FINAL

Water Supply Alternatives Analysis

Bulinski Point
West Shagawa Road
Ely, Minnesota

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Prepared for:

Minnesota Pollution Control Agency

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Acronyms and Abbreviations

µg .... micrograms
µg/L .... micrograms per liter
amsl .... above mean sea level
bgs .... below ground surface
ft. .... feet
GAC .... granular activated carbon
HBV .... health-based value
HRL .... health risk limit
MDH .... Minnesota Department of Health
mg/kg .... milligrams per kilogram
MPCA .... Minnesota Pollution Control Agency
O&M .... operations and maintenance
PCE .... tetrachloroethene
PE .... Professional Engineer
Terracon ..... Terracon Inc.
VOC .... volatile organic compound
WDC .... Wetland Delineator Certified
WSAA .... Water Supply Alternatives Analysis

Certification

The information contained in this report is true and correct to the best of my knowledge.

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1.0 INTRODUCTION

This Water Supply Alternatives Analysis (WSAA) has been prepared to evaluate alternatives for providing whole-house water supplies to residences with impacted drinking water wells on Bulinski Point in Ely, Minnesota. A map depicting the location of Bulinski Point is included as **Figure 1**, and a map depicting the locations of the subject residential properties (Site) is included as **Figure 2**. Four alternatives were evaluated, including Do Nothing, Continued Granulated Activated Carbon Treatment of Residential Wells, Installation of a Community Well, and Installation of a Public Water Service. Each of the potential alternatives was evaluated individually using four categories, including Effectiveness, Constructability/Feasibility, Community Acceptance, and Cost. The scores from each category were then tabulated to generate a composite score that can be used to compare the alternatives to one another.

This WSAA provides background information, including a description of the regional geology and hydrogeology at the Site, the initial discovery of contamination, the existing groundwater treatment systems, and a summary of the environmental investigations performed at the Site. A summary of the means and methods used to evaluate each of the alternatives is provided, as well as the final scores for each alternative and the conclusions of the WSAA. Score cards for each of the alternatives are included in Table A-1 and budgetary cost estimates for Alternatives WS-2, WS-3, and WS-4 are provided in Tables A-2, A-3, and A-4, respectively.

2.0 BACKGROUND

2.1 Site Location

The Site includes four residential properties located near the city of Ely in northeastern Minnesota, approximately 20 miles south of the border between the United States and Canada (**Figure 1**). The Site is located on the southern portion of a peninsula on Shagawa Lake, which is known locally as Bulinski Point (**Figure 2**). The surface elevation across the Site varies from Shagawa Lake's surface elevation of approximately 1,327 feet (ft.) above mean sea level (amsl) to 1,370 ft. amsl. Shallow bedrock and bedrock outcrops are present at the Site and along the lakeshore. Precambrian-age graywackes and slates of the Knife Lake Group are overlain by up to 50 ft. of Quaternary-age sand and gravel deposits in this area. The sand and gravel sediments are ice-contact deposits formed as part of the Rainy-Superior lobe of the late Wisconsinan glaciation. The local horizontal groundwater flow direction is anticipated to vary from east to west across the Site and likely discharges to Shagawa Lake. During subsurface investigation activities at the Site, groundwater was encountered at depths ranging from 6 to 9 ft. below ground surface (bgs).

2.2 Remedial Investigations

In May 2002, tetrachloroethene (PCE) was detected in groundwater samples collected from potable wells located at 1933 West Shagawa Road and 1925 West Shagawa Road (**Figure 2**). The samples were collected as part of a leaking underground storage tank investigation for a petroleum release identified at the 1933 West Shagawa Road (Leak #14216). Laboratory analysis indicated that the two potable wells contained PCE concentrations of 17 micrograms per liter (µg/L) and 42 µg/L, respectively, which exceeded the Minnesota Department of Health (MDH) health risk limit (HRL) of 5 µg/L and the cancer health-based value (HBV) of 4 µg/L for groundwater. The existing wells located on Bulinski Point were tested for volatile organic compounds (VOCs) at that time, and three residential wells (1936 Shagawa Road, 1933 West Shagawa Road, and 1925 West Shagawa Road) tested positive for PCE and were subsequently connected to granular activated carbon (GAC) water filtration systems in 2003 (Terracon Inc. [Terracon], 2005).

Minnesota Pollution Control Agency (MPCA) staff visited Bulinski Point to obtain information regarding dumping activities in the area, and reviewed groundwater quality and well construction data for potable wells in the area. Information obtained by the MPCA indicated that a dump area containing plastic barrels labeled "perchloroethylene" had been discovered at 1936 Shagawa Road. The dump area was discovered by the property owners, who had purchased the property from Ken and Carolyn Wittrup. The Wittrups reportedly owned and operated a dry cleaning facility in Ely. Based on the information available, this dump area was assumed to be located south of the house located on the property. Some of the barrels reportedly contained a dark, tarry residue and had a strong odor. The barrels and other debris were removed for disposal, and the area was filled (Terracon, 2003).

Several phases of investigations have been completed at the Site, and a soil vapor investigation is scheduled to be completed in the spring of 2017. In addition to the investigation activities, semiannual sampling and operations and maintenance (O&M) of the three GAC systems and sampling of the residential well located at 1932 West Shagawa Road are ongoing. Summaries of each of the completed investigations and ongoing routine O&M and sampling activities are provided in the following sections.

2.2.1 Initial Subsurface Investigation—2002

In December 2002, a limited phase II subsurface investigation was performed in three areas near the 1936 Shagawa Road property. The goal of the investigation activities was to assess the known and potential areas where dry cleaning solvents and/or associated waste dumping occurred and to assess potential pathways for contaminant migration to the potable wells where PCE impacts were detected. Soil probes were advanced just east of the originally identified dump area, which was near a greenhouse that was present at the Site and within an area that was used by a former construction company. The investigation consisted of advancing 14 soil probes to refusal at depths ranging from 4 to 37 ft. bgs. Soil and groundwater samples were collected from the soil borings and submitted for laboratory analysis of VOCs.

Neither PCE nor its associated daughter products were detected in the soil samples collected during the investigation. Groundwater was encountered at two of the investigation areas, including the area near the suspected dumping area and near the former construction company. PCE and its daughter products were not detected in the samples collected from the suspected dumping area, but PCE was detected in two of the samples collected from the area near the former construction company (Terracon, 2003).

2.2.2 Gore-Sorber Screening Surveys

In April 2003, a Gore-Sorber Screening Survey was completed near the former construction company and along West Shagawa Road in an attempt to identify the PCE source area(s) and to assess potential contaminant migration pathways. The survey consisted of 25 survey modules that were installed approximately 50 ft. apart from one another. The modules were submitted for analysis of the Gore Chlorinated VOC Target Compound List. PCE vapors were detected between 0.01 to 1.89 micrograms (µg) in samples collected from the investigation area. The Gore-Sorber data suggested that the source area may be located near the entrance to the driveway of the 1936 West Shagawa Road property; however, a definitive PCE source area was not identified.

In October 2003, a second Gore-Sorber Screening Survey was performed at the Site to identify the source(s) of the PCE contamination. The investigation consisted of 39 survey modules located between 20 and 50 ft. from one another. The survey modules were submitted for analysis of the Gore Chlorinated VOC Target Compound List. PCE vapors were detected between 0.03 and 2.07 µg in the area adjacent to the 1936 West Shagawa Road driveway, where PCE vapors were identified in the April 2003 survey. The survey results confirmed the findings of the April 2003 investigation and identified a potential source of PCE contamination south of the driveway entrance to the 1936 West Shagawa Road property (Terracon, 2004).

