SOURCE WATER PROTECTION PLAN

THE CITY OF RAWLINS

JUNE 2020

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1 INTRODUCTION

The city of Rawlins is dependent upon reliable, clean water for its existence as an oasis on the edge of the Red Desert on the high plains of Wyoming. Protection of its water source protects its future as a hospitable town for residents and visitors. These residents and visitors alike enjoy many of Wyoming's pristine natural resources; one of the most important of these is access to water.

Rawlins obtains water from three sources, including the North Platte River, the Nugget wells, and the Sage Creek Springs. For a discussion of each, see Section 1.3 below. The main purpose of this SWPP is to identify achievable protection measures for the basin, springs, and recharge area of the Sage Creek Springs groundwater resource, infrastructure, and collection system.

Figure 1 - Sage Creek Spring #11

In 1973, the Wyoming State Legislature passed the Environmental Quality Act to protect the state's valuable water resources (WDEQ, 2000). This Act created the Wyoming Department of Environmental Quality (WDEQ). The WDEQ was established to preserve the waters of the state and prevent, reduce, and eliminate water pollution in surface and groundwater sources. The waters of the State must be protected by either preventative measures or remediation activities. In accordance with this statute and the WDEQ, the City of Rawlins is developing a program that will protect the City's primary municipal water source.

The United States Congress passed legislation in 1996 requiring all states having "primacy" to develop a Source Water Assessment and Protection (SWAP) program under Sections 1453 and 1428(b) of the Safe Drinking Water Act. The SWAP program is a two-part program consisting of a source water assessment followed by a protection plan. States which have primacy are responsible for administering the federal rules and regulations established in the act. Although Wyoming is the only state that has elected not to take primacy, the value and benefit of a SWAP program is recognized by the State. During the 1998 legislative session, the Wyoming Legislature authorized the WDEQ to set aside 10%, or $1.2 million, of the federal 1997 Drinking Water State Revolving Fund resources to develop a statewide SWAP program (WDEQ, 2000).

In June of 2004, a source water assessment for the City of Rawlins was completed by Lidstone and Associates, Inc. (Lidstone and Associates, 2004). The assessment identified sources of contamination within the Rawlins watershed that could affect the municipal water supply and evaluated the susceptibility of the water supply to contamination. The findings from this initial assessment, in conjunction with additional research and data were compiled to produce this Source Water Protection Plan (SWPP) to determine what measures, the community and the City of Rawlins believe are appropriate to protect the City's municipal water supply.

1.1 Source Water Protection Plan Process

This Source Water Protection Plan was developed through a six-step process:

- Step 1: The formation of a steering committee to initiate, lead, and oversee the development and implementation of the SWPP through public and inter-governmental agency outreach.
- Step 2: Characterization of the Sage Creek Basin.
- Step 3: Delineation of the protection area that represents the surface and subsurface regions that recharge the Sage Creek Basin.
- Step 4: Development of a Contaminant Source Inventory that identifies the location of potential sources of contamination.
- Step 5: Development and implementation of a Contaminant Management Plan.
- Step 6: Development of a Contingency Plan that identifies alternative public water supplies and the required emergency response if contamination occurs.

1.2 Steering Committee

Establishing a Steering Committee was the first step in creating the SWPP. The Steering Committee was tasked to perform public and inter-governmental outreach to ensure community involvement with the development and implementation of the protection plan. The committee consists of:City of Rawlins manager Scott Hanum; City water operator Danny Rodriguez; City attorney Amy Bach and water attorney Harriet Hageman; City engineer Engineering Associates; andHydrologist Bern Hinkley.

Input was also received from City staff Danielle Gross and Karl Smith; and from Michelle Christopher with the Wyoming Association of Rural Water Systems; and from Jodie Pavlica with Wyoming Water Development Office.

Figure 2 - Location

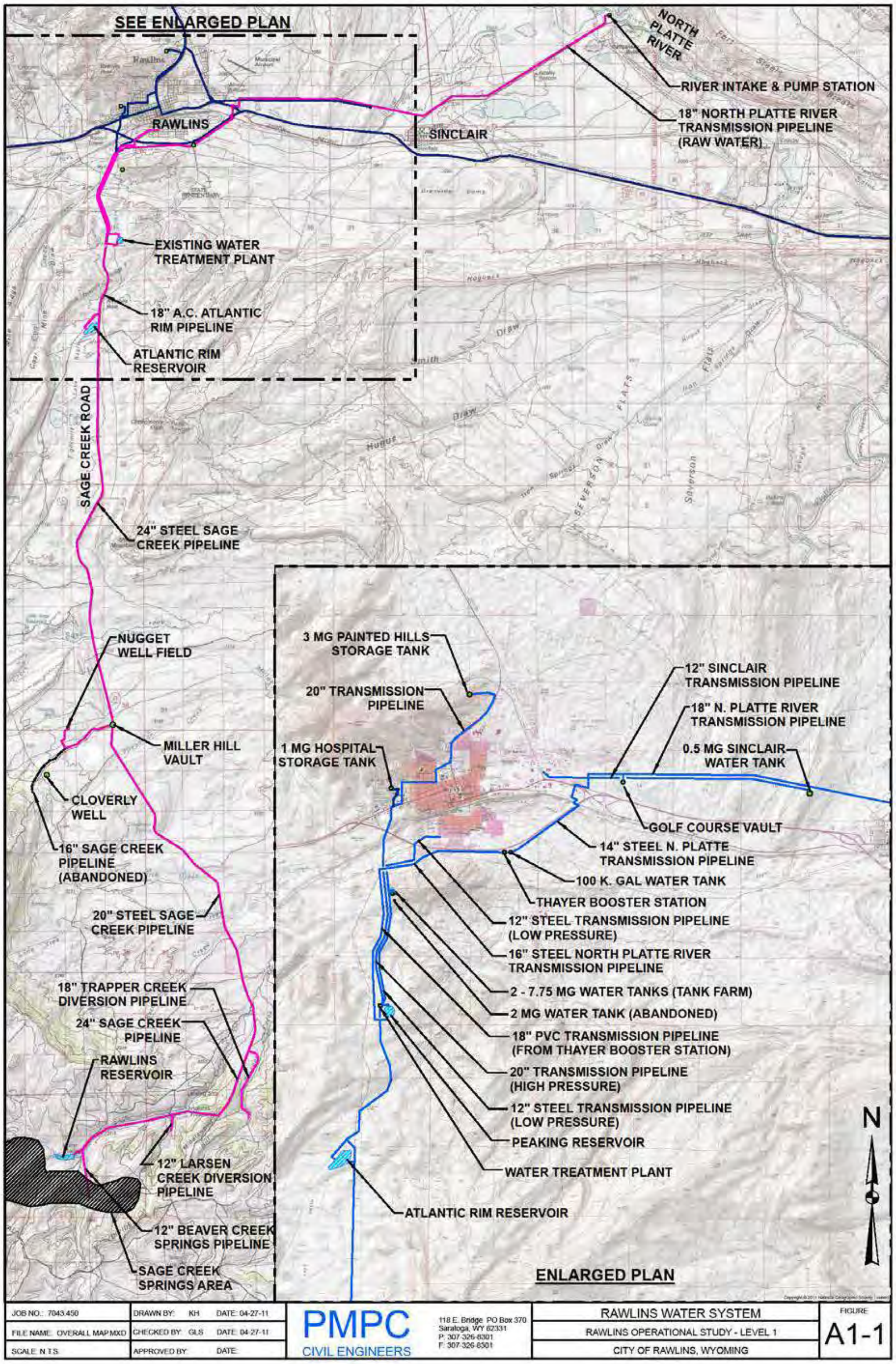

Figure 3 - Rawlins Water System

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PROJECT: SOURCE WATER PROTECTION PLAN

TITLE: SPRINGS OVERVIEW

SHEET 1 OF

CITY OF RAWLINS – SAGE CREEK SPRINGS

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1.3 City of Rawlins Water Sources

The City of Rawlins obtains water for municipal use from three supply sources: the Platte River, Nugget Wells, and Sage Creek Springs (Wester, 2010). The Sage Creek watershed is the primary source of water for the City, and the focus of this report. The Sage Creek Springs are the City's single most important water source. The other two sources are briefly introduced here, but for the reasons given below are not considered in detail in this report.

The preceding figures show the vicinity of the Sage Creek basin, and its location within Carbon County (Figure 2); the City of Rawlins water supply from Sage Creek (Figure 3) dating from 2011; and the collection system and springs within the basin (Figure 4). The original collection system and piping is shown in drawings included in Appendix A, originally dating to 1922. Improvements to the system have been made in the decades since.

1.3.1 Platte River Watershed

The Platte River watershed covers an enormous area with a variety of land ownership and management. While the supply of water from the river, through a diversion facility near the Town of Sinclair, is important, there would be little benefit to creating, let alone implementing, source water protection for the river based on the City's usage of this source. In addition, the river is protected by many local and state regulations that do not need repetition in a local plan. For these reasons, the upper North Platte watershed is not considered further in this plan.

The river has historically been used to replenish the City's reservoirs during winter, when the river is carrying less sediment. This is especially important during low-snow years when the springs do not produce adequate supply. The river remains an important water source, both supplementing water obtained from the springs, and as a redundant main source. The City has an operational pretreatment plant designed to treat raw river water to a level of quality that the main treatment plant can accept.

1.3.2 Nugget Wells

The Nugget wells, located approximately 15 miles south of the City of Rawlins, also have an extensive recharge area which is overlaid by a checkerboard of private and public land ownership. These wells are used as a backup source of water. While this region is less susceptible to surface disturbance, there may be impacts from future water exploration as well as oil and gas development. While protecting these wells would be a worthy goal, there would be little benefit to implementing source water protection due to the low City usage of these wells as a back-up water supply and the variety of land ownership in the recharge area.

The greatest risk to the wells is reduced static level within the wells. The wells currently flow free at the well head elevation at about 750-gpm. Water is added to the pressurized system at a vault at Miller Hill Road. Booster pumps within the vault can increase the delivered flow to about 1200-gpm.

1.4 Characterization of the Sage Creek Basin

In contrast to the other two sources, springs within the Sage Creek basin serve as the primary water source for the City. While they are located over 25-miles south of Rawlins, they produce a reliable supply of water within a basin that has little development. Given both the importance of the source, and that source protection practices can be readily implemented, the Sage Creek basin is the focus of this report. Additionally, given the City's ownership and relatively the small drainage basin, best practices and recommendations can be economically implemented.

An assessment of Sage Creek Basin's geology, water resources, biology, land use, and cultural resources was performed. The geology and water resource evaluations were performed by Hinckley Consulting (2015). The biology, land use and cultural resources assessments were extracted from existing sources such as BLM range studies and previous work by the City.

1.5 Delineation of the Source Water Recharge Area

The third step in creating the SWPP was to determine the delineation of the protection area that represents the surface and subsurface regions that recharge the Sage Creek Basin.

The Sage Creek Basin watershed originates at the 14 springs south of Rawlins, at the head of Sage Creek shown in Figure 1. The Sage Creek Basin supplies 80 percent of Rawlins' municipal water supply, making it the most important water source for the City (Bellis, 2015; Wester Wetstein 2010). Each of the springs are diverted into collection boxes through a system of underground collection lines. The collection lines terminate at a junction box downstream of the Rawlins Reservoir.

Surface runoff is collected in the Rawlins Reservoir from a watershed area of approximately 12 square miles around the Reservoir, which is bounded on the south and west by the Continental Divide (James M. Montgomery, Consulting Engineers, Inc., 1986). This drainage area contributing to the spring collection system and Rawlins Reservoir is herein referred to as the Sage Creek Basin. Chapter 5 will detail the methodology for determining the delineation of the specific recharge area for the Sage Creek Basin and identify the boundaries within the recharge area for specific types of protection.

1.6 Contaminant Source Inventory

The fourth step of the SWPP was to develop a contaminant source inventory. The contaminant source inventory identifies current and future potential contaminant sources that may threaten the Sage Creek Basin recharge area. Within this area the potential contaminant sources include oil and gas development, mining and other resource extraction, road use, construction, grazing, on-site wastewater treatment systems, storm water runoff, and other miscellaneous uses.

1.7 Contaminant Management Plan

Developing a contaminant management plan which presents a set of management strategies for the potential contaminant sources identified in the contaminant source inventory is the fifth step of the SWPP. Management strategies may include both regulatory and non-regulatory approaches. The following general approaches are recommended for managing potential contaminant sources in the Sage Creek Basin recharge area.

- Implement a monitoring program throughout the recharge area.
- Work with the public land management agencies to identify when leasing is at the permitting stage.
- Fund a city staff position (or portion thereof) that will be responsible for implementing the SWPP and monitoring city resources in Sage Creek Basin.
- Establish an education and outreach program.
- Use best management practices to protect the recharge area.
- Identify numerous management strategies for specific contaminant sources.

1.8 CONTINGENCY PLAN

The final step of the SWPP identifies a contingency plan in the event of a source water contamination event that impacts the City of Rawlins' ability to provide an adequate quantity of safe municipal water to the public.

2 STEERING COMMITTEE

The first step in creating this SWPP was to establish a Steering Committee. The Steering Committee's responsibility is to perform public outreach and guide the development and implementation of the SWPP.

2.1 FORMATION OF THE STEERING COMMITTEE

The Steering Committee established for this SWPP included the City's water treatment plant operator and maintenance staff, the City Manager, the City Engineer, Hydrogeologist, Engineering Associates, and the City's Water Attorney. The Committee's responsibilities include performing public outreach and overseeing all meetings with the public and any stakeholders potentially affected by the SWPP. The steering committee held meetings with the public and inter-governmental agencies providing both parties with the opportunity to become involved in the development and implementation of the SWPP.

2.2 OUTREACH

A main characteristic of successful SWPPs is recognizing the importance of public participation in both the development and implementation phases of the plan. Public outreach included meetings with the public as well as with inter-governmental agencies and land owners within the Sage Creek Basin recharge area.

An initial stakeholders' meeting was held on June 11th, 2018. The following government agencies and land owners within the recharge area were in attendance:

- Bureau of Land Management
- State of Wyoming
- US Forest Service
- City of Rawlins
- Carbon County
- Private land owners
- Governor's Office

During this meeting, the group discussed potential sources of contamination within the basin as well as management strategies for each source. Additionally, comments were collected from the group and follow-up meetings were scheduled to address any concerns from individual land owners. Stakeholders were provided a draft copy of the City of Rawlins' Source Water Protection Plan for review and comment.

3 SAGE CREEK BASIN

3.1 Introduction

The Sage Creek Basin is largely untouched by any major development. It provides the City a pristine water source, unique to only a few communities across the country. The Basin's geology, hydrology, biology, cultural resources, and land use make it an ideal location for the City's municipal water supply.

Figure 5 - Sage Creek Basin from Beaver Creek

3.2 Physiography

The rolling uplands above Sage Creek Basin have an average elevation of about 8,000 feet, with the valley floor of the basin at elevations of between 7,600 to 7,400 feet. The valley's side slopes are variable, ranging from 10% up to 50% in places (BLM, 2014).

Within the area of interest, above Adams Reservoir, the Sage Creek Basin has an area of about 24 square miles. Land cover within the Basin is generally open sage and grass upland, with limited conifer and aspen groves on some north-facing slopes. The valley bottoms support some riparian grasses and willows.

3.3 Water Resources

The Sage Creek Basin is located on the northern flanks of the Sierra Madre Range. Sage Creek, a tributary of the North Platte River, flows east from the Continental Divide to its confluence with the river, approximately 20 miles downstream. Overtime, the creek has eroded a valley creating the Sage Creek Basin, which lies within the rolling upland which typifies the northern portion of the Sierra Madre Range. The Sage Creek Springs, which provide the bulk of the City of Rawlins' municipal water supply, are located within this basin, above an elevation of 7600-ft.

There are no known flow gaging stations in the vicinity.

3.3.1 Flow from Springs

The total output of the 24 individual springs cannot be easily measured at the springs. Collected flows, delivered to the City, are measured and reported at a meter in the Miller Hill booster station on the main supply line to the water treatment plant. The springs may be producing more water than reported and leaks in the system and uncollected water, above the meter, are not accounted for in the reported springs' output.

A field assessment of the springs was completed in the late summer of 2016. Each of the 24 spring boxes were assessed for flow, temperature, conductivity, and general condition. The estimated flows in the spring boxes total 2900 gpm, while the delivered flow was less than 1200 gpm at the plant on that day. The difference may be the result of failing collection infrastructure or inadequate capacity for the developed flow at the springs.

Historical records for the delivered flow from the Sage Creek Basin Springs vary throughout the year, from a seasonal low of 800 gpm to spring runoff flows of over 2000 gpm (Master Plan, 2013). The flow is heavily influenced by seasonal precipitation. This connection between seasonal precipitation and spring output shows how sensitive the spring system is to surface disturbance.

3.4 GEOLOGY

According to BLM staff (2015), the springs originate from the Browns Park Formation. This formation consists of two layers, an upper stratum of up to 1,000 feet of gray, white, and brown, fine to medium grained sandstone and a lower basal stratum of up to 135 feet of conglomerate composed of quartz, quartzite, and diabase, interbedded with sandstone and volcanic ash. Both layers can yield moderate to large supplies of water to springs and wells (Berry, 1960).

The exposed surface of the upper Browns Park Formation is very permeable and an excellent groundwater recharge area (Berry, 1960). Groundwater occurs under water-table conditions in the Browns Park Formation and follows irregularities comparable with and related to those of the land surface (Berry, 1960). Groundwater gradients in the Browns Park Formation in the region indicate flow from the continental divide to the North Platte River (Bartos, 2006).

3.5 WATERSHED EROSION

Snowmelt and thunderstorms can produce moderate to high runoff with medium to high erosion rates within the Sage Creek Basin (BLM, 2014). Sheet and rill erosion occurring on soils derived from marine shales contribute sediments to Sage Creek and its tributaries, resulting in high levels of suspended sediment and colloidal clays (SERCD, 2002). The U.S. Department of Agriculture - Soil Conservation Service (USDA-SCS) estimated natural erosion rates for 95 percent of the watershed at between ½ and 1 acre-foot of sediment produced per square mile per year. Sources of the sediment include sheet and gully erosion and provide approximately 190 acre-feet of sediment to the mouth of Sage Creek (USDA-SCS, 1980).

3.6 LAND USE

Land ownership within the Sage Creek Basin recharge area is predominantly public land managed by the BLM and the State of Wyoming, with a small portion managed by the National Forest Service. The City of Rawlins owns the Rawlins Reservoir and the land surrounding it. There are several private land owners in the watershed as well. These include one small housing subdivision and multiple ranches. Figure 6 shows the distribution of the land ownership across the recharge area.

Principal land use in the watershed includes livestock grazing, recreation, and limited mineral exploration (BLM, 2014). Livestock use is primarily cattle, both cow/calf and yearling operations. Seasons of use for livestock vary by allotment. Winter use is somewhat dependent upon annual climate conditions. Recreational use tends to be primarily related to hunting during the fall months, September through October.

