City of Glenwood Springs
Source Water Protection Plan

Garfield County, Colorado
December 8, 2014

Written by: Paul Hempel
Colorado Rural Water Association
and
Steering Committee Members:
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For the Community Water Provider:
City of Glenwood Springs, PWSID# CO0123314

Cover photo: Grizzly Creek, taken by Jerry Wade

This Source Water Protection Plan for the City of Glenwood Springs was developed using the Colorado Rural Water Association's Source Water Protection Plan Template.

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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
USFS	United States Forest Service
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 (BMP's) 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.

City of Glenwood Springs, PWSID #CO 0123314, 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 May, 2012 to November, 2014, at the Glenwood Springs Community Center and Glenwood Springs City Hall. During the development of this Plan, a Steering 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 its development.

City of Glenwood Springs obtains its drinking water from three surface water intakes, one each on Grizzly and No Name Creeks and another on the Roaring Fork River. Zone 1 of the Source Water Protection Area for the No Name/Grizzly Creek watersheds represents the watershed boundary for both creeks and Zone 2 is defined as a 1,000 foot wide band on either side of the creeks. Zone 1 of the Source Water Protection Area for the Roaring Fork River watershed represents the watershed boundary and includes the 3 Mile Creek and Landis Creek drainages and portions of 4 Mile Creek and Cattle Creek. Zone 2 is defined as a 1,000 foot wide band on either side of the Roaring Fork River and the above mentioned creeks. These Source Water Protection Areas are the areas that the City of Glenwood Springs 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 for No Name and Grizzly Creeks are wildfire, camping and hiking activities and tampering with infrastructure/source water. The highest priority potential contaminant sources and/or issues of concern for the Roaring Fork River are commercial/industrial operations, transportation/vehicle corridors, septic systems, above and below ground storage tanks, residential practices, agricultural practices, storm water runoff, wildfire and tampering with infrastructure/source water.

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 BMP's which pertain to the highest priority potential contaminant sources and other issues of concern:

<u>No Name/Grizzly Creek</u>

- Install an updated/expanded kiosk at No Name trailhead
- Conduct an engineering study for both intakes to determine installing a diversion structure to protect intakes from post wildfire debris flow
- Install Security Camera/Motion Sensor/Lighting

<u>Roaring Fork River</u>

- Outreach material to septic system owners at selected HOA's when CBO, Inc. conducts a septic system maintenance demonstration
- Targeted Education and Outreach to storage tank owners
- Distribute Contingency/Emergency Action Plan to Glenwood Springs FPD, Garfield County Sheriff and Office of Emergency Management
- Install Source Water Protection Road Signs at strategic locations including rafting put-ins, Highway 82 and County roadways, foot traffic bridges and bike paths
- Conduct a public education and outreach program to residents and businesses to encourage practices that will protect their drinking water sources
- Conduct a storm water awareness and outreach campaign including the utilization of video's on Grassroots TV, local TV Channel 12, RFTA in-bus adds, radio spots, website postings and storm drain stenciling

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 as circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

INTRODUCTION

City of Glenwood Springs operates a community water supply system that supplies drinking water to 9,614 residents located within Garfield County, Colorado (according to 2010 Census). City of Glenwood Springs obtains their drinking water from 3 surface water intakes in the Colorado River watershed. City of Glenwood Springs 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 City of Glenwood Springs

PWSID	PWS Name	Name	Title	Address	Phone	Website
CO0123314	City of Glenwood Springs	Jerry Wade	Assistant Water Superintendent	1401 West 9th Street, Glenwood Springs, CO 81601	(970) 384-6345	www.cogs.us

Purpose of the Source Water Protection Plan

The Source Water Protection Plan (SWPP) is a tool for City of Glenwood Springs 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 surface water and/or 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 contingency plan in case of an emergency that threatens or disrupts the community 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.

[1] The information contained in this Plan is limited to that available from public records and the City of Glenwood Springs 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.

Protection Plan Development

Colorado Rural Water Association's (CRWA) Source Water Protection Specialist, Paul Hempel, helped facilitate the source water protection planning process. The goal of 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 City of Glenwood Springs 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 the 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
May 8, 2012	Water Provider Meeting – Water providers from City of Glenwood Springs, Town of Carbondale, Town of Basalt, Snowmass WSD, City of Aspen and Environmental Process Control convened to create a vision of source water protection in the Roaring Fork Valley
July 24, 2012	Stakeholder Meeting - Presentation on the process of developing a Source Water Protection Plan for the City of Glenwood Springs. Review of the State's Source Water Assessment for City of Glenwood Springs
October 31, 2012	Steering Committee Meeting – Discussion of surface water intakes at Grizzly and No Name Creeks along with identification of potential sources of contamination (psoc's) associated with these intakes
November 14, 2012	Steering Committee Meeting – Discussion of the potential for oil and gas development in the Grizzly and No Name Creek sub watersheds, watershed district ordinances and the Roaring Fork River intake and associated psoc's
December 4, 2012	Steering Committee Meeting – Discussion of septic systems and a pilot project for septic system education, outreach and maintenance conducted by CBO, Inc.
January 31, 2013	Steering Committee Meeting – Discussion of available water quality data from the Roaring Fork River and review of contaminant source inventory to identify psoc's
March 11, 2013	Steering Committee Meeting – Discussion of contaminant source inventory and delineation of source water protection area
April 12, 2013	Steering Committee Meeting – Discussion concerning watershed district ordinances
July 24, 2013	Steering Committee Meeting – Water quality presentation by Roaring Fork Conservancy and further discussion concerning watershed district ordinances
September 24, 2013	Steering Committee Meeting – Discussion concerning watershed district ordinances

October 21, 2013	Steering Committee Meeting – Confirm source water protection areas
November 20, 2013	Steering Committee Meeting – Prioritize potential sources of contamination
December 17, 2013	Steering Committee Meeting – Prioritize potential sources of contamination
February 12, 2014	Steering Committee Meeting – Discussion of Best Management Practices
March 17, 2014	Steering Committee Meeting – Discussion of Best Management Practices
April 29, 2014	Steering Committee Meeting – Discussion of Best Management Practices
August 4, 2014	Steering Committee Meeting – Discussion of Best Management Practices
September 23, 2014	Steering Committee Meeting – Finalize Best Management Practices
November 4, 2014	Steering Committee Meeting – Final Draft and Action Plan Review

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.

City of Glenwood Springs source water protection planning process attracted interest and participation from 11 stakeholders including water operators, local and county governments, agency representatives and local citizens. During the months of May, 2012 through November, 2014, 19 meetings were held in order to develop the plan. 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 City of Glenwood Springs 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. City of Glenwood Springs and CRWA are very appreciative of the participation and expert input from the following participants.

Table 3: Stakeholders and Steering Committee Members

Jerry Wade	Assistant Supt. Water Dept	City of Glenwood Springs	Yes
Terri Partch	City Engineer	City of Glenwood Springs	Yes
Ron Biggers	Deputy Fire Marshall	Glenwood Springs FD	Yes
Morgan Hill	Environmental Health Specialist	Garfield County Public Health	Yes
Sherry Caloia	Homeowner	No Name Creek Watershed Association	Yes
Justin Anderson	Hydrologist	US Forest Service	Yes
Tamra Allen	Tamra Allen	Garfield County Building and Planning	
Andy Schwaller	Planner	Garfield County Building and Planning	
Carla Ostberg	President	CBO, Inc.	
Chad Rudow	Water Quality Coordinator	Roaring Fork Conservancy	
Kristen Hughes	Source Water Specialist	CDPHE	Yes

Development and Implementation Grant

City of Glenwood Springs 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, either cash or in-kind, is required. City of Glenwood Springs was approved for this grant in February, 2012, and it expires on March, 2016. All of the matching funds provided for the grant were in-kind. 100% of the funds will be used for the implementation of Best Management Practices.

WATER SUPPLY SETTING

Location and Description

Glenwood Springs, CO is a municipality covering an area of 4.8 square miles, and is located in Garfield County on the western slope of Colorado. Primary access to the City is through Interstate 70. Glenwood Springs has 4,113 households, a population of 9,614 year round residents (according to the 2010 US census), and a small city charm. Future projections by City of Glenwood Springs estimate that growth will increase over the next ten years. (Wikipedia, 2013)

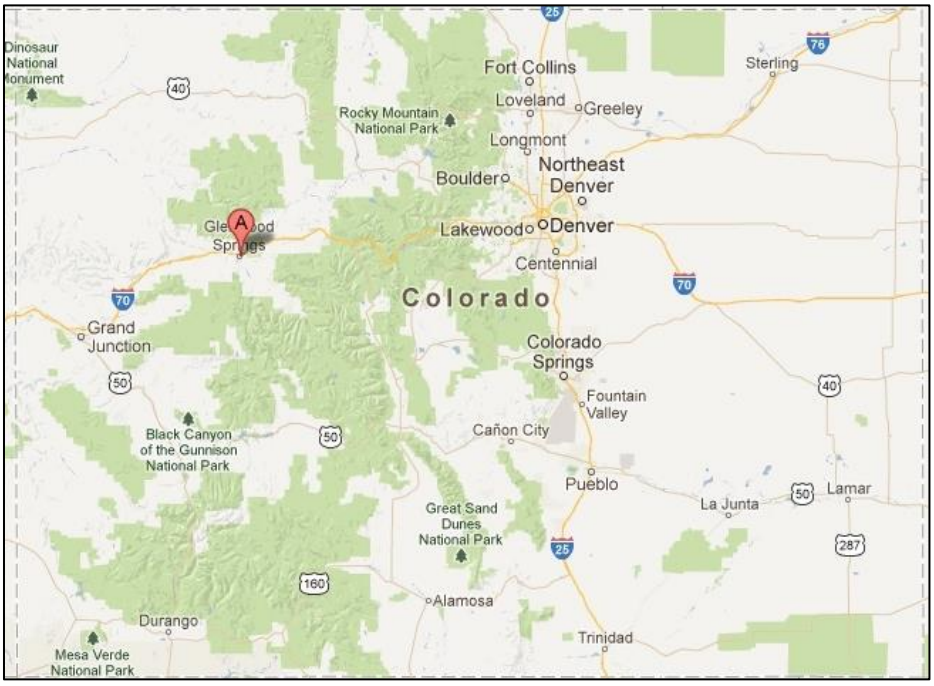


Figure 1: Location of Glenwood Springs in Colorado *Source: Google Maps*

Glenwood Springs was incorporated in 1883. Municipal affairs are governed by the Glenwood Springs City Council. Historically, Glenwood Springs was originally known as "Defiance". Defiance consisted of a camp of tents, saloons, and brothels with an increasing amount of cabins and lodging establishments. It was populated with the expected crowd of gamblers, gunslingers, and prostitutes. Town Founder Isaac Cooper's wife Sarah was having a hard time adjusting to the frontier life and in an attempt to make her environment somewhat more comfortable persuaded the founders to change the name to Glenwood Springs, Colorado, after her beloved hometown of Glenwood, Iowa. (Wikipedia, 2013)

The majority of City of Glenwood Springs source waters lie within municipal, county, public and private lands. Public lands are within the White River National Forest, managed by the Aspen – Sopris Ranger District and others managed by the Bureau of Land Management (BLM). Land use on private land consists mostly of agricultural and rural residential development.