2.2.3 Source Area Investigation—2005

In May 2005, a source area investigation was conducted to assess the shallow soils located in the suspected source area identified during the Gore-Sorber Screening Survey. The investigation consisted of advancing 33 hand auger borings to depths ranging from 0.5 to 3 ft. bgs, which coincided with refusal on bedrock obstructions in each boring. Twelve soil samples were collected and submitted to a laboratory for analysis of VOCs. PCE was detected in two of the soil samples at concentrations of 0.083 milligrams per kilogram (mg/kg) and 2.2 mg/kg. These PCE concentrations are below the MPCA-established tier 1 soil reference value of 72 mg/kg; however, they are above the MPCA-established tier 1 soil leaching value of 0.068 mg/kg. PCE was not detected in the other hand auger soil samples.

Based on the analytical results, the additional investigation work confirmed the presence of PCE in the shallow soils where the previous Gore-Sorber Screening Survey data indicated that PCE vapors were present. The PCE soil impacts appeared to be concentrated along the south side of the 1936 West Shagawa Road property driveway where it meets West Shagawa Road. This area may be the source area associated with the PCE groundwater impacts to residential wells located to the east-northeast. The investigation results also confirmed the absence of detectable PCE at various locations throughout the Site. Based on the depth of the soil samples, the soil was likely impacted from a surface release (i.e., spill or dumping). Furthermore, based on the results and distribution of the soil sampling, the lateral extent of the source area may be limited or have been previously removed, such as by excavating impacted soil/gravel (Terracon, 2005).

2.2.4 Receptor Survey—2012

In May 2012, a receptor survey of properties within 500 ft. of the suspected source area was conducted to identify potential ingestion, inhalation, and dermal contact exposure pathways associated with the PCE contamination. The survey included an evaluation of surface soil, groundwater, soil gas, and surface water. The survey referenced the surface soil impacts documented during the source area investigation as evidence that a surface soil exposure path was possible. The survey included an evaluation of drinking water wells in the area and research to confirm that no municipal wells were located within 500 ft. of the source area. It was confirmed that no municipal wells are located in the area and that two additional residential wells, which are located at 1950 and 1951 West Shagawa Road, could potentially be impacted. The survey also concluded that soil vapor intrusion into residential structures was possible and had not yet been adequately investigated. Surface water was also considered in the survey, and it was concluded that, based on the concentrations observed in the groundwater, risks to the surface water quality of Shagawa Lake are low (Bay West LLC, 2012).

2.2.5 Residential Potable Water Sampling

Following the discovery of PCE in water samples collected from the 1925, 1933, and 1936 West Shagawa Road potable wells in May 2002, GAC water filtration systems were installed on each of these wells. Each GAC treatment system consists of two vessels (GAC1 and GAC2) that are designed to remove PCE and other VOCs from the water before it is supplied for residential use. Since January 2003, water samples have been collected on varying time intervals (quarterly, semiannual, and annual) from these potable wells and submitted to a laboratory for laboratory analysis of VOCs. Water samples were collected from sample ports located before the GAC system (raw, untreated water), between the two GAC system vessels, and after the GAC systems (fully treated water) during the first years of sampling. Currently, samples are collected from sample ports located before and between the GAC system vessels.

The analytical data indicates that the concentration of PCE in raw groundwater has decreased to a concentration below the HRL and HBV at 1936 West Shagawa Road, while the concentration of PCE remains above the HRL and HBV at 1925 and 1933 West Shagawa Road. The analytical results from the samples collected after the first GAC vessel indicate that the concentrations of PCE were reduced below the HRL after passing through the first vessel. Since sampling began, PCE has not been detected in samples collected from the sample port on the second carbon vessel.

Since 2012, the groundwater well located at 1932 West Shagawa Road has been sampled to confirm that the well is not impacted. To date, PCE and its daughter products have not been detected at this location; therefore, no GAC system is installed at this location.

2.2.6 Vapor Intrusion Study—2012–2017

An evaluation of the risk posed by vapor intrusion into the residential structures at the Site began in 2013 and is scheduled to be completed in 2017. Sub-slab vapor sampling ports have been installed in the basements of the homes located at 1925, 1932, 1933, and 1936 West Shagawa Road. Samples of the sub-slab vapors have been collected and submitted for VOC analysis on multiple events at all the properties except for 1933 West Shagawa Road, which was only sampled during the initial sampling event in 2013. Since the initial sampling event, the owner of 1933 West Shagawa Road has declined to participate in the subsurface vapor evaluation. PCE and its daughter products have not been detected at concentrations above the sub-slab vapor screening level (33x intrusion screening level) in any of the samples collected at the Site.

2.3 Current Remedy

Whole-house water supplies are provided to the properties at the Site where PCE has been detected by treating groundwater from the private wells using GAC filtration systems. Each system includes two GAC vessels that are operated in series. Samples are collected before and between the two GAC vessels to monitor the concentration of PCE in the raw groundwater extracted from each of the wells and to evaluate if PCE breakthrough is occurring prior to the second GAC vessel. Currently, the systems are sampled on a semiannual basis; concentrations of PCE above the HRL or HBV have not been detected between the two GAC vessels or following the second GAC vessel.

These analytical results indicate that the residence time in the first GAC vessel provides sufficient contact time to reduce the concentration of PCE below the HRL and HBV and that the second GAC vessel serves as a failsafe to treat the groundwater in case the activated carbon in the first GAC vessel is exhausted. PCE has not been detected between the first and second GAC vessels at concentrations above the HRL or HBV, indicating that the effective life of the GAC is in excess of one year. The effective life of the GAC, the biennial sampling frequency, and operating two GAC vessels in series in each system make the current remedy a dependable and effective method to address the PCE-impacted residential wells.

In addition to the GAC system routine sampling and O&M activities, the drinking water well at 1932 West Shagawa Road is sampled on a semiannual basis. The analytical results indicate that PCE and its daughter products are not present at detectable levels in the groundwater at this property. Sampling this well provides data to demonstrate that the concentration of PCE and its daughter products have been and continue to remain below the HRL.

3.0 WATER SUPPLY ALTERNATIVES

Three water supply alternatives are being evaluated in this WSAA. The three alternatives are Continued GAC Treatment of Residential Wells, Installation of a Community Well, and Installation of a Public Water Service. A Do Nothing alternative is presented for comparative purposes.

3.1 Alternative WS-1: Do Nothing

The Do Nothing Alternative is not considered as an acceptable alternative and is only presented to provide a baseline comparison to the other alternatives. This alternative assumes that the existing GAC systems would be taken off-line and no additional action would be taken beginning in 2017.

3.2 Alternative WS-2: Continued GAC Treatment of Residential Wells

If the Continued GAC Treatment of Residential Wells Alternative is implemented, each of the residents in the area will continue to use their private wells and the existing GAC treatment systems will be used to treat impacted groundwater at the three residences where impacts have been detected. Semiannual sampling of the private wells and GAC system O&M will continue for the foreseeable future or until the groundwater impacts have naturally attenuated. For evaluation purposes, a project life of 30 years was assumed for this alternative.

3.3 Alternative WS-3: Installation of a Community Well

If the Installation of a Community Well Alternative is implemented, an easement will be obtained to install a single community well upgradient of the groundwater impacts, and individual service lines will be installed to supply water to the residences with impacted wells. A potential location for the well is shown on **Figure 3**, and other suitable locations are present in the area. The new well will be six inches in diameter and will be installed to a terminal depth of 325 ft. below grade, in the deep bedrock aquifer. The upper 50 ft. of the well will be cased to prevent migration of shallow groundwater into the well, and the lower portion of the well will be hydrofracked to ensure that a sustained flow of ten gallons per minute is provided to each of the three residences. The service lines will be 1.5 inches in diameter and will be installed at a depth of 5 ft. below grade, which is below the frost line. The service lines will be installed in areas that are outside of the suspected source area to reduce the likelihood that PCE-impacted soils are disturbed during the installation. Some bedrock blasting and removal may be required to achieve the minimum burial depth.

