PRELIMINARY

ENGINEERING

REPORT

FOR

QUARTZ CREEK PROPERTIES

PUBLIC WATER SYSTEMS

OWNER

QUARTZ CREEK PROPERTIES HOMEOWNERS, ASS.
GUNNISON COUNTY, COLORADO

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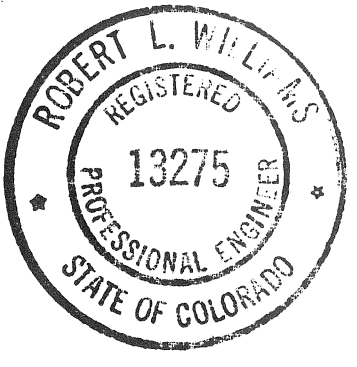

April 13 2017

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APPENDIX

I. EXECUTIVE SUMMARY

The Quartz Creek Property existing spring water systems has been classified by the Colorado Department of Public Health and Environment (CDPH&E) as a Public Water Supply and is subject to the rules and regulation of The Water Quality Control Division (Division). On May 22, 2015 the Division issued an Immediate Response Required Letter and assigned public Water System number CO0226620 to the Association. The Association is in contact with the Division and the Division has not taken any further actions since the May 22, 2015 letter. On March 24, 2017 the Division issued a Compliance Advisory, with response required, to the Association. The Division required that by no later than May 1, 2017 the Association must show continued progress toward compliance and was directed to submit a detailed compliance plan to meet the requirements of Regulation 11. This preliminary Engineering Study is one of the required steps towards getting the water systems into compliance with Division requirements.

Water treatment system concepts were developed for Armstrong Spring and for combining the spring flows from Gilmore and Pitkin View Springs. These springs are the primary water sources for the Quartz Creek property owners. At the present time there is insufficient field data and, as such, the programs set forth herein are conceptual in nature with respect to water collection, transmission, treatment, and storage programs, with arrangement, layout and location of the various elements to be determined from field evaluations in the spring and summer of 2017. In order to meet the requirement of the Division, water treatment systems will entail filtration, disinfection, storage and distribution.

The Association is concerned with the interests of the property owners, obtaining financing and the procurement of funds to construct the system, and for the yearly costs for the amortization of loans, and operation and maintenance costs. Conceptual cost estimates will be provided for each program after field evaluations and input from the Association. The property owners will debate and select a program(s) at the Association July 3, 2017 Annual meeting. Three following three programs are recommended to meet the property owner's needs and to bring the water systems into compliance with the applicable regulations of the Division:

- Establish Armstrong Spring as the property owner's public water system.
- Establish Gilmore/Pitkin View springs as the property owner's public water system.
- Select two water systems by simultaneously developing both spring systems.

The Association must comply with the requirements set forth in Compliance Advisory Letter from the Division and show continued progress by not later than May 1, 2017.

II. PURPOSE OF REPORT

The CDPH&E made the determination that the Association functions as a Public Water Supply and classified it as a Transient, Non-Community, Surface Water Public Water System serving an estimated 37 transients per day from May to September. The Quartz Creek Property Owners Association (Association) Board of Directors formed a Water Committee to investigate the classification and actions to be undertaken to comply with the requirements for a Public Water System.

The Association retained Williams Engineering to perform a Preliminary Engineering Study with the end result to:

- Evaluate the Division Classification
- Develop alternatives for compliance
- Provide an outline of basic concepts
- Analyze project feasibility
- Develop a recommended Course of action
- Recommend a water system program(s) to meet the Division's requirements
- Provide a conceptual construction cost estimate., and
- Provide a proposed time schedule for compliance.

The Association further directed that Williams Engineering investigate and provide opinions on the basic functionality and efficacy of a single Water Treatment Facility or multiple Point of Distribution Facilities to provide treated water to the Property Owners in order to serve the current and future needs for the next 10 years.

The water system(s) would be in operation seasonally from May 15 to October 15 with the system winterized and shut down the remainder of the year. Typically, an owner/resident of a property in the Quartz Creek Properties obtains water from one of four developed springs using approximate 300 gallon water transportation tanks in trucks or trailer-mounted. They transport the water to their residences and fill water storage tanks or connect the transport tanks directly to the dwelling's plumbing system.

After review and approval of the Preliminary Engineering Report the Association's intent is to present the findings and conclusions in the Preliminary Engineering Report to the property owners at their July 3, 2017 Annual Meeting to select a water system program(s) and obtain to approval to proceed with design. The final design phase would include, field-work, design, preparation of construction documents and construction costs estimates, and submittal to and obtaining approval from the Division.

III. GENERAL PROJECT DESCRIPTION AND LOCATION

Quartz Creek Properties is located in Gunnison County, Colorado as delineated on the Vicinity Map enclosed herewith in Appendix A. The Quartz Creek Properties was formed in 1977 and comprises approximately 393 individual properties (see Plat in Appendix B) with 308 owners, which vary in size and average about 10 acres. The parcels were originally patented mining claims

in the Quartz Creek Mining District. The Association has represented that there are construction improvements on approximately 100 of the parcels with the majority of them only occupied seasonally and intermittently from May 15 through October 15. Some of the owners of the unimproved parcels either camp or utilize RV's on the parcels, during summer season. The Association was formed to manage and oversee the common elements of the Properties such as the roads and the spring water systems. The existing spring water sources are available for use by all the property owners and each property has deeded water rights to the springs contained within the boundary of the properties.

