

Silver Heights Water & Sanitation District Source Water Protection Plan

Douglas County, Colorado
July 31, 2015



Written by: Paul D. Goldfain, P.E.
Senior Project Manager, Kennedy Jenks Consultants

For the Community Water Provider:
Silver Heights W. & S. D., CO0118075

This Source Water Protection Plan for the SHWSD was developed using version 05.09.14 of the Colorado Rural Water Association's Source Water Protection Plan Template.

TABLE OF CONTENTS

ACRONYMS.....	3
EXECUTIVE SUMMARY.....	4
INTRODUCTION	6
Purpose of the Source Water Protection Plan.....	6
Protection Plan Development.....	7
Stakeholder Participation in the Planning Process	7
Steering Committee.....	8
Development and Implementation Grant	9
WATER SUPPLY SETTING	10
Location and Description.....	10
Physical Characteristics.....	11
Hydrologic Setting.....	11
Groundwater Protection.....	13
Water Quality Data	14
Drinking Water Supply Operations	14
Water Supply and Infrastructure	14
Water Supply Demand Analysis.....	15
OVERVIEW OF COLORADO’S SWAP PROGRAM	16
Source Water Assessment Phase.....	17
Source Water Protection Phase	17
SOURCE WATER PROTECTION PLAN DEVELOPMENT.....	19
Source Water Assessment Report Review	19
Defining the Source Water Protection Area	19
Potential Contaminant Source Inventory and Other Issues of Concern	22
Priority Strategy.....	23
Susceptibility Analysis of Water Sources	25
DISCUSSION OF POTENTIAL CONTAMINANT SOURCES AND ISSUES OF CONCERN	26
Vandalism	26
Roads and Hazmat Transportation	26
Wells (Active and Abandoned)	27
Future Development	27

SOURCE WATER PROTECTION MEASURES28
 Best Management Practices28
 Evaluating Effectiveness of Best Management Practices28
REFERENCES31
APPENDICES.....32

ACRONYMS

BLM	Bureau of Land Management
BMP	Best Management Practice
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
COGCC	Colorado Oil and Gas Conservation Commission
CRWA	Colorado Rural Water Association
EPA	Environmental Protection Agency
GIS	Geographic Information System
NRCS	Natural Resources Conservation Service
PSOC	Potential Source of Contamination
SDWA	Safe Drinking Water Act
SWAA	Source Water Assessment Area
SWAP	Source Water Assessment and Protection
SWPA	Source Water Protection Area
SWPP	Source Water Protection Plan
TOT	Time of Travel
USDA	United States Department of Agriculture
WFSI	Wildfire Susceptibility Index
WUI	Wildland-Urban-Interface

EXECUTIVE SUMMARY

There is a growing effort in Colorado to protect community drinking water sources from potential contamination. Many communities are taking a proactive approach to preventing the pollution of their drinking water sources by developing a source water protection plan. A source water protection plan identifies a source water protection area, lists potential contaminant sources and outlines best management practices to implement to decrease risks to the water source. Implementation of a source water protection plan provides an additional layer of protection at the local level beyond drinking water regulations.

The Silver Heights Water & Sanitation District (SHWSD) values a clean, high quality drinking water supply and decided to work collaboratively with area stakeholders to develop a Source Water Protection Plan. The source water protection planning effort consisted of public planning meetings and individual meetings with water operators, government, and agency representatives during the months of November 2014 to May 2015, at the SHWSD office. During the development of this Plan, a Committee was formed to develop and implement this Source Water Protection Plan. Colorado Rural Water Association was instrumental in this effort by providing technical assistance in the development of this Source Water Protection Plan.

The SHWSD obtains its drinking water from three (3) groundwater wells in the Arapahoe and Denver deep Aquifers. The Source Water Protection Area for these water sources is comprised of two zones. The Primary Zone is defined as a 500 foot radius around the wellheads and encompasses an area of 21.63 acres. The Secondary Zone is defined as the district boundaries on the west and north, with expanded areas on the northwest to the drainage area boundary for area contributing water that flows past the wells, and on the south to drainage areas that could also impact the wells. This Secondary Zone encompasses 516.66 acres and is comprised of the major drainage areas that could contribute to surface water flows that might impact the SHWSD wells. This Source Water Protection Area is the area that the SHWSD has chosen to focus its source water protection measures to reduce source water susceptibility to contamination.

The Steering Committee conducted an inventory of potential contaminant sources and identified other issues of concern within the Source Water Protection Area. Through this process, it was determined that the highest priority potential contaminant sources and/or issues of concern are: existing roads and contamination from accidents, vandalism of facilities, active and abandoned wells, and future development. Other noted water quality threats include: Underground fuel storage tanks, Flooding and Retention Ponds, Structure Fire, Residential Issues, and Septic Systems.

The Steering Committee developed several best management practices that may help reduce the risks from the potential contaminant sources and other issues of concern. The best management practices are centered on the themes of building partnerships with community members, businesses, and local decision makers; raising awareness of the value of protecting

community drinking water supplies; and empowering local communities to become stewards of their drinking water supplies by taking actions to protect their water sources.

The following list highlights best management practices which pertain to the highest priority potential contaminant sources and other issues of concern.

- Construct fencing around the tank/OR review & provide a “more hardened” locking mechanism or hatch
- Share shapefiles of the source water protection areas with CDOT to be overlaid on their spill response maps.
- Compile a list of wells within the source water protection area that are of highest concern based on proximity to the PWS wells.
- Contact the Douglas County Engineer and participate in the implementation of the County Drainage Plan to address any threats to SHWSD wells from flooding.

The Steering Committee recognizes that the usefulness of this Source Water Protection Plan lies in its implementation and will begin to execute these best management practices upon completion of this Plan.

This Plan is a living document that is meant to be updated to address any changes that will inevitably come. The Steering Committee will review this Plan at a frequency of once every 5-10 years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

INTRODUCTION

The Silver Heights Water & Sanitation District (SHWSD) operates a community water supply system that supplies drinking water to approximately 300 residents located within Douglas County, Colorado. The Silver Heights Water & Sanitation District (SHWSD) obtains their drinking water from 2 wells in the Arapahoe and one well in the Denver Aquifer. The SHWSD recognizes the potential for contamination of the source of their drinking water, and realizes that it is necessary to develop a protection plan to prevent the contamination of this valuable resource. Proactive planning and implementing contamination prevention strategies are essential to protect the long-term integrity of their water supply and to limit their costs and liabilities.¹

Table 1: Primary Contact Information for SHWSD

PWS Name	Silver Heights Water & Sanitation District
PWSID #	CO0118075
Name	Richard T. Rasmussen
Title	President
Address	1027 Harvey St. Castle Rock, CO 80108
Phone	(303) 660-9280
Website	silverheightswws.org

Purpose of the Source Water Protection Plan

The Source Water Protection Plan (SWPP) is a tool for the SHWSD to ensure clean and high quality drinking water sources for current and future generations. This Source Water Protection Plan is designed to:

- Create an awareness of the community’s drinking water sources and the potential risks to groundwater quality within the watershed;
- Encourage education and voluntary solutions to alleviate pollution risks;
- Promote management practices to protect and enhance the drinking water supply;
- Provide for a comprehensive action plan in case of an emergency that threatens or disrupts the community water supply.

¹ The information contained in this Plan is limited to that available from public records and the SHWSD at the time that the Plan was written. Other potential contaminant sites or threats to the water supply may exist in the Source Water Protection Area that are not identified in this Plan. Furthermore, identification of a site as a “potential contaminant site” should not be interpreted as one that will necessarily cause contamination of the water supply.

