

WYOMING WATER ASSESSMENT AND PROTECTION PROGRAM (SWAP)



SOURCE WATER ASSESSMENT PROGRAM EXECUTIVE SUMMARY

Source Water Assessment Prepared For:
Redd Fox W&S Dist.

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SOURCE WATER ASSESSMENT SUMMARY FOR Redd Fox W&S Dist.

PWS Source Water Assessment Summary

Red Fox Water & Sewer District is consecutive with the City of Lander's municipal water system. The City of Lander's municipal water system is classified as a community surface water supply, serving a population of 7,100 through 2,500 service connections the year round. Four water sources are combined to provide an adequate water supply: a surface water intake on the Middle Fork of the Popo Agie River, an infiltration gallery, an alluvial aquifer well, and a flowing artesian Madison Aquifer well. A fifth source, groundwater from a Tensleep Formation well, will be added in the near future. Water from these sources is treated and disinfected prior to storage and distribution.

Lander's surface and groundwater sources generally received medium to high susceptibility ratings for both land use and point source contaminants. The high land use susceptibility ratings reflect the high percentage of forested land and irrigated cropland in the watershed. While forested land is not considered an immediate threat, it can be problematic following forest fires when hard rains wash the resulting ash and debris into surface water intakes and reservoirs. The high point source susceptibility ratings resulted from the fact that there are two underground tanks and underground injection points that lie upstream of the intakes and wells.

Delineation Methods

The Red Fox Water & Sewer District obtains water from the City of Lander water system. Because the City of Lander obtains water for its community water system from both surface and groundwater sources, Lidstone completed a conjunctive delineation using both surface and groundwater delineation methods. Surface water delineation methods were used to identify the source water areas for the City's intake on the Middle Popo Agie River, its infiltration gallery, and its Roaring Fork Creek diversion to Fry Lake Reservoir. For its groundwater sources, Lidstone used hydrogeologic mapping techniques to map the source water area for the City's deep carbonate well, and for its shallow alluvial well, used WhAEM and hydrogeologic mapping methods. The source water area delineation maps for each of Lander's sources are attached to this report.

Hydrogeologic mapping techniques use surface observations in combination with subsurface geologic and hydrogeologic data to identify aquifer boundaries and areas that contribute water to the aquifer. These techniques were used to delineate the source water area for the City of Lander #1 well because it obtains groundwater from a limestone or dolomite aquifer. Mapping techniques were also used to delineate the source water area for the City's Treatment Plant Well #3A. Conduit flow aquifers have extremely variable flow patterns and rates, making the calculation of time of travel difficult. Similarly, high permeability alluvial aquifers typically have above average flow rates. Because of these issues, aquifer vulnerability mapping techniques were also used as part of the hydrogeologic mapping effort to identify and delineate vulnerable areas. These areas (faults, fractures, exposed bedrock, etc.) are anticipated to be more susceptible to the rapid infiltration of contaminants released at the ground surface.

U.S. EPA's Wellhead Analytic Element Model or WhAEM method was initially used to estimate the source water area for Well #3A because this source is derived from a porous media aquifer. The WhAEM model uses well and limited hydrogeologic data to estimate time-of-travel capture zones in relatively simple hydrogeologic settings for either confined or unconfined aquifers. The delineation developed for the well using this method was discarded because it did not yield a reasonable source water area for the well.

Groundwater Sources

The District obtains groundwater from the City of Lander system. The City of Lander currently obtains groundwater from two wells, but is working toward obtaining groundwater from one other well that has been drilled for the City and is in close proximity to the water system. In 1998, Lidstone provided construction management and geologic services for the drilling and construction of several alluvial wells that are located in the Middle Popo Agie River drainage within one mile of the City's water treatment plant. One of these wells, Treatment Plant Well #3A, has recently been plumbed into the City's water system. In 2003, a flowing artesian Tensleep Aquifer well was completed and tested for the City. It is anticipated that this well will be plumbed into the system in the near future.

Two of Lander's three wells are located on the northeastern homoclinal flank of the Wind River Mountains and obtain water from the Tensleep-Madison Aquifer. The City of Lander #1 well is 2,320 feet deep and has a permitted yield of 130 gpm from the Madison Limestone. Up to 2,000 feet thick in the Wind River Basin, the Tensleep-Madison Aquifer is composed of permeable, saturated portions of the Tensleep Sandstone, Amsden Formation, Madison Limestone, and Bighorn Dolomite, which are exposed in the mountains to the southwest of the City. The outcrops provide ample recharge area for the aquifer through the direct infiltration of precipitation or through stream losses over outcrops. While yields from this aquifer range from 10 to 900 gpm along the flank of the Wind River Mountains, artesian flows of up to 3,000 gpm have reportedly been encountered along the Lander – Hudson Anticline. The reason for this difference in yield is largely due to the local permeability of the aquifer. Aquifer productivity is generally higher in areas where the intergranular and matrix permeability of the formations has been enhanced laterally and vertically through faulting, fracturing, and/or dissolution of the soluble formation, particularly in the Madison Limestone and Bighorn Dolomite. Additional information on Lander's current Tensleep-Madison Aquifer well is included on the attached Well Information Sheet.