Some of spring water collection systems were improved by the original developer in order to provide water availability for the various individual parcel owners. The spring systems were developed starting in 1978 with subsequent improvements made by individual property owners at their own expense over the ensuing years. Water wells have been drilled on a few of the parcels in the lower portions of the properties, but wells are not viable on a majority of the parcels and the property owners must obtain water from the various springs on the property or haul water from a remote location. The common practice of the property owners, who have developed their parcels, is to obtain water from the springs by filling water storage tanks and transporting them to their parcel.

At the time of the development of the spring water sources, there were no regulations in place with respect to this water source and it was not considered to be a public water system. Over time various parcels were developed, and Colorado water system regulations evolved and became more stringent. These regulations will be discussed in subsequent section of this report. In light of the new regulations on May 22, 2015 the Division issued an Immediate Response Required letter and assigned Public Water System Identification number CO0226620 to the Association. A copy of the letter mandating various actions on the behalf of the Association is in Appendix C. The Association contacted the Division and requested an explanation on the legal basis for treating the Association as a Public Water System. A copy of the response from the legal department is in Appendix D. In the response the Legal Department opined that the following springs and loading stations were classified as Public Water Systems:

- Armstrong Spring
- Armstrong Augmentation Pond
- Armstrong Spring Loading Station
- Pitkin View Spring
- No Name Loading Station
- Pitkin View Loading Station
- Chicago Park No. 3 Spring
- Chicago Park No. 3 Loading Station
- Western Star/Chicago Park No. 3 Spring
- Western Star Loading Station
- Gilmore Spring
- Gilmore Spring Loading Station

Division regulations define a Public Water System "as a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least 25 individuals daily at least 60 days per year. A public water system is either a community water system or a non-community water system including:

- Any collection, treatment, storage, and distribution facilities under control of the supplier of such system and used primarily in connection with such system.
- Any collection or pretreatment storage facilities not under such control, which are used primarily in connection with such system."

The Quartz Creek Properties water system is classified by the Regulations as a Transient, Non-Community, Surface Water Public Water System serving at least 25 different persons for 60 days or more per year. All public water systems are subject to the Division regulations and policies and the design must be approved by the Division.

On March 24, 2017 the Division issued a Compliance Advisory, with response required, to the Association. The Division required that by no later than May 1, 2017, the Association must show continued progress toward compliance and was directed to submit a detailed compliance plan to meet the requirements of Regulation 11. The Division required that the Association must conduct continuous public notice due to the boil water advisory and post a public notice at each fill station where water is available to the property owners. The Division further required the Association to develop and implement a compliance plan for resolving all violations. The Water Committee is preparing the required response to the Division. A copy of the Division's Compliance Advisory Letter is in Appendix E.

IV. WATER QUALITY CONTROL DIVISION REGULATIONS

A. Regulation No. 11 – Colorado Drinking Water Regulations

Regulation No. 11 of the Colorado Primary Drinking Water Regulations was established "to assure the safety of public drinking water supplies and to enable the state of Colorado to assume responsibility for enforcing the standards established by the federal Safe Drinking Water Act (i.e., Public Law 93-523), as amended. The Regulation applies to each public water system, unless the public water system meets all of the following conditions:

- Consists only of distribution facilities and/or storage facilities.
- Does not have any collection facilities.
- Does not have any treatment facilities.
- Obtains all of its water from a public water system to which these regulations apply.
- Is not owned or operated by a public water system to which these regulations apply.
- Does not sell water to any person.
- The water supplier is not a carrier which conveys passengers in interstate commerce."

B. Safe Drinking Water Program Policy Number 5

The CDPH&E was given regulatory authority for reviewing and approving public water systems. The Division reviews and approves all public water systems in accordance with the provisions of the Safe Drinking Water Program Policy Number 5 dated September 9, 2013 and titled State of Colorado Design Criteria for Potable Water Systems (Regulation). The Design Criteria was developed to:

- "Codify a set of standards that established minimum requirements for the design of new waterworks to protect the reliability and quality of the finished water capable of complying with the Colorado Primary Drinking Water Regulations.
- Summarize and characterize nationally-recognized industry best minimum practices for designing waterworks given that many designs occur without substantial site-specific data."

"The source of the potable water to be developed is the principal element in the evaluation process in respect to an adequate available quantity of water that will be delivered to the consumers that meets the current regulation of the Division with respect to microbiological, physical, chemical and radiological qualities. All springs are considered under the influence of surface water per Paragraph 3.1, Surface Water and Groundwater under the direct Influence of Surface Water of the Regulations unless sufficient evidence exists for the spring(s) to justify a groundwater classification." Paragraph 3.2.2, Spring Construction, sets forth the extensive standards for a spring to be considered groundwater.