Developing and implementing source water protection measures at the local level (i.e. county and municipal) will complement existing regulatory protection measures implemented at the state and federal governmental levels by filling protection gaps that can only be addressed at the local level.

Protection Plan Development

The Colorado Rural Water Association’s (CRWA) Source Water Protection Specialist, Mr. Dylan Eiler, helped facilitate the source water protection planning process. The goal of the CRWA’s Source Water Protection Program is to assist rural and small communities served by public water systems to reduce or eliminate the potential risks to drinking water supplies through the development of Source Water Protection Plans, and provide assistance for the implementation of prevention measures.

The source water protection planning effort consisted of a series of public planning meetings and individual meetings. Information discussed at the meetings helped the SHWSD develop an understanding of the issues affecting source water protection for the community. The Steering Committee then made recommendations for management approaches to be incorporated into the Source Water Protection Plan. In addition to the planning meetings, data and other information pertaining to Source Water Protection Area was gathered via public documents, internet research, phone calls, emails, and field trips to the protection area. A summary of the meetings is represented below.

Table 2: Planning Meetings

Date	Purpose of Meeting
November 20, 2014	First Planning Meeting - Presentation on the process of developing a Source Water Protection Plan for the SHWSD. Review of the State’s Source Water Assessment for SHWSD.
December 18, 2014	Second Planning Meeting - Finalize Source Water Project Area for SHWSD, discussion of the potential sources of contamination (PSOC’s), review and modify State Susceptibility Analysis.
January 15, 2015	Third Planning Meeting - Review and prioritize PSOC’s and other issues of concern, begin development of Best Management Practices (BMP’s).
February 19, 2015	Fourth Planning Meeting-Finalize BMP’s
May 21, 2015	Fifth Planning Meeting – review draft SWPP and create Action Plan.

Stakeholder Participation in the Planning Process

Local stakeholder participation is vitally important to the overall success of Colorado’s Source Water Assessment and Protection (SWAP) program. Source water protection was founded on the concept that informed citizens, equipped with fundamental knowledge about their drinking

water source and the threats to it, will be the most effective advocates for protecting this valuable resource. Local support and acceptance of the Source Water Protection Plan is more likely where local stakeholders have actively participated in the development of their Protection Plan.

The SHWSD source water protection planning process attracted interest and participation from stakeholders including customers and landowners, the water system operator, local and state governments, and fire district representatives. During the months of November 2014 through May 2015 five stakeholder meetings were held at the SHWSD office to encourage local stakeholder participation in the planning process. Stakeholders were notified by email and phone calls of the meetings and invited to attend. Input from these participants was greatly appreciated.

Steering Committee

During the development of this Plan, a volunteer Steering Committee was formed from the stakeholder group to develop and implement this Source Water Protection Plan. Specifically, the Steering Committee’s role in the source water protection planning process was to advise the SHWSD in the identification and prioritization of potential contaminant sources as well as management approaches that can be voluntarily implemented to reduce the risks of potential contamination of the untreated source water. All members attended at least one Steering Committee meeting and contributed to planning efforts from their areas of experience and expertise. Their representation provided diversity and led to a thorough Source Water Protection Plan. The SHWSD and the Colorado Rural Water Association are very appreciative of the participation and expert input from the following participants.

Table 3: Stakeholders and Steering Committee Members

Stakeholder	Title	Affiliation	Steering Committee Member
Rich Rasmussen	Board President	SHWSD	X
Debbie Emerick	Board Member	SHWSD	X
Bob Hall	Board Member	SHWSD	X
Bernie Acker	Board Member	SHWSD	X
Brian Dimock	Fire Prevention Officer	Castle Rock Fire & Rescue Department	
Jeffery Buske	Customer	Homeowner	
Renee Sweet	Customer	Homeowner	
Dylan Eiler	Source Water Specialist	Colorado Rural Water Association	
Paul Goldfain	Consultant	Kennedy/Jenks Consultants	

Dennis Schubert	Operator	SHWSD	
-----------------	----------	-------	--

Development and Implementation Grant

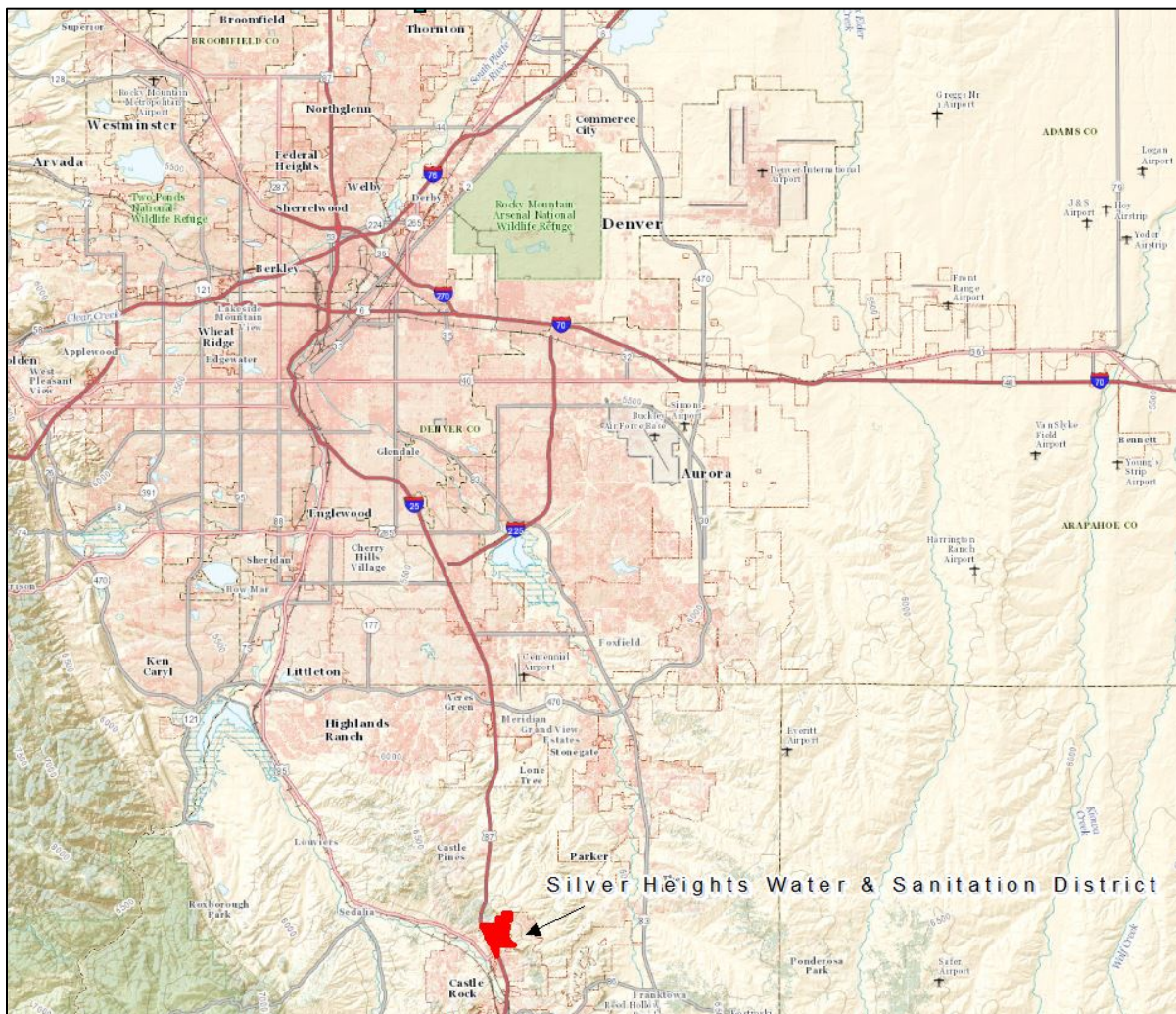
The SHWSD has been awarded a \$5,000 Development and Implementation Grant from the Colorado Department of Public Health and Environment (CDPHE). This funding is available to public water systems and representative stakeholders committed to developing and implementing a source water protection plan. A one to one financial match (cash or in-kind) is required. The SHWSD was approved for this grant in October 2014, and it expires on July 31, 2016. SHWSD will use sixty percent of the funds to pay Kennedy/Jenks Consultants to develop the Source Water Protection Plan, and the remaining funds will be used to implement management approaches that are identified in this Plan.