All public land has a multi-use philosophy, which may include energy development, livestock grazing, recreation, and timber harvesting. There is currently a wind energy development project, the Chokecherry and Sierra Madre Wind Energy Project, which falls within the northern most portion of the recharge area and it is currently in the construction phase. In the future, other multi-use activities have the potential to occur within the Sage Creek Basin.

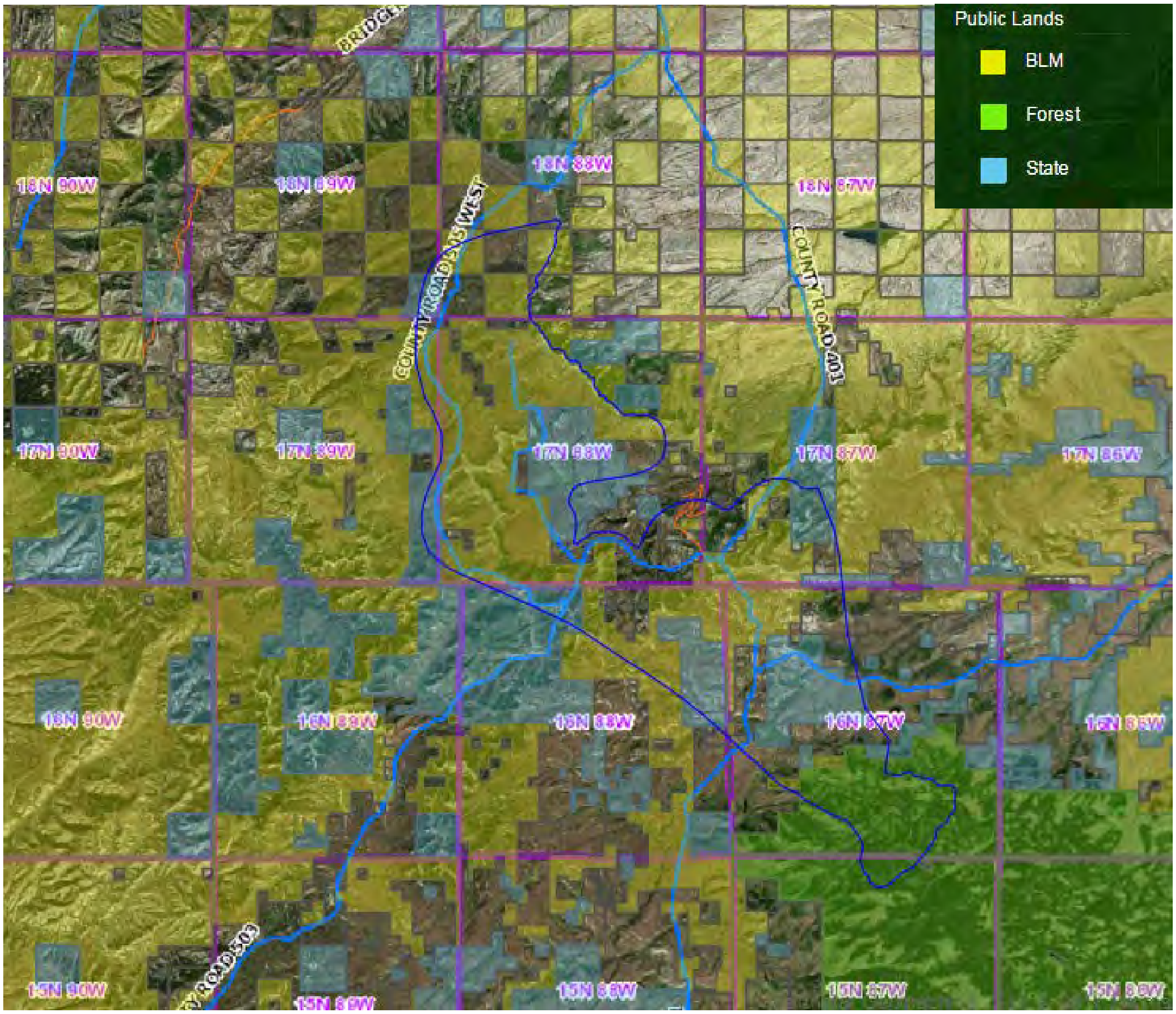

Figure 6 - Land ownership within the Sage Creek Basin Recharge Area

3.7 BIOLOGY

Vegetation in the Sage Creek Basin can be characterized as a sagebrush/grassland community. Species observed or expected to occur include sagebrush (Artemisia tridentata, A. frigida), grease wood (Sarcobatus vermiculatus), plains prickly pear cactus (Opuntia polyacantha), aster (Aster spp.), and wild daisy (Erigeron sp.). Western wheatgrass (Argopyron smithii), threadleaf sedge (Carex filifolia), Sandberg bluegrass (Poa secunda), needle-and-thread (Stipa comata), Indian ricegrass (Oryzopsis hymenoides), and cheatgrass (Bromus tectorum) comprise the grasses. Willow (Salix sp.), basin wild rye (Elymus sp.), and rush (Juncus sp.) were also noted along flowing watercourses (Hauff, 1986).

Figure 7 - Ute Ladies' Tresses (Alchetron, 2017).

Faunal species in the area include the pronghorn (Antilocapra americana), mule deer (Odocoileus hemionus), cottontail rabbit (Sylvilagus spp.), jackrabbit (Lepus sp.), ground squirrel (Spermophilus sp.), prairie dog (Cynomys sp.), packrat (Neotoma sp.), deer mouse (Peromyscus sp.), badger (Taxidea taxus), coycte (Canis latrans), and red fox (Vulpes vulpes). Numerous species of birds and reptiles also are found in the area. In the past, bison (Bison spp.) and the American elk (Cervus elaphus) were also inhabitants of the basin (Hauff, 1986).

There are four threatened, endangered, or candidates for threatened species that inhabit, or have the potential to inhabit, the Sage Creek Basin. These species include the black-footed ferret, the Canada lynx, Ute ladies' tresses, and the Greater Sage-Grouse (BLM, 2014).

3.7.1 Black-footed Ferret

The black-footed ferret is considered an endangered species and is the rarest and most endangered mammal in North America. They receive full protection under the Endangered Species Act of 1973. The United States Fish and Wildlife Service has designated the Black-footed Ferret as an experimental non-essential population throughout Wyoming. This species lives in prairie dog towns and relies on prairie dogs for both food and shelter. The original range of the black-footed ferret corresponded closely with that of the prairie dog, extending over the Great Plains, from southern Canada to the western Texas plains and from east of the 100th Meridian to Utah and Arizona (USDI-BLM 2002).

3.7.2 Canada Lynx

The current protection status of the Canada lynx is threatened. Lynx occur in the boreal, sub-boreal, and western montane-forests of North America. Snowshoe hares are their primary food source, comprising 35 to 97 percent of their diet throughout their range. Other prey species include red squirrels, ground squirrels, mice, voles, porcupines, beavers, and ungulates as carrion or occasionally as prey. Lynx prefer to move through continuous forests and use ridges, saddles, and riparian areas to move from preferred habitats. Lynx have been known to cross large rivers and lakes and have been documented in a variety of habitats, such as shrub-steppe, juniper, and ponderosa pine (USDI-FWS, 1999a).

3.7.3 Greater Sage-Grouse

The Greater Sage-Grouse, a candidate species for protection, are common inhabitants within Sage Creek Basin. Grouse populations have exhibited long-term declines throughout North America, with a 33% decline over the past 30 to 40 years. No one causal factor has been identified for these declines. Even though Wyoming supports the largest populations of grouse, more than all the other states combined, there are population declines occurring in Wyoming as well. Grouse are a sagebrush obligate species and each aspect of their life cycle requires slightly different elements within a sagebrush community. Grass height and cover play an important role in the nesting success of grouse. Early brood rearing habitats consist of relatively open stands of sagebrush or narrow, shrub-free stringers of meadows in draws or other areas with somewhat more soil moisture. Sagebrush, sometimes dense, often invades the latter habitat, making them less desirable or unsuited for brood habitat (Klebenow, D.A. 1972). During the summer months, grouse move to more mesic sites, seeking succulent forbs. Movements to winter ranges are slow and meandering and occur from late August to December. During the winter months, grouse feed almost exclusively on sagebrush leaves (USDI BLM 2002).

Some winter habitat has been identified for parts of this watershed. Specific project related areas were flown for winter habitat within this watershed; therefore, there is always the possibility that additional winter habitat areas for Greater Sage-Grouse could be identified in other areas of the watershed unit. Winter habitat must be assessed during very specific time periods and under specific winter conditions.

3.7.4 Ute Ladies' Tresses

Ute ladies' tresses (Figure 7 above) are considered a threatened species under the Endangered Species Act of 1973. This plant is a perennial, terrestrial orchid, which typically blooms from late July through August. Depending on location and climatic conditions, orchids may bloom in early July or still be in flower as late as early October. This orchid is endemic to moist soils in mesic or wet meadows near springs, lakes, seeps, and riparian areas within the 100-year flood plain of perennial streams ranging from 4,300-7,000 feet in elevation. It colonizes early successional riparian habitats, such as point bars, sand bars, and low lying gravelly, sandy, or cobbly edges, persisting in those areas where the hydrology provides continual dampness in the root zone throughout the growing season (USDI BLM 2002).

3.8 Cultural Resources

In 1986, Jeffrey L. Hauff conducted a cultural survey and review of the archeological literature for the Sage Creek Basin which identified several prehistoric and historic resources within the area. Earlier work done by Latady (1985) provided a synopsis of the prehistoric site localities which were reported from the basin in 1982. Several different prehistoric site types were documented from these studies. The most prevalent of these sites are lithic/fired rock scatters with hearths and lithic/fired rock scatters with no intact hearths. Other prehistoric site types in the area include lithic scatters, stone circles, hearth/fired rock scatters, and a prehistoric quarry. The time periods represented by these sites vary from Paleoindian, Middle Archaic, Late Archaic, Late Prehistoric, and Protohistoric. Historical resources from the basin include the Overland Trail and an early homestead/ranch. Hauff notes that the historical resources in the area are most likely underrepresented as a result of recording biases of earlier surveys (Hauff, 1986).

4 SAGE CREEK BASIN RECHARGE AREA

In 2015, Hinckley Consulting, in consultation with the City of Rawlins and the BLM, developed a recommended source water recharge area boundary for the City of Rawlins' municipal water supply within the Sage Creek Basin spring system.

4.1 DELINEATION OF THE RECHARGE AREA

Groundwater drainage from the North Park Formation has previously been identified as the source of water for the springs within the Sage Creek Basin. Due to the lack of detailed information on the North Park Formation geometry and groundwater levels, the recommended potential recharge area boundary emphasizes "potential" and may include marginally contributory areas. This is intentional, to ensure long-term protection of the municipal water supply (Hinckley, 2015). The elements Hinckley used to determine the Recharge Area are as follows:

4.1.1 North Park Formation Base

Figure 8 presents a generalized contour map of the base of the North Park Formation. In the idealization of the North Park Formation as the sand filling a "sandbox" excavated into generally less permeable underlying material, the Figure 8 surface represents the bottom of the sandbox. Known elevations for that surface are along the observable geologic contact where the base of the North Park Formation intersects the ground surface. For example, that contact occurs at 8400 ft. elevation at the north end of Miller Hill, at 7600 ft. elevation in Upper Sage Creek Basin near the Rawlins municipal springs, and at 7200 ft. elevation in the Savery Creek (to the south) and Jack Creek (to the east) drainages. Included on Figure 8 are the contact elevations from isolated outcrops of the North Park Formation east and west of Miller Hill. At one time, these outcrops were part of a continuous sheet of North Park Formation across the larger area. Suggested original base elevations are dotted where they are now "up in the air" due to removal of the formation by erosion.

The surface contouring of Figure 8 is controlled by:

1) the observable contact elevations;
2) the Rawlins North Park Exploration well that was deliberately drilled completely through the North Park Formation in 1982; and
3) comparison with the 7600-ft surface contour, i.e. the bottom of the formation must be lower than 7600 ft. if the formation is present along this contour. (7600-ft is the elevation of the lowest of the Rawlins springs.)

Away from these control points, this surface is hypothetical and details could be reasonably contoured in various ways, but the general geometry is constrained to:

- A southward slope from the Miller Hill area (north) and a northward slope from the Sierra Madre into the area (southeast) of the Rawlins springs; and
- A substantial thickening of the North Park Fm. as its lower contact slopes downward to the south and east of the Rawlins springs. These were apparently areas in which drainages had eroded substantially into the pre-North Park surface.

Prior to deposition of the North Park Formation, the underlying formations formed the ground surface, which included hills, valleys, plateaus, stream channels, etc. as does the present ground surface. Thus, the base of the North Park is certainly not the smooth surface presented by Figure 8, but we have no information with which to evaluate those topographic details.

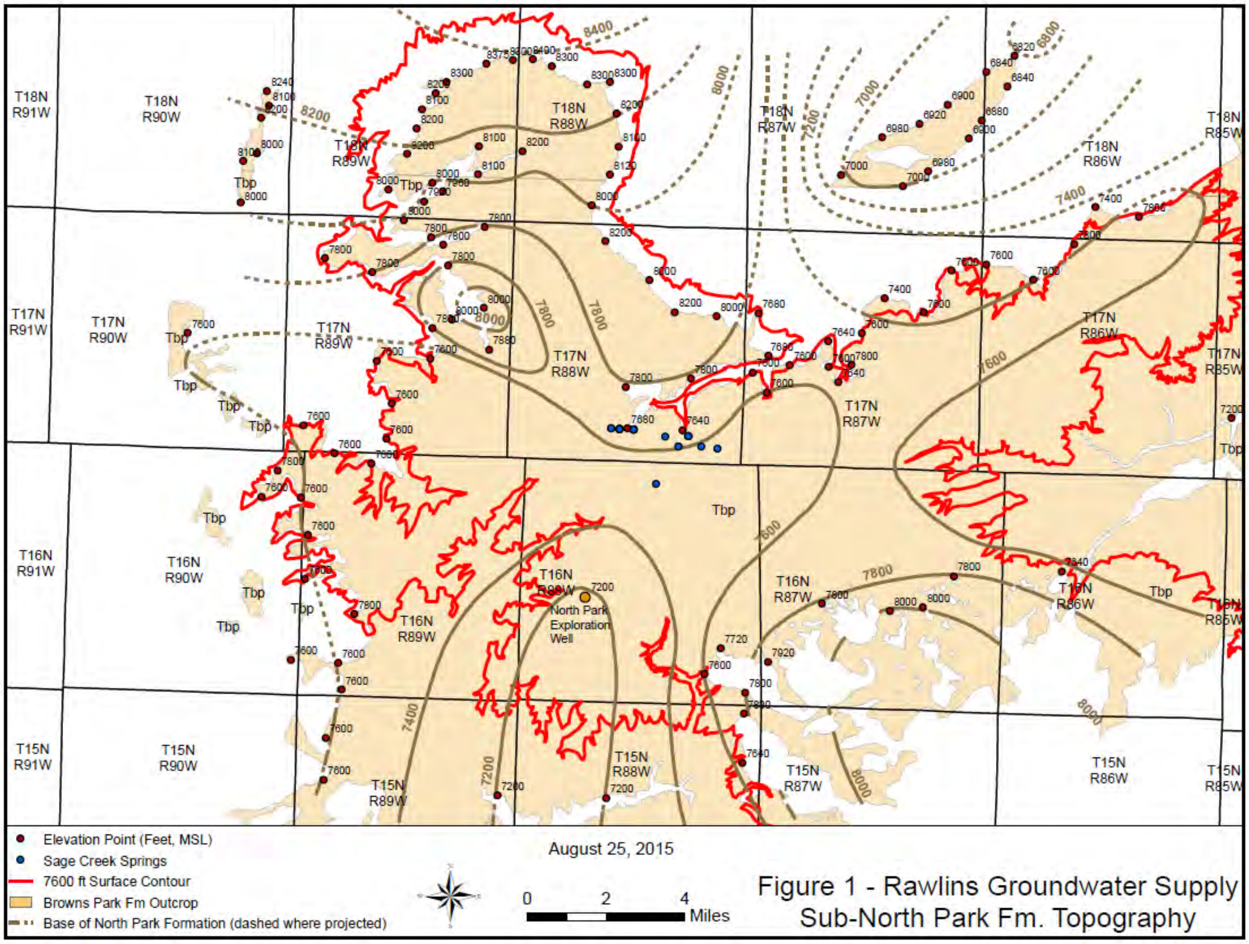

Figure 8 – Rawlins groundwater supply sub-North Park Fm topography (Hinkley, 2015).

4.1.2 North Park Formation Springs

Figure 9 presents significant springs issuing from the North Park Formation based on field inspection June 10, 2015 and examination of USGS 7.5-minute topographic mapping. “Significant” in this context means more than the simple accumulation of shallow groundwater beneath and adjacent to a large snowdrift that will typically produce a small seep for a few months following spring snowmelt. In most cases, the mapped features include observed flow more than approximately 50 gpm and channel characteristics indicating perennial flow. These springs are interpreted as draining groundwater from the larger North Park Formation. The perennial streams on Figure 9 are from USGS 7.5-minute topographic mapping, with minor additions to reflect observed field conditions.

In many cases, the important springs issue from near the base of the North Park Formation, where its contact with underlying less-permeable rocks forces groundwater to the surface. This is generally the case in the upper Sage Creek Basin, where the developed springs occur at or near this lower contact. This is consistent with a simple, “sandbox” concept of the aquifer, in which recharge infiltrates downward, filling up the sand and draining to the low spots. As noted above, the topography of the base of the North Park is unknown in detail and certainly includes filled-in stream channels and other features that serve to guide groundwater flow in complex local pathways.

In other cases, significant springs issue from strata within the formation. These are interpreted as the result of locally less-permeable strata intersecting the ground surface, providing a discharge path for local groundwater recharge from portions of the aquifer above that spring’s elevation.

4.1.3 Geologic Cross Sections

Figures 10, 11, and 12 present a series of cross-sections in various directions through the Rawlins springs area. (The lines of section are shown on Figure 9.) The surface topography is from standard USGS topographic maps. The generalized base of the North Park Formation is from Figure 8. The locations of the formations underlying the North Park are highly generalized, simply provided to indicate that the underlying formations vary with location and dip generally northward off the Sierra Madre Mountains.

The groundwater divides and flow paths on Figures 10, 11, and 12 are an interpretation based on the elevations and information on Figure 8 and Figure 9. Groundwater is assumed to flow preferentially toward lower elevation discharge points and through thicker sections of the aquifer (i.e. higher transmissivity) and to “split the difference,” creating a groundwater divide, where multiple discharge opportunities are present.