C. Safe Drinking Water Program Policy Number DW-003

Safe Drinking Water Program Policy Number DW-003 dated March 23, 2012 establishes the methodology used by the Department to classify drinking water supply sources as either groundwater or groundwater under the direct influence of surface water. Paragraph 5.5.1, Springs, of the Policy sets forth that "all new, discovered and existing spring sources, at regulated public water systems, as groundwater sources provided they have sufficient engineering modifications needed to protect the spring from surface runoff." The engineering modifications are set forth in paragraph 3.2.2 of the Safe Drinking Water Program Policy Number 5.

D. Safe Drinking Water Program Policy Number DW-004 dated October 1, 2010:

- Defines the criteria the Safe Drinking Water Program the Department uses to evaluate whether public water systems treating surface water are meeting regulatory requirements for removal/inactivation of specified microbiological contaminants.
- Establishes how compliance with the performance requirement of the surface water rule is evaluated by the Division.
- Provides a reference for proper operation of water treatment processes.
- References mechanisms to identify and resolve significant deficiencies.
- Defines the use of microscopic particulate analyses.
- Identifies incentives and department action to foster improvement in water system operations.

V. WATER RIGHTS AND RESERVOIRS

On January 11, 1979 the District Court for Water Division No. 4 issued a findings approving the Water Augmentation plan for Case No. 3276 for Quartz Creek Properties, Inc., which is in Appendix F. The plan addressed consumptive use, seasonal and full time residents, 100 individual wells, springs and reservoirs. An integral part of the Plan was to augment the structures by utilizing certain waters and water rights of the Properties through the 3.01 acre foot White House Reservoir, 2.58 acre foot Armstrong Reservoir, and the 2.31 acre foot Tipi Reservoir. These reservoirs were later all combined into the Armstrong Reservoir and the storage right increased to 7.9 acre feet. The reservoir was created to release 2.42 acre feet annually of stored waters to the Quartz Creek drainage to replace consumptive use depletion. The storage water has been called in the past and water had to be released to the Tomichi Creek basin.

- Throughout the years the conditional rights were made absolute by the Water Court. Appendix G is a tabulation of the water rights including case numbers and the adjudicated water amounts. Appendix H is a map denoting the locations of the property owner's springs, however there appears to be a lot of conflicts between the physical locations and the court approved locations. It was beyond the scope of this study to determine why the locations vary so much. The Association appears to not be utilizing and putting to beneficial use all of the water rights.

VI. AVAILABLE QUANTITY AND SUPPLIES OF WATER

The Division regulations set forth that "the source of the potable water to be developed is the principal element in the evaluation process in respect to an adequate available quantity of water that will be delivered to the property owners that meets the current regulation of the Division with respect to microbiological, physical, chemical and radiological qualities."

The following is a summary of water available to the property owners based on the springs being utilized and water right decrees:

• Armstrong Spring	0.22 cfs = 98.73 gpm =	864,000 gpd
• Gilmore Loading Station	0.01 cfs = 4.49 gpm =	6,465 gpd
• Pitkin View Spring	0.01 cfs = 4.49 gpm =	6,465 gpd
Total water available per water rights	0.23 cfs = 107.71 gpm =	876,930 gpd

The water flows as measured by the Association in the fall of 2015 are as follows:

• Armstrong Spring	600 gpm = 142,171 gpd
• Gilmore Loading Station	5.0 gpm = 7,200 gpd
• Pitkin View Spring	2.1 gpm = 3,024 gpd
Total physical water available	607.4 gpm = 152,395 gpd

The Water Augmentation Plan in Appendix F was approved by the Court based on utilization for 393 individual properties with the majority being seasonal occupancy and for 100 water wells for any of the parcels. The plan allocated 225 gpd per parcel as the average daily water requirement per parcel. The property deeds reflect an allocated amount of only 150 gpd. If all 393 parcels were developed and utilized 225 gpd, the average daily requirement would be 111,150 gpd. There is sufficient water rights and physical water for 100% development and occupancy of the parcels, excluding the 100 approved water wells.

VII. EXISTING FACILITIES

A. Armstrong Spring

Appendix I is a Google image denoting the location of the Armstrong Spring. It has been represented that the collection gallery consists of two 8 ft. long perforated 6-inch PVC pipes that are surrounded by washed rock. The pipes convey water to a 600 gallon precast perforated concrete storage tank with an access hatch. Approximately 400 feet of 6-inch schedule 40 PVC pipe conveys water to the discharge point, which continuously flows water into the natural stream channel during winter and summer. There is valve on the discharge line and when closed water is diverted to an elevated swing arm with a pulley and rope to lift a 2-inch flexible hose which is used to fill the individual water transport tanks. There is also a 5-1/4 inch dry barrel fire hydrant connection. The water source is an exceptional high production spring with the flow measured by the Association aof approximately 600 gpm. The water rights for Armstrong spring are all absolute and are for 0.22 cfs or 98.73 gpm consisting of four independent water rights with varying locations and a common discharge point as follows:

Armstrong Gulch 10 Spring Case No. W-2925 for 0.03 cfs = 13.46 gpm
Armstrong Gulch 10A spring Case No. W-2926 for 0.01 cfs = 4.49 gpm
Armstrong Gulch 11 Spring Case No. W-2927 for 0.15 cfs = 67.32 gpm
Armstrong Gulch 11A Spring Case No. W-2928 for 0.03 cfs = 13.46 gpm

