Albuquerque Bernalillo County
Water Utility Authority

The 2018 Update to the Water Quality Protection Policy
And Action Plan:

Rivers and Aquifers Protection Plan

DECEMBER 2018

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List of Acronyms and Abbreviations

AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Agency
ASR	aquifer storage and recovery
Bear Canyon Project	Bear Canyon Recharge Demonstration Project
City	City of Albuquerque
County	Bernalillo County
CWA	Clean Water Act
DBS&A	Daniel B. Stephens & Associates
DWQB	Drinking Water Quality Bureau
EPA	U.S. Environmental Protection Agency
EPTDS	Entry Point to the Distribution System
GPPAP	Ground-water Protection Policy and Action Plan
GWQB	Ground Water Quality Bureau
National SWA Guidance	Final National State Source Water Assessment and Protection Programs
MRG	Middle Rio Grande
MS4	municipal separate stormwater sewer systems
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NPDES	National Pollutant Discharge Elimination System
PIC	Policy Implementation Committee
PPCPs	Pharmaceuticals and Personal Care Products
PSOC	Potential Sources of Contamination
RAPP	Rivers and Aquifers Protection Plan
SDWA	Safe Drinking Water Act
SJC DWP	San Juan-Chama Drinking Water Project
Stormwater Team	Mid-Rio Grande Stormwater Quality Team

SWA	Source Water Assessment
SWCD	Soil and Water Conservation District
SWPA	Source Water Protection Area
SWQB	Surface Water Quality Bureau
TMDL	total maximum daily load
UCMR4	Unregulated Contaminant Monitoring Rule #4
UNM	University of New Mexico
USGS	U.S. Geological Survey
WATER 2120	Water 2120: Securing Our Water Future
Water Authority	Albuquerque Bernalillo County Water Utility Authority
WPAB	Water Protection Advisory Board
WQPPAP	Water Quality Protection Policy and Action Plan

Executive Summary

Since its formation in 2003, the Albuquerque Bernalillo County Water Utility Authority (Water Authority) has taken a proactive approach to preventing the pollution of its community's drinking water sources, first by adopting the 1994 Groundwater Protection Policy and Action Plan (GPPAP) and later with a 2009 update to the Water Quality Protection Policy and Action Plan (WQPPAP). The 2009 WQPPAP update included the addition of surface water to the source water protection plan, reflecting the Water Authority's addition of San Juan-Chama water to the drinking water supply.

Both the GPPAP and WQPPAP were multi-agency documents, emphasizing the need for, and benefits of, a collaborative, proactive approach with the City of Albuquerque (City), Bernalillo County (County), and the Water Authority. The Rivers and Aquifers Protection Plan (RAPP) is the 2018 update to the WQPPAP and serves as the source water protection plan for the Water Authority. The RAPP continues to emphasize the need and importance of collaboration with local, state, and federal entities to protect source water. The RAPP includes comprehensive source water assessments for both groundwater and surface water, along with recommended protection measures that address both drinking water supply sources.

The Water Authority has two sources of drinking water: groundwater and surface water. Groundwater comes from the Middle Rio Grande Basin aquifer through the operation of over 90 water supply wells located throughout the service area. Surface water is part of New Mexico's allotment of Colorado River water which has been apportioned among Western states. San Juan-Chama river water is diverted from the headwaters of the San Juan River, a tributary to the Colorado River, through a series of tunnels, reservoirs, and other diversion structures. The Water Authority receives its allotment of San Juan-Chama water in Heron Reservoir. It then flows downstream on the Rio Chama to Abiquiu Reservoir where the Water Authority currently has 170,900 acre-feet of storage space. Imported San Juan-Chama water released from Abiquiu Reservoir travels downstream to where it meets the Rio Grande River, passing through Cochiti Reservoir on its way to the Water Authority's San Juan-Chama Drinking Water Project diversion in Albuquerque.

The Water Authority places great value on a clean, high-quality drinking water supply and recognizes that protection of Albuquerque's water resources is best achieved by working with its customers, interagency partners, and stakeholders in the development of a source water protection program. The RAPP was developed through extensive discussions and meetings between the Water Authority and New Mexico Environment Department (NMED) staff, along with multiple meetings with the Policy Implementation Committee (PIC), and presentations to the Water Protection Advisory Board (WPAB), and the Water Authority Governing Board. The PIC members include City, County, and Water Authority technical staff members who serve as a forum for local agencies to share current and emerging issues related to source water protection, to discuss solutions for protecting human health, and to make recommendations for the protection of water quality and the environment. WPAB members reviewed the source water protection planning documents and provided comment and acceptance with recommendation for adoption.

In addition, public input was gathered for the RAPP through a series of customer meetings where Water Authority staff engaged the community in dialogue on their roles in source water protection, as well as a discussion of watershed protection and groundwater contamination. Stakeholder engagement and reviews are captured in the final RAPP that was posted for public review and recommended for adoption by the Water Authority.

Two source water assessments (SWAs) that analyzed groundwater and surface water susceptibility to contamination support the RAPP. As part of the SWAs, the Water Authority defined source water protection areas (SWPAs), built an inventory of potential sources of contamination (PSOCs) within those SWPAs, and analyzed each source’s susceptibility to contamination. A source’s susceptibility to contamination is a function of vulnerability and sensitivity. Vulnerability was assessed through scoring each SWPA, the risk of the PSOC types present, and the probability of PSOC impact occurring. Sensitivity assessed each source’s infrastructure and its ability to mitigate contamination, either naturally or engineered, if it occurred. The result is a susceptibility score ranking of low, moderately low, moderate, moderately high, or high. These rankings are used to identify and prioritize risks to Water Authority sources for planning purposes.

For the Groundwater SWA, SWPAs were defined as each of the Water Authority’s current water supply wells, applying a uniform radius of ½-mile around the well for analyzing PSOCs. A total of 64 PSOC types were identified in the SWPAs for the Water Authority’s groundwater source. Susceptibility rankings ranged from low to high, with the majority of wells ranked in the moderate category.

Surface water SWPAs were defined as the San Juan-Chama Drinking Water Project diversion, Cochiti Reservoir, and Abiquiu Reservoir; and the SWPAs were further divided into three buffer zones for more detailed analysis of PSOCs. A fourth buffer zone, Zone D, was defined for the analysis of PSOCs on a watershed scale. No surface water sources ranked higher than “moderately high” for susceptibility to contamination. The moderately-high rankings occurred along the river, upstream of the San Juan-Chama Drinking Water Project diversion. Both reservoirs, Abiquiu and Cochiti, had susceptibility rankings of moderate.

In 2016, the Water Authority Governing Board adopted the Water Authority’s 100-year water plan, *Water 2120*, that shows the community’s water needs can be met for the next one hundred years. Within *Water 2120*, there are thirteen policies to guide implementation of the water management strategy; and at the cornerstone, there is the WQPPAP which is recognized by *Water 2120* Policy H and its five sub-policies. The 2018 update to the WQPPAP, the RAPP, includes protection measures and activities for the protection of source waters and aligns the implementation of the RAPP with *Water 2120* Policy H. The protection measures and activities address watershed-scale protection measures, ordinance and policy actions, agency coordination, and public education and outreach. Both the Groundwater and Surface Water SWAs included recommendations for source water protection actions. These recommendations were developed to help reduce the risks from PSOCs and other areas of concern. These source water protection activities center on the themes of continuing and building partnerships with community members, businesses, and local agencies, and of raising awareness of the value of protecting source water. The following are highlights of the source water protection actions identified as part of the RAPP:

- Partnering with the City and County to provide information to business owners and operators on best practices at industrial and commercial properties, including dry cleaners, gas stations, autobody shops, and manufacturing plants.
- Active participation of the Water Authority in tracking cleanup progress on priority groundwater contamination sites in the City and County identified during the Groundwater SWA.
- Continued public education and outreach programs that encourage practices that protect drinking water sources. Topics may include: source water protection, household hazardous waste storage and disposal, fertilizer usage, pet waste cleanup, water conservation, and prescription drug disposal.
- The RAPP is a "living" document that is meant to be updated at a minimum of every five years or as major changes occur to operations and/or supply. Future updates to the plan should include review of the Groundwater and Surface Water SWAs for consistency and completeness. Key recommendations for future updates include:
- Advocating for legislative funding for the NMED to develop and maintain a complete and current database of PSOCs, land use, and permitted sites. This database will allow for a more robust analysis of source susceptibility and will also promote uniform source water assessments across the state, enhancing source water protection as a whole.
- Review of methodologies for analyzing susceptibility to ensure the SWAs are in line with current guidance and industry practices.

Introduction

SECTION 1

1.1 Introduction

This source water protection plan, Rivers and Aquifers Protection Plan (RAPP), has been prepared by the Albuquerque Bernalillo County Water Utility Authority (Water Authority) in collaboration with the New Mexico Environment Department (NMED), Drinking Water Quality Bureau (DWQB), and Daniel B. Stephens & Associates, Inc. (DBS&A). This plan is an update of the 2009 Water Quality Protection Policy and Action Plan (WQPPAP) and provides the Water Authority management and implementation strategies to ensure the security of the drinking water supply. A proactive approach to planning and implementing contamination-prevention strategies is essential for ensuring the longevity and availability of drinking water sources.

The RAPP includes a detailed description of how the plan was developed and will continue to be updated; a characterization of regional hydrogeology; an overview of the Water Authority drinking water supply including surface water, groundwater, and other water resources; information about the water system infrastructure, operation, and monitoring; identification and description of source water protection areas; an assessment of potential sources of contamination to source water protection areas; protection measures to manage source water resources; an overview of emergency and contingency plans for source water protection; and source water protection measures and activities. Although this plan is exclusively a Water Authority document, the Water Authority recognizes that successful source water protection requires cooperation and collaboration between local, state, and federal entities.

PURPOSE

The purpose of the RAPP is to protect both groundwater and surface water resources from known or potential sources of contamination thereby maintaining a safe drinking water supply and aquifer storage and recovery program (*Water 2120*, 2016). Implementation of the RAPP to protect source water from contamination is of paramount importance and a cornerstone of the Water Authority's Water Resources Management Strategy. To protect source water resources, an overarching mission for the source water protection program was first established in 1994, then modified to include surface water in 2009 for the WQPPAP. It continues to address the vision of the interagency source water protection program which is to:

> "Ensure the quality of our surface water and groundwater resources so that public health, quality of life, and economic vitality of this and future generations are not diminished."

To fulfill this mission, the RAPP provides goals, protection measures, and recommendations to guide source water protection efforts.

GOALS

The RAPP's goals are carried over from both the 1994 Groundwater Protection Policy and Action Plan (GPPAP) and the WQPPAP (2009) and are in line with the sub-policies listed in Policy H from *Water 2120*, 2016. Policy H states: "The Water Authority shall take steps to fully implement the Water Quality Protection Policy and Action Plan." The WQPPAP will now be referred to as the Rivers and Aquifers Protection Plan.

Groundwater goals were developed when the GPPAP was originally established and surface water goals were later developed when the WQPPAP was adopted in 2009. The goals of the source water protection program are to:

- Advocate for and protect the source water quality in the service area.
- Advocate for the enforcement of federal and state regulations implemented to protect source water from contamination.
- Maintain a current inventory of known groundwater contamination sites; identify priority sites; and work with local, state, and federal agencies to expedite corrective action.
- Define and improve the coordination and effectiveness of the multiple local jurisdictions with an interest in source water protection.
- Promote the coordinated protection and prudent use of groundwater throughout the region.
- Engage public participation in source water protection planning and implementation.

These goals informed the development of the protection measures presented in Section 5 of this document. These protection measures and activities will guide implementation activities to protect source waters. *Water 2120* in combination with the approval and adoption of the RAPP supersedes previous versions of the WQPPAP.

1.2 Background

Throughout the 1980s, local government officials and water resource professionals in Albuquerque became aware of several sources of groundwater contamination in the local aquifer threatening the only source of drinking water to the community at that time. After several groundwater contamination investigations were designated as "Superfund" sites, the City and County realized it was time to take actions to protect groundwater. In 1988 and 1989, the City and County passed resolutions calling for clean-up and to protect the Middle Rio Grande's shared groundwater resources. After five years of planning and research, the Albuquerque – Bernalillo County GPPAP was fully adopted by the County in November 1993, and by the City in August 1994. In 2003, after the Water Authority was created by state legislation, it adopted the GPPAP for protection of groundwater.

Beginning in late 2008, the Water Authority began diverting San Juan–Chama water from the Rio Grande as a source of drinking water. The addition of surface water to the Water Authority's drinking water supply prompted an update to the GPPAP to include surface water protection policies and activities. The result was a single WQPPAP, which served as a source water protection document for the Albuquerque – Bernalillo County area.

A Water Protection Advisory Board (WPAB) with members appointed by the City, County, and Water Authority was established to oversee the implementation of the WQPPAP. The WPAB also works with members of the WQPPAP Policy Implementation Committee (PIC) through which members from the City, County, and Water Authority share current and emerging issues regarding threats to source water protection measures, provide solutions to improve public health, and make recommendations to protect water quality and the environment.

Following adoption by the Water Authority Governing Board in September 2016, the Water Authority began implementation of its 100-year water resources management plan, titled *Water 2120*: Securing Our Water Future (Water 2120). The strategy describes multiple water supply and demand scenarios under varying climate conditions and provides policies and projects to implement over the next century to ensure an adequate water supply in the future. It is important for the Water Authority and other stakeholders in the region to invest in protecting the quality of source waters to protect the drinking water supply for future generations.

This RAPP is an update to the WQPPAP. The updates include a surface water source water assessment extending from the headwaters of the San Juan and Chama Rivers and down the Rio Grande to the Water Authority diversion in Albuquerque. The plan also includes an updated groundwater source water assessment for Water Authority supply wells. The RAPP is a “living” document which will be updated at a minimum of every five years or as major changes occur in the system. Updates will address any changes to the Water Authority’s water supply system, and newly-regulated contaminants, as well as any other changes that will impact the source water protection program.

Source Water Setting

SECTION 2

2.1 Location and Description

The Water Authority currently has two sources for its drinking water supplies: groundwater and surface water. Groundwater comes from the Middle Rio Grande Basin, discussed in further detail in Section 2.2 below. Surface water is part of New Mexico's allotment of Colorado River water which has been apportioned among Western states. San Juan-Chama water is diverted from three tributaries of the San Juan River which is a tributary to the Colorado River; the headwater diversion is located in southern Colorado (Figure 1). Water from the Rio Blanco, Little Navajo, and Navajo Rivers in southern Colorado is diverted into a series of conveyance facilities including Azotea Tunnel which crosses underneath the Continental Divide.

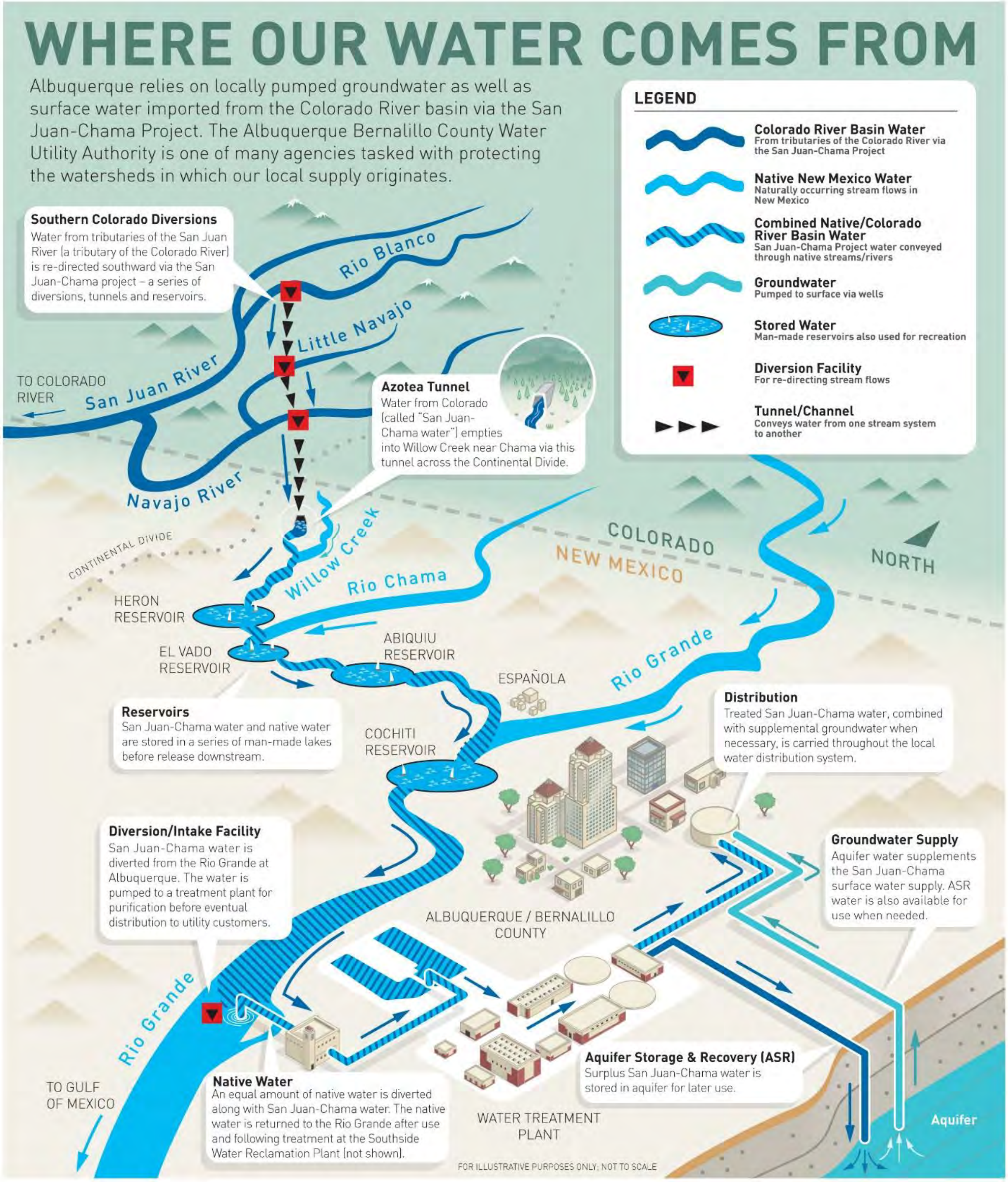
Imported water from the San Juan River is then discharged from Azotea Tunnel into Willow Creek, just upstream of Heron Reservoir in New Mexico. The imported water is stored in Heron Reservoir and is released to San Juan-Chama Contractors, including the Water Authority, at the outlet of Heron Reservoir. When released, the Water Authority's San Juan-Chama water is delivered for storage in Abiquiu Reservoir via the Rio Chama after it passes through El Vado Reservoir. The Water Authority currently has a contract for storage of 170,900 acre-feet of San Juan-Chama water. When the Water Authority is operating the San Juan-Chama Drinking Water Treatment Plant, San Juan-Chama water is released from Abiquiu Reservoir down the Rio Chama, and into the Rio Grande, through Cochiti Reservoir for diversion at the San Juan-Chama Drinking Water Project (SJC DWP) diversion structure in Albuquerque.

Groundwater and surface water are managed conjunctively, providing flexibility for managing Albuquerque's drinking water supply. Surface water (i.e., San Juan-Chama water) is now Albuquerque's primary source for drinking water; and groundwater from the aquifer is the secondary source (*Water 2120*, 2016). Albuquerque's drinking water supply is roughly 70% surface water and 30% groundwater.

2.2 Hydrogeology

Albuquerque sits within the Middle Rio Grande Basin which extends from roughly Cochiti Dam down to San Acacia, New Mexico, along the Rio Grande River (Figure 2). The Middle Rio Grande Basin covers approximately 3,060 square miles and refers to the geologic basin defined by the extent of Cenozoic-aged sedimentary deposits. The eastern boundary of the basin is mountainous with alluvial fans merging with stream terraces progressing downslope to the Rio Grande River. To the west, the basin surface has isolated mountains and volcanoes, generally sloping upwards to the Rio Puerco (Connell et al., 2001).

Figure 1 Where Our Water Comes From



Albuquerque Bernalillo County
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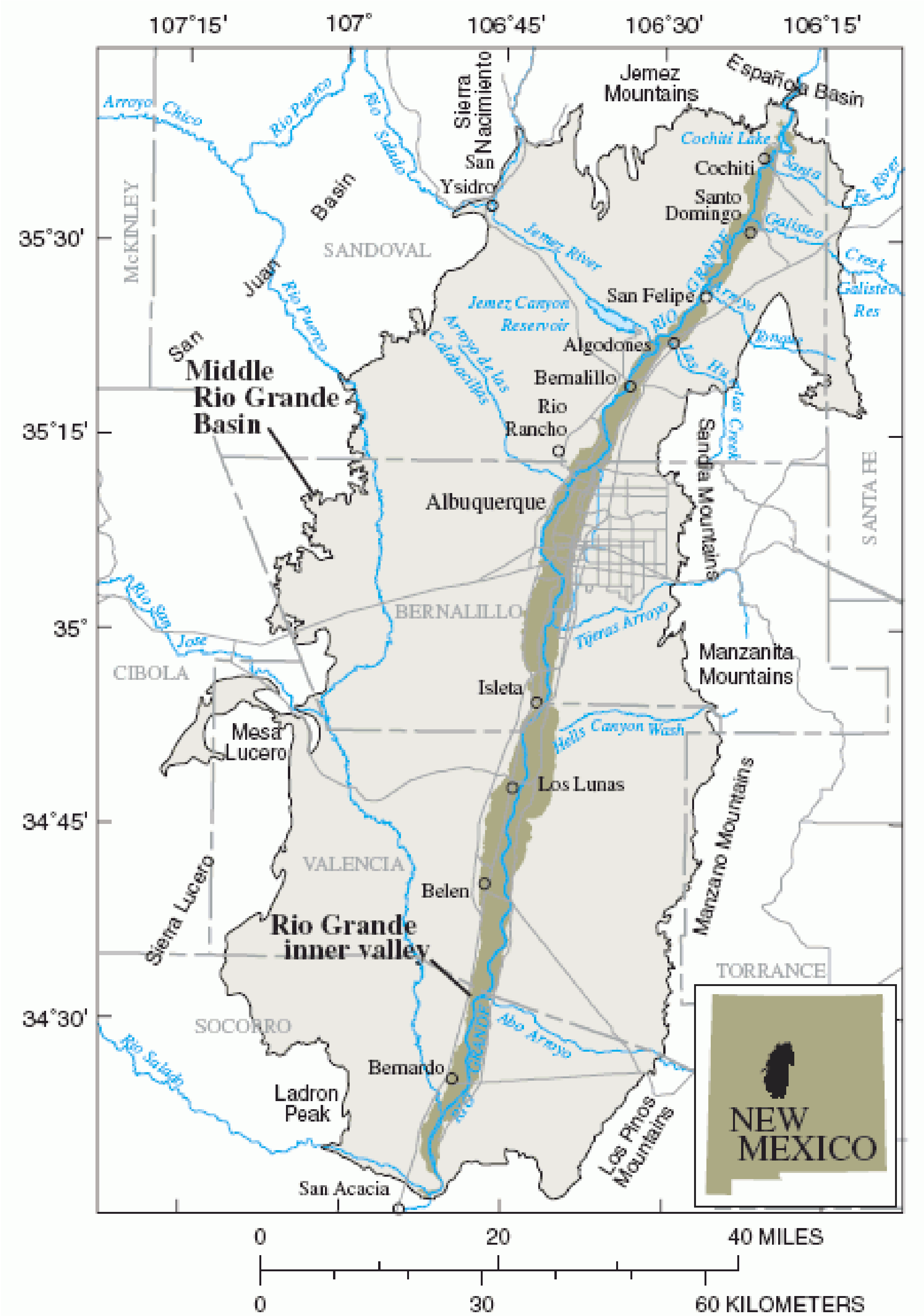
Figure 2 Middle Rio Grande Basin (Bartolino and Cole, 2002)



Major physiographic and hydrologic features of the Middle Rio Grande Basin.

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The most prominent hydrologic feature within the Middle Rio Grande Basin is the Rio Grande River which flows through the entire length of the basin. The Rio Grande is ranked as the fifth longest river in the United States, starting its course to the Gulf of Mexico from its headwaters in the San Juan Mountains of southern Colorado. Within the Middle Rio Grande Basin, tributary streams, wastewater treatment plants, flood-diversion channels, and a large number of arroyos contribute flow to the Rio Grande. Two cities along the Rio Grande, Bernalillo and Rio Rancho, discharge treated effluent directly into the Rio Grande. Two flood diversion channels, North Diversion Channel and South Diversion Channel, intersect several smaller arroyos and divert the flow to the river via hard channels at outlets north and south of Albuquerque.