Following the installation of the community well, the three existing impacted wells will be properly abandoned. The well and service line installation and well abandonment activities will take approximately one week to complete. Construction oversight will be performed throughout the project to ensure that the scope of work is properly implemented and that the construction workers are not exposed to PCE-impacted soils. A well installation report will be generated to document the project activities once construction has been completed.

Following the installation, a robust sampling plan will be implemented for the first year of the well's operation and semiannual sampling will continue for the following nine years to ensure the community well and the existing well at 1932 Shagawa Road are not impacted by the groundwater plume. As an additional precaution, a six-month startup period will be implemented. During this period, the existing GAC systems will remain online and samples will be collected before and after the first carbon vessel.

If this alternative is selected, project planning and easement negotiations will be completed in 2017. The community well and service lines will be installed and the existing wells will be abandoned in 2018. The sampling plan will be implemented for one year once the well is brought online, and will be completed in 2019. Semiannual sampling will be performed for the following nine years to complete the ten-year monitoring period.

3.4 Alternative WS-4: Installation of a Public Water Service

If the Installation of a Public Water Service Alternative is selected, a water main and individual water service lines will be installed to provide the residences with water from the city of Ely's public water works. The property owners will not be responsible for the cost of the installation, but will be responsible for the monthly water bills. PCE and its daughter products have not been detected in samples collected from the well located at 1932 West Shagawa Road. If this alternative is selected, a water service will be supplied to this residence and the existing well will be abandoned. The installation of a public water service will eliminate the need to continue sampling the water at this residence. Initial sampling will be performed, but no long-term sampling, aside from any requirements established by the city, will be required.

The water main will be a six-inch-diameter ductile iron line that will be connected to the existing water infrastructure near the intersection of West and North Shagawa Road. The water main extension will end near 1933 West Shagawa Road, and a fire hydrant will be installed at the termination point. The water line will be installed to a minimum depth of 7.5 ft. below grade, as required by the city, and approximately 500 tons of bedrock will be blasted and excavated to achieve this minimum depth. The water main and service lines will be installed outside of the suspected source area to reduce the likelihood that PCE-impacted soils are encountered during installation. Installation will require trench dewatering, and the non-impacted groundwater will be discharged without treatment. The approximate location of the water main is shown on **Figure 4**. Following the installation of the water main and service lines, the four existing residential wells will be properly abandoned. The water main and service line installation and well abandonment activities will take approximately nine weeks to complete. Construction oversight will be performed throughout the project to ensure that the scope of work is properly implemented and that the construction workers are not exposed to PCE-impacted soils. An installation report will be generated to document the project activities once construction has been completed. If this alternative is selected, project planning will begin in 2017 and will be completed in early to mid-2018. The water main and service line construction and well abandonment will be completed in 2018.

4.0 ANALYSIS OBJECTIVES AND SCORING METHODOLOGY

This section identifies the objectives and scoring methodology used to complete the individual and comparative evaluations of each alternative.

4.1 Water Supply Objectives and Criteria

The objective of the water supply alternatives selected for evaluation is to limit residential exposure to impacted groundwater and to provide a whole-house potable water supply source (i.e., for drinking, cooking, and sanitation purposes). For the purposes of this study, a potable water supply is defined as water with contaminant concentrations that do not exceed the HRLs or HBVs established by the MDH.

4.2 Technology Scoring Methodology

Four criteria were used to individually evaluate each alternative and to create a composite score that can be used to perform a comparative evaluation of the alternatives. The titles of the four criteria and a description of each are provided below:

<u>Effectiveness</u>

This criterion considered whether the alternative meets the objective of supplying a whole-house water supply with concentrations of contaminants of concern below the established HRLs and HBVs. The level of project-specific maintenance and the overall reliability of the alternative were also considered in this criterion. Each alternative was scored on a scale of one to five using the rubric below:

1) Does not meet the project objective.
2) Meets the project objective on an inconsistent basis and/or requires excessive project-specific (weekly) O&M to remain effective.
3) Consistently meets the project objective with frequent (monthly) project-specific O&M to remain effective.
4) Consistently meets the project objective with occasional (semiannual) project-specific O&M requirements.
5) Consistently meets the project objective and does not require project-specific O&M activities.

<u>Constructability/Feasibility</u>

This criterion considered the technical difficulties associated with the construction of each alternative. Each alternative was scored on a scale of one to five using the rubric below:

1) Alternative is not constructible.
2) Alternative construction requires the use of unproven technologies.
3) Alternative construction requires the use of highly specialized equipment and/or personnel skilled in specialized techniques that are not readily available in the project area.
4) Alternative construction requires the use of equipment and techniques that are readily available in the project area.
5) Alternative requires the use of equipment and techniques that are readily available in the project area, and does not require the installation of new infrastructure.

Community Acceptance

This criterion considered the project stakeholders' perception of each alternative. A survey was issued to the project stakeholders to gauge their perception of each alternative. One survey was provided to each of the four property owners whose wells are currently sampled and one was supplied to the city of Ely, whose municipal water works would supply the residence under Alternative 4. A survey was also provided to the township of Morris, where the Site is located, but the township did not submit a completed survey. Each alternative was scored by each stakeholder on a scale of one to five using the rubric below, and the average score for each alternative was calculated based on the survey results:

1) Strongly oppose/disapprove of the alternative.
2) Oppose/disapprove of the alternative.
3) Indifferent to alternative implementation.
4) Approve of alternative.
5) Believe that the alternative is the best solution.

Cost

This criterion considered capital and O&M costs of each alternative. Budgetary cost estimates were developed for each alternative using historical data, subcontractor quotes, and time and material estimates. For the purposes of comparison between the alternatives, the costs were adjusted to a present value based on 2016 dollars assuming a 7% interest rate. Present value, also known as present discounted value, is a future amount of money that has been discounted to reflect its current value, as if it existed today. The present value is always less than or equal to the future value because money has interest-earning potential, a characteristic referred to as the time value of money. Time value can be described with the simplified phrase "A dollar today is worth more than a dollar tomorrow." Here, "worth more" means that its value is greater. A dollar today is worth more than a dollar tomorrow because the dollar today can be invested and earn a day's worth of interest, making the total accumulate to a value that is more than the value of a dollar by tomorrow. Each alternative was scored on a scale of one to five based on the calculated present value using the rubric below:

1) Estimated alternative costs exceed $125,000 per residence.
2) Estimated alternative costs are between $100,000 and $125,000 per residence.
3) Estimated alternative costs are between $75,000 and $100,000 per residence.
4) Estimated alternative costs are between $50,000 and $75,000 per residence.
5) Estimated alternative costs are less than $50,000 per residence.

Each alternative was individually scored in each category, and then a composite score was calculated by tabulating the scores in each category.

5.0 SCREENING AND EVALUATION OF WATER SUPPLY ALTERNATIVES

In this section, water supply alternatives are evaluated in accordance with the criteria outlined in **Section 4.0**. The scores assigned for each criterion and the composite scores for each alternative are provided in **Section 5.2**. The Community Acceptance scores were calculated using the project stakeholder surveys, and the final scores are presented in Table A-1. More-detailed accounting of the cost estimates is presented in Tables A-2, A-3, and A-4.

5.1 Individual Evaluation of Alternatives

The alternatives were evaluated individually to ensure that the alternatives were constructible and capable of meeting the project objective. The results of the individual evaluations are summarized below.

5.1.1 Alternative WS-1: Do Nothing

Effectiveness

The Do Nothing Alternative does not meet the project objective.