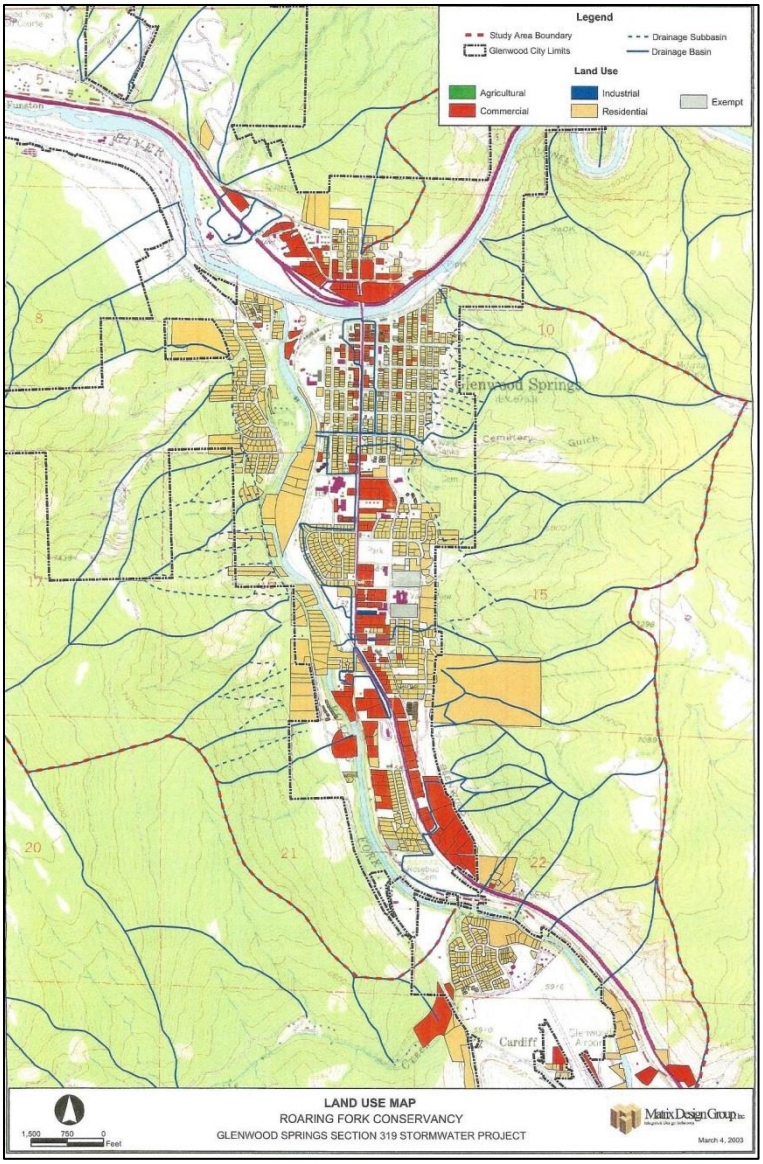


Figure 2: Glenwood Springs Land Use Map
Source: Roaring Fork Watershed State of the River Report

Physical Characteristics

Glenwood Springs is located at latitude 39^0 33' 10" N, longitude 107^0 19' 34" W. Glenwood Springs lies within a mountain valley at the confluence of the Roaring Fork and Colorado Rivers.

Elevations around Glenwood Springs range from 5741 to 8530 feet above sea level. The climate in Glenwood Springs is semi-arid. Temperatures range from an average of 80 degrees Fahrenheit in the summer to an average of 30 degrees Fahrenheit in winter. (City of Glenwood Springs Addendum to the Garfield County Natural Hazards Mitigation Plan, 2012)

The Glenwood Springs weather station has recorded temperature and precipitation data since 1900. The average annual precipitation is 16.7 inches, with half (8.3 inches) occurring in the winter months November through April. The average annual snowfall in Glenwood Springs is 55 inches. Table 4 summarizes the average annual precipitation data for Glenwood Springs on a monthly basis.

Table 4: Glenwood Springs Mean Monthly Precipitation (all values in inches)
Source: City of Glenwood Springs Stormwater Evaluation Report

Region: Glenwood Period of Record: 1900 – 2000 Gage Elevation (feet): 5,900

Month	Total Precipitation	Snowfall
January	1.50	16.4
February	1.30	10.9
March	1.44	6.1
April	1.64	1.7
May	1.43	0.3
June	1.14	
July	1.28	
August	1.51	
September	1.55	
October	1.46	1.1
November	1.14	4.9
December	1.30	13.5
Annual	**16.69**	**55.0**

Figure 3 shows a surface geology map of the watershed including a key for each geologic unit. Dr. John Emerick, a retired Colorado School of Mines ecologist, compiled this map, focusing on characteristics that could influence water quantity and quality. He relied on the following sources: Bryant, 1979; Freeman, 1971; Green, 1992; Tweto, 1979; and Olander et al., 1974. These sources used for the compilation of the geology map are listed in a separate geology sub-section within the references. What follows is the geologic description that pertains to the City of Glenwood Springs area and an illustration that corresponds with Figure 2.

> Pennsylvanian evaporites reside in the area around Glenwood Springs and were formed from the evaporation of shallow seawater. They are mostly found in the evaporitic parts of the Eagle Valley Formation. They are predominantly interbedded gypsum and dark grey shale beds of variable thickness, but believed to be around 3,000 feet thick at Cattle Creek. They have weak physical characteristics making it prone to unstable slopes; movement of surface or groundwater can produce serious subsidence problems;

and the formation's minerals can contribute to chemical degradation or pollution of surface and groundwater. This formation presents serious problems and hazards to development. Pennsylvanian evaporites are found in patches north of Ruedi Reservoir, on lower Thompson Creek, and in several strips along the lower Roaring Fork River and in the Cattle Creek Sub-watershed.

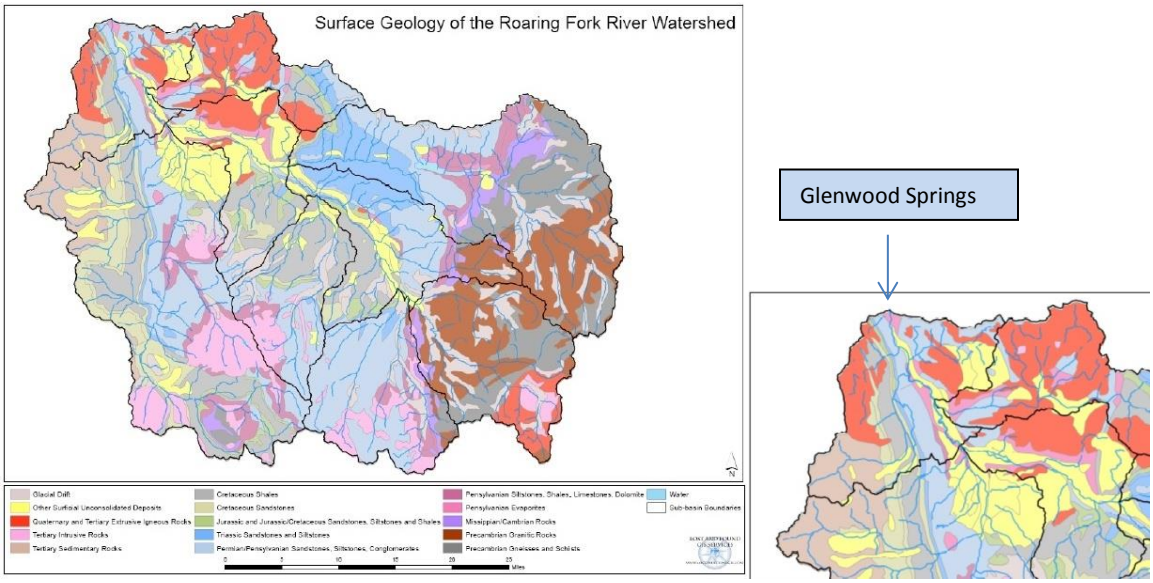


Figure 3: Surface geology of the Roaring Fork Watershed.
Source: Roaring Fork Watershed State of the River Report

Hydrologic Setting

Grizzly and No Name Creeks are the principal sources of drinking water for City of Glenwood Springs. These creeks drain approximately 59 square miles and are part of the Colorado River watershed (Hydrologic Unit Code (HUC) 1401001). The watershed extends north approximately 13 miles, east to west approximately 9 miles and has its headwaters in the Flat Top Wilderness. Grizzly and No Name Creeks have their confluence with the Colorado River just east of Glenwood Springs.

The secondary source of drinking water for City of Glenwood Springs is the Roaring Fork River. The headwaters of the Roaring Fork River originate approximately 60 miles southeast of Glenwood Springs at Independence Pass (elevation of 14,000 feet) west of Aspen, CO. At the confluence with the Colorado River the Roaring Fork River drains approximately 1453 square miles and is also part of the Colorado River watershed (Hydrologic Unit Code (HUC) 1401004). Flows are from high altitude glacial, and snowmelt fed lakes.

Water Quality Standards

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. Water quality is protected by the Colorado Water Quality Control Act through a number of state agencies. The CDPHE is the lead agency in Colorado.

The State of Colorado's Water Quality Control Commission has established water quality standards that define the goals and limits for all waters within their jurisdictions. Colorado streams are divided into individual stream segments for classification and standards identification purposes (Table 4). Standards are designed to protect the associated classified uses of the streams (Designated Use). Stream classifications can only be downgraded if it can be demonstrated that the existing use classification is not presently being attained and cannot be attained within a twenty year time period (Section 31.6(2)(b)). A Use Attainability Analysis must be performed to justify the downgrade.

Table 5: Water Quality Standards for No Name and Grizzly Creeks and Roaring Fork River
Source: CDPHE

REGION:12 BASIN: **Roaring Fork River** Stream Segment Description	Desig	Classifications	NUMERIC STANDARDS PHYSICAL and BIOLOGICAL	INORGANIC mg/l		METALS ug/l			TEMPORARY MODIFICATIONS AND QUALIFIERS
3a. Mainstem of the Roaring Fork River, from a point immediately below the confluence with Hunter Creek, to a point immediately below the confluence with the Fryingpan River. All tributaries to the Roaring Fork River, including wetlands, from a point immediately below the confluence with Hunter Creek to the confluence with the Colorado River, except for those tributaries included in Segment 1 and specific listings in Segments 3b-10.		Aq Life Cold 1 Recreation E Water Supply Agriculture	T=TVS(CS-I)°C D.O.=6.0 mg/l D.O.(sp)=7.0 mg/l pH=6.5-9.0 E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
3c. Mainstem of the Roaring Fork River, from a point immediately below the confluence with the Fryingpan River, to the confluence with the Colorado River. Mainstem of Three Mile Creek, including all tributaries and wetlands, from the source to the confluence with the Roaring Fork River.		Aq Life Cold 1 Recreation E Water Supply Agriculture	T=TVS(CS-II)°C D.O.=6.0 mg/l D.O.(sp)=7.0 mg/l pH=6.5-9.0 E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	

Water Quality Data

Water quality data for No Name and Grizzly Creeks is sparse and limited to In-House testing starting from 1978 to present. However, water quality data for the Roaring Fork River and its' tributaries has been collected by multiple entities including the United States Geological Survey (USGS), CDPHE and Roaring Fork Conservancy (RFC), who trains and manages citizen volunteers made up of members of the community, high school and middle school students included.