Within the Middle Rio Grande Basin is the Santa Fe Group aquifer system which ranges from 3,000 to over 14,000 feet in thickness. The hydrostratigraphic units defined in the basin are basin fill and valley fill that are grouped on the basis of origin, as well as on lithostratigraphic and chronologic position. The aquifer includes the Santa Fe Group deposits which are Oligocene to middle Pleistocene in age and make up the major basin-fill aquifer zones. The aquifer also includes valley-fill deposits from the channel and floodplains of the Rio Grande River and its tributaries, such as the Rio Chama and Rio Puerco. The valley-fill deposits are late-Quaternary in ages and form the upper part of the Middle Rio Grande Basin's most productive shallow-aquifer system (Hawley and Kernodle, 1999).

Depth to water varies widely across the basin, ranging from less than 2 feet near the Rio Grande river to greater than 1,000 feet beneath the West Mesa. As a result of the depositional history of the Santa Fe Group, it is believed that most of the lower part of the basin would make a poor aquifer due to decreased water quality. Consequently, the majority of groundwater withdrawals in the basin occur from the upper and middle portions of the aquifer; only the upper 2,000 feet (roughly) of the aquifer is used for groundwater withdrawal (Bartolino and Cole, 2002).

A major source of recharge to the Middle Rio Grande Basin aquifer system is from mountain-front and tributary recharge. The Rio Grande River which runs the length of the basin is another major source of recharge for groundwater in the basin. Basin underflow contributes groundwater at the subsurface basin margins. Natural recharge to the aquifer is estimated to total about 100,000 acre-feet per year (Throne et al., 1993; Kernodle et al., 1995; Tiedeman et al., 1998; McAda and Barroll, 2002). Under predevelopment conditions, natural recharge was balanced with discharge to the Rio Grande and evapotranspiration from riparian vegetation along the Rio Grande. Pumping of the aquifer since predevelopment has subsequently changed the water balance of the system.

2.3 Existing Protection Programs

Source water protection relies on the awareness, participation, and actions of federal agencies, state agencies, local governments, and individual citizens. The 1996 amendments to the Safe Drinking Water Act (SDWA) envisioned that source water protection measures would be implemented at the state, regional, and national levels, with guideposts to assess the progress of actions taken towards protecting drinking water sources. In response to the SDWA, states began working with water utilities, municipalities, and counties to develop protection programs to protect surface water and groundwater sources. This section provides a brief overview of existing programs that are designed to protect surface water and groundwater quality within the Albuquerque and Bernalillo County area, as well as applicable tribal programs.

FEDERAL

Section 1453 of the SDWA provided individual states with the lead responsibility for implementing source water assessments. As stated in Section 1453(a)(1) of the SDWA, the source water assessments are to be used for the "protection and benefit of public water systems" through the delineation of assessment boundary areas and identification of contaminants. Therefore, source water assessments are intended to be the foundation for the development of source water protection programs for drinking water.

Section 1453 of the SDWA does not require that states and water utilities develop formal source water protection programs, but the 1997 guidance document, Final National State Source Water Assessment and Protection Programs (National SWA Guidance), encourages the development of source water protection programs at the same time as the development and implementation of source water assessments. The 1997 National SWA Guidance also outlines tools in the amended SDWA that can be used to develop and implement these programs including: 1) continuation of the Wellhead Protection Program (Section 1428 SDWA); 2) an optional petition program (Section 1454 SDWA); and 3) the authority for states to use drinking water funds for source water protection programs (Section 1452(g)(2)(b)). Finally, the 1997 National SWA Guidance can be used to assist the U.S. Environmental Protection Agency (EPA) and states in collaborating with the many agencies and entities needed for source water protection.

The federal Clean Water Act (CWA) requires several surface water quality protection programs. Many of the programs under the CWA are administered by the State of New Mexico (see "State" section below). One of the key programs for surface water quality protection under the CWA is the National Pollutant Discharge Elimination System (NPDES) permit program which is currently administered by the EPA; the New Mexico Environment Department (NMED) provides "certification" input to the Region 6 EPA office for all NPDES permit applications.

The NPDES permit program was established in 1972 by Section 402 of the CWA and was designed to protect surface water quality through the regulation and control of "point source" discharges to surface water. Point sources are generated by a variety of municipal and industrial operations and include the discharge of treated wastewater, and stormwater runoff from drainage systems. In 1990, the EPA began the NPDES Stormwater Program which regulated discharges from municipal separate storm sewer systems (MS4s), construction activities, industrial activities, and other activities designated to impact water quality by the EPA.

STATE

The New Mexico Water Quality Act was established by the State of New Mexico in 1967. As part of that act, the New Mexico Water Quality Control Commission (NMWQCC) was formed to serve as the state water pollution control agency for all purposes of the federal CWA and for certain programs of the SDWA. As such, the NMWQCC is charged with the adoption of water quality standards that are designed to both protect public health and welfare and to enhance the quality of surface water and groundwater. The NMWQCC water quality standards are written into the New Mexico Administrative Code (NMAC) Section 20.6.4.

In accordance with Section 303(d) of the federal CWA, the NMED Surface Water Quality Bureau (SWQB) identifies stream reaches that are considered impaired or that do not meet water quality standards of the associated designated use. Additionally, the NMED SWQB establishes a total maximum daily load (TMDL) value for each pollutant of concern for designated Section 303(d) stream reaches. The TMDLs are created by NMED SWQB staff and are approved by the NMWQCC. They are designed to ensure that both state and tribal water quality standards can be met. The Watershed Protection Section of the NMED SWQB program involves implementation of best management practices within watersheds to control pollution from nonpoint sources, such as runoff from agricultural and/or residential areas. Additionally, the NMED SWQB Watershed Protection Section program can apply for CWA Section 319(h) grants for state and tribal programs to support a variety of activities to ensure the success of a nonpoint source implementation project.

The NMED Ground Water Quality Bureau (GWQB) is tasked with the protection of New Mexico’s groundwater resources as mandated by the New Mexico Water Quality Act and the New Mexico Ground and Surface Water Regulations in NMAC 20.6.4. The NMED GWQB issues groundwater pollution prevention permits under the Pollution Prevention Section of the bureau. Additional responsibilities of the NMED GWQB include implementation of the New Mexico Mining Act, oversight of groundwater investigation and remediation activities, implementation of the federal Superfund program, oversight of agreements between the state and responsible parties of impacted sites, and implementation of the State’s Voluntary Remediation Program. In 2017, the NMED GWQB proposed an amendment to the Ground Water and Surface Water Protection Regulations. The NMWQCC issued a decision on the proposed changes to NMAC 20.6.4 and the amended regulations will take effect in 2020.

CITY OF ALBUQUERQUE AND BERNALILLO COUNTY

Multiple groups and agencies work together in the Albuquerque and Bernalillo County area to protect surface water and groundwater sources. These groups include but are not limited to:

- *Water Protection Advisory Board (WPAB)* – WPAB (formerly known as the Ground-Water Protection Advisory Board) was established in 1988 by City Resolution R-143 and County Resolution R-49-88. The WPAB is composed of community members appointed by the City, County, and Water Authority and is tasked with oversight of the implementation of the WQPPAP, now known as the Rivers and Aquifer Protection Plan (RAPP). In addition to overseeing the implementation of source water protection, WPAB is tasked with promoting consistency in City, County, and Water Authority actions to protect source water and with advocating for the effective protection of surface water and groundwater sources.

- *Ciudad Soil and Water Conservation District (SWCD)* – Ciudad SWCD is organized and operated under the State Soil and Water Conservation Act of 1937; it was created in 1943 by a referendum vote of landowners. The Ciudad SWCD works with landowners and communities to sustain and improve soil and water along with other natural resources. The primary missions of New Mexico SWCD are to promote protection of watersheds through the reduction of water and wind erosion of soils, increasing infiltration, and improving the quality of surface waters by reducing sedimentation and other nonpoint source pollution. Additionally, the Ciudad SWCD mission includes increasing and maintaining the district's involvement in efforts to protect groundwater and surface water quality across the Albuquerque and Bernalillo County area.
- *Mid-Rio Grande Stormwater Quality Team* – The Stormwater Team was formed in 2004 to educate individuals and businesses on how to reduce stormwater pollution. The original members included the partner agencies in the one Municipal Separate Stormwater Sewer System (MS4) NPDES permit in Albuquerque and Bernalillo County. The MS4 partner agencies include the City of Albuquerque, Bernalillo County, the Albuquerque Metropolitan Area Flood Control Agency (AMAFCA), the University of New Mexico (UNM), and the New Mexico Department of Transportation (NMDOT). Since 2004, additional municipalities (e.g., Rio Rancho) and regional agencies (e.g., Eastern Sandoval County Arroyo Flood Control Authority) have joined the Stormwater Team.

TRIBAL

The Native American Tribes and Pueblos in New Mexico are responsible for protection of surface water quality within their lands. The Pueblo of Sandia and the Pueblo of Isleta have authority from the EPA to establish their own water quality standards. Surface water quality standards developed for tribal lands may affect discharge to waters upstream of those lands. Both the Pueblo of Sandia and the Pueblo of Isleta have set lower allowable concentrations for particular metals and other parameters in their water quality standards; and therefore, any NPDES permit upstream of these Pueblos must comply with their stricter water quality standards.

Drinking Water Supply Operations

SECTION 3

3.1 Water Supply and Infrastructure

Drinking water sources are treated for compliance with the Safe Drinking Water Act (SDWA) prior to use by Water Authority customers. Surface water goes through a complex treatment process that removes impurities from the water before it is distributed to customers. Groundwater is chlorinated to keep the water free of bacteria and viruses and may also be treated to remove arsenic. The federal SDWA is designed to provide maximum protection for public health.

SURFACE WATER

Surface water is treated at the San Juan-Chama Drinking Water Treatment Plant to meet the SDWA standards. San Juan-Chama surface water is diverted from the Rio Grande and conveyed to the San Juan-Chama Drinking Water Treatment Plant. The first treatment process at the San Juan-Chama Drinking Water Treatment Plant consists of grit removal and pre-sedimentation in the storage ponds where larger particles are removed by gravity. Following pre-sedimentation, ferric chloride and polymers are added to coagulate the smaller particles into larger particles which are then removed through sedimentation. Ozone is used to disinfect and breakdown organics in the water to remove taste and odor compounds.

After ozonation, the water is then filtered through a multimedia filter that includes sand and granular activated carbon. After the water has been through the filtration step of processing, chlorine is added to disinfect the water and to protect the overall water quality. Final treatment steps include adding a corrosion inhibitor that works to protect pipes and home plumbing as the water flows from the treatment facility to household taps. The entire treatment process (Figure 3) is designed to provide drinking water that meets all state and federal SDWA standards for water quality. Though not required by law or regulation, the Water Authority's treatment process and personnel strive to deliver water that is of better quality than provided by the minimum drinking water standards and also has an excellent taste.

GROUNDWATER

Groundwater is pumped from the regional aquifer to provide a potable supply of water that, in most cases, requires minimal treatment to meet drinking water standards. The sedimentary deposits that comprise the Middle Rio Grande Basin aquifer naturally filter groundwater as it flows through the basin. Groundwater is accessed from the aquifer through the drilling and installation of deep wells.

To create a well, a narrow hole is drilled into the ground, down into the aquifer, and a pipe is placed in the hole. The bottom of the pipe has slots in it that allow groundwater to flow from the aquifer into the pipe, where it is pumped to the ground surface. Once at the ground surface, the

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Figure 3 Surface Water Treatment Process

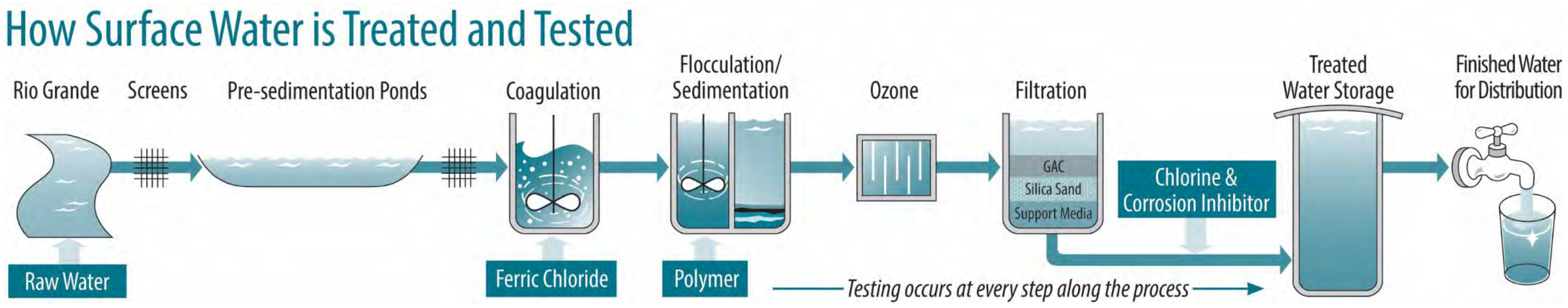
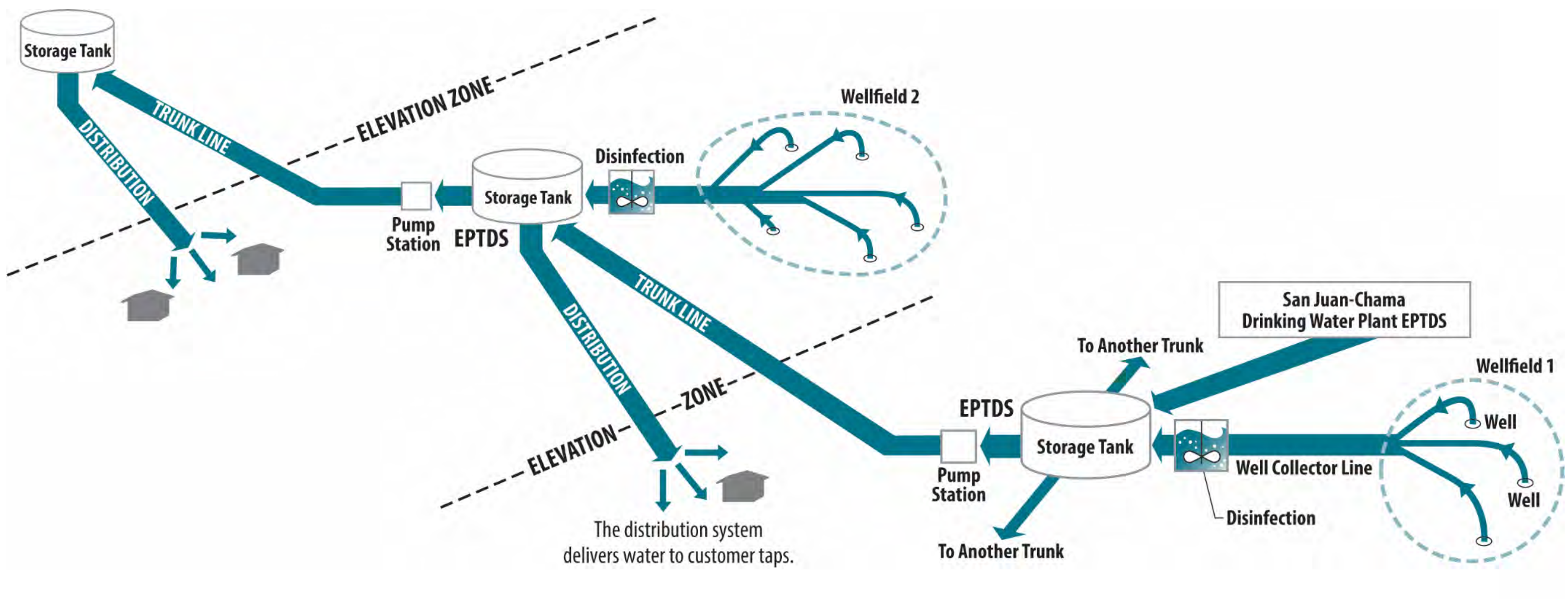


Figure 4 Entry Points to the Distribution System



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groundwater from the well is then treated by adding chlorine. In some cases, groundwater is treated to remove arsenic so that the quality of the water meets drinking water standards required by state and federal law. This potable, groundwater-sourced drinking water is transferred from the wells to storage tanks or “reservoirs” via large-diameter transmission pipelines.

Treated surface water is mixed with the treated groundwater in the reservoirs prior to distribution; the reservoirs are organized in trunk lines (Figure 4). Blended surface and ground water from the reservoirs are delivered to customers’ taps through distribution pipelines by gravity. The Water Authority service area is divided into multiple distribution zones; and there are numerous “Entry Point to the Distribution System” (EPTDS) locations where the treated and blended surface water and groundwater are pumped for delivery to Water Authority customers.

AQUIFER STORAGE AND RECOVERY

The Water Authority designed and implemented the Bear Canyon Recharge Demonstration Project (Bear Canyon Project) to demonstrate the effectiveness of artificial recharge through an in-stream infiltration system. It is the first permitted and operating artificial recharge project in the State of New Mexico. The project involves the use of non-potable surface water to recharge the aquifer through in-stream infiltration, using the aquifer to store surface water and establish a drought reserve. As part of *Water 2120*, the Water Authority plans on using artificial recharge to address the need for additional water supply storage and to provide water during times of drought.

The Bear Canyon Project uses an unlined, 2,800-feet long reach of Bear Canyon Arroyo between Wyoming Boulevard and Arroyo del Oso dam in Albuquerque. San Juan-Chama water diverted from the Rio Grande is delivered to the Arroyo Del Oso non-potable reservoir tank at Bear Canyon via existing non-potable infrastructure (Northside I-25 Reclamation and Reuse System). The source water delivered to the tank for in-stream filtration and infiltration into the aquifer is San Juan-Chama water diverted from the Rio Grande. Water is then released from the reservoir into the arroyo where it flows down the channel to where it will infiltrate into the streambed sediments, flow through the vadose zone, and eventually reach groundwater.

The Bear Canyon Project is permitted by the State Engineer for a maximum discharge volume of 3,000 acre-feet per year and from New Mexico Environment Department (NMED) through an approved Groundwater Discharge Plan; actual discharge is approximately 550 acre-feet per recharge season. The release of water into the stream is limited to a maximum period of six months (October through March), with the majority of releases occurring during the months of November through February. The Water Authority measures the volume of water released; and the quality of source water is tracked through sample collection in compliance with the discharge permit (Section 3.2 below).

In 2017, the Water Authority began construction of a large-scale aquifer storage and recovery (ASR) and vadose zone pilot projects. The projects include a vadose zone well and a large-scale ASR well at the San Juan-Chama (SJC) Drinking Water Treatment Plant. The vadose zone injection well is a dry well where water will percolate through the vadose zone down to groundwater. The large-scale ASR well is designed to directly inject drinking water into the aquifer and has the capability of recovering the injected water on-site. Both the vadose zone and ASR wells will have connecting infrastructure to the SJC Drinking Water Treatment Plant and give the Water Authority the ability to store drinking water in the aquifer. The construction phase of these pilot projects is ongoing. Once complete, the ASR and vadose zone wells will be utilized to store SJC drinking water in the aquifer when demands are lower during the winter.

3.2 Existing Monitoring Programs

Water quality monitoring is a requirement for all public water systems to ensure water delivered to customers' taps is safe for consumption. The Water Authority has multiple monitoring programs in place to ensure the drinking water arriving at customers' taps is always safe. Compliance monitoring, required by the SDWA and Environmental Protection Agency (EPA), occurs where any treated water sources are introduced to the distribution system for delivery to customers' taps. In addition to the required monitoring the Water Authority does for SDWA compliance, the Water Authority also performs voluntary monitoring for additional contaminants at greater frequencies than required by state or federal law. The Water Authority also has monitoring programs that sample source waters upstream of the SJC DWP diversion, including the Rio Grande and stormwater discharge channels. This added monitoring provides information to the Water Authority on ambient water quality and informs treatment operations.

The Water Authority strives to deliver the highest quality drinking water which typically exceeds the standards required by the SDWA. To achieve this goal, the Water Authority tests potable water for more contaminants, both regulated and unregulated, at more frequent intervals than required. The Water Authority collects over 4,500 water samples each year and conducts approximately 40,000 analyses of those samples. Analyses test for over 90 regulated contaminants and more than 50 unregulated contaminants. Monitoring not only ensures drinking water is always safe, it also provides the Water Authority opportunities to review analyses to identify areas for improvement. The following subsections provide further details about each of the monitoring programs implemented to protect Albuquerque's drinking water.

COMPLIANCE MONITORING

Water quality samples collected for compliance with the SDWA and EPA requirements are collected at numerous locations throughout the Water Authority's drinking water distribution system. As required by the SDWA, there are three locations for water quality sampling in the system depending on the contaminant for which the utility is monitoring. The most common sampling locations are the EPTDS; there are 27 EPTDS. Monitoring also occurs monthly at the source water intake for the SJC Drinking Water Treatment Plant (surface water) and annually at each production well (groundwater). The Water Authority monitors for disinfectants and disinfection byproducts at specified sampling locations in the distribution system. Additional microbiological sampling occurs at designated taps located throughout the distribution system to monitor water quality directly at customers' taps.

The Water Authority performs continuous monitoring at the SJC Drinking Water Treatment Plant and throughout the distribution system where new water sources are introduced (the EPTDS). Turbidity, pH, and chlorine residuals are continuously monitored (24 hours a day, 7 days a week) at the SJC Drinking Water Treatment Plant. Online monitoring for chlorine residual occurs continuously at each EPTDS to confirm inactivation of microorganisms in source water before it is delivered to customers. Microbiological sampling occurs throughout the distribution system at sample sites located at customers' taps and sampling hydrants. Sample sites are approved by NMED and visited on a regular rotation at least once every four months. There are approximately 600 established microbiological sampling sites distributed evenly throughout the drinking water system.

Federal and state regulation, including the SDWA, lay out specific requirements for monitoring and publishing those water quality results so they are available for public review. The EPA requires that results for water quality monitoring be reported annually to public water utility customers via the Consumer Confidence Report (CCR). The CCR is mailed out to Water Authority customers (physically and electronically) and is delivered to public locations throughout the city.

The SDWA and NMED limit the amounts of certain contaminants that can be found in tap water provided by public water utilities. Schedules for monitoring contaminants and lab methods for analyses are designed by the SDWA; and the Water Authority is required to demonstrate that the sampling results show that no EPA or NMED limits have been exceeded. As part of the SDWA requirements, the Water Authority monitors for contaminants that do not have drinking water standards. The Unregulated Contaminant Monitoring Rule #4 (UCMR4) requires public water systems to monitor for up to 30 unregulated contaminants. The concentrations for contaminants on the UCMR4 list are reported to the NMED and EPA and are used for informing future regulatory actions to protect human health. Results from UCMR4 and unregulated contaminant monitoring are reported to Water Authority customers annually in the CCR.

VOLUNTARY MONITORING

In addition to the monitoring required for compliance with the SDWA and EPA, the Water Authority conducts additional analyses to ensure production wells are not compromised in areas where groundwater contamination may be a concern. Water Authority staff are dedicated to tracking progress and protecting production wells from known environmental contamination sites (Groundwater Source Water Assessment Appendix A) in the Water Authority service area. For example, production wells in areas near known groundwater contamination are monitored quarterly for contaminants of concern to confirm the well has not been compromised. Several Water Authority production wells near the Kirtland Air Force Base Bulk Fuels Facility jet fuel leak are monitored monthly to confirm jet fuel constituents are not found in the drinking water supply.

The Water Authority voluntarily monitors for pharmaceuticals and personal care products (PPCPs) and published this information in the Voluntary Occurrence Monitoring for Pharmaceuticals & Personal Care Products study published in March 2011. The study was voluntarily undertaken by the Water Authority following the addition of San Juan-Chama surface water as a drinking water source, and a 2008 report by the Associated Press highlighting the possible presence of pharmaceuticals and personal care products in surface water. The 2011 Water Authority study included 500 analytical tests and the results found an overall low occurrence of PPCPs in the water system (pre- and post-treatment). This study is in the process of being updated and is anticipated to be completed in 2019/2020.

AQUIFER STORAGE AND RECOVERY MONITORING

As part of *Water 2120*, the Water Authority is implementing and expanding the use of ASR. Water quality in the non-potable system is monitored up to three times per week in accordance with the Water Authority's permit with NMED. Source water is monitored prior to introduction into Bear Canyon, once during operations, and once after conclusion of operations at the project.

U.S. GEOLOGICAL SURVEY SURFACE WATER MONITORING

Prior to utilizing San Juan-Chama water as a drinking water supply, the U. S. Geological Survey (USGS) extensively studied Rio Grande water quality upstream of Albuquerque to inform the Water Authority on treatment operations at the SJC Drinking Water Treatment Plant. Monitoring began in 2004; water quality has been monitored at multiple locations upstream including the Taos, Chamita, Otowi, Cochiti, San Felipe, Jemez, and Alameda gages. After establishing the ambient water quality of the Rio Grande, USGS monitoring has been scaled back to focus on three representative sites: Cochiti, Jemez, and Alameda gages. The USGS collects samples three times per year from the Cochiti and Alameda locations: during the winter for baseline conditions, spring runoff for high-water conditions, and irrigation/monsoon season. The Jemez site is monitored only during spring runoff. Monitoring sampling includes analyses for standard water chemistry parameters (e.g., major ions, trace elements, nutrients, coliforms, etc.), as well as analyses for anthropogenic compounds (e.g., volatile organic compounds, wastewater compounds, etc.) and radioisotopes (e.g., Tritium, Radium, etc.).