B. Gilmore Loading Station & Spring

At Appendix I is a map denoting the location of the Gilmore Loading Station & Spring. The water right for the spring appears to be the Chicago Park Spring and Tank No. 8, Case No. 89CW99 with an absolute 0.033 cfs or 15.0 gpm water right. The system consists of an unknown underground spring water collection system which collects and transports water to a 1,500 gallon aboveground plastic water storage tank. There is an old building that was installed and utilized by the individual who developed the spring. The private system has been abandoned and the piping system inside the building was bypassed by the Association. The storage tank has a 4-inch pipeline to a fire department connection and also connects to the loading station via a 2-inch connection. The piping from the spring to the storage tank is diverted to an overflow line for winter, which drains down slope from the storage tank.

C. Pitkin View Spring

Appendix I is a map denoting the location of the Pitkin View Spring. The water right for the spring is termed the Pitkin View Pipeline, Case No. 3271 with an absolute 0.01 cfs or 4.49 gpm water right. The system consists of an unknown underground collection system which flows into an aboveground 1,500 plastic water storage tank that is approximately 30 yards below the spring. A 2-inch black polyethylene gravity pipe line conveys water downhill from the water storage tank to the Pitkin View Loading Station and to the No Name Loading Station.

D. Pitkin View Loading Station

Appendix I is a map denoting the location of the Pitkin View Loading Station. There is a 1/3 section of a 55-gallon drum with an approximate 18-inch access hatch in the end section of the drum. A 1-1/2 inch spiral clear plastic hose is coiled inside the enclosure for the owners use to fill their water haul tanks.

E. No Name Loading Station

Appendix I is a map denoting the location of the No Name Loading Station. The loading station receives water from the Pitkin View Spring. The loading station is similar in construction to Pitkin View loading station. There is excessive head pressure at the loading station and a pressure reducing valve was installed in the line to obtain an acceptable water pressure.

F. Chicago Park No. 3 Spring Loading Station

Appendix I is a map denoting the location of the Chicago Park 3 No. Spring Loading Station. The water right for the spring is termed the Chicago Park Spring and Tank No. 3, Case No. W-1466 with an absolute 0.068 cfs or 30.52 gpm water right. There are also several individual Association property owners who have absolute decrees for this spring. Chicago Park Spring and Tank No. 3 has an approximate 2 ft. square carbon steel collection box buried about 1-1/2 feet below the surface. The collection box was recently repaired and was covered with a 10 mil plastic sheet and 30 lb. felt before being covered with dirt. A 1,500 gallon aboveground storage tank is located about 30 yards below the collection box and is connected by a 1.5-inch PVC pipe. The storage tank is connected to a fill station, similar in design to the Pitkin View and No Name loading stations, by a 1-1/2 inch black plastic pipe. Spring water is diverted from the storage tank and the tank drained for winterization of the system.

G. Western Star Spring and Loading station

The location of the spring and the fill station was not available in documents and the associated water right could not be ascertained at this point in time. The Association indicated the spring is not being utilized by the property owners.

VIII. COMPLIANCE ALTERNATIVES

A. No Action Alternative

The alternative of not taking any actions to bring the Properties water systems into compliance with the Regulations of the Division is not a viable alternative. The water system has been classified as a Public Water System and the Division has the authority per applicable regulations to shut down the Properties water systems and/or levy fines against the Properties until the systems are brought into compliance. In order to avoid shut down of the existing springs and/or levying of fines the Properties must undertake the steps set forth in the Compliance letter in Appendix E from the Division.

B. Obtain a Groundwater Classification

Any water beneath the surface of the ground which is neither surface water nor ground water under the direct influence of surface water is considered groundwater by the Division. All springs are considered under the influence of surface water per Paragraph 3.1, Surface Water and Groundwater of the Safe Drinking Water Program Policy Number 5. Further, all springs are classified by regulation to be under the direct Influence of Surface Water unless sufficient evidence exists for the spring(s) to justify a groundwater classification. Paragraph 3.2.2, Spring Construction, of the Policy sets forth the following criteria for a spring to be considered groundwater and not under the direct influence of surface water:

1. All facilities must be certified as out of the 100 year flood plain or sufficient flood protection must be provided to protect the facility from a 100 year flood event.
2. Springs must not be constructed in an area where either underground or surface contamination can impact such water source.
3. Springs must be enclosed by reinforced concrete walls and cover, or other durable and watertight material.
4. Spring boxes must have an overlapping, lockable, water tight access cover.
5. Water from springs must be carried by gravity flow directly into storage or the distribution system. Pumping is allowed only from a sump or other storage.
6. Spring boxes and storage basins must meet the criteria in Chapter 7 in order to protect the water from contamination.
7. Spring Design must include:
    a. Screened drain pipe with exterior valve.
    b. Overflow pipe just below maximum water level elevation protected by 24 mesh screen.
    c. Supply outlet from spring must be located 6 inches above drain outlet and be protected by 24 mesh screen.

d. Perforated collection pipe.

