each identified sampling point in the distribution system are used to determine compliance with the Stage 2 Rule instead of averaging the results of all sampling points together. As a result of this potential, BSB initiated operational changes at their three sources in order to try to stay in compliance with the Stage 2 Rule. (Actual compliance monitoring for this rule started in October of 2013.) The results of these steps are discussed later in this document.

Major Deficiencies Identified with the Moulton Supply

Major deficiencies identified with the Moulton Supply included:

- The potential to exceed the requirements of the Stage 2 Rule as discussed above;
- The potential need for the replacement of the Moulton 16-inch transmission pipeline between the Moulton Reservoir and the Moulton WTP; and

- Lack of adequate storage to meet fire flow demands for large structures in the Moulton Pressure Zone.

Other less critical deficiencies were also discussed in the 2008 document.

Major Deficiencies Identified with the Big Hole Supply

Major deficiencies identified with the Big Hole Supply included:

- The potential to exceed the requirements of the Stage 2 Rule as discussed above.
- The Big Hole Transmission Pipeline between the Big Hole River and the Colorado Hill Storage Tank had reached the end of its useful design life and was in danger of failing.
- The diversion dam on the Big Hole River at Divide was in poor condition and in imminent danger of failing. Failure of the diversion dam would have left Butte without its major source of water until emergency repairs could be completed.
- The Big Hole Transmission Pipeline was also having significant leakage issues and the bitumastic (coal tar) lining of the pipeline was leaching tetrachloroethene into the water supply (at low levels below EPA's MCL).

Major Deficiencies Identified with the Basin Creek Supply

Major deficiencies identified with the Basin Creek Supply included:

- The 24-inch steel transmission pipeline is approaching an age of 50 years and may be reaching the end of its design life. However, the leak frequency of this line is low.
- This source may not be able to meet the requirements of the Stage 2 Rule.
- In order to maintain the filtration waiver for this source, a second source of disinfection would need to be installed (UV disinfection).
- There was a potential that the filtration waiver for this source would be lost during the planning period due to a fire in the watershed or by failing to meet the requirements of the Stage 1 or Stage 2 Rules (This source exceeded the HAA5 MCL of the Stage 1 Rule and the filtration waiver for this source was revoked by the Montana Department of Environmental Quality (MDEQ) as discussed below).

Major Distribution System and Storage Deficiencies

Major deficiencies identified with the distribution and storage systems included the following:

- There are a large number of small diameter water mains in the distribution system (MDEQ requires a minimum main size of 6-inches in systems that provide fire protection).
- The Timber Butte Transmission Main is reaching the end of its useful life.
- The Colorado Hill to the West Side Storage Tank Transmission Main is reaching the end of its design life (the Summit Valley Pump Station is located on this main).
- Low pressures occur on the east side of the Basin Creek Pressure Zone during high demand periods. This requires that high pressure Colorado Hill Zone water be fed manually into the east side of the Basin Creek Zone to elevate pressures.
- There is currently no means to move water from the Basin Creek Zone into the Colorado Hill Zone in an emergency.

- Approximately one-half of all the water user accounts are not metered, contributing to high demands in the summer months.

Improvements Identified in the *2008 Water System Master Plan* that Have Been Completed

1. The Big Hole Diversion Dam was replaced in 2010. The new dam includes boat passage and portage features. Also a new raw water pump station was constructed (completed in 2012).
2. Replacement of the Big Hole Transmission Pipeline is underway. Approximately 68,502 feet of pipeline has been replaced and approximately 44,000 feet of the pipeline remains to be completed. Of the 44,000 feet of pipeline, about 32,000 feet will be replaced using NRD funding that was approved through the 2012 Groundwater Restoration Plan.
3. A new High Service Water Storage Tank was constructed.
4. 53,000 feet of water distribution lines in Butte have been replaced.
5. 964 water meters have been installed to date.

Changes That Have Occurred and Additional Improvements Identified After the Completion of the *2008 Water System Master Plan*

Loss of the Basin Creek Filtration Waiver

The most significant change that has occurred since completing the *2008 Water System Master Plan* was the loss of the Basin Creek Filtration Waiver in 2010. The waiver was revoked because the Basin Creek Water System exceeded the Stage 1 Rule HAA5 MCL of 60 ug/l in the third quarter of 2010 (60.6 ug/l). This MCL was also exceeded in the second quarter of 2011 (63.0 ug/l). Therefore, simple UV disinfection is no longer a viable alternative for the Basin Creek Supply. Instead a new WTP will have to be constructed in order to continue using this source. The preliminary design for the new Basin Creek WTP is currently underway.

Based on pilot testing completed in the fall of 2013, the final filtration process for the plant will be membrane filtration. This filtration process could be followed by filtration with granular activated carbon (GAC) to remove total organic carbon in the water supply to insure the compliance of this source with the Stage 2 Rule. The plant is scheduled to be online in 2016. BSB is currently in negotiations with the MDEQ to enter into an Administrative Order on Consent (AOC) to bring the Basin Creek Water Supply back into compliance with the Long Term 2 Enhanced Surface Water Treatment Rule and the Stage 2 Rule. The purpose of the AOC is to allow BSB sufficient time to come into compliance with the two rules and to avoid the fines that could be levied by MDEQ for violations that will continue to occur until the plant is constructed. The AOC will also allow BSB to continue to use the Basin Creek Supply until the new WTP is constructed. In order for the AOC to be finalized, MDEQ has to agree to the schedule for the treatment plant design and construction.

The possibility that a new Basin Creek WTP would have to be constructed during the planning period was discussed in the *2008 Water System Master Plan*. The Master Plan indicated that there was a high likelihood that the plant would be constructed during the 20-year planning period. The recommendation in the *2008 Water System Master Plan* was to maintain the filtration waiver as long as possible by installing a UV disinfection system on

the source and then constructing a new filtration plant should the filtration waiver be lost. Both the CAC process and membrane filtration were evaluated in the *2008 Water System Master Plan*, which recommended that both these treatment process be pilot tested. In the fall of 2013, BSB completed this pilot testing, which led to the decision to select the membrane filtration treatment process. The possibility of needing supplemental treatment with GAC to control disinfection byproducts was also discussed in the *2008 Water System Master Plan*.

The *2008 Water System Master Plan* also evaluated the adequacy of the water rights for the Basin Creek Supply. The analysis concluded that there were sufficient water rights available to support the operation of the plant. The Basin Creek Supply is served by two water rights:

1. An 1868 first priority right for 17,897 acre-feet per year on Basin Creek.
2. An 1866 second priority right for 3,628.7 acre-feet per year on an unnamed tributary of Fish Creek.

These two rights provide a total water right of 21,525.7 acre-feet. The *2008 Water System Master Plan* estimated the reliable yield for the Basin Creek Supply at 3,200.6 acre-feet per year. In the time period from 1996 to 2006, the yearly volume used from Basin Creek did not exceed 5000 acre-feet. The water right for the Basin Creek Supply significantly exceeds the actual volume of water available from the drainage in a typical year. The new WTP is being designed to provide a peak summer daily flow of 7 MG and an average daily flow of approximately 3 to 4 MG. The actual volume of water available from Basin Creek varies from year-to-year, depending upon yearly rain and snowfall.

<u>Ability of Moulton and Big Hole Supplies to Comply with the Stage 2 Rule</u>

There was a concern that the Moulton and Big Hole Supplies would not be able to consistently comply with the Stage 2 Rule. However, due to operational changes, it currently appears that the Moulton and Big Hole Supplies will be able to comply with the requirements of the Stage 2 Rule. This is based on sampling results obtained after changes were made to the overall operation of the Big Hole and Moulton Supplies. Those changes include the following:

- In March of 2012, the main chemical coagulant at the Big Hole WTP was changed from aluminum-chlorohydrate-polyamine to alum to increase organic carbon removal efficiency.
- The coagulant at the Moulton Plant was also changed to alum to increase organic carbon removal efficiency.
- Starting in March of 2012, chlorine dosage was more closely monitored and the actual dosage was reduced to the extent possible at both the Moulton and Big Hole plants.
- In September of 2012, a separate inlet and outlet pipe was incorporated into the Colorado Hill Storage Tank to reduce the water age in the tank. The reduction of the water age will help reduce the formation of disinfection byproducts.
- Installation of a temporary carbon dioxide feed (CO_2) system to control pH to optimize the removal of total organic carbon at the Big Hole Plant.

These changes in the operation have resulted in concentrations of disinfection byproducts in the distribution system well below the maximum contaminant levels allowed. Sample results to date indicate that both the Big Hole and Moulton Systems will be able to comply with the Stage 2 Rule without any major operational or process changes.

Additional Improvements Identified for the Big Hole WTP

In 2012, a recommendation was made to install an enhanced coagulation system at the Big Hole WTP to control disinfection byproduct formation. The project consisted of the addition of a new chemical feed system, flocculation tanks and plate settlers that would remove Total Organic Carbon (TOC) from the raw water. This project was slated for construction in 2013, at a total design and construction cost of approximately $9.0 million. However, the plant operators were able to make the changes in the operation of the plant as discussed above and compliance with the requirements of the Stage 2 Rule was achieved. As a result, the proposed project was cancelled. However there are still some remaining additional improvements required at the Big Hole WTP including:

- A new permanent carbon dioxide storage and feed system for pH control to replace the temporary system currently in place.
- Installation of three soft start devices on existing pumps at the plant.
- Installation of two new variable frequency drives (VFD's) on existing pumps at the plant.
- The telemetry and control system at the Big Hole Plant is outdated and needs to be upgraded with new software and equipment.

The new permanent carbon dioxide storage and feed system to replace the current temporary setup is needed to adjust the pH of the raw water at the treatment plant to optimize the removal of TOC. Reduction of the TOC concentration in the raw water reduces the potential for the formation of disinfection byproducts in the treated water. There are five high service pumps at the Big Hole WTP that pump treated water to the Colorado Hill Tank. Currently, two of the pumps are operated with variable frequency drives (VFD) which are used to vary flow to match system demands. The remaining three pumps are started with "across the line" starters that immediately start the pumps at full speed. The two existing VFD's have reached the end of their useful life and must be replaced. Installation of soft start devices on the remaining three pumps will bring them up to full speed over a time period ranging from 30 seconds to a few minutes. This reduces wear on the pumps, prevents water hammer (pressure surges), thus protecting the investment in the Big Hole Transmission Main. It also reduces the electrical current required to start the pumps, resulting in a significant savings in electrical costs.

Additional Improvements Identified at the Moulton WTP

The *2008 Water System Master Plan* indicated that the recirculation basin used to settle the solids out of the plant's filter backwash and clarifier sludge was somewhat undersized, thus requiring frequent cleaning (sludge removal). With the switch to alum as a coagulant, the amount of solids produced by the plant has increased which in turn has increased the manpower required for sludge removal. BSB staff has indicated that modification of the solids handling facility at Moulton is becoming more critical. Options being considered

include construction of new backwash lagoons, expansion of the existing recirculation basin, and/or installation of solids dewatering equipment such as a centrifuge, fan press or belt filter press. The telemetry and control system at the Moulton Plant is outdated and needs to be upgraded with new software and equipment.

Additional Improvements Identified to Address Pressure Issues on East Side of Basin Creek Pressure Zone

The new 18-inch main that was installed north of the airport along Elizabeth Warren and Mount Highland Drive, connecting to a 12-inch main running north on Continental Drive, has improved the pressure issues in this area. However, there are still occurrences of low pressures on the east side of the city north of Interstate 15/90. BSB would like to extend the 12-inch main north under I-15/90 to improve the hydraulic connection between the NE and SE portions of the Basin Creek pressure zone. Additionally, the pressure reducing valve stations located on Dewey Boulevard and Greenwood Avenue are old, parts are no longer available for the valves, and the valves are becoming difficult to adjust properly. Based on some adjustments that BSB staff was able to make to these valves, it appears that the eastside pressure issue could be further addressed by installing new valves with better adjustment capabilities.

Also, installation of a pressure reducing station at or near the intersection of Massachusetts and Cobban Avenues as discussed in the *2008 Water System Master Plan* is still needed. Currently, BSB operators bleed higher pressure Colorado Hill Zone water into the east side of the Basin Creek Zone at this location by manually opening a valve that connects the two pressure zones. The addition of a new pressure reducing station at Lexington Avenue and Rowe Road has been considered in order to provide an additional point for moving water into the Basin Creek Zone from the Colorado Hill Zone. BSB staff believes that an additional storage tank to serve the east side of the Basin Creek Zone is not warranted if some or all of the improvements discussed above can be made. If further development occurs on the east side, then a new storage tank may be warranted in the future.

Implement System Water Metering

Metering was discussed in the *2008 Water System Master Plan* and BSB would now like to increase its efforts and implement a more aggressive metering program. Currently, about one-half of the water service connections in the distribution system are metered. The *2008 Water System Master Plan* recommended that Butte meter all of the remaining service connections. Reasons for metering include:

- Metering promotes water conservation and reduces user demands.
- Modern flow meters can detect leaks in plumbing allowing the utility to alert homeowners and business owners that they have a potential leak that may require repairs.
- Metering allows the utility to compare the volume of water delivered to the distribution system from supply to the volume delivered to the system users. This comparison provides a means to estimate the amount of leakage that is occurring in the distribution system.

- Metering would eliminate the current dual rate system that is in place in Butte consisting of a flat rate for unmetered users and a variable rate based on usage for metered users.
- Metering is the most equitable way to bill system users, because bills are based on actual usage.
- Metering the entire system helps BSB qualify for other grant funding assistance, such as the Treasure State Endowment Program (TSEP).

Reduction in water usage of 10 percent to 40 percent has been documented when a community installs water meters. Butte currently has 12,772 water service accounts. Approximately 6,000 of these accounts are not metered. There are 2,800 metered accounts that are not equipped with radio transmitters, requiring them to be read manually each month. Equipping these meters with radio transmitters will improve the efficiency of the BSB water utility division. By metering the remaining unmetered services, Butte can expect to see a total reduction in system demand, ranging from 5 percent to 20 percent. This equates 0.70 to 2.8-million-gallons per day during summertime peak demands (assuming a peak day of 14-million-gallons) and 0.35- to 1.4-million-gallons per day on an average day (assuming an average day of 7-million-gallons per day). It is likely that a higher percentage of conservation will occur during the summer irrigation season because system users will likely monitor their irrigation practices more closely once they become metered. The promotion of water conservation by metering will in effect increase the amount of a finite resource (water) that is available. Increasing the available water supply by conservation will allow for additional future residential and commercial growth. Should full system metering be implemented, BSB would also need to perform a water rate study and adjust their metered rates to assure that sufficient revenues would be generated for utility operations.

Summary of Needed Remaining Improvements from *2008 Water System Master Plan* and Additional Improvements Identified Since the Completion of the *2008 Water System Master Plan*

This section will summarize the needed improvements that were identified in the *2008 Water System Master Plan* as well as the additional improvements that have been identified since completion of the 2008 document as further detailed in the *2013 Butte-Silver Bow Water System Master Plan Update*. Improvements have been prioritized into two phases:

- Phase One Improvements are the most critical due to regulatory issues, the need to replace outdated equipment, the need to improve operational flexibility of the water system, the need to reduce energy costs and the need to reduce system demands. These improvements must be completed in the next one to seven years.
- Phase Two Improvements are improvements that were identified in the *2008 Water System Master Plan* as having a high likelihood of needing to be completed during the 20-year planning period. In addition, the improvements to upgrade solids handling at the Moulton WTP have been included in Phase Two due to budgetary limitations and because the problem has been somewhat addressed with operational changes.

Phase One Improvements

The loss of the Basin Creek filtration waiver and the implementation of the requirements of EPA's Stage 2 Rule in October of 2013 necessitated the following improvements that must be completed under Phase One (Master Plan Update improvement number in parentheses):

1. (1-A) Construction of a new Basin Creek WTP.
2. (1-C) Installation of a new permanent carbon dioxide storage and feed system at the Big Hole WTP to provide a reliable means to enhance the removal of total organic carbon from the Big Hole Supply.

In order to insure system reliability and to increase operational efficiency, the following improvements are also proposed under Phase One:

3. (1-B) Upgrade the telemetry and control system at the Big Hole and Moulton WTPs.
4. (1-D) Installation of two variable frequency drives and three soft start systems on the high service pumps at the Big Hole WTP.
5. (1-F) Install radio read devices on existing meters and install water meters on the remaining unmetered service connections in the distribution system and perform a water rate study (study will be completed by BSB).
6. (1-G) Improve pressures on the east side of the Basin Creek Pressure Zone including:
    a. (1-Ga) Improve the hydraulic connection across I-15/90.
    b. (1-Gb) Install a new pressure reducing station at Cobban and Massachusetts Avenue.
    c. (1-Gc) Install new pressure reducing station at Lexington and Rowe Road.
7. (1-I) Complete the replacement of Big Hole Transmission Pipeline between the Colorado Hill Tank and Lexington Avenue using BSB labor and equipment.
8. (1-E) Provide means to transfer Basin Creek Water to the Colorado Hill Zone. This will be accomplished by the construction of a New Basin Creek to Colorado Hill Pump Station. The pump station was discussed in the *2008 Water System Master Plan* and would be used to pump water from the Basin Creek Zone to the Colorado Hill Zone in an emergency (if the Big Hole Supply is interrupted) and on a regular basis to make better use of Basin Creek water, which is currently Butte's most economical source. There is currently no way to move Basin Creek water into the Colorado Hill Zone and subsequently into the other upper pressure zones.
9. (1-H) Replace the Timber Butte Transmission Main. This transmission main will be used to transfer water from the Basin Creek Pressure Zone to the Colorado Hill Zone via the new Basin Creek to Colorado Hill Pump Station.

Phase Two Improvements

Phase Two Improvements discussed in the *2008 Water System Master Plan* include:

1. Upgrade or Replace the Basin Creek Transmission Main (Should replacement of all or some of this transmission main be required to achieve the needed hydraulic characteristics at the new treatment plant, this replacement could become a Phase One Improvement.)
2. Replace the Moulton Transmission Main.
3. Replace the Colorado Hill to West Side Storage Tank Transmission Main

4. Construct a New East Side Storage Tank.
5. Continue with the on-going Distribution System Main Replacement Program.
6. Construct additional storage in the Moulton Zone.
7. Complete improvements to improve solids handling at the Moulton WTP.
8. Increase fire protection in the Moulton Pressure Zone.

These Phase Two Improvements may be needed at some point in the 20-year planning period and are discussed in detail in the *2008 Water System Master Plan*.

3.0 BSB's Groundwater Restoration Plan

For this Groundwater Restoration Plan, BSB has selected six of the above Phase One improvements from the *2013 Butte-Silver Bow Water System Master Plan Update* to be funded with the $24.1 million available allocation from the UCFRB Restoration Fund. These improvements are listed in order of importance in **Table 3-1** below. Note the total estimated capital cost for these improvements exceeds the $24.1 million available from the UCFRB Restoration Fund and the $10.0 million from the Butte Area One (BAO) Restoration Fund (Contract #80005-10295) that has been allocated for the design and construction of the new Basin Creek WTP. Improvements will continue to be made to the system according to the priority listed in **Table 3-1** pursuant to this Groundwater Plan, as long as approved NRD funding remains available. BSB will rely on funding from ratepayers and other funding sources to complete improvements not accomplished with NRD funding.