WATER SUPPLY SETTING

Location and Description

SHWSD is a smaller water and sanitation district with an area of approximately 468 acres located in Douglas County, CO just north of Castle Rock, CO. The District provides service to approximately 110 homes and 2 commercial facilities. Projections by the District estimate little growth over the next ten years as most of the available property is developed.

The District was originally formed in 1961. SHWSD sources for water include three wells into the Denver Basin aquifer, two Arapahoe Aquifer wells and one Denver–Dawson Aquifer well. The District contains primarily residential, agricultural and commercial zoning with some open space.



Physical Characteristics

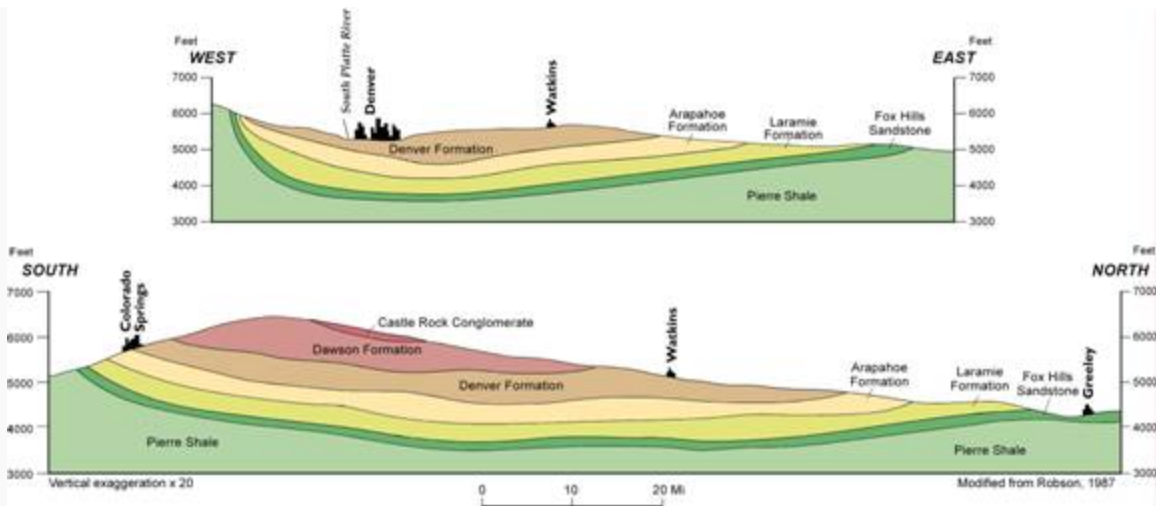
SHWSD is located at latitude (39 25 7.72 google) 39° 74' 23" N, longitude (104 52 5.87 google) 104° 99' 12" W. The topography of the area is foothills and plains, with an elevation of 6,200 feet above sea level.

The climate in the District is semi-arid. The precipitation generally is low to moderate with an estimated average annual precipitation of 16 inches. The heaviest rains fall during May, June, and July, the months that constitute the principal growing season. The average snowfall is 18.3 inches. On average, there are 261 sunny days per year in SHWSD. The July high is around 102 degrees Fahrenheit and the January low is 18 degrees Fahrenheit.

Hydrologic Setting

SHWSD obtains all of its water from aquifers that are part of the Denver Basin. The following description of the Denver Basin aquifers is from Douglas County.

Beneath the ground in the Denver Basin there is a view into the ancient past. Each geologic layer or formation within this basin took millions of years to form. Below is a cross-section image of these layers looking from east to west and north to south across the Basin. The deeper the formation, the older it is. Notice the asymmetric bowl shape of the basin.



Source: Colorado Geological Survey

Below the four aquifers of the Denver Basin lies a thick deposit of shale, which was formed over 100 million years ago during the Cretaceous Period. During this timeframe, a shallow sea invaded the middle portion of the North American Continent, including present day Colorado. Ancient rivers transported and deposited mud and clay onto the bottom of the seabed. Through time (millions of years) and immense pressure due to burial, the mud and clay formed into a sedimentary rock known today as Pierre Shale.

As the sea receded, sand was deposited as beaches and off-shore sandbars. Through burial and immense pressure, the sand formed into sandstone; this enormous deposit is now known as Fox Hills Sandstone. As the land continued to rise, river deposited sands were interbedded with coal pockets (lenses), mudstone, silts and clays to form the Laramie Formation. The sands within the Laramie Formation and the Fox Hills Sandstone make up the oldest of the four Denver Basin aquifers, the Laramie-Fox Hills.

The Laramide Orogeny, which was a major mountain building event that created the present day Rocky Mountains, began approximately 72 million years ago and continued for another 60 million years. The Rocky Mountains were created through massive uplift caused by the collision of the westerly moving North American Plate with the easterly-moving Pacific Plate. Through millions of years of uplift and erosion caused by precipitation and wind, particles from the rocks and soil were transported and deposited by rivers eastward into the subsiding Denver Basin where these silts, sands, and gravels accumulated. With deep burial and compaction, these materials became compacted to form mudstones, siltstones, and sandstones. The pore spaces between the rock grains became water saturated through precipitation and infiltration. This geologic process is what eventually formed the most water rich aquifers of the Denver Basin; the Arapahoe, Denver and Dawson Formations.

Denver Basin's most productive aquifer is the Arapahoe, which is largely composed of sandstones and conglomerates. SHWSD has two wells into the Arapahoe Formation. The conglomerates contain rounded chert and quartz pebbles, explaining why the Arapahoe Formation contains a large amount of pore spaces, and thus ideal water storage capacities. The Arapahoe is a major source of water for the users of Douglas County given its continually high well production rates.

Directly above the Arapahoe Formation are the Denver and Dawson Formations. SHWSD has one well in the Dawson/Denver Formation. The Denver and Dawson aquifers outcrop at the surface in certain locations of Douglas County and can thus be either a confined or unconfined aquifer depending on location in the basin. The Denver aquifer is primarily made up of volcanic rock while the Dawson is high in granitic fragments. Aquifer production rates vary significantly in the Denver and Dawson aquifers, depending on the amount of sandstone encountered at your location.

SHWSD has one backup supply well in the Dawson and Denver Formation. The following is a summary of the Denver use for water supplies in Douglas County.