8. An earth cover, natural or fill, depth of at least 5 feet. Hypalon or similar water proof fabric may be required as a seepage barrier.

9. A surface water drainage ditch must be located uphill from the source so as to intercept surface water runoff and carry it away from the source.

10. Fencing

a. Fence must be constructed to prevent entry of unauthorized persons and all but small animals.

b. Fence must be uphill of the drainage ditch and completely surround the area where the spring emanates from the ground. The fence must also surround any equipment associated with the development of the spring source (e.g., spring box, exposed collection pipe).

Groundwater Quality Performance Testing must be performed to demonstrate that the source is groundwater as described in 5.7.4 the Division's Safe Drinking Water Program Policy DW-003, otherwise it will be classified as groundwater under the direct influence of surface water. This performance testing is in addition to meeting the above criteria and consists of the following:

1. The system must conduct performance testing with the source operating under normal conditions and under standard operating procedures.
2. The system must conduct the groundwater quality performance testing using locations, frequencies and dates as specified in Table 1 of DW-003.

3. The Department will evaluate the groundwater quality performance testing results to determine if the source meets the criteria for groundwater consisting of:

a. Microscopic Particulate Analysis (MPA) or total coliform data must demonstrate that that there is no significant occurrence of insects or other macro organisms, algae, or large-diameter pathogens such as Giardia lamblia or Cryptosporidium.

b. Groundwater quality performance testing data must demonstrate that there are no significant or relatively rapid shifts in water quality parameters such as aerobic spores, turbidity, temperature, or conductivity which closely correlate with adjacent surface water or climatological conditions.

The observations from a physical field inspection of the existing springs, in light of the above criteria and performance testing of springs to be considered groundwater and not under the direct influence of surface water disclosed there are many improvements that would have to be implemented. Those improvements will be extensive, costly and the probability is high that a groundwater classification could not be obtained from the Division.

C. Classify the Springs as Under the Direct Influence of Surface Water

The most viable alternative is to accept the Division's Classification that the Springs are Under the Direct Influence of Surface Water. Article 11.8, Surface Water Rule of Regulations 11 states "The Supplier must provide filtration and disinfection of the surface water sources that meet the treatment technique requirements for all of the following: Cryptosporidium, Giardia Lamblia, viruses, Heterotrophic Plate Count bacteria, Legionella, and turbidly. These treatment techniques are as follows:

1. At a point between where the source water is not subject to recontamination and the entry point, the supplier must install and properly operate water treatment processes that reliably achieve at least the following levels of treatment:

    a. 99 percent (2-log) removal of Cryptosporidium.

    b. 99.9 percent (3-log) treatment, including filtration and disinfection, of Giardia Lamblia.

    c. 99.99 percent (4-log), including filtration and disinfection, of viruses."

The Association will have to install a water treatment system that meets the criteria set forth in Regulation 11 for Public Water System under the direct influence of surface water. The Division implemented the State of Colorado Design Criteria for Potable Water Systems, and the Safe Water Program Policy No. 5 for the review and subsequent approval of waterworks for public water systems. In addition, the Association will be required to retain a certified water system operator and submit all required water test results to the Division.

D. Offsite Public Water System

The Association has the alternative to obtain potable treated water from another public water system. The nearest system is owned and operated by the City of Gunnison which is approximately 30 miles away. Assuming an agreement could be entered into with City the Association owners could purchase a large potable water tank with a truck and haul the water to the site where a property owners could obtain water directly from the truck. The other alternative is for the Association to not provide any water and each property owner obtains water from the City of Gunnison. Obtaining water offsite is not economically feasible and would be very cumbersome for the property owners.

IX. PROJECT DESIGN CRITERIA

A General

- Seasonal water system operating from May 15 to October 15 with the systems winterized during the off season.
- Design to meet the current and future needs for the next 10 years.

B. Consumers

- 393 total parcels
- Estimated 100 parcels with some type of development.
- There are some parcels in the lower portions of the Association that have private water wells.
- 4 parcels to be developed each year.

C. Water usage

- 100 parcels x 225 average gpd = 2,250 gpd
- Water will only be used to fill water transport tanks.
- Transport tanks can be filled at any of the spring fill stations.
- Typical transport tank = 300 gallons
- Flow rate into tank = 30 gpm
- 10 minutes to fill water transport tanks
- Peak flow day = 100 parcels x 300 gpd = 30,000 gpd
- Average flow day during peak season = 50% of peak = 15,000 gpd

D. Projected water usage from fill stations:

Spring	%		Average Daily flow	Peak Daily flow
Armstrong Spring Fill Station	20%	=	3,000	6,000
Gilmore Spring	10%	=	1,500	3,000
Pitkin View Loading Station	25%	=	3,750	7,500
No Name Loading Station	45%	=	6,750	13,500

E. Spring fill station design flow rates

Controlled gpm flow rates to be determined.
300 gallon water transport tank requires 10 minutes to fill
Maximum hourly flow 300 gallons x 3 fills per hour = 900 gph

F. Water treatment system and fill station components:

- Building to house treatment system
- Solar power system or grid power
- Flow control orifices
- Sample ports
- Maintenance valves
- Filtration
- Disinfection
- Storage tanks
- Contact time tanks/chambers

- Key card operation at fill station
- Controls for system operation
- Telemetry system
- Drainage system
- Dechlorination of treated water storage tanks for winterization

G. Water storage tanks

Water storage tanks will be required to maintain adequate water availability from the Gilmore/Pitkin View springs during peak usage periods and for obtaining detention time for disinfection. The Armstrong Spring has a flow rate of approximately 600 gpm and based on this flow storage tanks may not be necessary. The maximum water flow to fill individual transportation tanks would be determined in the design process.