Table 3-1 Phase One Improvements from *2013 Butte-Silver Bow Water System Master Plan Update* for Inclusion into BSB's Groundwater Restoration Plan

IMPROVEMENT		ESTIMATED CAPITAL COST
1-A	BASIN CREEK WTP	$ 20,000,000*
1-B	TELEMETRY AND CONTROLS	$466,725
1-C	CO_2 FEED AT BIG HOLE WTP	$181,729
1-D	VFD'S AND SOFT STARTS FOR HIGH SERVICE PUMPS AT BIG HOLE WTP	$274,850
1-E	BASIN CREEK TO COLORADO HILL PUMP STATION	$1,587,000
1-F	INSTALL WATER METERS**	$1,589,696
	Total	**$24,100,000**

* While the total cost for the Basin Creek WTP and related site development features is $29.85 million, $20 million is the portion of those costs that would be covered by the UCFRB Restoration Fund pursuant to this Groundwater Restoration Plan. The remaining $10 million will come from the BAO Restoration Fund pursuant to the 2012 Final BAO Restoration Plan. Of the $20 million covered under this Plan, $19.41 million will be for costs of the WTP and $0.59 million will be for plant site development costs, as further detailed in the Appendix to this document. WTP costs include 20% engineering and 25% contingency.

** Note total cost for installing all remaining water meters is $3.23 million

Appendix A contains detailed estimated capital and annual costs for each improvement listed above.

The spending scenario reflected in **Table 3-1** assumes that a new storage tank will not be installed in conjunction with the construction of the new Basin Creek WTP. If the final design hydraulic analysis indicates that a treated water storage tank is required because pressurized flow through the WTP cannot be accomplished, contingency funds will be used to construct the tank.

Table 3-2 summarizes the remaining Phase One improvements that are projected to exceed the $24.1-million budget of this Plan. However, if actual costs are less than estimated costs and there are funds remaining after the completion of the six improvements identified in **Table 3-1,** BSB will utilize the remaining funds to complete as many of the improvements identified in **Table 3-2** pursuant to this Groundwater Restoration Plan as allowable within the total approved NRD

allocation of $24.1 million. These remaining improvements are listed in order of priority. The metering project would be completed first; however, the order of completion of the remaining improvements may change depending upon the amount of any remaining funds. Remaining improvements will be completed in the future using rate payer revenues and/or other funding sources.

Table 3-2 Remaining Phase One Improvements from *2013 Butte-Silver Bow Water System Master Plan Update*

	IMPROVEMENT	CAPITAL COST
1-F	REMAINING WATER METERS	$1,695,637
1-Ga	HYDRAULIC CONNECTION UNDER I-15/90	$718,338
1-H	REPLACE TIMBER BUTTE TRANSMISSION MAIN	$3,609,677
1-I	BIG HOLE TRANSMISSION MAIN BETWEEN COLORADO HILL TANK AND LEXINGTON AVENUE	$1,860,450
1-Gb	PRESSURE REDUCING STATION AT COBBAN AND MASS.	$206,475
1-Gc	PRESSURE REDUCING STATION AT LEXINGTON AND ROWE ROAD	$ 219,700
	TOTAL	**$8,310,277**

Appendix A contains detailed capital and annual costs for each improvement listed above.

Figure 1-1 is an overview of BSB's Groundwater Restoration Plan and the components that are anticipated to be repaired, replaced or rehabilitated. In **Figure 1-1**, various capital improvements are noted in blue, and the existing infrastructure is shown in grey.

3.1 Description of Improvements

The following sections provide a description of the type and locations of each of the six improvements to be implemented within the overall framework of the BSB Groundwater Restoration Plan. Also described are the remaining Phase One Improvements from the 2013 *Master Plan Update,* which BSB would like to complete if there are any remaining funds after the first six items are completed. **Figure 1-1** summarizes all of the Phase One Improvements. The descriptions in this section of each improvement cover: background and current status, which summarizes alternatives considered; schematic layout and description, operational, energy, regulatory, and land requirements; environmental and constructability considerations; and cost estimates.

Improvement 1-A: New Basin Creek WTP

Background and Current Status

The *2013* ***Butte-Silver Bow*** *Master Plan Update* discussed two treatment alternatives for the Basin Creek Supply:

- Construct a new Contact Adsorption Clarification (CAC) WTP with mixed media filtration.

- Construct a new Membrane Filtration WTP.

In June of 2013, BSB selected the Engineering Team of HDR Engineering/ Robert Peccia and Associates (RPA) through a competitive procurement process to design a new Basin Creek WTP and related improvements. Preliminary design steps that have recently been completed include:

- Pilot testing of the CAC and membrane filtration processes (as recommended in the *2008 Water System Master Plan*) with subsequent process selection. Completion of a site selection study.[2] Completion of a capacity analysis on the Basin Creek Transmission Main.

In the fall of 2013, BSB completed the pilot testing and evaluation of the CAC and membrane filtration processes. That evaluation concluded the best treatment option would be membrane filtration for the following reasons:

- Membrane filtration provides a better barrier against *Cryptosporidium* and *Giardia* when compared to the CAC process (4-log removal for membranes vs. 2-log removal for CAC).
- Membrane filtration should be more capable of meeting future regulatory challenges.
- The membrane filtration is accomplished under pressure, eliminating the need to reduce pressures on the inlet side of the plant. This will allow full utilization of the elevation head in the Basin Creek Reservoir, allowing gravity flow for most of the year. The pumping will only be required for peak summertime flows above 5-million-gallons per day.
- The plant can operate under pressure, eliminating the need to break to atmosphere which would require the construction of a storage tank.
- The CAC process would require the installation of a standpipe or pressure reducing valve upstream of the plant to reduce the inlet pressure to the plant to near atmospheric. This would result in the loss of a significant amount of energy, requiring year around pumping of the treated water.
- Operation of the membrane filtration plant will be simpler. Chemical coagulant addition may not be required at all times and when it is required the feed rates will be less than what would be required for the CAC process.
- The membrane process will produce significantly less backwash wastewater, reducing the cost of disposal.
- On a 30-year present worth basis, membrane filtration is less expensive (about $51.7 million than the CAC process (about $61.9 million) based on the results of the pilot plant testing and the subsequent present worth cost analysis.

The remainder of this component description section is specific to a membrane water filtration plant. The preliminary design phase for the Basin Creek WTP was completed by the end of 2013, and the final design process will be initiated at that time.

[2] *Basin Creek Water Filtration and Ancillary Facilities – Site Alternatives Evaluation; Butte-Silver Bow Montana* Prepared by HDR Engineering, dated Sept. 2013)

Schematic Layout and Description

A schematic layout and description of the membrane treatment process was provided in the *2008 Water System Master Plan*. Changes from the *2008 Water System Master Plan* include the following:

- Results from the recently completed site selection study for the WTP show that the preferred location for a new treatment plant is on a 5 acre parcel of privately owned land and on a portion of an adjacent 10 acre state owned land located just north of Herman Gulch. BSB is currently in negotiations with the State of Montana to obtain a lifetime easement on a portion of the state parcel of land and to purchase the small parcel of private land. **Figure 3-1** shows the current proposed WTP site. All land acquisitions, appraisals and easements are subject to the approval of the NRD Program.
- The new treatment plant must control the formation of disinfection byproducts in order to adequately protect the consumers' health and stay in compliance with the Stage 2 Rule. Preliminary results from the pilot study indicate that compliance can be achieved with the membrane process by feeding alum ahead of the filters to remove organic carbon. However, GAC filtration may also need to be included to provide additional organic carbon removal. Therefore, GAC filters may be added as a final treatment step.
- Results from the preliminary hydraulic analysis of the Basin Creek Transmission Line indicate that treated water may have to be pumped from the plant into the distribution system under at least peak flow conditions.

An updated preliminary schematic layout for the new WTP is provided in **Figure 3-2.** The treatment process would consist of banks of membrane filters through which the raw water would flow under pressure from the Basin Creek Reservoir. A coagulant would be fed as needed ahead of the filters to aid in the removal of dissolved organic carbon and turbidity. The pores in the membrane material are 0.1 microns or less in size. This pore size allows the membrane material to act as a strainer filtering out floc particles, turbidity particles and *Cryptosporidium* and *Giardia* cysts. Coagulant addition may not be necessary if the membrane filters are not used to remove dissolved organic matter in the raw water.

The membrane filters are capable of meeting the requirements of the Long Term 2 Enhanced Surface Water Treatment Rule without coagulant addition. Finished water turbidities of less than 0.10 NTU and 4 log removal of *Cryptosporidium* and *Giardia* are typical for a membrane system. GAC filters may be placed downstream of the membrane filters to provide additional removal of dissolved organic matter to control the formation of disinfection byproducts. The membrane filters are backwashed on a regular basis with an air scour and water to remove buildup on the outside of the membranes. The membranes are also chemically cleaned on a regular basis to remove material that "sticks" to the membranes such as dissolved organic matter, dissolved iron etc. Typical cleaning chemicals include sodium hydroxide, sodium hypochlorite and citric acid. Backwash wastewater from the filters must be processed and disposed of properly.

Options for backwash waste disposal include solids removal with disposable filter bags or settling in a lagoon or sedimentation basin. After solids removal, the wastewater would be

disposed of by discharge to either surface water or groundwater (with infiltration lagoons). A discharge permit will be required for either surface water or groundwater discharge. The cleaning chemicals would be neutralized before they are disposed of and would likely be hauled to the wastewater treatment plant for final treatment and discharge.

The finished water will be disinfected with chlorine and possibly ultraviolet light. Treated water will either flow by gravity or will be pumped (peak flows only) to the distribution system.

Water from the Basin Creek Reservoir will flow under pressure through the membrane filtration system. Filtered water will be disinfected under pressure and treated water will flow either by gravity or be pumped (peak flows) to the distribution system via the Basin Creek Transmission Main. The configuration of the new membrane WTP will allow water to flow through the plant under pressure utilizing the head from the Basin Creek Reservoir. The reservoir will provide storage for the Basin Creek Zone as it does now. If the final design hydraulic analysis indicates that a treated water storage tank is required because pressurized flow through the WTP cannot be accomplished, contingency funds will be used to construct the tank.

Operational Requirements

The new WTP will be designed to operate up to 365 days per year while producing up to 7 MGD of treated water. The new treatment plant will require additional staffing beyond that used for the existing Basin Creek facility. The addition of at least one full-time and one part-time equivalent licensed Class I surface water treatment Operator is anticipated for expanded maintenance and operational needs.

It is anticipated that the plant would be staffed seven days a week for a minimum of 8 hours per day. When the building is not staffed, plant function and status would be monitored by the SCADA system. Operators at the Big Hole plant would be notified via SCADA of alarm conditions at the Basin Creek facility. The SCADA system would be designed to allow system operators to shut down the plant from the existing Big Hole WTP or other remote location during an alarm situation.

Additional operating needs will be associated with testing and monitoring of filter performance, additional backwash wastewater handling and treatment, and maintenance of more treatment and instrumentation and control equipment.

Energy Requirements

Electrical energy will be required for the backwash pumps, high service pumps, chemical pumps, solids handling pumps and equipment air compressors, building lights and ventilation, controls etc. Propane will be used to heat enclosed buildings.

Regulatory Compliance and Permits

The new membrane filtration plant should be capable of full regulatory compliance for its 20-plus year design life. Based on sampling performed to determine the concentration of *Cryptosporidium* cysts in the source water (as required by the Long Term 2 Enhanced

Surface Water Treatment Rule) the Basin Creek Supply has a Bin One classification. This Bin classification means that the WTP must provide at a minimum a 2 log reduction of *Cryptosporidium* in the raw water. Membrane filtration will be credited with a minimum of a 4.0 log reduction for *Cryptosporidium*. Disinfection is also provided to achieve a 4.0 log credit for virus inactivation. The addition of UV disinfection could provide a logical remedy to achieve the required 4.0 log reduction of viruses in lieu of constructing a pressurized contact chamber to achieve the 4.0 log reduction with chlorine alone.

UV disinfection would also provide additional log removal credits for *Cryptosporidium.* The decision on including a UV disinfection system will be made during the final design phase. The membrane plant will be capable of meeting the Stage 2 Rule THM and HAA5 MCL's, and the addition of GAC filtration for additional dissolved organics removal can be installed either at initial construction or during a subsequent upgrade. Disposal of backwash and cleaning water may require a surface water or groundwater discharge permit from MDEQ. If the new pipeline is needed to connect the new plant to the existing Basin Creek Transmission Main crosses Basin Creek, a DNRC 310 permit, Army Corps 404 permit and a floodplain permit may be required. A storm water discharge permit will be required for construction activities that disturb more than one acre.

Land Requirements

The new Basin Creek WTP will require approximately 15 acres of land and will be located on property just north of Herman Gulch on the site that includes 5.04 acres of private land that is being acquired by Butte-Silver Bow and 10 acres of the adjoining state property (see **Figure 3-2**). As indicated in **Figure 3-2**, the majority of the WTP facility would be located on the 5-acre private parcel. A buried standpipe and new tank/clearwell, if needed, would be located on the state-owned parcel. BSB has obtained a survey and appraisal for the 5-acre parcel at $30,000 and is in the process of obtaining a survey and appraisal for a permanent easement for the 10 acres of the adjacent state parcel. All appraisals, land acquisition and easements will be subject to the approval of the NRDP. The permanent easement will also require approval of the State Land Board.

Environmental Considerations

Environmental considerations of the new WTP are primarily beneficial. The currently unfiltered source will be filtered, making it a safer source for human consumption. Chemical containment, ventilation, and alarm provisions for the new liquid chemical systems enhance personnel and environmental protection. The coagulant chemicals involved are generally innocuous, although the potential use of concentrated acids or sodium hydroxide for pH control or membrane cleaning and sodium hypochlorite for disinfection involves certain hazards. Isolated storage with secondary containment and high-rate ventilation, double wall containment piping, protective equipment, and special operating procedures can be used to promote operator and public safety. Solids settled from filter backwash water will be dewatered to meet EPA Paint Filter Test limits, and landfilled at an approved facility, in accordance with the Code of Federal Regulations Part 503. No adverse environmental impacts from disposal of these solids originating from the raw water from Basin Creek are anticipated. Chemical residuals in the dewatered solids should be negligible, and if present in minor amount, will be contained by landfill liners.

Construction will require disruption at the existing Basin Creek facility, although the existing disinfection building and reservoir operation will necessarily have to be maintained. Work will be staged to allow continued operation of the existing process during construction. Connection of raw and finished water piping to the new WTP will require scheduling those activities during low water demand periods to minimize the effects of downtime. The relative isolation of the Basin Creek site reduces the construction-related impacts to Butte residents. The roads accessing the site will see a minor increase in construction period traffic. An additional (temporary) site access road may be necessary during construction. Limited resources will be consumed for fuel during construction, along with metal and synthetic raw materials used in the manufacture of new equipment and products. A discharge permit may be required for disposal of backwash water. The proposed location of the new WTP will allow the available head in the Basin Creek Reservoir to be utilized so that pumping of treated water is required only during peak summertime demands, minimizing energy requirements.

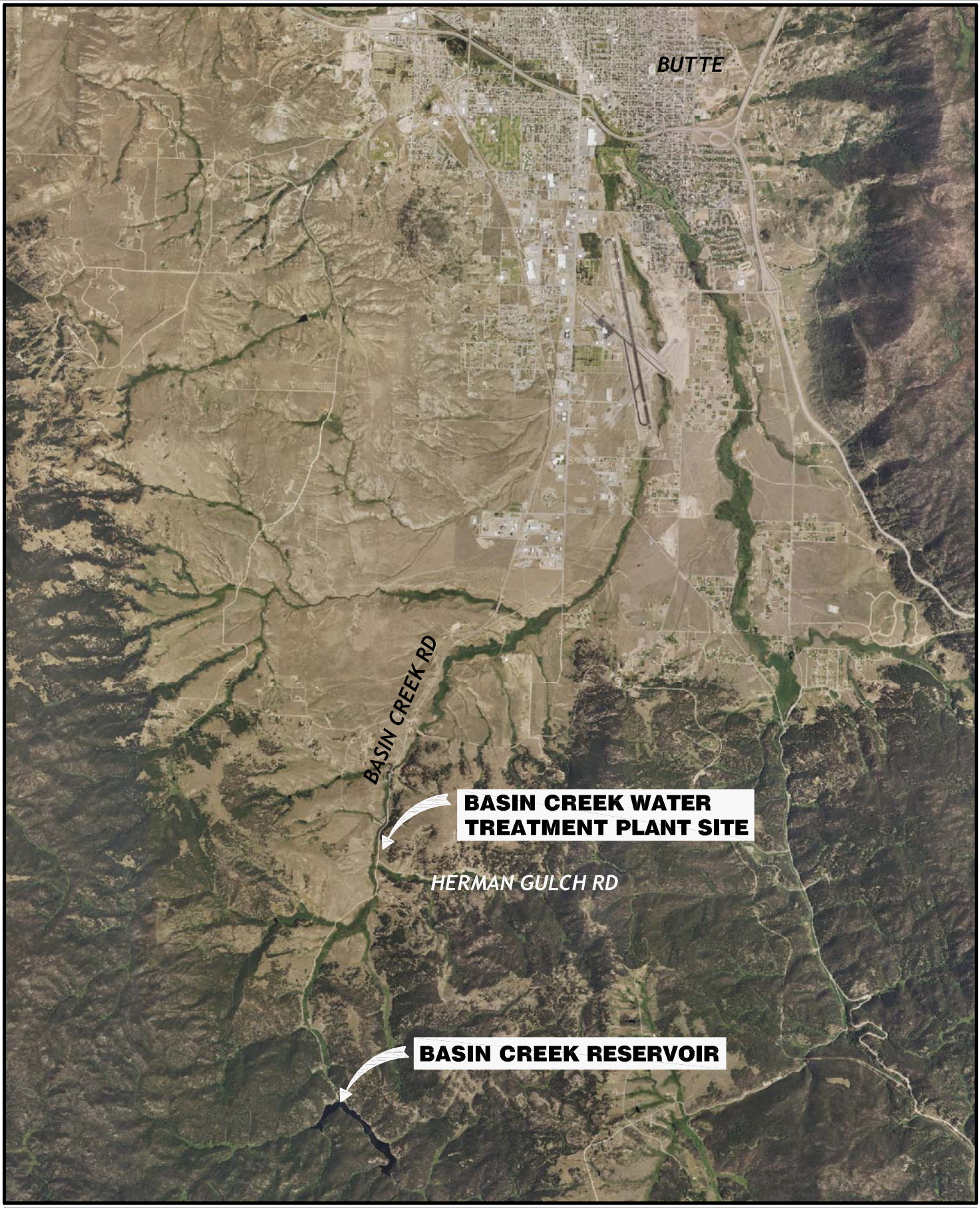
Constructability

Sustaining operable capacity from the Basin Creek system will be required during construction. The new plant structures will require major construction at separate locations, adequately removed from existing facilities. The major construction involved will nonetheless be moderately disruptive to operations and maintenance activities for the existing system. Close consultation between the construction contractor(s), BSB, and water system operators will be necessary throughout construction to minimize adverse impacts to municipal water supply and treatment.