Constructability/Feasibility

The Do Nothing Alternative does not require the use of specialized equipment or the installation of any infrastructure.

Community Acceptance

Since the Do Nothing Alternative is not considered a viable option, it was not included in the survey and, for comparative purposes, has been assigned the minimum score for this criterion.

Cost

The Do Nothing Alternative does not have any monetary cost associated with it.

5.1.2 Alternative WS-2: Continued GAC Treatment of Residential Wells

Effectiveness

The Continued GAC Treatment of Residential Wells Alternative has a proven track record that demonstrates it is an effective means of providing a whole-house water supply. Laboratory analysis of samples collected from the GAC systems has confirmed that the existing treatment systems meet the project objective of providing a whole-house water source with contaminant concentrations below the established HRLs and HBVs. This alternative requires routine semiannual sampling and O&M activities to remain effective.

Constructability/Feasibility

The Continued GAC Treatment of Residential Wells Alternative is currently being implemented, and the required infrastructure has already been installed. Considering that the system is installed and that O&M and sampling have been implemented for several years, this alternative has proven to be both constructible and feasible to operate.

Cost

Historic cost data was used to develop a budgetary cost estimate to operate the GAC systems assuming a project life of 30 years. Historic cost data indicates that annual O&M and system sampling currently costs approximately $12,100, the cost for exchanging the GAC in a filter vessel is approximately $3,700 per event, and the cost for replacing a complete vessel is approximately $4,100.

For estimating purposes, it was assumed that one carbon vessel will require GAC exchange every year and that complete vessel replacement will be required every five years. Historical O&M data shows that these assumptions are very conservative and that the time period between GAC exchange and carbon vessel replacement will likely be significantly longer than assumed.

Based on the cost information and the assumptions presented above, it is estimated that the present value of sampling and operating the systems for 30 years is approximately $205,000. A 25% contingency has been included in the budgetary cost estimates prepared for each of the alternatives, bringing the final budgetary estimate to approximately $257,000, or $65,000 per residence. A more-detailed accounting of the cost estimate is provided in Table A-2.

5.1.3 Alternative WS-3: Installation of a Community Well

Effectiveness

The Installation of a Community Well Alternative assumes that a well will be installed to a minimum depth of 325 ft. at a location upgradient of the Site. The upper 50 ft. of the well would be cased to prevent the migration of shallow groundwater into the well. This construction is based on the well that was constructed at 1932 West Shagawa Road. This well is screened in the deep bedrock aquifer and has been sampled seven times since 2012. The samples were submitted for laboratory analysis, and no VOCs have been detected in the samples to date.

The analytical data collected from this well indicates that the groundwater in the deep bedrock aquifer upgradient of the Site is not impacted. Based on this information, a similarly constructed well located upgradient from the Site would provide an adequate whole-house water supply for the three residences with impacted wells. This alternative would require startup and routine semiannual sampling as well as limited project-specific O&M activities to remain effective.

Constructability/Feasibility

Multiple drinking water wells have been installed in the area, including wells installed in the deep bedrock aquifer. A local well-drilling service that has installed multiple wells in the area was contacted to discuss the level of effort that would be required to install a well in the deep bedrock aquifer. The contractor indicated that installing the well would likely require hydrofracking the bedrock formation. Hydrofracking technology has been used on wells in the area and has proven to be effective.

The fact that shallow bedrock is present at the Site poses another logistical issue, since rock blasting may be required to achieve sufficient trench depth to bury the water service lines below the frost line. A local contractor was contacted to determine whether rock blasting services were available in the area and to determine the level of effort associated with this method. Based on contractor feedback, it was determined that the service is locally available and performed on a routine basis.

This evaluation indicates that the installation of a community well may require the use of specialty equipment and techniques. The discussions with local contractors indicate that the equipment and personnel required to implement these techniques are available locally.

Cost

A budgetary cost estimate, which was based on local subcontractor quotes, historic project activities, and time and material estimates, was developed to evaluate the cost criterion. Local contractors were contacted to supply quotes for installing and abandoning wells, and time and material estimates were made for installing the well service lines. Historic project activities were referenced to estimate the costs associated with project planning, startup and routine well sampling, construction oversite, and reporting efforts.

Based on the proposed community well location, approximately 1,000 ft. of trench will be installed to provide water service lines to 1933 and 1925 West Shagawa Road, and approximately 500 ft. of trench will be installed to provide a water service line to 1936 West Shagawa Road. These trenches will be installed to a depth of 5.5 ft. to ensure that the water lines are located below the frost line.

A robust well startup sampling plan and nine years of semiannual routine sampling are also included in the budgetary cost estimate. The well startup sampling plan includes four phases:

- **Phase 1:** Sampling of each residence twice during the first week of operation.
- **Phase 2:** Weekly sampling of each residence for one month following Phase 1.
- **Phase 3:** Sampling of each residence twice per month for the next three months following Phase 2.
- **Phase 4:** Monthly sampling of each residence for the next year following the completion of Phase 3.

To ensure that this alternative continues to meet the project objective, nine years of routine semiannual sampling will also be conducted.

The present value of this estimate is approximately $265,000. A 25% contingency has been included in each of the cost estimates, bringing the final present value estimate to approximately $331,000, or $82,750 per residence. A detailed accounting of this budgetary cost estimate is provided in Table A-3.

5.1.4 Alternative WS-4: Installation of a Public Drinking Water Service

Effectiveness

The extension of public water supply infrastructure to the impacted residence would meet the project objective of supplying a whole-house water supply. In addition, this alternative would not require any project-specific sampling or O&M activities.

Constructability/Feasibility

Municipal water or sewer lines have not been installed on Bulinski Point, but have been installed in relatively close proximity to the area. Despite the fact that lines have not been installed in this specific location, water and other utility lines are routinely installed in areas where shallow bedrock is present. A local excavation contractor that has implemented multiple projects in the area (including water line repair projects) was contacted to discuss the level of effort that would be required to implement this alternative. The contractor indicated that installation would likely require shallow bedrock blasting and significant dewatering efforts. Bedrock blasting and dewatering technology has been used in the area by local contractors on a routine basis and has proven to be effective.

This evaluation indicates that the installation of a public water service may require the use of specialty equipment and techniques. The discussions with local contractors indicate that the equipment and personnel required to implement these techniques are available locally.

Cost

A budgetary cost estimate based on local subcontractor quotes, historic project activities, and time and material estimates was developed to evaluate the cost criterion. Local contractors were contacted to supply quotes for installing the water main and service lines and for abandoning the existing wells. Historic project activities were referenced to estimate the costs associated with project planning, construction oversite, and reporting efforts.

A local contractor prepared a budgetary cost estimate to complete the construction of the water main and service lines. The contractor also supplied equipment and personnel standby rates, which were used to allow for additional time for soils screening and sampling that are not typically required in construction projects. The costs to generate the required project construction implementation plans and to perform construction oversight were developed using historical project data and the estimated time to complete the project as provided by the contractor. The present value of this estimate is approximately $662,000. A 25% contingency has been included in each of the cost estimates, bringing the final present value estimate to approximately $828,000, or $207,000 per residence. A detailed accounting of this budgetary cost estimate is provided in Table A-4.

5.2 Comparative Evaluation of Alternatives

The comparative evaluation can be used to evaluate the alternatives based on the composite score calculated for each individual alternative. The scores assigned to each of the alternatives are summarized in **Table 5-1**.