STORMWATER QUALITY MONITORING

Integral to source water protection is protecting the quality of stormwater runoff. Rainwater and snowmelt run off streets, farms, homes, businesses, and construction sites, and accumulate pollutants like oils, fertilizers, and pet waste. Stormwater runoff from Albuquerque collects in a series of diversion channels and is conveyed directly to the Rio Grande. The largest stormwater channel, the North Diversion Channel, discharges upstream of the Water Authority's SJC Drinking Water Treatment Plant diversion structure; and therefore, monitoring the quality of stormwater is critical to the operations of the water treatment plant. Stormwater flows in the North Diversion Channel are monitored and trigger a shut-down of the SJC DWP diversion when flows reach 300 cubic feet per second. Shutting down the SJC DWP diversion allows for a "first flush" of the system to pass water with heavy sediment loads to prevent unnecessary wear and tear on pumps at the SJC Drinking Water Treatment Plant.

The watershed-based municipal separate stormwater sewer systems (MS4) permit for the Middle Rio Grande has eighteen co-permittees (Section 2.3 Albuquerque and Bernalillo County) who are responsible for implementing, monitoring, and managing stormwater quality in the Middle Rio

Grande. Monitoring for the watershed-based permit occurs during dry seasons to establish baseline water quality, and during storm events in the wet seasons, winter, and summer monsoon season. In addition to monitoring the stormwater quality, permittees must implement a storm water management program that includes public education and participation, illicit discharge detection and elimination, construction site runoff controls, and pollution prevention.

3.3 Future Supply and Sources

In September 2016, the Water Authority updated and adopted a new Water Resources Management Strategy titled *Water 2120*. The available water supplies and three different future demand projections were evaluated in the development of *Water 2120*. During the 100-year planning horizon, the Water Authority may need to pursue alternative supplies of water. While the analysis suggests that these alternative sources will not be needed until the 2060s at the earliest, it is important to be prepared with a portfolio of options to ensure long-term water supply sustainability. As alternative water supplies are added to the Water Authority's drinking water supply, the Rivers and Aquifers Protection Plan (RAPP) will be updated to include detail on the added source (e.g., quality and quantity). Depending on the alternative supply source, changes to the source water assessments may be necessary, as well. This RAPP includes protection measures and actions set forth based on current operations and supply sources. As the new supply sources are implemented, these recommendations and actions may be revised to reflect reality; and updates should always be done with forward-looking, proactive approaches to source water protection.

Water 2120 includes implementation of multiple projects, along with a new water conservation goal, over the 100-year management period. The implementation dates for the future supply projects are not predetermined and will instead be based on the actual need and time for project implementation. Future alternative supplies identified in *Water 2120* include: additional water conservation; additional wastewater reuse, ASR and/or new storage; stormwater capture; indirect/direct potable reuse; and watershed management. These potential supplies were evaluated for a variety of criteria including infrastructure needs, reliability, regional impact, frequency of availability, and more. These alternatives, when combined with conjunctive aquifer management, form a reliable water supply for the next century. Detailed descriptions of how each alternative was evaluated, along with the results, can be found in the *Water 2120* document.

Plan Development

SECTION 4

The source water protection planning consisted of a series of planning meetings both internal to the Source Water Protection Team (Section 4.3 below) and stakeholder outreach. The discussions at the various meetings with the Water Authority, local agencies and committees (e.g., Policy Implementation Committee [PIC]), along with customer conversations, helped with a comprehensive understanding of issues affecting source water protection in the source water protection areas. Local stakeholder participation is crucial to the overall success of source water protection. Source water protection will be most effective if citizens are informed and equipped with fundamental knowledge of their drinking water. Additionally, local support and acceptance of a source water protection plan is more easily achieved when stakeholders have been actively participating in the plan development.

4.1 Development

The Rivers and Aquifers Protection Plan (RAPP) and source water assessments were developed with direction from New Mexico Environment Department (NMED) and assistance from Daniel B. Stephens & Associates (DBS&A), a contractor to the NMED and Water Authority. The Groundwater Source Water Assessment (SWA) and Surface Water SWA provided the foundation from which the RAPP was built. Each assessment was reviewed by the PIC; and the members of the Water Protection Advisory Board (WPAB) provided final review and acceptance of the assessments prior to the finalization of the RAPP. These assessments included recommendations for source water protection actions that informed the protection measures and recommendations in this document (Section 5).

This RAPP was reviewed by a team of Water Authority staff members branching across the Compliance and Engineering divisions; this panel of reviewers was selected to capture the multi-division approach required for source water protection. As with the assessments, the RAPP was reviewed by PIC and WPAB. Upon completion of public review and comment, the RAPP will be presented to the Water Authority Governing Board and adopted as the source water protection plan by the Board.

4.2 Outreach

Stakeholders played an integral role in the development of the RAPP, including the development of both the Groundwater SWA (Appendix A) and Surface Water SWA (Appendix B). As part of the stakeholder-outreach process, the Water Authority hosted “Customer Conversations,” a series of four public meetings around the City to discuss source water protection. These meetings, held in May 2018, focused on watershed protection, groundwater contamination, and opportunities for our customers to get involved in protecting source waters. Customer ideas and thoughts about source water protection were recorded and developed into a comprehensive report to inform the Water Authority about the effectiveness of the source water protection program, and to capture suggestions for program enhancements and improvements for outreach

(May 2018 Customer Conversations Report Appendix C). In addition to the Customer Conversations, the Water Authority made several presentations to various stakeholder groups during the plan development process (Table 1).

Table 1: Public Outreach for the Development of the Source Water Protection Plan.

Date	Outreach
February 9, 2018	WPAB Presentation – Groundwater Susceptibility Analysis Methodology – Daniel B. Stephens & Associates
February 28, 2018	Urban Waters Presentation – Source Water Planning and Assessments – NMED and Water Authority
May 1, 2018	Customer Conversations – Source Water Protection – Water Authority
May 8, 2018	Customer Conversations – Source Water Protection – Water Authority
May 16, 2018	Customer Conversations – Source Water Protection – Water Authority
May 30, 2018	Customer Conversations – Source Water Protection – Water Authority
June 7, 2018	Technical Customer Advisory Committee Presentation – Customer Conversation Results – Water Authority
June 8, 2018	WPAB Presentation – Groundwater Source Water Assessment Results – Water Authority
July 25, 2018	Urban Waters Presentation – RAPP, Surface Water and Groundwater Source Water Assessments Results – Water Authority
August 10, 2018	WPAB Presentation – Surface Water Source Water Assessment Results – Water Authority
September 2018	RAPP public comment period
September 14, 2018	WPAB Endorsement and Adoption of the RAPP
September 19, 2018	Water Authority Governing Board Presentation – RAPP, Source Water Assessments, and Customer Conversations Results – Water Authority
October 17, 2018	Water Authority Governing Board Endorsement and Adoption of the RAPP

4.3 Source Water Protection Team

The RAPP is the Water Authority's guiding document for source water protection efforts in the identified source water protection areas (see Section 4.2). Identified in Table 2 are the Water Authority staff involved in daily activities to protect source waters, along with staff members that support source water protection, as needed, through the sharing of pertinent information and deliverable review(s).

Table 2: Water Authority Staff on the Source Water Protection Team.

Name	Title	E-mail
Dedicated Staff		
Diane Agnew	Water Quality Hydrologist	dagnew@abcwua.org
Kate Mendoza	Water Resources Specialist	kmendoza@abcwua.org
Technical Support		
Liz Anderson	Water Quality Program Manager	eanderson@abcwua.org
Scott Salvas	Chief Engineer	ssalvas@abcwua.org
Katherine Yuhas	Water Resources Division Manager	kyuhas@abcwua.org
Mark Kelly	Compliance Division Manager	mkelly@abcwua.org

Interagency collaboration is necessary and beneficial for source water protection. Although the Water Authority is charged with providing and protecting drinking water, other agencies, including the City and County, have important roles in source water protection. The City and County have different protection programs that compliment Water Authority operations to protect source water. Consistent coordination between agencies occurs at PIC meetings and ensures source water protection efforts are covering all the bases. The PIC keeps the WPAB informed about ongoing source water protection projects and new studies occurring to improve source water protection in the Middle Rio Grande. In addition, PIC concerns and suggestions for better source water protection are presented to the WPAB for consideration. As part of their ordinance, WPAB can make recommendations to the PIC agencies for improvements to their source water protection programs. WPAB and PIC member recommendations can be presented to the City Council, County Commission, and Water Authority Governing Board for changes to policies, programs, or implementation of new large-scale projects.

Implementation of the RAPP occurs with the PIC members who regularly collaborate on projects to protect source water. PIC membership as of August 2018 is listed in Table 3.

Table 3: Policy Implementation Committee (PIC) Membership in 2018.

Name	Department	Email
Albuquerque Metropolitan Arroyo Flood Control Authority		
Patrick Chavez	Stormwater Quality Engineer	pchavez@amafca.org
Bernalillo County		
Kali Bronson	Natural Resource Services	kbronson@bernco.gov
Rick Heckes	Natural Resource Services	raheckes@bernco.gov
Dan McGregor	Natural Resource Services	dmcgregor@bernco.gov
City of Albuquerque		
Jake Daughtery	Solid Waste	ddaugherty@cabq.gov
Shellie Eaton	Municipal Development	seaton@cabq.gov
Bart Faris	Environmental Health	bfaris@cabq.gov
Kathy Verhage	Municipal Development	kverhage@cabq.gov
Ken Ziegler	Environmental Health	krziegler@cabq.gov
Water Authority		
Diane Agnew	Water Resources	dagnew@abcwua.org
Liz Anderson	Compliance	eanderson@abcwua.org
Mark Kelly	Compliance	mkelly@abcwua.org

Name	Department	Email
Kate Mendoza	Water Resources	kmendoza@abcwua.org
Rick Shean	Water Resources	flshean@abcwua.org

4.4 Source Water Assessments

The RAPP represents a progression of source water protection planning for the Water Authority, building on the findings of the Groundwater SWA and Surface Water SWA. Both SWAs followed the general methodology outlined in the NMED guidance documents titled Source Water Assessment and Protection Program Report for Water Utility (NMED, 2004). As part of the assessments, the Water Authority defined source water protection areas (SWPAs), built an inventory of potential sources of contamination (PSOCs), and analyzed each water source's susceptibility to contamination.

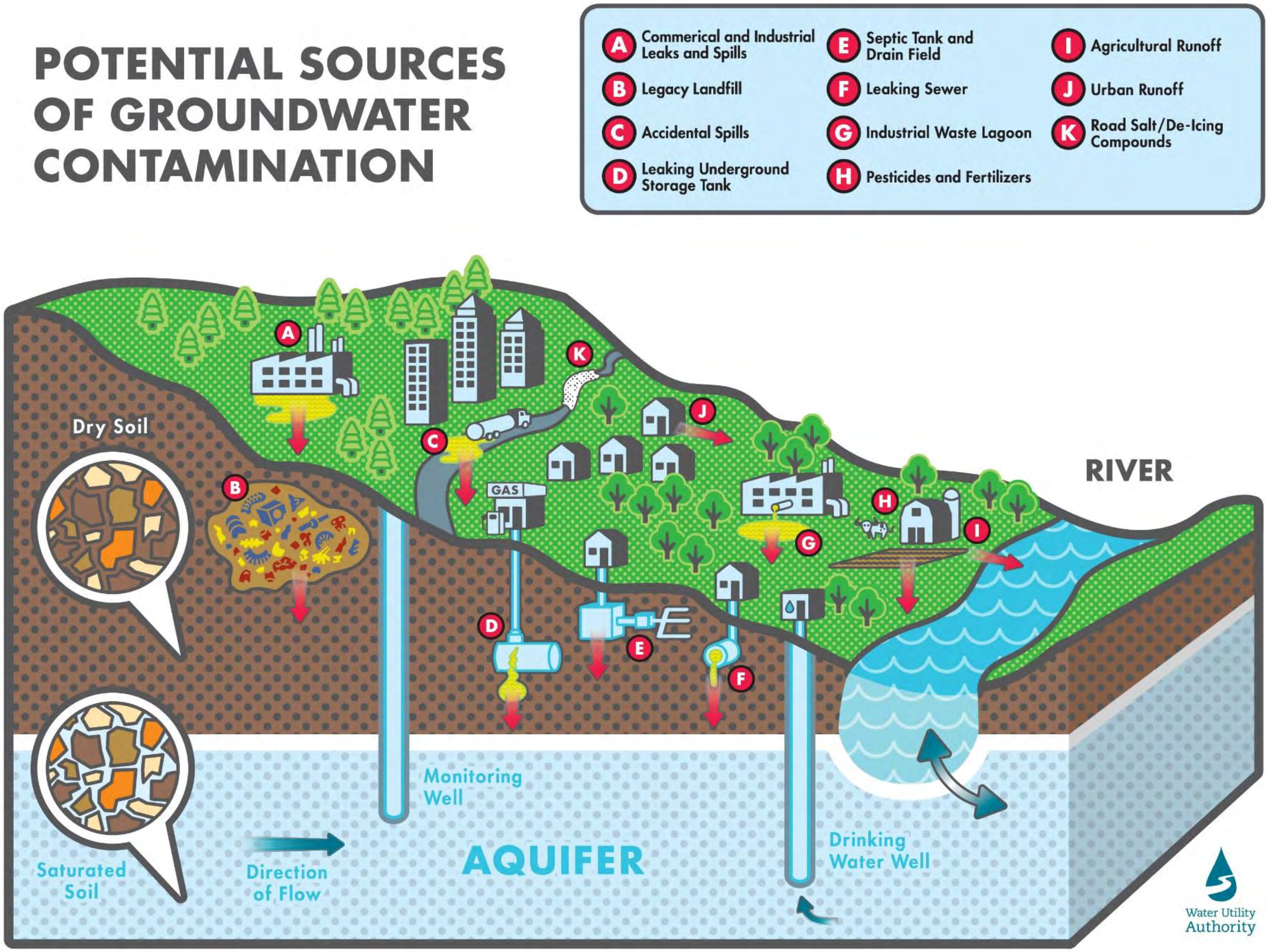
A source's susceptibility to contamination is determined through an analysis of a source water's vulnerability and sensitivity. Vulnerability is a function of the types and numbers of PSOCs; and a water source's sensitivity is a function of infrastructure and mitigation measures (natural or engineered) in place to prevent or control impacts to a source. PSOCs are defined as any possible sites or events that could, under any circumstance and time frame, lead to contamination of a water system's sources. Figure 5 conceptually illustrates PSOCs for groundwater in an urban area like Albuquerque. Inventories of PSOCs for surface water and groundwater were built using multiple data resources, as detailed in Groundwater Source Water Assessment (SWA) Appendix A and Surface Water Source Water Assessment (SWA) Appendix B.

Susceptibility rankings for each Source Water Protection Area (SWPA) were analyzed by the Water Authority to develop this RAPP, including the protection measures and recommendations discussed in Section 5. Both the Groundwater SWA and Surface Water SWA highlight the importance of collaboration between stakeholders for the protection of drinking water sources.

GROUNDWATER SOURCE WATER ASSESSMENT

The purpose of the Groundwater SWA is to assess the threat to public water supply sources from potential contaminants. The Groundwater SWA identifies the water supply sources, defines the SWPAs, provides an inventory of existing and potential sources of contamination, and makes a determination of the sources' susceptibility to contamination. For groundwater, a well's sensitivity

Figure 5 Potential Sources of Contamination



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to contamination was determined through a combined evaluation of well infrastructure and the hydrogeology of the aquifer at a given well. Each of the Water Authority's assessed wells were assigned a susceptibility to contamination ranking of low, moderately low, moderate, moderately high, or high. The resulting susceptibility rankings serve as a method to identify and prioritize risks to Water Authority wells for planning purposes.

Source Water Protection Areas

Eighty-three Water Authority wells were evaluated in the Groundwater SWA. Each groundwater source (i.e., well) has a SWPA that extends half a mile from the wellhead. Each groundwater SWPA is divided into four buffer zones for analysis:

- Zone A: radius of 0 to 200 feet from the wellhead
- Zone B: radius of 200 to 500 feet from the wellhead
- Zone C: radius of 500 to 1,000 feet from the wellhead
- Zone D: radius of 1,000 to 2,640 feet (1/2-mile) from the wellhead

Key Findings

In the Groundwater SWA, there were 64 PSOC types identified in the SWPAs for the Water Authority's groundwater sources, including groundwater contamination sites; natural sources such as arroyos; and human-caused sources including those associated with certain land uses, such as dry cleaners. Susceptibility rankings ranged from low to high with the majority of wells ranked in the moderate category (Table 4).

Table 4: Susceptibility Ranking Summary from the Groundwater Source Water Assessment.

Susceptibility Ranking	Number of Wells
Low	1
Moderately Low	18
Moderate	43
Moderately High	20
High	1

The results of the Groundwater SWA informed a list of recommendations and actions to improve the Water Authority, City, and County source water protection programs to protect the groundwater drinking water source now, and into the future.

SURFACE WATER SOURCE WATER ASSESSMENT

The purpose of the Surface Water SWA is to assess the threat to surface water supplies from potential contaminants. As part of the Surface Water SWA, the Water Authority defined SWPAs, built an inventory of PSOCs within those SWPAs, and analyzed the susceptibility to contamination for each surface water source. Surface water source sensitivity to contamination was determined through a combination of access (e.g., public access) and infrastructure (e.g., sediment control at reservoirs). Similar to the Groundwater SWA, each SWPA was assigned a susceptibility to contamination ranking of low, moderately low, moderate, moderately high, or high. The resulting susceptibility rankings serve as a method to identify and prioritize risks to Water Authority surface water infrastructures and supplies for planning purposes.

Source Water Protection Areas

The Water Authority defined three SWPAs: 1) San Juan-Chama Drinking Water Project (SJC DWP) diversion; 2) Cochiti Reservoir; and 3) Abiquiu Reservoir. These SWPAs were further divided into three buffer zones for a more detailed analysis of PSOCs, their proximity to the source, and the source's vulnerability. The buffer zones are designated as Zone A (0 to 200 feet), Zone B (200 to 500 feet), and Zone C (500 to 2,640 feet), and extend outward from the source (river or reservoir) with the outermost boundary set to half a mile from the source. A fourth zone, Zone D, is also included in the assessment; and it represents the watershed for the three SWPAs, extending from the headwaters in southern Colorado to the SJC DWP diversion in Albuquerque. The SJC DWP diversion SWPA is specific to the river, beginning 500 feet downstream of the diversion and extending 15 river miles upstream of the diversion. The susceptibility to contamination for each river mile was analyzed.

Key Findings

There were no surface water sources ranked higher than "moderately high" for susceptibility to contamination. The moderately high susceptibility rankings occurred along the river, upstream of the SJC DWP diversion, at four out of the 16-river mile segments analyzed. Both reservoirs, Abiquiu and Cochiti, had susceptibility rankings of moderate. A list of recommendations was developed based on the results of the Surface Water SWA and informed the source water protection actions recommended in Section 5.

Protection Measures

Section 5

5.1 Source Water Protection Measures

In practice, the process of completing a source water protection plan results in many utilities developing and/or evaluating protection measures and policies to protect source waters. In 2016, the Water Authority Governing Board adopted the Water Authority's 100-year water plan, *Water 2120*, which shows how the community's water needs can be met for the next one hundred years. Within *Water 2120*, there are thirteen policies to guide implementation of the water management strategy. At the cornerstone is the Water Quality Protection Policy and Action Plan (WQPPAP) which is recognized by *Water 2120* as Policy H which states:

"The Water Authority shall take steps to fully implement the Water Quality Protection Policy and Action Plan."

Water 2120 Policy H has five sub-policies to support implementation of the policy:

H.1 The Water Authority should continue to be proactive in identifying potential water quality threats to surface and groundwater resources and should implement programs to the extent possible to protect the water resources in the Middle Rio Grande (MRG).

H.2 The Water Protection Advisory Board (WPAB) shall provide annual updates on the implementation of the Water Quality Protection Policy and Action Plan (WQPPAP) to the Water Authority Board through submission of the Annual WPAB Reports and presentations at regular WPAB meetings.

H.3 The Water Authority shall provide pertinent information regarding updates to the water resource management strategy activities to the WPAB during its triennial review of the WQPPAP implementation activities.

H.4 The Water Authority should consider the occurrence, fate and potential treatment of emerging contaminants in current and future water supplies and should actively participate in research which will become more important as the availability of water resources becomes more constrained.

H. 5 The Water Authority should coordinate with the City, County, and State to maintain the quality of groundwater and surface waters.

The 2018 update to the WQPPAP builds on Policy H and its associated sub-policies to develop the protection measures and actions to protect source waters and implement the RAPP. The measures described below address protection activities that the Water Authority is committed to carrying out in order to meet the goals of the source water protection plan and utilize advice from the WPAB and Policy Implementation Committee (PIC) members, as well as the input from the public via local workshops and stakeholder focus groups. The relevant sub-policy is noted in parenthesis for each described protection measure which follows.

WATERSHED-SCALE MEASURES

Protection of source water quality is the first and foremost goal of the source water protection plan. Pollution prevention costs much less than remediation. In many cases, remediation may be technically or economically infeasible, making prevention of utmost importance. A watershed-scale approach to source water protection is a more holistic and representative approach to developing protection measures and activities for the Water Authority drinking water sources. The following protection measures have been identified on the watershed-scale for proactivity in identifying potential water quality threats, implementation of protection programs, and water resource protection.

- Maintain a current inventory of known groundwater contamination sites, identify priority sites, and work with local, state, and federal agencies to expedite corrective action (H.1 and H.5).
- As appropriate, the Water Authority should perform independent reviews of groundwater contamination sites (H.1).
- Prioritize areas of known or potential septic tank contamination and pursue expansion of wastewater collection and treatment facilities (H.1 and H.5).
- Encourage improved understanding of baseline water quality of receiving surface waterbodies in the watershed during both wet and dry season conditions (H.4 and H.5).
- Encourage improved understanding of the relationship between ambient water quality of surface water bodies and contaminant loads due to runoff and other events (H.4 and H.5).
- Advocate for improved environmental management from industrial areas, agricultural lands, and national laboratories in the watershed (H.1 and H.5).

ORDINANCE AND POLICY ACTIONS

Several jurisdictions in the Albuquerque/Bernalillo County area, including but not limited to the City, County, and Water Authority, have a common interest in water quality protection. Ordinances and policies are mechanisms to proactively address potential impacts to the environment, including groundwater and surface water. Collaboration and cooperation among the City, County, Water Authority, and the State of New Mexico, as well as other entities, is necessary to ensure that source water is protected.

- Advocate for the development, adoption, and implementation of source water protection policies by the appropriate agencies, including the Albuquerque City Council and Bernalillo County Commission (H.5).

AGENCY COORDINATION

The Water Authority source waters span City, County, and State jurisdictions and therefore require coordination and collaboration with numerous agencies.

- Advocate for the enforcement of all local, state, and federal regulations pertaining to source water protection (H.1 and H.5).
- Identify and work with existing local government agencies that have a source water quality protection component or effect (H.1 and H.5).
- Work collaboratively to identify principally responsible agencies for activities associated with protection of source water quality (H.5).

- Continue communication and collaboration with PIC agencies (H.5).
- Support local and state agencies, through outreach and information sharing in the enforcement ordinances to prohibit or control releases of substances with the potential to degrade groundwater and/or surface water quality (H.1 and H.5).
- Work with appropriate enforcement agencies to prohibit or restrict certain activities within SWPAs to minimize potential contamination of source waters (H.4 and H.5).
- Support the promotion of City and County activities for the recycling, source reduction, waste minimization, and product substitution throughout the production, handling, and management of hazardous materials and wastes (H.5).
- In collaboration with the New Mexico Environment Department (NMED) Drinking Water Quality Bureau (DWQB), establish wellhead protection areas within which additional restrictions apply surrounding the immediate vicinity of public water supply wells (H.1 and H.5).
- Advocate for the use of federal or state funds to cleanup groundwater contamination sites that pose immediate threats to public health, safety, or welfare, as well as the recovery of cleanup costs from responsible parties (H.5).
- Maintain up-to-date protocols for coordination of inter-agency notifications of spills or releases (H.5).

PUBLIC EDUCATION AND OUTREACH

An informed public can contribute to solving environmental problems. By engaging communities, along with business owners and operators, the Water Authority can proactively work towards preventing impacts to source water and protection of water resources now, and into the future.