Construction scheduling will be very critical to target lower water production periods for the more disruptive construction activities, particularly when disconnection/reconnection of raw and finished water pipelines is involved. Such scheduling and acceleration of certain tasks to minimize treatment downtime will result in higher than normal construction costs. The work proposed is nonetheless of a type for which ample contractor resources are available in the state. Some manufactured equipment and specialty subcontractor services will necessarily come from outside the region.

Capital and Annual Cost Estimates

Detailed Capital and Annual Cost Estimates are provided in Appendix A. The total estimated capital cost for the WTP and related components is **$29.85 million.** This cost includes 25 percent contingency and 20 percent engineering. The current preliminary design concept assumes that raw water from the Basin Creek Reservoir will flow through the membrane plant under pressure without the need to "break to atmosphere". This concept will allow the existing Basin Creek Reservoir to act as the storage tank (as it does now), likely eliminating the need for a large storage/tank clearwell.



RPA

Map Created by:
ROBERT PECCIA & ASSOCIATES
www.rpa-hln.com

N

3000 0 3000 6000
(SCALE IN FEET)

Butte - Silver Bow Water
BASIN CREEK WATER TREATMENT PLANT SITE
Figure 3-1

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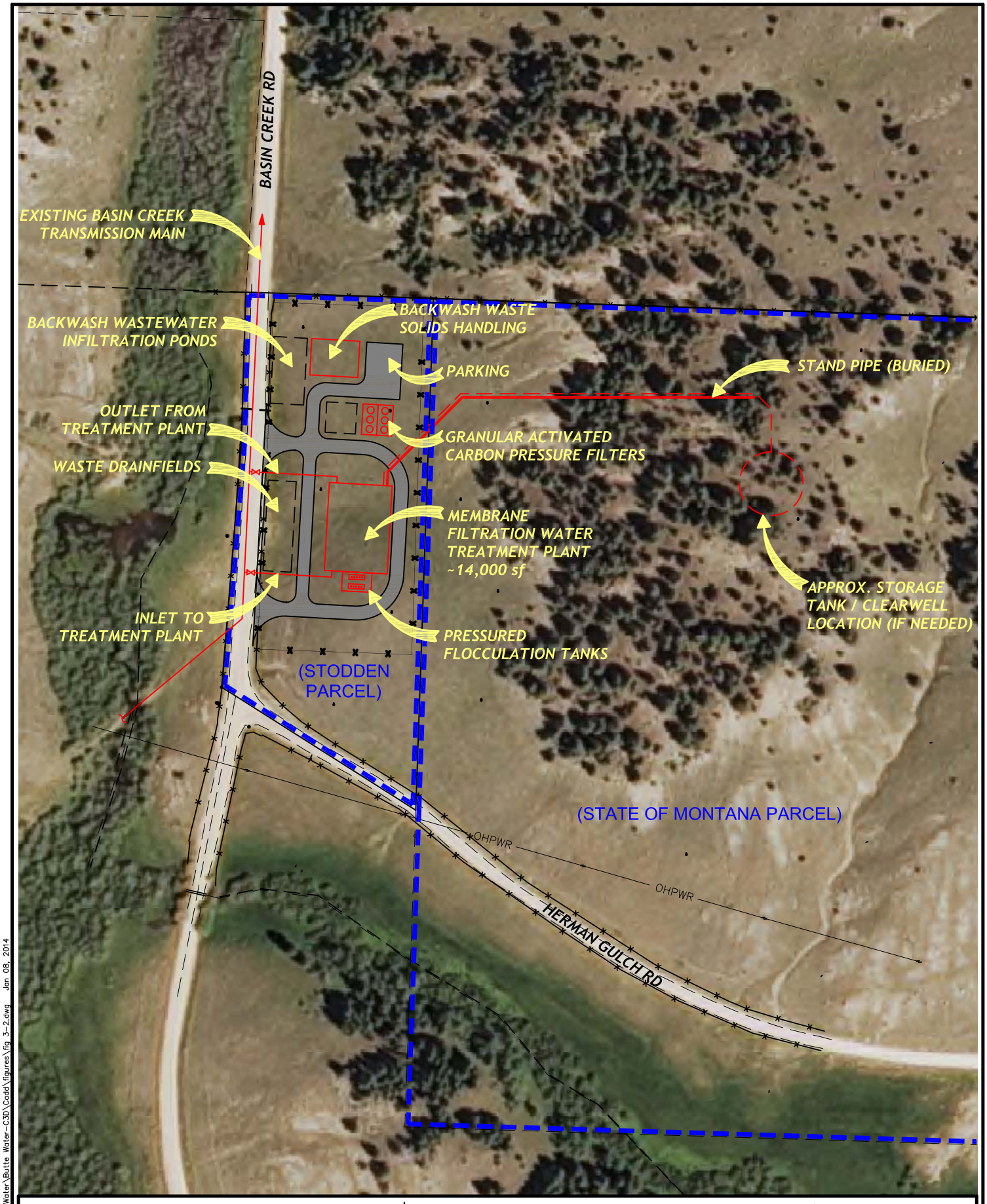

RPA

Map Created by:
ROBERT PECCIA & ASSOCIATES
www.rpa-hln.com

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Butte - Silver Bow Water
BASIN CREEK WATER TREATMENT PLANT
Figure 3-2

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Improvement 1-B: Upgrade the telemetry and control system at the Big Hole and Moulton WTPs

Background and Current Status

The core of the telemetry and control system for the Moulton and Big Hole systems has been in place since the plants were constructed in the early 90's. Parts and software upgrades for the system are becoming difficult to obtain. The system needs a major upgrade, which will be compatible with the telemetry and control system for the new Basin Creek WTP. The only other alternative to this improvement is the No Action Alternative, which would result in an existing outdated system that can no longer be serviced and would not be compatible with the new control system at the Basin Creek WTP.

Description

The proposed upgrade includes the following components:

- New high speed digital network to connect all system stations (treatment plants, pump stations etc.);
- New system software and licensing, and
- Component upgrades at each remote transmitting station and the central control station at the Big Hole WTP.

The new control system will allow system operators to communicate with and monitor all operational systems in the water system including the treatment plants, pump stations, storage tanks, pressure reducing stations etc. with one standardized modern system. Control and monitoring of the each of the plants can be accomplished with the control system located at each plant or through the central control station at the Big Hole WTP. The control system at each of the plants will be backed up by the plants emergency electrical generator in the event of a power outage.

Operational Requirements

System operation and control will be simplified with new modern equipment and software. This will allow the operators to be more efficient with their time and provide them with the ability to monitor and control all major systems from one location.

Energy Requirements

A more efficient control system should provide an overall savings in energy costs. It will reduce travel to the various sites in the water system reducing fuel costs.

Regulatory Compliance and Permits

There are no issues with regulatory compliance with these improvements. A modern control system will increase the overall efficiency of the water system and will help the operators to maintain regulatory compliance.

Land Requirements

The system will be installed at sites owned or controlled by BSB.

Environmental Considerations
There will be no major environmental impacts with this new system. An effort will be made to minimize the visual impact of any new transmission towers if they are required.

Constructability
The system can be installed with standard construction practices.

Capital and Annual Cost Estimates
A detailed cost estimate is provided in Appendix A. The total capital cost for this item is approximately **$467,000** including contingency**.**

Improvement 1-C: New CO_2 Storage and Feed System at the Big Hole WTP

Background and Current Status
CO_2 is currently being fed at the Big Hole WTP to optimize the pH of the raw water for removal of dissolved organics. The current feed system is temporary, consisting of small 400-lb. capacity tanks that are delivered on a regular basis to the plant. The feed rates for the CO_2 can range up to 1,000 lbs./day during peak water flows, requiring frequent tank change out and deliveries. The cost of the 400-lb tanks is currently $0.45/lb. The cost of bulk CO_2 is approximately $0.24/lb., almost one-half the cost of the 400 lb. tanks. A permanent bulk CO_2 feed system is needed with a large on-site bulk tank to decrease operator time, eliminate the need for tank change out and decrease the overall cost of the CO_2.

The only other alternatives for this improvement are the No Action Alternative or using an acid such as sulfuric acid for pH control. The No Action Alternative was not acceptable because of the cost of the 400-lb. tanks and frequent handling of the tanks. Storing large volumes of toxic acid on-site poses a significant operator and environmental safety issue and requires costly storage tanks and containment measures; this alternative was not considered further for these reasons.

Description
The proposed system would consist of the following components:

- One 14-ton capacity steel vertical bulk tank with a refrigeration unit.
- One vaporizer unit to convert the liquid CO_2 to gas.
- Misc. plumbing and piping to connect the tank to the raw water injection point.
- A 14ft x 14ft concrete support pad for the tank.
- Electrical feed for the tank refrigeration, vaporizer and feed systems.

Operational Requirements
Installation of a bulk feed system will simplify the current operations. The frequent tank change outs and deliveries will not be required. Deliveries can be scheduled on a monthly basis. Space for storing numerous 400 lb. tanks will no longer be required, freeing up needed space at the plant.

Energy Requirements
Minimal electrical energy will be required to operate the proposed system and will not change significantly from what is currently required. Fuel required for deliveries will decrease with the bulk system.

Regulatory Compliance and Permits
There are no regulatory or permitting issues associated with this improvement.

Land Requirements
The facility will be located on the existing plant property and will take up less space than the current system.

Environmental Considerations
There are no significant environmental issues associated with this alternative.

Constructability
There are no significant construction issues associated with this alternative. A crane will be required to offload and set the tank.

Capital and Annual Cost Estimates
A detailed cost estimate for this improvement is provided in Appendix A. The total capital cost for this item is approximately **$182,000** including engineering and contingency. The proposed bulk system will save an estimated $39,000 a year over the present system, which will pay for the new system in five years or less.

Improvement 1-D: Installation of two variable frequency drives and three soft start systems on the high service pumps at the Big Hole WTP

Schematic Layout and Description
Water is pumped from the Big Hole WTP clearwell to the Colorado Hill Storage Tank using five high service pumps. In order to meet variable system demands, two of the pumps are controlled by variable frequency drives (VFD) that increase and decrease the pumped flows to match system demands. The other three pumps are fixed speed pumps that use across the line starters, starting the pumps instantaneously at full speed. The two VFD's are old and are in need of replacement. The soft starters to be installed on the remaining three pumps will allow the pumps to ramp up slowly to full operating speed, which will extend the life of the pumps and also greatly reduce the demand charges that occur when the pumps start instantaneously. In addition to the drives and soft starters, existing isolation valves, check valves and pump control valves will be replaced on the discharge piping of each pump to replace worn aging valves that are almost 20 years old. The only other alternative to this group of improvements is the No Action Alternative, which would result in outdated controls that could no longer be maintained and continued high energy costs. Failure of the VFD's would result in the loss of two high service pumps. Therefore, the No Action Alternative was eliminated from consideration.

Operational Requirements
The proposed improvements will not significantly change the operations at the Big Hole WTP. The new components will replace aging components insuring reliable operation of the finished water pumping system. Electrical energy costs will be reduced with the installation of the soft start devices. The possibility of water hammer (pressure surges) will be eliminated by or significantly reduced by starting the pumps at reduced speed, protecting BSB's investment in the new Big Hole Transmission Main.

Energy Requirements
As discussed above, current energy use will be decreased with the installation of the new components.

Regulatory Compliance and Permits
There are no regulatory issues or permitting requirements associated with the proposed improvements.

Land Requirements
The proposed improvements do not require any additional land or building space.

Environmental Considerations
The reduction in energy consumption will benefit the environment and reduce the carbon footprint of the treatment plant.

Constructability
Work will have to be staged such that only one or two pumps at a time are taken out of service so that flows to Butte are not interrupted. The work should occur during low demand periods. No special construction techniques will be required to install the new components.

Capital and Annual Cost Estimates
The capital cost for this improvement is approximately **$275,000** including contingency. Detailed costs are provided in Appendix A.

Improvement 1-E(a):Pump Station to Transfer Basin Creek Water to the Colorado Hill Zone
Note: Improvement 1-E(b), a New 18-inch Gravity Transmission Main to Transfer Water from Basin Creek to the Colorado Hill Zone as described in the *2013 Butte-Silver Bow Master Plan Update*, was eliminated as a viable alternative due to its higher capital cost and present worth.

Schematic Layout and Description
There is currently no means to transfer Basin Creek water to the Colorado Hill and upper pressure zones. This improvement would consist of a pump station to pump treated water from Basin Creek WTP to the Colorado Hill Zone. Basin Creek water can then be transferred from the Colorado Hill Zone to the upper pressure zones. The new pump station would possibly include a new Basin Creek PRV station or improvements to that station. Modifications or replacement of the Basin Creek PRV station is needed to replace the aging pressure reducing valves in the existing pressure reducing station and to insure compatibility with the new pump station. The new pump station would be located near the intersection of

Waterline Road and Harrison Avenue and would have a firm capacity of approximately 3-million-gallons per day.

If service from the Big Hole Supply is interrupted for a long period of time, water shortages would occur in the Colorado Hill and upper pressure zones, with no current means to transfer water from the Basin Creek system. Also, the Basin Creek Supply and treatment plant will be less expensive to operate (compared to the Big Hole Supply) due to its quality and because less pumping is required to transfer water to the distribution system.

Operational Requirements

The pump station would be activated under different scenarios:

- Manage unexpected interruption or reduction in supply from the Big Hole source;
- Manage disinfection byproduct formation in the distribution system;
- Allow maintenance to be performed at the Big Hole WTP or on the Big Hole Transmission Pipeline;
- Allow for extended interruption of supply to accommodate the remaining portion of the Big Hole Transmission Line replacement project; and
- Maximize the usage of cheaper Basin Creek water.

Energy Requirements

Electrical energy will be consumed to operate the pumps. The amount of power consumption will be dependent upon the frequency of operation. It will be more cost effective from an energy standpoint to maximize the use of Basin Creek water due to the energy requirements associated with pumping water from the Big Hole River.

Regulatory Compliance and Permits

There are no regulatory requirements associated with the construction of the pump station. A local building permit will be required to construct the building. A stormwater discharge permit will be required if more than 1 acre of ground is disturbed during construction.

Land Requirements

A small parcel of land (approximately ¼ acre) may have to be purchased if the pump station cannot be constructed on BSB property or right-of-way. BSB will obtain NRDP approval of the appraisal and associated land transaction document if NRD funds are to be used for this possible acquisition.

Environmental Considerations

There are no significant environmental impacts associated with the construction of the pump station. Short-term impacts associated with construction will be mitigated by requiring that the construction contractors meet the requirements of all construction related permits and implement best management practices to control erosion, dust, noise etc. associated with construction.

Constructability
The pump station can be constructed using standard construction techniques.

Capital and Annual Cost Estimates
The capital cost for this improvement is approximately **$ 1.59 million** including contingency and engineering. A detailed cost estimate is provided in Appendix A.

Improvement 1-F: Install water meters on the remaining unmetered service connections in the distribution system and install radio read devices

Background, Current Status and Description
Currently, about one-half of the service connections in the water distribution system are metered. Approximately 2,800 of the metered connections have to be read manually. The remaining existing metered connections are equipped with transmitters on the meters allowing them to be read with a vehicle equipped with mobile radio reading equipment. BSB's goal is to install radio read devices on all meters and to install water meters on the remaining unmetered services (approximately 5,922 connections) over the next five years. BSB requires all new service connections to be metered at the customer's expense. The proposed metering improvements include the following:

- Installation of approximately 5,992 new radio read meters on existing unmetered services.
- Installation of approximately 2,800 radio transmitters on manually read meters.
- Installation of fixed base radio read units eliminating the need to send staff in the field to read meters.

There is no other alternative for this improvement other than the No Action Alternative, which has been eliminated from consideration. BSB wishes to completely meter the water system to promote water conservation and implement a fair and consistent means to bill its users. The installation of the fixed base reading system can be postponed until funds become available. In this case, the meters would be read using vehicles with a mobile radio read unit.

Operational Requirements
Once the improvements are complete, the entire water system will be equipped with radio read meters. Installation of fixed base meter reading units will eliminate the need to send staff in the field to read meters. All readings will be transmitted to the billing office via radio which should also shorten the time required to prepare the monthly bills. Overall the proposed improvements will reduce manpower requirements and increase the efficiency of the billing operation. The metering of the entire water system will also promote water conservation by reducing system demands especially during the summer irrigation season. Water metering also is the most equitable means for billing, as the bill is based on actual customer usage.

Energy Requirements
System demands should decrease by 5 percent to 20 percent once all of the meters are installed. Lower demands translate to lower energy costs for pumping and treating water.

Regulatory Compliance and Permits

There are no regulatory issues or permitting requirements associated with these metering improvements. An FCC license may be required for the radio equipment.

Land Requirements

There will be no significant land requirements associated with these improvements. At locations where it is not possible to install new meters in a basement or crawl space (such as a mobile home), a buried meter pit will have to be used. In most cases these buried pits would be located in BSB right-of-way; however, in some cases an easement may have to be purchased for the pit. Easements may also be required for the fixed base radio reading stations.

Environmental Considerations

There will be no significant environmental impacts associated with metering. Positive benefits will occur in the form of reduced energy consumption and reduced water consumption. There may be some limited visual impacts associated with the fixed base radio read stations. However, it should be possible to locate the majority of the stations on top of existing buildings, thus limiting the requirement for a tall receiving antenna.

Constructability

The meters can be installed using standard construction and plumbing practices.

Capital and Annual Cost Estimates

There is currently not enough funding available to complete the entire project. The meters will be installed until the budget is expended. If contingency funds become available from the other projects or if the project costs less than anticipated, these excess funds will be applied toward the metering project. A detailed cost estimate for this improvement is provided in Appendix A. The total capital cost for completing the metering is approximately **$3.3 million** with contingency.