Table 5-1 Summary of Composite Scores

Alternative	Effectiveness	Constructability/ Feasibility	Community Acceptance	Cost	Total Comparative Score
WS-1: Do Nothing	1	5	1	5	12
WS-2: Continued GAC Treatment of Residential Wells	4	5	1.8	4	15
WS-3: Installation of a Community Well	4	4	2.6	3	14
WS-4: Installation of a Public Water Service	5	4	4.4	1	14

The composite score for each alternative was calculated by adding the effectiveness, constructability/feasibility, community acceptance, and cost scores for each alternative. This method provides a total score that weights each evaluation category equally. Nontechnical project requirements may make alternative composite score calculations such as weighted calculation more appropriate.

6.0 CONCLUSIONS

Based on the findings of this report, all the alternatives except for the comparative Do Nothing Alternative meet the project objective of providing whole-house water supply to the residences at the Site. The constructability/feasibility score assigned to each alternative is based on the data currently available and is subject to change following more-detailed evaluations. The budgetary cost estimates were developed based on several assumptions that will need to be verified to develop more-accurate estimates before developing work plans to implement an alternative. This evaluation used four scoring criteria and a simple additive total of the scoring criteria to develop the composite score. Additional scoring criteria and/or an alternate composite score calculation method may be more appropriate depending on the nontechnical project-specific requirements or the consideration of information that was not available at the time this analysis was completed.

7.0 REFERENCES

Bay West LLC, 2012. *Residential Water/GAC System Sampling and Site Data Review, Bulinski Point, Ely Minnesota, MPCA ID: SA#4493*. June.

Terracon Inc., 2003. *Limited Phase ll Investigation, Bulinski Point - Wittrup Property - MPCA/SF, 1936 West Shagawa Road, Ely, Minnesota*. June.

Terracon Inc., 2004. *Gore-Sorber Screening Survey, Bulinski Point - Wittrup Property - MPCA/SF, 1936 West Shagawa Road, Ely, Minnesota*. February.

Terracon Inc., 2005. *Source Area Investigation, Bulinski Point - Wittrup Property - MPCA/SF, 1936 West Shagawa Road, Ely, Minnesota*. June.

Figures

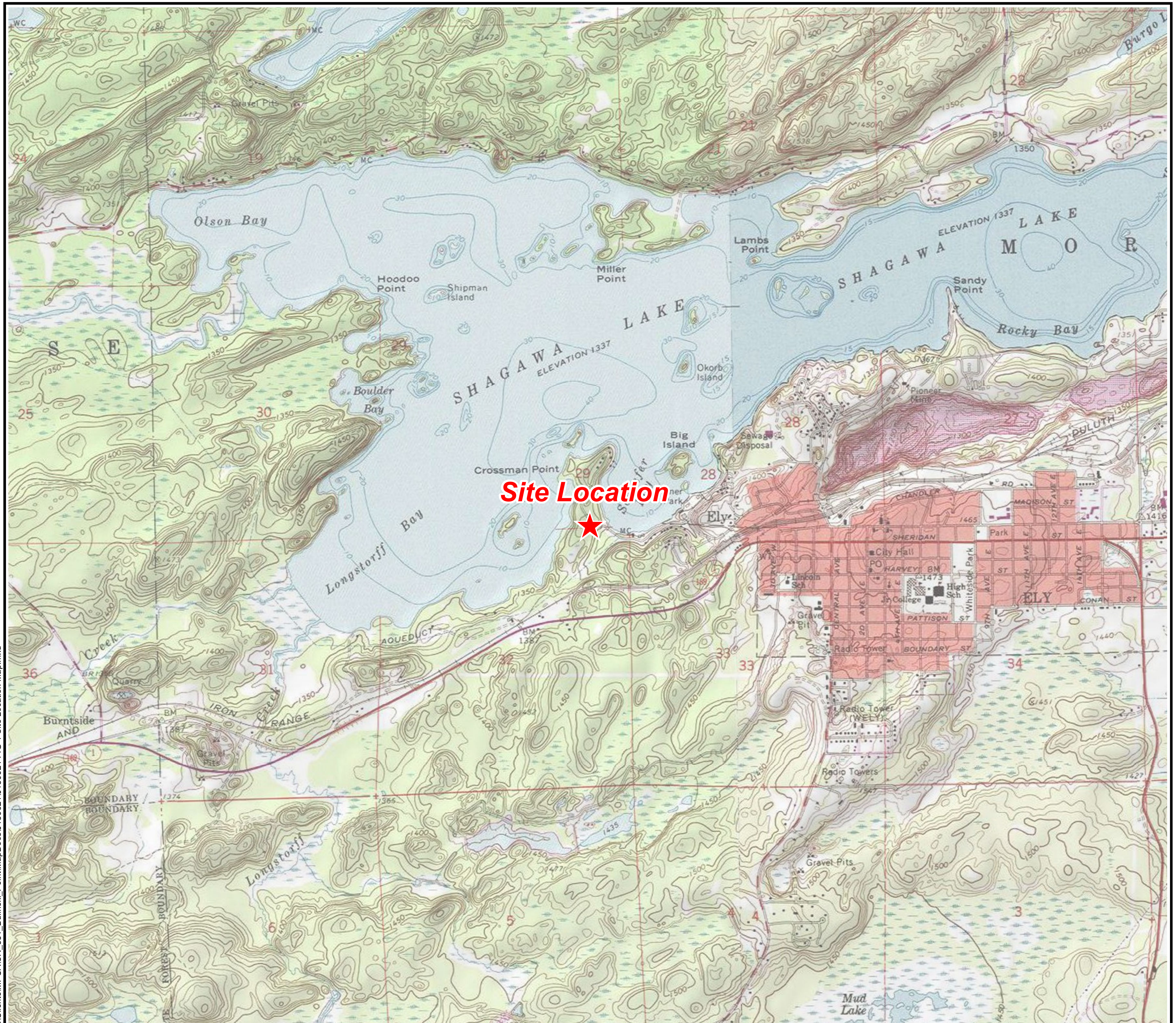
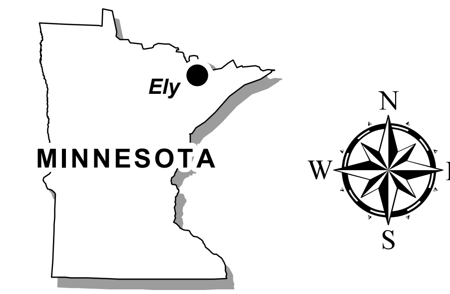


Figure 1

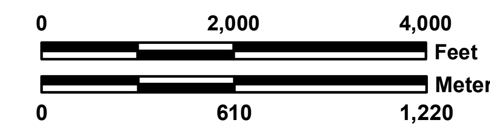
Site Location Map

Bulinski Point SR#381

Ely, Minnesota



Coordinate System: UTM 15N NAD 1983 Meters
Basemap: National Geographic Society, i-cubed WMS



★ Site Location

Bay West
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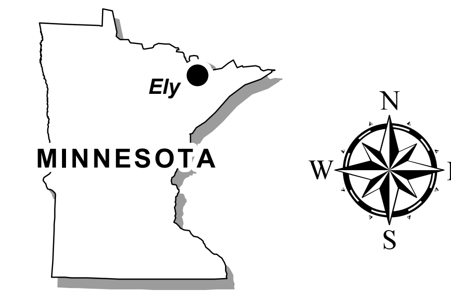
Y:\Clients\MPCA\SR_381_Bulinski_Point\MapDocs\U150621\U150621 FIG 1 Site Location Map.mxd

Figure 2

Site Map

Bulinski Point SR#381

Ely, Minnesota



Coordinate System: UTM 15N NAD 1983 Meters
Basemap: Bing Aerial Map Service

0 100 200 Feet
0 30 60 Meters

1:1,200

Potential PCE Source Area

Potable Well Location (Field Verified)

Approximate Parcel Boundaries
(St. Louis County GIS)

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: SG | Date Drawn/Revised: 12/30/2016 | Project No. J150621