The Quaternary Alluvial Aquifer along the Middle Popo Agie River is the groundwater source for Lander's Treatment Plant Well #3A which is located behind the water treatment facility. In this area, the alluvium is composed of sand, gravel, and boulders that where saturated will yield groundwater to wells through porous media flow. Well #3A was completed to a depth of 85 feet and has a permitted yield of 250 gpm. Additional information on this well is included on the attached Well Information Sheet.

As shown on the attached source water area maps, the contaminant inventory zones for Lander's Alluvial and Tensleep-Madison Aquifer wells vary substantially due to the different hydrogeologic characteristics associated with these two aquifers. For the Tensleep-Madison Aquifer wells, Zone 2 includes the outcrop areas for the Tensleep Sandstone, Madison

Limestone, and Bighorn Dolomite between anticipated groundwater divides in the aquifer. Zone 3 encompasses watershed areas to the southwest which could deliver water to these outcrops. For Treatment Plant Well #3A, Zone 2 includes the alluvial areas along the Middle Popo Agie River, while Zone 3 extends to the drainage divides upgradient from the well.

Surface Water Sources

The Red Fox Water & Sewer District obtains surface water from the City of Lander system. Lander obtains surface water supplies for its municipal system from three locations along the Middle Fork of the Popo Agie River. Due to its proximity to the river, Lander generally obtains water in sufficient quantities to meet its average and maximum daily demands from these surface water sources, which include a direct surface water diversion from the Middle Popo Agie River, an infiltration gallery located near the river, and a diversion on Roaring Fork Creek that diverts water to Fry Lake Reservoir. On July 8, 1997, Lander received notification from the U.S. EPA that water obtained from the infiltration gallery required treatment as groundwater under the direct influence of surface water. Lander has recently finished upgrading its water treatment plant to meet these requirements. Additional information on these surface water sources is included in the attached Surface Water Information Sheet.

While maintaining adjudicated surface water rights on the Middle Popo Agie River totaling approximately 13 cubic feet per second, Lander is concerned about the susceptibility of this drinking water source to drought conditions within the drainage basin. Since 2000, Lander has experienced below average precipitation that has resulted in diminished flows in the Middle Popo Agie River. As a result of this drought, Lander has been working to supplement its surface water sources with groundwater.

As shown on the enclosed source water area maps, contaminant inventory Zones 2 and 3 were delineated for each surface water source on the Middle Popo Agie River in the Wind River Mountains. For the Middle Popo Agie River intake and infiltration gallery, Zone 2 includes a 1,000 foot buffer on both banks of the river and perennial tributaries a distance of 15 river miles upstream from each intake, while Zone 3 includes the remaining watershed. For the Roaring Fork Creek diversion to Fry Lake Reservoir, Zone 2 includes a 1,000 foot buffer along both banks of Roaring Fork Creek that extends about a mile upstream and includes the next upstream lake. Zone 3 includes the remaining watershed above the intake.

Integrity Summary

Red Fox Water & Sewer District is consecutive with the City of Lander's municipal water system. Lander supplies its municipal system with surface water obtained from the Middle Fork of the Popo Agie River, and with groundwater from one Madison Aquifer well and one alluvial well. The integrity of the wells and intakes associated with these sources is described below according to the source type and location.

Within and near the base of the Wind River Mountains, Lander maintains an infiltration gallery and surface water intake on the Middle Popo Agie River, and a diversion on Roaring Fork Creek near Fry Lake Reservoir. These diversions were constructed prior to 1983, when less stringent construction standards were required by the State of Wyoming. The intakes are screened and inspected regularly, but the infiltration gallery is publicly accessible. As shown on the Integrity Summary Table, these intakes received integrity scores of 4 and 6. The surface water intake and Roaring Fork diversion received a relatively lower score than the infiltration gallery because access to the area around the gallery is not restricted.

