BRN-W-12-1

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Brian Water Corporation – Facility Plan

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Brian Water Corporation

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Level of Study

This technical document provides the alternatives of the appraisal level engineering evaluation for bringing Brian Water Corporation into compliance with IDAPA 58.01.08. This facility plan will identify the alternatives from which the homeowners will choose a preferred alternative that will meet drinking water standards of nitrate minimum contaminant level (MCL) and treatment requirements, where appropriate.

Introduction and Background

Brian Water Company (BWC) entered into a consent order (amended date March 7, 2012) with the Idaho Department of Environmental Quality. BWC is a community public water system (System) that serves forty six (46) homes, refer to Appendix A-1 and A-2. The system currently supplies drinking water to the homeowners that does not meet the drinking water standards for nitrate. Samples staked from the system show nitrate levels that exceed the MCL of 10 milligrams per liter (mg/L).

Existing Conditions

Brian Subdivision is located near the intersection of Warm Springs Avenue and Highway 21. It is outside the limits of the City of Boise in Ada County, Idaho. The subdivision is flanked by the Boise River to the west and Hammer Flats to the east. The subdivision has 48 homes. The remainder of the homes has individual wells. Most of the homes in the subdivision were built in the 1970s, while others were built earlier in the 1960s.

Brian Water Company serves drinking water to 46 of the 48 homes in Brian Subdivision. It is deemed unlikely that additional homes will be served by the drinking water system. The community drinking water system has two wells located in parcel legally described as Lot 2 Block 2, refer to Appendix A-2. It is our understanding that well #1 has a flow capacity of approximately 110 cfs and has a depth of 75 feet and well #2 has a flow capacity of 110 cfs and a depth of 80 feet. Both wells are contained in a well house. The wells have no metering devices. Information on the capacity and depth of the wells is based on the well driller's report and an approximation set forth by the BWC's operator. The proximity to agricultural lands and the relatively shallow depth of the wells has led to an increase in the nitrate levels of the sources beyond the allowable MCL.

There are two homes that are not connected to the PWS. One home on 5890 Boven Drive has a 150-foot well, refer to Appendix A-2. Nitrate levels at the well were at 0.6 mg/L, refer to Appendix C-3 and C-4. Another home on 6199 Brian Way has a 200+-foot well with nitrate levels at 0.2 mg/L, refer to Appendix A-2 and C-5. The drill reports of these individual wells are included in Appendix C-7 and C-8. The data from the well driller's reports of these homes prove useful in terms of how deep new wells would have to be drilled if BWC chooses to drill two completely new sources.