The Denver aquifer covers an area of approximately 3,500 square miles and ranges in thickness from 800 to 1,000 feet, a considerably larger footprint than the Dawson. The maximum depth of the aquifer is approximately 1,300 feet. The Denver aquifer is comprised of both unconfined and confined layers depending on your location within its boundary (see diagram below). The

aquifer is composed of interbedded shale, claystone, siltstone and sandstone pockets. This can result in a lower well production rate than found in the Dawson aquifer (20-100 gallons per minute). There is an estimated annual withdrawal of over 72,000 acre-feet of water from approximately 800 high-capacity wells.

SHWSD primary water source is the Arapahoe Formation. The following is a summary of the Arapahoe use for water supplies in Douglas County.

The Arapahoe aquifer encompasses approximately 4,700 square miles and ranges in thickness from zero to 400 feet. Its maximum depth is approximately 1,700 feet. The aquifer is comprised of an interbedded sequence of conglomerate, sandstone, siltstone and shale. Municipal wells drilled in this aquifer yield up to 700-gallons per minute. The Arapahoe contains over 1,000 high-capacity wells with an estimated total annual withdrawal of more than 168,000 acre-feet. Since well yields are much higher, it is widely used as a source for municipal water. Many Douglas County water providers rely on this aquifer for their water supply.

Groundwater Protection

Groundwater protection is managed as two separate issues of quantity and quality in Colorado. Quantity issues are managed through the Colorado Division of Water Resources/Office of the State Engineer. The Division of Water Resources administers and enforces all surface and groundwater rights throughout the State of Colorado, issues water well permits, approves construction and repair of dams, and enforces interstate compacts. The Division of Water Resources is also the agency responsible for implementing and enforcing the statutes of the Groundwater Management Act passed by the Legislature as well as implementing applicable rules and policies adopted by the Colorado Groundwater Commission and the State Board of Examiners of Water Well Construction and Pump Installation Contractors.

The CDPHE's Colorado Water Quality Control Commission is responsible for promulgating groundwater and surface water classifications and standards. Colorado's Water Quality Control Commission has established basic standards for groundwater regulations that apply a framework for groundwater classifications and water quality standards for all waters within their jurisdictions. Standards are designed to protect the associated classified uses of water or a designated use. The groundwater classifications are applied to groundwaters within a specified area based upon use, quality and other information as indicated in the CDPHE Water Quality Control Commission's Regulation No. 41, "The Basic Standards for Ground Water." Statewide standards have been adopted for organic chemicals and radionuclides. Significant areas of the state have been classified for site specific use classification and the remainder of the state's groundwater is protected by interim narrative standards.

Classifications and standards are implemented by seven separate state agencies through their rules and regulations for activities that they regulate. Regulated activities include mining and reclamation, oil and gas production, petroleum storage tanks, agriculture, Superfund sites,

hazardous waste generation and disposal, solid waste disposal, industrial and domestic wastewater discharges, well construction and pump installation, and water transfers.

Colorado has proactive groundwater protection programs that include monitoring groundwater for agricultural chemicals and pesticides, issuing groundwater discharge permits; voluntary cleanup program, permitting for large hog farm operations, and educational programs. In addition, water wells must have a permit and meet minimum standards of construction and pump installation.

Water Quality Data

SHWSD routinely monitors for contaminants in its drinking water according to Federal and State laws. The district’s “2014 Drinking Water Quality Report for Calendar Year 2013” or Consumer Confidence Report (CCR) is included in Appendices.

Drinking Water Supply Operations

Water Supply and Infrastructure

SHWSD’s water supply comes entirely from Denver Basin Arapahoe and Denver aquifers. The Arapahoe aquifer is the primary source. There are two wells drilled and only one currently equipped into the Arapahoe. The Denver aquifer well provides a backup supply and is seldom used. The Denver aquifer requires augmentation per the District’s approved augmentation plan.

Each well is pumped to the collection tank where it is disinfected using liquid sodium hypochlorite (bleach). That is the only treatment currently provided. Water is then pumped by the main booster pump station through the distribution system to the main 300,000 gallon storage buried storage reservoir. All customers are served by the 300,000 gallon reservoir and existing piping distribution system.

Table 4: Groundwater Supply Information

Water System Facility Name	Water System Facility Number	Total Depth of Well (ft)	Depth of Plain Casing (ft)	Depth of Perforation (ft)	Yield (gpm)	Year Drilled	Permit Number	Annual Permitted Amount (acre feet)
Arapahoe Well #1	118075-001	1862	0-1466	1466-1862	50	1979	17752-F	Included w/ Well # 2.
Arapahoe Well #2	118075-004				100	3/1999	51294-F	249
Denver/Dawson Well #3	118075-002	800	0-357	357-784	50	9/1986	8891-F	210

Water Supply Demand Analysis

SHWSD serves an estimated 113 connections consisting of approximately 111 residents and other users in the service area. This is the equivalent of approximately 141 single family connections since the commercial customers have 2-inch and 3-inch taps. The water system currently has the capacity to produce 144,000 gallons per day. Current estimates by the water system indicate that the average daily demand is approximately 60,000 gallons per day, and that the average peak daily demand is approximately 110,000 gallons per day. Using these estimates, the water system has a surplus capacity of average peak daily demand capacity of 34,000 gallons per day.

Using the surplus estimates above, SHWSD has evaluated its ability to meet the average daily demand and the average peak daily demand of its customers in the event the water supply from one or more of its water sources becomes disabled for an extended period of time due to potential contamination. The evaluation indicated that SHWSD may not be able to meet the average daily demand of its customers if both aquifer sources became disabled for an extended period of time. The evaluation also indicated that SHWSD may not be able to meet the average peak daily demand of its customers if the Arapahoe water source became disabled for an extended period of time. The ability of SHWSD to meet these demands for an extended period of time is not appreciably affected by the amount of treated water the water system has in storage at the time a water source(s) becomes disabled.

SHWSD recognizes that potential contamination of its ground water source(s) could possibly result in having to treat the ground water and/or abandon the water source if treatment proves to be ineffective or too costly. To understand the potential financial costs associated with such an accident, SHWSD evaluated what it might cost to replace one of its well water sources if this occurs. The evaluation did not attempt to estimate treatment costs, which can be variable depending on the type of contaminant(s) that need(s) to be treated. The evaluation indicated that it could cost approximately \$1,250,000 to drill and equip a new Arapahoe well and pump in today's dollars.