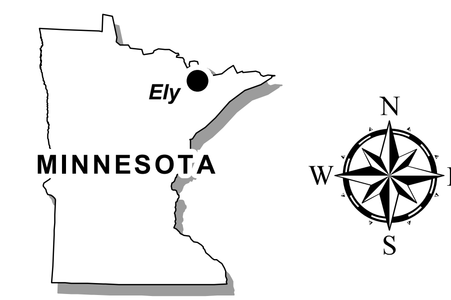
Y:\Clients\MPCA\SR_381_Bulinski_Point\MapDocs\J150621\J150621 FIG 2 Site Map.mxd

Figure 3

Alternative WS-3 Installation of a Community Well

Bulinski Point SR#381

Ely, Minnesota



Coordinate System: UTM 15N NAD 1983 Meters
Basemap: Bing Aerial Map Service

0 100 200 Feet
0 30 60 Meters
1:1,200

Potential PCE Source Area

Potable Well Location (Field Verified)

Approximate Parcel Boundaries (St. Louis County GIS)

Potential Community Well Location

NOTE:

The location of service lines depends on the existing plumbing and underground utilities at each residence and will be determined if this alternative is selected

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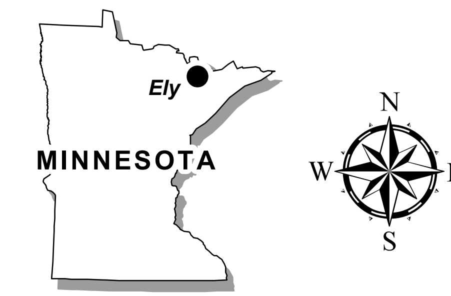
Figure 4

Alternative WS-4 Installation of a Public Water Service

Bulinski Point SR#381

Ely, Minnesota



Coordinate System: UTM 15N NAD 1983 Meters
Basemap: Bing Aerial Map Service

0 200 400 Feet
0 60 120 Meters

1:2,400

- Potable Well Location (Field Verified)
- Approximate Parcel Boundaries (St. Louis County GIS)
- Approximate Water Main Extension Location
- Approximate Fire Hydrant Location

NOTE:

The location of service lines depends on the existing plumbing and underground utilities at each residence and will be determined if this alternative is selected

Bay West
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Y:\Clients\MPCA\SR_381_Bulinski_Point\MapDocs\U150621\J150621 FIG 4 Alternative WS_4 Installation of a Public Water Service.mxd

Appendix A

TABLE A-1
REMEDIAL ALTERNATIVE SCORE CARDS
BULINSKI POINT
ELY, MN
MINNESOTA POLLUTION CONTROL AGENCY

ALTERNATIVE-1: DO NOTHING	
Criteria	***Score***
Effectiveness	1
Constructability/Feasibility	5
Community Acceptance	1
Cost	5
Total	***12***

ALTERNATIVE-2: CONTINUED GAC TREATMENT OF RESIDENTIAL WELLS (LIMITED ACTION)	
Criteria	***Score***
Effectiveness	4
Constructability/Feasibility	5
Community Acceptance	1.8
Cost	4
Total	***15***

ALTERNATIVE-3: INSTALLATION OF COMMUNITY WELL	
Criteria	***Score***
Effectiveness	4
Constructability/Feasibility	4
Community Acceptance	2.6
Cost	3
Total	***14***

ALTERNATIVE-4: INSTALLATION OF PUBLIC DRINKING WATER SERVICE	
Criteria	***Score***
Effectiveness	5
Constructability/Feasibility	4
Community Acceptance	4.4
Cost	1
Total	***14***

DESCRIPTION OF CRITERIA	
Criteria	***Description***
Effectiveness	This criterion considered if the alternative met the objective of supplying a whole-house water supply with concentrations of COCs below the established HRL. The level of project specific maintenance and overall reliability of the alternative was also considered in this criteria.
Constructability/Feasibility	This criterion considered the technical difficulties associated with the construction of each alternative.
Community Acceptance	Survey based measure of stakeholder perception of the effective alternatives.
Cost	Evaluation of the cost per residence to implement each alternative .

DESCRIPTION OF EFFECTIVENESS SCORE	
Score	***Description***
1	Does not meet the project objective.
2	Meets the project objective on an inconsistent basis and/or requires excessive project specific (weekly) operation and maintenance to remain effective.
3	Consistently meets the project objective with frequent (monthly) project specific operation and maintenance to remain effective.
4	Consistently meets the project objective with occasional (semi-annual) project specific operation and maintenance requirements.
5	Consistently meets the project objective and does not require project specific operation and maintenance activities.

DESCRIPTION OF CONSTRUCTIBILITY/FEASIBILITY SCORE	
Score	***Description***
1	Alternative is not constructible.
2	Alternative construction requires the use of unproven technologies.
3	Alternative construction requires the use of highly specialized equipment and/or personnel skilled in specialized techniques that are not readily available in the project area.
4	Alternative construction requires the use specialized equipment and techniques that are readily available in the project area.
5	Alternative does not require the use of specialized equipment and/or installation of infrastructure.

DESCRIPTION OF COMMUNITY ACCEPTANCE SCORE (based on survey results)	
Score	***Description***
1	Stakeholders strongly oppose/disapprove of alternative implementation.
2	Stakeholders oppose/disapprove of alternative implementation.
3	Stakeholders are indifferent to alternative implementation.
4	Stakeholders approve of alternative implementation.
5	Stakeholders believe that alternative implementation is the best solution.

DESCRIPTION OF COST SCORE	
Score	***Description***
1	Estimated alternative costs are over $125,000/residence
2	Estimated alternative costs are between $100,000 and $125,000/residence.
3	Estimated alternative costs are between $75,000 and $100,000/residence.
4	Estimated alternative costs are between $50,000 and $75,000/residence
5	Estimated alternative costs are less than $50,000/residence

TABLE A-2
WS-2 COST ESTIMATE
ALTERNATIVE-2: CONTINUED GAC TREATMENT OF RESIDENTIAL WELLS
BULINSKI POINT
ELY, MN
MINNESOTA POLLUTION CONTROL AGENCY

ROUTINE SEMI-ANNUAL DRINKING WATER SAMPLING

Item	*Frequency (times/yr.)*	*Quantity*	*Unit*	*Unit Cost*	*Estimated Annual Cost*
Sample Collection	**2**	**1**	**LS**	**$3,032.80**	**$6,100**
Project Manager		6	HR	$115.00	$690
Engineer 3		1	HR	$119.00	$119
Scientist 2		6	HR	$89.00	$534
Field Technician 2		10	HR	$64.00	$640
Field Technician 1		2	HR	$54.00	$108
Per diem		1	EA	$36.00	$36
Equipment		1	LS	$175.00	$175
Mileage		270	EA	$0.54	$146
Laboratory Analysis (7-VOC, trip blank and DUP/event)		9	EA	$65.00	$585
Routine Reporting	**2**	**1**	**LS**	**$1,968.00**	**$4,000**
Project Manager		6	HR	$115.00	$690
Scientist 2		12	HR	$89.00	$1,068
CADD Specialist		3	HR	$70.00	$210
Project Management/Coordination	**1**	**1**	**EA**	**$1,988.00**	**$2,000**
Project Manager		8	HR	$115.00	$920
Scientist 2		12	HR	$89.00	$1,068
				SUBTOTAL: ANNUAL COST	***$12,100***
				SUBTOTAL: 30 YR PROJECT LIFE	***$363,000***