Improvement 1-G: Pressure Improvements on Upper East Side of Basin Cr. Pressure Zone: Improve Hydraulic Connection Under I-15/90 (1-G(a)), Install Pressure Reducing Station at Intersections of Cobban and Massachusetts Ave (1-G(b)), and Install Pressure Reducing Station at Lexington and Rowe Road (1-G(c))

Background and Description

Low pressure issues have been a chronic problem for the northeast portion of the Basin Creek pressure zone during high summertime demand periods. In recent years, a new 20-inch diameter transmission main was installed from a connection at Harrison Avenue and Elizabeth Warren Avenue. This main runs east along the north side of the airport to Continental Drive where it connects to an existing 12-inch distribution main that runs north along Continental Drive and ends just south of I-15/90. This upgrade has improved the low pressure problems south of I-15/90; however, low pressure still occurs in the zone north of I-15/90. System operators have to manually bleed high pressure water from the Colorado Hill Zone using a manual valve at a connection between the two zones at the intersection of

Cobban and Massachusetts Avenues during the high demand summer months. In order to further address the remaining low pressure issues and to eliminate the need for using man power to transfer high pressure Colorado Hill water into the east side of the Basin Creek zone, some or all of the following improvements are needed:

- 1-G(a) Improve the hydraulic connection between the southeast and northeast portions of the zone by extending the 12-inch main on Continental Avenue north under I-15/90. This will extend the effect of the 20-inch transmission main that was recently installed on the north side of the airport.
- 1-G(b): Install a new pressure reducing station at the location of the manual valve in the intersection of Cobban and Massachusetts Avenues that will automatically open when pressures drop in this area.
- 1-G(c): Install a new pressure reducing station at the location of the intersection of Lexington Avenue and Rowe Road to provide an additional point that will allow Colorado Hill high pressure water to automatically enter the Basin Creek Zone during low pressure occurrences. This station would connect a 20-inch transmission main in the Colorado Hill Zone to an existing 12-inch main in the Basin Creek Pressure Zone.

These improvements would be done in a stepwise fashion, with the hydraulic connection under I-15/90 being constructed first. The remaining improvements would only be undertaken if the low pressure problems persist.

Operational Requirements

The proposed improvements will reduce or eliminate the low pressure occurrences in the northeast portion of the Basin Creek pressure zone. They will eliminate the need for BSB staff to manually bleed water from the Colorado Hill Zone into the Basin Creek Zone, which takes time away from other operations and also poses a safety hazard to staff.

Energy Requirements

These improvements will not consume energy and will improve the overall efficiency of the distribution system (which in turn may reduce electricity consumption needed for pumping).

Regulatory Compliance and Permits

There are no regulatory issues associated with these improvements. A permit will have to be obtained from the Montana Department of Transportation for boring and jacking the new water main under I-15/90.

Land Requirements

No additional land will be required for these improvements; they will occur within existing right-of-ways.

Environmental Considerations

There are no significant environmental impacts associated with these improvements.

Constructability

Standard construction practices can be used to implement the improvements. Boring and jacking or directional drilling will have to be used to install the new 12-inch connecting main under I-15/90. Existing streets will have to be repaired after the pressure reducing stations and the new water main are installed.

Capital and Annual Cost Estimates

Costs for each pressure reducing station and the new 12-inch main are broken out separately and summarized in **Table 3-2** above. Detailed capital and annual costs are provided in Appendix A. The improvements will be completed in a stepwise fashion to assess the effect of each improvement. It may not be necessary to complete all of the improvements at this time. The first project will be the installation of the hydraulic connection under I-15/90 (**$718,338**), second would be the pressure reducing station at Cobban and Massachusetts (**$206,475**) and third would be the pressure reducing station at Lexington Avenue and Rowe Road (**$219,700**).

Improvement 1-H: Replace Timber Butte Water Main

Schematic Layout and Description

There is approximately 24,000 feet of the pipeline that needs to be replaced, starting at the intersection of Waterline Road and Harrison Avenue, extending west along Waterline Road and proceeding north along the east side of Timber Butte to the intersection of Lexington Avenue and Greenwood Avenue. BSB would utilize its staff to complete the work. NRD funds would be used to cover the cost of materials, fuel and equipment.

Operational Requirements

Completion of the Timber Transmission Pipeline replacement will reduce the maintenance that is currently required to repair the frequent leaks that occur along the pipeline. It will also greatly reduce the potential for a significant failure along the pipeline that would prevent the transfer of water to the Colorado Hill Zone and leave the residents on the north side of Waterline Road that are in the Colorado Hill Zone without water.

Energy Requirements

Replacement of the pipeline will reduce the pressure loss in the pipeline and will decrease the amount of energy needed to pump water from the Basin Creek Zone into the Colorado Hill Zone.

Regulatory Compliance and Permits

There are no significant regulatory requirements associated with replacing the pipeline. A permit will have to be obtained from the Montana Department of Transportation for crossing Rowe Road. A railroad crossing permit will be required for crossing the tracks adjacent to Rowe Road. A stormwater discharge permit will be required for construction.

Land Requirements

No additional land will be required. All work is occurring within existing easements or on BSB property.

Environmental Considerations

There are no long-term environmental impacts associated with replacement of the pipeline. Eliminating the leaks that are currently occurring will conserve both water and energy. Short-term impacts associated with construction will be mitigated by requiring that the construction contractors and or/BSB crews meet the requirements of all construction related permits and implement best management practices to control erosion, dust, noise etc. associated with construction.

Constructability

Standard construction practices can be used for the pipeline replacement. The new line will be installed adjacent to the existing line and the pipeline must be periodically shut down to connect the new piping. Connections must be scheduled during low demand periods.

Capital and Annual Cost Estimates – Add in missing discussion on this criterion

A detailed cost estimate for this improvement is provided in Appendix A. The capital cost for this alternative is approximately **$3.6 million** with contingency and engineering.

Improvement 1-I: Finish Replacement of Big Hole Transmission Main

Background and Current Status

The replacement of the Big Hole Transmission Pipeline has been under way since 2008, and funded through contract agreements with the NRDP. The only remaining section that will require replacement in the near future is approximately 12,000 feet of the transmission main between the Colorado Hill Storage Tank and Lexington Avenue. The only section of the pipeline that will not be replaced through past NRD funding or the work proposed under this Plan is a 2,800 foot section from the Big Hole Pump House to the top of Hill 208. BSB has decided not to replace this section because it consists of thick walled high pressure pipe that has not had any significant leaks.

Schematic Layout and Description

The remaining sections of pipeline to be replaced include 11,850 feet between the Colorado Hill Tank and Lexington Avenue, and approximately 25,000 feet between the Big Hole WTP and the Colorado Hill tank (including 3,400 feet under Interstate 15). Replacement of the 25,000-foot section is underway, pursuant to the NRDP Contract #800002 for $6 million. The work on both of these segments will be conducted by BSB crews. BSB will fund all labor costs and the NRD funds will be used for engineering, construction materials, fuel, and equipment costs.

Operational Requirements

Completion of the Big Hole Transmission Pipeline replacement will eliminate the risk of failure in this remaining section of the original pipeline that would leave Butte without its major source of drinking water.

Energy Requirements
Replacement of the pipeline will reduce the pressure loss in the pipeline and will decrease the amount of energy needed to pump Big Hole water to Butte.

Regulatory Compliance and Permits
There are no significant regulatory requirements associated with replacing the pipeline. A permit will have to be obtained from the Montana Department of Transportation for crossing Interstate 15. A stormwater discharge permit will be required for construction.

Land Requirements
No additional land will be required. All work is occurring within existing easements or on BSB property.

Environmental Considerations
There are no long-term environmental impacts associated with replacement of the pipeline. Eliminating the leaks that are currently occurring will conserve both water and energy.

Constructability
Standard construction practices can be used for the pipeline replacement. The new line is being installed adjacent to the existing line and the pipeline must be periodically shut down to connect the new piping. Connections must be scheduled during low demand periods.

Capital and Annual Cost Estimates
A detailed cost estimate for this improvement is provided in Appendix A (Colorado Hill to Lexington Avenue). The capital cost for this alternative is approximately **$1.86 million** with contingency and engineering.

3.2 Benefits

Improvement 1-A: Basin Creek WTP
There are several benefits associated with the construction of the new Basin Creek WTP. First and foremost, it will allow BSB to continue to utilize this source of water supply. Basin Creek provides approximately 30 percent to 40 percent of the systems total capacity, and without the new treatment plant MDEQ would not allow Butte to use this source for human consumption. This source is also more economical when compared to the Big Hole supply, even when treatment costs are considered. While there will be minimal pumping required from the new WTP, the pumping costs will still be significantly less than those associated with the Big Hole supply. Other benefits include:

- Insuring that BSB will be able to comply with the Stage 2 Rule and Long Term 2 Enhanced Surface Water Treatment Rule;
- Providing added protection against waterborne pathogens such as *Giardia* and *Cryptosporidium;* and
- The possible addition of granular activated carbon (GAC) to the treatment process will minimize or eliminate taste and odor issues caused by algae in the Basin Creek Reservoir.

Improvement 1-B: Upgrade the Existing Telemetry and Control System at the Big Hole and WTP's

Benefits associated with these improvements include:

- Improve the overall operational efficiency of the system by allowing operators to communicate with and control all major system facilities from one location;
- Facilitate the ability to obtain parts and software updates;
- Insure compatibility with the control system at the new Basin Creek WTP;
- Ease the manpower requirements that will occur with the operation of a new WTP; and
- Reduce overall energy costs (fuel and electrical) by making the operation of the system more efficient.

Improvement 1-C: CO_2 Storage and Feed System at the Big Hole WTP

Installation of a permanent CO_2 storage and feed system will allow system operators to optimize the removal of total organic carbon in the raw water, which in turn will reduce the formation of disinfection byproducts. This will help the operators to maintain compliance with the Stage 2 Rule and protect public health. Replacing the current temporary CO_2 feed system is estimated to provide a $39,000 a year savings by allowing the purchase of bulk CO_2 delivered in tanker trucks vs. the cost of purchasing CO_2 in 400 lb. tanks. Other benefits include:

- Eliminate the daily effort the operators currently expend changing out the 400 lb. tanks (up to 1000 lbs. per day is required depending upon plant flow);
- Free up room currently needed to store numerous 400 lb. tanks; and
- Reduce the amount of fossil fuel needed to make deliveries.

Improvement 1-D: Install Variable Frequency Drives (VFD), Soft Starts on the Big Hole WTP High Service Pumps and Related Piping and Valve Improvements.

These improvements at the Big Hole WTP will have the following benefits:

- Energy costs will be reduced by allowing the pumps to ramp up slowly to speed reducing demand charges that are assessed when high horsepower pumps start instantaneously;
- Potential for water hammer will be reduced with the new VFD's, soft starts, check valves and pump control valves;
- Installation of the VFD's and soft starts will prolong the life of the high service pumps by allowing them to ramp up slowly to full operating speed; and
- New isolation valves will insure that the system operators can isolate the pumps for maintenance.

Improvement 1-E (a): New Basin Creek to Colorado Hill Pump Station

The benefits associated with this new pump station include:

- Provide the ability to transfer Basin Creek Water to the upper pressure zones in the event the Big Hole Supply is interrupted for an extended period of time and will provide additional fire flow capacity;

- Allow the Big Hole Supply to be taken off line for repairs or maintenance;
- Allow the Big Hole Supply to be taken off line to help facilitate the remaining replacement of the Big Hole Transmission Line. Installation of the segment of the transmission main under I-15 may require the system to be down for several days;
- Permit BSB to fully utilize this source, which can produce water at less cost than the Big Hole Supply; and
- Provide the system operators more options for minimizing the potential formation of disinfection byproducts in the distribution system.

Improvement 1-F: Install Water Meters on the Remaining Unmetered Water Service Lines
Benefits include:

- Installation of the remaining meters will promote water conservation reducing system demands by 5 percent to 20 percent, especially during the summer irrigation season;
- Eliminate the current dual flat rate and metered rate system. Water metering is the most equitable means to bill system users;
- Allow BSB to monitor leakage in the distribution system by comparing the volume of water delivered to the distribution system versus the volume of water delivered to the system users;
- The new fixed base radio read system will minimize the manpower required to read meters and may eliminate the need altogether; and
- The radio read system will be able to detect the potential for leaks in user plumbing by monitoring for constant low flows in the service line. This will allow BSB to notify the user of increased usage and the potential need to repair a leak, further promoting water conservation and minimizing user expenses.

Improvement 1-G (a-c): Improve Pressures on the East Side of the Basin Creek Zone
This improvement is comprised of a series of components as noted above that all relate to eliminating the low pressure problems on the east side of the Basin Creek Pressure Zone. Benefits associated with these improvements include:

- Insure that users in this area have adequate pressure for irrigation and plumbing fixtures;
- Provide adequate pressure for fire protection; and
- Eliminate the manpower required to manually open the valve at the intersection of Cobban and Massachusetts to bleed high pressure Colorado Hill Zone water into the Basin Creek Zone each day during the summer months.

Improvement 1-H: Replacement of the Timber Butte Transmission Line
Replacing the Timber Butte Transmission Main will:

- Minimize the potential for future failure providing a reliable means to transfer water from the Basin Creek Zone into the Colorado Hill Zone;
- Potentially reduce time spent by BSB staff to repair leaks on this line;
- Reduce maintenance costs; and
- The new pipeline will produce less head loss, which will in turn reduce the energy costs associated with pumping.

Improvement 1-I: Finish Replacement of the Big Hole Transmission Line
Replacing the remaining sections of the Big Hole Transmission Main:

- Will minimize the potential for future failure and increase the reliability of Butte's primary water supply;
- Reduce the time currently spent by BSB staff to repairing leaks on the line thus minimizing maintenance costs; and
- Will produce less head loss, which will in turn reduce the energy costs associated with pumping.

3.3 Improvement Costs, Budget and Funding Plan

BSB has developed a priority listing of components, estimated total project costs and timelines for completion in its recently completed *2013 Butte-Silver Bow Water System Master Plan Update* (Oct. 6, 2013). With the available budget and based on current cost estimates, it appears the following prioritized projects can be completed:

- 1-A: New Basin Creek WTP;
- 1-B: New Telemetry and Control System at Big Hole and Moulton WTPs;
- 1-C: CO_2 Storage and Feed System at the Big Hole WTP;
- 1-D: VFD's and Soft Starts for High Service Pumps at Big Hole WTP,
- 1-E: Basin Creek To Colorado Hill Pump Station; and
- 1-F: Install Water Meters on Remaining Unmetered Water Services (based on current estimates only a portion of this item can be completed with the available funds).

The Budget Summary Form and the Budget Detail form are provided below in **Table 3-3**. In conjunction with the improvements covered under this Plan for $24.1 million from the UCFRB Restoration Fund, BSB is executing Contract #820002 with NRDP for $6 million allocated from the UCFRB Restoration Fund for the ongoing replacement of the Big Hole Transmission Main (with the exception of the Colorado Hill Tank to Lexington Avenue section). Contract #80005-10295 with the NRDP provides $10 million from the BAO Restoration Fund for the construction of the Basin Creek WTP.

Given that some final design decisions remain to be determined and that engineering costs have not been finalized, BSB anticipates that budget transfers between the construction and the contingency categories and between engineering and the contingency categories could be required in the future. BSB will seek NRDP approval of any needed budget transfers and acknowledges that the NRDP will determine what budget transfers would constitute a substantive change that would require additional review/approval, as set forth in the NRDP/BSB contract for project implementation. If there are funds remaining in the UCFRB Restoration Fund (due to contingency funds not being spent or low bid prices), some or all of the remaining improvements identified in **Table 3-3** as "Possible Improvements" will be completed. The metering project would be completed first. The order of completion of the remaining improvements will be dependent upon the amount of remaining funds. Conversely, if bid prices come in higher than expected or if project costs increase due to design

changes, unexpected conditions etc., then some of the lower priority improvements may not be completed. The remaining items will be completed in the future with BSB water system user revenues and/or other funding sources.

TABLE 3-3 OVERALL PROJECT BUDGET SHOWING ALLOCATION OF UCFRB RESTORATION FUND FUNDS

	REV DEC 24 2013						
	Improvement	**Construction**	**Land Acquisition**	**Contingency**	**Engineering**	**Total**	
1-A	Basin Creek WTP	$ 19,812,400	$ 90,000	$ 4,975,600	$ 4,975,600	$ 20,000,000	*
1-B	Telemetry and Controls	$ 444,500		$ 22,225		$ 466,725	
1-C	CO_2 Feed System at Big Hole WTP	$ 150,500		$ 7,525	$ 23,704	$ 181,729	
1-D	VFD's and Soft Start at Big Hole WTP	$ 239,000		$ 35,850		$ 274,850	
1-E	Basin Creek to Colorado Hill Pump Station	$ 1,120,000.00	$ 30,000	$ 172,500	$ 264,500	$ 1,587,000	
1-F	Water Service Meters	$ 1,382,344		$ 207,352		$ 1,589,696	**
	Total Cost	**$ 23,148,744**		**$ 5,421,052**	**$ 5,263,804**	**$ 24,100,000**	
	Possible Improvements						
1-F	Remaining Water Meters	$ 1,474,467		$ 221,170		$ 1,695,637	
1-Ga	Hydraulic Conn Under I=15	$ 543,167		$ 81,475	$ 93,696	$ 718,338	
1-H	Replace Timber Butte Transmission Main	$ 2,853,500		$ 285,350	$ 470,827	$ 3,609,677	
1-I	Colorado Hill to Lex. Ave Tran Main	$ 1,567,755		$ 174,195	$ 118,500.00	$ 1,860,450	
1-Gb	PRV at Cobban and Mass	$ 156,125		$ 23,419	$ 26,931	$ 206,475	
1-Gc	PRV at Lexington and Rowe Rd.	$ 166,125		$ 24,919	$ 28,656	$ 219,700	
	Total					**$ 8,310,277**	
	*Total Estimated Cost for the WTP is $29.85 Million; $10 million of the WTP Cost will be Paid with Butte Area One Restoration Funds to Supplement						
	the $20 Million of UCFRB RESTORATION FUND Funding						
	**Note total cost for installing all remaining water meters is $3.23 million						

The categories in the above table are described as follows:

Construction
This budget category includes the improvements that will be put out for bid, including the construction of the Basin Creek WTP and at least a portion of the Basin Creek to Colorado Hill Pump Station (concrete work and building). BSB will perform portions of the work under the construction category where it is cost-effective to do so. Potential items to be completed by BSB may include:

- The preliminary site work at the Basin Creek WTP site in Herman Gulch;
- The site work and installation of the pumps, piping, telemetry, and electrical for the Basin Creek to Colorado Hill Pump Station;
- Water meter and radio read transmitter installations;
- Installation of VFD's, soft starters, valves and CO_2 feed system at the Big Hole WTP;
- Transmission main installation; and
- Installation of certain telemetry and control components.

NRD funds will be used to cover materials, fuel, and equipment for the construction work items that will be completed by BSB. All BSB wages and salaries will be funded by BSB and will not be charged to the NRDP.

This category will also include construction materials that will be directly purchased by BSB in compliance with any applicable competitive bidding requirements, such as:

- The VFD's, soft starters, valves, and CO_2 feed system at the Big Hole WTP;
- Certain components of the telemetry and control system;
- Water meters and radio read transmitters;
- Pipe, valves and fittings for the Big Hole Transmission Main;
- Pumps and electrical equipment for the Basin Creek to Colorado Hill Pump Station; and
- Membrane filters for the Basin Creek WTP.