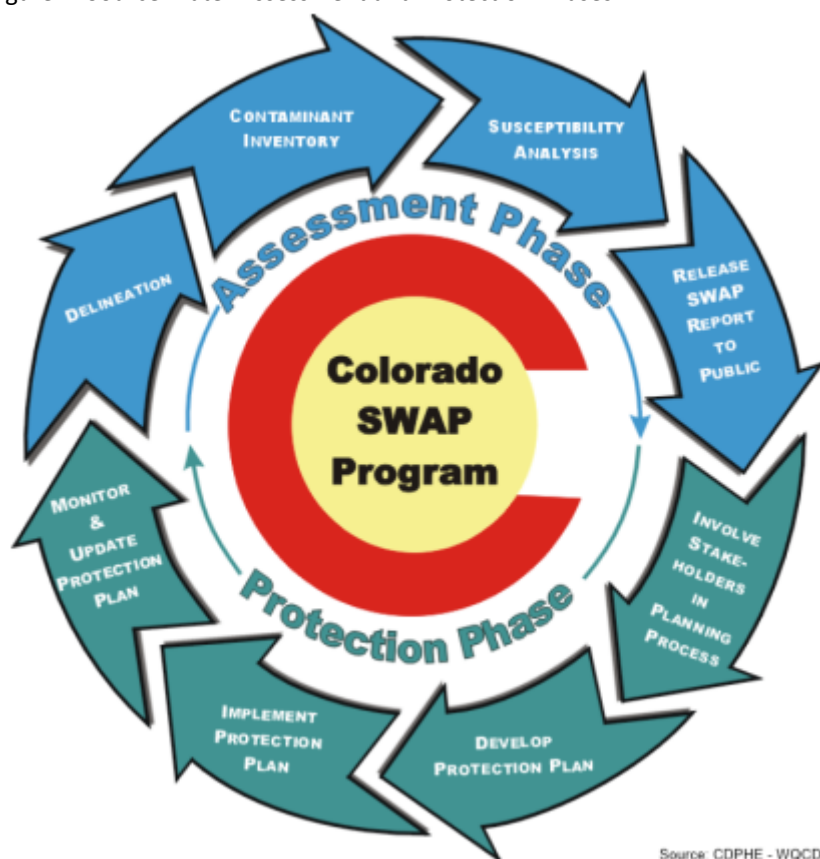
The potential financial and water supply risks related to the long-term disablement of one or more of the community's water sources are a concern to the Steering Committee. As a result, the Steering Committee believes the development and implementation of a source water protection plan for SHWSD can help to reduce the risks posed by potential contamination of its water source(s). Additionally, the SHWSD has developed an emergency response plan or contingency plan (Appendix A) to coordinate rapid and effective response to any emergency incident that threatens or disrupts the community water supply.

OVERVIEW OF COLORADO'S SWAP PROGRAM

Source water assessment and protection came into existence in 1996 as a result of Congressional reauthorization and amendment of the Safe Drinking Water Act. The 1996 amendments required each state to develop a source water assessment and protection (SWAP) program. The Water Quality Control Division, an agency of the Colorado Department of Public Health and Environment (CDPHE), assumed the responsibility of developing Colorado's SWAP program. The SWAP program protection plan is integrated with the Colorado Wellhead Protection Program that was established in amendments made to the federal Safe Drinking Water Act (SDWA, Section 1428) in 1986.

Colorado's SWAP program is an iterative, two-phased process designed to assist public water systems in preventing potential contamination of their untreated drinking water supplies. The two phases include the Assessment Phase and the Protection Phase as depicted in the upper and lower portions of Figure 1, respectively.

Figure 1: Source Water Assessment and Protection Phases



Source Water Assessment Phase

The Assessment Phase for all public water systems consists of four primary elements:

1. Delineating the source water assessment area for each of the drinking water sources;
2. Conducting a contaminant source inventory to identify potential sources of contamination within each of the source water assessment areas;
3. Conducting a susceptibility analysis to determine the potential susceptibility of each public drinking water source to the different sources of contamination;
4. Reporting the results of the source water assessment to the public water systems and the general public.

The Assessment Phase involves understanding where the Silver Heights Water & Sanitation District's source water comes from, what contaminant sources potentially threaten the water sources, and how susceptible each water source is to potential contamination. The susceptibility of an individual water source is analyzed by examining the properties of its physical setting and potential contaminant source threats. The resulting analysis calculations are used to report an estimate of how susceptible each water source is to potential contamination. A Source Water Assessment Report was provided to each public water system in Colorado in 2004 that outlines the results of this Assessment Phase.

Source Water Protection Phase

The Protection Phase is a voluntary, ongoing process in which all public water systems have been encouraged to voluntarily employ preventative measures to protect their water supply from the potential sources of contamination to which it may be most susceptible. The Protection Phase can be used to take action to avoid unnecessary treatment or replacement costs associated with potential contamination of the untreated water supply. Source water protection begins when local decision-makers use the source water assessment results and other pertinent information as a starting point to develop a protection plan. As depicted in the lower portion of Figure 1, the source water protection phase for all public water systems consists of four primary elements:

1. Involving local stakeholders in the planning process;
2. Developing a comprehensive protection plan for all of their drinking water sources;
3. Implementing the protection plan on a continuous basis to reduce the risk of potential contamination of the drinking water sources; and
4. Monitoring the effectiveness of the protection plan and updating it accordingly as future assessment results indicate.

The water system and the community recognize that the Safe Drinking Water Act grants no statutory authority to the Colorado Department of Public Health and Environment or to any other state or federal agency to force the adoption or implementation of source water protection measures. This authority rests solely with local communities and local governments. The source water protection phase is an ongoing process as indicated in Figure 1. The evolution of the SWAP program is to incorporate any new assessment information provided by the public water supply systems and update the protection plan accordingly.

SOURCE WATER PROTECTION PLAN DEVELOPMENT

Source Water Assessment Report Review

The SHWSD has reviewed the Source Water Assessment Report along with the Steering Committee. These Assessment results were used as a starting point to guide the development of appropriate management approaches to protect the source water(s) of SHWSD from potential contamination. A copy of the Source Water Assessment Report for SHWSD can be obtained by contacting the SHWSD or by downloading a copy from the CDPHE's SWAP program website located at: <http://www.colorado.gov/cs/Satellite/CDPHE-WQ/CBON/1251596793639>.

Defining the Source Water Protection Area

A source water protection area is the surface and subsurface areas from which contaminants are reasonably likely to reach a water source. The purpose of delineating a source water protection area is to determine the recharge area that supplies water to a public water source. Delineation is the process used to identify and map the area around a pumping well that supplies water to the well or spring, or to identify and map the drainage basin that supplies water to a surface water intake. The size and shape of the area depends on the characteristics of the aquifer and the well, or the watershed. The source water assessment area that was delineated as part of the Silver Heights Water & Sanitation District's Source Water Assessment Report provides the basis for understanding where the community's source water and potential contaminant threats originate, and where the community has chosen to implement its source water protection measures in an attempt to manage the susceptibility of their source water to potential contamination.