The Colorado Data Sharing Network (CDSN) offers pertinent water quality data via their website and RFC has generated water quality summary reports for the Roaring Fork watershed, also available on their website. Links to these websites are as follows:

http://www.coloradowaterdata.org/
http://www.roaringfork.org/

Water Quality Data collected by the CDPHE and RFC was used to determine if these segments meet the stream standards for their designated uses (Regulation 38: Rule Making Hearing, June 2009). Stream segments that do not meet their designated uses are placed on the 303(d) or

Monitoring and Evaluation List for Impaired Waters (Regulation 93: Rule Making Hearing, March 2012).The results of the data showed the following:

- All tributaries to the north of the Colorado River have been 303(d) listed for Selenium, a naturally occurring element due to geology within the Colorado River basin.
- Thompson Creek, a tributary of the Crystal River, is on the Monitoring and Evaluation List for iron.
- The Roaring Fork River is on the Monitoring and Evaluation List for sediment, e-coli, copper, lead, zinc and iron

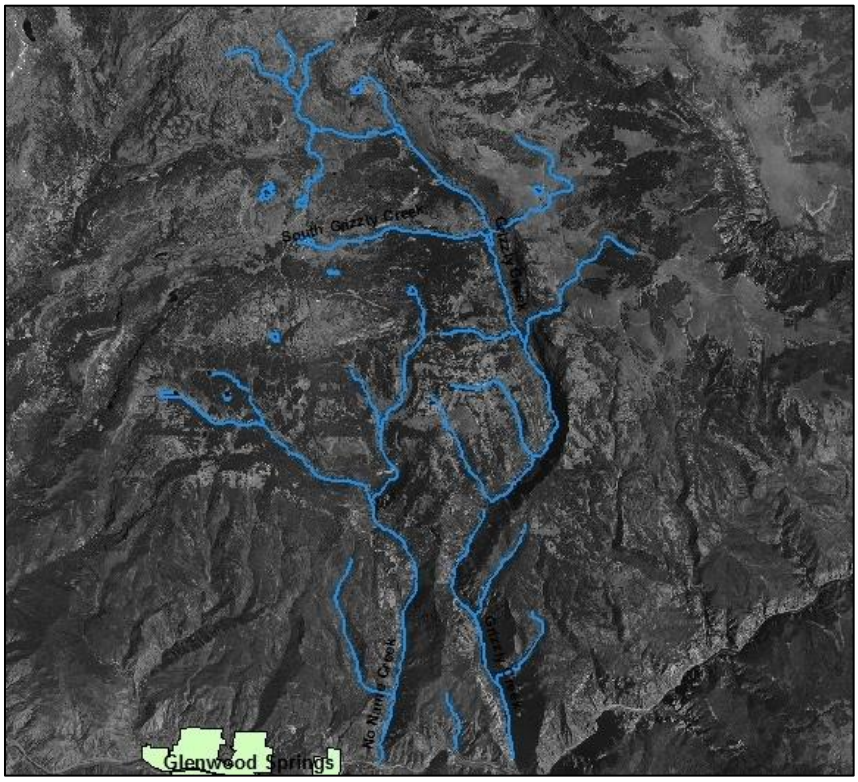


Figure 4: No Name and Grizzly Creek watersheds *Source: CRWA*

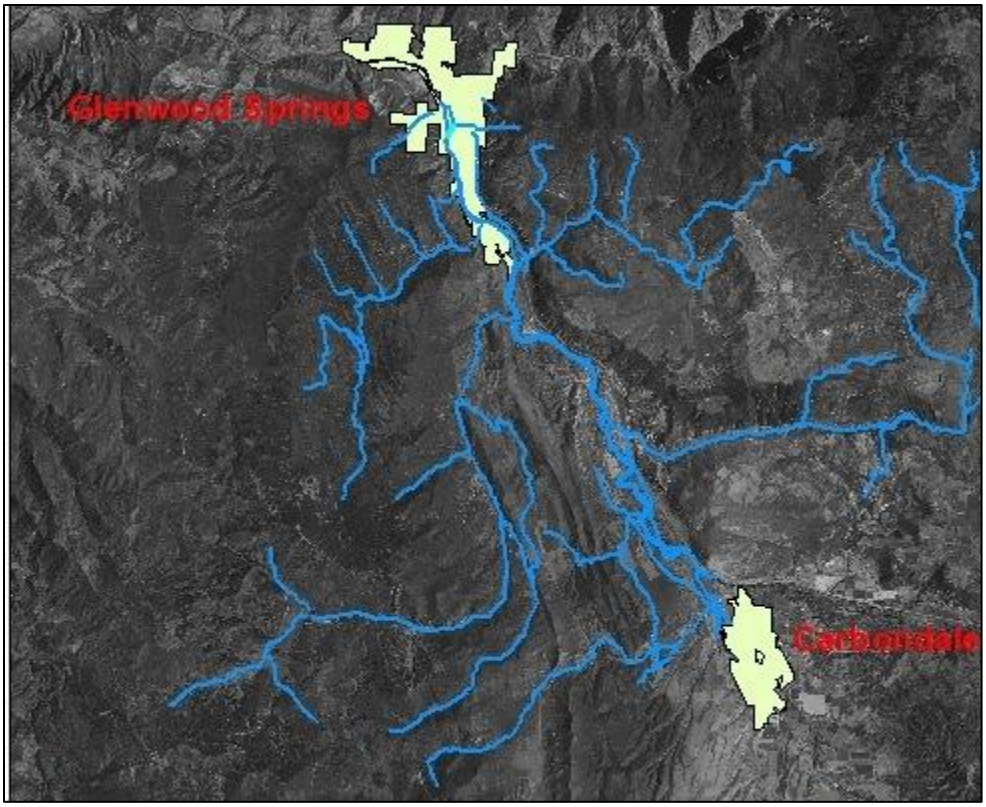


Figure 5: Lower Roaring Fork Watershed *Source: CRWA*

Drinking Water Supply Operations

Water Supply and Infrastructure

City of Glenwood Springs has three surface water intakes. The primary intakes from No Name and Grizzly Creeks are located north of Interstate 70 and the Colorado River. City of Glenwood Springs secondary intake is located on the Roaring Fork River at the 7th Street Bridge in Glenwood Springs.

The raw water diverted from the water sources is sent to one surface water treatment system. The treatment system has the maximum capacity to treat 8,650,000 gallons of drinking water per day. Treated water in stored in seven storage tanks prior to distributing the drinking water to customers. The storage systems have a maximum capacity of 5,650,000 gallons of treated drinking water.

Table 6: Surface Water Supply Information

Water System Facility Name	Water System Facility Number	Surface Water Source	Constructed Date	Appropriation Date	Appropriation Amount (af/yr)
No Name Creek	CO0123314-002	No Name Creek	1904	5/5/1887	8,687.60
Grizzly Creek	CO0123314-003	Grizzly Creek	1904	5/14/1904	5,791.73
Roaring Fork River	CO0123314-004	Roaring Fork River	1998	10/3/1996	500.00

Figure 6: Roaring Fork River at 7th Street Bridge in Glenwood Springs *Source: CRWA*