- Provide education and technical assistance to the public and regulated entities to make them aware of the Water Authority's source water protection program and to help them to meet their source water protection goals (H.1).
- Engage public participation in the continuing development, updating, and implementation of source water protection activities (H.1).
- As appropriate, inform the public of existing and potential groundwater issues, hazardous materials and waste releases, progress made in protection of groundwater and surface water, and lessons learned in the implementation of the source water protection plan (H.1).
- As appropriate, recognize local businesses and organizations for exemplary source water protection practices in support of the source water protection plan (H.1).

5.2 Source Water Protection Actions

Based on the results of the Groundwater SWA and the Surface Water SWA, specific actions were recommended to maintain or improve susceptibility rankings for drinking water sources. These actions are detailed in Appendices A and B in their respective SWA. Implementation of these activities, along with the protection measures detailed in this section, results in a proactive, collaborative approach for protecting drinking water sources for now, and into the future.

Emergency and Contingency Planning

Section 6

6.1 Overview

A key component of source water protection is the development of a contingency plan. The contingency plan is a tool that can be used by the Water Authority and its divisions to organize responses to emergencies that impact the Water Authority's drinking water sources. Contingency planning provides the necessary information to help focus resources when an event, either expected or unexpected, impacts drinking water sources. This planning includes identification of emergency contact information, protocols and strategies, and revenues to support the emergency/contingency response.

At the state level, the New Mexico Environment Department (NMED) Office of Emergency Preparedness organizes assistance for damage caused by events such as wildfires and will provide water utilities, like the Water Authority, with information regarding damage assessments related to drinking water systems. Additionally, the New Mexico National Guard is the government agency tasked with providing public water utilities a source of water under emergency conditions, should that be necessary. Elements that should be addressed in an emergency/contingency plan are:

- Water outages due to contamination, mechanical or physical breakdown of a system, and natural disasters, such as floods and drought;
- Water conservation; and
- Accidental leaks or spills.

6.2 Emergency Response Plans

A public water utility must be prepared for any number of emergency scenarios and events that would require an immediate response. Information about key contacts, emergency services, and downstream systems must be posted and readily available in the event of an emergency. The Water Authority Emergency Response Plans were developed to implement and maintain an emergency management program for the utility and to network with other local emergency management programs, thereby ensuring an efficient and effective response during system interruptions. The Emergency Response Plans are specific to divisions (i.e., groundwater and surface water), are available in hard copy at Water Authority facilities, and include the following information:

- Emergency Response Team members;
- Emergency communication protocols;
- Facility inventory; and
- Procedures for specific emergency incidents.

In addition to the information listed above, the Emergency Response Plans include information on alternate sources of water for drinking and household uses that will be available in case of emergency. Should they be needed, the plan includes procedures for effective communication with Water Authority customers with details on emergencies and recommended precautions. The Emergency Response Plans are evaluated as needed to determine if any updates are needed to reflect current operations and conditions.

Conclusions

SECTION 7

7.1 Summary

Successful source water protection programs utilize interagency collaboration to implement many projects dedicated to improving source water quality. The importance of interagency collaboration to protect source water was recognized beginning in the late 1980s in the Middle Rio Grande and has expanded into a well-coordinated effort by multiple agencies, including the City, County, and Water Authority. Dedication to protecting source water by the Policy Implementation Committee (PIC) agencies and the Water Protection Advisory Board (WPAB) has led to the development of many projects and programs to improve water quality in the Middle Rio Grande, and the adoption of protection measures to guide current and future protection activities.

In practice, the process of completing a source water protection plan results in many utilities developing and/or re-evaluating the protection measures and emergency planning procedures in place to protect source waters. As part of the update to the 2009 Water Quality Protection Policy and Action Plan (WQPPAP), the Water Authority confirmed the utility is already doing many of the recommended actions determined by the source water assessments. For example, the Water Authority already has a robust monitoring program to monitor for both regulated and unregulated contaminants more frequently than required, in addition to the voluntary monitoring the Water Authority performs to confirm nearby contamination sites have not impacted drinking water sources. The Water Authority also had previously established emergency response procedures for both surface water and groundwater emergencies, and those plans are re-evaluated on a regular basis.

For implementation efforts and future updates of the Rivers and Aquifers Protection Plan (RAPP) and its assessments, Section 7.2 identifies recommendations for consideration during future plan updates.

7.2 Future Updates

The RAPP is a living document meant to be updated as changes to operations or source waters occur. Whenever an update occurs, both the Groundwater Source Water Assessment (SWA) and Surface Water Source Water Assessment (SWA) should be reviewed for consistency with plan updates and to update the Potential Source of Contamination (PSOC) inventories. For full plan and assessment reviews or updates, the Source Water Protection Team suggests the following for consideration:

General

- *Data Quality:* The completeness and quality of the source water assessments is a function of the data used to identify potential sources of contamination in the source water study areas. Both the Groundwater SWA and Surface Water SWA used multiple data sources that varied in their quality. A single database built and maintained by the New Mexico Environment Department (NMED) would ensure that the Water Authority and other water utilities across New Mexico are using a robust dataset for thoroughly assessing a water source's susceptibility to contamination. The Water Authority recommends that the Source Water Protection Team advocate for legislative funding for the NMED to assemble and continuously maintain a database, building on their existing EnviroMap tool, with current land use, site data, and permits. Alternatively, using a continuously-updated data source, such as GoogleMaps, for current land uses would be beneficial for future source susceptibility analyses.

- *Susceptibility Rankings:* The analyses of the Water Authority's sensitivity and vulnerability to contamination of both the groundwater and surface water systems to determine overall susceptibility represents one approach to assessing source waters. As part of the development of the RAPP, the Water Authority reviewed source water protection plans for comparably-sized water utilities across the county. Some large utilities with source water protection programs apply different ranking systems or alternative analyses to determine effectiveness and improvements to their source water protection programs. The Water Authority recommends that future updates review alternative methodologies to assess the water system's susceptibility to contamination, as well as suggestions from the American Water Works Association for standards for source water protection.

Groundwater

- *Capture Zones:* Source water protection areas for wells were analyzed by buffer zones extending uniformly outward from each wellhead. Future analyses should consider modeling capture zones around each well for specified periods of time. Knowledge of the geology and hydrogeologic parameters in the capture zones will be used to develop the numerical model of flow of water from the aquifer to the production wells. Utilizing true capture zones for the vulnerability analysis will provide a better understanding of what potential sources of contamination may be more threatening to a source. Once capture zones are established for each production well, the Source Water Protection Team should pursue establishment of source water protection areas that are recognized by zoning and planning laws.
- *Pumping Sensitivity:* As part of developing capture zones for each well, long-term pumping rates should be considered for modeling. Additionally, pumping rates should be considered in the sensitivity scores for each well. This will allow the assessment of groundwater to account for the fact that a well that is not regularly pumped may not be as sensitive to receiving contamination as a well that is continuously operated.
- *Contamination Properties:* Maintaining an inventory of contaminants known to exist in the groundwater in the Albuquerque Basin will help future assessments of groundwater susceptibility. Additionally, identifying the chemical properties of these contaminants will support the understanding of the fate and transport of these compounds in the saturated zone.
- *Maximum Contaminant Levels (MCL):* The NMED and Environmental Protection Agency (EPA) periodically update groundwater standards to both adjust existing MCLs to be more protective of human health and the environment, and to add emerging contaminants once standards have been established. Changes in MCLs could result in additional groundwater

contamination sites which will be evaluated and added to the inventory for the source water assessment. Additionally, existing data may be reviewed to determine if additional actions should be requested from the NMED.

Surface Water

- *Dilution Factors:* Surface water analyses should consider how contamination moves downstream over time. The Surface Water SWA analyzes each river segment upstream of the SJC DWP diversion for potential sources of contamination present at one moment in time. If a river segment upstream is ranked higher than a downstream segment, consider ranking the downstream segments equal or higher than the higher ranked upstream segment. The rationale here is that if contamination occurs in the upstream segment, contamination will continue downstream from that point, thereby subsequently raising the susceptibility of each river mile downstream.
- *Data Updating:* The Surface Water SWA completed in 2018 did not incorporate land-use data for the vulnerability analysis. Future updates should add land-use data to the analysis for consistency with the Groundwater SWA.

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Groundwater Source
Water Assessment

Albuquerque Bernalillo County
Water Utility Authority

Groundwater Source Water Assessment

August 2018

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Appendix

List of Acronyms and Abbreviations

AGIS	Albuquerque Geographical Information System
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
AMP	Asset Management Plan
BFF	Bulk Fuels Facility
bgs	below ground surface
BNSF	Burlington Northern Santa Fe
City	City of Albuquerque
County	Bernalillo County
DBS&A	Daniel B. Stephens & Associates
EMNRD	Energy, Minerals, and Natural Resources Department
GIS	Geographic Information System
GWQB	Ground Water Quality Bureau
KAFB	Kirtland Air Force Base
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
OCD	Oil Conservation District
OSE	Office of the State Engineer
PCE	Tetrachloroethene
PLSS	Public Land Survey System
PSOC	Potential Source of Contamination
RAPP	Rivers and Aquifers Protection Plan
RCRA	Resource Conservation and Recovery Act
SICs	Standard Industrial Classifications
SNL	Sandia National Laboratories
SVOCs	Semi-Volatile Organic Compounds
SDWA	Safe Drinking Water Act
SWA	Source Water Assessment
SWPA	Source Water Protection Area
VOC	Volatile Organic Compounds
Water Authority	Albuquerque Bernalillo County Water Utility Authority
WQPPAP	Water Quality Protection Policy and Action Plan

Executive Summary

The purpose of the Groundwater Source Water Assessment (SWA) is to assess the threat to public water supply sources from potential contaminants. The Groundwater SWA provides information used in the development of the Rivers and Aquifers Protection Plan (RAPP), the source water protection plan developed by the Albuquerque Bernalillo County Water Utility Authority (Water Authority). The RAPP is a management tool that outlines current and future approaches to preventing source water contamination, thereby protecting the drinking water system and public health. This Groundwater SWA identifies the water supply sources, defines the source water protection areas (SWPAs), provides an inventory of existing and potential sources of contamination, and makes a determination of the sources' susceptibility to contamination. This report focuses on the Water Authority's groundwater sources and a Surface Water SWA has been developed under separate cover.

Eighty-three Water Authority wells were evaluated in this study that includes 62 active wells, 19 wells that are inactive due to their arsenic concentrations, and 3 wells that are currently decommissioned for various reasons. Each well has a Source Water Protection Area (SWPA) that extends half a mile from the wellhead. The delineated SWPAs are further divided into four buffer zones for analysis:

- Zone A: radius of 0 to 200 feet from the wellhead
- Zone B: radius of 200 to 500 feet from the wellhead
- Zone C: radius of 500 to 1,000 feet from the wellhead
- Zone D: radius of 1,000 to 2,640 feet (0.5 mile) from the wellhead

Potential sources of contamination (PSOCs) were inventoried within the source water protection area (SWPA) for each water source. PSOCs are defined as any possible site or event that could, under any circumstance and time frame, lead to contamination of a water system's sources. In this study, known groundwater contamination is also included as a PSOC. Not all sites identified as PSOCs pose the same level of risk and depend on type, proximity to source, and associated contaminants.

PSOCs can be either naturally occurring or human-caused. There were 64 PSOC types identified in the SWPAs for the Water Authority's groundwater sources, including groundwater contamination sites, natural sources such as arroyos, and human-caused sources including those associated with certain land uses, such as dry cleaners.

Each of the Water Authority's assessed wells were assigned a susceptibility to contamination ranking of low, moderately low, moderate, moderately high, or high. The susceptibility ranking is a combination of a particular well's vulnerability ranking and sensitivity ranking. Vulnerability is based on an inventory of the type, number, and proximity of PSOCs near a source. This ranking is a weighted combination of three factors: PSOC risk factor, proximity to source, and PSOC count. Sensitivity is an evaluation of a source's infrastructure and hydrogeology. The resulting susceptibility rankings serve as a method to identify and prioritize risks to Water Authority wells for planning purposes.

One well ranked as low for susceptibility (College W-1); 18 wells ranked as moderately low; 43 wells ranked as moderate; 20 wells ranked as moderately high; and one well ranked as high (Atrisco W-4). The most important outcome of the evaluations and rankings is a list of policies and actions for ensuring the protection of the groundwater drinking water source for now, and into the future.

1. Introduction

The Albuquerque-Bernalillo County Water Utility Authority (Water Authority) is currently updating the 2009 Water Quality Protection Policy and Action Plan (WQPPAP). The 2018 update to the WQPPAP also involves renaming the document to the Rivers and Aquifer Protection Plan (RAPP) in order to reflect the surface water and groundwater sources that comprise the drinking water supply sources for the Water Authority. As part of the RAPP, the Water Authority is completing source water assessments for both surface water and groundwater. This report is specific to groundwater sources – Water Authority production wells. The Groundwater Source Water Assessment (SWA) identifies source water protection areas for each well in order to determine a particular well's susceptibility to contamination. In order to evaluate susceptibility to contamination, this assessment inventoried potential sources of contamination (PSOCs), well infrastructure and construction details, and hydrogeology.

Sources of information reviewed as part of this Groundwater SWA include data from the New Mexico Environment Department (NMED) online geodatabase and mapping tool (EnviroMap); City of Albuquerque (City) databases on land use and landfills (active and closed); Bernalillo County (County) septic tank locations; and New Mexico Office of the State Engineer (OSE) wells. Details of the data sources used and data quality issues identified are discussed in further detail in Section 5 of this Groundwater SWA. As the assessment was performed, information from Water Authority staff, NMED bureaus, and City and County counterparts increased the overall quality and completeness of the assessment by ensuring the use of updated and site-specific information.

The result of this Groundwater SWA is the assignment of susceptibility rankings for each Water Authority well. These rankings and the findings of this Groundwater SWA will support the Water Authority in moving forward with its source water protection planning and in implementing policies and actions to ensure the protection of the groundwater drinking water source, from now and into the future. One of the best ways to ensure safe drinking water and maximize management of our drinking water sources is to protect against potential contamination. The recommendations in this Groundwater SWA encourage the continued collaboration of the Water Authority, City, County, and NMED, as well as the public and other state and local agencies, for the implementation of source water protection measures.

This Groundwater SWA was developed through the collaboration of Daniel B. Stephens & Associates (DBS&A), a contractor to the Water Authority, and the NMED Drinking Water Quality Bureau's Source Water Protection Program. The methodology for assessing the susceptibility of groundwater drinking water source is based on a guidance document developed by the NMED titled *Source Water Assessment & Protection Program Report of New Mexico Water Utility, for Ground Water Systems* (NMED, 2004).

2. Groundwater Sources

The Water Authority's groundwater system has 111 wells: 61 are active, 19 are inactive due to high arsenic levels, and 31 are decommissioned for various reasons. This Groundwater Source Water Assessment (SWA) analyzes 83 wells. This includes 61 active wells, 19 wells that are inactive due to high arsenic levels, and 3 wells that are currently inactive/decommissioned but could potentially be used in future operations. The wells selected for inclusion in this study are based on recommendations from the Water Authority's Well Asset Management Plan (AMP) dated June 2018 and represent wells that are either currently active in the system or are being recommended for consideration for future use.

3. Source Water Protection Areas

For groundwater sources, a source water protection area (SWPA) is a buffer around each wellhead used to identify potential contamination from sites within close proximity (NMED, 2013). In this assessment, the groundwater SWPAs are defined as the area within a ½-mile radius of each groundwater well. The delineated SWPAs are further divided into four buffer zones:

- Zone A: radius of 0 to 200 feet from the wellhead
- Zone B: radius of 200 to 500 feet from the wellhead
- Zone C: radius of 500 to 1,000 feet from the wellhead
- Zone D: radius of 1,000 to 2,640 feet (0.5 mile) from the wellhead

4. Potential Sources of Contamination

4.1 Definition and Description

For source water assessments, Potential Source of Contamination (PSOCs) are defined as any possible site or event that could, under any circumstance and time frame, lead to contamination of a water system's sources. In this assessment, PSOCs also include any known groundwater contamination site (e.g., Fruit Avenue Plume). Not all sites identified as PSOCs pose the same level of risk. Depending on the type of PSOC, some sites may pose little-to-no contamination risk, while others may pose an imminent threat. The inventory used in this assessment includes known sources of groundwater contamination that occur within the Water Authority's Source Water Protection Areas (SWPAs); these known sources of contamination are included as individual PSOCs in the inventory.

Multiple resources were used to inventory possible PSOCs within the Water Authority's SWPAs. New Mexico Environment Department (NMED) maintains an interactive web map called "EnviroMap" which provides information on sites that are registered with the state, such as wastewater discharge permits and fuel storage tanks, and federal sites such as Superfund sites and National Pollutant Discharge Elimination System (NPDES) permits. The Geographic Information System (GIS) data underlying the web-based map were provided by NMED and were used to map the PSOCs in the study area. Additionally, NMED has compiled an extensive, but not all inclusive, list of PSOC types that may be found within a water source's SWPA (Appendix A). Appendix B lists the contaminants of concern associated with each of the PSOC types in Appendix A.

In addition to the inventory of PSOCs from NMED's "EnviroMap," this Groundwater Source Water Assessment (SWA) also includes the following information and data sources:

- Oil and gas wells from the New Mexico Energy, Mineral and Natural Resources Department (EMNRD);
- New Mexico Office of the State Engineer (OSE) permitted wells;
- Land use data (updated in 2017) maintained by the City and used to identify Standard Industrial Classifications (SICs) for parcels and assign PSOCs;

- Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) mapped drainages;
- Roads and railroads from the New Mexico Department of Transportation (NMDOT) GIS database;
- Active septic tanks from County; and
- Groundwater contamination plume footprints delineated from NMED file reviews (Appendix D).

Section 5 provides a more complete description of data sources and methodologies associated with the PSOC inventory.

The PSOC types identified in this assessment have been grouped into categories along with the types of contaminants that are generally associated with each category type (Tables 1a and 1b).

There are 39 known groundwater contamination sites that were identified during the Water Authority's review of NMED files for NMED Ground Water Quality Bureau (GWQB) Remediation Oversight Section, Superfund Oversight Section, and Voluntary Remediation Program. Additionally, three Resource Conservation and Recovery Act (RCRA) permits were identified within the assessment area that are under the regulatory oversight of the NMED Hazardous Waste Bureau: Sparton Technologies, Sandia National Laboratories (SNL), and Kirtland Air Force Base (KAFB). Contaminants associated with these groundwater sites include chlorinated solvents (e.g., tetrachloroethene [PCE]), hydrocarbons, light non-aqueous phase liquid, dense non-aqueous phase liquid, metals, and nitrate.

Potential contamination from the types of land uses identified in this assessment could be the result of manufacturing, use, waste disposal, and/or accidental spills. Dry cleaners still using PCE as their principal cleaning agent could potentially impact groundwater through accidental releases to the ground surface and drains during operation. Failure of fueling tanks, either aboveground or underground, could result in the release of fuel to the ground surface and pose a threat to groundwater. Fertilization of green spaces, such as golf courses and parks, is another PSOC type in this study due to the potential release of nitrate to the subsurface and the mobility of nitrate once in the ground.

Table1a. PSOC Types and Associated Contaminants

PSOC Category [a]	Acute Health Concerns								Chronic Health Concerns										Aesthetic Concerns
	Microorganisms	Nitrate/nitrite	Pesticides	SVOCs	VOCs	Arsenic	Lead	Ammonia/nitric acid	Herbicides	Pesticides	VOCs	Non-Metal Inorganic Compounds	Metals - Primary Drinking Water	Radionuclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
Oil and gas facilities				X	X	X					X					X	X	X
Pipeline companies				X	X			X	X		X	X	X			X	X	X
Electrical companies				X	X		X	X	X		X	X	X			X	X	X
Gas companies					X			X	X		X	X	X			X	X	X
Water and sewage companies - utilities	X	X		X	X	X		X			X	X	X			X	X	X
Parks, lawns, and grounds maintenance		X	X						X	X					X	X	X	X
Campgrounds		X														X	X	X
Septic tanks/systems cleaning/repairing	X	X														X	X	X
Landfills		X		X	X			X			X	X	X			X	X	X
Pet care/veterinary	X	X						X								X		X
Groundwater remediation sites		X		X	X	X					X	X	X			X	X	X
Groundwater discharge permits																X	X	X
Surface water permits																X	X	X
Land Uses																		
Agricultural fields/farming/irrigated cropland	X	X	X					X	X	X					X	X	X	X
Commercial/industrial/transportation land use		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Stormwater	X	X	X	X	X			X	X	X	X			X	X	X	X	X

Table1a. PSOC Types and Associated Contaminants

PSOC Category [a]	Acute Health Concerns								Chronic Health Concerns									Aesthetic Concerns
	Microorganisms	Nitrate/nitrite	Pesticides	SVOCs	VOCs	Arsenic	Lead	Ammonia/nitric acid	Herbicides	Pesticides	VOCs	Non-Metal Inorganic Compounds	Metals - Primary Drinking Water	Radionuclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
Natural features																X	X	X
Road miles	X	X	X	X	X			X	X	X	X	X			X	X	X	X
Mining															X	X	X	X
Military		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X

[a] See table 2b for PSOC types included in each category

PSOC Potential Source of Contamination
SVOC Semi-volatile organic compound
VOC Volatile organic compound

Table 1b. Grouping of PSOC Types into PSOC Categories

Oil and Gas Facilities	*Commercial/Industrial/Transportation Land Use*
AST facility	Airport - Albuquerque International Sunport
Automotive body shop	Carwash
Automotive repair shop	Concrete/cement plants
Bulk petroleum	Construction and open equipment storage
Gas well, temporarily abandoned	Dry-cleaning shop
Gasoline service station	Electronic/electrical equipment manufacturing
Gasoline service tank	Funeral home/crematory
Storage tank, LUST	Furniture repair and manufacturing
Storage tank, underground	Hardware/lumber/parts store
Pipeline Companies	Hazardous waste facility - Safety Kleen - Albuquerque
Oil/gas pipeline	Metal processing facility
Electrical Companies	Motor pools - RT 66 Enterprises and Aragon Inc.
Electric utility	Paint store
Utility/transportation right of way	Photo-processing laboratory
Gas Companies	Primary wood industries (wood, stone, clay and glass manufacturing)
Utility/transportation right of way	
Water and Sewage Companies - Utilities	Printing shop
Private well	Research laboratory (medical laboratory)
Water supply well	Stone, tile, and glass manufacturing
Water treatment plant	Utility/transportation right of way
Parks, Lawns, and Grounds Maintenance	*Natural Features*
Cemetery	Arroyo
Golf course	Drainage
Park	Drainage canals, ditches, or acequias - unlined
Agricultural Fields/Farming/Irrigated Cropland	*Road Miles*
Campgrounds	Major road
Septic Tanks/Systems Cleaning/Repairing	*Surface Water Permits*
Septic tank	NPDES permit: City of Bernalillo/WWTP-001
Landfills	NPDES permit: City of Rio Rancho No. 3
Closed landfill	NPEDS permit: MS4 Watershed-based Stormwater
Unregulated dump	*Mining*
Pet Care/Veterinary	Mining operations - crushed stone, sand, and gravel extraction
Veterinary services	
Stormwater	*Military*
Lined stormwater channels and arroyos	Military facilities - Kirtland Airforce Base
Street storm drain	
Stormwater pond	
Groundwater Remediation Sites	*Groundwater Discharge Permits*

Table 1b. Grouping of PSOC Types into PSOC Categories

Brownfield - Luna Lodge	Groundwater discharge permit: City of Rio Rancho Reuse Project
Brownfield - Winrock Town Center	
Contamination plume - BNSF Albuquerque	Groundwater permit, active - Bear Canyon Recharge Demonstration Project
Contamination plume - Digital/Hewlett Packard	
Contamination plume - Fox & Associates Albuquerque	Groundwater permit, ceased - APS - Martin Luther King Elementary
Voluntary remediation site - First Federal Bank @ Digital	Groundwater permit, ceased - APS - Ann Binford Elementary School
Voluntary remediation site - Thriftway - Wright Gallery	
Voluntary remediation site - Triple S, Inc. (Kerr McGee Number #6007)	Groundwater permit, ceased - Contract Carriers
	Groundwater permit, terminated - Albuquerque Six-Plex Theatre
	Groundwater permit, terminated - Former Digital Equipment Corporation
	Groundwater permit, terminated - Yale Auto Sale Site

APS Albuquerque Public Schools
AST Aboveground storage tank
BNSF Burlington Northern Santa Fe Railway
LUST Leaking underground storage tank
NPDES National Pollutant Discharge Elimination System
PSOC Potential Source of Contamination
WWTP Wastewater treatment plant

Tables listing the PSOC types and counts by zone for each well are provided in Appendix C, along with figures showing the locations of PSOCs by well field.