GRANULATED ACTIVATED CARBON CHANGE OUT					
Item	***Frequency (times/yr.)***	***Quantity***	***Unit***	***Unit Cost***	***Estimated Annual Cost***
Sub-Contractors	**1**	**1**	**LS**	**$2,075.00**	**$2,100**
GAC Exchange		2	EA	$725.00	$1,450
GAC Disposal		2	EA	$62.50	$125
Mobilization		1	LS	$500.00	$500
Oversight and Project Management	**1**	**1**	**LS**	**$1,553.80**	**$1,600**
Field Technician		10	HR	$64.00	$640
Scientist 2		2	HR	$89.00	$178
Project Manager		2	HR	$115.00	$230
Mileage		270	EA	$0.54	$146
Equipment		1	LS	$100.00	$100
Laboratory Analysis		4	EA	$65.00	$260
				SUBTOTAL: ANNUAL COST	***$3,700***
				SUBTOTAL: 30 YR PROJECT LIFE	***$111,000***

GRANULATED ACTIVATED CARBON FILTER HOUSING REPLACEMENT					
Item	***Frequency (times/5 yr.)***	***Quantity***	***Unit***	***Unit Cost***	***Estimated Annual Cost***
Vessel Replacement	**1**	**1**	**LS**	**$4,099.80**	**$4,100**
Replacement Vessel Purchase (Includes Carbon)	1	2	EA	$750.00	$1,500
Field Technician	1	16	HR	$64.00	$1,024
Mileage	1	270	EA	$0.54	$146
Equipment	1	1	LS	$250.00	$250
Laboratory Analysis	1	4	EA	$65.00	$260
Project Management	1	8	HR	$115.00	$920
				SUBTOTAL: EVENT COST	***$4,100***
				SUBTOTAL: 30 YR PROJECT LIFE	***$24,600***

ALTERNATIVE - 2 COST SUMMARY	
Cost Alternative - 2	
SUBTOTAL ALTERNATIVE-2	*$498,600*
+ 25 CONTINGENCY	$124,700
ESTIMATED TOTAL ALTERNATIVE-2	**$624,000**

Present Discounted Value: Cost Alternative - 2	
SUBTOTAL PRESENT VALUE ALTERNATIVE 2	***$205,000***
SEMI-ANNUAL GROUND WATER MONITORING	$150,149
GRANULATED ACTIVATED CARBON CHANGE OUT	$45,913
GRANULATED ACTIVATED CARBON FILTER HOUSING REPLACEMENT	$8,847
+ 25% CONTINGENCY	$51,300
ESTIMATED TOTAL ALTERNATIVE WS-2 PRESENT VALUE	**$257,000**
ESTIMATED TOTAL ALTERNATIVE WS-2 PRESENT VALUE/RESIDENCE	**$65,000**

TABLE A-3
WS-3 COST ESTIMATE
INSTALLATION OF COMMUNITY WELL
BULINSKI POINT
ELY, MN
MINNESOTA POLLUTION CONTROL AGENCY

WELL INSTALLATION AND ABANDONMENT				
Item	***Quantity***	***Unit***	***Unit Cost***	***Estimated Cost***
Project Preparation (Obtain access agreements/easements, develop SSHP and work plan, schedule contractors)	**1**	**LS**	**$17,652.00**	**$17,700**
Project Manager	40	HR	$115.00	$4,600
Engineer 3	16	HR	$119.00	$1,904
Scientist 2	80	HR	$89.00	$7,120
Scientist 1	20	HR	$74.00	$1,480
Field Technician 2	12	HR	$64.00	$768
Field Technician 1	20	HR	$54.00	$1,080
CADD Specialist	10	HR	$70.00	$700
Well Installation (Subcontractor)	**1**	**LS**	**$60,300.00**	**$60,300**
Service Line Materials (Fittings, manifold, pipe etc..)	2400	LF	$2.50	$6,000
Trenching (Trench will be 5.5 feet deep and 3 feet wide. Includes service installation, pipe bedding, directional boring and backfill)	1400	LF	$16.00	$22,400
Well Drilling (Well will be 6 inch diameter, 325 feet deep and cased from 0-50 feet)	325	LF	$28.00	$9,100
Hydro fracking	1	LS	$3,000.00	$3,000
Well Pump Assembly (Includes drop pipe, pitless adaptor, electrical cable and fittings)	1	LS	$5,200.00	$5,200
Pressure Test and Well Notification	1	LS	$600.00	$600
Pressure Tank and Water Supply Connection	1	LS	$3,500.00	$3,500
Well Abandonment (Abandon the three existing impacted wells)	3	EA.	$3,500.00	$10,500
Construction Oversight	**1**	**LS**	**$25,444.00**	**$25,500**
Project Manager	20	HR	$115.00	$2,300
Engineer 3	24	HR	$119.00	$2,856
Scientist 2	80	HR	$89.00	$7,120
Field Technician 2	80	HR	$64.00	$5,120
Per diem & Lodging	14	EA	$136.00	$1,904
Equipment	1	LS	$1,500.00	$1,500
Mileage	1200	EA	$0.54	$648
Laboratory Analysis (VOC, PAH, Metals, Nitrate, Coliform, E.coli)	1	LS	$3,996.00	$3,996

Well Installation Report	**1**	**LS**	**$8,390.00**	**$8,400**
Project Manager	16	HR	$115.00	$1,840
Engineer 3	2	HR	$119.00	$238
Scientist 2	56	HR	$89.00	$4,984
Field Technician 2	12	HR	$64.00	$768
CADD Specialist	8	HR	$70.00	$560
			Subtotal: Well Installation	***$111,900***

WELL START UP DRINKING WATER SAMPLING

Item	*Quantity*	*Unit*	*Unit Cost*	*Estimated Cost*
Phase 1 (Two sampling events the first week of operation)	**1**	**LS**	**$7,605.80**	**$7,700**
Project Manager	8	HR	$115.00	$920
Engineer 3	2	HR	$119.00	$238
Scientist 2	16	HR	$89.00	$1,424
Field Technician 2	40	HR	$64.00	$2,560
Field Technician 1	4	HR	$54.00	$216
Per diem	2	EA	$36.00	$72
Equipment	1	LS	$725.00	$725
Mileage	520	EA	$0.54	$281
Laboratory Analysis	18	EA	$65.00	$1,170
Phase 2 (Weekly sampling of each residence for first month)	**1**	**LS**	**$16,888.60**	**$16,900**
Project Manager	24	HR	$115.00	$2,760
Engineer 3	1	HR	$119.00	$119
Scientist 2	24	HR	$89.00	$2,136
Field Technician 2	120	HR	$64.00	$7,680
Field Technician 1	12	HR	$54.00	$648
Per diem	4	EA	$36.00	$144
Equipment	1	LS	$500.00	$500
Mileage	1040	EA	$0.54	$562
Laboratory Analysis	36	EA	$65.00	$2,340
Phase 3 (Two sampling events per month for three months)	**1**	**LS**	**$15,255.40**	**$15,300**
Project Manager	18	HR	$115.00	$2,070
Engineer 3	1	HR	$119.00	$119
Scientist 2	18	HR	$89.00	$1,602
Field Technician 2	90	HR	$64.00	$5,760
Field Technician 1	9	HR	$54.00	$486
Per diem	6	EA	$36.00	$216
Equipment	1	LS	$650.00	$650
Mileage	1560	EA	$0.54	$842
Laboratory Analysis	54	EA	$65.00	$3,510