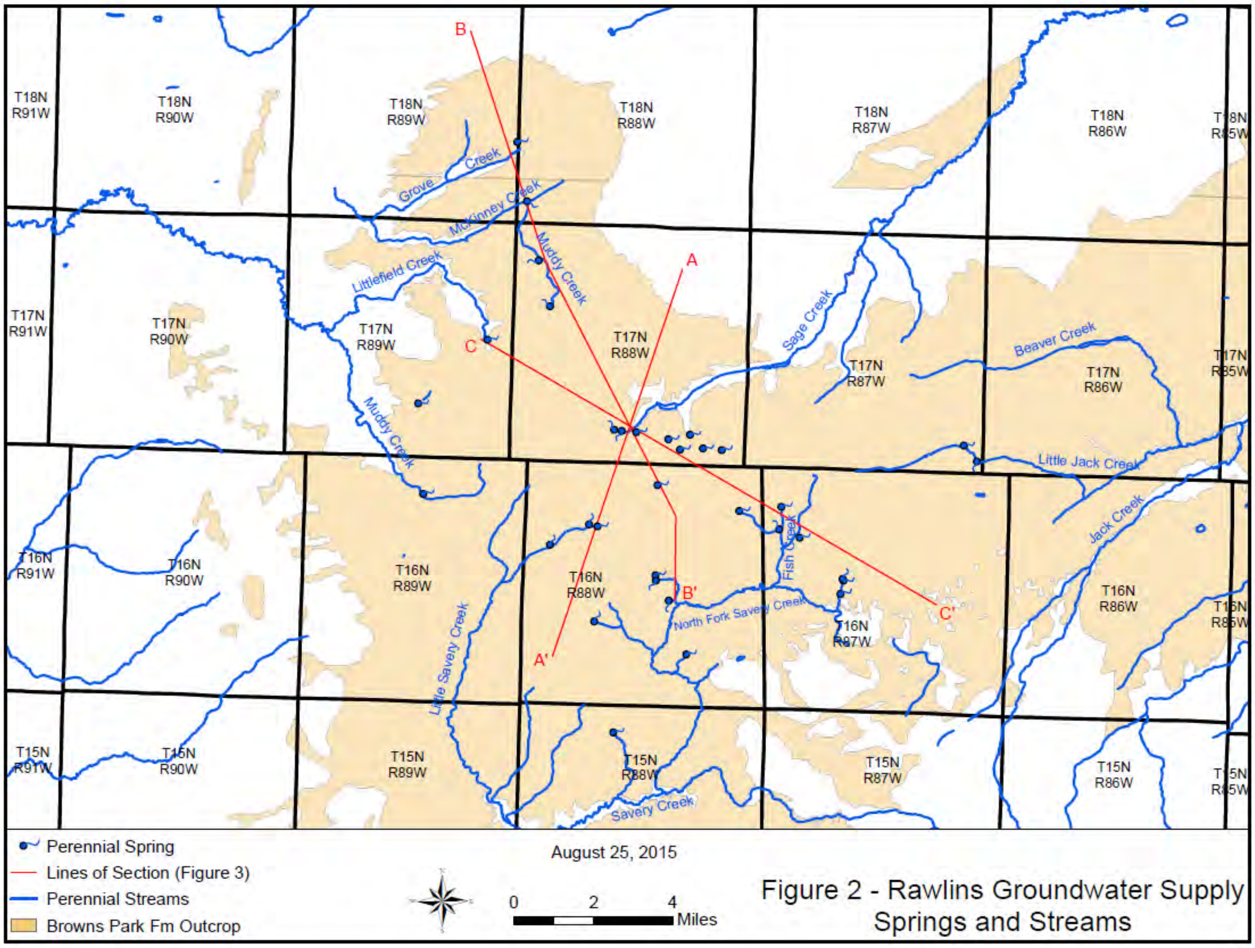

Figure 9 - Rawlins groundwater supply springs and streams (Hinckley, 2015).

Section A-A' (Figure 10): This section starts at the Miller Hill rim north of the Rawlins springs. From there, the North Park Formation base runs generally downhill to the Rawlins springs and infiltrating groundwater will flow towards the low area of the springs. South of the Rawlins springs, significant aquifer discharge occurs at surface elevation of approximately 7600 ft. along McCarty Creek, i.e. at the same elevation as the lowest Rawlins springs. The Rawlins springs discharge near the base of the aquifer; the McCarty Creek springs are presumably well above the base of the aquifer, e.g. the result of a locally less permeable layer guiding groundwater to surface discharge. If both spring areas were near the base of the aquifer and recharge were constant across the intervening surface, a groundwater divide would be created midway between the two discharge points. Because the aquifer is much thicker on the McCarty Creek side of this divide, however, the divide may skew away from that side. Thus, interpretation of a divide near the midpoint may be conservative (i.e. encompassing an area somewhat larger than the actual recharge area for the Rawlins springs), and provides some allowance for permeability variations within the aquifer allowing groundwater to migrate to the Rawlins springs from greater distance.

Section B-B' (Figure 11): This section intersects springs at the head of Grove Creek which discharge near the base of the aquifer. Such springs serve to drain the surrounding aquifer and preempt flow toward more distant discharge points. The section also intersects a reach with perennial flow in McKinney Creek, and springs along Muddy Creek. In those areas, groundwater discharges from strata above the base of the aquifer. Drainage of upper portions of the local aquifer occurs, but recharge reaching the deeper portions of the aquifer has opportunity to continue southward toward the substantially lower discharge elevation provided by the Rawlins springs. To the south of the Rawlins springs, the North Park Formation provides opportunity for groundwater to flow southward to lower-elevation discharge. A groundwater divide is conservatively estimated to occur in the approximate area of the Continental Divide.

Section C-C' (Figure 12): At the west end of this section, springs near the base of the North Park Formation drain local groundwater recharge, but the thicker aquifer and lower-discharge elevation of the Rawlins springs likely captures groundwater from most of the intervening area. Similarly, to the southeast, springs on Fish Creek act as local drains for the upper strata of the North Park Formation, but groundwater likely travels beneath these springs from the higher areas further southeast to discharge at the lowest point in the section, the Rawlins springs. The aquifer thins to zero at the east end of this section, exposing the underlying granitic rocks of the Sierra Madre and forming the south rim of the bowl-shaped aquifer defined by the C-C' section.

A 1953 University of Wyoming Department of Geology Master’s thesis on the Miller Hill area describes the southeast area of Section C-C’ as the major source of groundwater for the Sage Creek Springs. The author’s interpretation of groundwater flow was apparently based more on a perceived NNW-SSE structural control (down-warping of the sub-North Park Formations and minor faulting within the North Park Formation in this trend) than on a detailed comparison of elevations. He also reported, second-hand (no details available), experimentation with adding dye to the aquifer SSE of the Rawlins springs and observing NNW migration toward the springs (Del Mauro, 1953).

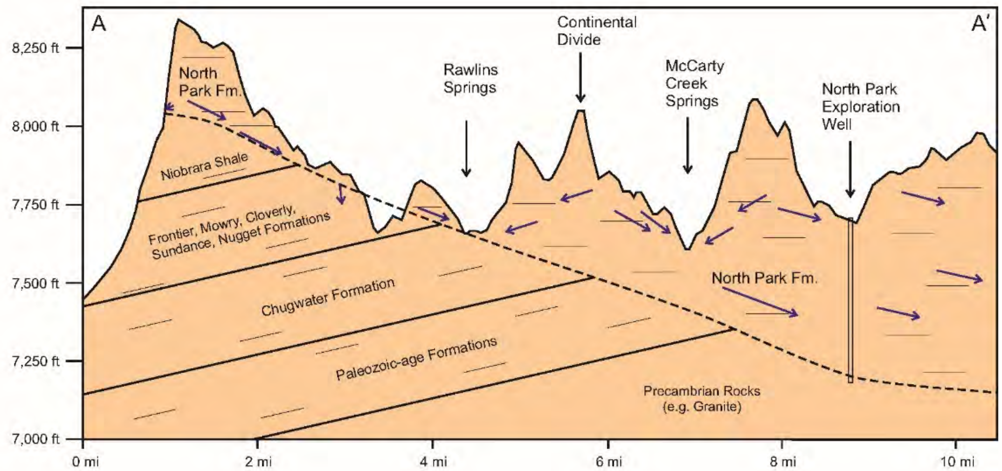

Figure 3A - Cross-Section A - A1through Rawlins Springs in Upper Sage Creek Basin

Figure 10 - Cross-section A-A', upper Sage Creek Basin (Hinckley, 2015).

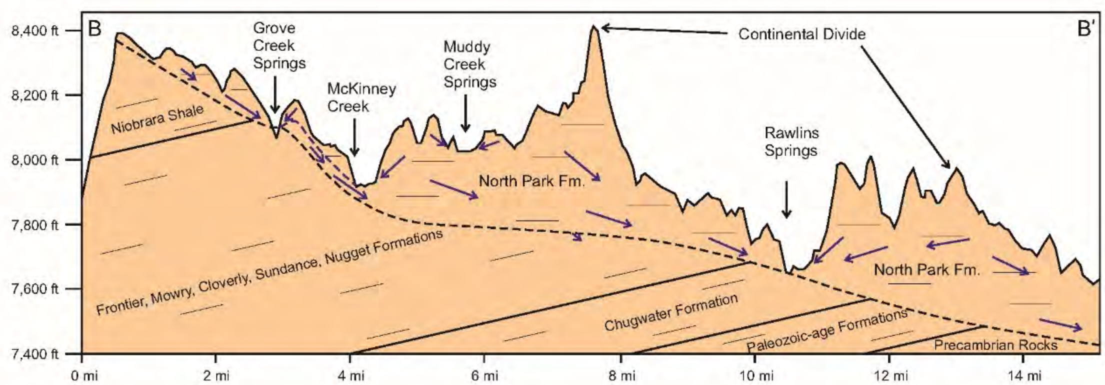

Figure 3B - Cross Section B-B′ through Rawlins Springs in Upper Sage Creek Basin

Figure 11 - Cross-section B-B', upper Sage Creek Basin (Hinckley, 2015).

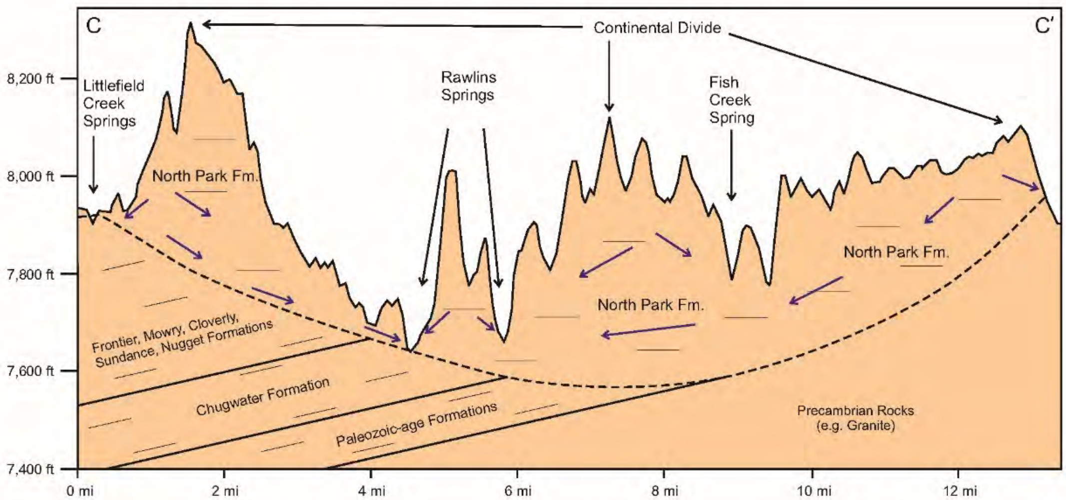

Figure 3C - Cross Section C-C′ through
Rawlins Springs in Upper Sage Creek Basin

Figure 12 - Cross-section C-C', upper Sage Creek Basin (Hinckley, 2015).

4.2 RECHARGE AREA

Finally, Figure 13 presents a potential Recharge Area for the Rawlins springs based on the information and interpretations presented above. This includes areas outside the topographic catchment of the springs where the groundwater divides are interpreted not to coincide with the surface divides. This includes areas in which shallow portions of the aquifer may discharge to streams flowing in one direction (e.g. Muddy Creek, Fish Creek), while deeper portions of the aquifer discharge to the Rawlins Springs.

The precise boundaries of the suggested recharge area cannot be known without considerably more information, e.g. drilling to establish water-level elevations. However, Hinckley Consulting believes Figure 13 represents a credible, conservative (i.e. larger rather than smaller) potential Recharge Area based on current knowledge, suitable for establishment of appropriate protective measures.

Figure 13 includes an area at the southeast end of the suggested Recharge Area where the basement rocks (largely granitic) of the Sierra Madre are exposed at the surface. This area drains (surface topography) onto the Browns Park Formation potentially contributing to the Rawlins Springs via subsurface flow beneath the surface drainage basin of the North Fork of Savery Creek. Evidence that this water is infiltrating into the Browns Park is the change in streamflow from perennial to intermittent, as indicated on USGS mapping, and direct observation. The "potential recharge" boundary in this area is defined by the surface drainage onto the North Park Formation. (This topography-based boundary is the "bulge" at the lower right in Figure 13.)

The area of the suggested potential Recharge Area of Figure 13 is 65 square miles. This boundary includes areas seemingly remote from the Rawlins springs, but is consistent with the mass balance required by the 884 million-gallon average annual production from the springs (PMPC, 2013). Based on the average 22-inch annual precipitation reported for the Sage Creek Basin SNOTEL site, the suggested Recharge Area requires 10% of the annual precipitation infiltrates to recharge groundwater and 37% of that recharge is captured by the Rawlins springs.

Competition with groundwater recharge for the annual precipitation input to the area includes surface runoff, evaporation of rainfall, sublimation and off-site transport of snow, and vegetation evapotranspiration from the soil profile. A 10% factor is not well constrained but reasonable for this setting. Lower values are commonly indicated for basin areas of Wyoming.

Recharge reaching the groundwater table is lost to various perennial springs and streams draining the upper portions of the Browns Park Formation (as shown on the cross sections), to many small, intermittent springs and seeps, to further infiltration to deeper formations, and to leaks and bypasses in the Rawlins springs collection and transmission system above the points of measurement. With the understanding that the overall capture efficiency of a system of this scale and type is very poorly bounded, the calculation that the Rawlins springs capture 37% of all groundwater recharge within this area suggests the proposed potential Recharge Area is not overly expansive (conservative). A substantially lower capture ratio would not be unreasonable, all things considered.

Seasonal variations in spring flow reflect commensurate variations in recharge, e.g. a pulse of recharge resulting from spring snowmelt followed by a slow decline in groundwater levels as the aquifer "drains down" via the springs. Travel times have not been evaluated for this system, but likely include both immediate (local snowmelt) and long-term (migration from remote portions of the Recharge Area) components. Contamination entering the aquifer from surface and/or subsurface sources within the Recharge Area will eventually migrate to discharge at the springs.

Figure 13 also shows surface ownership (shading), federal mineral ownership (cross hatching), the extent of the RMP Amendment withdrawal from mineral leasing activity, and the existing withdrawal of the Grizzly Habitat Management Area. Federal mineral ownership within the suggested potential Recharge Area, outside the Grizzly HMA, totals 23,326 acres, approximately 56% of the total area (Hinckley, 2015).

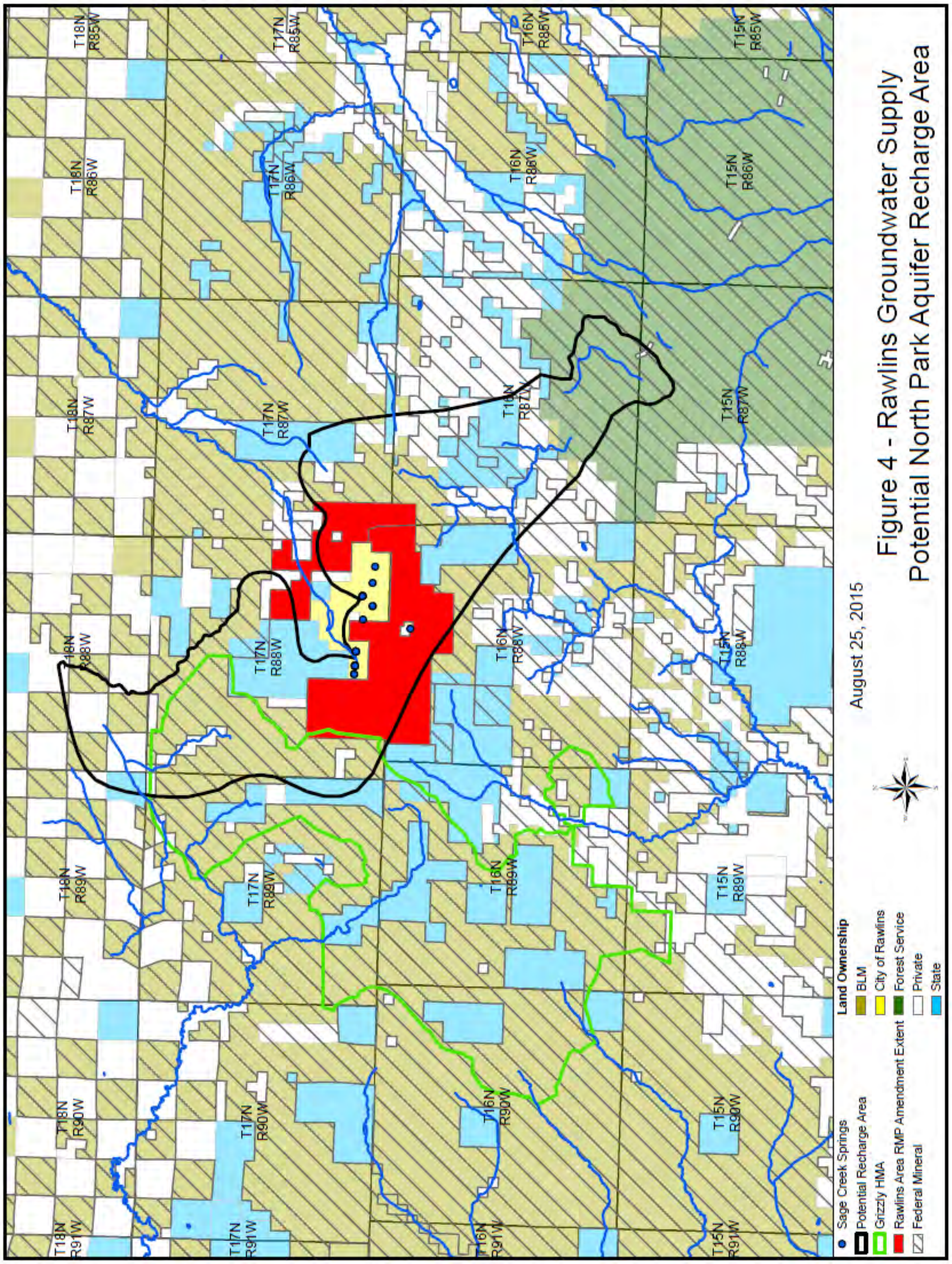

Figure 13 - Potential North Park Aquifer recharge area (Hinckley, 2015)

5 CONTAMINANT SOURCE INVENTORY

5.1 INTRODUCTION

Due to its high alpine location, largely untouched by development, there are few risks to the City of Rawlins' source water in the Sage Creek Basin. However, because this land has not been extensively developed, it may present itself as an opportunity to future investors. Energy development, mineral extraction, logging, recreation, and residential development are all viable uses for the land within the recharge area. Therefore, this SWPP identifies potential current contaminant risks as well as possible future contaminant risks and how to manage them.