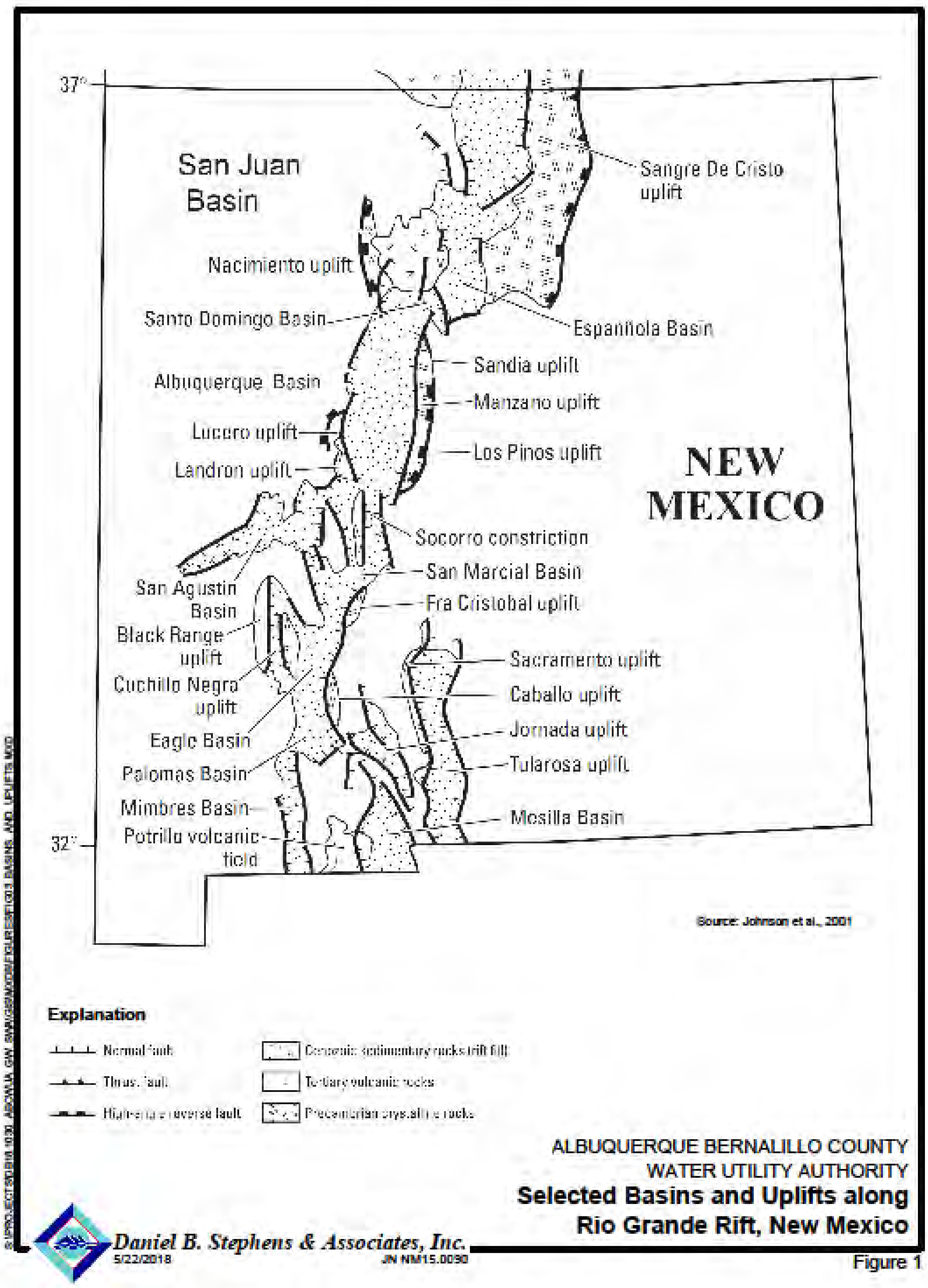
4.2 Oil and Gas Considerations

Oil and gas activities have been a significant component of the economy for New Mexico, with development booms and busts ranging from the San Juan Basin in the northwestern corner of the state to the Permian Basin in the southeastern part of the state. New Mexico is currently ranked as one of the nation's top producing states for oil and gas—a ranking driven primarily by development of resources in the Permian Basin. There is the potential for a shifting landscape of oil and gas development in New Mexico in response to the constant and rapid evolution of technical developments in the oil and gas industry, such as horizontal drilling, coupled with hydraulic fracturing. Currently, oil and gas activities are focused in the regions where there are plentiful and economic resources, the San Juan and Permian Basins. Consequently, there is no current activity in the Albuquerque Basin, and therefore, no eminent threat to groundwater quality. Consequently, there is time for the proactive development of legislation and ordinances on a local and regional scale to protect groundwater drinking water sources.

Oil and gas development could potentially impact both surface water and groundwater quality, depending on the location and type of activity. Surface water could potentially be impacted by stormwater runoff and spills in production fields. Groundwater can become contaminated through surface spills, leaking waste pits, and poor disposal practices. Additionally, fracturing of the gas-producing geologic units could hypothetically create preferential pathways, such as through improperly plugged wells or subsurface faults, for fracturing fluids to migrate upwards and degrade potable groundwater sources.

The groundwater source for the Water Authority drinking water supply is located within the Albuquerque Basin, one of the longest and deepest sedimentary basins of the Rio Grande Rift (Figure 1). The basin is significantly different from other basins in the Rocky Mountain basins because it is actively subsiding and is currently at near maximum burial and heating conditions. Burial reconstructions of the basin suggest that gas accumulation in the Albuquerque Basin began about 20 million years ago in Cretaceous-age source rocks, and that gas accumulation continues at the present time (Johnson et al., 2001). This basin-centered, "unconventional" gas

Figure 1. Selected Basins and Uplift along Rio Grande Rift, New Mexico



accumulation is different from the conventional gas accumulations in that it is occurring in a low permeability rock, like the Mancos Shale, extending across stratigraphic units that have no obvious structural or stratigraphic trapping mechanism for the gas.

Figure 2 is a geologic cross section extending across the width of the Albuquerque Basin showing the thick interval of Cretaceous-age coals, carboniferous shales, and marine shales represented by the “Mz” geologic unit (light green). These Cretaceous-age rocks are thought to be the primary source of gas accumulations in basin-centered gas accumulation basins, such as the Albuquerque Basin. Exploratory well drilling in the Albuquerque Basin suggests the presence of over-pressuring from the gas accumulation, and gas shows have been reported. However, all attempts to complete wells within the gas-bearing Cretaceous-aged rocks have resulted in sub-economic quantities of gas due to low formation permeability. The abnormal over-pressures observed during exploratory drilling indicate that the gas accumulations are isolated from the regional groundwater table (Johnson et al., 2001) and occur at depths greater than 10,000 feet below ground surface (bgs); the deepest Water Authority supply well is 1,700 feet bgs. The burial reconstruction, along with pressure data and documented gas shows, indicate that the deep, central portion of the Albuquerque Basin contains basin-centered gas accumulation that is continuing to form in present time. The limiting factor to accessing this resource is the advancement of technologies used in the oil and gas industry to access low-permeability accumulations in deep sedimentary basins.

“Wildcat” oil and gas activities ceased in the mid-1980s, largely due to the inability to complete wells in the low-permeability Cretaceous-age rocks. This assessment includes the locations of all permitted oil and gas wells, as well as three wells permitted through the OSE that could potentially be installed within and/or across the gas-bearing formations in the basin. The oil and gas wells registered with the EMNRD Oil Conservation Division (OCD) are either permanently plugged or temporarily abandoned. These wells would need to obtain a new, approved permit with both EMNRD OCD and the OSE before being redrilled and constructed.

State, local, and federal government agencies have some established regulatory mechanisms for protecting source water from most of these potential impacts. For example, the federal Safe Drinking Water Act (SDWA) requires the development and implementation of source water protection programs at the state level and by water providers like the Water Authority. As part of

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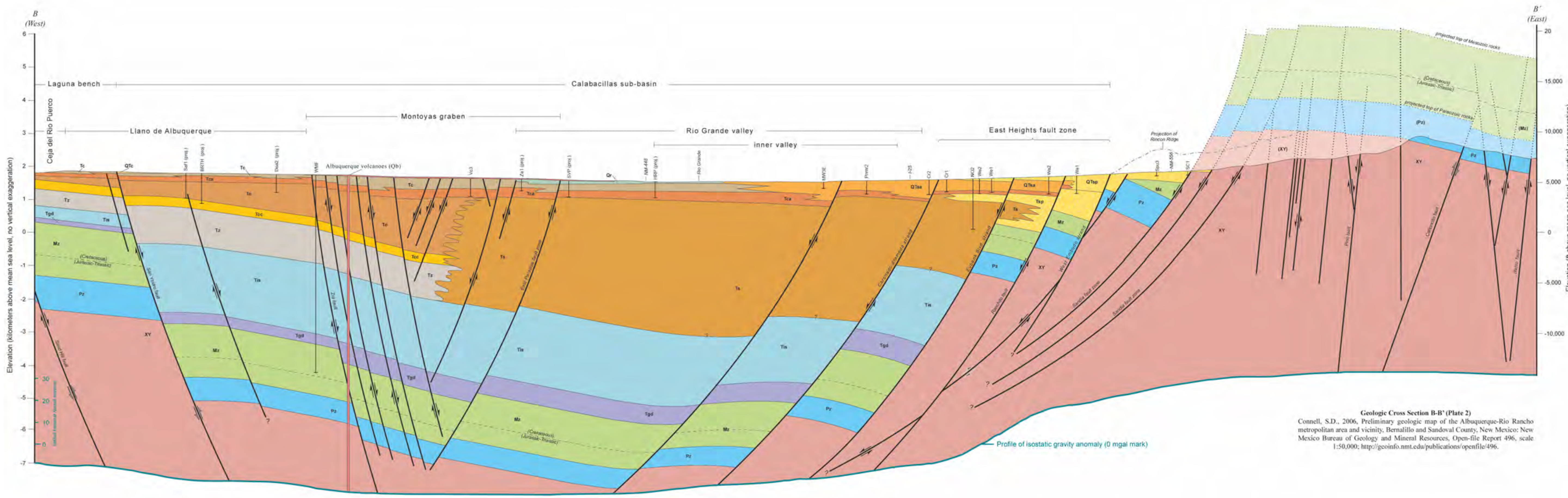

Source: Connell, S.D., 2006

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5/22/2018 JN DB18.1030

ALBUQUERQUE BERNALILLO COUNTY
WATER UTILITY AUTHORITY

Geologic Cross Section

Figure 2

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the Water Authority's source water protection plan, existing and potential impacts to source water from oil and gas development have been analyzed within the Water Authority service area and watershed. If the City or County develops a new ordinance, the Water Authority has recommended that it include provisions that address concerns from oil and gas, including protection of water resources, along with zoning and special permit regulations, fiscal assurance requirements, and the development of a fee structure that will fund local and county level enforcement of the ordinance.

There are no immediate concerns or risks to Water Authority sources from oil and gas exploration or production. The findings of this Groundwater SWA support the continued, proactive, and multi-agency approach to development of ordinances and permitting requirements at both the city and county level to ensure the continued protection of the Water Authority source waters.

5. Susceptibility Analysis

A particular well's risk of being contaminated was evaluated by calculating a susceptibility ranking. This ranking represents a combination of the well's vulnerability and sensitivity that accounts for a particular well's construction, hydrogeology, and identified Potential Source of Contamination (PSOCs) within a given well's Source Water Protection Area (SWPA). This section describes in detail how each of the vulnerability and sensitivity scores were determined along with the assignment of the concluding susceptibility ranking on a well-by-well basis. The susceptibility ranking for a well provided the Water Authority a qualitative method for identifying priorities and recommendations for the protection of the system's resources and for Water Authority operational planning purposes.

5.1 Vulnerability Assessment

The vulnerability ranking is based on an inventory of the type, number, and proximity of PSOCs near a well. This ranking is a weighted combination of three factors: 1) PSOC Risk; 2) Proximity to Source; and 3) PSOC Count. Weights are assigned to each factor as a percentage, with weights for all three factors adding up to 100 percent. After being weighted, the three factors are summed, and the source is assigned a vulnerability ranking of low, moderately low, moderate, moderately high, or high, based on that sum.

Appendix C tabulates the types of PSOCs encountered within each buffer zone of the SWPA. For linear or polygon features extending across more than one buffer zone, the PSOC is listed and counted in all zones in which it occurs. For example, the Digital/Hewlett Packard contamination plume is present in Zones A through D at Vol Andia W-6 and is therefore listed and counted in Table C-6 in all four zones for this well.

5.1.1 PSOC ArcGIS Data Sources

5.1.1.1 New Mexico Environment Department (NMED) EnviroMap

The EnviroMap geodatabase (formerly known as the Source Water Protection Atlas), provided by NMED, served as the primary source of data for this study for potential sources of contamination. This geodatabase includes PSOCs for locations subject to permitting or registration by the State.

It contains data on the locations of aboveground and underground storage tanks, animal feeding operations, abatement sites, brownfields, hazardous waste facilities, groundwater permits, voluntary remediation sites, and more. These data were supplemented by other sources described in the following subsections.

5.1.1.2 Land Use

The City maintains a Geograpic Information System (GIS) land use coverage map that records current land use for each parcel. This study used the 2017 version from the City Planning Department Albuquerque GIS (AGIS). The City's land use dataset contains land use codes (as numbers) and categories for each parcel polygon. Parcels that were associated with land uses that could be potential sources of contamination within the Water Authority SWPAs were selected out of the City's land use dataset. The land use codes were matched to NMED's List of Potential Sources of Contamination (Appendix A) and the corresponding map codes (three-letter PSOC code) to generate a list of PSOC parcels. The table relating land use codes/categories from the City's land use dataset to PSOC codes/categories from Appendix A is provided in Appendix C. For some PSOC parcels, there are multiple corresponding land use codes from the City's land use dataset; and those were listed in Appendix C with the corresponding PSOC category to ensure no land uses were skipped because they were not exact matches for each PSOC category. The boundaries of land use parcels that correspond to a PSOC category are shown on the maps, labeled with the three-letter PSOC code.

5.1.1.3 Parks

The City maintains a polygon GIS coverage for parks. This study used the 2009 version from the City Planning Department AGIS. The parks' layer is described in the metadata as "Parks managed by the City of Albuquerque and Albuquerque Public Schools (APS)." Park counts in the PSOC tables relied upon these polygons, as well as satellite imagery. The dataset did not include some of the local school parks or green spaces. To ensure all parks in SWPAs were counted, additional parks were digitized for this project from satellite imagery, including ballfields, school parks, and University of New Mexico campus fields. Where a park is segmented by a road or other landmark but exists as a single (multi-part) entity in the GIS data, it was counted as one park for the PSOC counts.

5.1.1.4 Office of the State Engineer (OSE) Wells

This study used the OSE "Point of Diversions" GIS layer dated January 2018 representing wells that are registered with the OSE. These data are maintained by OSE and frequently updated with the latest water right and permit information available.

The original well data were extracted from the OSE Water Administration Technical Engineering Resource System (W.A.T.E.R.S) database. The points of diversion have varying degrees of locational accuracy depending on the location data available, and many have not been validated. Additionally, there may be small diameter wells (2.38 inches in diameter) throughout the study area that are not in the OSE database. Permits for small diameter wells were not required by the state until 1956; in 1987 the County began requiring permits for these wells. Some location coordinates (presumably for older wells) were derived from Public Land Survey System (PLSS) information and only had township, range, and section information listed in the OSE database.

For wells without specific PLSS location descriptions, including which quarter of a section the well is located, wells were plotted in the middle of a section. Some wells had specific PLSS location descriptions that described the quarter, of the quarter, of the quarter, of the section and were plotted accordingly on the maps. More recent wells in the database may be global positioning system GPS/survey located and plot to more accurate locations on the maps. For this reason, there are many instances on the maps where multiple wells occur in the same location in the GIS data and only one point is visible. The selection tool in ArcGIS was used to select every point within a particular buffer zone to ensure all wells plotting to the same location were identified for the analysis. The resulting selected record count in the attribute table was used as the count for the zone in the PSOC table. For this study, the Water Authority differentiated between monitoring wells (monitoring) and wells for other types of uses (other) and those two categories are displayed on the maps. Well construction, access, and maintenance for monitoring wells are different from the other types of uses so they are evaluated as a separate category in this study.

5.1.1.5 Arroyos/Drainages

This study used the 2014 linear drainage shapefile from the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA). It contains the location of hard- and soft-lined channels, dikes, selected crossings, and selected storm drains within the AMAFCA district. Whole arroyo

Figure 3. Arroyo/Drainage County Method

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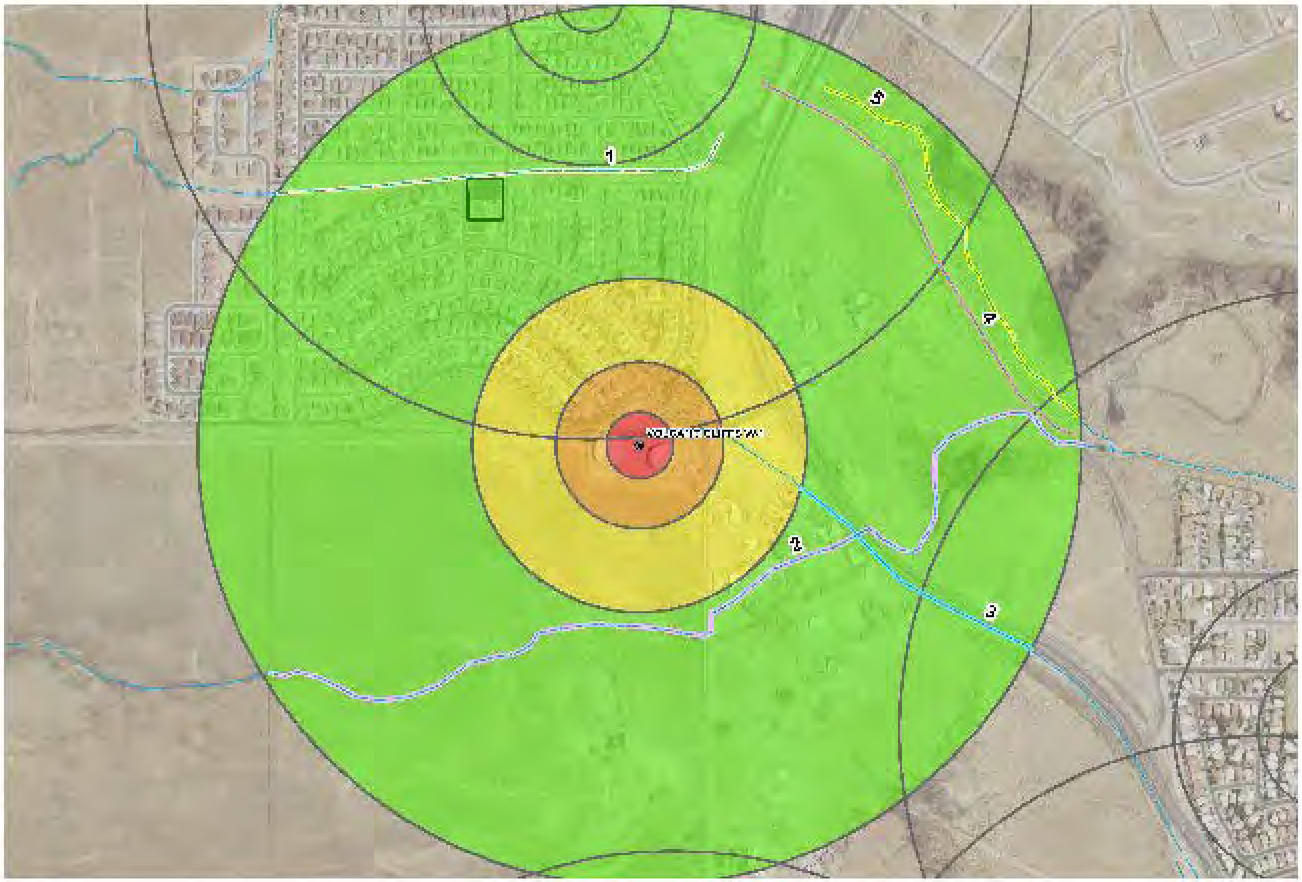

ALBUQUERQUE BERNALILLO COUNTY
WATER UTILITY AUTHORITY
Arroyo/Drainage Count Method

Figure 3

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5/21/18

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segments were counted in each buffer zone that they intersected. Figure 3 shows Volcano Cliffs W-1 as an example to demonstrate how arroyo segments were counted. Storm drain ponds were counted separately using polygon data from AMAFCA (PSOC code MSD).

5.1.1.6 Landfills

The landfill dataset is from the City Planning Department AGIS (dated 2009). The City data includes a shapefile of areas within the City currently or previously serving as landfills or unregulated dumps. The dataset distinguishes between open, closed, and unknown landfill sites; the three landfill types are shown on the maps and in the vulnerability tables (Appendix C). Landfill entrances exist as a feature in the NMED EnviroMap geodatabase and only show open landfills.

5.1.1.7 Agricultural Fields

The dataset used to count the agricultural fields within the SWPAs of the wells in this study stems from a previously digitized shapefile based on 2015 aerial photography created by Daniel B. Stephens & Associates (DBS&A). The PSOC inventory included only agricultural fields greater than 1 acre in area. Agricultural fields were counted in each buffer zone the field intersected.

5.1.1.8 Major Transportation Corridors

For this study, transportation corridors categorized as PSOCs were taken from a GIS dataset of major roads from the New Mexico Department of Transportation (NMDOT) dated 2014. The dataset for railroads also came from NMDOT. The metadata notes that the major roads data are a vector representation of the state's public road system, which includes all interstates, interchange ramps, U.S. routes, state routes, business loops, and frontage roads. Additionally, it may include county highways and local roads functionally classified as Collector or higher (FL or Federal Aid Local), Bureau of Indian Affairs (BIA) roads, federal park (FP) roads, federal wildlife (FW), or U.S. Forest Service (FS) roads. This dataset was used to count the "major roads" listed in the PSOC tables.

5.1.1.9 Septic Tanks

Septic tanks were identified using the County's list of addresses with permitted septic tanks within the County. This list contains permits dating from 1998 through April 2018. However, it should be noted that there could be a number of unpermitted septic systems in the study area because permits were not required prior to the 1980s. There also could be additional septic systems in the study area that are out of compliance for filing requirements. For this study, that file was geocoded to create a point file depicting septic tanks. The addresses in towns away from the city (Sandia Park, Tijeras, etc.) were excluded from the original list. This left 2,628 records, and all but 100 of them were successfully geocoded. Those that could not be geocoded were, in many instances, missing key information, such as quadrants or zip codes, and therefore could not be accounted for in this study. The septic tanks within the SWPAs were tabulated and counted in the PSOC tables; and septic tanks outside of the SWPAs are shown on the maps for informational purposes (Appendix C).

5.1.1.10 Environmental Sites

Environmental site footprints were digitized for sites with information from Water Authority review of site-specific reports. In some instances, the most current data available for a site is several years old due to a combination of lack of available information from NMED (e.g., Sparton Technologies) and slowed progress at a site (e.g., Fox and Associates). In some instances, plume extents were estimated using the available information and professional judgment.

5.1.1.11 Oil and Gas Wells

The dataset used for oil and gas wells originated from the Energy, Minerals, and Natural Resources Department (EMNRD). It contains both inactive and active energy production wells, including oil, gas, and carbon dioxide producing wells, as well as injection and salt-water disposal wells.

5.1.1.12 Airports and Kirtland Air Force Base (KAFB)

Both the Albuquerque International Sunport and the KAFB boundaries are polygon GIS files from the County.

5.1.2 Vulnerability Factor 1: PSOC Risk

Each type of PSOC was assessed for risk, and the risk score was then used to assess each well's vulnerability. The PSOC Risk has two sub-components:

1. *Probability of occurrence:* Considers the likelihood of a contamination event of this PSOC type occurring. This accounts for site regulatory status, engineering controls, etc.
2. *Severity of impact score:* A function of the type of contaminant that would impact the water source. This accounts for contaminant properties (e.g., solubility) and regulatory standards (e.g., emerging contaminant vs. a contaminant with a defined standard). For example, contamination from runoff likely is less severe than contamination from a dry cleaner, where the concern is a chemical spill.

Scores for each sub-component are assigned on a scale from 1 to 5. The two sub-component scores are then summed into an overall PSOC Risk score, which ranges from 2 to 10. Table 2a demonstrates how each type of PSOC was evaluated for assigning both the probability of occurrence and severity of impact scores. Table 2b provides risk scores for individual PSOC types and shows the ranking for each subcomponent to produce the PSOC Risk score.