The combined Gilmore and Pitkin View Springs have a combined marginal low season flow of 7.1 gpm. In order to control flow and limit water storage volumes an orifice will be installed to limit the flow of 30 gpm of treated water to the consumers. The water availability is not adequate to meet a sustained 30 gpm flow rate and, as such, water storage tank capacity will be required to meet the flow rates. At 30 gpm it will take approximately 10 minutes to fill a 300 gallon water transportation tank. Assuming a peak day usage of 3 fillings per hour in an 8 hour time frame the required water volume would be 7,200 gallons. During this 8 hour period the low water flow would be 5,112 gallons. The springs are capable of supplying adequate water but water storage will be required to meet the water demand. The recommended water storage would be one 2,000 gallon tank which would provide for adequate water to meet the current needs. Supplemental tanks could be added in the future to meet those demands.

H. Controls, Monitoring and Automation

The Association desires to automate the controls to the maximum extent possible and to provide for instrumentation for monitoring and obtaining required tests data. The basic elements in the controls and automation as presently envisioned would be as follows:

- Instrumentation to monitor turbidly.
- Instrumentation to monitor residual chlorine.
- Probes to monitor Nitrates.
- PH sensors.
- Data log selected parameters.
- Key card system to disperse water to consumers.
- Remote telemetry to monitor system components.

X. WATER TREATMENT SYSTEM ALTERNATIVES

A. Armstrong Spring

1. General

Appendix J is the proposed Water Treatment Flow Schematic for the Armstrong Spring Public Water System. The Armstrong Spring is capable of delivering over 600 gpm, the water right is for 98.73 gpm, and the design water flow rate for filling transport tanks would be determined during the design phase. There is insufficient field data at this point in time to provide a firm recommendation to the Association on the location of the water treatment and loading station, and the treatment system components. The location of the spring and the collection tank are fixed, but it is not necessary that the water treatment system and loading station be at the spring collection and storage tank. The factors to be considered to determine the locations of the water system components are:

- Any existing easements.
- Property ownership.
- Survey and locate corners for surrounding parcels
- Access road assessments and evaluations.
- Wetlands delineation.
- Accurate vertical elevations to define static pressure heads.
- Electric grid power availability.
- Field evaluations to locate potential turnaround areas.

2. Install the water treatment system at the existing loading station location

The first alternative is to install the water treatment system at the existing fill station which has advantages and disadvantages.

The advantages are:

- The existing turnaround and fill area is in place.
- Water conveyance lines will not have to be constructed.
- There is adequate space for the treatment system depending on selected location.
- Easements for the water system could be in the 60 foot road right of way.
- The loading station remains in its known historical location.

The disadvantages are:

- The access road to the fill station is narrow with sharp curves and improvements should be made to the road.
- There is only a maximum of 12 ft. or 5 psi of static pressure at the treatment works.
- Pumps will be required for filtration and disinfection and to fill water transport tanks.

- Available electric power is over 3,600 ft. from the spring.

3. A combined treatment and fill station down-gradient of the spring

The second alternative is to abandon the existing loading station and install a water line down gradient to a new location for a combined treatment and loading station. Without research and field investigations, a location cannot be recommended at this point in time. One potential location is the vicinity of the intersection of Upper Armstrong Gulch Road and Charlies Challenge. Based on Google Earth the intersection is approximately 1,800 ft. from the loading station and there is a 128 ft. elevation drop. The advantages of this alternative are:

- A static pressure of approximately 55 psi is available and pumps would not be required to operate the filtration and disinfection systems.
- Electric power is available in the vicinity of the intersection of Upper Armstrong Gulch Road and Charlies Challenge Road.
- Improves access and eliminates traveling on the narrow Upper Armstrong Gulch Road.
- Fire department connection could remain in place at the existing location.
- If a 6-inch line water transmission is installed, a fire department connection could be installed and accessibility to fill a fire truck would be better than at the spring.
- Eliminates potential improvements to the road for better access.

The disadvantages are:

- Additional cost to install the water transmission pipeline.
- Potential wetland issues.