Land Acquisition
These costs cover the purchase of the 5-acre private parcel and a permanent easement for approximately 10 acres of the 40-acre state-owned parcel at the Basin Creek WTP site. These costs are conservatively estimated based on the appraisal of the private parcel at $6,000 per acre since an appraisal of the easement has not been completed. A small parcel of land may have to be purchased for the Basin Creek to Colorado Hill Pump Station if it cannot be constructed on BSB property. If land must be purchased for the pump station the parcel will be appraised. NRDP approval of the appraisals is required and the purchase price will be at or below the appraised value.

Contingency
Contingency funds have been identified to cover unforeseen costs or costs higher than estimated in the other categories. Contingencies range from 5% to 30%, depending upon the uncertainty associated with the cost of the improvement. A 25% percent contingency has been assigned to the

Basin Creek WTP. If further design and hydraulic analyses indicate a new storage tanks is needed associated with the Basin WTP, contingency funds would be used to cover the costs of the tank.

Engineering
Engineering costs are associated with the engineering effort to design, assist with project bidding, provide construction inspection services and provide construction administration services. Engineering costs indicated in Table 3-3 are estimated at 22% of the total budgeted amount.

3.4 Implementation Timeline

BSB anticipates completing the various improvements as outlined in the project schedule below:

Table 3-4 Proposed Project Schedule

WORK ITEM		TIMEFRAME	NOTES
1-A	*BASIN CREEK WTP*		Schedule Dependent Upon MDEQ Approval
	Finish Pilot Testing	Oct. to Dec. 2013	Started in August 2013
	Select Final Treatment Process	Nov. to Dec. 2013	
	Property Acquisition	Oct. to Dec. 2013	
	Refine Cost Estimates	Oct. to Dec. 2013	
	Design Improvements	Jan. to Dec. 2014	
	MDEQ Approval	Dec. 2014	
	Advertise for Bids	Jan. to Feb. 2015	
	Construct Improvements	Feb. 2015 to July 2016	
	Plant Start-up	Sept. 2016	
1-B	*TELEMETRY AND CONTROLS*	Jan. to Dec. 2014	To Be Completed by BSB Staff
1-C	*CO_2 FEED AT BIG HOLE WTP*	Jan. to Dec. 2014	To Be Completed by BSB Staff
1-D	*VFD'S AND SOFT STARTS FOR HIGH SERVICE PUMPS AT BIG HOLE WTP*	Jan. to Dec. 2014	To Be Completed by BSB Staff
1-E	*BASIN CREEK TO COLORADO HILL PUMP STATION*	Jan. 2014 to July 2016	To Be Completed by BSB Staff
1-F	*WATER METERS*	Jan. 2015 to Dec. 2020	Schedule Dependent Upon Available Funds
1-Ga	*HYDRAULIC CONNECTION UNDER I-15/90*	Unknown	Schedule Dependent Upon Available Funds
1-H	*REPLACE TIMBER BUTTE TRANSMISSION MAIN*	Unknown	Schedule Dependent Upon Available Funds
1-I	*1-I BIG HOLE TRANSMISSION PIPELINE*	Unknown	To Be Completed by BSB Staff; Schedule Dependent Upon Available Funds
1-Gb	*PRESSURE REDUCING STATION AT COBBAN AND MASS.*	Unknown	Schedule Dependent Upon Available Funds
1-Gc	*PRESSURE REDUCING STATION AT LEXINGTON AND ROWE ROAD*	Unknown	Schedule Dependent Upon Available Funds

BSB will implement items 1-B, C, D, and E simultaneously with the construction of item 1-A, the new Basin Creek WTP. Item 1-F Water Meters will not be implemented until the first five items are or are nearly complete. Items 1-F, Ga, H, I, Gb, and Gc will only be implemented if there are funds remaining, with item 1-F being first in line.

3.5 Monitoring

Component monitoring is used to determine the long-term effectiveness of the proposed improvements. Long-term monitoring can be accomplished using the steps outlined below:

Review Regulatory Compliance Monitoring
BSB water system operators are required to perform water system compliance monitoring on a regular basis to insure compliance with EPA's Stage 2 Rule, Long Term 2 Enhanced Surface Water Treatment Rule, Lead and Copper Rule and other drinking water rules and regulations. Water monitoring results are reported to the MDEQ, who acts as EPA's regulatory arm for the federal drinking water regulations in Montana. Regular review of these monitoring results will allow BSB to evaluate the performance of the new Basin Creek WTP and the treatment related improvements at the Big Hole WTP (new CO_2 feed system). Sampling and monitoring results that can be reviewed to evaluate long-term performance include:

- TOC removal efficiency;
- Disinfection byproduct concentrations in the distribution system (THM and HAA5);
- Raw and finished water turbidities; and
- Calculated log removals for viruses, *Cryptosporidium* and *Giardia* based on chlorine concentrations in the finished water and contact time.

Periodic Review of Energy Costs
Periodic review of energy use and billing can help determine the long-term effectiveness of energy saving steps including the installation of VFD's, soft starters and the telemetry and control system. Installation of the remaining portions of the Big Hole Transmission Main and increasing the efficiency of the distribution system will also contribute to energy savings. The new Basin Creek to Colorado Hill Pump Station will allow increased utilization of cheaper Basin Creek water.

Review System Flow and Leak Repair Records
Review of the flow, usage and leak repair records routinely kept by BSB operators will help determine the effectiveness of pipeline replacements and the installation of water meters.

Review of System Maintenance Records.
Review of system maintenance records will provide staff with a means to determine the effect of the proposed improvements on operation and maintenance. The installation of the new telemetry and control system will improve the ability of the system operators to perform component monitoring.

3.6 Summary

Butte's water system has made great strides, starting in the mid 1990's with the construction of two new WTPs for the Moulton and Big Hole Supplies, two new storage tanks, and the implementation

of a water main replacement program. Butte continues to make significant investments in its water system with the recent replacement of the Big Hole Diversion Dam, Big Hole Pump Station, on-going replacement of the Big Hole Transmission Main and the on-going distribution main maintenance program. The implementation of new drinking water regulations including the Stage 1 and 2 Rules and the Long Term 2 Enhanced Surface Water Treatment Rule has initiated a major planning and study effort by BSB to determine how to remain in compliance with these new regulations and be protective of human health. Loss of the filtration waiver on Basin Creek has accelerated the effort and Butte is current in the preliminary design phase for a new Basin Creek WTP. In order to identify the improvements outlined in this plan, and to determine the most cost effective way to protect human health and comply with the new regulatory climate, BSB has undertaken the following efforts:

- Completion of a *2008 Water System Master Plan*;
- Completion of Water System Master Plan Updates in 2012 and 2013, initiated by the loss of the Basin Creek Filtration Waiver and operational changes at the Moulton and Big Hole WTPs;
- Initiation of Pilot Plant Studies for the New Basin Creek WTP;
- Completion of a siting study for the New Basin Creek WTP; and
- Starting the preliminary design phase for the New Basin Creek WTP.

As a result of the above analysis, BSB has identified and prioritized the improvements needed to be protective of public health, bring the water system into compliance with EPA's drinking water regulations and to upgrade aging components in the water system. **Table 3-1** above provides a list of the Phase One Improvements as identified in the most recent *2013 Butte-Silver Bow Water System Master Plan Update*. Also included in the *2013 Butte-Silver Bow Master Plan Update* is a list of Phase Two Improvements that may be required during the 20-year planning period, but that are not part of this Groundwater Restoration Plan.

4.0 Legal Criteria

The following summary of the legal criteria analysis of the collective projects was prepared using the NRD Evaluation Criteria specified in Section 6.0 of the Final Upper Clark Fork River Basin Interim Restoration Process Plan dated May of 2012. The eight Evaluation Criteria include:

1. Technical Feasibility;
2. Relationship of Expected Costs to Expected Benefits;
3. Cost Effectiveness;
4. Results of Response Actions;
5. Adverse Environmental Impacts;
6. Recovery Period and Potential for Natural Recovery;
7. Federal, State, and Tribal Policies, Rules and Laws; and
8. Resource of Special Interest to the Tribes and DOI.

Technical Feasibility
The technical feasibility of all of the proposed Phase One improvements has been evaluated in the documents cited in **Section 3.6.** These efforts are summarized below.

Improvement 1-A: New Basin Creek WTP
The *2013 Butte-Silver Bow Master Plan Update* discussed two treatment alternatives for the Basin Creek Supply in detail:

- Construct a new Contact Adsorption Clarification (CAC) WTP with mixed media filtration, or
- Construct a new Membrane Filtration WTP.

As explained in Section 3.1, BSB has selected membrane filtration based on evaluation of pilot test results and a present worth cost analysis. Membrane filtration technology has been in place for 20 years and is the most "modern" of the water filtration processes available today. Preliminary analysis indicate that the new treatment plant and related components can likely be constructed within the $30 million currently budgeted for these items. A site has been selected for the plant that consists of 10 acres of a 40-acre parcel of State of Montana owned land and a small 5-acre parcel of private land adjacent to the state land. The state has expressed a willingness to provide a lifetime easement for the WTP and related components; however, the needed survey, appraisal, and approval processes remain to be completed. The private landowner has expressed a willingness to sell the needed parcel and BSB is in the process of purchasing this parcel of land. All land acquisitions, appraisals and easements are subject to the approval of the NRDP. Membrane filtration is technically feasible; it has a long track record and will be able to bring the Basin Creek Supply into compliance with EPA's drinking water regulations.

Improvement 1-B: Upgrade the Telemetry and Control System at the Big Hole and Moulton WTPs
The operators of the BSB water system have completed a significant amount of work to identify the improvements needed to upgrade the existing aging system. The only alternative to this upgrade is the No Action Alternative, which is not feasible because the system will shortly become obsolete.

The upgrades consist of proven technologies and will provide a state of the art communications system that will be compatible with and connected to the control system at the new Basin Creek WTP.

Improvement 1-C: New Permanent CO_2 Storage and Feed System at the Big Hole WTP

The plant operators have installed a temporary CO_2 feed system at the plant to optimize TOC removal by adjusting raw water pH. The system has proven to be a cost effective means to optimize TOC removal and control the formation of disinfection byproducts. Using CO_2 to adjust pH is a common practice at WTPs throughout the United States. It is also much safer for system operators than using a corrosive chemical such as sulfuric acid to adjust pH. A new permanent facility will pay for itself within five years due to the savings offered by the ability to purchase CO_2 in bulk. The only other alternative would be the No Action Alternative, which is not acceptable due to its cost and increased operational requirements.

Improvement 1-D: Installation of two variable frequency drives and three soft start systems on the high service pumps at the Big Hole WTP

These improvements are essentially an upgrade for the existing high service pumps at the Big Hole WTP. These improvements will increase pumping efficiency, save energy and protect the investment in the Big Hole Transmission Main by minimizing or eliminating the possibility of a pressure surge in the main. The existing VFD's have been in place for almost 20 years and have proven their effectiveness. Soft starters are proven technology and have been in existence for many years. In fact, electrical utilities recommend their use for high horsepower electrical motors to reduce the demand load on the utility.

Improvement 1-E(a): Basin Creek to Colorado Hill Pump Station

There are three alternatives for this improvement, the No Action Alternative, construction of a gravity transmission main, and construction of the pump station. The No Action Alternative has been eliminated because there would be no means to transfer water from the Basin Creek Zone to the upper pressure zones in an emergency. The ability to manage the formation of disinfection byproducts would be reduced and the ability to manage overall system efficiency would be reduced. The gravity transmission main alternative was eliminated because of cost and because it is not feasible without the construction of a storage tank at the WTP site. Construction of the pump station will provide BSB operators with the ability to move Basin Creek water into the upper pressure zones.

Pump stations are commonly used in municipal water distribution systems to transfer water from lower pressure zones to higher pressure zones and into water storage tanks. Butte has three existing pump stations in the distribution system which transfers water from the Colorado Hill Zone to the upper pressure zones. They include the Summit Valley, Main Street and West Side Pump Stations. These stations have been in operation for many years, demonstrating the technical feasibility of this type of installation.

Improvement 1-F: Installation of Water Meters on the Remaining Unmetered Services Connections and Radio Read Devices

Butte currently has radio read meters on more than one-half of its water service connections. These existing installations have demonstrated the technical feasibility of metering the system. Radio read

water meters are common in almost all large water utilities in the United States. BSB will install meters that are the same as those that are already in place and have demonstrated their effectiveness. These meters are supplied by one of the major meter manufacturers in the United States. Each meter has a lifetime warranty on the body and a 20-year warranty on the remaining components. Water metering is the most technically feasible method of billing for water usage that is available. The only other feasible alternative is the No Action Alternative. Implementation of the No Action Alternative would occur only if sufficient funds are not available to complete all or a portion of the remaining meter installation. Permanent implementation of the No Action Alternative is not feasible, as BSB wishes to implement a fair billing system based on usage and to eliminate the two different rate systems currently in effect (flat rate for unmetered services and variable rate for metered services) and accomplish water conservation through full metering.

If there are not sufficient NRD funds to complete the metering project pursuant to this Groundwater Restoration Plan, BSB plans to complete the metering project as other funds become available in the future.

Improvement 1-H: Replace the Timber Butte Transmission Main

The Timber Butte Transmission Main currently conveys water from the Colorado Hill Tank to an isolated section of the Colorado Hill Zone on the South Side of Butte. This main will become more critical once the pump station is constructed to transfer Basin Creek Water to the Colorado Hill Zone. The pump station will be connected to the Timber Butte Main to facilitate the transfer of water into the Colorado Hill Zone. The main is old and needs replacement to ensure future reliability. The only other alternative available is the No Action Alternative, which would be implemented temporarily if sufficient funds are not available to complete the work. The No Action Alternative is not feasible on a permanent basis due to the age of this transmission main. The transmission main is nearing the end of its design life and will have to be replaced to avoid intensive maintenance and future failure. If it there is not adequate funding available to complete this improvement under this Groundwater Restoration Plan, BSB will complete it in the future as other funds become available.

Improvement 1-G: Pressure Improvement on the Upper East Side of the Basin Creek Pressure Zone

Installation of two new pressure reducing stations to allow the flow of high pressure water from the Colorado Hill pressure zone into the Basin Creek pressure zone and a new pipeline under I-15/90 to improve the hydraulic connection between the SE and NE sections of the Basin Creek Zone are proposed. The existing water system has many pressure reducing stations in place that allow the flow of high pressure water in the upper pressure zones into the lower zones. It is a technology that has proven itself in Butte's water system, and it is common in water systems throughout the world. The new stations would be similar to those that are already in place. Valves from various manufacturers will be evaluated during design to select a type that will work best in the distribution system.

Installation of a new pipeline under I-15/90 will be performed with proven construction methods. These improvements are technically feasible and have been demonstrated as such in the existing distribution system. These improvements will be completed one at a time with the I-15/90 crossing being completed first, the Cobban and Massachusetts PRV next and the Lexington Avenue and PRV

last. This will allow BSB to evaluate the effectiveness of each improvement separately. If the problem is resolved before the subsequent improvements are completed, the remaining improvements will not be implemented. The only other alternative is the "no action" alternative, which will prolong the low pressure problem in this area. However, this alternative will be selected if there are not adequate funds available.

Improvement 1-I: Complete the Replacement of the Big Hole Transmission Between the Colorado Hill Tank and Lexington Avenue

Beginning in 2007, BSB has aggressively pursued the replacement of this very critical piece of infrastructure that conveys treated water from the Big Hole WTP into Butte. This pipeline is the major artery for the Butte water system. BSB has replaced the entire section of the raw water transmission main from the Big Hole River near Divide to the Big Hole WTP near Feely, except for the initial 2,800 feet at the Big Hole Pump Station Complex. BSB decided not to replace this stretch because it is thick walled pipe and has not had any significant leakage issues.

To date, BSB crews have installed nearly 65,000 feet of 36-inch ductile iron pipeline or nearly two-thirds of the total pipeline scheduled for replacement. The technical feasibility of replacing this line, the design and construction standards and procedures, materials selection and installation practices are well documented and proven. The only other alternative available is the "no action" alternative, which will leave the water system at risk should this section of pipeline fail and BSB staff will have to continue to monitor and repair this section of pipeline.

Relationship of Expected Cost to Expected Benefits

The total cost of all the identified Phase One improvements identified in this document and in the *2013 Butte-Silver Bow Water System Master Plan Update* is $38.26 million. There appears to be sufficient funding available from the UCFRB Restoration Fund ($24.1 million) and BAO Restoration Fund ($10 million) to complete the first five Phase One improvements and a portion of the water meter component. This investment is significant, but some of the benefits are immeasurable. The new Basin Creek WTP ($29.85 million) will allow Butte to continue to use its Basin Creek water supply, which consists of approximately 30 to 40 percent of the total available water supply. Without the use of this source, Butte would not have enough water to supply all of its residents and fire protection would be compromised posing a significant risk to human health and safety. Implementation of the other improvements will provide the following benefits:

- Reduction in energy costs (VFD's, new controls, new pipe with less pressure loss, Basin Creek to Colorado Hill pump station).
- Ongoing compliance with the Stage 2 Disinfection Byproducts Rule and other EPA drinking water regulations (CO_2 feed system, new control system, pump station).
- Increase in the overall operational efficiency of the system (pump station, PRV's, water meters).
- Water Conservation (water meters).

The expected costs are necessary and unavoidable in order to keep the water system protective of public health and in compliance with drinking water regulations. The proposed improvements will replace outdated equipment and reduce the annual operation and maintenance costs for the water system.

Cost Effectiveness
The development of alternatives or potential solutions was provided by the *2008 Water System Master Plan* and the *2013 Butte-Silver Bow Water Master Plan Update*. Various alternatives and improvements have been evaluated through the planning process and through meetings with various local, state and federal agency representatives and the general public. Consideration of the alternatives analyses conducted for the Master Plan and Update determined only two viable alternatives to evaluate - No Action or Proceed - with the strategies as developed in the *2013 Butte-Silver Bow Master Plan Update* and this Groundwater Restoration Plan document.

No Action Alternative
The No Action Alternative is not viable, due to the condition and age of the existing infrastructure and equipment within the BSB Domestic Water System, the ability of the system to meet current and upcoming drinking water regulations and the potential to lose the Basin Creek Water Supply. However, sufficient funding is currently not available to complete all of the needed Phase One Improvements. BSB is proceeding with the completion of the Phase One improvements in their order of priority. Other funding sources and user rates will have to be used to complete the remaining Phase One improvements after the UCFRB Restoration Funds ($24.1 million) and BAO Restoration Funds ($10 million) are expended.