The Source Water Assessment Report (Lidstone 2004) determined that the susceptibility of Rawlins' water sources to contamination is generally low, with the Sage Creek Springs each given an integrity score of 8. An integrity score of 8 is the highest score obtainable while still being classified as having low susceptibility. This score was determined based on three factors. First, improvements to the springs were completed before 1983, which was when the State of Wyoming had less stringent construction standards. Second, there is a long conveyance length between the springs and the City of Rawlins. Third, although each of the springs is enclosed, they are accessible to the public and they are not inspected regularly (Lidstone and Associates, Inc., 2004).

5.2 APPROACH

Engineering Associates researched existing data sources and identified the potential contaminant sources located within the Sage Creek Basin recharge area. Existing sources were then verified in the field. Research included looking at regulatory reporting databases including the following EPA and WDEQ databases:

- Underground Injection Control (UIC),
- National Pollution Discharge Elimination System (NPDES),
- Spill Prevention Control and Countermeasure (SPCC),
- Toxic Chemical Release Inventory (TRI),
- CERCLA Information System (CERCLIS),
- Hazardous Waste Data Management System (HWDMS),
- RCRA Information System (RCRIS),
- Waste Management Permit Compliance System,
- Hazardous Material Incident Reporting System,
- Underground Storage Tanks Case History File,
- The Pollution Prevention Information Clearinghouse (PPIC),
- Federal Reporting Data System (FRDS),
- Leaking Underground Storage Tank database (LUST),
- Groundwater Pollution Control Program database.

A field investigation was also conducted to determine the various land use activities in the recharge area for potential contaminates. Land uses activities observed included livestock grazing allotments, recreation areas, residential areas, and forestry activities.

After identifying the current sources of potential contaminates, possible future sources were identified by contacting land managers within the recharge area. A list of possible contaminates stemming from development or leasing opportunities was developed with the land managers.

5.3 EXISTING SOURCES OF POTENTIAL CONTAMINATION

All sources of contamination are designated as potential because they have not yet been documented to have caused source water contamination. Table 1 contains a list of potential known contaminants within the recharge area and Table 2 contains a list of potential future contaminants.

Table 1 - Known potential contaminants

Nature of Site	Site Location	Potential Source	Priority
Aging infrastructure	Throughout the recharge area	Conduit for contaminants	High
Residential areas	T17N R88W: Sections 24 and 25	Septic systems, hazardous wastes, pesticides and fertilizers, erosion	Medium
Springs	T17N R88W: Sections 33, 34, 35, 36. T16N R88W Section 3	Conduit for contaminants	Low
Wells	T17N R88W: Sections 24 and 25.	Conduit to groundwater	Low
Erosion	Throughout the recharge area	Sediment; application of pesticides	Low
Agricultural use	Throughout the recharge area	Animal waste, grazing impacts, application of pesticides	Medium
Recreational use	Throughout the recharge area	Human waste, trash resulting from dispersed camping	Medium
National Forest	T16N R87W: Sections 21, 22, 26, 27, 28, 29, 33, 34, 35. T15N R87W: Sections 2 and 3	Fuel from operating equipment, pesticide application	Low

Table 2 - Potential future contaminants

Type of Development	Site Location	Potential Future Source	Priority
Road Development	Throughout the recharge area	Sediment	High
Chokecherry Sierra Madre Wind Energy Project	T18N R88W, various sections	Fuel from operating equipment, erosion, spills	Low
Oil and Gas Development	Throughout the recharge area	Fuel from operating equipment, erosion, spills	Medium
Mining	BLM and State Land	Fuel from operating equipment, erosion, spills runoff,	Low
Above Ground Storage Tanks	Throughout the recharge area	Diesel	High

5.3.1 Aging Infrastructure

The Sage Creek Transmission infrastructure was originally constructed in 1923 with wood stave, steel banded pipe. The original drawings are included in this Plan as Appendix A. The estimated design life, at the time of original construction, was 90 years. Today, the wood stave pipelines have exceeded their useful life and should be replaced. Some lines have been replaced with PVC pipe in the decades since.

The main transmission line from Rawlins Reservoir to the City of Rawlins was replaced with steel pipe in the late 1980s. The pipeline was replaced in two phases, starting from the city and finish at the collection structure in Sage Creek basin. However, much of the pipe from the spring boxes to the main transmission line is still the original wood stave pipe, generally near the spring boxes. These original pipes could be susceptible to failure from deterioration or steel band failure. Figure 14 shows a leak surfacing from a wood stave pipe, where water supply to the City is lost and a conduit for contamination is present.

Figure 14 – Water surfacing from a leak in a wood stave pipe

5.3.2 Residential Areas

There is one remote residential community, the Hidden Valley Estates, on the north-eastern border of the recharge area with approximately 15 homes. Septic systems within the recharge area, especially any poorly functioning or system injecting without treatment, are of concern because they may provide a direct route for sewage effluent to enter the groundwater. Nitrates, bacteria, and household hazardous wastes are all potential contaminants associated with septic systems. Additionally, remote residences may generate household hazardous wastes that, if improperly disposed of, may enter groundwater. Fertilizers and pesticides have the potential to enter the groundwater either through runoff into drainages or through leaching if improperly applied.

5.3.3 Springs

There are 24 developed springs with spring boxes across the Sage Creek Basin, with an estimated three to five additional undeveloped springs. Water flows freely at the ground surface around some of the spring boxes during peak flow periods. Spring boxes can provide a direct pathway for surface contaminants to enter the groundwater.

5.3.4 Wells

Water supply, stock watering, irrigation, and domestic use wells are all present within the recharge area. Improperly abandoned wells within the recharge area could provide a direct pathway for contaminants to enter the groundwater.

5.3.5 Erosion

The Sage Creek watershed has highly erosive soils as well as an arid climate making the source water susceptible to sediment loads. Surface erosion from the deterioration of existing dirt roads within the recharge area presents a low risk as much of the collection system is underground. Since much of soils in the watershed are naturally erosive and display erosional features in response to precipitation events in the forms of gullies and sheet and rill soil movement, there is an increased sediment load in the source water because of roads and grazing (BLM, 2014). However, the fine soils can be transported from the soil matrix adjacent to the collection system into the pipe. Reducing sediment into the system by effective collection system design will improve water quality, treatment, and reservoir life.

5.3.6 Agricultural Use

Waste from livestock grazing and the applications of fertilizers and pesticides pose a risk to the source water within the basin. Furthermore, livestock can break or damage the shallow-buried wood stave pipe, especially where soils are muddy from leaking pipes.

5.3.7 Recreational Use

Dispersed camping, often associated with hunting, occurs frequently within the recharge area. Poor sanitation practices around more popular dispersed camping areas can result in human waste left on the ground surface. Trash and litter can also be left behind. These can be a risk to the water supply when occurring near the springs. Damage from vandalism to infrastructure is also possible.

5.4 Potential Future Contaminant Risks

Currently, there is generally high integrity and low susceptibility to contamination within the Sage Creek Basin (Lidstone and Associates, Inc., 2004). Abating future risk is one objective of this protection plan.

5.4.1 Road Development

Two track roads are common throughout the recharge area. Without proper design and maintenance, these roads can erode heavily and transport sediment into the water supply. Automobile wastes and petroleum products associated with these informal transportation routes can also accumulate over time and become introduced into the groundwater through storm runoff. These risks increase when roads are developed for commercial purposes and receive increased traffic.

5.4.2 Wind Farm

The Chokecherry and Sierra Madre Wind Energy Project is currently in its construction phase, which includes road development and the assembly of wind turbines. Road development will be the primary potential source of contamination during this phase of the project. Development of dirt roads and construction sites can cause erosion, dramatically increasing sediment loads in the source water.

The roads being developed for the project will provide access to approximately 50 turbines that will be located within the potential recharge area. Each turbine will be erected on a concrete pad. Concrete trucks and heavy equipment will be operating within the recharge area. Contaminants from spills and petroleum products accumulating on the roadways can be introduced to the groundwater through storm water runoff.

5.4.3 Oil and Gas and Pipeline Development

The Sage Creek Basin is currently a highly functioning riparian area but because of highly erosive soils, has a naturally high sediment load. Surface disturbance from oil and gas development would cause increased erosion that would potentially increase sediment loading in the source water (Bellis, 2015).

5.4.4 Logging

The southern end of the recharge area is located within the Medicine Bow National Forest. Logging operations include the development of roads and the use of heavy equipment. Road development in the highly erosive soils within the Sage Creek Basin would allow sediments to enter the groundwater more readily. Petroleum products from heavy equipment operation can also be introduced to the groundwater through storm runoff.

5.4.5 Mining

A U.S. Geological Survey Bulletin found that several areas of the Sage Creek Basin have uranium deposits. These deposits are located only about a mile south of the springs (James M. Montgomery, Consulting Engineers, Inc., 1982). According to Mark Newman, a geologist with the Bureau of Land Management, the USGS followed up on this study and found that the minerals are likely not developable. Geologic conditions are not favorable for sand, gravel, or other ore minerals (Hinckley, 2018). Small scale quarry operations for the purpose of road building are likely in the immediate vicinity of new road construction.

Mining operations use fuel and blasting materials that if improperly handled or stored, may contaminate the source water of the basin. In addition, disturbance to the ground can cause acid mine drainage to enter the groundwater.

5.4.6 Above Ground Storage Tanks

With any major construction projects, above ground storage tanks containing diesel or other effluent may be located within the recharge area during potential future development.

6 CONTAMINANT MANAGEMENT

The purpose of the SWPP is to identify and minimize the existing and potential contaminant threats to the City of Rawlins' municipal water supply. To meet this goal, effective management of the identified sources of potential contamination must be implemented. A wide variety of management strategies can be executed depending on the potential threat to the water supply and the public's reception of the proposed strategies. The Steering Committee has compiled the following management strategies for the potential contaminant sources.

Figure 15 - Direct connection between spring box and water on ground surface

6.1 SPRINGS

Numerous springs are located throughout the recharge area and provide a potential direct pathway from the ground surface to the underlying groundwater. There are several undeveloped springs within the Sage Creek Basin. These springs are exposed to the environment and are at greater risk for groundwater contamination. Springs that are in undeveloped upland areas, away from contaminant sources, present less of a threat. Some of the developed springs currently in use by the City occasionally exceed the capacity of their pipes and surfaces around their spring boxes. When the water level decreases seasonally, contaminants present in near-surface water surrounding the spring boxes have a pathway to be transported back into the City's water supply. This makes these developed springs a potential conduit for contaminants within near-surface groundwater to be transported into the City of Rawlins' municipal water supply.

6.2 AGING INFRASTRUCTURE

The existing water system consists in many places of wood stave pipeline and aged concrete spring boxes. Spring boxes are estimated to date from the early 1950s. In many locations, the original tile spring collection lines were replaced with perforated PVC pipe throughout the 1970s, 80s, and 90s, but not recently. Most or all concrete spring boxes are in acceptable shape.

The remaining wood stave pipe and other broken infrastructure result in water loss, and connection between surface water and the water system. It is strongly recommended that the City of Rawlins replace all wood stave pipeline with PVC pipe. Proper pipeline design would allow capture of the spring water without pooling of water on the ground surface at the collection boxes which greatly increases the risk of contamination.

As a lower priority, it is also recommended that the existing collection pipe and boxes be replaced with new construction to improve capture and limit the potential for contamination. Systematic replacement and/or maintenance of the spring collection system would ensure maximum flow is received into the system with minimal losses, and reduced potential for contamination. At over 50 years old, even in serviceable condition, these boxes are reaching the end of their expected design life.

We opine that pooling of water on the ground surface adjacent to the spring boxes is the greatest potential pathway for contamination of the city's water. Improving the collection and pipe infrastructure will limit the possibility of contaminants entering the water system.

In addition, new collection boxes could be installed at springs that are not connected to the system to ensure these springs do not become a pathway for surface contaminants. This would likely require an enlargement of the City's water rights. New springs should be connected to the system with PVC pipe. A detailed description of proposed improvements, with costs estimates, is presented in Section 7.

6.3 RESIDENTIAL AREAS

6.3.1 On-site Wastewater Treatment (Septic) Systems

Carbon County does not currently inspect or permit septic systems. It is recommended that Carbon County require permitting and inspection of new and replaced septic systems and leach fields. This could be accomplished by a zoning overlay district covering the recharge area.

6.3.1.1 Inspections

Inspection could be performed by County or City staff prior to backfilling. This would allow the City to verify proper installation and confirm design information stated in the permit application. In high-risk locations, inspections could be performed every five years thereafter.

6.3.1.2 Pumping

The septic systems should be pumped out at least once every five years or on a schedule that is recommended by a licensed wastewater hauler/pumper. As an alternative to mandatory pumping, an inspection by licensed pumper could be required to evaluate septic system performance.

6.3.1.3 Education

Approximately 12 locations within the Sage Creek Basin recharge area have conventional septic systems. Public education is recommended to promote proper maintenance of these septic systems. The Environmental Protection Agency provides the following information on their website:

- How septic systems work,
- Septic system maintenance and care,
- Proper responses for septic system failure, and
- How septic systems can impact nearby water sources.

Landowners should receive education on the effect their septic system has on the water quality for the City.

6.3.1.4 Design and Location Standards and Certification of Systems

It is recommended that the City and County regulate installation, design, repair, and removal of septic systems located within the recharge area. Systems should be constructed in accordance with plans and specifications prepared by a professional engineer licensed to practice in the State of Wyoming. This has been implemented in other communities and groundwater protection areas in Wyoming, and results in better compliance with existing state regulations governing the construction of on-site wastewater treatment systems.

6.3.1.5 Evaluate Septic System Risks

It is recommended that a site-specific investigation be conducted as part of designing proposed on-site wastewater treatment systems or whenever any septic system is being repaired, replaced, or installed. The site-specific investigation should be performed by a Wyoming registered engineer and/or Wyoming licensed geologist qualified to perform the investigation.

If the site-specific investigation determines that leachate from the on-site wastewater treatment system may infiltrate through faults, fractures, or dissolution features and into the Rawlins water supply, it is recommended that the septic system be deemed inappropriate for the subject site and either the development must connect to a centralized system or be moved to an appropriate site.

This requirement may be incorporated into County land planning regulations, and addressed at the time of development and occupancy.

6.3.2 Pesticide and Fertilizer Application

Residents within the recharge area may apply pesticides and fertilizers to landscaped areas. These chemicals have the potential to leach into the groundwater, especially if applied improperly.

6.3.3 Landscaping Requirements

New developments which may require landscaping within the recharge area are recommended to use native plants, low maintenance and low water vegetation, and xeriscape concepts. Native vegetation will reduce the amount of pesticides, herbicides, and fertilizers that need to be applied. County Planning commission should be aware of these benefits and encourage the use of native plants and xeriscape landscaping.

6.4 WELLS

Any well completed in the recharge area provides a direct conduit for the potential introduction of contaminants into the groundwater. Wells, whether for water supply, stock watering, irrigation, or domestic use, must comply with the well construction standards from the Wyoming State Engineer's Office (SEO) or the WDEQ. The SEO provides well design requirements in their Regulations and Instructions, Part III, Water Well Minimum Construction Standards. The WDEQ does not regulate the construction of domestic wells, but Chapter 11, Part G, and Chapter 12, Section 9 of Wyoming Water

Quality Rules and Regulations apply to the construction of monitoring wells and municipal water supply wells, respectively.

6.4.1 Recommendations for New and Existing Wells

6.4.1.1 Design of New Wells

It is recommended that the City and County adopt the regulations defined in WDEQ Chapter 26, and enforce as a condition of building permit Certificate of Occupancy. The regulations prohibit wells that are not properly capped and not cased to at least the top of the production zone with an annular space between the top of the production zone and the ground surface to be sealed with grout. The cement grout seal prevents the vertical migration of chemical, biological, or radiological contaminants via the well and annulus. Annular seals will also reduce the waste of groundwater leakage and prevent the mixing of groundwater between aquifers.

6.4.1.2 Education

Public education will increase awareness of how private wells may become a pathway for contaminants. Of importance is that wells should be properly capped (i.e. locked or bolted closed) to prevent unauthorized direct access to the interior of the well. Information in the form of a brochure should be prepared to inform well owners of the importance of properly constructing, capping, and abandoning wells. These can be distributed to residences within the recharge area.

6.4.2 Recommendations for Abandoned Wells

Proper abandonment of wells is imperative to protecting the source water. Improperly abandoned wells are particularly hazardous because the well is an open direct conduit between the ground surface and the groundwater. The locations of improperly abandoned wells are often unknown, making accidental introduction of contaminants more likely. It is also difficult or impossible for City or County staff to identify abandoned well locations or owners.

Wyoming Department of Environmental Quality Rules and Regulations require landowners to properly plug and abandon wells in accordance with Chapter 11, Section 70, Part G.

If staff become aware of the presence of an abandoned well, City staff should contact the well owner. The landowner should first be educated and advised of the hazards posed by an improperly abandoned well and instructed on the proper methods of closing it. The WDEQ and the SEO should also be advised of the presence of an abandoned well for the enforcement of existing regulations.

Information in the form of a brochure should explain that abandoned and improperly constructed wells may serve as a conduit for surface contamination to reach groundwater. The brochure should provide information on how to properly plug and abandon a well.

Information on new and abandoned wells can be provided to the public through an annual mailing; newspaper article; or other means. A campaign targeted towards people who own property within the recharge area may be most effective.

6.5 Underground Injection Control (UIC) Wells

UIC wells have the potential to introduce contaminants directly to the aquifer, but are regulated by the Wyoming DEQ under various regulations. Currently there are no known UIC wells in the recharge area but because of their inherent purpose, could cause future groundwater degradation and should be prohibited.

Classes I, II, III, and IV UIC wells as defined in WDEQ Chapter 13, and most Class V UIC wells as defined in WDEQ Chapter 16, would cause groundwater or aquifer degradation due to their inherent use. However, some types of UIC wells are considered beneficial. Beneficial uses include but are not limited to remediating groundwater, replenishing groundwater in an aquifer, or confining contaminants inside an aquifer. Class V: 5E3, 5E4, and 5E5 UICs are all types of wastewater disposal systems which are permitted by WDEQ. They are appropriate alternatives to septic systems and may help protect groundwater quality. Class V: 5A1 (e.g. direct heat reinjection facilities) and 5A2 (e.g. heat pump/air conditioner return flow facilities) should be restricted to only those which use plain water without additives, and with special construction to prevent surface contamination.