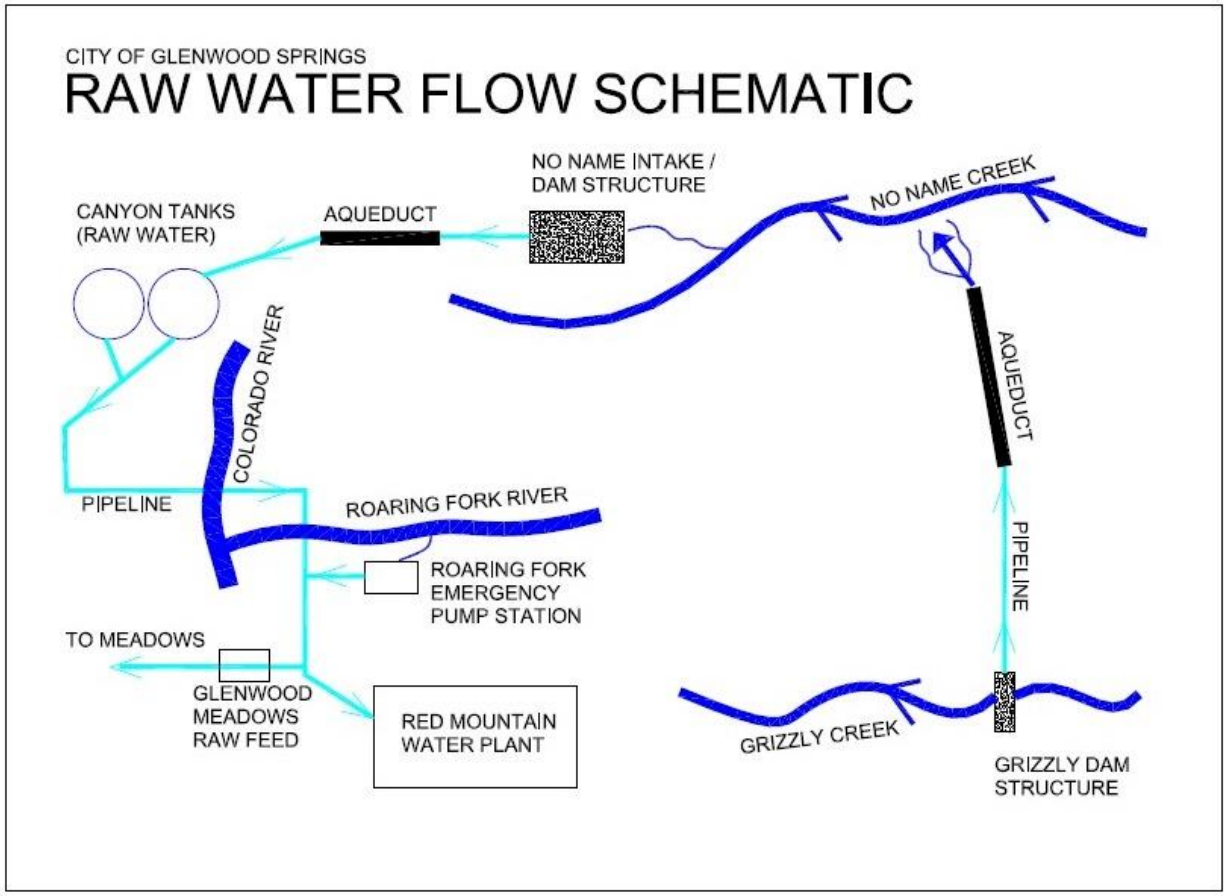


Figure 7: Water System Process Schematic Source: City of Glenwood Springs

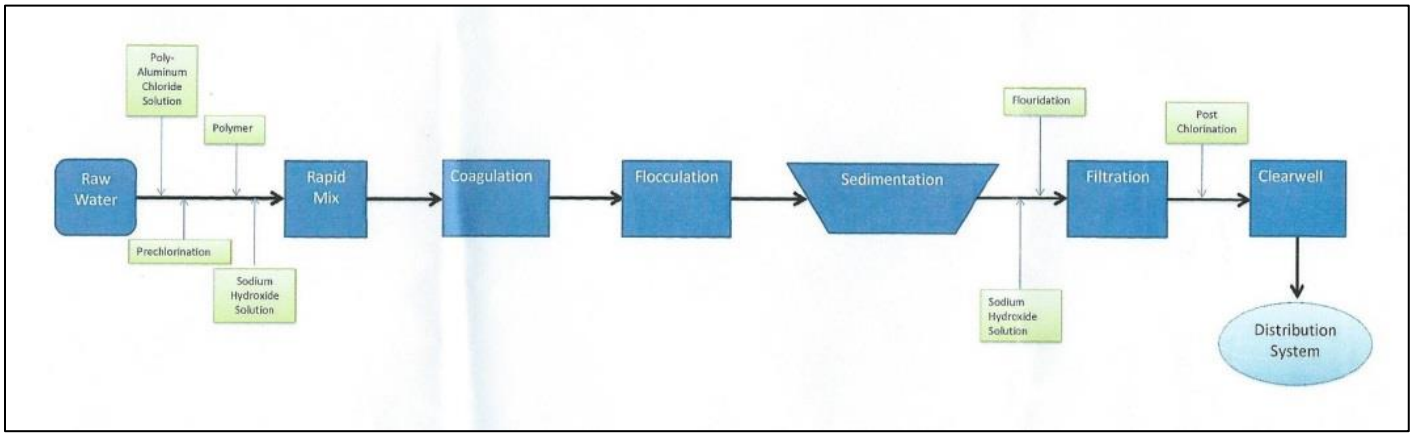


Figure 8: Red Mountain Water Plant Schematic *Source: City of Glenwood Springs*

Water Supply Demand Analysis

City of Glenwood Springs serves an estimated 3500 connections and approximately 9,614 residents and other users in the service area annually. The water system currently has the capacity to produce 8,650,000 gallons per day. Current estimates by the water system indicate that the average daily demand is approximately 2,014,000 gallons per day, and that the average peak daily demand is approximately 4,500,000 gallons per day. Using these estimates, the water system has a surplus average daily demand capacity of 6,636,000 gallons per day and a surplus average peak daily demand capacity of 6,164,000 gallons per day.

Using the surplus estimates above, City of Glenwood Springs 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 City of Glenwood Springs may not be able to meet the average daily demand of its customers if as few as two of the water sources became disabled for an extended period of time. The evaluation also indicated that City of Glenwood Springs may not be able to meet the average peak daily demand of its customers if as few as two of the water sources became disabled for an extended period of time. The ability of City of Glenwood Springs to meet either of these demands for an extended period of time is also affected by the amount of treated water the water system has in storage at the time a water source(s) becomes disabled.

City of Glenwood Springs recognizes that potential contamination of its surface water sources could potentially result in having to treat the surface 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, City of Glenwood Springs evaluated what it might cost to replace one of its water sources (i.e., replacement of the intake structure and the associated infrastructure) 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 $100,000 - $250,000 in today's dollars to replace one of its water sources.

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 City of Glenwood Springs and the greater Glenwood Springs community can help to reduce the risks posed by potential contamination of its water source(s). Additionally, City of Glenwood Springs has developed a 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 9, respectively.

Figure 9: 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 City of Glenwood Springs 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 non-regulatory, 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. This document constitutes the voluntary and proactive effort by the City of Glenwood Springs to protect their drinking water supplies. As depicted in the lower portion of Figure 9, 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 CDPHE 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 8. 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

City of Glenwood Springs 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 waters of City of Glenwood Springs from potential contamination. A copy of the Source Water Assessment Report for City of Glenwood Springs can be obtained by contacting the City of Glenwood Springs 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 City of Glenwood Springs 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 City of Glenwood Springs 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 based on the local issues of concern,

conducting an onsite survey of land uses, immediacy of the potential contamination sources to the source water, the type of potential contaminants, and topographic mapping.

City of Glenwood Springs delineated two Source Water Protection Areas, one for the No Name and Grizzly Creek watersheds and one for the Lower Roaring Fork watershed. They are defined as:

No Name Grizzly Creek watershed

Zone 1 represents the watershed boundary for both creeks.

Zone 2 is defined as a 1,000 foot wide band on either side of the creeks.

Lower Roaring Fork River watershed:

Zone 1 represents the watershed boundary and includes the 3 Mile Creek and Landis Creek drainages and portions of 4 Mile Creek and Cattle Creek.

Zone 2 is defined as a 1,000 foot wide band on either side of the Roaring Fork River and the above mentioned creeks.

The Source Water Protection Areas are illustrated in the following maps:

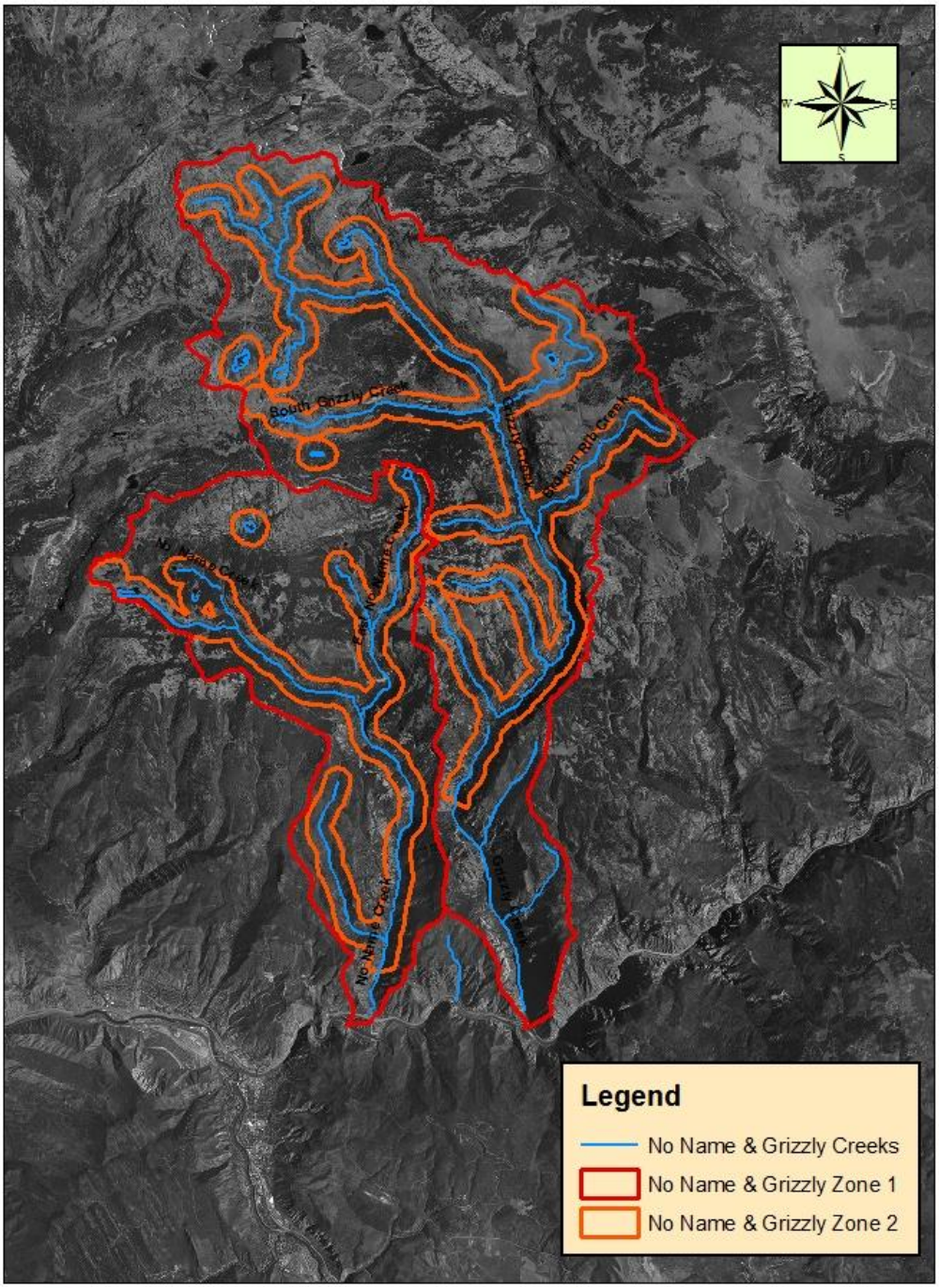


Figure 10: No Name and Grizzly Creeks Source Water Protection Areas *Source: CRWA*

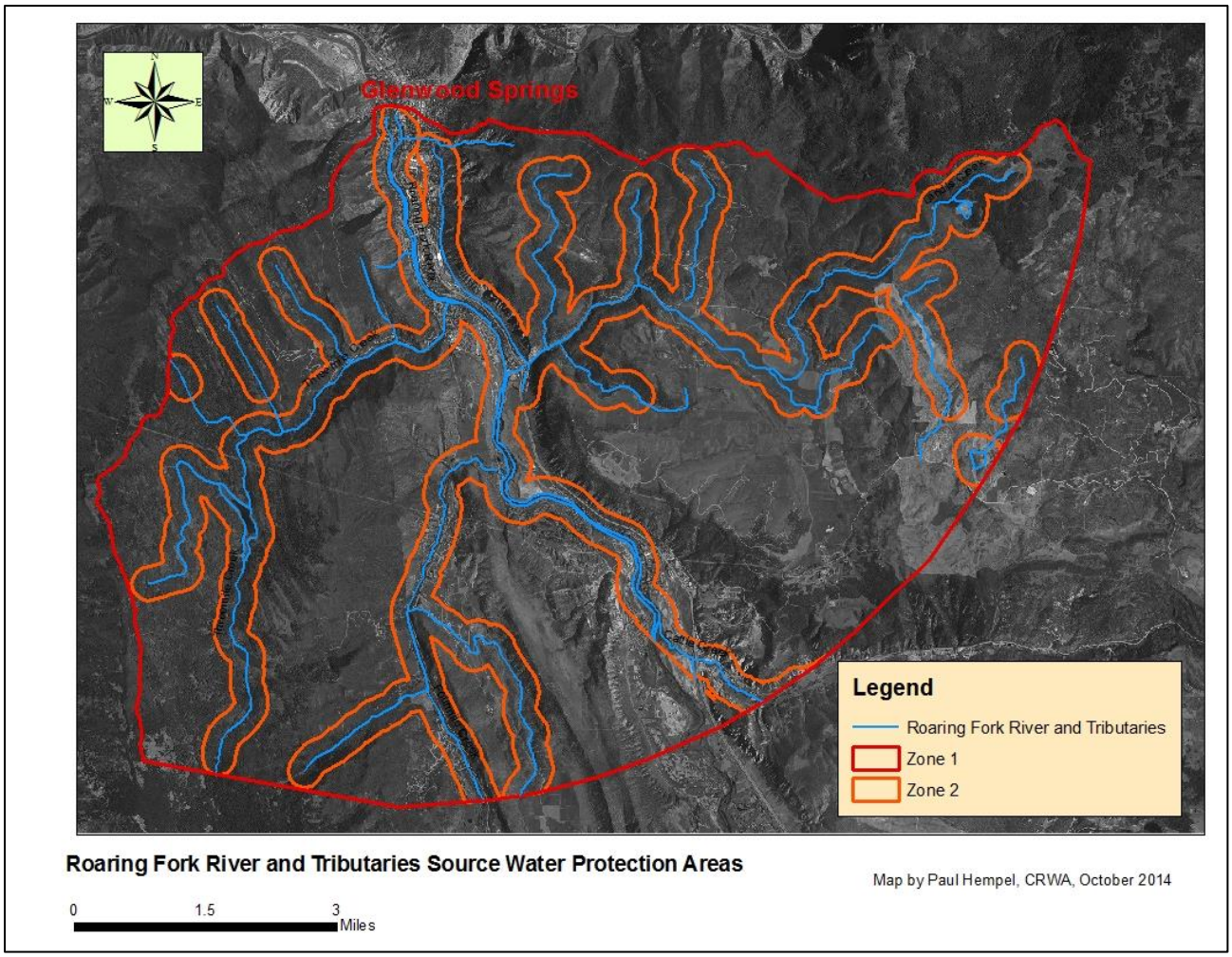


Figure 11: Roaring Fork River & Tributaries Source Water Protection Areas *Source: CRWA*