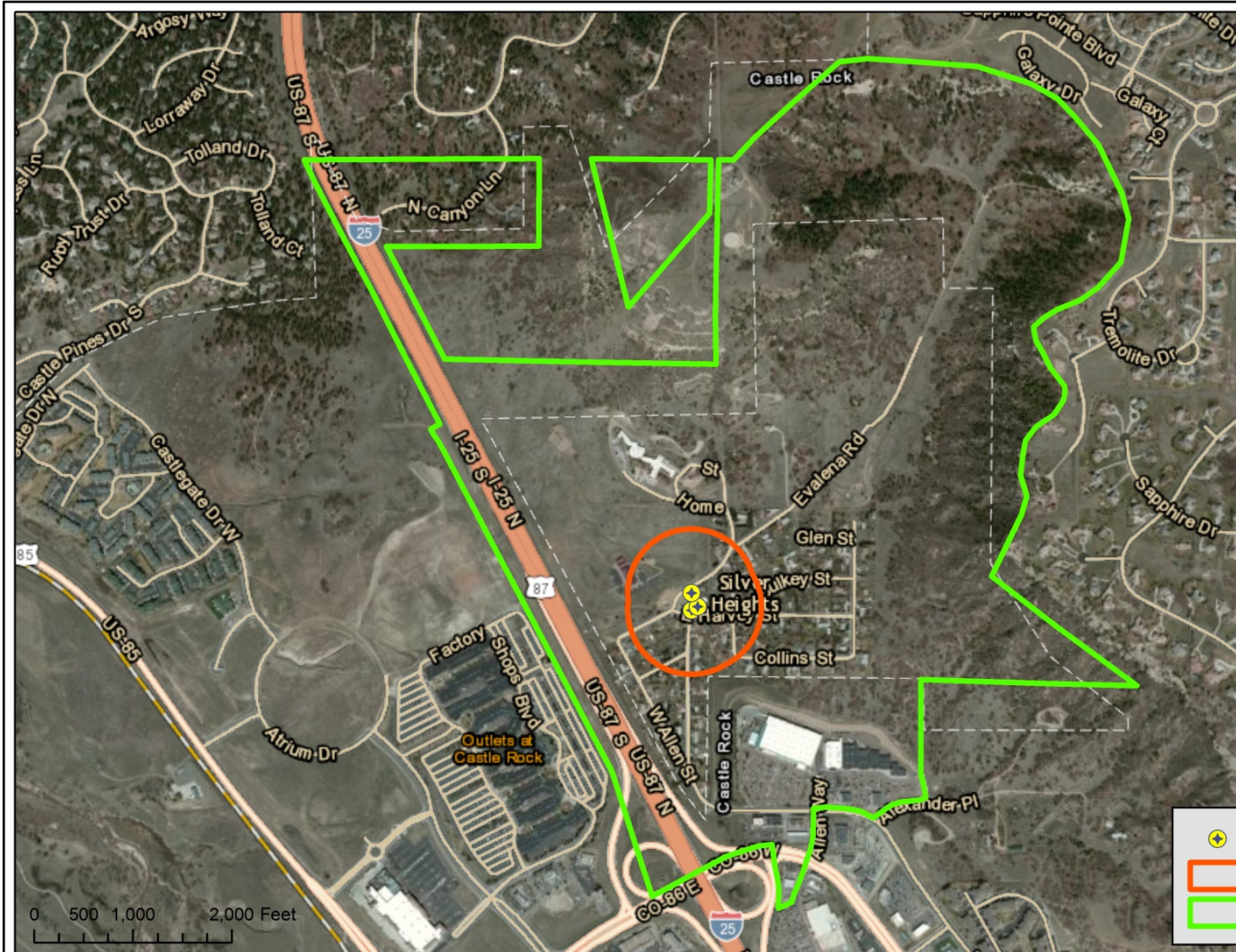
After carefully reviewing their Source Water Assessment Report and the CDPHE's delineation of the Source Water Assessment Area for each of the SHWSD's sources, the Steering Committee chose to modify it before accepting it as their Source Water Protection Area for this Source Water Protection Plan. The Source Water Protection Area was created from the original source water assessment area. It was revised based on local issues of concern, source location correction, reviewing land uses, immediacy of the potential contamination sources to the source water, the type of potential contaminants, and topographic mapping.

The SHWSD's Source Water Protection Area is defined as:

1. **The Primary Zone** is defined as a 500 foot radius around the wellheads. This area encompasses 21.63 acres
2. **The Secondary Zone** is defined as the district boundaries on the west and north, with expanded areas on the northwest to the drainage area boundary for area contributing water that flows past the wells, and on the south to drainage areas that

could also impact the wells. This area encompasses approximately 516.66 acres.

The Source Water Protection Area is illustrated in the following map.



Silver Heights WSD Source Water Protection Area

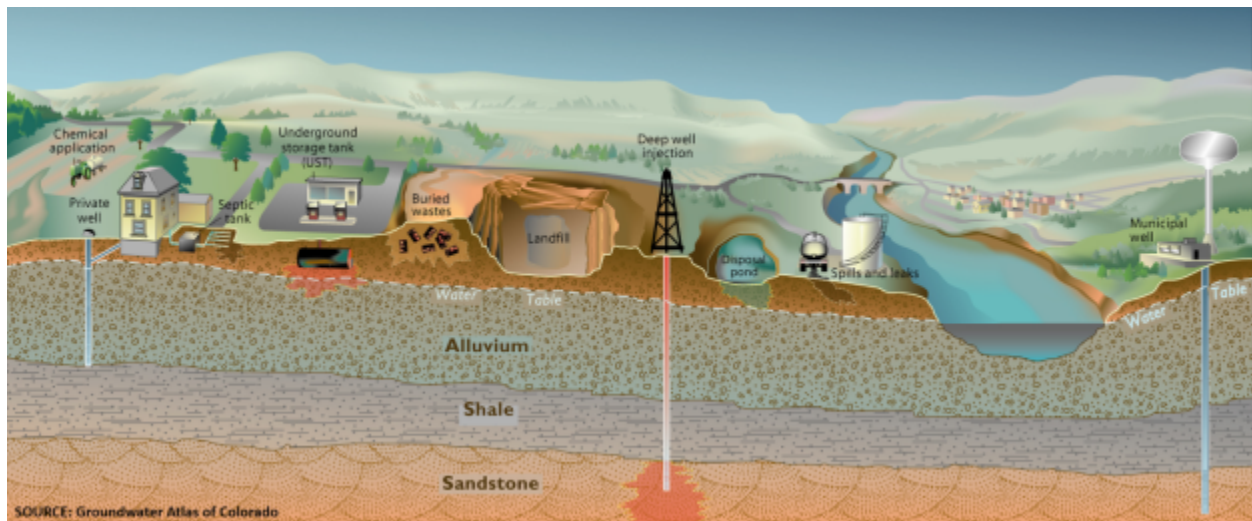
The mapping contained within this document is intended to be used for reference purposes only and is not suitable for construction and/or surveying purposes.

Map prepared by: I
Colorado Rural Water A

Potential Contaminant Source Inventory and Other Issues of Concern

Many types of land uses have the potential to contaminate source waters: spills from tanks, trucks, and railcars; leaks from buried containers; failed septic systems, buried or injection of wastes underground, use of fertilizers, pesticides, and herbicides, road salting, as well as urban and agricultural runoff. While catastrophic contaminant spills or releases can wipe out a water resource, groundwater degradation can result from a plethora of small releases of harmful substances. According to the USEPA, nonpoint-source pollution (when water runoff moves over or into the ground picking up pollutants and carrying them into surface and groundwater) is the leading cause of water quality degradation (GWPC, 2008).

Figure 2: Schematic drawing of the potential source of contamination to surface and groundwater



In 2001 – 2002, as part of the Source Water Assessment Report, a contaminant source inventory was conducted by the Colorado Department of Public Health and Environment to identify selected potential sources of contamination that might be present within the source water assessment areas. Discrete² contaminant sources were inventoried using selected state and federal regulatory databases including: mining and reclamation, oil and gas production, above and underground petroleum tanks, Superfund sites, hazardous waste generators, solid waste disposal, industrial and domestic wastewater dischargers, and water well permits. Dispersed contaminant sources were inventoried using then recent land use / land cover and transportation maps of Colorado, along with selected state regulatory databases. The contaminant inventory was completed by mapping the potential contaminant sources with the aid of a Geographic Information System (GIS).

The State's contaminant source inventory consisted of draft maps, along with a summary of the discrete and dispersed contaminant sources inventoried within the source water assessment

² The WQCD's assessment process used the terms "discrete" and "dispersed" potential sources of contamination. A discrete source is a facility that can be mapped as a point, while a dispersed source covers a broader area such as a type of land use (crop land, forest, residential, etc.).

area. The SHWSD was asked, by CDPHE, to review the inventory information, field-verify selected information about existing and new contaminant sources, and provide feedback on the accuracy of the inventory. Through this Source Water Protection Plan, the SHWSD is reporting its findings to the CDPHE.