4. Separate the location of the treatment plant and the loading station.

The third alternative is to separate the location of the treatment plant and the loading station. The treatment facility could be installed in the road right of way at a location where there is sufficient room for the construction of the building and appurtenances and there is adequate pressure to operate the treatment equipment without installing pumps. If an adequate site could not be located within the road right of way an easement would have to be procured from a property owner. Gunnison Counties' implied easement right of way is 60 ft. wide with 30 ft. each side of the road centerline and the plat sets forth the easement width for major roads as 60 feet and 30 feet for minor roads. The water storage tank(s), if required, would be installed adjacent to the treatment plant. The loading station would be located downhill from the water storage tank at a location where there is adequate space for transferring water to vehicles and an area for turnaround space. A water line to convey treated water from the storage tank to the loading station would be installed in the road right of way. The advantages of this alternative are:

- Adequate static water pressure would be available to operate the treatment equipment without pumps.
- If an adequate space can be developed in the road right of way it will provide shorter access and eliminate traveling on the narrow Upper Armstrong Gulch.

- The location of the storage tank(s) and the water transmission line will help in obtaining contact time.

The disadvantages are:

- Additional cost to install the water transmission pipeline.
- Potential wetland issues.
- Easements may have to be procured from private property owners.

B. Gilmore Spring

1. General

The Gilmore Spring is capable of delivering a late season low water flow of 5 gpm, the water right is for 15.0 gpm, and the proposed design water flow for filling transport tanks is 30 gpm. There is insufficient field data at this point in time to provide a firm recommendation to the Association on the location of the water treatment system and the loading station. The location of the spring and the collection tank are fixed, but it is not necessary that the water treatment system and loading station be located at the spring collection and storage tank and could be located down-gradient in order to obtain adequate pressure. The general factors to be considered to determine the locations of the water system components are the same as set forth in paragraph A for the Armstrong Spring. The proposed Water Flow Schematic for the Gilmore and/or Pitkin View is in Appendix J.

2. Install water treatment system at or near the existing spring

The first alternative is to install the water treatment system at or near the existing spring water storage tank and loading station, which has advantages and disadvantages.

The advantages are:

- Water transmission pipeline will be minimal.
- Fill station would be near the historical fill point.
- Wetlands should not be an issue at this location.

The disadvantages are:

- There would be no static pressure at the treatment works.
- Pumps will be required for filtration and disinfection and to fill water transport tanks.
- Electric power lines are a considerable distance from the spring.
- There is not a turnaround area at the spring location.

3. A combined treatment and fill station down-gradient of the spring

This alternative would move the treatment and fill station down-gradient of the spring and still on Grass Hopper Road. The advantages are as follows:

- Water transmission pipeline length will be minimal.
- Loading station would be on Grass Hopper Road below the historical fill point.
- Wetlands should not be an issue at this location.
- Adequate static water pressure would be available to operate the treatment equipment without pumps.

The disadvantages are:

- Additional cost to install the water transmission pipeline.
- Power is not available at the site and installation of lines is not cost effective.
- Turn around area would have to be constructed at the new location.

4. Combine Gilmore Spring and Pitkin View Spring flows

The Pitkin View Spring is down-gradient from Gilmore Spring and a gravity pipe line can be installed to transport the untreated water from the spring to the water storage tanks. This alternative is discussed under Section C for combining the flow from the Pitkin View and Gilmore Springs. The advantages of combining the flows are as follows:

- Eliminates the maintenance and operation costs for an additional treatment system.
- Eliminates the cost of an additional water treatment system for Gilmore Spring.
- The installation of a pipeline is viable and economically feasible.

C. Pitkin View Spring and Pitkin View Loading Station

1. General

The Pitkin View Spring is capable of delivering a late season low water flow of 2.1 gpm, the water right is for 4.49 gpm, and the proposed design water flow for filling transport tanks is 30 gpm. The location of the spring and the collection tank are fixed and the terrain is such that the treatment system cannot be located at the water storage tank. The general factors to be considered to determine the locations of the water system components are similar to those as set forth in paragraph A for the Armstrong Spring. The untreated water which flows from the Gilmore Spring can be combined with each of the following alternatives for the Pitkin View Spring.

2. Install water treatment system at the existing water storage tank

The water treatment system and storage tanks would be installed near the existing water storage tank with the loading station located downhill at the existing or relocated loading stations. The water treatment system installed slightly below gradient at the existing Pitkin View water

storage tank offers no advantages when compared to other alternatives but has several significant disadvantages as follows:

- Access to the location is not good and would have to be improved.
- Earthwork and grading would be necessary for installation of the water treatment facility.
- There would be no static water pressure to operate the filtration and disinfection system.
- Pumps would be required to operate the filtration and disinfection system.
- Power is not available at the site and installation of lines is not cost effective.
- A major investment in springs with very low flows is questionable.

3. Install the water treatment system above the existing Pitkin View Loading Station

The water treatment system water storage would be installed above the existing water loading station at an elevation that would provide adequate pressure to operate the treatment components and to obtain a 30 gpm water flow for filling water transport tanks. An uphill installation will have to be evaluated in the field to determine if it is feasible. There is more than adequate elevation drop from the water storage tank to the fill station in order to operate the treatment system components. There is an existing transmission water line from the Pitkin View Fill Station to the No Name Fill Station, which can be used to deliver treated water to the No Name Fill Station. Electrical power is not available at the site and solar power would have to be installed for all power requirements. This alternative has advantages over the other alternatives as follows:

- Pumps would not be required to operate the filtration and disinfection system.
- The loading station would remain in the historical location.