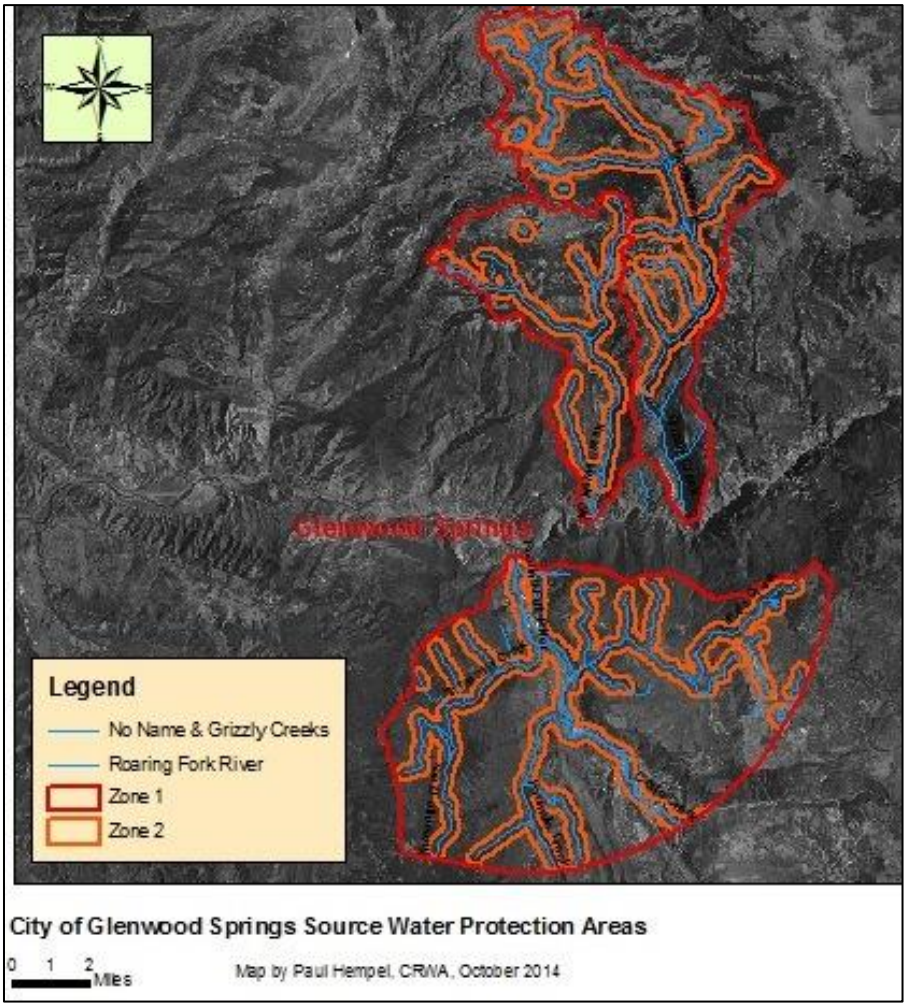


Figure 12: City of Glenwood Springs Source Water Protection Areas *Source: CRWA*

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).

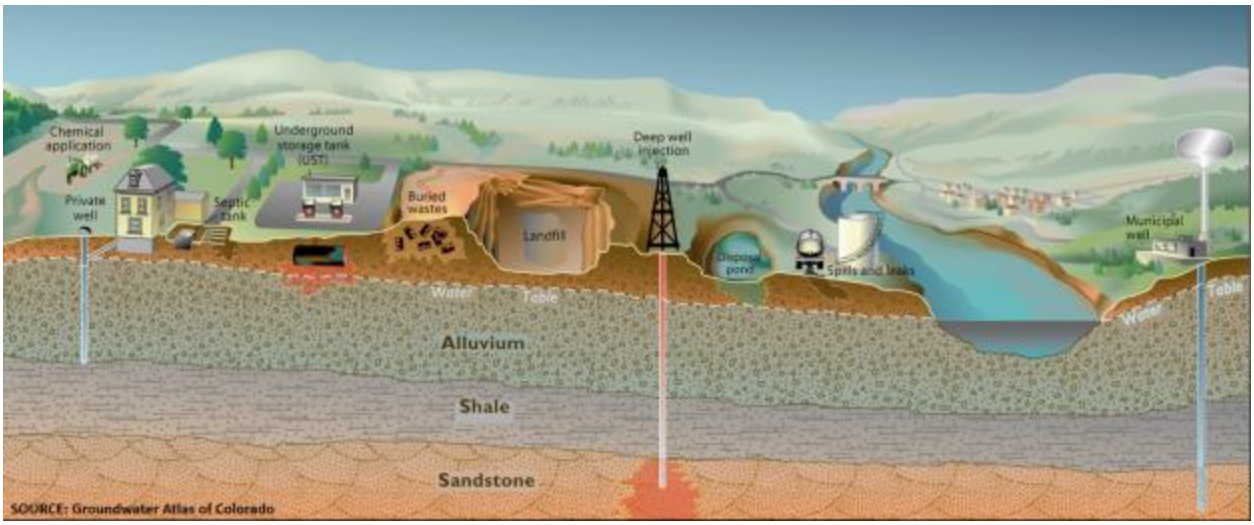


Figure 13: Schematic drawing of the potential source of contamination to surface and groundwater

In 2001 – 2002, as part of the Source Water Assessment Report, a contaminant source inventory was conducted by the CDPHE to identify selected potential sources of contamination that might be present within the source water assessment areas. Discrete[2] 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 area. City of Glenwood Springs 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. The City of Glenwood Springs did so in May of 2003. Through this Source Water Protection Plan, City of Glenwood Springs is reporting its findings to the CDPHE.

After much consideration, discussion, and input from local stakeholders, City of Glenwood Springs 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, City of Glenwood Springs has decided to adopt it in place of the original contaminant source inventory provided by the CDPHE.

[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.).

No Name and Grizzly Creeks Contaminant Source Inventory (in no particular order):

- Oil and Gas Operations
- Wildfire
- Livestock Grazing
- Outdoor Recreation
- Tampering with infrastructure/source water
- Plane Crashes

Roaring Fork River and Tributaries Contaminant Source Inventory (in no particular order):

- Septic Systems
- Transportation and Roads
- Above/Below Ground Fuel Storage Tanks
- Oil and Gas Facilities
- Residential Practices
- Agricultural Practices – herbicides and pesticides
- Permitted Wastewater Discharge Sites
- Existing Abandoned Mine Sites and Gravel Pits
- Storm Water Runoff
- Wildfire
- Commercial and Industrial Operations
  (including solid and hazardous waste)
  - Asphalt, Sand and Gravel Operations
  - Automobile Shops
  - Carpet Cleaners
  - Dry Cleaners
  - Copying and Printing
  - Furniture Repair
  - Golf Courses
  - Landscapers
  - Oil and Petroleum Companies
  - Restaurants
  - Sheet Metal Fabrication
  - Veterinarians
  - Welders
- Tampering with Infrastructure/Source Water
- Urban Recreational Grasses
- Golf Courses

Priority Strategy

After developing a contaminant source inventory and list of issues of concern that is more accurate, complete, and current, the Steering Committee began the task of prioritizing this inventory for the implementation of the Best Management Practices outlined in this Source Water Protection Plan. The following was considered by the Steering Committee when devising this strategy:

1. **Migration Potential or Proximity to the Water Source** - The migration potential generally has the greatest influence on whether a contaminant source could provide contaminants in amounts sufficient for the source water to become contaminated at concentrations that may pose a health concern to consumers of the water. Shorter migration paths and times of travel mean less chance for dilution or degradation of the contaminant before it reaches water sources. The proximity of a potential sources of contamination to the City of Glenwood Springs water sources was considered relative to the three sensitivity zones in the Source Water Protection Area (i.e. Zone 1, Zone 2, and Zone 3).

2. **Contaminant Hazard** - The contaminant hazard is an indication of the potential human health danger posed by contaminants likely or known to be present at the contaminant source. Using the information tables provided by CDPHE (see Appendices E-H), the Steering Committee considered the following contaminant hazard concerns for each contaminant source:

    - **Acute Health Concerns** - Contaminants with acute health concerns include individual contaminants and categories of constituents that pose the most serious immediate health concerns resulting from short-term exposure to the constituent. Many of these acute health concern contaminants are classified as potential cancer-causing (i.e. carcinogenic) constituents or have a maximum contaminant level goal (MCLG) set at zero (0).

    - **Chronic Health Concerns** - Contaminants with chronic health concerns include categories of constituents that pose potentially serious health concerns due to long-term exposure to the constituent. Most of these chronic health concern contaminants include the remaining primary drinking water contaminants.

    - **Aesthetic Concerns** - Aesthetic contaminants include the secondary drinking water contaminants, which do not pose serious health concerns, but cause aesthetic problems such as odor, taste or appearance

3. **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.

4. **Likelihood of Release** - The more likely that a potential source of contamination is to release contaminants, the greater the contaminant threat posed. 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 Steering Committee then utilized Tables 6 and 7 as a method to further rank their potential sources of contamination.

Table 7: Priority Strategy for No Name and Grizzly Creeks

Issue/Contaminant	In Our Control?	Impact (H, M, L)	Probability (H, M, L)	Total Factor (H, M, L)	Priority for Focus (#)
Wildfire	No	H	M	M	1
Oil and Gas Operations	No	L	L	L	3
Livestock Grazing	Yes - Indirect Via USFS & BLM Watershed Conservation Practices	L	L	L	3
Outdoor Recreation	Yes - Indirect	M	M	M	2
Plane Crashes	No	M	L	M-mitigation as occurs	3
Tampering with Infrastructure/Source Water	Y	H	M	M-daily protocol/inspection	2

Table 8: Priority Strategy for Roaring Fork River

Issue/Contaminant	In Our Control?	Impact (H, M, L)	Probability (H, M, L)	Total Factor (H, M, L)	Priority for Focus (#)
Septic Systems	Yes – post 1980 No – pre 1980	M	M-if controlled	M	2
Above/Below Ground Fuel Storage Tanks	Yes - Indirect	M	M	M	2
Transportation and Roads	Yes - Indirect	H	H	H	1
Oil and Gas Operations	Yes - Indirect	M	L	M	3

Residential Practices	Yes	M	M	M-education	2
Agricultural Practices	No	M	M	M-education/enforced	2
Permitted Wastewater Discharge Sites – via EPC, El Rocco MHP a potential concern	No	L	L	L	3
Existing/Abandoned Mine Sites and Gravel Pits	Yes - Indirect	L	L	L-regulated	3
Storm Water Runoff	Yes - Indirect future permitting	M	M	M	2
Commercial and Industrial Operations	Yes - regulated	M	H	H - education/enforced	1
Tampering with Infrastructure/Source Water	Yes	H	M	M-daily protocol/inspection	2
Wildfire	No	H	M	M+	2
Urban Recreational Grasses	Yes	L	M	L	3
Golf Courses	Yes – Indirect	L	M	L	3

Based on the above criteria and calculations from Table 6, the Steering Committee has ranked the potential contaminant source inventory and issues of concern in the following manner:

Prioritized Potential Contaminant Sources and Issues of Concern

Grizzly/No Name Intakes

- Wildfire
- Outdoor Recreation
- Tampering with infrastructure/source water

Roaring Fork River Intake

- Commercial/Industrial Operations
- Transportation and Roads
- Septic systems
- Above and Below Ground Fuel Storage Tanks
- Residential practices
- Agricultural practices
- Storm water runoff
- Wildfire
- Tampering with infrastructure/source water

Susceptibility Analysis of Water Sources

City of Glenwood Springs Source Water Assessment Report contained a susceptibility analysis[3] 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 surface water sources and ground water sources under the influence of surface water, and another model for groundwater sources. Both models 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 the susceptibility analysis, the Steering Committee determined that the Physical Setting Vulnerability Rating and the Total Susceptibility Rating needed updated to more accurately reflect the current situation. The Steering Committee created a better analysis through discussion, on-site observation, and review of historical data involving stakeholders and experts.