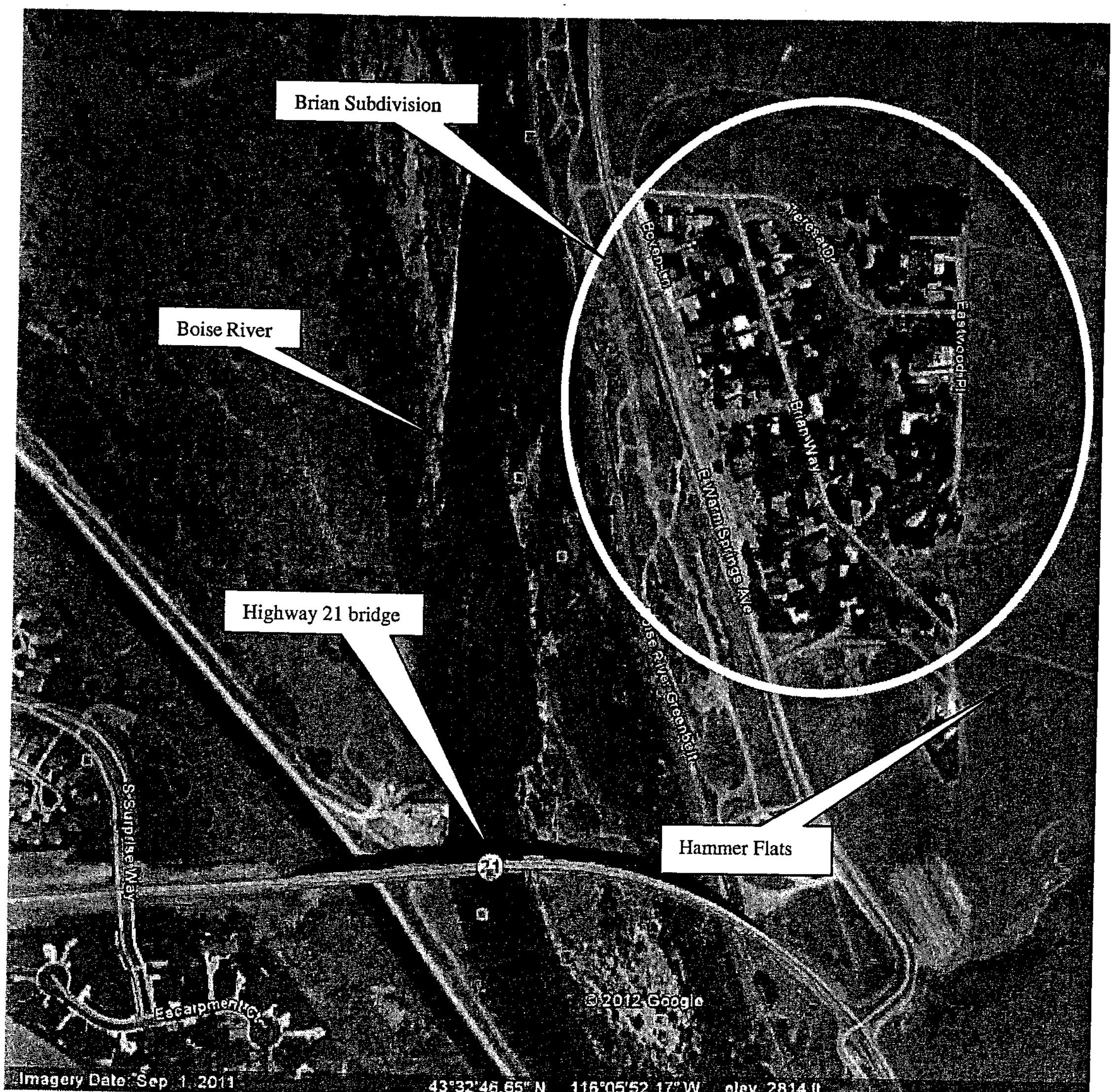

Figure 1. Location of Brian Subdivision on Warm Springs Avenue.

Evaluation of Alternatives

Rejected Alternatives

Several alternatives were considered to treat or replace the existing drinking water sources. One alternative that was considered, but rejected, is to drill one well to a minimum depth of 150 feet below ground surface. Provided that the new well produces water that meets drinking water standards, water from that source would be used to blend with the nitrate-contaminated water from the two existing sources. This alternative has up-front uncertainties in cost to the homeowners. BWC would have to drill a test well to a depth of at least 150 feet to determine the capacity of the source and to test for water quality. If the test well indicates that the hole will have to be drilled deeper due to insufficient yield or nitrate or poor water quality, then the homeowners will be subject to even more uncertain costs beyond the cost of a test well. In addition, should the new well be subject to maintenance or repair indefinitely, homeowners would be subject to contaminated water from the remaining sources or Brian Water Corporation would be required to inform homeowners of the potential of consuming high nitrate laden water from the existing wells during the renovation or maintenance of the new well.

Another alternative was to drill deeper through the existing wells, but was rejected due to the age of the existing wells. It is assumed that the existing wells are of questionable condition. Also, there needs to be a redundant source at all times.

Finally, the last alternative that was considered but rejected was to install an ion exchange unit or a reverse osmosis system in each home. The reasons for eliminating these alternatives include cost. More importantly, the installation of individual treatment units puts the burden on the homeowner to purchase a unit that will range from $400 to $1,500. It would also put the expense on the individual homeowner to recharge a unit, which is one of the major costs of maintenance and operation. Lastly, ion exchange and reverse osmosis units also require constant monitoring of the unit to ensure that they are producing "clean" water, a task that should not be the responsibility of BWC, not the homeowner. Refer to Appendix C-9 through C-171 for reference information.

For the remainder of this section, the viable alternatives to mitigating or replacing the existing drinking water system will be described. The following alternatives were analyzed:

- Connect to existing public drinking water system
- Incorporate ionization treatment at the source
- Drill two new wells
- Incorporate RO system at each house, for information only (FIO)

The engineer's preferred alternative will be given; however, it does not mean that the BWC will choose the preferred alternative. BWC and Brian Subdivision have the option to discard alternatives or selectively choose alternatives to develop into a detailed predesign.

Connect to Existing Public Drinking Water System

The majority of the residences in the city of Boise are serviced by United Water Idaho (UWI). Connection to UWI is an option that would require no maintenance and operational efforts once the homeowners of Brian Subdivision are connected. As an existing drinking water system, UWI monitors the water quality and ensures adequate pressure and quantity of water to the customers they service. UWI also has the technical, financial, and managerial capacity to maintain their drinking water system. However, the nearest water main to Brian Subdivision is located approximately 7,600 feet away. Assuming the installation of an 8-inch pipe plus a pump station to maintain adequate pressure, the cost to extend the water would be approximately $400,000 at minimum, refer to Appendix E-2.