Proceed with the Developments as Outlined in the Master Plan Update
As noted, since the No Action Alternative is not an option, then the action to be taken is to immediately begin with the improvements as outlined in the *2013 Butte-Silver Bow Water Master Plan Update*. This includes installing the most cost effective treatment technology and related items to bring the Basin Creek Supply into compliance with the Stage 2 Rule and the Long Term 2 Enhanced Surface Water Treatment Rule and to address the loss of the filtration waiver. As discussed in **Section 3.1**, pilot testing of treatment options in the fall of 2013 led to BSB's selection of membrane filtration as the most cost effective treatment system for the Basin Creek Supply. Improvements 1-B, C, D, E, F, G, H and I do not have other alternatives other than the No Action Alternative. Partial implementation of these improvements would not be cost-effective in the long-term. Steps that will be taken to insure these proposed improvements are implemented cost effectively include:

- Obtaining quotes from suppliers for equipment and materials where more than one manufacturer or supplier is available.
- Utilization of BSB manpower and equipment where possible.
- Comparing the cost of a package pre-manufactured lift station vs. a custom built lift station for improvement 1-D.
- Evaluating the feasibility of using a re-conditioned storage tank for the CO_2 feed system vs. purchasing a new tank.

In all cases BSB will follow all applicable procurement requirements, including the state bidding requirements that apply to city-county governments in order to obtain the most cost-effective prices for materials and services.

Results of Superfund Response Actions

It has long been recognized that the deposition of wastes in the city of Butte from mining and mineral-processing operations has resulted in injury to groundwater resources and the surface water of Silver Bow Creek. Injury to groundwater has been demonstrated by the occurrence of concentrations of heavy metals (including cadmium, zinc, iron, lead, copper, arsenic, mercury and sulfate) that exceed drinking water standards in the alluvial and bedrock aquifers. In turn, surface water and streambed contamination to Silver Bow Creek has resulted from the discharge of contaminated surface runoff. In the past, surface runoff from storms and snowmelt carried hazardous substances from hundreds of dispersed waste source sites to Silver Bow Creek through surface drainages and the Butte storm water collection system.

The loss of this groundwater and surface water source has required the citizens of Butte to assume responsibility for a vast and extensive water supply, treatment and distribution systems that rely upon raw water supplies considerable distance from the customer base. Moreover, the infrastructure for this system was put in place over a century ago and is in dire need of replacement and upgrades.

While various response actions are both contemplated and being implemented for the Butte Superfund sites, it is unlikely these actions will in the foreseeable future, restore the groundwater resources lost to Butte for municipal water supply. In the absence of an effectual restoration response for this extensive groundwater contamination, BSB is left with "replacement" – i.e., maximizing use of its existing water resources, conserving them and extending their availability wherever possible. The proposed Groundwater Restoration Plan projects are consistent with that goal.

The Groundwater Restoration Plan projects will proceed independently of on-going or planned CERCLA response actions relative to the Butte Superfund sites. These projects will not impact other remediation or response actions. As part of its institutional controls relative to Superfund, BSB has a Development Permit System (DPS) to assure safe management of hazardous materials disturbed by construction.

Adverse Environmental Impacts

This section itemizes the anticipated effects to the physical and human environment during and after construction of the proposed projects. References consulted to assess potential environmental impacts and suitable mitigation if required include the Montana Natural Resource Information System database (www.nris.state.mt.us), the National Historic Register (www.nr.nps.gov), Federal Emergency Management Agency (FEMA) floodplain maps, and construction experience by BSB with similar domestic water system improvements within its urban areas over the past nine years.

Impacts to the physical environment resulting from the proposed project include both short-term transient impacts associated with the construction, and long-term environmental benefits resulting from completion. The majority of the proposed construction for the Phase One improvements will not occur in or adjacent to waterways. However, the connecting piping for the new Basin Creek WTP may have to pass under Basin Creek. The appropriate permits will be obtained for this crossing including: Army Corps 404 permit, floodplain permits, DNRC 310 permit and others as required. The components involve a combination of underground construction and vertical construction; however, in both cases upon completion, the ground surface will be restored to pre-project elevations and conditions.

No identified wetlands or watercourses will be traversed or disturbed by the various components, with the exception of the Colorado Hill to Lexington Avenue Transmission Main and the possible pipeline associated with the Basin Creek WTP described above. The appropriate permits will be obtained prior to the construction of the transmission main including an Army Corps 404 permit. Likewise no Threatened or Endangered Species will be impacted and no impacts are anticipated with any historic properties and districts currently listed in the National Historic Register. No archeological sites of significance are known to exist within the limits of the proposed activities for each of the components. With the exception of the WTP site, the locations of the proposed improvements are urban and/or have been disturbed previously on several occasions for WTP construction, pipe line installations, road improvements and excavation of underground utilities. A cultural resources survey has been performed on the WTP site in Herman Gulch and there were no significant findings identified. A copy of this survey has been provided in Appendix B.

Should any potentially significant archeological findings be encountered during the course of project construction, work will be halted to allow assessment of such findings by qualified personnel, with full involvement of the State Historic Preservation Office.

The site for the new Basin Creek WTP is on state-owned land managed by the Department of Natural Resources (DNRC) and a small adjacent parcel of private land. BSB will have to follow the requirements of the DNRC to maintain an easement on this parcel. A cultural resources survey of this site was conducted by DNRC and results indicated that there are no significant cultural resources on this site. A permit was obtained from DNRC to conduct the site geotechnical investigation.

Following construction, the component sites and corridors will be fully restored to the pre-project condition including fertilizing and seeding and mulching on disturbed areas. Construction impacts to soil and surface water resources will be mitigated by use of erosion control measures (strategic soil stockpiling and silt fencing) around excavated areas to prevent sediment transport. Such construction measures will concentrate on prevention of siltation in the adjoining waterways. During construction, construction site storm water management permits from MDEQ will be required and enforced since the area of disturbances will exceed the one-acre exemption.

Potential transient impacts to human health and safety during construction will be effectively mitigated by proper fencing and signage at the work site to prohibit access and protect the public against hazards. Blasting is not anticipated to be necessary for any of the expected excavation, with the exception of some of the plant piping and standpipe at the site of the new WTP. Local and state and federal regulations will be followed if blasting is required and the work will be performed by certified contractors. Transient air quality and noise impacts due to operation of construction machinery will be attenuated by dust and noise control standards and proper operation and maintenance of equipment. State of Montana air quality standards for fugitive dust emissions govern such releases, and will be enforced. Noise impacts may cause localized disturbance, but can be minimized by limiting equipment operation to traditional work hours.

Construction work will be executed in full compliance with OSHA standards, including designation of the job sites as “hard hat areas,” and trench excavation and other work place safety conforming to applicable requirements. The Construction Contractor will assure adequate barriers and protection

for the public are provided during and after work hours and will be required to have a jobsite safety plan. The Construction Contractor will be assigned contractual responsibility for all job site safety and regulatory compliance.

Protection of public (sanitary) health during construction, specifically isolation and replacement of existing water mains and storage tanks, will be provided by adherence to MDEQ Circular DEQ1 and Montana Public Works Standard Specifications requirements for thorough disinfection and bacteriological testing of new water lines, treatment facilities and storage tanks. Adherence to these standards and requirements will be legally required in the construction contract. Currently BSB is pursuing a new discharge permit for discharging treated backwash wastewater into Basin Creek. If the permit is obtained, BSB will comply with all requirements of the permit and the wastewater will be treated to the effluent limits defined in the permit.

Recovery Period and Potential for Natural Recovery

Because of cost and "technical infeasibility" limitations, EPA opted to cap large areas of mining wastes in the Butte Superfund area and allow groundwater contamination to remain without direct remedial action. While surface reclamation should reduce infiltration through the waste material, the large expanse of contamination continues to impact groundwater resources. Natural recovery of contaminated water resources has been discounted, due partly to the magnitude of the problem. This results in an irreversible loss for Butte, and limits availability of potable water resources to meet the existing and future needs of its residents.

Prospects for natural recovery of contaminated groundwater resources are improbable, as addressed above. The prospects and time frame for natural recovery are not affected by this project. In lieu, the project promotes efficient utilization of Butte's existing surface water sources as an alternative to natural recovery.

Federal, State, and Tribal Policies, Rules and Laws

Multiple regulatory approvals and permits will be required. The agencies to be contacted include the following:

a. State Department of Fish, Wildlife and Parks (MFWP)
b. Department of Natural Resources and Conservation (DNRC)
c. State Historic Preservation Office (SHPO)
d. National Resource Conservation Service (NRCS)
e. Montana Department of Environmental Quality (MDEQ)
f. Montana Department of Transportation (MDT)

Public involvement and agency coordination activities will lead into the application and acquisition of a variety of permits including:

a. Montana Floodplain and Floodway Management Act. (SP124 Permit). This permit is obtained from the Floodplain Management Section of the DNRC. This permit is required for all construction within the 100-year floodplain.
b. Army Corps of Engineers 404 Permit for any work that will result in the discharge or placement of dredged or fill material into waters of the United States.

c. Montana Natural Streambed and Land Preservation Act (310 Permit) for work in or near a stream on public or private land.
d. Storm Water Discharge Permit Authorization. Required for any construction project that will have a discharge of storm water into surface waters. Obtained from the MDEQ.
e. MPDES General Permit for Discharges Associated with Construction Dewatering for any construction project that will have a construction dewatering discharge into surface waters. Obtained from the MDEQ.
f. MPDES Discharge Permit for discharge of backwash wastewater. Negotiations are currently underway with MDEQ.
g. Public Water Supply Authorization obtained from the MDEQ.
h. Since this is a BSB project, all appropriate local government personnel will be contacted.

BSB has the legal authority to enter into a binding contract with the State of Montana to authorize funding for the proposed improvement projects and will comply with all applicable state and federal laws and regulations in the completion of these projects. MDEQ jurisdiction over public water systems will require approval of design plans and specifications by that agency for all main replacements and central water system improvements. A Professional Engineer licensed by the State of Montana must be in "responsible charge" of preparation of central system improvements design. Following completion of construction, the Engineer must also file with MDEQ a "Certification of Completion in Accordance with Approved Plans and Specifications". Railroad or state/federal highway crossings will be permitted as required by the appropriate agencies.

Other than the regulatory requirements indicated herein and concurrence by the NRDP that the Engineer's completed design plans conform to the project scope under this Groundwater Restoration Plan, no other permitting or approvals are anticipated to be required for the project. BSB will enter into a funding contract with the NRDP for implementation of this Groundwater Restoration Plan, and abide by the conditions therein. No other ramifications of the proposed project to laws, rules, policies, or Consent Decree requirements are anticipated.

Resources of Special Interest to the Tribes and DOI

There are no known Tribal cultural resources of special interest to the Tribes or Department of Interior (DOI) in the vicinity of the proposed components. With the exception of the WTP site, the locations of the proposed improvements are urban and/or have been disturbed previously on several occasions for WTP construction, pipe line installations, road improvements and excavation of underground utilities. A cultural resources survey has been performed on the WTP site in Herman Gulch and there were no significant findings identified. A copy of this survey has been provided in Appendix B.

No Tribal lands are present. Therefore, it is anticipated that this project will have no adverse impacts on resources related to Tribal Nations, or the DOI. BSB acknowledges that appropriate actions and consultation with Tribes and/or the DOI will be required if any unanticipated Resources of Special Interest relative to these entities are encountered in the course of executing the project, pursuant to the Memorandum of Agreement between the Tribes, DOI and NRDP.[3]

3 Memorandum of Agreement among the State of Montana, Confederated Salish and Kootenai Tribes and United States Department of Interior Regarding Restoration, Replacement, or Acquisition of Natural Resources in the Clark Fork River Basin, dated November 1998. This agreement is available from the NRDP website at: https://doj.mt.gov/lands/restoration-guidance/.

APPENDIX A

COST ESTIMATES FOR IMPROVEMENTS

Estimate of Probable Construction Cost

Improvement 1-A BSB Filtration - Predesign- Without Storage Tank/Clearwell

Project	Basin Creek Water Treatment	**Date**	13-Sep-13
		Estimator	nkutil
Task	Alt membrane	**Checked By**	ctc
Task No.	pressure filter	**Check Date**	08-Oct-13

HDR Engineering, Inc.

Description	Quantity	Unit	Unit Price ($/unit)	Total ($)
Division 1 - Special Conditions				
General Conditions, Bidding, Submittals, Start-up	1	LS	$ 163,320	$ 163,320
Division 2 - Site Work				
Excavation	3500	CY	$ 20	$ 70,000
Granular Fill	600	CY	$ 40	$ 24,000
Backfill	800	CY	$ 30	$ 24,000
Finish grading	2000	CY	$ 30	$ 60,000
Entrance road	1450	SY	$ 12	$ 17,400
Culvert	2	EA	$ 5,000	$ 10,000
Asphalt	2700	SY	$ 20	$ 54,000
Infiltration/Geobag Facility	1	LS	$ 110,000	$ 110,000
Fence	1300	LF	$ 40	$ 52,000
Entrance gate	1	LS	$ 15,000	$ 15,000
Manholes	5	EA	$ 5,000	$ 25,000
Septic System	1	LS	$ 10,000	$ 10,000
Division 3 - Concrete				
Concrete slab	900	CY	$ 500	$ 450,000
Foundation & Footing	300	CY	$ 300	$ 90,000
Concrete walls	150	CY	$ 750	$ 112,500
Elevated slab	20	CY	$ 900	$ 18,000
Miscellaneous	1	LS	$ 75,000	$ 75,000
Tip up wall panels	10400	SF	$ 25	$ 260,000
Sidewalk	60	CY	$ 400	$ 24,000
Retaining walls	1	LS	$ 20,000	$ 20,000
Storage Tank/Clearwell	0	LS	$ 1,700,000	$ -
Division 4 - Masonry				
Intermediate Walls	3000	SF	$ 20	$ 60,000
Divison 5 - Metals				
Miscellaneous Metals	1	LS	$ 50,000	$ 50,000
Handrail	750	LF	$ 75	$ 56,250
Grating	2000	SF	$ 50	$ 100,000
Stairs	1	LS	$ 10,000	$ 10,000
Standing Seam Roof	16500	SF	$ 4	$ 66,000
Division 6 - Wood and Plastics				
Rough carpentry	1	LS	$ 10,000	$ 10,000
Finish carpentry	1	LS	$ 10,000	$ 10,000
Architectural cabinets	1	LS	$ 15,000	$ 15,000
FRP fabriations	1	LS	$ 20,000	$ 20,000
Division 7 - Thermal and Moisture Protection				
Damproofing	1	LS	$ 20,000	$ 20,000
Joint Sealant	1	LS	$ 10,000	$ 10,000
Insulation	1	LS	$ 20,000	$ 20,000
Skylight	1	LS	$ 30,000	$ 30,000

Division 8 - Doors and Windows				
Metal Doors	15	EA	$ 2,500	$ 37,500
Overhead doors	5	EA	$ 5,000	$ 25,000
Storefront	1	LS	$ 40,000	$ 40,000
Finish hardware	1	LS	$ 10,000	$ 10,000
Glass and glazing	1	LS	$ 10,000	$ 10,000
Division 9 - Finishes				
Painting and coatings	1	LS	$ 100,000	$ 100,000
Accoustic ceiling	7000	SF	$ 4	$ 28,000
Gypsum WB	5000	SF	$ 5	$ 25,000
Ceramic tile	2000	SF	$ 15	$ 30,000
Division 10 - Specialties				
Bathroom partitions	1	LS	$ 2,000	$ 2,000
Louvers and vents	1	LS	$ 10,000	$ 10,000
Identification and signage	1	LS	$ 10,000	$ 10,000
Lockers	1	LS	$ 1,000	$ 1,000
Fire extinguishers	1	LS	$ 5,000	$ 5,000
Toilet and bath accessories	1	LS	$ 5,000	$ 5,000
Miscellaneous specialties	1	LS	$ 10,000	$ 10,000
Division 11 - Equipment				
Sump pumps	4	EA	$ 5,000	$ 20,000
Sample pumps	6	LS	$ 500	$ 3,000
Chemical feed pumps	15	EA	$ 4,000	$ 60,000
Service water pumps	4	EA	$ 5,000	$ 20,000
Solids handling pumps	2	LS	$ 5,000	$ 10,000
Laboratory fume hood	1	EA	$ 7,500	$ 7,500
Shop and storage equipment	1	LS	$ 10,000	$ 10,000
Membrane equipment	1	LS	$ 4,000,000	$ 4,000,000
Installation of membranes	1	LS	$ 420,000	$ 420,000
GAC System	1	LS	$ 1,200,000	$ 1,200,000
Installation of GAC	1	LS	$ 110,000	$ 110,000
GenSet & Transfer Switch	1	EA	$ 180,000	$ 180,000
Genset Installation	1	LS	$ 18,000	$ 18,000
Division 12 - Furnishings				
Laboratory casework	1	LS	$ 40,000	$ 40,000
Window treatment	1	LS	$ 3,000	$ 3,000
Floor mats	1	LS	$ 2,000	$ 2,000
Laboratory equipment and supplies	1	LS	$ 10,000	$ 10,000

Division 13 - Special Construction				
Noise control	1	EA	$ 80,000	$ 80,000
Intermediate bulk containment	1	LS	$ 20,000	$ 20,000
FRP tanks	7	EA	$ 20,000	$ 140,000
Settling Tanks	3	EA	$ 56,000	$ 168,000
Fire alarm	1	LS	$ 15,000	$ 15,000
Monitoring equipment	1	LS	$ 100,000	$ 100,000
PLC	1	LS	$ 8,000	$ 8,000
Division 14 - Conveying Systems				
Hoists, trolleys, monorails	1	LS	$ 100,000	$ 100,000
Division 15 - Mechanical				
Misc Mechanical	1	LS	$ 100,000	$ 100,000
Service water piping	1	LS	$ 100,000	$ 100,000
Piping to and from plant and tank	1	LS	$ 500,000	$ 500,000
Raw water piping inside plant	1	LS	$ 40,000	$ 40,000
chemical piping	1	LS	$ 100,000	$ 100,000
residuals piping	1	LS	$ 50,000	$ 50,000
HPA piping	1	LS	$ 30,000	$ 30,000
Floor drain piping	1	LS	$ 75,000	$ 75,000
Overflow piping	1	LS	$ 25,000	$ 25,000
Vent piping	1	LS	$ 20,000	$ 20,000
Finished water piping	1	LS	$ 40,000	$ 40,000
Backwash piping	1	LS	$ 40,000	$ 40,000
Miscellaneous yard piping/standpipe	1	LS	$ 750,000	$ 750,000
Sample piping	1	LS	$ 10,000	$ 10,000
Chemical fill stations	1	LS	$ 30,000	$ 30,000
Valves	1	LS	$ 500,000	$ 500,000
Gates	1	LS	$ 20,000	$ 20,000
HVAC duct work	1	LS	$ 100,000	$ 100,000
Plumbing	1	LS	$ 150,000	$ 150,000
Boiler	2	EA	$ 30,000	$ 60,000
Unit heaters	10	EA	$ 5,000	$ 50,000
Air conditioing	1	LS	$ 40,000	$ 40,000
HVAC instrumentation	1	LS	$ 50,000	$ 50,000
HVAC Startup	1	LS	$ 15,000	$ 15,000
Division 16 - Electrical and Instrumentation				
Electrical & Instrumentation (30% of materials cost)	1	LS	$ 3,595,845	$ 3,595,845
VFD's and switchgear	1	LS	$ 150,000	$ 150,000
Extend power to site	1	LS	$ 500,000	$ 500,000
Lighting	1	LS	$ 80,000	$ 80,000
Communications	1	LS	$ 20,000	$ 20,000
Land Acquisition and Permanent Easement	1	LS	$ 90,000.00	$ 90,000.00
			Subtotal	$ 16,585,300
			Mobilization, Bonds, and Insurance 5%	$ 829,300
			Contractor's Overhead and Profit 15%	$ 2,487,800
			Subtotal	$ 19,902,400
			Miscellaneous Items and Contingencies 25%	$ 4,975,600
			Subtotal	$ 24,878,000
			Engineering 20%	$ 4,975,600
			Total Estimated Project Cost	$ 29,853,600

Butte-Silver Bow Master Plan Update
Improvement 1-B
Telemetry and Control System Upgrade

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
New High Speed Digital Microwave Network	1	LS	$ 110,000.00	$ 110,000.00
RTU Upgrades	1	LS	$ 120,000.00	$ 120,000.00
Software and Licensing Cost	1	LS	$ 39,000.00	$ 39,000.00
Labor for I&C Design, Programming, Start-Up and Commissioning	1	LS	$ 175,500.00	$ 175,500.00
Total Cost				**$ 444,500.00**
Contingency @ 5%				$ 22,225.00
Total Project Cost				**$ 466,725.00**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Equipment Maintenance	1	LS	$ 20,000.00	$ 20,000.00
Software Upgrades and License Fees	1	LS	$ 15,000.00	$ 15,000.00
Total Annual O&M Cost				**$ 35,000.00**

TOTAL ANNUAL COST

Annual O&M Cost	$ 35,000.00
Annualized Capital Cost i=6%, n=20 yrs.	$ 40,691.21
Total Annual Cost	**$ 75,691.21**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$ 868,172.24**
i=6%, n=20 yrs.	