5.1.3 Vulnerability Factor 2: Proximity to Source

The proximity of a PSOC to a source is another factor in the vulnerability scoring and ranges from 1 to 5 depending on the location of the PSOC. Note that for the PSOC type of known groundwater contamination, a score of 5 is assigned, regardless of which zone it is located in. The score of 5 was applied to known groundwater contamination sites since they are known impacts to groundwater which are considered the source for this factor scoring. A score of 5 was applied to contamination plumes, voluntary remediation sites, brownfields, and leaking underground storage tanks (LUSTs):

- 1: Zone D
- 2: Zone C
- 3: Zone B
- 4: Zone A
- 5: Known groundwater contamination site

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Table 2a PSOC Risk by PSOC Type

	1	2	3	4	5
Probability of Occurrence	Unlikely to occur	→	→	→	Likely to occur/has occurred
	Utilities, OSE Permitted Wells, Groundwater Discharge permits, Wastewater Treatment Facilities	Natural Features, Parks, Lawns and Grounds Maintenance, Road Miles, Stormwater, Farming/Irrigated Cropland	Mining	Oil and Gas Facilities, Septic Tanks, Commercial/Industrial /Transportation Land Use, Closed Landfills	Known Groundwater Contamination, Permitted Groundwater Remediation Sites, Unregulated Dumps
	1	2	3	4	5
Severity of Impact	Low impact	→	→	→	High impact
	Parks, Lawns and Grounds Maintenance, Campgrounds, Treated Water	Farming/Irrigated Cropland, Stormwater, Natural Features, Wastewater Treatment Facilities	Unknown COCs	Oil and Gas Facilities, Septic Tank	Commercial/Industrial /Transportation Land Use, Military Activities, Landfills, Groundwater Contamination

COC Contaminant of concern
OSE New Mexico Office of the State Engineer
PSOC Potential Source of Contamination

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Table 2b PSOC Risk Scores

PSOC/SOC Description	PSOC/SOC Risk Score		
	Probability of Occurrence	Severity of Impact	Sum
Abatement site - Compaq/Digital	1	5	6
Agricultural field	2	2	4
Airport - Albuquerque International Sunport	4	4	8
Arroyo	2	2	4
Automotive body shop	4	4	8
Automotive repair shop	4	4	8
Brownfield - Winrock Town Center	1	3	4
Brownfield - Luna Lodge	1	3	4
Bulk petroleum	4	4	8
Carwash	4	4	8
Cemetery	2	1	3
Closed landfill	4	5	9
Concrete/cement plant	3	3	6
Construction and open equipment storage	3	3	6
Contamination plume - BNSF Albuquerque	5	5	10
Contamination plume - Digital/Hewlett Packard	5	5	10
Contamination plume - Fox & Associates Albuquerque	5	5	10
Drainage	2	2	4
Dry-cleaning shop	4	5	9
Electric utility	1	4	5
Electronic/electrical equipment manufacturing	4	5	9
Funeral home/crematory	3	3	6
Furniture repair and manufacturing	4	3	7
Gas well, temporarily abandoned	1	4	5
Gasoline service station	4	4	8
Gasoline service tank	4	4	8
Golf course	2	1	3
Groundwater permit, active - Bear Canyon Recharge Demonstration Project	1	1	2
Groundwater permit, ceased - APS - Martin Luther King Elementary	1	3	4
Groundwater permit, ceased - APS - Ann Binford Elementary School	1	3	4
Groundwater permit, ceased - Contract Carriers	1	3	4
Groundwater permit, terminated - Albuquerque Six-Plex Theatre	1	3	4
Groundwater permit, terminated - Former Digital Equipment Corporation	1	3	4
Groundwater permit, terminated - Yale Auto Sale Site	1	3	4
Hardware/lumber/parts store	3	3	6
Hazardous waste facility - Safety Kleen - Albuquerque	1	5	6
Major road	2	4	6
Metal processing facility	4	5	9

Table 2b PSOC Risk Scores

PSOC/SOC Description	PSOC/SOC Risk Score		
	Probability of Occurrence	Severity of Impact	Sum
Military facilities - Kirtland Airforce Base	5	5	10
Mining operations - crushed stone, sand, and gravel extraction	3	3	6
Motor pool	4	4	8
North Diversion Channel	2	2	4
Oil/gas pipeline	1	4	5
Paint store	3	3	6
Park	2	1	3
Photo-processing laboratory	4	3	7
Primary wood industries (wood, stone, clay and glass manufacturing)	4	3	7
Printing shop	4	3	7
Private well	1	3	4
Research laboratory	3	3	6
Research laboratory (medical laboratory)	3	3	6
Septic tank	4	4	8
Stone, tile, and glass manufacturing	4	3	7
Storage tank facility, AST	4	4	8
Storage tank, leaking underground	5	4	9
Storage tank, underground	4	4	8
Stormwater pond	2	2	4
Unregulated dump	5	5	10
Utility/transportation right of way	2	4	6
Veterinary services	3	3	6
Voluntary remediation site - First Federal Bank @ Digital	5	5	10
Voluntary remediation site - Thriftway - Wright Gallery	5	5	10
Voluntary remediation site - Triple S, Inc. (Kerr McGee Number #6007)	5	5	10
Water supply well	1	1	2
Water treatment plant	1	1	2

APS	Albuquerque Public School
AST	Aboveground storage tank
BNSF	Burlington Northern Santa Fe Railway
LUST	Leaking underground storage tank
PSOC	Potential Source of Contamination
SOC	Source of Contamination

5.1.4 Vulnerability Factor 3: PSOC Count

A score from 1 to 5 is assigned for PSOC Count based on the number of occurrences for a PSOC type per zone:

- 1: 1 PSOC
- 2: 2 to 4 PSOCs
- 3: 5 to 10 PSOCs
- 4: 11 to 100 PSOCs
- 5: 101 or more PSOCs

5.1.5 Calculating the Vulnerability Ranking

After scores for each of the three main factors of PSOC Risk, Proximity to Source, and PSOC Count were determined, each factor was weighted for the vulnerability scoring:

- PSOC Risk: 80 percent
- Proximity to Source: 15 percent
- PSOC Count: 5 percent

For each well, the total of these three weighted factors was summed to provide a PSOC value for each PSOC type per zone. The PSOC sum values for each well were added together to provide an overall vulnerability score for each well. For example, if Example Well 1 has 1 golf course (PSOC risk score of 3) in Zone A, 3 printing shops (PSOC risk score of 7) in Zone C, and 15 private wells (PSOC risk score of 4) in Zone D, the calculation would be as shown in Table 3.

Table 3 Vulnerability Ranking Score Example

Well	PSOC Type	PSOC Risk Score		Weight		Proximity to Source Score		Weight		PSOC Count Score		Weight	PSOC Sum	Vulnerability Score
Example Well 1	Golf course	(3	x	0.80)	+	(4	x	0.15)	+	(1	x	0.05) =	3.05	12.60
	Printing shop	(7	x	0.80)	+	(2	x	0.15)	+	(2	x	0.05) =	6.00	
	Private well	(4	x	0.80)	+	(1	x	0.15)	+	(4	x	0.05) =	3.55	

$$Vulnerability\ Score = 0.8(PSOC\ Risk) + 0.15(Proximity\ to\ Source) + 0.05(PSOC\ Count)$$

The vulnerability scores range from 6.9 (Corrales W-7) to 191.6 (Ridgecrest W-1). This range was divided evenly by five to give the following scale for vulnerability provided in Table 4.

Table 4. Vulnerability Ranking Scale

Vulnerability Ranking	Vulnerability Score
Low	6.9–43.7
Moderately low	43.8–80.7
Moderate	80.8–117.7
Moderately high	117.8–154.6
High	154.7–191.6

The vulnerability analysis tables in Appendix C show the calculations, vulnerability score, and corresponding vulnerability rankings for each well. Table 5 summarizes the vulnerability scores and vulnerability rankings by well.

Table 5 Vulnerability Ranking Score Summary

Well	Vulnerability Score	Vulnerability Ranking
Atrisco W-1	86.9	Moderate
Atrisco W-2	127.0	Moderately high
Atrisco W-3	114.9	Moderate
Atrisco W-4	129.4	Moderately high
Burton W-1	62.8	Moderately low
Burton W-2	78.8	Moderately low
Burton W-3	123.3	Moderately high
Burton W-4	80.8	Moderate
Burton W-5	111.4	Moderate
Charles W-1	96.8	Moderate
Charles W-2	66.1	Moderately low
Charles W-3	61.3	Moderately low
Charles W-4	53.1	Moderately low
Charles W-5	114.8	Moderate
College W-1	9.7	Low
College W-2	37.6	Low
Coronado W-1	74.9	Moderately low
Coronado W-2	126.9	Moderately high
Corrales W-1	23.9	Low
Corrales W-2	47.7	Moderately low
Corrales W-4	35.9	Low
Corrales W-5	42.9	Low
Corrales W-7	6.9	Low
Corrales W-8	39.9	Low
Corrales W-9	35.5	Low
Duranes W-2	44.4	Moderately low
Duranes W-3	51.6	Moderately low
Duranes W-7	48.1	Moderately low
Gonzales W-1	68.9	Moderately low
Gonzales W-2	71.3	Moderately low
Gonzales W-3	116.9	Moderate
Griegos W-1	69.3	Moderately low

Table 5 Vulnerability Ranking Score Summary (cont.)

Well	Vulnerability Score	Vulnerability Ranking
Griegos W-3	50.3	Moderately low
Griegos W-4	81.2	Moderate
Leavitt W-1	36.8	Low
Leavitt W-2	27.4	Low
Leavitt W-3	41.6	Low
Leyendecker W-1	72.0	Moderately low
Leyendecker W-2	69.6	Moderately low
Leyendecker W-3	83.0	Moderate
Leyendecker W-4	81.3	Moderate
Lomas W-1	77.2	Moderately low
Lomas W-5	77.0	Moderately low
Lomas W-6	83.3	Moderate
Love W-1	69.5	Moderately low
Love W-3	78.2	Moderately low
Love W-4	119.0	Moderately high
Love W-6	74.5	Moderately low
Love W-7	109.0	Moderate
Love W-8	89.5	Moderate
Ponderosa W-2	84.1	Moderate
Ridgecrest W-1	191.6	High
Ridgecrest W-2	157.9	Moderately high
Ridgecrest W-3	134.0	Moderately high
Ridgecrest W-4	82.2	Moderate
Ridgecrest W-5	140.6	Moderately high
Santa Barbara W-1	141.3	Moderately high
Thomas W-1	76.6	Moderately low
Thomas W-4	61.0	Moderately low
Thomas W-5	98.9	Moderate
Thomas W-6	81.7	Moderate
Thomas W-7	35.5	Low
Thomas W-8	42.5	Low
Vol Andia W-1	103.0	Moderate
Vol Andia W-2	91.6	Moderate
Vol Andia W-3	132.4	Moderately high
Vol Andia W-4	134.5	Moderately high
Vol Andia W-5	121.2	Moderately high

Table 5 Vulnerability Ranking Score Summary (cont.)

Well	Vulnerability Score	Vulnerability Ranking
Vol Andia W-6	144.7	Moderately high
Volcano Cliffs W-1	44.5	Moderately low
Volcano Cliffs W-2	14.3	Low
Volcano Cliffs W-3	46.7	Moderately low
Walker W-1	56.4	Moderately low
Walker W-2	40.1	Low
Walker W-3	62.9	Moderately low
Walker W-4	43.6	Low
Webster W-1	68.0	Moderately low
Webster W-2	103.6	Moderate
Yale W-1	93.7	Moderate
Yale W-2	100.2	Moderate
Yale W-3	100.6	Moderate
Zamora W-1	33.7	Low
Zamora W-2	39.6	Low

5.2 Sensitivity Assessment

A well's sensitivity was determined through an evaluation of two factors: 1) Well Infrastructure; and 2) Hydrogeology. Each well was assigned a sensitivity ranking of low, moderately low, moderate, moderately high, or high.

5.2.1 Sensitivity Factor 1: Well Infrastructure

In November 2017, the Water Authority issued a Draft Well Asset Management Plan (AMP) update. As part of this Well AMP update, the Water Authority uses asset management criteria to develop the overall risk of failure of a well. The overall risk score will then be used by the Water Authority as a guidance metric for well rehabilitation, modification, or replacement. The criteria fall into two general categories: Likelihood of Failure and Consequence of Failure. The criteria associated with these two categories are listed as follows:

- Likelihood of Failure: Lowest scoring wells in this criterion are wells less than 20 years old which are non-sand producing. Higher scores are reserved for wells that are 50 years or older and are sand producing.
  - Well Condition:
    - Age of Well
    - Sand Production
    - Decline in Production (specific capacity)
  - Arsenic concentration
- Consequence of Failure: Well production is measured in terms of mega gallons per day. To determine operational criticality, the plan looks at whether or not the San Juan-Chama Water Treatment plant is operational and the level of arsenic concentration.
  - Well Production
  - Operational Criticality

The range of possible well risk scores in the Well AMP is 1 to 18.8; the actual range of assigned scores is 1.25 (Leavitt W-2) to 15.2 (Vol Andia W-1).

Table 6 shows each well's risk score from the Water Authority's Well AMP.

Table 6 Well Risk Score

Wells	Well Risk Score
Atrisco W-1	8.00
Atrisco W-2	7.60
Atrisco W-3	10.50
Atrisco W-4	10.75
Burton W-1	*6.00*

Table 6 Well Risk Score (cont.)

Wells	Well Risk Score
Burton W-2	6.30
Burton W-3	5.40
Burton W-4	*5.75*
Burton W-5	13.65
Charles Wells W-1	5.20
Charles Wells W-2	5.20
Charles Wells W-3	5.20
Charles Wells W-4	5.20
Charles Wells W-5	6.65
College W-1	*3.75*
College W-2	*3.75*
Coronado W-1	*6.45*
Coronado W-2	6.75
Corrales W-1	7.70
Corrales W-2	*4.40*
Corrales W-4	3.45
Corrales W-5 [a]	4.60
Corrales W-7	5.20
Corrales W-8	5.60
Corrales W-9	6.50
Duranes W-2	5.75
Duranes W-3	6.90
Duranes W-7	5.70
Gonzales W-1	8.10
Gonzales W-2	9.45
Gonzales W-3	9.10
Griegos W-1	6.30
Griegos W-3	5.40
Griegos W-4	7.50
Leavitt W-1	*3.75*
Leavitt W-2	*1.25*
Leavitt W-3	*4.60*
Leyendecker W-1	6.30
Leyendecker W-2	4.90
Leyendecker W-3	6.30
Leyendecker W-4	11.90
Lomas W-1	4.20

Table 6 Well Risk Score (cont.)

Wells	Well Risk Score
Lomas W-5	5.60
Lomas W-6	3.60
Love W-1 [b]	4.00
Love W-3	4.20
Love W-4	9.00
Love W-6	4.35
Love W-7	5.10
Love W-8	3.85
Ponderosa W-2	3.90
Ridgecrest W-1	4.20
Ridgecrest W-2	4.80
Ridgecrest W-3	4.80
Ridgecrest W-4	4.80
Ridgecrest W-5	10.80
Santa Barbara W-1	*6.50*
Thomas W-1	9.00
Thomas W-4 [b]	4.00
Thomas W-5	3.30
Thomas W-6	6.75
Thomas W-7	10.75
Thomas W-8	5.40
Vol Andia W-1	15.20
Vol Andia W-2	7.20
Vol Andia W-3	11.90
Vol Andia W-4	9.10
Vol Andia W-5	6.30
Vol Andia W-6	8.80
Volcano Cliffs W-1	8.70
Volcano Cliffs W-2	7.25
Volcano Cliffs W-3	*4.80*
Walker W-1	*3.60*
Walker W-2	*4.60*
Walker W-3	*3.60*
Walker W-4	*3.60*
Webster W-1	*6.00*
Webster W-2	*6.00*
Yale W-1	9.00

Table 6 Well Risk Score (cont.)

Wells	Well Risk Score
Yale W-2	*7.25*
Yale W-3	*5.00*
Zamora W-1	6.75
Zamora W-2	7.80

5.2.2 Sensitivity Factor 2: Hydrogeology

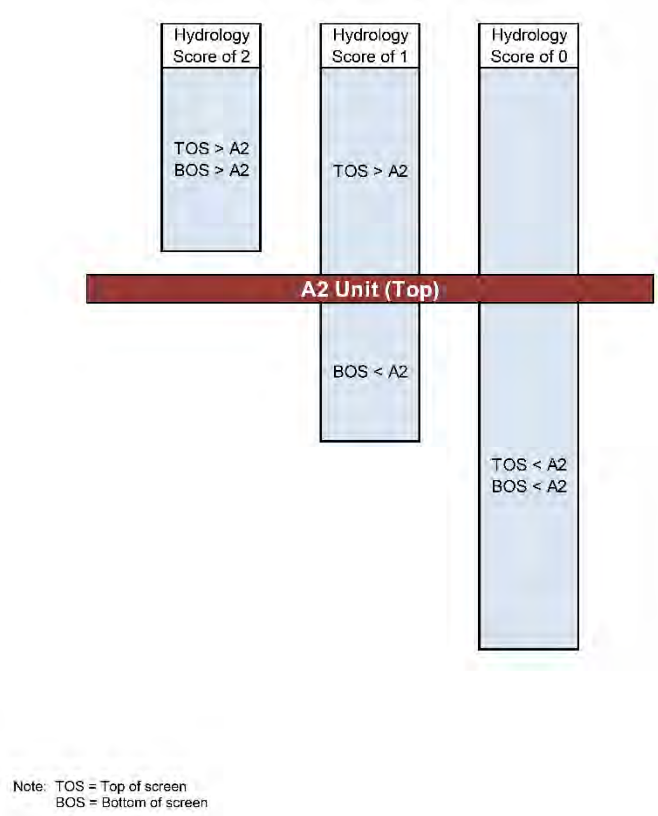
The Albuquerque Basin has been filled with sediments classified as the Santa Fe Group. The Santa Fe Group includes alluvial fan deposits from the Sandia and Manzanita Mountains, Ancestral Rio Grande fluvial system deposits, and fluvial fan deposits. Although the Albuquerque Basin is generally an unconfined basin aquifer, a braided-type fluvial deposit present in the Ancestral Rio Grande deposits resulted in the formation of two fine-grain clay layers called A1 and A2. These fine-grained deposits are regionally present throughout the Albuquerque area though the thickness and continuity is variable across the basin.

The A1 and A2 units are low permeability zones that create localized confining and semi-confining conditions, acting as a barrier to flow from shallow aquifer intervals to deeper portions of the aquifer. For the purposes of this study, the presence of the A2 unit, the shallower of the two, low permeability clay layers, is factored into the sensitivity ranking for a well (Connell and Love, 2009; Hawley, 1978). Groundwater contamination is assumed to primarily impact shallower portions of the aquifer, resulting from the downward migration of contamination releases at the ground surface. If a well is fully screened below the A2 unit, it is assumed that the low permeability layer would prevent downward migration into a well screen (lower risk of impact). In the cases where wells are fully screened above the A2 unit, there is assumed to be none to minimal hydrologic barriers to flow (higher risk of impact).

The A2 elevation data used in the sensitivity scoring were based on mapped elevations by Connell (2006) and Connell et al. (1998), as well as geophysical profiles for wells drilled as part of the KAFB Bulk Fuels Facility (BFF) jet fuel spill project (U. S. Army Corps of Engineers [USACE], 2017). The A2 clay layer is present on the eastern margin of the basin; therefore, wells west of the Rio Grande River have the lowest score possible, assuming no confining layer and barrier to flow. A hydrogeology score was assigned to each well based on the elevation of the top of screen (TOS) and bottom of screen (BOS) relative to the regionally present A2 clay layer.

The hydrogeology score was either 0, 1, or 2 based on the following criteria (Figure 4):

Figure 4 Hydrogeology Score



- Score of 2: TOS and BOS are both above the A2 layer
- Score of 1: TOS is above the A2 layer, but BOS is below the A2 layer
- Score of 0: TOS and the BOS are both below the A2 layer

Table 7 shows the information involved in determining the hydrogeology score for each well.

Table 7 Hydrogeology Score Determination

Well	Elevation (feet msl)	Depth to Top of Screen (feet)	Top of Screen Elevation (feet msl)	Depth to Bottom of Screen (feet)	Bottom of Screen Elevation (feet msl)	Length of Screen (feet)	Top of A2 Unit Elevation (feet msl)	Top of Screen – Top of A2 Unit (feet)	Bottom of Screen to A2 Unit (feet)	Hydrogeology Score	Notes
Atrisco W-1	—	—	—	—	—	—	NA	—	—	2	QTsa unit not in this area of the basin; therefore, no A2 unit
Atrisco W-2	4,945	100	4,845	250	4,695	150	NA	NA	NA	2	
Atrisco W-3	4,950	180	4,770	804	4,146	624	NA	NA	NA	2	
Atrisco W-4	—	—	—	—	—	—	NA	—	—	2	
Burton W-1	5,322	676	4,646	1,292	4,030	616	4,920	–274	–890	0	USGS elevation
Burton W-2	5,282	425	4,857	845	4,437	420	4,907	–50	–470	0	USGS elevation
Burton W-3	5,215	358	4,857	994	4,221	636	4,858	–1	–637	0	USGS elevation
Burton W-4	5,275	630	4,645	1,275	4,000	645	4,983	–338	–983	0	USGS elevation
Burton W-5	5,278	550	4,728	1,150	4,128	600	4,711	17	–583	1	USGS elevation
Charles W-1	5,315	456	4,859	1,032	4,283	576	4,680	179	–397	1	Elevation from Charles W-5
Charles W-2	5,262	432	4,830	996	4,266	564	4,343	487	–77	1	Elevation from calculated elevation at Charles W-4
Charles W-3	5,275	420	4,855	996	4,279	576	4,363	492	–84	1	
Charles W-4	5,325	456	4,869	1,032	4,293	576	4,343	526	–50	1	Elevation calculated from slope with Thomas W-5 and Love W-8
Charles W-5	5,220	625	4,595	1,385	3,835	760	4,680	–85	–845	0	USGS elevation
College W-1	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	0	Score assigned by the Water Authority
College W-2	5,228	550	4,678	1,564	3,664	1,014	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Coronado W-1	—	—	—	—	—	—	—	—	—	2	Not enough geology information or well construction information to determine A2 elevation; conservatively scored
Coronado W-2	5,242	590	4,652	1,390	3,852	800	—	NA	NA	2	
Corrales W-1	5,455	450	5,005	1,095	4,360	645	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore, no A2 unit
Corrales W-2	5,291	495	4,796	1,605	3,686	1,110	NA	NA	NA	2	
Corrales W-4	5,467	692	4,775	1,362	4,105	670	NA	NA	NA	2	
Corrales W-5	5,420	690	4,730	1,290	4,130	600	NA	NA	NA	2	
Corrales W-7	5,576	855	4,721	1,655	3,921	800	NA	NA	NA	2	
Corrales W-8	5,260	430	4,830	1,660	3,600	1,230	NA	NA	NA	2	
Corrales W-9	5,471	800	4,671	1,600	3,871	800	NA	NA	NA	2	
Duranes W-2	4,970	180	4,790	804	4,166	624	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Duranes W-3	4,962	132	4,830	950	4,012	818	NA	NA	NA	2	
Duranes W-7	4,962	144	4,818	814	4,148	670	NA	NA	NA	2	
Gonzales W-1	5,107	350	4,757	950	4,157	600	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Gonzales W-2	5,100	400	4,700	1,000	4,100	600	NA	NA	NA	2	
Gonzales W-3	5,102	420	4,682	940	4,162	520	NA	NA	NA	2	
Griegos W-1	4,972	232	4,740	802	4,170	570	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Griegos W-3	4,968	260	4,708	916	4,052	656	NA	NA	NA	2	
Griegos W-4	4,975	586	4,389	804	4,171	218	NA	NA	NA	2	
Leavitt W-1	—	—	—	—	—	—	NA	—	—	2	QTsa unit not in this area of the basin; therefore no A2 unit