Table 9: Updated Susceptibility Analysis

Source ID #	Source Name	Source Type	Total Susceptibility Rating	Physical Setting Vulnerability Rating
CO0123314 - 002	No Name Creek	Surface Water	Moderate	Moderately Low
CO 0123314-003	Grizzly Creek	Surface Water	Moderately Low	Low
CO0123314 - 004	Roaring Fork River	Surface Water	Moderately High	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 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.

1. Wildfire – No Name Grizzly Creek Intakes

Much of the attention paid to wildfire and its impacts on the hydrologic cycle focuses on increased danger from flooding and mudslides during the immediate post-fire period. While threats to human health and safety posed by floods, debris flows, and mudslides certainly cause the greatest concern, water quality impacts and their associated risks are nonetheless critical for water utilities and regulatory agencies to address. Important questions are:

1. What impact does wildfire have on surface water quality?
2. How long does the impact last?
3. How far away from burned areas can water quality impacts be felt?
4. What beneficial uses can be affected by the changes in water quality induced by wildfire?
5. How can adverse impacts of wildfire on water quality be prevented, mitigated, or otherwise minimized?

The quality of surface waters can be examined in terms of physical, chemical, and biological characteristics. Here we consider only the impacts of fire on physical and chemical water properties, based on research in the coniferous forests and chaparral watersheds of California. Biological impacts are inferred from the changes in the physical and chemical properties of surface waters.

Most impacts on the physical characteristics of fire-impacted streams are evidenced by changes in sediment load. Increased sediment flows following a fire can impact both ecological health and drinking water operations. The large quantities of post-fire sediment can overwhelm the biological habitat available for aquatic organisms such as fish, as well as organisms that depend on water for some life stage, such as amphibians and insects.

Large post-fire sediment fluxes impact drinking water systems two ways. First and perhaps foremost is the danger that reservoirs, infiltration basins, and treatment works will be filled, damaged, or otherwise disrupted by sediment. Second, high sediment load is likely to increase pre-treatment processing needs (and costs) for suspended sediment removal. These impacts are highest in areas immediately adjacent to fires. (Meixner and Wohlgmuth, 2004)

Wildfire and related suppression activities are potential sources for surface water contamination. Sources of contaminants from a burned area may include increased sediment, debris, and ash flows into surface waters. The chemicals used in fire retardants can also be a

source of contamination should they migrate through runoff into drinking water supplies. The degree of contamination is controlled by the size of the burned area, distance to surface water, remaining vegetation cover, terrain, soil erosion potential, and subsequent precipitation and intensity (Walsh Environmental, 2012). The potential of a watershed to deliver sediments to surface waters after a wildfire depends on forest and soil conditions, the physical condition of the watersheds, and the sequence and magnitude of rain fall on the burned area. In cases of a high-severity fire, normal runoff and erosion processes can be dramatically altered and magnified.

Most of Colorado's wildfires are caused by lightning strikes from the many thunderstorms that pass through the state on a regular basis during the summer months. Lightning strikes sometimes create hotspots which can spread into full-fledged fires under the right conditions.

Figure 14: Wildfire in Relation to Community Water System Source: KMGH Channel 7

Figure 15: Debris and Mudflow from Post Wildfire Storm Event Source: CRWA

Figure 16: Debris and Mudflow from Post Wildfire Storm Event
Source: gippslandwater.net

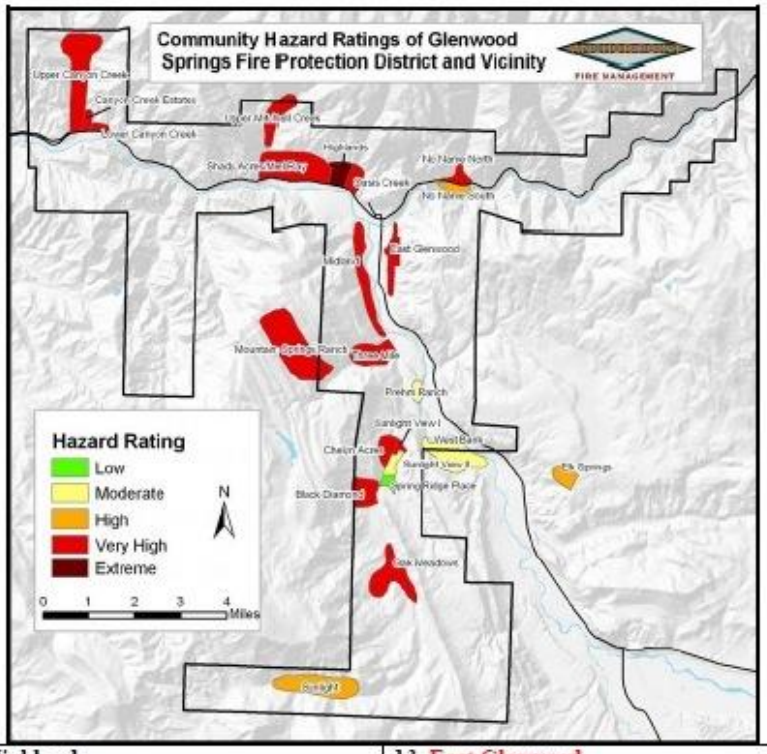
Community Wildfire Protection Plan

As part of its Hazard Mitigation Planning efforts, the Glenwood Springs Fire Department commissioned Anchor Point Group to develop a Community Wildfire Protection Plan (CWPP). The plan purposes include the assessment of wildfire risks and hazards to Glenwood Springs and the surrounding areas in Garfield County and to help communities and their local fire departments coordinate their preparation and response to a wildfire. The CWPP is focused on the Wildland-Urban Interface. As we have seen, wildfires can pose significant threats to water

supplies. This Source Water Protection Plan, therefore, will be included as a component of the Community Wildfire Protection Plan.

Building on CWPP efforts are Critical Community Watershed Wildfire Protection Plans (CCWWPPs), which broaden the CWPP concept to incorporate critical watersheds within wildfire protection areas. CCWWPPs are written plans that provide guidance to local stakeholders about the types and locations of treatments necessary to reduce wildfire hazards within the watershed, as well as to protect reservoirs, intakes, water transportation and distribution services and other facilities through the use of specific site-level treatments. For the Glenwood Springs CCWWPP Anchor Point Fire Management Group used an approach developed by the Front Range Watershed Wildfire Protection Working Group. Their group developed a method to rank watershed risk to wildfire; a method applicable to Glenwood Springs and Garfield County.

The working group strategy uses several components to develop a composite score of watershed hazard ranking. These include: wildfire hazards, flooding or debris flow risk, soil erosion potential, and water use rankings. This composite hazard ranking score characterizes watershed risk to wildfire damage from very low to very high. Once this ranking is completed, mitigation strategies are put in place. These begin with pre-fire fuel treatments and stabilization plans. Initial attack strategies once a fire begins could be employed to reduce the potential for watershed damage from loss of vegetation cover and soil disturbance. Finally, post fire response plans can identify specific treatments and locations that are of highest benefit or priority to protect streams and rivers.



1. Highlands	13. East Glenwood
2. North No Name	14. Three Mile
3. Midland	15. Oak Meadows
4. Canyon Creek Estates	16. Lower Canyon Creek
5. Mel Ray/Shady Acres	17. Sunlight
6. Chelyn Acres	18. South No Name
7. Upper Canyon Creek	19. Elk Springs
8. Upper Mitchell Creek	20. Sunlight View II
9. Oasis Creek	21. Prem Ranch
10. Sunlight View I	22. West Bank
11. Black Diamond	23. Spring Ridge Place
12. Mountain Springs Ranch	

Extreme Very High High Moderate Low

Figure 17: Glenwood Springs CWPP Community Hazard Ratings
Source: Anchor Point Group, Glenwood Springs Wildland Urban Interface CWPP

As can be seen in Figure 17 above, the area up to the City of Glenwood Springs intakes at No Name and Grizzly Creeks has a “very high” wildfire hazard rating. However, the area above the intakes and to the top of the Flat Tops Wilderness is not a major concern because of exposed granite and overall lack of fuel. The Steering Committee, however, feels that there is enough of a potential danger to the intakes if a catastrophic wildfire should occur and has decided to proceed with education and outreach to the hunters and campers on how to prevent unwanted fire emissions from happening.

For more information on wildfires or wildfire mitigation, go to the Garfield County website at http://www.garfield-county.com/emergency-management/community-wildfire-protection-plan.aspx or call The Glenwood Springs Fire Department at 970-384-6433.

Wildfire Best Management Practices:

1. Post signage at the Grizzly/No Name Creek trailheads and at various points along the trails and at bridge crossings alerting the public of the hazardous fire potential.
2. Install an updated/expanded kiosk at No Name trailhead highlighting wildfire awareness.
3. Conduct an engineering study for both intakes to determine installing a diversion structure to protect intakes from post wildfire debris flow.
4. Conduct wildfire mitigation in the form of thinning out and clearing of fuels as recommended by local wildfire mitigation experts.

2. Commercial/Industrial Operations – Roaring Fork River Intake

Businesses and industries that use toxic and hazardous chemicals can generate wastes which, when improperly stored and contained, can leak or spill on to impervious surfaces and enter surface rivers and streams. Proper disposal of these chemicals can also be an issue. Solvents, corrosives, dry cleaning agents, heavy metals, inks, lead, paint, cyanide and wood preservers are just some of the chemicals utilized in these business and industry practices. For a list of business types associated with this chemical use please refer to page 27.

There are numerous businesses, commercial establishments and industrial facilities that generate toxic and/or hazardous waste as a product of their operations within the five mile radius source water protection area upstream from the Roaring Fork River intake. Some of these facilities are close to the river while others are located along Highway 82 and Grand Avenue leading into Glenwood Springs. Additional facilities exist along county and city roads all within a mile of the rivers banks.