Phase 4 (Monthly Sampling for next year, 72 samples, 60 samples excluding routine sampling.)	**1**	**LS**	**$33,304.00**	**$33,400**
Project Manager	40	HR	$115.00	$4,600
Engineer 3	10	HR	$119.00	$1,190
Scientist 2	80	HR	$89.00	$7,120
Field Technician 2	200	HR	$64.00	$12,800
Field Technician 1	20	HR	$54.00	$1,080
Per diem	10	EA	$36.00	$360
Equipment	1	LS	$850.00	$850
Mileage	2600	EA	$0.54	$1,404
Laboratory Analysis	60	EA	$65.00	$3,900
Summary Report	**1**	**LS**	**$8,390.00**	**$8,400**
Project Manager	16	HR	$115.00	$1,840
Engineer 3	2	HR	$119.00	$238
Scientist 2	56	HR	$89.00	$4,984
Field Tech 2	12	HR	$64.00	$768
CADD Specialist	8	HR	$70.00	$560
				Subtotal: Well start up drinking water sampling	***$81,700***

ROUTINE SEMI-ANNUAL DRINKING WATER SAMPLING

Item	***Frequency (times/yr.)***	***Quantity***	***Unit***	***Unit Cost***	***Estimated Annual Cost***
Sample Collection	**2**	**1**	**LS**	**$2,837.80**	**$5,700**
Project Manager		6	HR	$115.00	$690
Engineer 3		1	HR	$119.00	$119
Scientist 2		6	HR	$89.00	$534
Field Technician 2		10	HR	$64.00	$640
Field Technician 1		2	HR	$54.00	$108
Per diem		1	EA	$36.00	$36
Equipment		1	LS	$175.00	$175
Mileage		270	EA	$0.54	$146
Laboratory Analysis		6	EA	$65.00	$390
GAC Filter Replacement		1	LS	$4,100.00	**$4,100.00**
Routine Reporting	**2**	**1**	**LS**	**$1,968.00**	**$4,000.00**
Project Manager		6	HR	$115.00	$690.00
Scientist 2		12	HR	$89.00	$1,068.00
CADD Specialist		3	HR	$70.00	$210.00
Project Management/Coordination	**1**	**1**	**EA**	**$1,988.00**	**$2,000**
Project Manager		8	HR	$115.00	$920
Scientist 2		12	HR	$89.00	$1,068
				SUBTOTAL: ANNUAL COST	***$11,700***
				SUBTOTAL: 12YR PROJECT LIFE	***$144,500***

ALTERNATIVE - 3 COST SUMMARY	
Cost Alternative - 3	
SUBTOTAL ALTERNATIVE-3	$338,100
+ 25% CONTINGENCY	$84,525
TOTAL ALTERNATIVE-3	**$423,000**
Present Discounted Value: Cost Alternative - 3	
SUBTOTAL ALTERNATIVE-3	$265,000
WELL INSTALLATION	$98,820
WELL START UP SAMPLING	$68,971
ROUTINE SEMI-ANNUAL SAMPLING	$96,761
+ 25% CONTINGENCY	$66,250
TOTAL ALTERNATIVE - 3 PRESENT VALUE (INCL. CONTINGENCY)	**$331,000**
TOTAL ALTERNATIVE - 3 PRESENT VALUE/RESIDNECE (INCL. CONTINGENCY)	**$82,750**

TABLE A-4
WS-4 COST ESTIMATE
INSTALLATION OF A PUBLIC DRINKING WATER SERVICE
BULINSKI POINT
ELY, MN
MINNESOTA POLLUTION CONTROL AGENCY

WATERMAIN AND SERVICE LINE INSTALLATION				
Item	***Quantity***	***Unit***	***Unit Cost***	***Estimated Cost***
Project Preparation (Obtain access agreements/easements, develop SSHP and work plan, schedule contractors)	**1**	**LS**	**$21,004.00**	**$21,100**
Project Manager	48	HR	$115.00	$5,520
Engineer 3	24	HR	$119.00	$2,856
Scientist 2	88	HR	$89.00	$7,832
Scientist 1	24	HR	$74.00	$1,776
Field Technician 2	16	HR	$64.00	$1,024
Field Technician 1	24	HR	$54.00	$1,296
CADD Specialist	10	HR	$70.00	$700
Water Line Installation (Subcontractor)	**1**	**LS**	**$541,950.00**	**$542,000**
Mobilization	1	LS	$10,000.00	$10,000
6" CL 52 Ductile Iron Pipe and Fittings	2000	LF	$52.00	$104,000
Connection to Existing Ductile Iron Pipe	1	LS	$4,500.00	$4,500
1" Type K Copper Water Service Pipe	4	EA.	$100.00	$400
1" Corporation Stop Installed	5	Ea.	$550.00	$2,750
1" Curb Stop and Box Installed	5	Ea.	$550.00	$2,750
6" Valve Box Installed	2	Ea.	$3,000.00	$6,000
Fire Hydrant Installed	1	Ea.	$6,500.00	$6,500
Asphalt Installed (4")	1600	Ton	$85.00	$136,000
Asphalt Saw Cuts and Removal	1600	Ton	$20.00	$32,000
Class 5 Aggregate Base MDOT 3138 Installed	3000	Ton	$28.00	$84,000
Insulation Installed	100	SY	$100.00	$10,000
Rock Blasting and Removal	500	Ton	$100.00	$50,000
Pre Rock Blasting Inspections	5	Ea.	$2,500.00	$12,500
Pit Run Installed	500	Ton	$20.00	$10,000
Pipe Bedding	250	Ton	$25.00	$6,250
Site Restoration	1	LS	$28,000.00	$28,000
Dewatering	1	LS	$1,500.00	$1,500
Pressure Testing	1	LS	$2,500.00	$2,500
Removal of 3" Copper	1	LS	$2,500.00	$2,500
3" Copper to Ductile Iron Adaptor Installed	1	LS	$6,500.00	$6,500
Equipment Standby Rate	5	Day	$2,500.00	$12,500
Staff Standby Rate	24	hrs.	$200.00	$4,800
Decontamination Station	1	LS	$1,000.00	$1,000
Decontamination Disposal	1	LS	$5,000.00	$5,000
Well Abandonment (Subcontractor)	**4**	**Ea.**	**$3,500.00**	**$14,000.00**
Construction Oversight	**1**	**LS**	**$127,965.00**	**$128,000**
Project Manager	108	HR	$115.00	$12,420
Engineer 3	40	HR	$119.00	$4,760
Scientist 2	550	HR	$89.00	$48,950
Field Technician 1	56	HR	$54.00	$3,024
Field Technician 2	550	HR	$64.00	$35,200
Per diem & Lodging	115	EA	$136.00	$15,640
Equipment	1	LS	$4,700.00	$4,700
Mileage	3650	EA	$0.54	$1,971
Laboratory Analysis (10 Expedited VOC Soil Samples))	1	LS	$1,300.00	$1,300
Installation Report	**1**	**LS**	**$17,456.00**	**$17,500**
Project Manager	32	HR	$115.00	$3,680
Engineer 3	8	HR	$119.00	$952
Scientist 2	120	HR	$89.00	$10,680
Field Technician 2	16	HR	$64.00	$1,024
CADD Specialist	16	HR	$70.00	$1,120

ALTERNATIVE - 4 COST SUMMARY	
Cost Alternative - 4	
SUBTOTAL ALTERNATIVE-4	$722,600
+ 25% CONTINGENCY	$180,650
TOTAL ALTERNATIVE-4	**$904,000**
Present Discounted Value: Cost Alternative - 4	
SUBTOTAL ALTERNATIVE-4	***$662,000***
PROJECT PLANNING	$19,719.63
WATER LINE INSTALLATION	$597,432.09
INSTALLATION REPORT	$15,285.18
ROUTINE SAMPLING AND O&M	$28,566.69
+ 25% CONTINGENCY	$165,500.00
TOTAL ALTERNATIVE - 4 PRESENT VALUE (INCL. CONTINGENCY)	**$828,000**
TOTAL ALTERNATIVE - 4 PRESENT VALUE/RESIDENCE (INCL. CONTINGENCY)	**$207,000**