Table 7 Hydrogeology Score Determination

Well	Elevation (feet msl)	Depth to Top of Screen (feet)	Top of Screen Elevation (feet msl)	Depth to Bottom of Screen (feet)	Bottom of Screen Elevation (feet msl)	Length of Screen (feet)	Top of A2 Unit Elevation (feet msl)	Top of Screen – Top of A2 Unit (feet)	Bottom of Screen to A2 Unit (feet)	Hydrogeology Score	Notes
Leavitt W-2	—	—	—	—	—	—	NA	—	—	2	
Leavitt W-3	—	—	—	—	—	—	NA	—	—	2	
Leyendecker W-1	5,285	468	4,817	996	4,289	528	4,481	336	–192	1	USGS elevation
Leyendecker W-2	5,298	468	4,830	996	4,302	528	4,463	367	–161	1	Leyendecker W-2 elevation from Thomas W-5
Leyendecker W-3	5,268	456	4,812	996	4,272	540	4,494	318	–222	1	Leyendecker W-3 equal to Leyendecker W-4
Leyendecker W-4	5,325	480	4,845	996	4,329	516	4,494	351	–165	1	Leyendecker W-4 calculated from slope with Thomas W-5 to Leyendecker W-1
Lomas W-1	5,595	700	4,895	1,300	4,295	600	4,475	420	–180	1	Lomas W-1 from Ridgecrest W-5
Lomas W-5	5,494	830	4,664	1,658	3,836	828	4,475	189	–639	1	Lomas W-5 from Ridgecrest W-5
Lomas W-6	5,529	880	4,649	1,692	3,837	812	4,448	201	–611	1	Lomas W-6 from Ridgecrest-3
Love W-1	5,465	596	4,869	1,096	4,369	500	4,343	526	26	2	Elevation from calculated elevation at Charles W-4; pump pull pending
Love W-3	5,405	600	4,805	1,260	4,145	660	4,343	462	–198	1	Love W-3 from Love W-4 elevation
Love W-4	5,370	600	4,770	1,284	4,086	684	4,343	427	–257	1	USGS elevation
Love W-6	5,505	753	4,752	1,509	3,996	756	4,343	409	–347	1	Elevation from calculated elevation at Charles W-4
Love W-7	5,440	645	4,795	1,473	3,967	828	4,343	452	–376	1	Elevation from calculated elevation at Charles W-4
Love W-8	5,314	640	4,674	1,440	3,874	800	4,327	347	–453	1	USGS elevation
Ponderosa W-2	5,600	801	4,799	1,569	4,031	768	4,481	318	–450	1	Elevation from Leyendecker W-1
Ridgecrest W-1	5,442	636	4,806	1,260	4,182	624	4,448	358	–266	1	Elevation from Ridgecrest W-3
Ridgecrest W-2	5,416	730	4,686	1,500	3,916	770	4,475	211	–559	1	Elevation from Ridgecrest W-5
Ridgecrest W-3	5,385	620	4,765	1,436	3,949	816	4,448	317	–499	1	USGS elevation
Ridgecrest W-4	5,344	572	4,772	1,412	3,932	840	4,398	374	–466	1	USGS elevation
Ridgecrest W-5	5,355	650	4,705	1,450	3,905	800	4,475	230	–570	1	USGS elevation
Santa Barbara W-1	5,139	312	4,827	984	4,155	672	4,363	464	–208	1	Set to elevation calculated for Charles W-3
Thomas W-1	5,445	624	4,821	1,092	4,353	468	4,481	340	–128	1	
Thomas W-4	5,485	673	4,812	1,020	4,465	347	4,494	318	–29	2	Set to elevation calculated for Leyendecker W-4; assigned a score of 0 because of distance from bottom of well screen to A2 and the error in estimating the elevation of A2 at this location
Thomas W-5	—	—	—	—	—	—	—	—	—	2	Score assigned by the Water Authority
Thomas W-6	5,410	760	4,650	1,520	3,890	760	4,493	157	–603	1	USGS elevation
Thomas W-7	5,345	659	4,686	1,460	3,885	801	4,493	193	–608	1	Set to elevation for Thomas W-6
Thomas W-8	5,462	835	4,627	1,635	3,827	800	4,493	134	–666	1	Set to elevation for Thomas W-6
Vol Andia W-1	5,144	300	4,844	972	4,172	672	4,481	363	–309	1	Elevation estimated from Leyendecker W-1
Vol Andia W-2	5,208	360	4,848	852	4,356	492	4,463	385	–107	1	Elevation estimated from Thomas W-5
Vol Andia W-3	5,110	264	4,846	900	4,210	636	4,463	383	–253	1	Elevation estimated from Thomas W-5
Vol Andia W-4	5,200	372	4,828	876	4,324	504	4,481	347	–157	1	Elevation estimated from Leyendecker W-1
Vol Andia W-5	5,112	260	4,852	900	4,212	640	4,481	371	–269	1	Elevation estimated from Leyendecker W-1

Table 7 Hydrogeology Score Determination

Well	Elevation (feet msl)	Depth to Top of Screen (feet)	Top of Screen Elevation (feet msl)	Depth to Bottom of Screen (feet)	Bottom of Screen Elevation (feet msl)	Length of Screen (feet)	Top of A2 Unit Elevation (feet msl)	Top of Screen – Top of A2 Unit (feet)	Bottom of Screen to A2 Unit (feet)	Hydrogeology Score	Notes
Vol Andia W-6	5,178	324	4,854	984	4,194	660	4,494	360	–300	1	Elevation estimated from Leyendecker W-3
Volcano Cliffs W-1	5,335	528	4,807	1,056	4,279	528	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Volcano Cliffs W-2	5,328	528	4,800	876	4,452	348	NA	NA	NA	2	
Volcano Cliffs W-3	5,345	659	4,686	1,302	4,043	643	NA	NA	NA	2	
Walker W-1	—	—	—	—	—	—	—	—	—	2	No well construction information available for these wells. Due to the lack of data on the A2 unit in these well fields, along with the lack of well construction information, these wells were conservatively scored as 2.
Walker W-2	—	—	—	—	—	—	—	—	—	2	
Walker W-3	—	—	—	—	—	—	—	—	—	2	
Walker W-4	—	—	—	—	—	—	—	—	—	2	
Webster W-1	—	—	—	—	—	—	—	—	—	2	
Webster W-2	—	—	—	—	—	—	—	—	—	2	
Yale W-1	5,159	336	4,823	960	4,199	624	4,858	–35	–659	1	Elevation set to Burton W-3; scored as a 1 due to the distance between the est. top of screen to A2 being within the error of the estimations/data.
Yale W-2	5,128	351	4,777	1,179	3,949	828	4,983	–206	–1,034	0	Elevation set to Burton W-4
Yale W-3	—	—	4,800	—	4,074	—	4,858	–58	–784	1	Elevation set to Burton W-3; scored as a 1 due to the distance between the est. top of screen to A2 being within the error of the estimations/data.
Zamora W-1	5,168	450	4,718	950	4,218	500	NA	NA	NA	2	QTsa unit not in this area of the basin; therefore no A2 unit
Zamora W-2	5,160	440	4,720	977	4,183	537	NA	NA	NA	2	

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5.2.3 Calculating the Sensitivity Ranking

Because the Well Infrastructure, as represented by the well risk score, and Hydrogeology sensitivity factors have different scales, they were normalized in order to be weighted and totaled. Both factors were normalized to a scale of 1 to 10.

The range of possible well risk scores is 1 to 18.8. This range was divided by 10 to give the normalized scoring scale provided in Table 8.

Table 8 Normalized Well Risk Score

Well Risk Score	Normalized Score
1.00–2.77	1
2.78–4.55	2
4.56–6.33	3
6.34–8.11	4
8.12–9.90	5
9.91–11.68	6
11.69–13.46	7
13.47–15.24	8
15.25–17.02	9
17.03–18.80	10

The range of possible hydrogeology scores is 0 to 2. The normalized scoring scale for hydrogeology is provided in Table 9.

Table 9 Normalized Hydrogeology Score

Hydrogeology Score	Normalized Score
0	1
1	5.5
2	10

Once the two sensitivity factor scores were normalized, the weighting was applied. The well infrastructure (well risk) score was weighted 60 percent and the hydrogeology score was weighted 40 percent. The normalized, weighted factor scores were then added together to give an overall sensitivity score. The sensitivity scores ranged from 1.60 (College W-1) to 7.60 (Atrisco W-3 and Atrisco W-4). This range was divided evenly by five to give the scale for sensitivity ranking provided in Table 10.

Table 10. Sensitivity Ranking Scale

Sensitivity Score	Sensitivity Ranking
2.20–3.28	Low
3.29–4.36	Moderately low
4.37–5.45	Moderate
5.46–6.52	Moderately high
6.53–7.60	High

Table 11 shows the calculations, sensitivity scores, and sensitivity rankings for each well.

Table 11 Sensitivity Calculations

Wells	Assigned Well Risk Score	Assigned Hydrogeology Score	Weights 60% Normalized Well Risk Score	Weights 40% Normalized Hydrology Score	Sensitivity Score	Sensitivity Ranking
Atrisco W-1	8.00	2	4	10	6.40	Moderately high
Atrisco W-2	7.60	2	4	10	6.40	Moderately high
Atrisco W-3	10.50	2	6	10	7.60	High
Atrisco W-4	10.75	2	6	10	7.60	High
Burton W-1	6.00	0	3	1	2.20	Low
Burton W-2	6.30	0	3	1	2.20	Low
Burton W-3	5.40	0	3	1	2.20	Low
Burton W-4	5.75	0	3	1	2.20	Low
Burton W-5	13.65	1	8	5.5	7.00	High
Charles Wells W-1	5.20	1	3	5.5	4.00	Moderately low
Charles Wells W-2	5.20	1	3	5.5	4.00	Moderately low
Charles Wells W-3	5.20	1	3	5.5	4.00	Moderately low
Charles Wells W-4	5.20	1	3	5.5	4.00	Moderately low
Charles Wells W-5	6.65	0	4	1	2.80	Moderately low
College W-1	3.75	0	2	1	1.60	Low
College W-2	3.75	2	2	10	5.20	Moderate
Coronado W-1	6.45	2	4	10	6.40	Moderately high
Coronado W-2	6.75	2	4	10	6.40	Moderately high
Corrales W-1	7.70	2	4	10	6.40	Moderately high
Corrales W-2	4.40	2	2	10	5.20	Moderate
Corrales W-4	3.45	2	2	10	5.20	Moderate
Corrales W-5	4.60	2	3	10	5.80	Moderately high
Corrales W-7	5.20	2	3	10	5.80	Moderately high
Corrales W-8	5.60	2	3	10	5.80	Moderately high

Table 11 Sensitivity Calculations

Wells	Assigned Well Risk Score	Assigned Hydrogeology Score	Weights 60% Normalized Well Risk Score	40% Normalized Hydrology Score	Sensitivity Score	Sensitivity Ranking
Corrales W-9	6.50	2	4	10	6.40	Moderately high
Duranes W-2	5.75	2	3	10	5.80	Moderately high
Duranes W-3	6.90	2	4	10	6.40	Moderately high
Duranes W-7	5.70	2	3	10	5.80	Moderately high
Gonzales W-1	8.10	2	4	10	6.40	Moderately high
Gonzales W-2	9.45	2	5	10	7.00	High
Gonzales W-3	9.10	2	5	10	7.00	High
Griegos W-1	6.30	2	3	10	5.80	Moderately high
Griegos W-3	5.40	2	3	10	5.80	Moderately high
Griegos W-4	7.50	2	4	10	6.40	Moderately high
Leavitt W-1	3.75	2	2	10	5.20	Moderate
Leavitt W-2	1.25	2	1	10	4.60	Moderate
Leavitt W-3	4.60	2	3	10	5.80	Moderately high
Leyendecker W-1	6.30	1	3	5.5	4.00	Moderately low
Leyendecker W-2	4.90	1	3	5.5	4.00	Moderately low
Leyendecker W-3	6.30	1	3	5.5	4.00	Moderately low
Leyendecker W-4	11.90	1	7	5.5	6.40	Moderately high
Lomas W-1	4.20	1	2	5.5	3.40	Moderately low
Lomas W-5	5.60	1	3	5.5	4.00	Moderately low
Lomas W-6	3.60	1	2	5.5	3.40	Moderately low
Love W-1	4.00	2	2	10	5.20	Moderate
Love W-3	4.20	1	2	5.5	3.40	Moderately low
Love W-4	9.00	1	5	5.5	5.20	Moderate
Love W-6	4.35	1	2	5.5	3.40	Moderately low
Love W-7	5.10	1	3	5.5	4.00	Moderately low

Table 11 Sensitivity Calculations

Wells	Assigned Well Risk Score	Assigned Hydrogeology Score	Weights 60% Normalized Well Risk Score	Weights 40% Normalized Hydrology Score	Sensitivity Score	Sensitivity Ranking
Love W-8	3.85	1	2	5.5	3.40	Moderately low
Ponderosa W-2	3.90	1	2	5.5	3.40	Moderately low
Ridgecrest W-1	4.20	1	2	5.5	3.40	Moderately low
Ridgecrest W-2	4.80	1	3	5.5	4.00	Moderately low
Ridgecrest W-3	4.80	1	3	5.5	4.00	Moderately low
Ridgecrest W-4	4.80	1	3	5.5	4.00	Moderately low
Ridgecrest W-5	10.80	1	6	5.5	5.80	Moderately high
Santa Barbara W-1	6.50	1	4	5.5	4.60	Moderate
Thomas W-1	9.00	1	5	5.5	5.20	Moderate
Thomas W-4	4.00	2	2	10	5.20	Moderate
Thomas W-5	3.30	2	2	10	5.20	Moderate
Thomas W-6	6.75	1	4	5.5	4.60	Moderate
Thomas W-7	10.75	1	6	5.5	5.80	Moderately high
Thomas W-8	5.40	1	3	5.5	4.00	Moderately low
Vol Andia W-1	15.20	1	8	5.5	7.00	High
Vol Andia W-2	7.20	1	4	5.5	4.60	Moderate
Vol Andia W-3	11.90	1	7	5.5	6.40	Moderately high
Vol Andia W-4	9.10	1	5	5.5	5.20	Moderate
Vol Andia W-5	6.30	1	3	5.5	4.00	Moderately low
Vol Andia W-6	8.80	1	5	5.5	5.20	Moderate
Volcano Cliffs W-1	8.70	2	5	10	7.00	High
Volcano Cliffs W-2	7.25	2	4	10	6.40	Moderately high
Volcano Cliffs W-3	4.80	2	3	10	5.80	Moderately high
Walker W-1	3.60	2	2	10	5.20	Moderate
Walker W-2	4.60	2	3	10	5.80	Moderately high

Table 11 Sensitivity Calculations

Wells	Assigned Well Risk Score	Assigned Hydrogeology Score	Weights 60% Normalized Well Risk Score	Weights 40% Normalized Hydrology Score	Sensitivity Score	Sensitivity Ranking
Walker W-3	3.60	2	2	10	5.20	Moderate
Walker W-4	3.60	2	2	10	5.20	Moderate
Webster W-1	6.00	2	3	10	5.80	Moderately high
Webster W-2	6.00	2	3	10	5.80	Moderately high
Yale W-1	9.00	1	5	5.5	5.20	Moderate
Yale W-2	7.25	0	4	1	2.80	Moderately low
Yale W-3	5.00	1	3	5.5	4.00	Moderately low
Zamora W-1	6.75	2	4	10	6.40	Moderately high
Zamora W-2	7.80	2	4	10	6.40	Moderately high

5.3 Susceptibility Ranking

The ultimate goal of the Groundwater Source Water Assessment (SWA) was to assess each Water Authority well for its susceptibility to contamination. This assessment and resulting susceptibility rankings will be used to inform decisions, coordinate between Water Authority divisions, and to develop policies and actions to protect groundwater drinking water sources from now, and into the future. In order to determine a well's susceptibility ranking, this study overlays the results of the vulnerability assessment with the well's calculated sensitivity ranking, following the matrix shown in Table 12. While the susceptibility analysis cannot predict how or when a release of contamination will occur, it does identify conditions and areas of focus for the Water Authority in source water protection planning.

Table 12 Susceptibility Ranking Matrix

		Sensitivity Ranking				
		High	Moderately High	Moderate	Moderately Low	Low
Vulnerability Ranking	High	High	High	Moderately high	Moderately high	Moderate
	Moderately high	High	Moderately high	Moderately high	Moderate	Moderate
	Moderate	Moderately high	Moderately high	Moderate	Moderate	Moderately low
	Moderately low	Moderately high	Moderate	Moderate	Moderately low	Moderately low
	Low	Moderate	Moderate	Moderately low	Moderately low	Low

Table 13 summarizes the susceptibility rankings for each well.

Table 13 Susceptibility Rankings

Well	Vulnerability Ranking	Sensitivity Ranking	Susceptibility Ranking
Atrisco W-1	Moderate	Moderately high	Moderately high
Atrisco W-2	Moderately high	Moderately high	Moderately high
Atrisco W-3	Moderate	High	Moderately high
Atrisco W-4	Moderately high	High	High
Burton W-1	Moderately low	Low	Moderately low
Burton W-2	Moderately low	Low	Moderately low
Burton W-3	Moderately high	Low	Moderate
Burton W-4	Moderate	Low	Moderately low
Burton W-5	Moderate	High	Moderately high
Charles W-4	Moderate	Moderately low	Moderate
Charles W-1	Moderately low	Moderately low	Moderately low
Charles W-2	Moderately low	Moderately low	Moderately low
Charles W-3	Moderately low	Moderately low	Moderately low
Charles W-5	Moderate	Moderately low	Moderate
College W-1	Low	Low	Low
College W-2	Low	Moderate	Moderately low
Coronado W-1	Moderately low	Moderately high	Moderate
Coronado W-2	Moderately high	Moderately high	Moderately high
Corrales W-1	Low	Moderately high	Moderate
Corrales W-2	Moderately low	Moderate	Moderate
Corrales W-4	Low	Moderate	Moderately low
Corrales W-5	Low	Moderately high	Moderate
Corrales W-7	Low	Moderately high	Moderate
Corrales W-8	Low	Moderately high	Moderate
Corrales W-9	Low	Moderately high	Moderate
Duranes W-2	Moderately low	Moderately high	Moderate
Duranes W-3	Moderately low	Moderately high	Moderate
Duranes W-7	Moderately low	Moderately high	Moderate
Gonzales W-1	Moderately low	Moderately high	Moderate
Gonzales W-2	Moderately low	High	Moderately high
Gonzales W-3	Moderate	High	Moderately high
Griegos W-1	Moderately low	Moderately high	Moderate
Griegos W-3	Moderately low	Moderately high	Moderate
Griegos W-4	Moderate	Moderately high	Moderately high
Leavitt W-1	Low	Moderate	Moderately low
Leavitt W-2	Low	Moderate	Moderately low
Leavitt W-3	Low	Moderately high	Moderate
Leyendecker W-1	Moderately low	Moderately low	Moderately low

Table 13 Susceptibility Rankings

Well	Vulnerability Ranking	Sensitivity Ranking	Susceptibility Ranking
Leyendecker W-2	Moderately low	Moderately low	Moderately low
Leyendecker W-3	Moderate	Moderately low	Moderate
Leyendecker W-4	Moderate	Moderately high	Moderately high
Lomas W-1	Moderately low	Moderately low	Moderately low
Lomas W-5	Moderately low	Moderately low	Moderately low
Lomas W-6	Moderate	Moderately low	Moderate
Love W-1	Moderately low	Moderate	Moderate
Love W-3	Moderately low	Moderately low	Moderately low
Love W-4	Moderately high	Moderate	Moderately high
Love W-6	Moderately low	Moderately low	Moderately low
Love W-7	Moderate	Moderately low	Moderate
Love W-8	Moderate	Moderately low	Moderate
Ponderosa W-2	Moderate	Moderately low	Moderate
Ridgecrest W-1	High	Moderately low	Moderately high
Ridgecrest W-2	Moderately high	Moderately low	Moderate
Ridgecrest W-3	Moderately high	Moderately low	Moderate
Ridgecrest W-4	Moderate	Moderately low	Moderate
Ridgecrest W-5	Moderately high	Moderately high	Moderately high
Santa Barbara W-1	Moderately high	Moderate	Moderately high
Thomas W-1	Moderately low	Moderate	Moderate
Thomas W-4	Moderately low	Moderate	Moderate
Thomas W-5	Moderate	Moderate	Moderate
Thomas W-6	Moderate	Moderate	Moderate
Thomas W-7	Low	Moderately high	Moderate
Thomas W-8	Low	Moderately low	Moderately low
Vol Andia W-1	Moderate	High	Moderately high
Vol Andia W-2	Moderate	Moderate	Moderate
Vol Andia W-3	Moderately high	Moderately high	Moderately high
Vol Andia W-4	Moderately high	Moderate	Moderately high
Vol Andia W-5	Moderately high	Moderately low	Moderate
Vol Andia W-6	Moderately high	Moderate	Moderately high
Volcano Cliff s W-1	Moderately low	High	Moderately high
Volcano Cliffs W-2	Low	Moderately high	Moderate
Volcano Cliffs W-3	Moderately low	Moderately high	Moderate
Walker W-1	Moderately low	Moderate	Moderate
Walker W-2	Low	Moderately high	Moderate
Walker W-3	Moderately low	Moderate	Moderate
Walker W-4	Low	Moderate	Moderately low

Table 13 Susceptibility Rankings

Well	Vulnerability Ranking	Sensitivity Ranking	Susceptibility Ranking
Webster W-1	Moderately low	Moderately high	Moderate
Webster W-2	Moderate	Moderately high	Moderately high
Yale W-1	Moderate	Moderate	Moderate
Yale W-2	Moderate	Moderately low	Moderate
Yale W-3	Moderate	Moderately low	Moderate
Zamora W-1	Low	Moderately high	Moderate
Zamora W-2	Low	Moderately high	Moderate

6. Conclusions

Many of the Potential Source of Contamination (PSOCs) identified in this study do not pose an imminent threat to wells; and water supply contamination can be prevented with good housekeeping and implementation of best management practices for each type of business (e.g., dry cleaners, hardware/lumber/parts stores, gasoline service stations, underground storage tanks, etc.). Figures 5 and 6 are bar charts showing the total number of PSOCs counted on a per well basis overlain with the vulnerability ranking (Figure 5) or sensitivity ranking (Figure 6). Color coding of the columns correspond to the susceptibility ranking, as defined in the legend.

This study resulted in only one well in the Water Authority's system ranked "high" for susceptibility (Atrisco W-4). This well has a high well risk score and is identified in the Well Asset Management Plan (AMP) as a well requiring replacement. This is because the well is greater than 50 years old and is showing declining efficiency, sanding, and is also a key well for production demands. One well scored "low" for susceptibility (College W-1). College W-1 is the westernmost well and has the second lowest number of PSOCs combined with a low well risk score. The majority of wells were ranked "moderate" for susceptibility. The following subsections summarize and discuss the rankings assigned by well field.

6.1.1 Corrales

The Corrales wells ranked moderately low to moderate for overall susceptibility. PSOCs encountered in this area include Office of the State Engineer (OSE) permitted wells, arroyos/drainages, stormwater ponds, underground storage tanks, a golf course, parks, and septic tanks. An abatement site was noted outside of the Source Water Protection Area (SWPAs) but near Corrales W-9. This abatement site is an erroneous location and there is not actually an abatement site at this location.