D. No Name Loading Station

No Name Loading Station would remain in use at the existing location with treated water delivered to the station by means of an existing pipeline. Upgrades to modernize the loading station would be undertaken similar to other loading stations. Maintaining the fill station would continue to provide this source of water to the property owners.

E. Chicago Park 3 Spring Loading Station

The Association has represented that the Chicago Park 3 Spring Loading Station will be abandoned as a source for public water for the property owners.

XI. RECOMMENDED WATER TREATMENT SYSTEMS

A. Armstrong Spring

Adequate field data is not available at this point in time to provide a well-founded recommendation for the overall Armstrong Spring water system. The recommended course of action is to abandon the existing loading station and install a pipeline from the spring outlet to the water treatment facility that would be located downgradient in order to obtain sufficient static water pressure. A water storage tank would be installed in the vicinity of the treatment system

with piping to a water loading station. Contact time for disinfection will be obtained via the water storage tank and a piping array designed to meet the Division requirements in respect to log inactivation requirements. The Preliminary Flow Schematic for the Armstrong Spring water system is in Appendix J. Development of the Armstrong Spring Water System is the best alternative for the property owners, because there are more than adequate water flows to meet immediate and all future requirements. The development of one spring is cost effective and eliminates duplicating operation and maintenance on additional spring. The major consideration is acceptance by the property owners of only one spring and the location of the loading station.

B. Gilmore Spring and Pitkin View Spring

It is recommended to combine the flows from the two springs and install one water treatment system. Water from the Gilmore Spring would be piped to the Pitkin View Spring and the combined flows would be transported to the existing Pitkin View Loading Station. The Gilmore and Pitkin View water storage tanks and loading stations would be abandoned with the treatment system would be constructed at the existing Pitkin View Loading Station. A field evaluation needs to be conducted to determine if this is the best location for the treatment system. Water storage tanks would be installed at the water treatment facility and the existing pipeline to No Name Loading Station would convey treated water to the upgraded No Name Loading Station. The Preliminary Flow Schematic for the Gilmore and Pitkin View Spring Water System is at Appendix K.

XII. WATER SYSTEM CONSTRUCTION PROGRAMS

The property owners may not desire to install water treatment systems but must realize that a public water system must be installed in order to bring the springs into compliance with applicable laws and regulations. Items that must be considered in selecting the overall water system program are to determine initial capital investment, evaluate reliability, convenience, property owner's desires, obtaining financing through loans or capital contributions by all property owners, and operation and maintenance costs.

Adequate data is not available at the present time to provide reasonably accurate construction costs estimates, but the alternatives can be evaluated on their advantages, disadvantages, desirability, and property owners input in respect to convenience and acceptable loading station locations. Three programs for the water system have been developed with members of the Water Committee to meet the requirement for the Property Owner's Public Water System. The selection of a final program(s) would be debated by the property owners and a plan selected. The property owner's must select one of the following programs:

- Program A: Develop Armstrong Spring as the property owner's only public water system and pipe the spring water to the vicinity of Armstrong Reservoir and provide for water treatment, storage facilities, and a loading station.

- Program B: Combine flows from Gilmore/Pitkin View springs as the property owner's only water system and utilize the No Name Loading Station. This program will meet the

immediate needs of the property owners but depending on the amount of development it will not be adequate to meet future needs without the installation of additional storage tanks.

- Program C: Provide two water systems by simultaneously developing Armstrong Spring and Gilmore/Pitkin View Spring.

XIII. CONSTRUCTION COSTS

At the present time there is insufficient data and the lack of a defined plan of action in order to develop reasonable construction cost estimates. Based on experience in the market place, similar projects, and a general overall understanding of the programs the costs are anticipated to be in the vicinity of $125,000 each for the Armstrong and Gilmore/Pitkin View Public Water Systems. A more accurate cost estimate will be developed after a thorough field evaluation and consultation with the Water Committee and will be available prior to the July 3, 2017 Annual Property Owners Meeting.

XIV. PROJECT SCHEDULE

There are many factors that need to be taken into consideration in the preparation of a project schedule varying from the Association's approval of the project, obtaining field data, procuring financing, loans, grants, obtaining any required easements, design time, Division approval of design, weather and construction time. The conceptual proposed schedule which was developed in conjunction with the Water Committee is as follows:

Association responds to the Compliance Advisory issued by the Division	May 1, 2017
Engineer conducts field evaluations and obtains data for design	May 15, 2017
Homeowners Association meeting annual meeting	July 3, 2017
Board of Directors determines selects the final water treatment program	July 3, 2017
Association engages Engineer to design the selected water system	July 15, 2017
Engineer completes field investigations & provides recommendation	July 30, 2017
Engineer meets with Committee for approval of design concept	August 1, 2017
Final systems design and construction cost estimate	August 30, 2017
Submittal of construction documents to Division	September 1, 2017
Approval of design by Division	December 1, 2017
Procurement of funds to construct water sytem(s)	April 31, 2018
Bidding or negotiating construction contract for Phase 1	May 15, 2018
Start Construction	June 5, 2018
Construction complete and water system put into operation	September 1, 2018
Inventory and approval by Division	September 15, 2018