6.5.1 Regulation

All UIC wells should be prohibited in the recharge area, except those disposing of residential wastewater free of contaminants; treated stormwater; and for groundwater remediation. All UIC facilities, including residential wastewater systems, should be designed by a professional engineer licensed in Wyoming.

6.6 EROSION

Identify and correct problems with improved roads, which affect the local hydrology and soil erosion. Erosional problem areas on two-track roads should also be identified and fixed, or the road(s) should be closed and reclaimed. Supporting the WGFD in implementing a seasonal closure for antler collecting throughout the watershed during the beginning of each year would further reduce seasonal road damage (BLM, 2014).

The implementation of vegetation treatments where needed would minimize surface runoff and soil erosion. This would also restore plant communities to diverse species, age classes, and cover types as well as promote composition of communities to maximize herbaceous cover and litter.

The public should be educated on their role in public land management, particularly in regards to the impacts resulting from driving vehicles off-road, or on unimproved roads.

6.7 AGRICULTURAL USE

Agriculture plays a large part in the quality of surface water within the Sage Creek Basin. The Saratoga Encampment Rawlins Conservation District (SERCD) realizes this and has been creating and implementing Best Management Practices (BMPs) to improve water quality as part of its watershed planning efforts (BLM, 2014). The Sage Creek Basin falls under these planning efforts.

The City currently leases pasture to the Overland Trail ranch. The current lease is due to expire in 2022. Careful livestock management will reduce the risk of contamination to the water source by livestock.

The current livestock grazing management system manipulates duration and season of use to provide some growing season rest in each pasture, coupled with the development of upland water sources to improve livestock distribution. Most allotments within the watershed now have some type of pasture management system. Specific dates or times for grazing must be decided upon on a case-by-case basis.

These management plans have resulted in both improved cover and site stability. Species, such as basin wildrye, have expanded in the valley bottoms, adding litter and cover that help hold sediment from adjacent uplands.

Figure 16 - Evidence of spring use by livestock

Along wetter draws, willows have expanded greatly to improve channel stability. Heavy grazing often results in loss of willows. Areas with historical impacts, still observable today, are old sheep bed-grounds along trail routes, adjacent to water sources, and on ridge tops. Plant cover and species composition were negatively affected by the trampling and soil compaction, with site recovery still occurring.

It is recommended that fencing be installed around critical system components such as collection boxes and shallow pipelines to ensure these fixtures are not damaged by grazing livestock (see Figure 16). This will also prevent contamination to the system from animal waste in the event of a break in a pipeline.

It is also recommended to work with private landowners to continue to implement BMPs for livestock grazing. It is also recommended that Rawlins work with the BLM to include BMPs and additional language as needed in grazing leases within the Recharge Area. BMPS may include:

- Managing the duration of and season of grazing (dates specified),
- Managing the distribution of livestock, including herd size and movement,
- Constructing and maintaining pasture fencing,
- Maintaining riparian buffers, filter strips, and grassland swales,
- Implementing various vegetation treatments.

These BMPs and others are detailed in a manual intended for private landowners in Wyoming produced by the Wyoming DEQ (Wyoming DEQ 2013).

Alternatives to intensive grazing could include limited or no grazing. Reductions in grazing could be coupled with managed recreational use.

6.8 Recreational Use

Recreational use contributes to potential for contamination by human waste and litter. The construction of vault toilet(s) in conjunction with managed dispersed or campground camping could reduce impacts from recreation.

6.9 Road Development

It is recommended that public land agencies require BMPs for road development on public land and that private land owners adopt these same road design techniques. BMPs may include:

- Surface roughening,
- Diversion ditches, slope drains, and earthen berms,
- Rock checks in ditches,
- Use of vegetative buffers and silt fences,
- Inlet protection, including sediment traps,
- Erosion control blankets and mulching.

6.10 Wind Farm Development

Wind farm development brings significant road construction, land disturbance, and higher traffic at target areas. These bring increased risks of disruption of surface hydrology, sediment transport, petroleum spills. The City should monitor the construction and operation of the proposed Chokecherry and Sierra Madre Wind Energy Project to ensure BMPs are adhered to throughout the lifespan of the project. It is recommended the City work closely with the BLM to ensure best management practices for wind farm development are strictly followed within the recharge area.

As currently proposed, the referenced wind farms are mostly outside the recharge area, and present low risk. However, this should be monitored by the City as new projects are proposed or modified.

6.11 Oil and Gas

The Sage Creek Basin is underlain predominantly by federal minerals. Rawlins, concerned about oil and gas leasing within its water supply, approached the BLM about the possibility of closing the area to mineral leasing. The Rawlins Field Office (RFO) initiated the process for a Resource Management Plan (RMP) amendment which would require no surface occupancy within "Rawlins Area RMP Amendment Extent" or Zone 1. The RMP Amendment process is lengthy so the City of Rawlins, in conjunction with the BLM, will continue to pursue the amendment until completion.

It is recommended that the City work with the BLM to require BMPs and additional language as needed for lease stipulations in areas outside the RMP Amendment area, but still within the potential Sage Creek Basin recharge area. These BMPs would include:

- No surface occupancy in the Basin,
- Centralized liquid storage facilities,
- Centralized hydraulic fracturing operations,
- Closed-loop drilling,
- Cementing each casing string to surface,

- Use of biodegradable and eco-friending drilling additives,
- Multi-well pads,
- Pad/mat drilling,
- All produced/flow back water would be deposited in tanks and not pits,
- Green completions.

A complete list of oil and gas BMPs can be found in the Rawlins Field Office Resource Management Plan in Appendices 13, 15 and 20.

6.12 Logging

The Wyoming State Forestry Division (WSFD) and the WDEQ jointly developed the Forestry BMPs – Water Quality Protection Guidelines. It is recommended that forestry leases require the adherence to the BMPs outlined in this document. In addition, the USDA and the Forest Service developed the National Best Management Practices for Water Quality Management on National Forest System Lands – Volume 1: National Core BMP Technical Guide. It is recommended that forestry leases require adherence to the BMPs required for aquatic zones outlined in this document.

6.13 Mining

It is recommended that the BLM turn down permits for common variety minerals (ex: sand, gravel, stone, etc.) in the recharge area. Locatable minerals (ex: uranium, coal, molybdenum, etc.) fall under the protections of the Mining Law of 1872. The Bureau of Land Management, in conjunction with the City of Rawlins, can withdrawal the Sage Creek Basin from the Mining Law of 1872, however, it is an extensive process that requires congressional approval. Due to the small probability of mineral resources in this area it is only recommended that common variety minerals in the recharge area be regulated.

6.14 Aboveground Storage Tanks (ASTs)

ASTs are generally used to store fuel. Leaks from tanks storing hazardous materials may pose a threat to the City's municipal water source. New ASTs are regulated by the state of Wyoming. These regulations, when followed, would significantly reduce the risk of contamination from storage. They do not address the greater risk from a spill during transport of fuel to a place of use or storage.

6.14.1 Design and Location Standards

ASTs should be designed and operated according to the State of Wyoming's standards (Chapter 17, Water Quality Rules and Regulations). Regulations include:

- Store hazardous material in an enclosed structure or under a roof which eliminates stormwater entry to the containment area.
- Provide floors within a structure where hazardous material is stored, coated to protect the surface of the floor from deterioration due to spillage of any such material. A structure which may be used for storage or transfer of hazardous material shall be protected from stormwater run-on and groundwater intrusion.
- Store hazardous material within an enclosed impermeable containment area which is capable of containing at least the volume of the largest container of such hazardous material present in the area or 110% of the total volume of all such containers in the area, whichever is larger, without overflow of released hazardous material from the containment area.
- Store hazardous material in a manner that will prevent the contact of chemicals with any materials so as to create a hazard of fire, explosion or generation of toxic substances.

- Store hazardous materials only in containers that have been certified by a state or federal agency or the American Society of Testing Materials as suitable for the transport or storage of the material.
- Store all hazardous material in an area secured against entry by the public, except items offered for retail sale in their original unopened containers.
- Not use, maintain, or install floor drains, dry wells or other infiltration devices or appurtenances which allow the release of wastewater to the groundwater.
- Not discharge any substance or material to the ground unless the discharge is permitted by law.

6.15 Land Acquisition

Land acquisition may be used as a management strategy to protect the most sensitive areas of the recharge area. Land acquisition includes: purchasing, donations, conservation easements, land exchanges, transfer of development rights, and Memorandums of Agreement (MOA) or Memorandums of Understanding (MOU).

6.15.1 Purchasing

Purchasing land would allow the City the greatest control of land use and access, ensuring protection of the most critical areas within the Sage Creek watershed. As a long-term goal, it would be advantageous if the City of Rawlins were to purchase all land within recharge area. However, given the extent of the recharge area and the varied land ownership of the area, this is unrealistic. Public lands, and other Federal and state-owned lands are not available for purchase. Instead, the City should work towards purchasing parcels that would offer the greatest value for protection of the water source. To accomplish this, the City can:

- Budget funds for the express purpose of protecting lands in the recharge area.
- Identify privately owned parcels that pose greatest risk of contamination of the water source. These might be parcels surrounding and/or adjacent to the springs; contribute significant recharge to the City's springs; or are likely to be developed in ways that increase the risk of contamination.
- Evaluate and rank various parcels according to their risk to the water source versus cost of acquisition.
- Implement a program to purchase the parcels as funds are available.

6.15.2 Conservation Easements and Other Land Acquisition Mechanisms

It is recommended that the City implement a conservation easement program that will allow landowners to set aside a portion of their land to protect the land from development. Transferring development rights and land exchanges would also allow the City developmental control over specific land areas and should be considered as the City continues to protect the recharge area. These methods allow landowners to continue agricultural land uses while reducing risk to the City. These easements can be significantly less costly than purchasing the land outright, and often are of greater interest to landowners.

The same steps identified above for the purchase of lands can be applied to purchase of conservation easements.

7 CONCLUSIONS AND RECOMMENDATIONS

Recommended improvements, management actions, and cost estimates are presented in this section.

7.1 LAND MANAGEMENT

A holistic approach to managing City-owned lands within the basin is recommended. The land should be managed to protect the City's water resource. This will include:

- Careful, limited grazing for optimum range health. Grazing lease should be tied to range-health indicators. Consideration should be given to very short-term or no grazing.
- Management of recreational uses, including dispersed camping, to prevent human waste in or near springs.
- Regular inventory and assessment of land and water resource health.
- Education of the public including outreach, signage, mailings, and publications.

7.2 FENCING AND ACCESS CONTROL

Protecting the ground surface in the vicinity of the springs from surface disturbance should lead to better vegetation, less sediment transport, and higher water quality. Springs, seeps, and water courses in the vicinity of the springs should be fenced to keep out livestock, limit wildlife grazing, and reduce human access. Fencing should surround riparian areas, and be wildlife friendly. Fenced areas will prevent cattle and other animals from congregating in springs and riparian areas, which is shown to decrease water quality. Considerations should be made for ongoing maintenance access.

Provision may need to be made to provide stockwater to grazing allotments in the vicinity, and to wildlife. Furthermore, managed (brief) grazing within the fenced areas may be beneficial, when rotated as part of a grazing plan incorporating BMPs for riparian zones.

7.3 SPRING PROTECTION

7.3.1 Properly Size Collection System

Resize and replace spring pipeline and collection boxes to ensure proper capacity and eliminate connection between interior of spring box and standing water on ground surface. If there are springs that are not connected to the system that have adequate flow, they could have a collection box installed and be connected to the existing system with PVC pipe, with appropriate water rights enlargement(s).

7.3.2 Land Purchases and Regulations

It is recommended that the City purchase lands within the Sage Creek Basin that are near or contain the springs, and prohibit all uses except for open space.

7.3.1 Education

Public education will increase the awareness of how these springs may provide a potential pathway for the migration of contaminants from the ground surface to the source water. Through education, the City and County should work to ensure that land use practices in the vicinity of the springs protect the water source. This should include signage in the vicinity of the springs.

Local landowners can receive education from Carbon County Weed and Pest regarding the potential for various applied chemicals to contaminate drinking water, and what applicators can do to reduce potential harm to the aquifer and/or springs.

7.4 Spring Boxes and Collection Laterals

A significant risk to the City of Rawlins' source water is failure of the wood stave pipeline that connects the springs to the main transmission line (see also Appendix A). Failure of these pipes could not only create a conduit for contaminants to enter the City's drinking water supply, it would substantially decrease the supply of drinking water to the City.

It is recommended that the City of Rawlins rehabilitate the spring collection system. Rehabilitation would consist of the following:

- Replacement of 24 spring boxes (this work could be phased).
- Installation of 24 spring laterals with perforated pipe and filter gravel.
- Installation of sluice gates in each new spring box.
- Replacement and enlargement of about 34,000 feet of pipeline with modern PVC (C900 or SDR26).
- Installation of 12 new junction boxes (none currently exist).
- Installation of 7 new water meters. These could be non-powered totalizing meters.

Cost estimates are presented in the next section. Important cost considerations include the remote location, short construction season, and a 4-ft typical bury depth.

7.5 Collection System Rehabilitation Cost Estimate

The estimated capital costs to rehabilitate the spring collection system are shown in Table 3, as introduced above. Note that the opinions of probable construction cost presented here are preliminary, and contain a significant amount of uncertainty due to timing and changing local economic conditions due to windfarm development. The contingency was set at 15%.

Table 3 - Collection System Rehabilitation Cost Estimate

RAWLINS SPRING COLLECTION SYSTEM REHABILITATION				
ITEM	**UNIT**	**EST QTY**	**UNIT PRICE**	**TOTAL ESTIMATED PRICE**
MOBILIZATION	LS	1	$190,638	$190,638
FENCING AND ACCESS CONTROL	LF	30,000	$5	$135,000
SPRING BOX REPLACEMENT W/ SLUICE GATE	EA	24	$15,000	$360,000
SPRING BOX LATERALS	EA	24	$12,500	$300,000
JUNCTION BOX	EA	12	$15,000	$180,000
WATER MAIN CONNECTION	EA	1	$3,000	$3,000
6" PVC WATER MAIN	LF	15,487	$50	$774,350
12" PVC WATER MAIN	LF	8,759	$62	$543,058
15" PVC WATER MAIN	LF	9,580	$75	$718,500
12"X6" DIP TEE	EA	5	$3,000	$15,000
12"X12" DIP TEE	EA	1	$3,500	$3,500
6" DIP BEND	EA	4	$2,000	$8,000
12" DIP BEND	EA	4	$2,200	$8,800
15" DIP BEND	EA	2	$2,300	$4,600
6" WATER METER	EA	3	$4,000	$12,000
12" WATER METER	EA	4	$6,000	$24,000
METER VAULTS	EA	7	$9,000	$63,000
AIR RELEASE VALVE	EA	7	$3,500	$24,500
SUBTOTAL				**$3,367,946**
DESIGN ENGINEERING (10%)				$336,795
CONSTRUCTION ENGINEERING (10%)				$336,795
CONTINGENCY (15%)				$505,192
OPINION OF PROBABLE CONSTRUCTION COST				**$4,546,728**

The same costs in the table above are summarized in Table 4 below, in WWDC format.

Table 4 - Summary of Collection System Rehab Cost Estimate, WWDC Format

Preparation of Final Designs and Specifications	$336,795
Permitting and Mitigation	$10,000
Legal Fees	$5,000
Acquisition of Access and Rights of Way	$0
Pre-Construction Costs (Subtotal # 1)	**$351,795**

Cost of Project Components	$3,367,946
Construction Engineering Cost (Subtotal #2 x 10%)	$336,795
Components and Engineering Costs (Subtotal #3)	$3,704,741
Contingency (Subtotal #3 x 15%)	$555,711
Total Construction Cost (Subtotal #4)	**$4,597,247**

Total Project Cost (Subtotal #1 + Subtotal #4)	**$4,949,042**

7.6 SPRING EXPLORATION AND DEVELOPMENT COST ESTIMATE

There are several undeveloped springs located in the Sage Creek Basin. It is recommended that the springs which exhibit the greatest flows be flow tested. Flow tests can be performed by excavating a trench for the spring water to flow into and measuring the change in height of water in the trench over a known area to determine an approximate flow. If significant flows are obtained, the spring should be fully developed and tied to the existing collection system. Anticipated costs for spring exploration and development are shown in Table 5.

Table 5 - Spring Exploration and Development

RAWLINS SPRING EXPLORATION AND DEVELOPMENT				
ITEM	**UNIT**	**EST QTY**	**UNIT PRICE**	**TOTAL ESTIMATED PRICE**
EXPLORATION AND MOBILIZATION	LS	1	$25,000	$25,000
SPRING BOX W/ SLUICE GATE	EA	3	$15,000	$45,000
SPRING BOX LATERALS	EA	3	$12,500	$37,500
6" PVC WATER MAIN	LF	600	$50	$30,000
12"X6" DIP TEE	EA	3	$3,000	$9,000
SUBTOTAL				**$146,500**
DESIGN ENGINEERING (10%)				$14,650
CONSTRUCTION ENGINEERING (10%)				$14,650
CONTINGENCY (15%)				$21,975
OPINION OF PROBABLE CONSTRUCTION COST				**$197,775**

The same costs in the table above are summarized in Table 6 below, in WWDC format.

Table 6 - Summary of Spring Exploration and Development Cost Estimate, WWDC Format

Preparation of Final Designs and Specifications	$14,650
Permitting and Mitigation	$5,000
Legal Fees	$1,000
Acquisition of Access and Rights of Way	$0
Pre-Construction Costs (Subtotal # 1)	**$20,650**

Cost of Project Components	$146,500
Construction Engineering Cost (Subtotal #2 x 10%)	$14,650
Components and Engineering Costs (Subtotal #3)	$161,150
Contingency (Subtotal #3 x 15%)	$24,173
Total Construction Cost (Subtotal #4)	**$199,973**

Total Project Cost (Subtotal #1 + Subtotal #4)	**$220,623**

7.7 Funding of Recommended Improvements

It is recommended that the City of Rawlins pursue Wyoming Water Development Commission (WWDC) funding for the rehabilitation of the spring collection system. WWDC requires that two funding scenarios be developed to demonstrate adjustments to water system revenues required for the system to be self-supporting. Values below are given in 2019 dollars.

7.7.1 No Funding Assistance

The first funding scenario assumes that there will be no state, federal, or outside funding assistance utilized. Under this scenario, the entire cost of the project must be spread among users over the course of one year to generate the revenues required for the users to pay for the entire project themselves. This scenario assumes that the project will be constructed one year after the publication of this Source Water Protection Plan, therefore, a 3% inflation factor per year has been applied for two years.

Table 7 – Project funding without WWDC assistance

USER RATES WITHOUT FUNDING ASSISTANCE						
Cost Estimate	Years to Replacement	Inflation 3% / yr	Project Budget incl. Inflation	Rawlins Contribution	Increase to User Rate Per Month (4,000 Users)	Projected Monthly Rate Based on Approx. $23/Mo Bill
$4,546,728	2	$276,896	$4,823,623	$4,823,623	$100	$123

7.7.2 WWDC Grant (67%) and Loan (33%)

The second funding scenario assumes that a WWDC grant will cover 67 % of the project costs and the remaining 33% will be funded by a 4% WWDC loan. This scenario assumes that the project will be constructed 4 years after the publication of this SWPP, and a 3% inflation factor per year has been applied.