Figure 18: Storage Yard Approximately 565 Feet from Intake Source: CRWA

Figures 19 - 21: Petroleum Facility - approximately 0.5 River Miles from Intake Source: CRWA

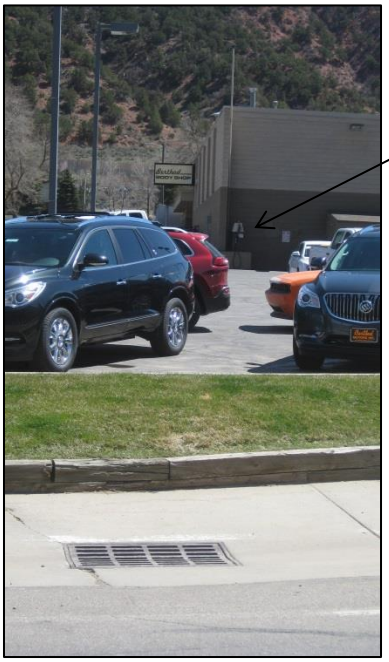


Figure 22: Fuel Tank with no Secondary Containment - approximately 1.8 River Miles from Intake
Source: CRWA

Figure 23: Storage Tank with no Secondary Containment - approximately 3.7 River Miles from Intake
Source: CRWA

Figure 24: Vehicle Storage and Maintenance Facility - approximately 4.0 River Miles from Intake
Source: CRWA

Figure 25: Heavy Equipment Operation - approximately 5.8 River Miles from Intake Source: CRWA

Figure 26: Industrial Area - approximately 8.0 River Miles from Intake Source: CRWA

Commercial/Industrial Operations Best Management Practices

1. Distribute education and outreach material to businesses and industries that explains how to properly store and dispose of toxic and hazardous waste in order to prevent the potential contamination of the Roaring Fork River and the City of Glenwood Springs drinking water supply.
2. Utilize SWAP funds for secondary containment of storage tanks and 55 gallon drums.

3. Transportation and Roads – Roaring Fork River Intake

Motor vehicles, roads and parking facilities are a major source of water pollution to both surface and groundwater. An estimated 46% of US vehicles leak hazardous fluids, including crankcase oil, transmission, hydraulic, and brake fluid, and antifreeze, as indicated by oil spots on roads and parking lots, and rainbow sheens of oil in puddles and roadside drainage ditches. An estimated 30-40% of the 1.4 billion gallons of lubricating oils used in automobiles are either burned in the engine or lost in drips and leaks, and another 180 million gallons are disposed of improperly onto the ground or into sewers. Runoff from roads and parking lots has a high concentration of toxic metals, suspended solids, and hydrocarbons, which originate largely from automobiles (Gowler and Sage, 2006). Storm water runoff over these roads can deliver contaminants from the road surface into nearby streams and rivers.

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 groundwater. 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.

During the winter season CDOT applies a salt-sand mixture and de-icer (magnesium chloride, M1000, or Ice Slicer) to highways along routes within the source water protection areas. Surface and groundwater quality problems resulting from the use of road de-icers are causing

concern among federal, state, and local governments. Salt from the highway is introduced into the groundwater through a number of ways:

1) When runoff occurs from highways, flows are sometimes carried to ditches and unlined channels through which the water infiltrates into the soil and eventually into the groundwater.

2) Also, when snow is plowed together with the salt, the pile that is accumulated on the roadside melts during warmer weathers. The water that results contains dissolved salt which can also infiltrate. Plowing and splashing of salt causes the salt to deposit along the pavement, especially near the shoulders where it melts causing runoff to enter drainage ways and then the groundwater system (Seawell, et al, 1998).

Salt contributes to increased chloride levels in groundwater through infiltration of runoff from roadways. Unlike other contaminants, such as heavy metals or hydrocarbons, chloride is not naturally removed from water as it travels through soil and sediments and moves towards the water table. Once in the groundwater, it may remain for a long time if groundwater velocity is slow and it is not flushed away. Chloride may also be discharged from groundwater into surface water and can account for elevated levels of chloride throughout the year, not just in winter. Thus, regardless of the path that the runoff takes, salt poses a water quality problem.

Figure 27 & 28: Transportation Corridors along the Roaring Fork River Source: CRWA

<u>Transportation and Roads Best Management Practices</u>

1. Provide the Garfield County Office of Emergency Management a copy of the final Source Water Protection Plan and Emergency Action Plan including emergency notification cards and maps of the source water protection areas. By providing this information, local emergency response teams can be aware of the proximity of the intake to the roads so that any spills within the protection areas can be effectively contained and mitigated.
2. Provide CDOT, Garfield County Transportation Department and Garfield County Parks Department with a map of the source water protection area and encourage the use of Best

Management Practices (BMP's) to prevent road de-icing and grounds maintenance materials and from entering the source waters.
3. Install Source Water Protection Road Signs at strategic locations including rafting put-ins, Highway 82 and County roadways, foot traffic bridges and bike paths.

4. Septic Systems - – Roaring Fork River Intake
A septic system is a type of onsite wastewater treatment system consisting of a septic tank that collects all the sewage and a soil treatment area that disperses the liquid effluent onto a leach field for final treatment by the soil.

Septic systems are the second most frequently cited source of groundwater contamination in our country. Unapproved, aging, and failing septic systems have a large impact on the quality and safety of the water supply. The failure to pump solids that accumulate in the septic tank will also eventually clog the lines and cause untreated wastewater to back up into the home, to surface on the ground, or to seep into groundwater. If managed improperly, these residential septic systems can contribute excessive nutrients, bacteria, pathogenic organisms, and chemicals to the groundwater. If the storage tank overflows or the leach fields become saturated, runoff to surface waters can also result. (Amick, R. & Burgess, E., 2000)

In Garfield County, individual Onsite Wastewater Treatment Systems (OWTS) are permitted by the Community Development Department. The County administers and enforces the minimum standards, rules, and regulations outlined in the state of Colorado's Revised Statutes (CRS 25-10-105). Residents with septic systems are required to utilize the proper materials and spacing requirements in the construction process. The number of septic systems installed before the County began to take records is unknown at this time. Therefore, the exact number of septic systems within Garfield County, the number of unapproved systems currently in use and the age of many of the septic systems in the county are also unknown.

While most residential dwellings in the source water protection area are connected to the municipal waste water system, there are scattered areas of residential dwellings with septic systems including those belonging to members of residential developments. The two most prominent residential developments include Westbank Ranch HOA and Westbank Mesa HOA located along the banks of the Roaring Fork River and Oak Meadows Service Company and Oak Meadows Homeowners Association up the 4 Mile Creek drainage. All four of these entities have developed Source Water Protection Plans, have identified septic systems as a potential contaminant source and have distributed educational material to property owners highlighting proper septic system management practices. However, the Steering Committee feels that additional education to the residents with septic systems is warranted.

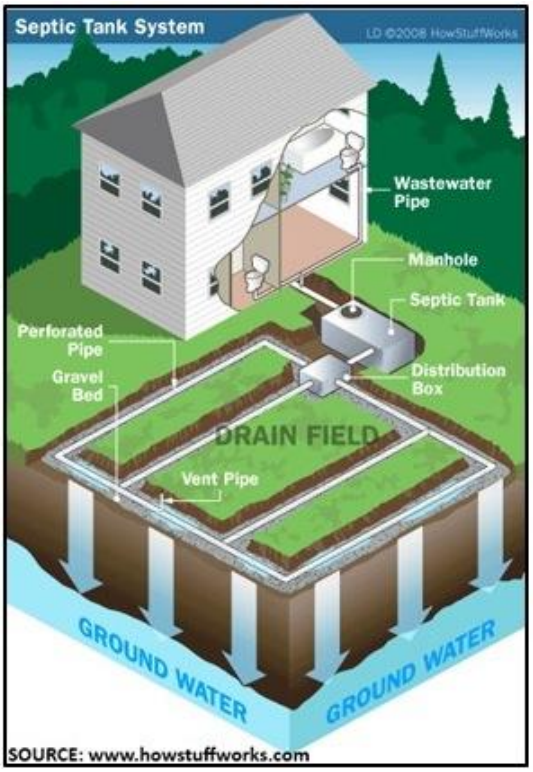


Figure 29: Schematic of Septic System

Septic System Best Management Practices

1. Distribute outreach material to septic system owners at selected HOA's.
2. Conduct a septic system maintenance demonstration to property owners at selected HOA's.

5. Above and Below Ground Fuel Storage Tanks – Roaring Fork River Intake

Storage tank releases can contaminate soil and drinking water supplies. Petroleum products are composed of volatile organic compounds (VOCs). Any oil spill can pose a serious threat to human health and the environment, requires remediation that extends be-yond your facility's boundary, and results in substantial cleanup costs. Even a small spill can have a serious impact. A single pint of oil released into the water can cover one acre of water surface area and can seriously damage an aquatic habitat. A spill of only one gallon of oil can contaminate a million gallons of water. It may take years for an ecosystem to recover from the damage caused by an oil spill. The location of the facility must be considered in relation to drinking water wells, streams, ponds and ditches (perennial or intermittent), storm or sanitary sewers, wetlands, mudflats, sandflats, farm drain tiles, or other navigable waters. Factors such as the distance to drinking water wells and surface water, volume of material stored, worse case weather conditions, drainage patterns, land contours and soil conditions must also be taken into consideration. (Source: US EPA)

Both businesses and property owners own storage tanks in the Roaring Fork River source water protection area.

Above and Below Ground Storage Tank Best Management Practices

1. Targeted Education and Outreach to tank owners on how they can implement storage tank Best Management Practices to prevent petroleum products from leaking onto the ground.
2. Investigate residential or farm unregulated storage tanks within the source water protection area.

6. Residential Practices – Roaring Fork River Intake

Common household practices may cause pollutants to runoff residential property and enter the surface or ground water as indicated in Figure 30 below. Prevention of ground water contamination requires education, public involvement, and people motivated to help in the effort. Educating the community and decision-makers is one of the challenges and cornerstone of this protection plan. Public education will help people understand the potential threats to their drinking water sources and motivate them to participate as responsible citizens to protect their valued resources.