The City also obtains its water supply from one alluvial well and one Madison Aquifer well. While Lander Treatment Well #3A was completed after 1993 when stringent construction standards were required by the State of Wyoming, City of Lander #1 was completed before 1983 when less stringent construction standards were required. Available records indicated that both of the wells were completed with both surface and annular seals. Access to each of these wells is restricted. As shown on the Integrity Summary Table, the wells received integrity scores of 1 and 3. These scores solely reflected the well completion dates.

Water Source Sensitivity Summary

The District is consecutive with the City of Lander's municipal water system. Lander obtains water for its municipal system from several surface water sources, and from one shallow alluvial and one confined Madison Aquifer well. As shown on the Source Sensitivity Summary Table, all of Lander's groundwater and surface water sources received sensitivity scores of 10.

The wells and intakes received the maximum sensitivity scores for two reasons. While confined, the Madison Aquifer is known to be susceptible to contamination due to the fact that its permeability is attributed to interconnected fracture and cavern networks. This matrix typically results in high and variable groundwater transmission rates. Similarly, alluvial groundwater and surface water obtained from the Middle Popo Agie River are known to be vulnerable to contamination. In addition, laboratory analysis of water samples within the last five years detected several contaminants that are listed on EPA's primary and secondary drinking water standards. These included nitrate and sulfate among others. Despite detection, these contaminants were generally detected at concentrations below the EPA's maximum contaminant levels.

Water System Susceptibility Rating

Susceptibility is defined as the potential for a public water supply to draw water contaminated at concentrations that would pose a threat or concern to human health. The susceptibility of

Lander's surface and groundwater sources is detailed in the following sections.

Lander's surface water sources, the Middle Popo Agie River intake, the Roaring Fork Creek diversion, and the infiltration gallery, generally received high susceptibility ratings for both land use and point source contaminants. The high land use susceptibility ratings reflect the high percentage of forested land within Zone 2 of the watershed. While forested land is not considered an immediate threat, it can be problematic following forest fires when hard rains wash the resulting ash and debris into surface water intakes and reservoirs. The high point source susceptibility ratings resulted from the fact that there are two underground tanks and an underground injection point that lie within Zone 2. The intakes were assigned a low susceptibility for all four types of transportation corridor contaminants due to the lack of these sources in the watershed.

Similarly, the City's groundwater sources received high susceptibility ratings for land use contaminants, but medium to high ratings with respect to point source contaminants. Land use susceptibility ratings were high due to the presence of forested and irrigated croplands in the source water areas. While these land uses are not really a serious threat to the City's Madison well due to its depth and completion in a confined aquifer, Lander's alluvial well is more susceptible to these land uses. Point sources in the source water areas rated medium to high due to the presence of the same underground tanks and underground injection points. Susceptibility ratings for each type of potential contaminant source are summarized on the attached susceptibility tables.

A review of your PWS's routine water analysis results revealed that one or more chemicals that are considered contaminants in drinking water were detected at some time within the last five years. Chemical detections have a large impact on your PWS's sensitivity score because it may indicate that there is a pathway for contaminants to reach the water supply. However, it is likely that these chemicals are present only in small amounts and are not a danger to your health. Some of these chemicals may also occur naturally in water.

For more information about which chemicals were detected, please contact the PWS for a copy of the most recent Consumer Confidence Report or water analysis results. Chemical detections at levels that are a concern to human health are reported on the EPA's website: http://www.epa.gov/enviro/html/sdwis/sdwis_query.html. To see if your PWS has exceeded the federal primary or secondary drinking water standards, just click on the State of Wyoming and then type in the name of your PWS. Consumer Confidence Reports are prepared by the PWS on a yearly basis. The reports should include information about any chemicals found in the water, even those found at very low levels. Please contact Kim Parker at DEQ, 307-777-7781, or WARWS for assistance. You may also contact EPA to find out what contaminants were detected. You may have to fill out a Freedom of Information Act request to obtain the water test results for your PWS. Please call EPA's Safe Drinking Water Hotline at 1-800-426-4791.

**POINT SUSCEPTIBILITY SUMMARY TABLE
FOR Redd Fox W&S Dist.**

Point Source Susceptibility Summary

It may appear from the results of this point source susceptibility summary table that your system has too many PSOCs influencing the final ratings. In some cases, a specific PSOC falls within a specific contaminant inventory zone shared by multiple wells or intakes. When this is the case, that PSOC will be scored for each intake. For example, an underground storage tank may appear within a contaminant inventory zone shared by four different wells. This would cause that single storage tank to be entered into the table four times, or once for each well or intake.

Point Source Type	Low	Medium	High
Underground Tank	N/A	N/A	4
Underground Injection	N/A	3	3

- * Illustrates the number of PSOCs in a particular rating class for all water sources
- * N/A - Not Applicable