Table 8 – Project funding with WWDC grant and loan

67% GRANT AND 33% WWDC LOAN FUNDING									
Cost Estimate	Years to Replace-ment	Inflation 3%/yr	Project Budget incl. Inflation	67% WWDC Grant	33% WWDC Loan @ 4.0%	Interest Over Life of Loan	Monthly Debt Service	Impact to User Rate (4,000 Users)	Projected Monthly Rate Based on Approx. $23/Mo Bill
$4,546,728	4	$570,654	$5,117,382	$3,411,588	$1,705,794	$804,512	$10,460	$2.61	$27

7.7.3 Other Funding Sources

Funding may also be available from the USDA Rural Development program. Funding may be obtained through low-interest loans or grants for qualifying projects and communities. As funding through WWDC becomes more difficult to obtain, USDA RD may be a more attractive option.

Finally, there is the possibility of a special purpose excise tax, if approved by local voters.

7.8 Maintenance, Oversight, and Management

In addition to the physical improvements discussed above, a number of management goals can be implemented by the City to better protect the City's water source. These are briefly summarized in the subsections below. In general, they can be divided between specific maintenance activities performed by City staff on an ongoing basis; and regulatory and oversight actions to ensure long-term water quality. While many of the actions have been discussed above, they are consolidated into action items below.

7.8.1 Maintenance Activities

- Perform monthly inspections of the recharge area and collection system.
    - Look for excessive sedimentation, land disturbance, trespassing, and evidence of spills.
    - Open spring boxes to look for sediment, contaminants, or disturbance.
    - Exercise valves.
- Perform inspections of recharge area and collection immediately after large precipitation events, and during significant thaws and/or snowmelt.
- Review new construction, subdivisions, and other development within recharge area.

7.8.2 Carbon County Septic System Regulations

These items require the City to work with Carbon County to implement recommendations.

- Implement new regulations protecting water quality within recharge area.
- Require design of septic systems by PE within recharge area.
- Require city or county inspection of completed system prior to Certificate of Occupancy.

7.8.3 Land Management within Basin

- Maintain communication with Overland Trail Land and Cattle regarding land use within recharge area.
- Review the following websites for leases within the recharge area on a monthly basis and comment on leases/plans/projects that may affect the City's source water:
    - https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do
    - https://www.energynet.com/cartographer.pl
    - https://www.fs.fed.us/sopa/forest-level.php?110206
- Create a land acquisition and land protection program to identify ownership and easement opportunities within the recharge area.

7.8.4 Maintenance of Other Sources

The City should maintain the Nugget Wells and North Platte water sources, including occasionally making use of those sources for normal use. This will ensure that the infrastructure will work if called upon in the event of a disruption of supply from the Sage Creek Basin source. Even if not typically used, those sources should be maintained with regular pump exercise, line flushing, valve exercise, and other normal maintenance practices.

7.9 Implementing Recommendations

This section summarizes tasks that should be performed by the City in the near- and long-term to implement the recommendations above.

7.9.1 Two-Year Goals

These tasks are recommended to be performed by the City in the next two years to ensure immediate protection of the City's source water:

- Draft proposed regulations for residential septic systems within the recharge area. Present draft regulations to Carbon County for consideration, revision, and implementation.
- Identify preferred source of funding for rehabilitation of spring collection system.
- Design, bid, and construct project to rehabilitate spring collection system.

7.9.2 Five-Year Goals

These tasks should be performed by the City in the next five years to ensure long-term protection of the City's source water:

- Consistently engage with the BLM to ensure protection of the Sage Creek Basin is included in the next RMP Amendment.
- Identify privately-owned parcels within the recharge area that would most benefit the City to protect via purchase, conservation easement, or other real estate transfer.
- Identify large construction or energy projects within the recharge area that may adversely impact water quality. Advocate with appropriate Federal and state agencies for enforcement of existing rules and regulations to protect water resources.

These tasks should be considered on-going commitments by the City to protect the water source.

8 CONTINGENCY PLAN

8.1 WATER SHORTAGE OR SUPPLY INTERRUPTION

The Contingency Plan presented here addresses problems that need to be overcome in the event of a water supply shortage or a contamination incident. A contingency plan will aid in providing potable water to the public during water supply emergencies and is critical to any municipal water protection program. The contingency plan defines a chain of command and creates descriptions of individual roles and responsibilities during an emergency. Evaluating potential emergency situations and developing appropriate responses prior to an event can reduce reaction times and reduce the risk of making inappropriate decisions that result in further harm or extension of the emergency.

8.2 IMPLEMENTATION

The Contingency Plan will be implemented, at the discretion of the County Emergency Management Coordinator, when springs or surface water systems are rendered inoperable as a consequence of direct contamination, potential contamination, or other shortage. The County Emergency Management Coordinator will coordinate this effort with the Public Works Director, the Utility Manager, the City Manager, and elected and appointed City officials.

Contamination of the springs will result in the isolation or shut down of the affected supply source at the discretion of water utility operators based on their understanding of the contamination event. In the event of a permanent denial of use of the springs, new municipal water sources must be developed. The water management plan can be reviewed in the Utility Division Manager's office.

However, as noted in Section 1, the City has two other water sources that can provide water in the event of contamination of the springs. Given their geographic separation, there is low risk that all three sources would be contaminated at the same time. In the event of disruption of supply from the springs, the first action is to activate and/or increase production from the Nugget Wells and North Platte sources. If these sources are adequately maintained, they provide a significant hedge against the risk of loss of water supply for the City.

The following Contingency Plan elements are listed in the recommended order of implementation. With any contamination scenario, all Contingency Plan elements should be chosen in consideration of the duration of the contamination event and loss of the water supply.

- Implement the Emergency Response Plan outlined below.
- Determine which water source has been affected, and make arrangements to bring other sources of supply into use. Should other sources be inadequate or similarly affected, proceed with steps below.
- Set priorities for water use (i.e., drinking and food preparation, for facilities such as hospital, medical clinics, and veterinary facilities).
- Water use restrictions can be voluntary or mandatory depending on the severity of the situation. If public health is an immediate issue, the Emergency Broadcast System should be invoked.
- Increase production from unaffected water sources.
- Expected shortfalls of up to 25 percent of the anticipated water supply or less can be handled by public notification and a request for voluntary cooperation or compliance.

- Expected shortfalls greater than 25 percent of anticipated water supply may require mandatory controls to ensure minimum delivery to the entire population.
- Import and distribute bottled water - Consult Section and the emergency notification roster in Section 8.5 for bottled water suppliers and emergency assistance agencies for possible help with distribution.
- Obtain and operate a temporary water treatment unit – This unit must be requested by the Governor through WEMA.
- Implement the next phase of City's current water source development or treatment options based upon characteristics and projected duration of water supply shortage.
- Determine potential disaster relief funds as outlined in Section 8.5.

8.3 EMERGENCY RESPONSE

Carbon County and the City of Rawlins have an emergency notification protocol in place. In the event of a water supply emergency, a call to 911 or to any City or County official will invoke dispatch of the County Emergency Management Coordinator. The County Emergency Management Coordinator assumes the following assignments in preparation or during an emergency.

- Coordinates responsible personnel for Contingency Plan (see Emergency Notification Roster at the end of this chapter).
- Coordinates channels of command, responsibilities, and designates staff or teams
- Makes contact with the Wyoming Office of Homeland Security, WDEQ, Wyoming Highway Patrol, a local geologist, and other state and federal agencies that are deemed necessary and responsible for coordinating and providing emergency relief.
- Activates the Emergency Operations Center (EOC), if necessary.
- Coordinates authorization to hire consultants to perform remediation or source development projects.
- Coordinates review and exercising of a water conservation program in conjunction with the Director of Public Works and elected and appointed City and County officials.
- Coordinates all emergency functions, and if necessary, assigns a Public Information Officer (PIO).

8.4 ALTERNATIVE POTABLE SHORT-TERM EMERGENCY WATER SUPPLIES

Emergency agencies that might assist in the distribution of short-term emergency potable water are listed below (see Emergency Notification Roster for contact information).

- American Red Cross
- Salvation Army
- Army Corps of Engineers: They would most likely enlist the help of commercial trucking companies to supply potable water.
- National Guard
    - To obtain 400-gallon water tank trucks (buffalos) from other parts of Wyoming, or to obtain portable water purification units, the governor must request assistance from the Quartermaster Corp in Ft. Carson, Colorado. Contact the Wyoming Emergency Management Agency (WEMA) to initiate this process.
    - WEMA advised that the Wyoming Army National Guard's ability to provide potable water to Rawlins is negligible. The Guard has one 5,000-gallon water truck and eight to ten 350-gallon water buffaloes. This may be enough to supply one gallon per person per day for a couple of days, depending on the location of the water source. This supply would sustain life only and would not meet any requirements for sanitation or auxiliary needs.

- Local contractors equipped to haul water (trucking firms, energy industry support services, heavy construction contractors).
- Local grocery stores such as City Market and Wal-Mart.
- Through local coordination there may be additional sources of water from private wells and with water hauling equipment already being used by many residents surrounding Rawlins who haul potable water to their homes.

The federal and state governments have no responsibility to provide their towns/cities with potable water. Consequently, it is the responsibility of local government to coordinate and assist in the procurement of emergency potable water. An emergency water conservation ordinance should be promulgated for Rawlins residents to conserve water limited to essential uses necessary for survival.

8.5 Sources of Funds and Disaster Relief

Financing for developing or cleaning up water sources due to spills, sabotage, or other man-made activities would most likely entail the City of Rawlins hiring a consultant to perform the work, and then seeking compensation from the responsible parties.

8.5.1 Local Emergency Fund Reserves

Since legal compensation, as well as disaster relief funds, can take up to a year (or more) to receive, reserved funds should be an integral part of Rawlins municipal water system emergency preparedness effort (Contact Rawlins City Manager).

8.5.2 Governor's Contingency Fund

In 1989, the Governor of Wyoming established provisions which allow the Governor's Contingency Fund to be utilized for containment, cleanup, and disposal of substances posing an eminent threat to the health, safety or welfare of humans, wildlife and/or waters of the State (including groundwater). These funds are available only when immediate action is required or the responsible party is unknown. The funding must be requested from the Governor and the WDEQ Director.

8.5.3 Pollution Revolving Fund

Limited federal funding may be available through the Pollution Revolving Fund, administered by the U.S. Coast Guard, for the reimbursement of state and federal costs related to the containment, removal, mitigation, and disposal of oil releases. In addition, EPA may provide limited funds to ensure timely initiation of containment action when use of the Pollution Revolving Fund is not authorized. Requests for EPA funds must come from the Governor. Additional information is available in the Wyoming Oil and Hazardous Substances Pollution Contingency Plan (1989) and Section 311(k) of the Clean Water Act.

8.5.4 Legal Compensation

Generally, the burden of the cost of clean-up following a contamination incident rests with the responsible party. The County and City Attorneys should be directed to pursue legal remedies whenever possible.

8.5.5 Federal Emergency Management Agency (FEMA)

In the event of a major disaster, FEMA may provide mobile telecommunications, operational support, life support, and power generation assets for the on-site management of the disaster. Requests would be made through the Wyoming Emergency Management Agency.

8.6 EMERGENCY NOTIFICATION ROSTER

Agency	Contact	Roles	Phone
Wyoming Office of Homeland Security	Lynn Budd-Director Leland Christensen-Deputy Dir.	Respond/ Guidance	(307) 777-4663
Federal Bureau of Investigation		Respond/ Guidance	(307) 772-2124
Wyoming DEQ Herschler Bldg. Cheyenne, WY 82002	Joe Hunter Emergency Coordinator General line	Respond/ Guidance	(307) 777-5885 (307) 777-7781
National Response Center Washington D.C.	Emergency Line	Respond/ Guidance	(800) 424-8802
US EPA Region VIII Emergency Operation Center	Emergency Line	Respond/ Guidance	(303) 293-1788
County Emergency Management Coordinator (EMC)	Ron Brown (interim)	Guidance/ Coordination	(307) 920-0804
Fire Department	John Rutherford	Respond/ Guidance	(307) 328-4596 (307) 328-2720
Carbon County Sheriff	Jerry Colson	Respond/ Guidance	(307) 324-2776
City Engineer	Engineering Associates	Guidance	(307) 326-8301
City Public Works Director	LeRoy Lucero	Guidance	(307) 328-4599
City Utility Manager	Adolf Bernal	Respond/ Guidance	(307) 328-4599
City Operations Manager	Danielle Gross	Respond/ Guidance	(307) 328-4599
Chief of Police	Troy Palmer	Respond/ Guidance	(307) 328-4539
County Commission Chairman		Guidance	
City Manager		Guidance	(307) 328-4500
Bottled Water	City Market Wal-Mart	Respond	(307) 328-1421 (307) 417-3001
Water Buffaloes	National Guard	Respond	Contact Carbon County EMC
Emergency Assistance	American Red Cross National Guard Salvation Army	Respond	Contact Carbon Co. EMC to coordinate these agencies
News Media			
Rawlins Daily Times			(307) 324-3411
KTGA			(307) 326-8642
KIQZ			(307) 324-5555
KUWI (Wyo. Public Radio)			(307) 766-4240
Saratoga Sun			(307) 326-8311

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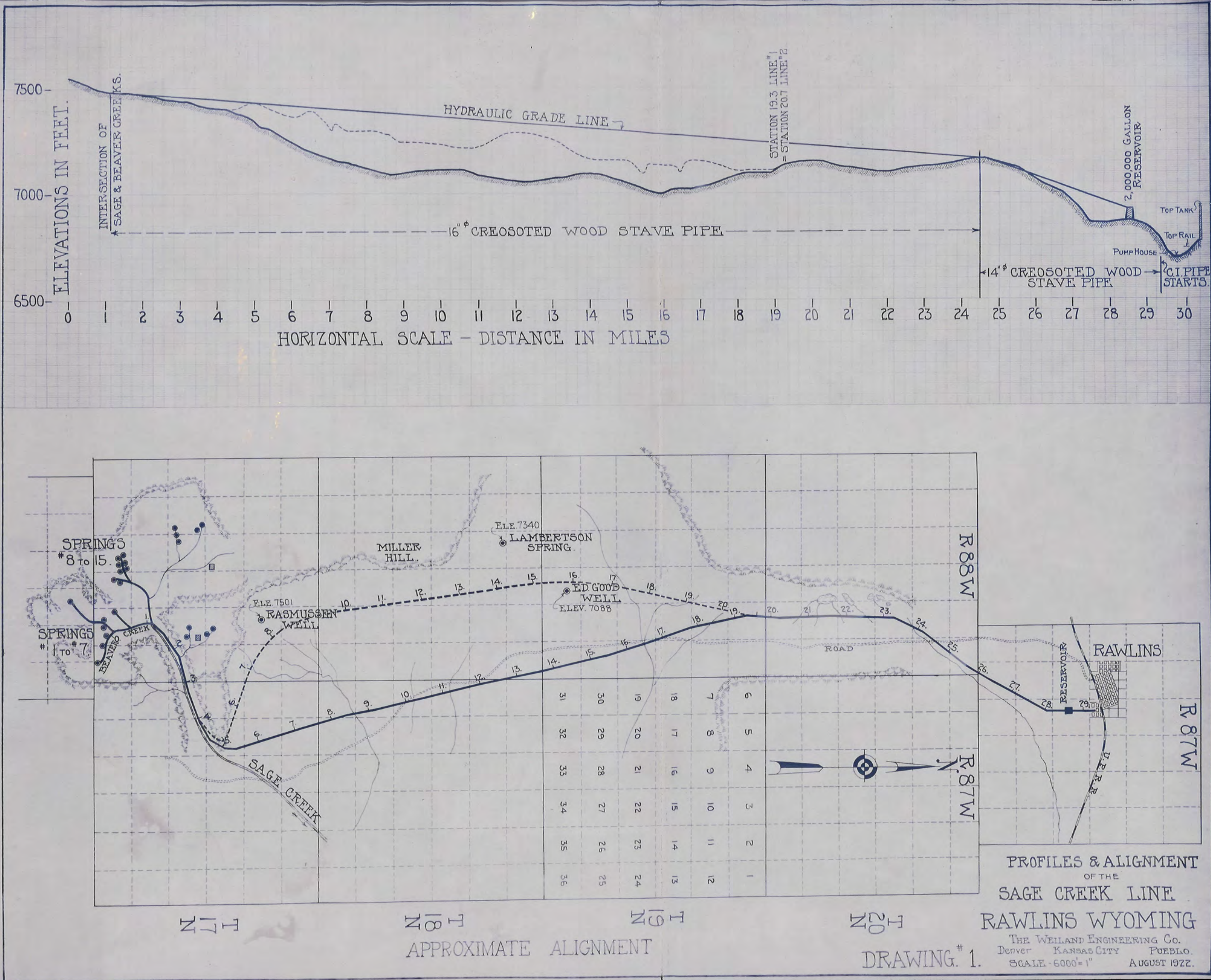
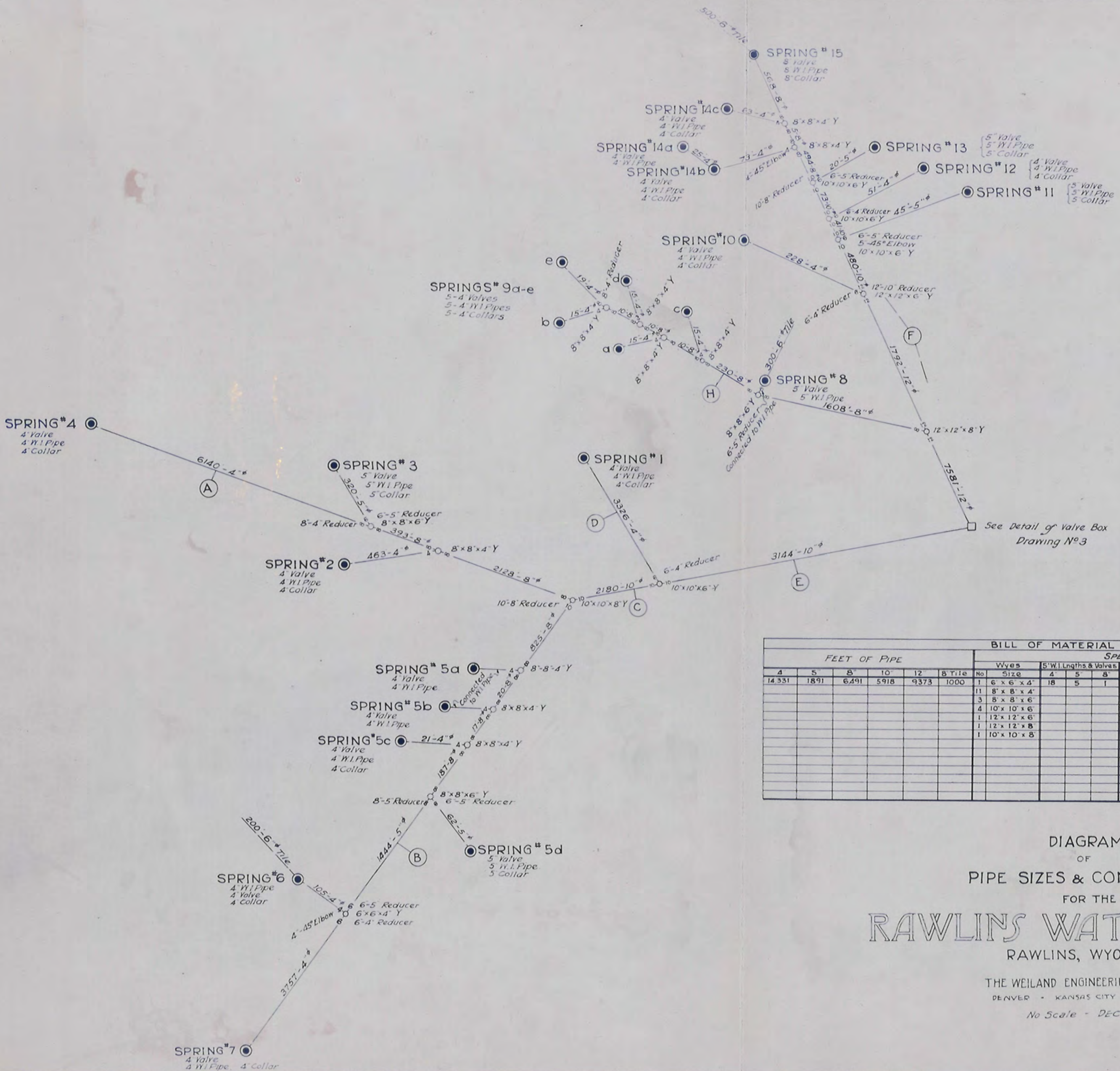
APPENDIX A – 1922 CONSTRUCTION DRAWINGS