Butte-Silver Bow Master Plan Update
Improvement 1-C
New CO_2 Feed System at Big Hole Water Treatment Plant

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
14 Ton Vertical Steel CO_2 Tank w/ Refrigeration Unit	1	EA	$ 100,000.00	$ 100,000.00
Shipping	1	LS	$ 20,000.00	$ 20,000.00
Installation	1	LS	$ 3,000.00	$ 3,000.00
14 ft x 14 ft Concrete Support Pad	12	CY	$ 500.00	$ 6,000.00
Vaporizer	1	EA	$ 6,000.00	$ 6,000.00
Buried Copper Injection Piping	400	FT	$ 20.00	$ 8,000.00
Crane to Unload and Set Tank	1	DAY	$ 3,000.00	$ 3,000.00
Plumbing	1	LS	$ 2,500.00	$ 2,500.00
Electrical	1	LS	$ 2,000.00	$ 2,000.00
Total Cost				**$ 150,500.00**
Contingency @ 5%				$ 7,525.00
Engineering @ 15%				$ 23,703.75
Total Cost				**$ 181,728.75**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Maintenance	1	LS	$ 1,000.00	$ 1,000.00
Labor	100	HOURS	$ 35.00	$ 3,500.00
Carbon Dioxide Delivered	182,500	LBS	$ 0.24	$ 43,800.00
Total Annual O&M Cost				**$ 48,300.00**

TOTAL ANNUAL COST

Annual O&M Cost	$ 48,300.00
Annualized Capital Cost i=6%, n=20 yrs.	$ 15,843.94
Total Annual Cost	**$ 64,143.94**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$ 735,725.94**
i=6%, n=20 yrs.	

Butte-Silver Bow Master Plan Update
Improvement 1-D
Installation of Two Variable Frequency Drives and Three Soft Start Systems on the High Service Pumps at the Big Hole Water Treatment Plant

Oct. 8, 2013

Item	Quantity	Units	Unit Cost		Total Cost
Purchase New Variable Frequency Drives on Two High Service Pumps	2	EA	$ 14,000.00	$	28,000.00
Remove Old Drives and Install New Drives	2	EA	$ 15,000.00	$	30,000.00
Purchase New Soft Start Devices on Three High Service Pumps	3	EA	$ 12,000.00	$	36,000.00
Remove Old Starters and Install New Starters	3	EA	$ 15,000.00	$	45,000.00
Install new isolation valves, check valves and pump control valves	1	LS	$ 100,000.00	$	100,000.00
Total Cost				**$**	**239,000.00**
Contingency @ 15%				$	35,850.00
Total Project Cost				**$**	**274,850.00**

ANNUAL O&M COST

	Quantity	Units	Unit Cost		Total Cost
Equipment Maintenance	1	LS	$ 20,000.00	$	20,000.00
Total Annual O&M Cost				**$**	**20,000.00**

TOTAL ANNUAL COST

Annual O&M Cost	$	20,000.00
Annualized Capital Cost i=6%, n=20 yrs.	$	23,962.68
Total Annual Cost	**$**	**43,962.68**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$**	**504,248.42**
i=6%, n=20 yrs.		

Butte-Silver Bow Master Plan Update
Improvement 1-E

Construction Basin Creek to Colorado Hill Pump Station (3 MGD)
Custom Built Station
Dec. 6, 2013

Item	Quantity	Units	Unit Cost	Total Cost
New Variable Frequency Drives 130 hp	2	EA	$ 50,000.00	$ 100,000.00
New Variable Frequency Drive 75 hp	1	EA	$ 35,000.00	$ 35,000.00
130 hp Split Case Horizontal Pumps	2	EA	$ 50,000.00	$ 100,000.00
75 hp Split Case Horizontal Pump	1	EA	$ 35,000.00	$ 35,000.00
Telemetry and Electrical	1	LS	$ 80,000.00	$ 90,000.00
Basin Cr. Creek PRV Upgrade	1	LS	$ 125,000.00	$ 125,000.00
Building	1,200	SF	$ 250.00	$ 300,000.00
Land Acquisition	1	LS	$ 30,000.00	$ 30,000.00
Site Work/Harrison Ave. Approach	1	LS	$ 35,000.00	$ 35,000.00
Fencing and Security	1	LS	$ 15,000.00	$ 15,000.00
HVAC	1	LS	$ 15,000.00	$ 15,000.00
Tapping Tees and Valves	2	EA	$ 35,000.00	$ 70,000.00
Valves and Piping	1	LS	$ 200,000.00	$ 200,000.00
Total Cost				**$ 1,150,000.00**
Contingency @ 15%				$ 172,500.00
Engineering @ 20%				$ 264,500.00
Total Project Cost				**$ 1,587,000.00**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost	
Equipment Maintenance	1	LS	$ 20,000.00	$ 20,000.00	
Power Costs	209,477	KW-H	$ 0.09	$ 18,852.91	(130 hp 90 days/yr)
Total Annual O&M Cost				**$ 38,852.91**	

TOTAL ANNUAL COST

Annual O&M Cost	$ 38,852.91
Annualized Capital Cost i=6%, n=20 yrs.	$ 138,361.89
Total Annual Cost	**$ 177,214.80**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$ 2,032,639.84**
i=6%, n=20 yrs.	

Butte-Silver Bow Master Plan Update
Improvement 1-F
Water Service Meter Installation

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
Material Cost				
Interior Meters				
5/8" x 3/4" Meters w/ Transmitters	5822	EA	$ 200.00	$ 1,164,400.00
5/8" x 3/4" Meter Yoke	5822	EA	$ 50.00	$ 291,100.00
5/8" x 3/4" Meter Loop Coupling & Gasket	5822	EA	$ 18.00	$ 104,796.00
3/4" Ball Valves	11644	EA	$ 10.00	$ 116,440.00
3/4" Meters w/ Transmitters	75	EA	$ 250.00	$ 18,750.00
3/4" Meter Yoke	75	EA	$ 55.00	$ 4,125.00
3/4" Meter Loop Coupling & Gasket	75	EA	$ 18.00	$ 1,350.00
3/4" Ball Valves	150	EA	$ 10.00	$ 1,500.00
1" Meters w/ Transmitters	25	EA	$ 300.00	$ 7,500.00
1" Meter Yoke	25	EA	$ 90.00	$ 2,250.00
1" Meter Loop Coupling & Gasket	25	EA	$ 20.00	$ 500.00
1" Ball Valves	50	EA	$ 15.00	$ 750.00
Exterior Meters				
Exterior Meter Pits w/ Adaptors(5/8"x3/4")	640	EA	$ 450.00	$ 288,000.00
Meter Pit Pad and Lids	640	EA	$ 115.00	$ 73,600.00
Meter Pit Meters (5/8"x3/4"or 3/4")& Transmitters	640	EA	$ 270.00	$ 172,800.00
Exterior Meter Pits (1")	10	EA	$ 750.00	$ 7,500.00
Meter Pit Pad and Lids	10	EA	$ 125.00	$ 1,250.00
Meter Pit Meters (1")& Transmitters	10	EA	$ 320.00	$ 3,200.00
Add Radio Read to Existing Manual Read Meters				
Radio Read Units	2800	EA	$ 100.00	$ 280,000.00
Radio Read Mobile Unit	1	EA	$ 20,000.00	$ 20,000.00
Radio Read Fixed Base Units Installed	12	EA	$ 15,000.00	$ 180,000.00
Total Material Cost				**$ 2,739,811.00**
Install Exterior Buried Meters	650	EA	$ -	$ -
Equipment Hours	1950	HOUR	$ 60.00	$ 117,000.00
Total Installation Cost				**$ 117,000.00**
Total Installation and Material Cost				**$ 2,856,811.00**
Contingency @ 15%				$ 428,521.65
Total Project Cost				**$ 3,285,332.65**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Meter Maintenance	1	LS	$ 15,000.00	$ 15,000.00
Labor	192	HOUR	$ 35.00	$ 6,720.00
Total Annual O&M Cost				**$ 21,720.00**
TOTAL ANNUAL COST				
Annual O&M Cost				$ 21,720.00
Annualized Capital Cost i=6%, n=20 yrs.				$ 286,430.27
Total Annual Cost				**$ 308,150.27**
TOTAL PRESENT WORTH OF ALTERNATIVE				
Present worth of annual O&M and estimated capital cost				**$ 3,534,459.34**
i=6%, n=20 yrs.				

Butte-Silver Bow Master Plan Update
Improvement 1-Ga
Improve Hydraulic Connection Under I-15/90

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
12-inch PVC Water Main	3,250	LF	$ 50.00	$ 162,500.00
Bore and Jack Under I-15	250	LF	$ 500.00	$ 125,000.00
Connect to Existing Distribution Mains	3	EA	$ 15,000.00	$ 45,000.00
Pavement Removal and Replacement	4,333	SY	$ 35.00	$ 151,666.67
Traffic Control	1	LS	$ 5,000.00	$ 5,000.00
Buried Valves	12	FT	$ 4,500.00	$ 54,000.00
Total Cost				**$ 543,166.67**
Contingency @ 15%				$ 81,475.00
Engineering @ 15%				$ 93,696.25
Total Cost				**$ 718,337.92**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Maintenance	1	LS	$ 500.00	$ 500.00
Total Annual O&M Cost				**$ 500.00**

TOTAL ANNUAL COST

Annual O&M Cost	$	500.00
Annualized Capital Cost i=6%, n=20 yrs.	$	62,627.97
Total Annual Cost	**$**	**63,127.97**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$**	**724,072.88**
i=6%, n=20 yrs.		

Butte-Silver Bow Master Plan Update
Improvement 1-Gb
Install Pressure Reducing Station at Intersection of Cobban and Massachusetts Ave

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
Cobban and Massachusetts PRV Station				
Excavation	150	CY	$ 7.50	$ 1,125.00
Concrete PRV Vault	1	LS	$ 35,000.00	$ 35,000.00
12-Inch PRV	1	EA	$ 20,000.00	$ 20,000.00
6-Inch PRV	1	EA	$ 10,000.00	$ 10,000.00
2-Inch PRV	1	EA	$ 2,500.00	$ 2,500.00
12-Inch Butterfly Valves	2	EA	$ 5,000.00	$ 10,000.00
6-Inch Butterfly Valves	2	EA	$ 2,500.00	$ 5,000.00
Msc. Piping and Fittings	1	LS	$ 15,000.00	$ 15,000.00
Telemetry and Electrical	1	LS	$ 30,000.00	$ 30,000.00
Street Restoration	1	LS	$ 5,000.00	$ 5,000.00
Traffic Control	1	LS	$ 2,500.00	$ 2,500.00
Connection to Existing Distribution Piping (Tapping Tee, piping and Shutoff Valve)	1	LS	$ 20,000.00	$ 20,000.00
Subtotal				**$ 156,125.00**
Contingency @ 15%				$ 23,418.75
Engineering @ 15%				$ 26,931.56
Total Project Cost				**$ 206,475.31**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Equipment Maintenance	1	LS	$ 1,000.00	$ 1,000.00
Power	1	LS	$ 200.00	$ 200.00
Total Annual O&M Cost				**$ 1,200.00**

TOTAL ANNUAL COST

Annual O&M Cost	$ 1,200.00
Annualized Capital Cost i=6%, n=20 yrs.	$ 18,001.46
Total Annual Cost	**$ 19,201.46**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$ 220,239.22**
i=6%, n=20 yrs.	

Butte-Silver Bow Master Plan Update
Improvement 1-Gc
Install Pressure Reducing Station at Intersection of Lexington and Rowe Road

Oct. 8, 2013

Item	Quantity	Units	Unit Cost	Total Cost
Lexington and Rowe Road PRV Station				
Excavation	150	CY	$ 7.50	$ 1,125.00
Concrete PRV Vault	1	LS	$ 35,000.00	$ 35,000.00
12-Inch PRV	1	EA	$ 20,000.00	$ 20,000.00
6-Inch PRV	1	EA	$ 10,000.00	$ 10,000.00
2-Inch PRV	1	EA	$ 2,500.00	$ 2,500.00
12-Inch Butterfly Valves	2	EA	$ 5,000.00	$ 10,000.00
6-Inch Butterfly Valves	2	EA	$ 2,500.00	$ 5,000.00
Msc. Piping and Fittings	1	LS	$ 15,000.00	$ 15,000.00
Telemetry and Electrical	1	LS	$ 30,000.00	$ 30,000.00
Street Restoration	1	LS	$ 5,000.00	$ 5,000.00
Traffic Control	1	LS	$ 2,500.00	$ 2,500.00
Connection to Existing Distribution Piping (Tapping Tee, Piping and Shutoff Valve)	1	LS	$ 30,000.00	$ 30,000.00
Subtotal				**$ 166,125.00**
Contingency @ 15%				$ 24,918.75
Engineering @ 15%				$ 28,656.56
Total Project Cost				**$ 219,700.31**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Equipment Maintenance	1	LS	$ 1,000.00	$ 1,000.00
Power	1	LS	$ 200.00	$ 200.00
Total Annual O&M Cost				**$ 1,200.00**

TOTAL ANNUAL COST

Annual O&M Cost	$ 1,200.00
Annualized Capital Cost i=6%, n=20 yrs.	$ 19,154.47
Total Annual Cost	**$ 20,354.47**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present worth of annual O&M and estimated capital cost	**$ 233,464.22**
i=6%, n=20 yrs.	

Butte-Silver Bow Master Plan Update
Improvement 1-H
Timber Butte Transmission Main

Oct. 9, 2013

Item	Quantity	Units	Unit Cost	Total Cost
18-Inch Ductile Iron Water Main	24,000	LF	$ 80.00	$ 1,920,000.00
(Includes Fittings, etc.)				
18-Inch Gate Valves	12	EA	$ 5,500.00	$ 66,000.00
Bore and Jack under RR	350	LF	$ 850.00	$ 297,500.00
New 18-Inch Main on Lexington Avenue	4,000	LF	$ 125.00	$ 500,000.00
Connect to Existing Mains	2	EA	$ 35,000.00	$ 70,000.00
Total Cost				**$ 2,853,500.00**
Contingency @ 10%				$ 285,350.00
Engineering @ 15%				$ 470,827.50
Total Cost				**$ 3,609,677.50**

ANNUAL O&M COST

	Quantity	Units	Unit Cost	Total Cost
Maintenance	1	LS	$ 60,000.00	$ 60,000.00
Total Annual O&M Cost				**$ 60,000.00**

TOTAL ANNUAL COST

Annual O&M Cost	$	60,000.00
Annualized Capital Cost i=6%, n=20 yrs.	$	314,708.13
Total Annual Cost	**$**	**374,708.13**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost	**$**	**4,297,872.77**
i=6%, n=20 yrs.		

Butte-Silver Bow Master Plan Update
Improvement 1-I
Big Hole Transmission Main Colorado Hill to Lexington Avenue

Oct. 9, 2013

Item	Quantity	Units	Unit Cost		Total Cost
36-Inch Ductile Iron Water Main	11,850	LF	$ 147.00	$	1,741,950.00
(Includes Fittings, Valves, etc. and 10% Contingency)					
Total Cost				**$**	**1,741,950.00**
Engineering	11,850	LF	$ 10.00	$	118,500.00
Total Cost				**$**	**1,860,450.00**

ANNUAL O&M COST

	Quantity	Units	Unit Cost		Total Cost
Maintenance	1	LS	$ 50,000.00	$	50,000.00
Total Annual O&M Cost				**$**	**50,000.00**

TOTAL ANNUAL COST

Annual O&M Cost				$	50,000.00
Annualized Capital Cost i=6%, n=20 yrs.				$	162,202.51
Total Annual Cost				**$**	**212,202.51**

TOTAL PRESENT WORTH OF ALTERNATIVE

Present Worth of Annual O&M and Estimated Capital Cost				**$**	**2,433,946.06**
i=6%, n=20 yrs.					

APPENDIX B

CULTURAL RESOURCES SURVEY

CULTURAL AND PALEONTOLOGIC RESOURCES INVENTORY OF THE NWNE1/4 SECTION 36, T2N R8W: SILVER BOW COUNTY, MONTANA

Report prepared for
the Montana Department of Natural Resources
and Conservation (DNRC)
Helena, MT 59620

by

Patrick J. Rennie (DNRC, Helena)

October 2013

DNRC Project No. 2013-2-1

ABSTRACT

On October 18th, 2013, the author conducted a Class III level intensity inventory of cultural and paleontologic resources of a 40 acre block of state land legally described as the NWNE1/4 Section 36, T2N R8W. The inventory was conducted in response to proposed development of a municipal water treatment facility designated as the Butte-Silver Bow Basin Creek Plant. Although proposed ground disturbances will not affect the entire 40 acre parcel, the additional acreage inspected contributes to both the SHPO's and DNRC's overall inventory of state owned land.

Despite a detailed examination of the state parcel, no cultural or paleontologic resources were identified. No state owned Antiquities will be affected with the proposed development, so no additional archaeological of paleontologic review of the project area is recommended.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The city/county municipality of Butte-Silver Bow is proposing construction of a water treatment plant approximately 6 miles south of Butte in central Silver Bow County (Figures 1 and 2). The present location of the proposed facility is within a 40 acre parcel of state School Trust land legally described as the NWNE1/4 Section 36, T2N R8W. The Montana Department of Natural Resources and Conservation (DNRC) administers this property and is responsible for State Antiquities Act compliance. The proposed development is designated as the Butte-Silver Bow Basin Creek Water Treatment Plant.