If BWC chooses to connect to an existing drinking water (i.e. United Water Idaho), they would need to provide a written agreement with the existing water system that provides a timeline of the connection to the existing distribution system in Brian Subdivision. Similar to the remaining alternatives discussed in this report, the cost to connect to an existing system would be a monumental burden on the homeowners. Each homeowner would have to pay a minimum of $8,700 to construct the lines and the booster pump that would allows them to connect to the system.

Incorporate Ion Exchange Unit at the Sources

Another alternative to remediating the nitrate levels is to install nitrate removal systems at the sources. The ion exchange unit works like a household water softener. For nitrate removal, unit uses a resin that exchanges chloride ions for nitrate (and sulfate) in the water. However, the resin only contains so much chloride ions that is eventually depleted after so many gallons of water. The resin is recharged of chloride ions using a concentrated solution of sodium chloride. Backwash brine from recharging the unit will be in high nitrate concentration and will require proper disposal, which is a large portion of the operation and maintenance costs.

Another drawback of an ion exchange system is that the resin prefers the sulfate exchange. It is not certain if the BWC sources are high in sulfate. Water high in sulfate would reduce the system's effectiveness. Once the resin is saturated, it releases nitrates in place of sulfates, which would increase the nitrate concentration in the water. Ion exchange also makes water corrosive, but the water can be neutralized. The drinking water operator will need to be certified to operate and maintain an ion exchange unit to ensure that the unit continues to produce compliant water and will need to conduct continuous and frequent monitoring of nitrate levels. Finally, ion exchange is expensive and requires maintenance.

One study developed by the Minnesota Department of Agriculture and the Minnesota Department of Health summarized the costs of several public water systems that used ionization or reverse osmosis to remove nitrate from the drinking water system, refer to Appendix C-9 through C-171. The study shows that the cost per resident increases as the population served decreases. In their example, the largest public water system is Lincoln-Pipestone Rural Water, which serves 4,100 people. The construction cost of nitrate removal added up to $1,706,000, which amounted to $416 per resident. The summary also included the cost to produce every 1,000 gallons of clean water assuming a 20-year amortization (without interest expense) plus annual operating costs, which was $1.35 for the Lincoln-Pipestone system. The smallest public water system was Clear Lake, which serves 435 people. Their construction cost of nitrate removal was $412,390, which was about $970 per resident. The cost to produce every 1,000 gallons of clean water was $4.38. For a very small community like BWC, these extrapolated costs would be much higher. Based on the Minnesota study, an extrapolated construction cost is estimated to be $190,066, or $1,358 per resident and the cost to produce every 1,000 gallons of clean water would be $7.20, refer to Appendix D-3. At an estimated per capita use of 0.14 acre-feet (WRIME report, 2010), the annual water use of Brian Water is about 6.4 million gallons per year. It would cost the BWC customers an estimated $46,080 per year to produce clean water from their existing sources, or $329 per resident per year.

Drill Two New Wells

The system modifications would be designed using the following flows: total consumption on a maximum day of 153 gallons per minute (GPM) and a peak use for an expected one-hour duration of 308 GPM excluding fire flows, refer to Appendix D-2. The flows were calculated based on 46 homes, 2.47 houses per acre and a factor of safety of 2, in the absence of metered usage data from the drinking water system. The design flow rates were estimated using the Design Flows Calculation (dated 7/9/2007) spreadsheet provided by DEQ.

BWC has an estimate from a local drilling and pump company, refer to Appendix E-5. The existing pumps have a capacity of 110 GPM, which we understand has been adequate. The estimate was based on a 110 GPM standard or VFD pump system at $29,734 or $32,645, respectively. This estimate is for one well. If this well is not in operation, there must be another well that can provide the peak hour demand flow, plus fire flows. BWC will be required to drill a second well of equal or greater capacity. The cost estimate provided will need to be revised for drilling two wells that meet the peak hour demand of 308 GPM, plus what will be required for fire flows, unless the 110 GPM is authorized. If the wells do not provide sufficient flow for fire suppression, Brian Water will need to install elevated storage to cover the fire flow requirement. Other concerns that will need to be addressed if BWC chooses to install two new wells and the existing capacity pump is not authorized is the water right. The drinking water standards require more flow capacity than what the existing system provides. BWC will need to request for sufficient water rights to meet the required capacity of the two new wells. In addition, BWC will also need to request a waiver to drill in the same lot as the existing wells as the current lot does meet current setback requirements.