After much consideration, discussion, and input from local stakeholders, the SHWSD and the Steering Committee have developed a more accurate and current inventory of contaminant sources located within the Source Water Protection Area. Upon completion of this contaminant source inventory, the SHWSD has decided to adopt it in place of the original contaminant source inventory provided by the CDPHE.

Contaminant Source Inventory (in no particular order):

- Vandalism
- Roads and Hazmat Transportation
- Active and abandoned wells owned by other parties
- Future Development
- Fuel Storage Tanks
- Flooding and Retention Ponds
- Structure Fire
- Residential Issues
- Septic Systems

Priority Strategy

After developing a contaminant source inventory and list of issues of concern that is more accurate, complete, and current, the Steering Committee utilized CRWA’s SWAP Risk Assessment Matrix (Appendix D) to assist with the prioritization of this inventory for the implementation of the Best Management Practices outlined in this Source Water Protection Plan (see Table 7).

The SHWSD and Steering Committee considered the following criteria when estimating the risk of contaminant sources and issues of concern.

1. **Impact to the Public Water System** – The risk to the source waters increases as the impact to the water system increases. The impact is determined by:
 - **Proximity to the Water Source** - The proximity of a potential contaminant source of contamination to the Silver Heights Water & Sanitation District’s water source(s) was considered relative to the two sensitivity zones in the Source Water Protection Area.
 - **Potential Volume** - The volume of contaminants at the contaminant source is important in evaluating whether the source water could become contaminated

at concentrations that may pose a health concern to consumers of the water in the event these contaminants are released to the source water. Large volumes of contaminants at a specific location pose a greater threat than small volumes.

- 2. Probability of Occurrence** – The risk to the source waters increases as the relative probability of damage or loss increases. The regulatory compliance history for regulated facilities and operational practices for handling, storage, and use of contaminants were utilized to evaluate the likelihood of release.

The SHWSD and Steering Committee determined whether each PSOC or issue of concern is in the water system's Direct Control (i.e. water system can take direct measures to prevent), Indirect Control (i.e. water system cannot directly control the issue, but can work with another person or entity to take measures to prevent) or No Control (i.e. PSOC or issue of concern is outside the control of the public water system and other entities). This determination of control in conjunction with the estimation of risk to the source water(s), helped guide the prioritization of the contaminant source inventory and of issues of concern in a way that best fits the needs and resources of the community. The SHWSD and Steering Committee ranked the potential contaminant source inventory and issues of concern in the following way:

Table 5: Potential Sources of Contamination and Issues of Concern Prioritization Table

Potential Source of Contamination or Issue of Concern	Controllable (Direct, Indirect, No)	Impact to Water System (Minor, Moderate, Major)	Probability of Occurrence (Unlikely, Possible, Likely, Very Likely)	Risk (Very Low, Low, Intermediate, High, Very High)	Priority Ranking
Roads	Indirect	Major	Possible	High	Primary
Vandalism	Indirect	Major	Possible	High	Primary
Wells (Active and Abandoned)	Indirect	Moderate	Possible	Intermediate	Primary
Future Development	Indirect	Minor	Likely	Low	Primary
Underground Fuel Storage Tanks	Indirect	Major	Possible	High	Secondary
Flooding and Retention Ponds	No	Moderate	Possible	Intermediate	Secondary
Structure Fire	Indirect	Minor	Possible	Low	Secondary
Residential Issues	Indirect	Minor	Possible	Low	Secondary
Septic Systems	Direct	Minor	Unlikely	Very Low	Secondary

Susceptibility Analysis of Water Sources

The Silver Heights Water & Sanitation District’s Source Water Assessment Report contained a susceptibility analysis³ to identify how susceptible an untreated water source could be to contamination from potential sources of contamination inventoried within its source water assessment area. The analysis looked at the susceptibility posed by individual potential contaminant sources and the collective or total susceptibility posed by all of the potential contaminant sources in the source water assessment area. The CDPHE developed a susceptibility analysis model for groundwater sources. The model provided an objective analysis based on the best available information at the time of the analysis. The two main components of the CDPHE’s susceptibility analysis are:

1. **Physical Setting Vulnerability Rating** – This rating is based on the ability of the surface water and/or groundwater flow to provide a sufficient buffering capacity to mitigate potential contaminant concentrations in the water source.
2. **Total Susceptibility Rating** – This rating is based on two components: the physical setting vulnerability of the water source and the contaminant threat.

Upon review of CDPHE’s susceptibility analysis, the Steering Committee determined that both the Physical Setting Vulnerability Rating and the Total Susceptibility Rating for each of the Silver Heights Water & Sanitation District’s source(s) are accurate and should remain the same (see table below).

Table 6: Updated Susceptibility Analysis

Source ID #	Source Name	Source Type	Total Susceptibility Rating	Physical Setting Vulnerability Rating
118075-001	Arapahoe Well #1	Groundwater	Moderately Low	Low
118075-004	Arapahoe Well #2	Groundwater	Moderately Low	Moderately Low
118075-002	Dawson/Denver Well #3	Groundwater	Moderately Low	Low

³ The susceptibility analysis provides a screening level evaluation of the likelihood that a potential contamination problem could occur rather than an indication that a potential contamination problem has or will occur. The analysis is NOT a reflection of the current quality of the untreated source water, nor is it a reflection of the quality of the treated drinking water that is supplied to the public.

DISCUSSION OF POTENTIAL CONTAMINANT SOURCES AND ISSUES OF CONCERN

The following section provides a brief description of four highest priority (Primary) potential contaminant sources and issues of concern that have been identified in this plan, describes the way in which they threaten the water source(s), and outlines best management practices.

Vandalism

Vandalism could endanger the water supply even though measures have been taken to protect the area. Although no recent incidents have occurred, this is a concern of the steering committee. Vandalism Best Management Practices Recommendations:

1. Construct fencing around the tank/OR review & provide a “more hardened” locking mechanism or hatch.
2. Continue to rely on existing measures (locked well heads and fencing) around wells to prevent vandalism/tampering.
3. Remain vigilant to recognize if/when vandalism/tampering occurs.
4. Install Drinking Water Protection Area signs at strategic locations throughout source water protection area.
5. Share Source Water Protection Plan with Douglas County Sheriff Department and enlist their support for regular patrol of area.

Roads and Hazmat Transportation

A portion of the source water protection area is located outside the boundaries of the District and includes Interstate Highway 25 or I-25. The roads within the Protection Area are maintained by Douglas County Road and Bridge Department.

Vehicular spills may occur along the transportation route within the source water protection areas from trucks that transport fuels, waste, and other chemicals that have a potential for contaminating the source waters if the spill reaches the aquifer. Chemicals from accidental spills are often diluted with water, potentially washing the chemicals into the soil and infiltrating into the groundwater. Roadways are also frequently used for illegal dumping of hazardous or other potentially harmful wastes. Since the aquifers are in the Denver Basin there is a low likelihood of aquifer contamination as a spill would have to occur directly adjacent to a well and the wells are located distant from I-25 but close to local roads. The following BMP's are recommended:

1. Share shapefiles of the source water protection areas with CDOT to be overlaid on their spill response maps.
2. Maintain current PWS contact information with CDOT to improve notification of spill response activities.

3. Share SHWSD contact list and maps/shapefiles of the source water protection areas and wells with the Douglas County Office of Emergency Management and commit to update it annually.