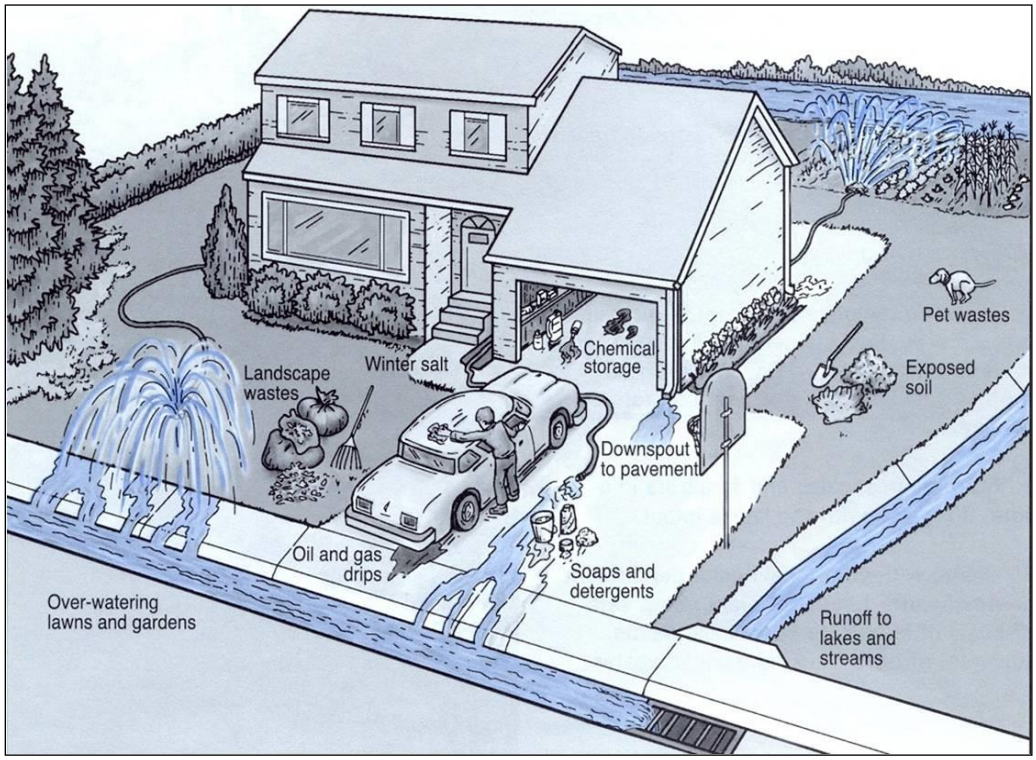


Figure 30: Residential Practices Source: CSU Extension

Figure 31: Mobile Home Park - approximately 0.2 River Miles from Intake Source: CRWA

Figure 32: Residences along Roaring Fork River - approximately 2.0 River Miles from Intake
Source: CRWA

Figure 33: 55 Gallon Drums at Residence along Roaring Fork River - approximately 3.8 River Miles from Intake Source: CRWA

Residential Practices Best Management Practices

1. Conduct a public education and outreach program to residents to encourage practices that will protect their drinking water sources. Opportunities for public education include:
* brochures and other outreach material.
* material posted on the City of Glenwood Springs website.
* Include education and outreach material in utility bills.

7. Agricultural Practices – Roaring Fork River Intake

Agricultural land use has been a historical mainstay in Colorado for over a century. Even though land use changes have occurred over this time period with development of homes and businesses, agriculture will continue to be a presence in local communities and a key part of local heritage. "Right to Farm" laws and the preservation of private property rights are important to the landowners and will be respected when developing and implementing source water protection plans.

Small ranching operations are ubiquitous to the landscape of much of Garfield County. There are a few ranches in the area that have cattle grazing near the waterways. When this is the case, the greatest risks to the water supply include fecal/bacterial contamination, sedimentation, and increased temperatures. Potential pathogens carried in animal waste include *E. coli*, *salmonella*, *cryptosporidium*, and *giardia*. Significant damage to wetland areas and stream-bank erosion may also occur. This damage can add large amounts of sediment

directly into streams, particularly wet meadow streams or those with erosive topography that is prone to gully formation. (Hill, 2012)

Figure 34: Small Ranching Operation Approximately 4.0 River Miles from Intake Source: CRWA

Agricultural Practices Best Management Practices

1. Conduct a presentation to Mount Sopris Conservation District on Source Water Protection.

8. Storm Water Runoff – Roaring Fork River Intake

Storm water runoff is rain or snow melt that flows off the land, from streets, roof tops, and lawns. The runoff carries sediment and contaminants with it to a surface water body or infiltrates through the soil to ground water.

Urban and suburban areas are predominated by impervious cover including pavements on roads, sidewalks, and parking lots; rooftops of buildings and other structures; and impaired pervious surfaces (compacted soils) such as dirt parking lots, walking paths, baseball fields and suburban lawns.

During storms, rainwater flows across these impervious surfaces, mobilizing contaminants, and transporting them to water bodies. All of the activities that take place in urban and suburban areas contribute to the pollutant load of storm water runoff. Oil, gasoline, and automotive fluids drip from vehicles onto roads and parking lots. Storm water runoff from shopping malls and retail centers also contains hydrocarbons from automobiles. Landscaping by homeowners, around businesses, and on public grounds contributes sediments, pesticides, fertilizers, and nutrients to runoff. Construction of roads and buildings is another large contributor of sediment loads to waterways. In addition, any uncovered materials such as improperly stored hazardous substances (e.g., household cleaners, pool chemicals, or lawn care products), pet

and wildlife wastes, and litter can be carried in runoff to streams or ground water. Illicit discharges to storm drains (e.g., used motor oil), can also contaminate water supplies.

Storm water is also directly injected to the subsurface through Class V storm water drainage wells. These wells are used throughout the country to divert storm water runoff from roads, roofs, and paved surfaces. Direct injection is of particular concern in commercial and light industrial settings (e.g., in and around material loading areas, vehicle service areas, or parking lots).

EPA considers nonpoint source pollution, including storm water runoff, to be one of the most important sources of contamination of the nation's waters. According to a nationwide study, 77 of 127 priority pollutants tested were detected in urban runoff. Some of the principal contaminants found in storm water runoff include heavy metals, toxic chemicals, organic compounds, pesticides and herbicides, pathogens, nutrients, sediments, and salts and other de- icing compounds. Some of these substances are carcinogenic; others lead to reproductive, developmental, or other health problems that are associated with long-term exposure. Pathogens can cause illness, even from short-term exposure that can be fatal to some people.

Urban runoff is commonly collected in storm sewers and discharged to waterways untreated, so that any contaminants carried by the storm water are discharged to surface water bodies that are used as the sources of drinking water. In addition, about 20 percent of the population in the U.S. is served by combined sewer systems (for both sanitary waste and storm water) that, during heavy storm events, allow contaminants from sanitary sewage to discharge directly to waterways untreated. (US EPA, 2001)

Figure 35: Storm Water Runoff Area within 1.4 River Miles from Intake Source: CRWA

As can be seen in Figure 35 above, the urban area to the south of the Roaring Fork River intake has a substantial portion made up of impervious services. Additionally, the topography of the land slopes down to the river from both the east and west. Therefore, any constituents found in storm water runoff will flow into storm drains and ultimately, to the River.

Storm Water Runoff Best Management Practices

1. Conduct a storm water awareness and outreach campaign including the utilization of video's on Grassroots TV, local Channel 12, RFTA in-bus adds, radio spots, website postings, outreach material sent out with utility bills and storm drain stenciling
2. Additional outreach could include movie theatre and bus stop advertising, restaurant place setters and articles in the "Community Briefs" newspaper
3. Conduct a Storm Water slogan and logo campaign to local elementary schools
4. Conduct Education and Outreach to local elementary schools by expanding on the established 5th grade program. Distribute Storm Water Activity Book
5. Establish a storm water violation hotline

9. Tampering with Infrastructure/ Source Water – Grizzly/No Name and Roaring Fork River Intakes

The Grizzly/No Name intakes have security measures in place including a neighborhood watch program and motion detector lighting. Understanding that indiscriminate vandalism could endanger the water supply, additional security including a security camera and fencing may be warranted.

Tampering with Infrastructure/ Source Water Best Management Practices:

City of Glenwood Springs will address additional security of their Grizzly/No Name intakes by utilizing the following Best Management Practices:

1. Installing fencing around intake.
2. Install security camera at intake.

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 10, "Source Water Protection Best Management Practices" be considered for implementation by the City of Glenwood Springs.

Evaluating Effectiveness of Best Management Practices

The City of Glenwood Springs 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 as circumstances change resulting in the development of new water sources and source water protection areas, or if new risks are identified.

The City of Glenwood Springs 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 10: Source Water Protection Best Management Practices

Issues	Best Management Practices	Implementers
Wildfire – Grizzly/No Name Intakes	1. Post signage at the Grizzly/No Name Creek trailheads and at various points along the trails and at bridge crossings alerting the public of the hazardous fire potential. 2. Install an updated/expanded kiosk at No Name trailhead highlighting wildfire awareness. Install a SWP sign. 3. Conduct an engineering study and construct structure for intake to determine installing a diversion structure to protect intake from post wildfire debris flow. 4. Conduct wildfire mitigation in the form of thinning out and clearing of fuel	USFS/City of Glenwood Springs USFS/City of Glenwood Springs City of Glenwood Springs City of Glenwood Springs
Commercial/Industrial Operations	1. Distribute education and outreach material to businesses and industries that explains how to properly store and dispose of toxic and hazardous waste in order to prevent the potential contamination of the source water. 2. Utilize SWAP funds for secondary containment of storage tanks, and 55 gallon Drums.	City of Glenwood Springs City of Glenwood Springs
Transportation and Roads	1. Provide the Garfield County Office of Emergency Management a copy of the final Source Water Protection Plan and Emergency Action Plan including emergency notification cards and maps of the source water protection areas. 2. Provide CDOT, Garfield County Road and Bridge Department and Garfield County Parks Department with a map of the source water protection area and encourage the use of Best Management Practices (BMP's) to prevent road de-icing and grounds maintenance materials and from entering the source waters. 3. Install Source Water Protection Road Signs at strategic locations including rafting put-ins, Highway 82 and County roadways, foot traffic bridges and bike paths.	City of Glenwood Springs City of Glenwood Springs City of Glenwood Springs
Septic Systems – Roaring Fork River Intakes	1. Distribute outreach material to septic system owners at selected HOA's. 2. Conduct a septic system maintenance demonstration to property owners at selected HOA's.	City of Glenwood Springs City of Glenwood Springs, CBO, Inc.
Above and Below Ground Fuel Storage Tanks	1. Targeted Education and Outreach to storage tank owners on how they can implement storage tank Best Management Practices to prevent petroleum products from leaking onto the ground. 2. Investigate residential or farm unregulated storage tanks within the source water	City of Glenwood Springs City of Glenwood Springs

	protection area.	
Residential Practices	1. Conduct a public education and outreach program to residents to encourage practices that will protect their drinking water sources. Opportunities for public education include brochures and other outreach material, material posted on the City of Glenwood Springs website and include education and outreach material in utility bills.	City of Glenwood Springs
Agricultural Practices	1. Conduct a presentation to Mount Sopris Conservation District on Source Water Protection.	City of Glenwood Springs CRWA
Storm Water Runoff	1. Conduct a storm water awareness and outreach campaign including the utilization of videos on Grassroots TV, RFTA in-bus adds, radio spots, website postings, outreach material sent out with utility bills and storm drain stenciling. 2. Additional outreach could include movie theatre and bus stop advertising, restaurant place setters and articles in the "Community Briefs" newspaper. 3. Conduct a Storm Water slogan and logo campaign to local elementary schools 4. Conduct Education and Outreach to local elementary schools by expanding on the established 5th grade program. Distribute Storm Water Activity Book 5. Establish a storm water violation hotline. 6. Provide brochures to construction companies, gas station owners, landscapers and restaurants on how to use Best Management Practices (BMPs) to prevent storm water runoff from entering the source waters.	City of Glenwood Springs City of Glenwood Springs City of Glenwood Springs City of Glenwood Springs City of Glenwood Springs
Tampering with Infrastructure/Source Water - Grizzly/No Name Intakes	1. Install fencing and a security camera at intake:	City of Glenwood Springs

TABLES AND FIGURES

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The following references were used in the development of the geologic map of the watershed and the accompanying legend.

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APPENDICES

A. Emergency Response Plan

B. Source Water Assessment Report

C. Source Water Assessment Report Appendices

D. MOU Between CDPHE and U.S. Forest Service Rocky Mountain Region

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