On October 18th, 2013, the author conducted a Class III level intensity inventory of cultural and paleontologic resources of the entire 40 acre block of state land that fully contains the proposed area of potential effect (APE). The following report provides a detailed description of the project area, the field methods used, and the results of that inventory.

2.0 PREFIELD AND POSTFIELD STUDIES

Prior to conducting field work, the author inspected the DNRC's sites/site leads database, land use records, General Land Office maps, and control cards for potential cultural resources in the proposed project area. That series of searches indicated that cultural resource sites have not been identified, and previous cultural resource inventories have not occurred, in the project area.

3.0 PROJECT AREA DESCRIPTION

The area of potential effect (APE) for this proposed project consists of as much as 10 acres in the W1/2NWNE1/4 Section 36, T2N R8W where a proposed water treatment facility may be constructed. Presently, the precise location of any of the associated facilities has not been determined. Preliminary exploratory work for this proposed project consisted of a series of backhoe trenches and auger holes randomly excavated throughout the W1/2NWNE1/4 Section 36, T2N R8W. However, because the state parcel containing the APE is a block of 40 acres, the entire state tract was inventoried to Class III standards (Figure 2).

The area inventoried consists of intermittent and sparse stands of Douglas fir intermixed with open, steep to precipitous hillsides where large granitic boulders intermittently outcrop. Rabbitbrush and xeric grasses dominate the areas where timber is not present (Figures 3 and 4). Ground surface visibility was good due to short and thin vegetation.

The geology of the project area is characterized as granitic rock (Ross et al 1955). Based on the geology of the area, the potential for sources of tool quality stone, rock shelters, or caves is low. Soils in the site locale are coarse-sandy to coarse-gravelly loams that shallowly cover bedrock (Veseth and Montagne 1980).

The terrain is moderately steep (40% slopes). The closes source of water is Herman Gulch creek which flows through the SW corner of the state tract.

Table 1: Summary of land inventoried in response to the proposed Butte-Silver Bow Basin Creek Water Treatment Plant.

Legal Location	County	Acres Potentially Effected	Acres Inventoried	Cultural or Paleontologic Resources	Ownership
T2N R8W Section 36 NWNE1/4	Silver Bow	10	40	None	State

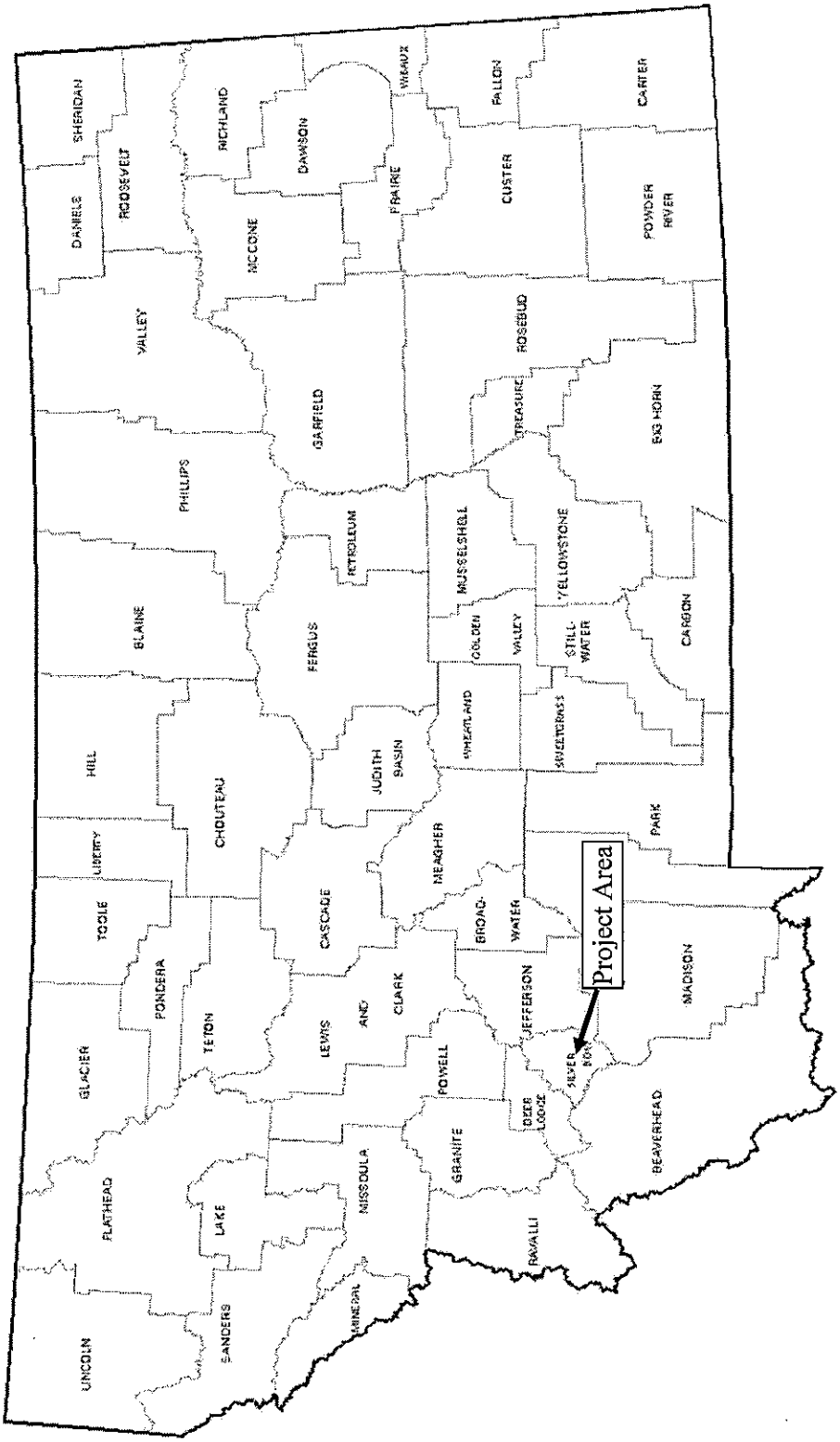

Figure 1: General location of the project area in Montana.

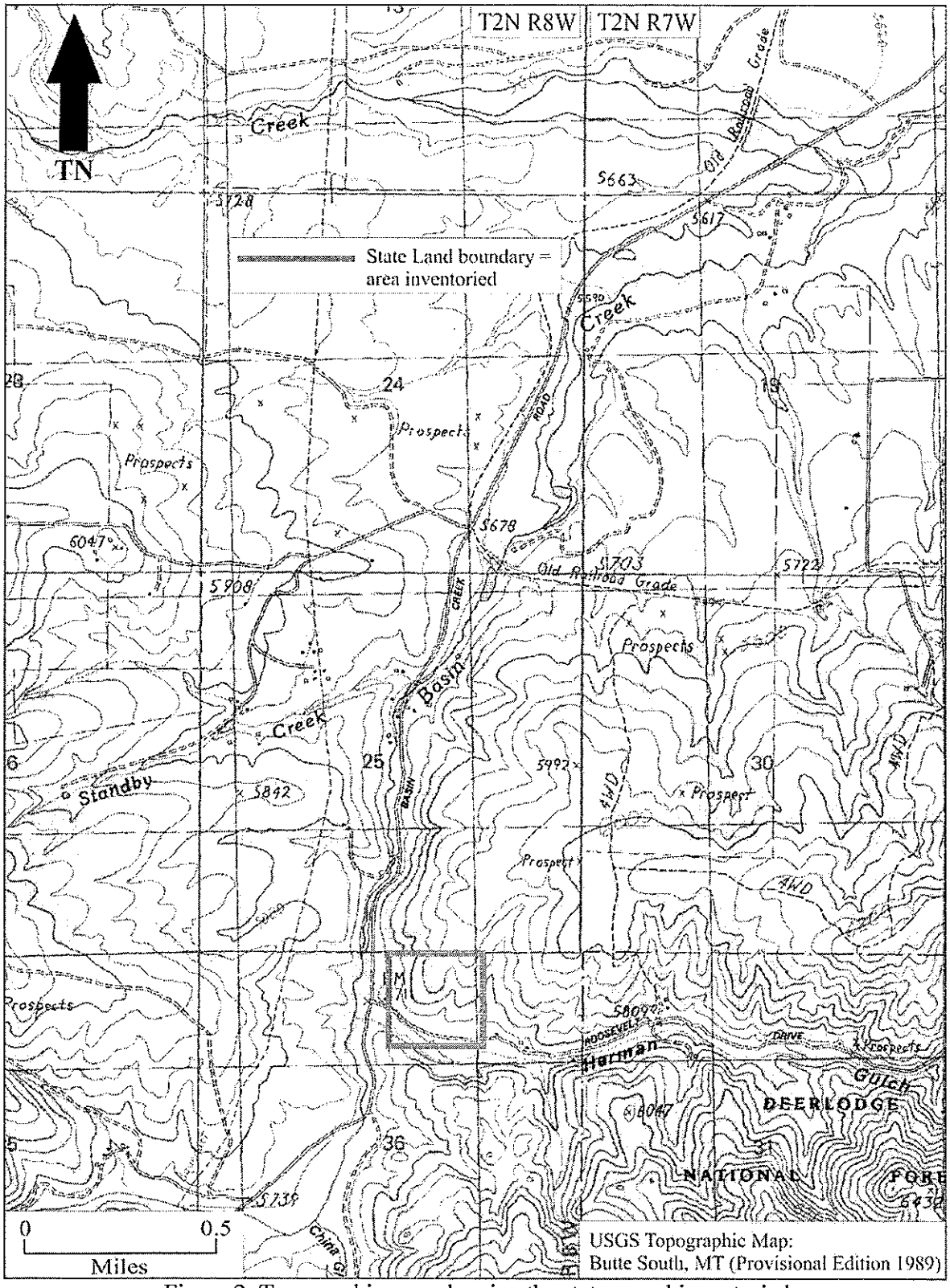

Figure 2: Topographic map showing the state parcel inventoried.

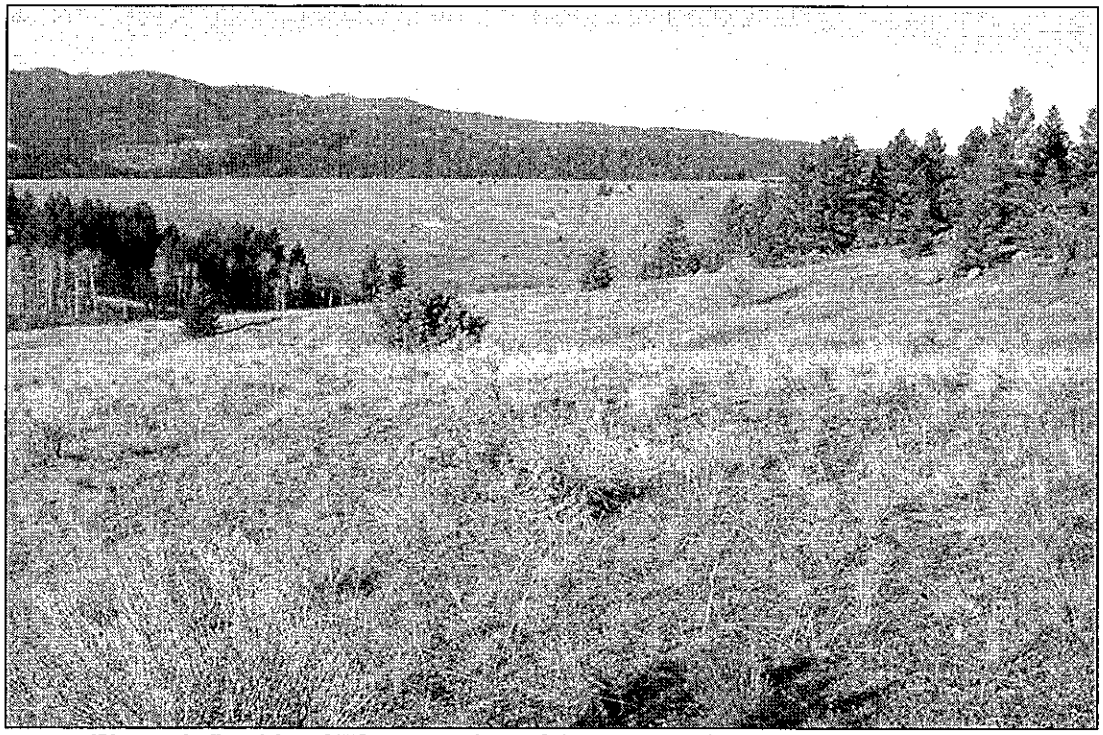

Figure 3: Looking SW at a portion of the NWNE1/4 Section 36, T2N R8W.

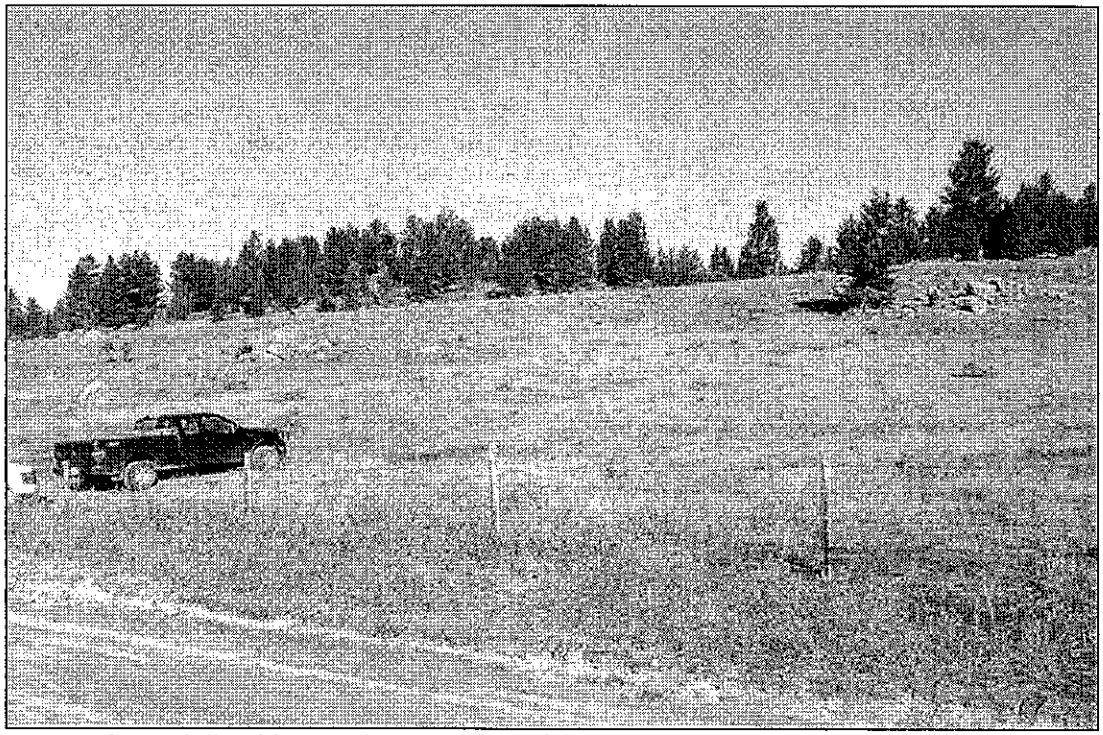

Figure 4: Looking NW at a portion of the NWNE1/4 Section 36, T2N R8W.

4.0 FIELD INVESTIGATIVE METHODS

The NWNE1/4Section 36, T2N R8W was inventoried using generally parallel pedestrian transects spaced at a maximum width of 30 m (Table 1; Figure 2). Only the north boundary of the tract is delimited with a barbed-wire fence. All other boundaries are unmarked. Accurate navigation of the state parcel was accomplished in the field using an ownership overlay programmed into a Garmin GPSmap 62S. Subsurface inspection in the project area consisted of an examination of project related exploratory backhoe trenches and auger hole spoil dirt as well as existing exposures such as eroded/denuded ground surfaces, cut bank profiles, road/trail cuts and surfaces, and the spoil dirt generated from the activities of small size burrowing mammals.

5.0 RESULTS OF FIELDWORK

Despite a detailed examination of the project area, no cultural or paleontologic resources were identified. No state owned Antiquities will be affected with proposed developments. No additional archaeological of paleontologic review of the project area is recommended.

6.0 SUMMARY AND RECOMMENDATIONS

On October 18th, 2013, the author conducted a Class III level intensity inventory of cultural and paleontologic resources of a 40 acre block of state land legally described as the NWNE1/4 Section 36, T2N R8W. The inventory was conducted in response to proposed development of a municipal water treatment facility designated as the Butte-Silver Bow Basin Creek Plant. Although proposed ground disturbances will not affect the entire 40 acre parcel, the additional acreage inspected contributes to both the SHPO's and DNRC's overall inventory of state owned land.

Despite a detailed examination of the state parcel, no cultural or paleontologic resources were identified. No state owned Antiquities will be affected with the proposed development, so no additional archaeological of paleontologic review of the project area is recommended.

REFERENCES CITED

Ross, C. P.
1963 The Belt Series in Montana. *U.S. Geologic Survey Professional Paper #346.* pp. 1-122.

Veseth, R. and C. Montagne
1980 Geologic Parent Materials of Montana Soils. Montana State University and USDA-Soil Conservation Service *Bulletin 721.* Document dated November, 1980.

DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION

DIVISION OF TRUST LAND MANAGEMENT

STEVE BULLOCK, GOVERNOR

1625 ELEVENTH AVENUE

STATE OF MONTANA

DIRECTOR'S OFFICE: (406) 444-2074
FAX: (406) 444-2684

PO BOX 201601
HELENA, MONTANA 59620-1601

October 18, 2013

- KATHRYN

CONCUR
MONTANA SHPO
DATE 10/23/2013 SIGNED

Montana State Historic Preservation Office
Attn: Dr. Stan Wilmoth
P.O. Box 201202
Helena, MT 59620-1202

RE: A Cultural and Paleontologic Resources Inventory of the NWNE1/4 Section 36, T2N R8W: Silver Bow County. Report prepared by Patrick Rennie (DNRC, Helena) for the DNRC (Helena, MT). Report dated 10-2013.

Dear Stan:

Enclosed for your review and files please find a copy of the above referenced report. That report details the results of a cultural resources inventory of 40 acres of state land in Silver Bow County where a proposed municipal water treatment facility is proposed. Despite a detailed examination of the state parcel, no cultural or paleontologic resources were identified. As such, the DNRC is seeking concurrence of the SHPO that there should be **No Effect** to state owned Antiquities with the proposed development.

Thank you in advance for your time, and if you have any questions or concerns regarding the above referenced report or project please let me know.

Sincerely,

Patrick

Patrick J. Rennie
DNRC Archaeologist

Thanks!

encl.