Wells (Active and Abandoned)

There are approximately 20-25 existing or abandoned wells within the source water protection area according to the records of the State Engineer. Each well is a potential aquifer contaminant location that while outside of District control could affect the District's water supply. The following BMP's are recommended:

1. Compile a list of wells within the source water protection area that are of highest concern based on proximity to the PWS wells.
2. Collaborate with the DWR to follow up with private landowners with wells in the focus group and to work with them to properly cap or plug any abandoned wells.
3. Education and Outreach for active wells within the source water protection area.
4. If any wells are found to be of high risk to the aquifer, then Silver Heights WSD will collaborate with the owner to explore funding opportunities to cap or plug them.

Future Development

Future Development could endanger the water supply by changing drainage patterns and introducing land uses potentially harming the water supply. Measures have been taken to review new developments both inside and outside the source water protection areas as they are proposed. Recent developments are a concern of the steering committee. To understand if development could pose a threat to the water supply the following Best Management Practices Recommendations have been developed:

1. Provide the Douglas County planners with a copy of the Source Water Protection Plan and GIS data of the protection area. Encourage them to overlay Silver Heights' SWPA on their land use map and refer to it during decisions on land use in the area.
2. Meet with Douglas County Planners to get Silver Heights on the referral list for land development within the District Boundaries.

SOURCE WATER PROTECTION MEASURES

Best Management Practices

The Steering Committee reviewed and discussed several possible best management practices that could be implemented within the Source Water Protection Area to help reduce the potential risks of contamination to the community's source water. The Steering Committee established a "common sense" approach in identifying and selecting the most feasible source water management activities to implement locally. The focus was on selecting those protection measures that are most likely to work for the community. The best management practices were obtained from multiple sources including: Environmental Protection Agency, Colorado Department of Public Health and Environment, Natural Resources Conservation Service, and other source water protection plans.

The Steering Committee recommends the best management practices listed in Table 7, "Source Water Protection Best Management Practices" be considered for implementation by:

- Silver Heights Water & Sanitation District
- Castle Rock Fire & Rescue Department

Evaluating Effectiveness of Best Management Practices

The SHWSD is committed to developing a tracking and reporting system to gauge the effectiveness of the various source water best management practices that have been implemented. The purpose of tracking and reporting the effectiveness of the source water best management practices is to update water system managers, consumers, and other interested entities on whether or not the intended outcomes of the various source water best management practices are being achieved, and if not, what adjustments to the Source Water Protection Plan will be taken in order to achieve the intended outcomes. It is further recommended that this Plan be reviewed at a frequency of once every 5-10 years or if circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

The SHWSD is committed to a mutually beneficial partnership with the Colorado Department of Public Health and Environment in making future refinements to their source water assessment and to revise the Source Water Protection Plan accordingly based on any major refinements.

Table 7: Source Water Protection Best Management Practices

PSOC's and/or Issues of Concern	Best Management Practices	Partners
Vandalism	<ol style="list-style-type: none"> 1. Construct fencing around the tank/OR review & provide a “more hardened” locking mechanism or hatch. 2. Continue to rely on existing measures (locked well heads and fencing) around wells to prevent vandalism/ tampering. 3. Remain vigilant to recognize if/when vandalism/ tampering occurs. 4. Install Drinking Water Protection Area signs at strategic locations throughout source water protection area. 5. Share Source Water Protection Plan with Douglas County Sheriff Department and enlist their support for regular patrol of area. 	<ol style="list-style-type: none"> 1. Silver Heights 2. Silver Heights 3. Silver Heights 4. Silver Heights 5. Silver Heights and Brian Dimock
Roads and Hazmat Transportation	<ol style="list-style-type: none"> 1. Share shapefiles of the source water protection areas with CDOT to be overlaid on their spill response maps. 2. Maintain current PWS contact information with CDOT to improve notification of spill response activities. 3. Share Silver Heights WSD contact list and maps/ shapefiles of the source water protection areas and wells with the Douglas County Office of Emergency Management and commit to update it annually. 	<ol style="list-style-type: none"> 1. Silver Heights 2. Silver Heights 3. Silver Heights
Wells (Active and Abandoned)	<ol style="list-style-type: none"> 1. Compile a list of wells within the source water protection area that are of highest concern based on proximity to the PWS wells. 2. Collaborate with the DWR to follow up with private landowners with wells in the focus group and to work with them to properly cap or plug any abandoned wells. 3. Education and Outreach for active wells within the source water protection area. 4. If any wells are found to be of high risk to the aquifer, then Silver Heights WSD will collaborate with the owner to explore funding opportunities to cap or plug them. 	<ol style="list-style-type: none"> 1. Silver Heights 2. Silver Heights and DWR 3. Silver Heights 4. Silver Heights
Future Development	<ol style="list-style-type: none"> 1. Provide the Douglas County planners with a copy of the Source Water Protection Plan and GIS data of the protection area. Encourage them to overlay Silver Heights’ SWPA on their land use map and refer to it during decisions on land use in the area. 2. Meet with Douglas County Planners to get Silver Heights on the referral list for land development within the District Boundaries. 	<ol style="list-style-type: none"> 1. Silver Heights 2. Silver Heights

Fuel Storage Tanks	<ol style="list-style-type: none"> 1. Share maps, shapefiles, and contact information with the Division of Oil and Public Safety and the Colorado Department of Public Health and Environment so that public water systems can be notified of spill events in a timely manner. 2. Meet with the local management of the gas stations to distribute maps of the source water protection area and to open channels of communication to facilitate timely notification in the event of a spill. 	<ol style="list-style-type: none"> 1. Silver Heights 2. Silver Heights
Flooding and Retention Ponds	<ol style="list-style-type: none"> 1. Contact the Douglas County Engineer and participate in the implementation of the County Drainage Plan to address any threats to SHWSD wells from flooding. 	<ol style="list-style-type: none"> 1. Silver Heights
Structure Fire	<ol style="list-style-type: none"> 1. Provide the Castle Rock Fire Department with maps of the source water protection area, maps, and shapefiles. This will better equip them to implement appropriate protocols to prevent groundwater contamination from structure fire runoff that occurs near the PWS wells. 	<ol style="list-style-type: none"> 1. Silver Heights and Castle Rock Fire Department
Residential Issues	<ol style="list-style-type: none"> 1. Silver Heights will continue to distribute brochures from SDA, AWWA and others on source water protection. 	<ol style="list-style-type: none"> 1. Silver Heights
Septic Systems	<ol style="list-style-type: none"> 1. Monitor and consider the use of public outreach to educate specific OWTS owners about how to maintain and check their systems. Consider sending this information out in the water utility billing (ex: Are you aware that not operating your septic system properly could affect your drinking water quality?) 	<ol style="list-style-type: none"> 1. Silver Heights

REFERENCES

Ground Water Protection Council. (2008). *Ground Water Report to the Nation: A Call to Action*. Oklahoma City, Oklahoma: Ground Water Protection Council.

Douglas County Planning website. Ground Water Basins

APPENDICES⁴

- A. Contingency Plan
- B. Source Water Assessment Report
- C. Source Water Assessment Report Appendices
- D. CRWA's SWAP Risk Assessment Matrix
- E. Table A-1 Discrete Contaminant Types
- F. Table A-2 Discrete Contaminant Types (SIC Related)
- G. Table B-1 Dispersed Contaminant Types
- H. Table C-1 Contaminants Associated with Common PSOC's
- I. MOU Between CDPHE and U.S. Forest Service Rocky Mountain Region
- J. SHWSD Consumer Confidence Report

⁴ All appendices are located on the CD version of this SWPP.