ELEVATIONS IN FEET.
7500
7000
6500
INTERSECTION OF SAGE & BEAVER CREEKS.
HYDRAULIC GRADE LINE
STATION 19.3 LINE #1 = STATION 20.7 LINE #2
2,000,000 GALLON RESERVOIR.
TOP TANK
TOP RAIL
PUMP HOUSE
16" ϕ CREOSOTED WOOD STAVE PIPE
14" ϕ CREOSOTED WOOD STAVE PIPE
C.I. PIPE STARTS.
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
HORIZONTAL SCALE - DISTANCE IN MILES
SPRINGS #8 TO 15.
SPRINGS #1 TO #7
BEAVER CREEK
MILLER HILL.
ELE. 7340
LAMBERTSON SPRING.
ELE. 7501
RASMUSSEN WELL
ED GOOD WELL
ELEV. 7088
SAGE CREEK
ROAD
R 88 W
R 87 W
R 87 W
N.
RESERVOIR
RAWLINS
U.P.R.R.
T 17 N
T 18 N
T 19 N
T 20 N
APPROXIMATE ALIGNMENT
PROFILES & ALIGNMENT
OF THE
SAGE CREEK LINE.
RAWLINS WYOMING
THE WEILAND ENGINEERING CO.
DENVER KANSAS CITY PUEBLO.
SCALE - 6000' = 1"
AUGUST 1922.
DRAWING # 1.



BILL OF MATERIAL																					
FEET OF PIPE						SPECIALS															Remarks
						Wyes		5" W.I. Lngths & Valves			Reducers		Collars			45° Elbows			5" C.I. O-flow P.		
4"	5"	8"	10"	12"	8" Tile	No	Size	4"	5"	8"	No	Size	4"	5"	8"	4"	5"				
14,331	1891	6491	5918	9373	1000	1	6" x 6" x 4"	18	5	1	4	6" to 4"	15	4	1	4	2		24		Total lineal
						11	8" x 8" x 4"				6	6" - 5"									ft. wood stave
						3	8" x 8" x 6"				1	8" - 5"									pipe for col-
						4	10" x 10" x 6"				2	10" - 8"									lection sys-
						1	12" x 12" x 6"				2	8" - 4"									tem 38,004
						1	12" x 12" x 8"				1	12" - 10"									Tile - 1,000
						1	10" x 10" x 8"														

DIAGRAM

OF

PIPE SIZES & CONNECTIONS

FOR THE

RAWLINS WATER SUPPLY

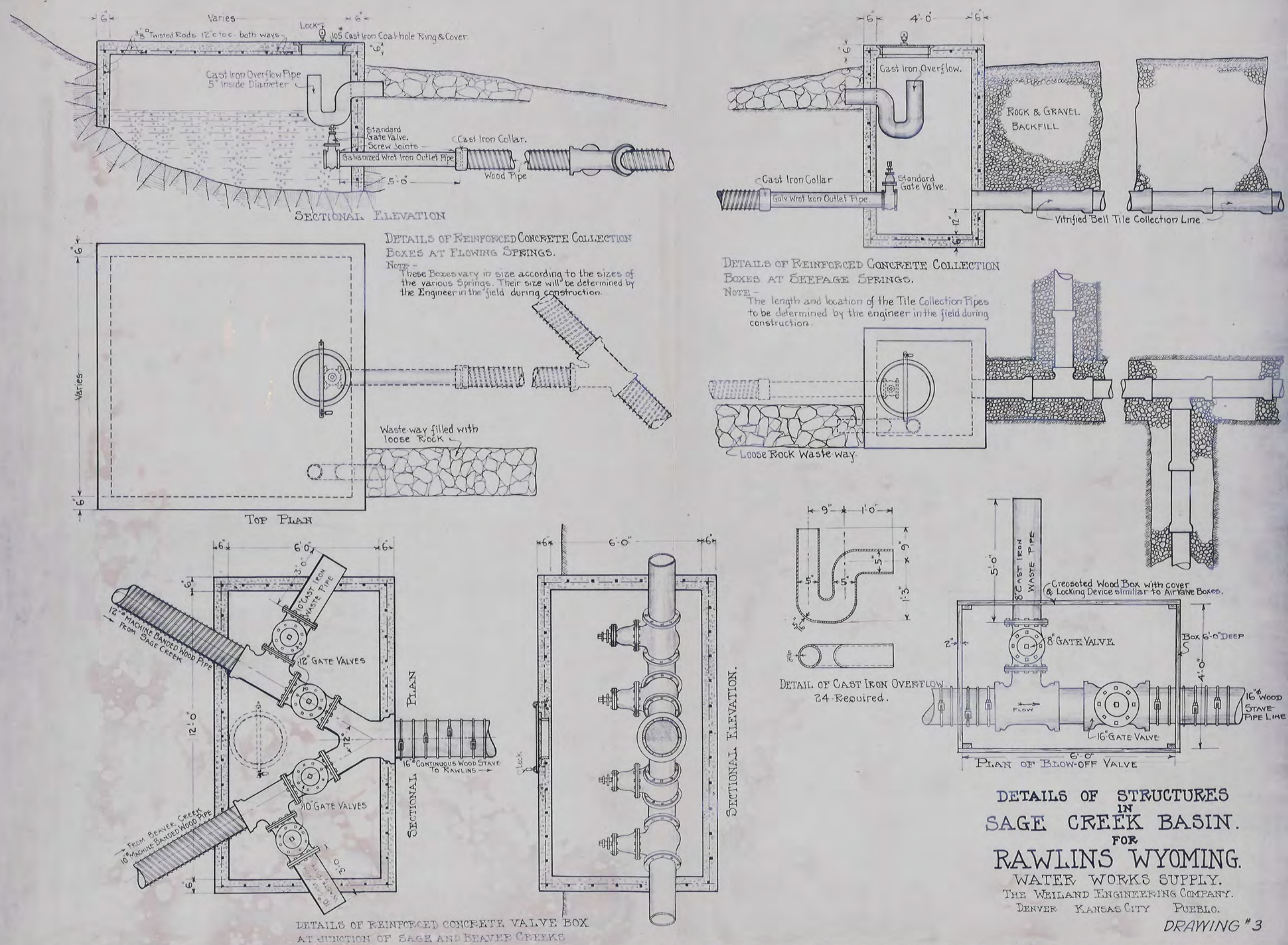
RAWLINS, WYOMING

THE WEILAND ENGINEERING COMPANY

DENVER - KANSAS CITY - PUEBLO

No Scale - DEC 1922

DRAWING # 2



DETAILS OF STRUCTURES IN SAGE CREEK BASIN.

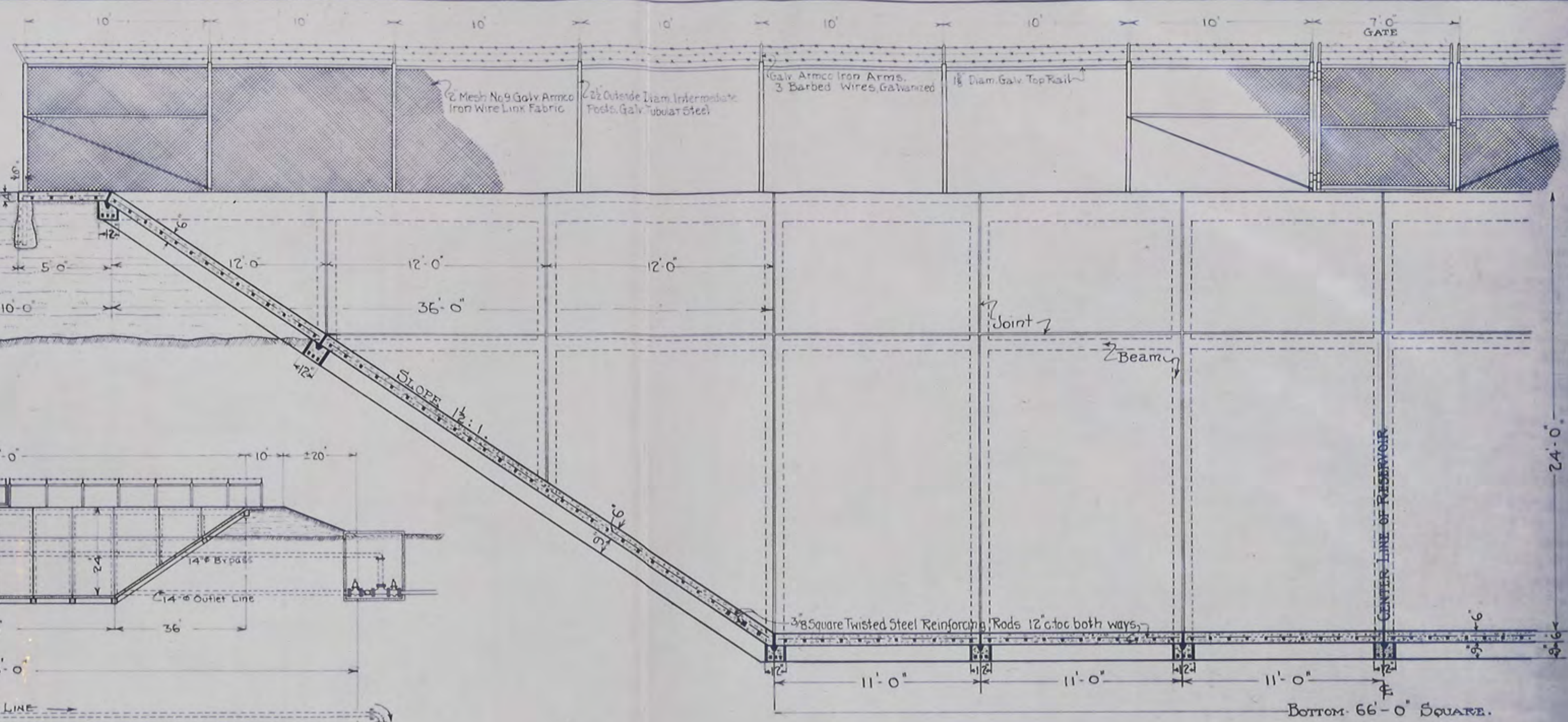
FOR RAWLINS WYOMING.

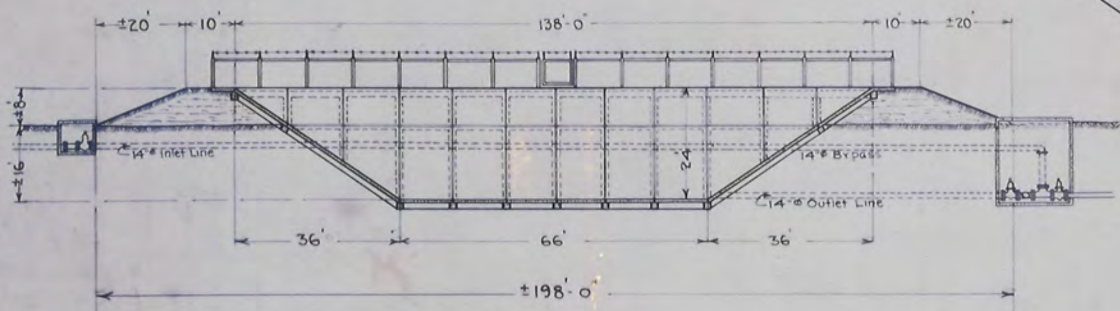
WATER WORKS SUPPLY.

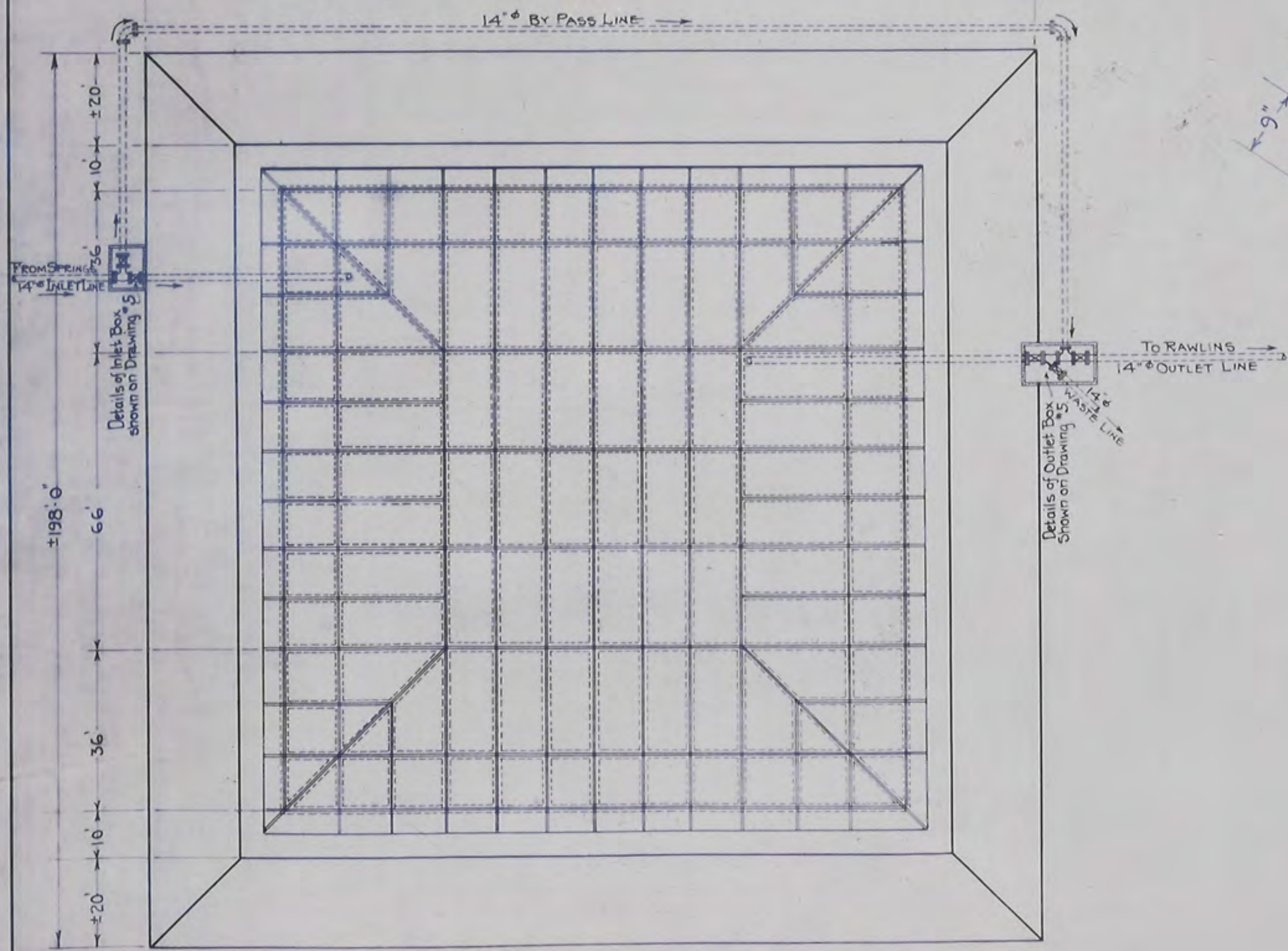
THE WEILAND ENGINEERING COMPANY.

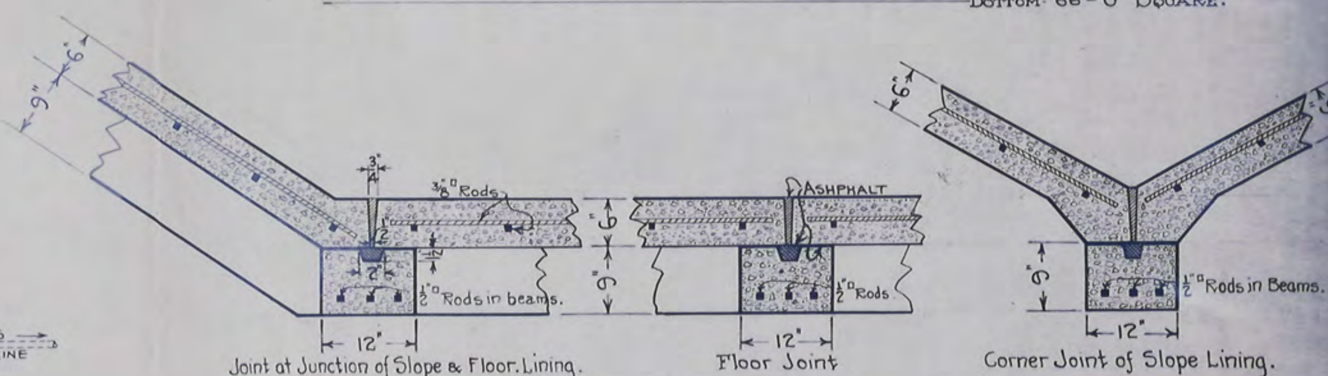
DENVER KANSAS CITY PUEBLO.