Other significant costs not accounted for in this estimate are the operation and maintenance costs to replace all of the mechanical parts of the drinking water system. In addition to having a redundant source, Brian Water will need to provide a generator that is large enough to maintain power in the largest well and provide an automatic transfer switch to the generator in the event of a power outage to avoid service interruption. A 20-year life cycle cost analysis to replace the two pumps, the generator, and other mechanical parts, in addition to the power requirement to maintain at least one of the pumps year round is shown in Table 1 below. In the long term, if the current owner can no longer manage or serve as the drinking water operator of the system, the burden will be on the homeowners to find the means to manage, operate, and maintain the system.

Incorporate a Reverse Osmosis System in Each Home (For Information Only)

The system is a multifaceted system that includes a reverse osmosis (RO) system that will remove 99 percent of most contaminants in the water and 70 percent of any nitrate levels. The other 30 percent will be cleaned up by the deionization canister filter which will take place of a "polish" carbon filter and will fit in one of the bottom housings of the RO system. There is a monitoring system required with an audible alarm to alert the homeowner of any problem associated with the system. The alarm will plug into the system using a tee on the line going to the faucet. A separate water line can be run to the refrigerator to supply clean water to the refrigerator water dispensers.

This alternative is not considered due to yearly cost of item shown in life cycle costs below.

Cost Estimate

Table 1 summarizes the initial cost of each alternative, the life expectancy, as well as the annual cost for the life of each alternative.

Table 1. Cost Summary of all alternatives

Alternatives	Initial Cost	Life Expectancy	Annual Cost
Connect to Existing Drinking Water System	$400,000	150	$2,667
Incorporate Ion Exchange Unit at the Sources	$190,000	5	$38,000
Drill Two New Wells	$81,000	20	$4,050
Incorporate RO Sys at houses (for info only)	$40,020	2	$20,010

Life cycle cost information is prepared as a decision making tool. The costs indicate an alternative's cost per year for the life of the alternative.
The cost estimate developed for this option is for the purpose of planning only and is not intended to be at a the level required for construction.

Recommendation

All of these alternatives will be costly to the homeowners and it will impose financial hardship on every single homeowner that is currently being served by Brian Water as the cost of any of these alternatives will be passed on to them. The ultimate goal of this report is to ultimately provide recommendation for what would be the most reliable alternative source of safe and clean drinking water for the homeowners at Brian Subdivision.

The recommended alternative is to connect to an existing drinking water, such as United Water Idaho. First, once the homes in the subdivision are connected to the system, the homeowners will have peace of mind that the quality of their water will meet strict drinking standards and that they will always have adequate pressure at the tap. Second, smaller drinking water systems are likely to have more difficulty in meeting the increasingly stricter drinking water standards. Third, the cost to maintain and operate a drinking water system once all standards are met, may be high when considering the long term need to replace parts and pay staff. A smaller drinking water system would have to relay a higher share of those costs per household than a home that is connected to a large drinking water system. Also, it is likely that property values will rise with the peace of mind that a connection to a large, established drinking water system.

APPENDIX E

BRIAN WATER CORPORATION

FACILITY PLAN

COST ESTIMATES

UWI Connection Cost Estimate			
Cost/ft of 8" pipe	Length of pipe	Booster pump and pump house	Total
$50.00	~~$~~7,600.00 ft	$20,000.00	$400,000.00

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1240 N W Beaman St
Mountain Home, ID 83647
208-587-9055
fax 208-587-9816

HIDDLESTON

DRILLING & PUMP CO.
www.hiddlestondrilling.com

Boise Office
5932 W Victory
Boise, ID 83709
208-362-2900
fax 208-362-9723

ESTIMATE

Date: October 4, 2012

Jesse Cham
Boise, Idaho

Phone: 412-6012
Email: jcham33@live.com

RE: 1-8" x 150 Community well for Brian Water Corp. Subdivision, Boise, Idaho

DRILLING

QUANTITY	UNITS	DESCRIPTION	UNIT PRICE	EXTENDED
1	Each	Drilling Permit Community Well	$225.00	$225.00
100	Feet	12" Diameter Borehole	$95.00	$9,500.00
50	Feet	8" Diameter Borehole	$24.00	$1,200.00
150	Feet	8" Casing	$33.27	$4,990.50
1	Each	8" Drive Shoe	$344.35	$344.35
20	Feet	8" SS Well Screen	$187.92	$3,758.40
100	Each	State of Idaho required Surface Seal	$25.00	$2,500.00
		Drill Subtotal		$22,518.25

**** Drilling prices are based on current fuel prices. We reserve the right to charge a reasonable fuel surcharge to cover fuel price increases.****

Thank you for the opportunity to bid this project.

Gary Oyler
Hiddleston Drilling and Pump Co.

Accepted By______________________________**Date:**______________

Estimate good for 30 days