DRAWING # 3









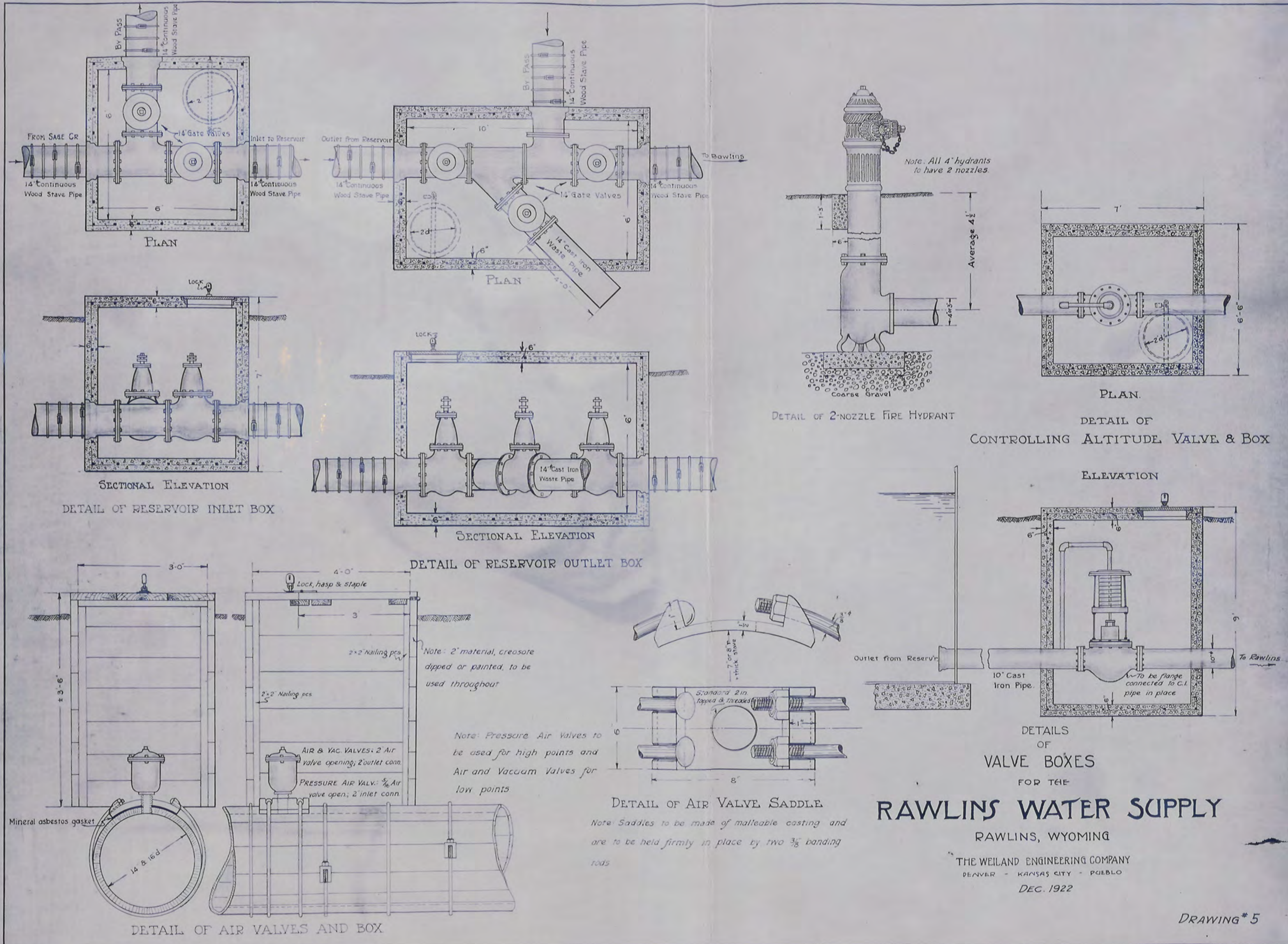
DETAILS OF LINING JOINTS.

DESIGN OF

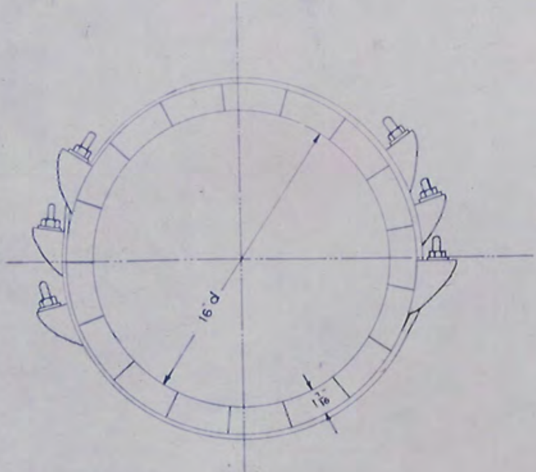
REINFORCED CONCRETE RESERVOIR FOR RAWLINS WYOMING

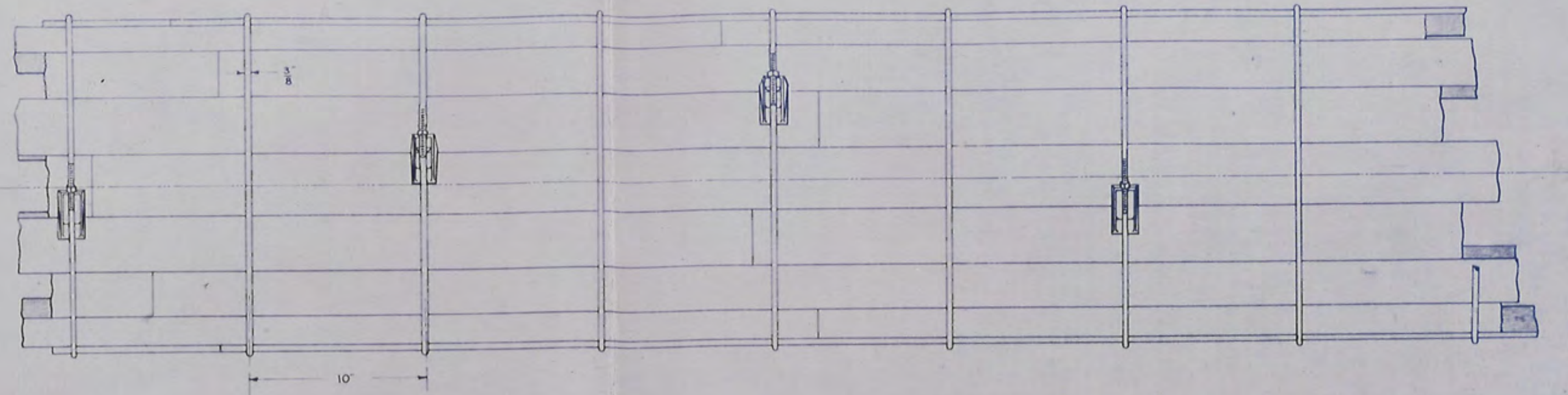
THE WEILAND ENGINEERING COMPANY
CONSULTING ENGINEERS.
DENVER KANSAS CITY PUEBLO
December - 1922.

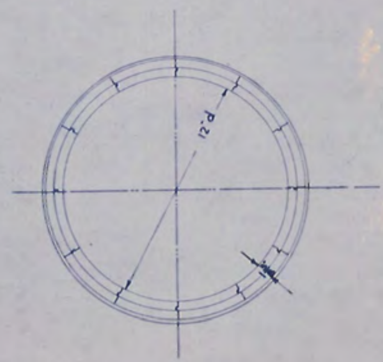
DRAWING. # 4.

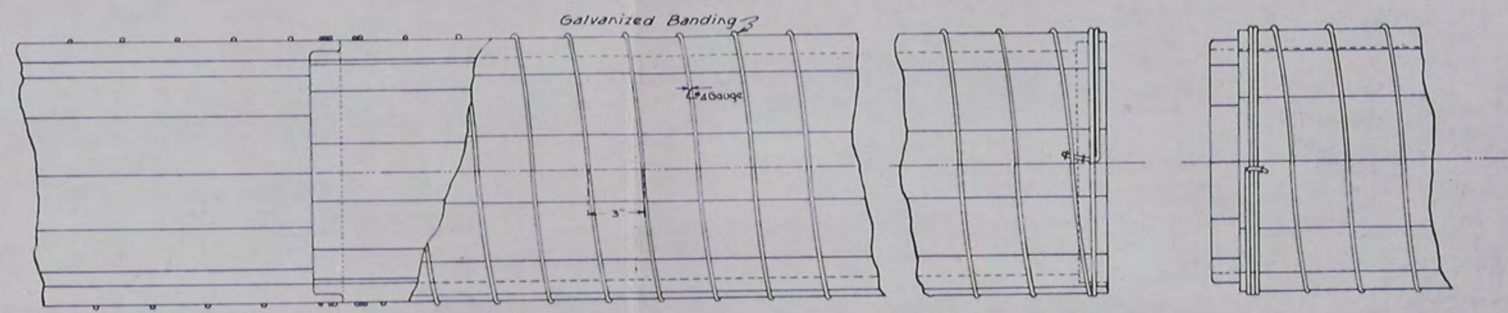


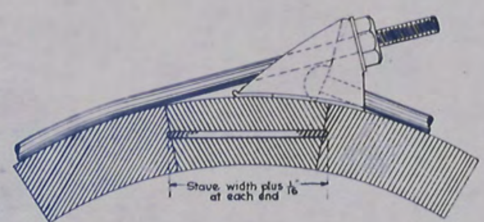
By Pass
14" Continuous Wood Stave Pipe
From Sage Cr
14" Gate Valves
Inlet to Reservoir
14" Continuous Wood Stave Pipe
14" Continuous Wood Stave Pipe
PLAN
Lock
SECTIONAL ELEVATION
DETAIL OF RESERVOIR INLET BOX
Outlet from Reservoir
To Rawlins
14" Gate Valves
14" Cast Iron Waste Pipe
PLAN
14" Cast Iron Waste Pipe
SECTIONAL ELEVATION
DETAIL OF RESERVOIR OUTLET BOX
Note: All 4" hydrants to have 2 nozzles.
Average 4½'
Coarse Gravel
DETAIL OF 2-NOZZLE FIRE HYDRANT
PLAN.
DETAIL OF
CONTROLLING ALTITUDE VALVE & BOX
ELEVATION
Outlet from Reserv'r
10" Cast Iron Pipe.
To be flange connected to C.I. pipe in place
To Rawlins
Lock, hasp & staple
2"×2" Nailing pcs
Note: 2" material, creosote dipped or painted, to be used throughout
2"×2" Nailing pcs
Note: Pressure Air Valves to be used for high points and Air and Vacuum Valves for low points
AIR & VAC. VALVES: 2" Air valve opening; 2" outlet conn.
PRESSURE AIR VALV.: 5/16" Air valve open; 2" inlet conn.
Mineral asbestos gasket
DETAIL OF AIR VALVES AND BOX
Standard 2 in. tapped & threaded
DETAIL OF AIR VALVE SADDLE
Note: Saddles to be made of malleable casting and are to be held firmly in place by two 3/8" banding rods
DETAILS
OF
VALVE BOXES
FOR THE
RAWLINS WATER SUPPLY
RAWLINS, WYOMING
THE WEILAND ENGINEERING COMPANY
DENVER - KANSAS CITY - PUEBLO
DEC. 1922
DRAWING # 5

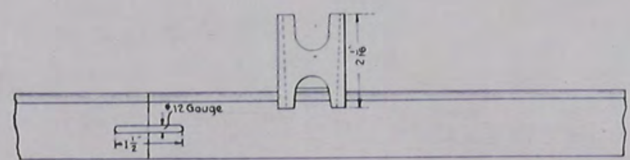


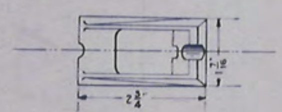












Head	Size of Pipe 16"	14"	Head	Size of Pipe 12"	10"	8"	5"	4"	Remarks
0-40ft	10"	10"	50ft	3"	3"	3"	3"	3"	
40-50	8 1/8	8 1/4	100	2 1/8	2 1/4	2 1/4	2 3/8	2 3/8	
50-60	6 13/16	6 13/16	150	1 3/8	1 1/2	1 5/8	1 5/8	1 3/4	
60-70	5 13/16	5 13/16	200	1 1/8	1 3/8	1 1/4	1 1/4	1 3/8	
70-80	5 1/8	5 3/16	250	13/16	1 1/8	1	1 1/16	1 1/8	
80-90	4 1/2	4 5/8	300	—	—	13/16	7/8	15/16	
90-100	4 1/16	4 1/8							
100-110	3 11/16	3 3/4							
110-120	3 3/8	3 7/16							
120-130	3 1/8	3 3/16							
130-140	2 15/16	2 15/16							
140-150	2 11/16	2 3/4							
150-160	2 9/16	2 9/16							
160-170	2 3/8	2 7/16							
170-180	2 1/4	2 5/16							
180-190	2 1/8	2 3/16							
190-200	2"	2 1/16							
200-210	1 15/16	1 15/16							
210-220	1 13/16	1 7/8							
220-230	1 3/4	1 13/16							
230-240	1 11/16	1 3/4							
240-250	1 5/8	1 11/16							
250-260	1 9/16	1 5/8							
260-270	1 1/2	1 9/16							
270-280	1 7/16	1 1/2							
280-290	1 3/8	1 7/16							
290-300	1 5/16	1 3/8							

Continuous Wood Stave

Approx. no ft. of Pipe	Size Pipe	Thick of Stave Min	Thick of Stave Max	Size of Band	No. pcs in Band	Min spacing of Bands	Head	Remarks
26,928	14"	1 3/16"	1 3/8"	3/8"φ	1	10"	0-40'	
136,752	16"	1 1/4"	1 7/16"	3/8"φ	1	10"	0-40'	
Machine Banded								
14,331	4"	1 1/16"		#8		3"	0-40'	
1,891	5"	1 1/16"		#8		3"	"	
6,491	8"	1 1/8"		#6		3"	"	
5,918	10"	1 1/8"		#4		3"	"	
9,373	12"	1 3/8"		#4		3"	"	

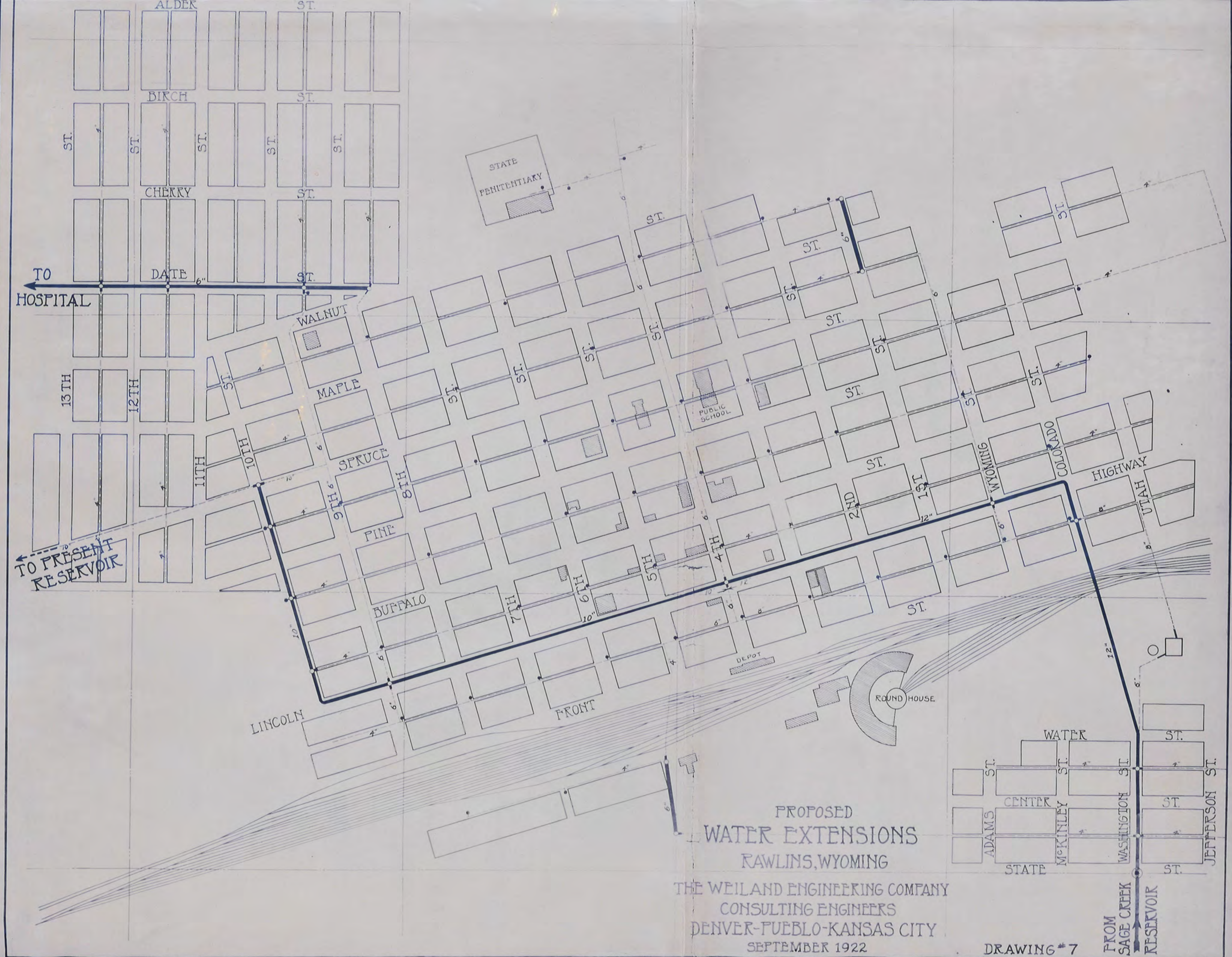
DETAILS OF WOOD STAVE PIPE FOR THE RAWLINS WATER SUPPLY

RAWLINS, WYOMING

THE WEILAND ENGINEERING COMPANY
DENVER - KANSAS CITY - PUEBLO

DEC. 1922

DRAWING #6


PROPOSED
WATER EXTENSIONS
RAWLINS, WYOMING
THE WEILAND ENGINEERING COMPANY
CONSULTING ENGINEERS
DENVER-PUEBLO-KANSAS CITY
SEPTEMBER 1922
DRAWING #7
ALDER ST.
BIRCH ST.
CHERRY ST.
DATE ST.
WALNUT
MAPLE
SPRUCE
PINE
BUFFALO
LINCOLN
FRONT
ST.
13TH
12TH
11TH
10TH
9TH
8TH
7TH
6TH
5TH
4TH
2ND
1ST
WYOMING
COLORADO
UTAH
HIGHWAY
STATE PENITENTIARY
PUBLIC SCHOOL
DEPOT
ROUND HOUSE
TO HOSPITAL
TO PRESENT RESERVOIR
WATER ST.
CENTER ST.
STATE ST.
ADAMS ST.
McKINLEY ST.
WASHINGTON ST.
JEFFERSON ST.
FROM SAGE CREEK RESERVOIR