There are two points within the SWPA Zone D of Corrales W-4 that represent a large number of OSE permitted wells. There are 66 geothermal wells at each location, as shown in the map, based

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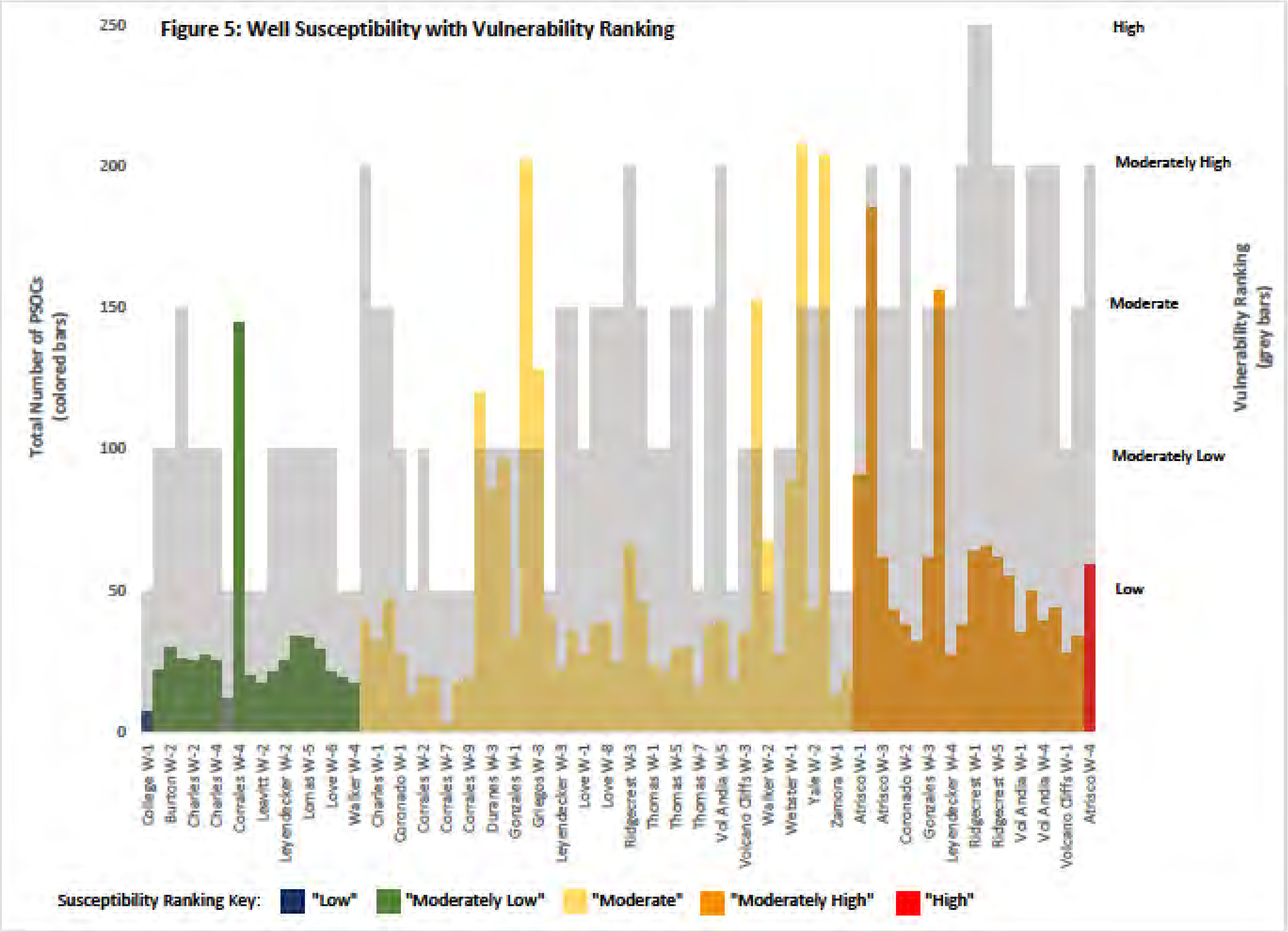

Figure 5: Well Susceptibility with Vulnerability Ranking
Total Number of PSOCs (colored bars)
Vulnerability Ranking (grey bars)
250
200
150
100
50
0
High
Moderately High
Moderate
Moderately Low
Low
College W-1
Burton W-2
Charles W-2
Charles W-4
Corrales W-4
Leavitt W-2
Leyendecker W-2
Lomas W-5
Love W-6
Walker W-4
Charles W-1
Coronado W-1
Corrales W-2
Corrales W-7
Corrales W-9
Duranes W-3
Gonzales W-1
Griegos W-3
Leyendecker W-3
Love W-1
Love W-8
Ridgecrest W-3
Thomas W-1
Thomas W-5
Thomas W-7
Vol Andia W-5
Volcano Cliffs W-3
Walker W-2
Webster W-1
Yale W-2
Zamora W-1
Atrisco W-1
Atrisco W-3
Coronado W-2
Gonzales W-3
Leyendecker W-4
Ridgecrest W-1
Ridgecrest W-5
Vol Andia W-1
Vol Andia W-4
Volcano Cliffs W-1
Atrisco W-4
Susceptibility Ranking Key: "Low" "Moderately Low" "Moderate" "Moderately High" "High"

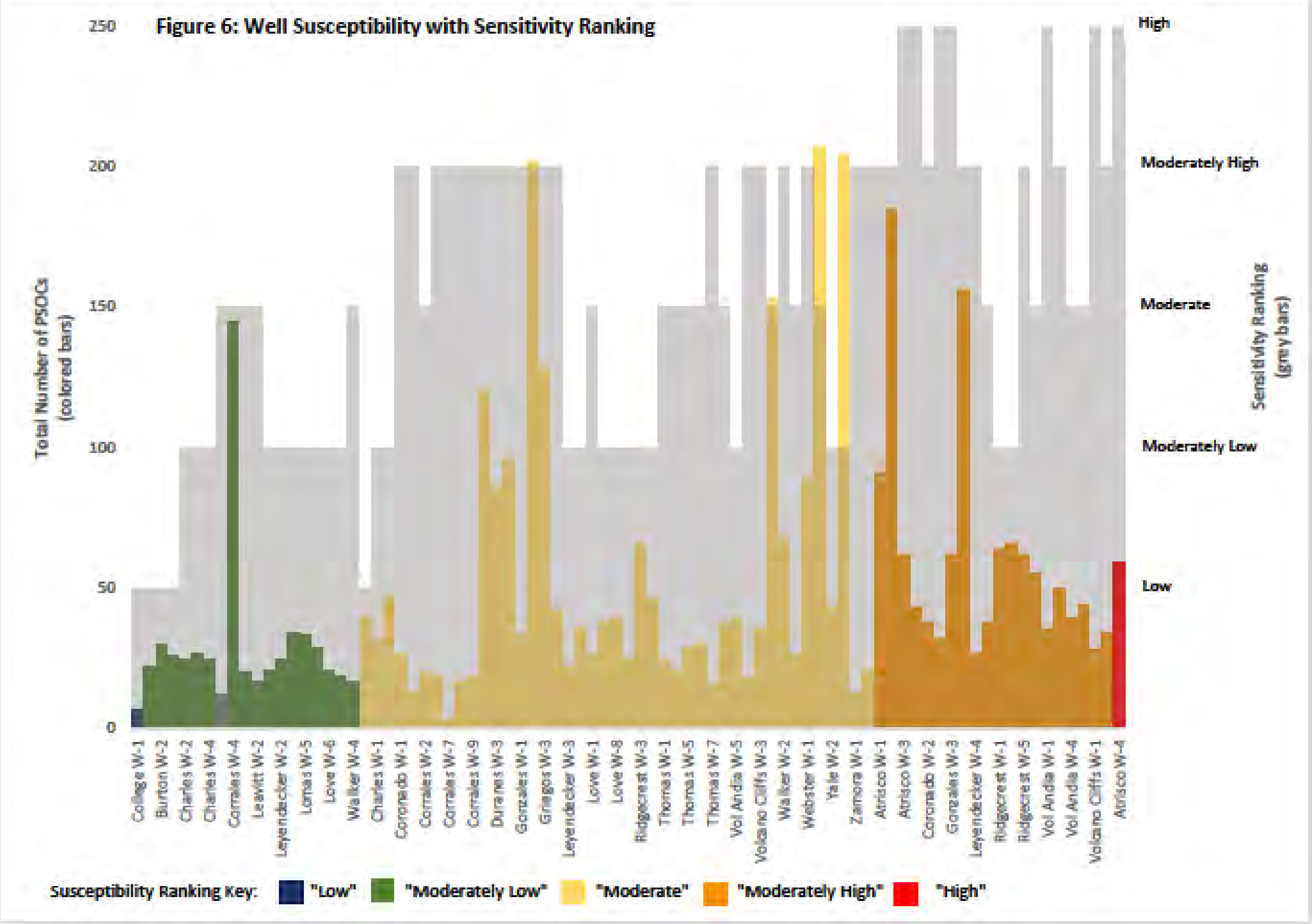

Figure 6: Well Susceptibility with Sensitivity Ranking

on available OSE records; the presence of geothermal wells at this location were not verified for this study.

6.1.2 Volcano Cliffs, Zamora, and Griegos Well Fields

The Volcano Cliffs and Zamora well fields ranked low to moderate in susceptibility. The Griegos well field ranked moderate for susceptibility across all wells in the field.

PSOCs in the area include OSE permitted wells, septic tanks, agricultural fields, parks, automotive land uses, arroyos/drainages, major roads, an electric utility, and automotive body shops. The abandoned Griegos W-2 lies within the SWPA for Griegos W-3 and is labeled as "MWP" (Water Treatment Plants and Water Supply Wells) in the PSOC inventory in Appendix A. According to the Well AMP, the Water Authority has scheduled Griegos W-2 for replacement.

6.1.3 Coronado, Webster, and Walker Well Fields

The Coronado well field ranked moderate to moderately high for susceptibility. The Webster wells ranked moderate to moderately high for susceptibility. The Walker well field ranked moderately low to moderate for susceptibility. The PSOCs in these areas include arroyos, a crushed stone mining operation, a concrete/cement plant, the closed San Antonio municipal landfill, a Brownfield site, a golf course, a metal plating processing facility, electric utilities, an aboveground storage tank, and gasoline service stations. The closed San Antonio municipal landfill is monitored for landfill gas on a semi-annual basis and annually for groundwater, by the City Environmental Health Department.

There are a high number of OSE permitted wells and septic tanks in the Walker W-1 SWPA. This area includes "Albuquerque Acres" where the residents are on private wells and septic tanks. Additionally, this is an area recently added to the Water Authority's service area. Within the Webster W-1 SWPA, the OSE private well data indicate that there is a cluster of 65 geothermal boreholes near the North Domingo Baca Multigenerational Center; the presence of these geothermal boreholes was not verified in the field as part of this study. A City construction equipment storage and motor pool facility exists within the Coronado W-2 SWPA. An abandoned gas well appears in Zone C of the SWPA for Webster W-2; no additional information is available for this well beyond confirmation that it has been abandoned in compliance with the OSE requirements for well abandonment (New Mexico Administrative Code 19.27.4).

6.1.4 College, Gonzales, and Duranes Well Fields

The College wells ranked low to moderately low for susceptibility. The Gonzales well field ranked moderate to moderately high for susceptibility. The Duranes well field ranked moderate for susceptibility. Primary PSOCs in these areas include parks, golf course, arroyos/drainages, agricultural fields, automotive related facilities, utilities, major roads, hardware stores, and OSE permitted wells.

College W-1 had the lowest susceptibility score in this study due to its low sensitivity and vulnerability rankings. The College well field is located on the edge of the developed area in west Albuquerque. At the time of this study, the College well field was mostly inactive due to high arsenic. However, there is an arsenic treatment facility located at College W-2. The parcel representing inactive Duranes W-4 overlaps the SWPAs for Duranes W-3 and Gonzales W-2. Duranes W-4 is inactive because it is filled with sand and Duranes W-6 is inactive because it is sand producing and has not been operated since 2010.

6.1.5 Vol Andia and Santa Barbara Well Fields

The Vol Andia well field ranked moderate to moderately high for susceptibility. The Santa Barbara well ranked moderately high for susceptibility. PSOCs in the area include groundwater abatement sites, a voluntary remediation site, underground storage tanks, automotive body/repair shops, hardware stores, major roads, electrical/ electronic part manufacturing, parks, research labs, and gasoline service stations.

The SWPA for Vol Andia W-6 includes the Digital/Hewlett Packard environmental site. A summary of this site and available groundwater data can be found in Appendix D of this report. The monitoring wells for this site are not included in the OSE database and therefore do not appear as PSOCs for this study. The Geographical Information System (GIS) boundary shown for the

Digital site does not extend to the well; however, based on the recent and historic groundwater monitoring results for contaminants of concern, the susceptibility analysis included this PSOC in all buffer zones.

The SWPAs for Vol Andia W-3 and Santa Barbara W-1 are in close proximity to the Fox and Associates contamination site. This groundwater abatement site is summarized in Appendix D and is currently resuming site investigation efforts by the responsible party. The Vol Andia W-3 and Santa Barbara W-1 wells are located to the north, south, and east of this environmental site.

6.1.6 Leyendecker, Thomas, and Ponderosa Well Fields

The Leyendecker well field ranked moderately low to moderately high for susceptibility. The Thomas well field ranked moderately low to moderate for susceptibility. Ponderosa W-2 ranked moderate for susceptibility. PSOCs in this area include arroyos/drainages, gasoline service stations, major roads, arroyos/drainages, carwashes, and underground storage tanks. The active groundwater discharge permit shown in Zone D for wells Thomas W-1 and W-4 represents the Water Authority's Bear Canyon Aquifer Storage and Recovery demonstration project. Thomas W-2 and W-3, have been abandoned in compliance with the OSE requirements for well abandonment (New Mexico Administrative Code 19.27.4).

6.1.7 Charles and Love Well Fields

The Charles well field ranked moderately low to moderate for susceptibility. The Love well field ranked moderately low to moderately high for susceptibility rankings. PSOCs in the area include the Winrock Town Center Brownfield (which has been remediated and redeveloped), arroyos/drainages, automotive repair shops, paint stores, printing shops, gasoline service stations, a golf course, parks, and underground storage tanks.

Love W-4 had the highest susceptibility ranking in this group due to its higher sensitivity ranking of those in the group and moderate sensitivity ranking. Love W-4 is one of seven wells identified by the Water Authority for monthly sampling in response to the upgradient Kirkland Air Force Base

Bulk Fuels Facility (KAFB BFF) jet fuel leak project. At the time of this study, Love W-1 was not operational because of low flow issues.

Two wells, Charles W-2 and W-5, are proactively sampled for Volatile Organic Compounds (VOCs) on a monthly basis due to the presence of the upgradient KAFB BFF jet fuel leak groundwater contamination site.

6.1.8 Atrisco and Leavitt Well Fields

Wells in the Atrisco well field ranked moderately high to high for susceptibility ranking. Wells in the Leavitt well field ranked moderately low to moderate for susceptibility. PSOCs in this area include private wells, arroyos/drainages, parks, agricultural fields, private wells, arroyos/drainages, and land uses such as dry cleaning and metal processing.

Atrisco W-4 is the only well in this study ranked high for susceptibility. This ranking was due to the well's high sensitivity. This well is greater than 50 years and has shown a decline in well efficiency (specific capacity) and is a sand producing well. Atrisco W-4 has been identified in the Well AMP for replacement. The well's moderately high vulnerability ranking reflects the instance of leaking underground storage tanks, and higher-risk businesses such as metal plating, gasoline service stations, dry cleaner, and automotive.

6.1.9 Yale and Burton Well Fields

The Yale well field ranked moderate for susceptibility. The Burton well field ranked moderately low to moderately high for susceptibility. PSOCs within this area include the Albuquerque International Sunport, the former Yale municipal landfill, the closed Schwartzman private landfill, major roads, underground storage tanks, gasoline service stations, a golf course, automotive body/repair shops, dry cleaning shops, and OSE permitted wells. The KAFB installation boundary crosses into Zone D of the SWPA for Burton W-4.

The Burlington Northern Santa Fe (BNSF) contamination plume extent crossed into Zone D of the SWPA for Yale W-3. A summary of the BNSF groundwater abatement site can be found in

Appendix D. Wells Yale W-3 and Burton W-4 are the nearest wells downgradient of the former Yale municipal landfill where there is known groundwater contamination. These wells are not operational due to high arsenic concentrations. The next nearest downgradient well is Yale W-1 which is sampled on a quarterly basis. A summary of the Yale landfill site is included in Appendix D.

The KAFB BFF jet fuel leak site is to the east of Burton well field. Appendix D includes a summary of this groundwater contamination plume. Due to its close proximity to the fuel plume, Burton W-5 is proactively sampled on a monthly basis for VOCs.

6.1.10 Ridgecrest Well Field

The Ridgecrest well field received rankings from moderate to moderately high for susceptibility. The PSOCs in this area include the KAFB BFF jet fuel leak contamination plume, nitrate contamination plumes on KAFB, hardware stores, automotive body/repair shops, underground storage tanks, KAFB, a voluntary remediation site (Triple S, Inc.), metal processing facilities, gasoline service facilities, parks, a golf course, and veterinary services.

The KAFB BFF contamination plume, as well as the four nitrate plumes located on KAFB, are located south of this well field. Not all of the monitoring wells associated with these sites are in the OSE well database and therefore do not appear in this study. A summary of the KAFB BFF plume along with the nitrate plumes is included in Appendix D. Wells Ridgecrest W-3, W-4, and W-5 are proactively sampled on a monthly basis for VOCs; these wells are the nearest downgradient Water Authority wells to the KAFB BFF plume.

6.1.11 Lomas Well Field

The Lomas well field ranked moderately low to moderate for susceptibility. PSOCs in this well field include underground storage tanks, automotive repair shops, carwashes, construction and open equipment storage, stone, tile and glass manufacturing, parks, and major roads.

7. Recommendations

The actual susceptibility of each groundwater drinking water source depends on a number of factors including infrastructure, hydrogeology, and both known and potential sources of contamination. The Water Authority has evaluated each particular well susceptibility ranking to formulate recommendations for continued source water protection efforts. By evaluating the drivers for each well susceptibility score, the Water Authority has identified priority considerations for the Operations, Compliance, and Water Resources Divisions. The goal of the recommendations listed below are to decrease “high” and “moderately high” susceptibility rankings and maintain “low” and “moderately low” susceptibility rankings.

7.1 Priority Contamination Sites

Proximity and/or occurrence of these contamination plumes within a source water protection area was reviewed to identify priority sites for the Water Authority. If a regulated site and/or delineated groundwater contamination plume is within 1-mile or less and upgradient of a Source Water Protection Area (SWPA), it is considered a priority site for the Water Authority. Identification of priority sites helps to focus resources for the Water Authority and New Mexico Environment Department (NMED) to push rapid progress towards cleanup of contamination, managing the risk to Water Authority wells, and thereby reducing nearby Water Authority well(s) susceptibility to the priority site contamination. The following five groundwater contamination sites are recommended for “Priority” site status as a result of this assessment:

- Digital Equipment/Hewlett Packard
- Kirtland Air Force Base Bulk Fuels Facility (KAFB BFF) jet fuel leak
- Burlington Northern Santa Fe (BNSF)
- Fox and Associates, Inc.
- Sparton
- Former Yale Landfill

For each priority site, it is recommended that the Water Authority:

- Receive copies of correspondence involving the NMED, including letters to/from the Responsible Party and the NMED Project Manager, work plans, reports, and data transmittals.
- Consider adjustments to the rate and suite of analytes (components being examined) for sampling of Water Authority supply wells where a known site is within the source water protection area.
- Advocate for the allocation of NMED and Responsible Party resources to ensure rapid progress towards cleanup of the site.

The Water Authority will maintain the comprehensive list of groundwater contamination sites, staying engaged in site progress. The list of priority sites is meant to emphasize sites nearest Water Authority wells and provide points for focused discussions.

7.2 Monitoring & Coordination

The Water Authority proactively monitors water supply wells near known groundwater contamination sites of concern and coordinates with related agencies, as needed. Water Authority Compliance Division and Water Resources Division employees regularly interact with City and County counterparts to discuss and evaluate emerging issues within the service area. The following recommendations are made to continue and/or expand the Water Authority's current monitoring program:

- Continue monitoring the seven water supply wells identified for increased sampling near the KAFB BFF jet fuel leak site.
- Continue annual monitoring of every water supply well for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and Safe Drinking Water Act (SDWA) regulated compounds, including the sampling of inactive wells as operationally available.

- Continue quarterly monitoring for a suite of VOCs and SVOCs that include tetrachloroethene (PCE) and trichloroethene at wells where contamination could be a concern.
- Use data collected at wells near known contamination sites to communicate with NMED and advocate for more rapid site remediation, if needed.
- Continue regular coordination meetings within the Water Authority between the Operations and Compliance Divisions.
- Regularly evaluate detection limits for current sampling protocols and evaluate potential improvements available with changes in technology and methods of analysis.

7.3 Ordinance and Policy Actions

The following are specific policies and/or actions that are recommended that the Water Authority initiate or endorse for source water protection. These ordinances and policies are mechanisms to proactively address potential impacts to drinking water sources, thereby reducing well susceptibility to contamination. These recommendations are consistent with the approved and final policies in the Water Quality Protection Policy and Action Plan (WQPPAP).

- Support continued enforcement of the City and County liquid waste disposal ordinances.
- Consider incentives, such as rebates, to promote the removal of septic systems when a connection to sanitary sewer service occurs.

Endorse source water protection with respect to oil and gas activities. Continue participation in multi-agency committees such as the Policy Implementation Committee (PIC) and the Mid-Region Council of Governments (MRCOG) where oil and gas technical issues and considerations are discussed.

7.4 Agency Coordination

The Water Authority groundwater source water protection areas span City and County jurisdictions and therefore require close coordination with these agencies. Additionally, several of the Potential Source of Contamination (PSOCs) identified in this assessment are regulated and overseen by the NMED. The results of this study support the continued requirements of the Albuquerque/Bernalillo County Ground-Water Protection Policy and Action Plan adopted in 1993 by the City and County. The following are specific coordination efforts recommended for the Water Authority, City, County, and NMED:

- Continue to support the City and County in their efforts to bring septic systems up-to-date and into compliance with Ordinance Division 10, Sections 42-491 through 42-517.
- Work with the Water Protection Advisory Board to advocate to NMED for the establishment of a “Dry Cleaning Fund” to support the investigation, cleanup, containment, or mitigation of contamination resulting from the releases of dry cleaning contaminants such as PCE. The terms, requirements, and fee structure could be modeled after dry cleaning programs in states like Texas. Advocate for NM joining the State Coalition for Remediation of Drycleaners (https://drycleancoalition.org/) in order share in information and lessons learned from states with established remediation programs.
- Coordinate with the City, County, Albuquerque Public Schools, University of New Mexico, agricultural interests, and private golf courses to provide information and training on best practices for the use of fertilizers, herbicides, and pesticides.
- Coordinate with NMED to receive notifications of spills and/or releases that occur within established source water protection areas, including identification of leaking storage tanks.
- Present the findings and recommendations of this assessment to NMED Ground Water Quality and Hazardous Waste Bureaus to discuss priority sites, the path forward for engagement of the Water Authority, and coordination of information sharing to promote cleanup of groundwater contamination sites.
- Support funding for NMED to build and continuously update a robust database with current land use, site data, and permits.
- Discuss the potential for future changes to zoning laws with City and County planning departments to recognize source water protection areas and restrict land uses that could potentially result in contamination within a SWPA.

7.5 Source Water Protection Outreach

By engaging communities, along with business owners and operators, the Water Authority can proactively work towards preventing future impacts to groundwater. The following outreach efforts are recommended for the Water Authority:

- Coordinate with commercial real estate groups, such as the Commercial Association of Realtor and National Association of Industrial and Office Properties, to ensure completion of due diligence during commercial property sales and transfers. For example, completion of a Phase I Environmental Site Assessment as part of property sale due diligence could confirm or eliminate potential sources of contamination. This could result in corrective actions to remove sources of contamination and address any associated groundwater contamination.
- Partner with the City and County to provide information to business owners and operators on best practices at industrial and commercial properties, including dry cleaners, gas stations, autobody shops, and manufacturing plants.
- Create education materials that can be distributed by the Water Resources group at meetings, outreach events, and online for the use of fertilizers and pesticides.
- Partner with the City and County on community cleanup days for household hazardous waste disposal and prescription take-back stations. The City and County already have a program for hosting cleanup days, and the Water Authority can support these efforts by promoting events through bill inserts and the Water Authority newsletter.

7.6 Future Groundwater Assessment Considerations

This assessment defines the source water protection area for each well as a set of uniform, concentric circles that do not account for water-flow dynamics and the area of capture/influence for a given well. Future updates to this assessment should consider using groundwater modeling to define capture zones for each well that can then be used to better define a well’s source water protection area. A modeling approach will account for groundwater-flow dynamics and, therefore, provide a more representative analysis of well susceptibility to contamination. Once capture zones for each well have been developed, a City and/or County ordinance should be developed to officially recognize source water protection areas and restrict land uses that could potentially be sources of contamination.

The current groundwater assessment sensitivity scoring does not account for whether a Water Authority production well is actively operational. In this current assessment, if a well could potentially be pumped and used as a source of drinking water, it is assigned a sensitivity ranking and scored for susceptibility. This approach is conservative and does not necessarily represent current or planned Water Authority operations. Once the Well Asset Management Plan (AMP) is complete and final, well asset risk scores are assigned; this groundwater assessment should be updated with a sensitivity score that accounts for whether a given well is active or inactive, and whether the Water Authority plans to use the well again, in the future.

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Appendix A

Appendix A

NMED List of Potential Sources of Contamination

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
AGRICULTURAL LAND USE			
AAP	Animal Processing or Rendering Plants	Commercial Operations/Waste Storage/Disposal Facility	Nitrates, Pathogens, Organic/Inorganic Chemicals
ACS	Farm/Ranch Agrochemical Storage Facilities or Sites	Farm/Ranch Storage Site	Pesticides, Herbicides, Fertilizers
ADC	Drainage Canals, Ditches or Acequias-Unlined, Wells (Private, Stock wells, and Irrigation)	Runoff and Infiltration	Pesticides, Herbicides, Fertilizers, Nitrate, Pathogens
ADF	Livestock Production-Dairies	Livestock Wastes, Runoff and Infiltration	Nitrate, Phosphate, Chloride, Pathogens, Pharmaceuticals
AFI	Farming-Irrigated Croplands	Runoff and Infiltration	Nitrate, Ammonia, Chloride, Fertilizers, Pesticides, Herbicides
AFL	Confined Animal Feeding Operations	Runoff and Infiltration of Livestock Wastes	Nitrate, Phosphate, Chloride, Pathogens, Pharmaceuticals
AFM	Farm Machinery Storage or Maintenance Areas	Farm Machinery Maintenance Areas	Automotive Wastes, Welding Wastes, Fuels, Oils, Lubricants
AFN	Farming - Non-irrigated Croplands	Runoff and Infiltration Operations	Nitrate, Ammonia, Chloride, Fertilizers, Pesticides, Herbicides
AHC	Horticultural/Gardens/Nurseries/Greenhouses	Operations/Storage	Pesticides, Herbicides, Fertilizers
AHF	Hay/Feed and Veterinary Product Storage Sites	Farm/Ranch Storage Site	Fungicides, Pesticides, Nitrates, Pharmaceuticals
AMA	Manure or Livestock Waste - Land Application Areas	Land Application of Manure	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
AMS	Manure or Livestock Waste-Storage Facilities or Sites	Lined and Unlined Manure Storage Facilities	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
AOA	Livestock Production-Other Animal	Livestock Wastes	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
APF	Livestock Production - Poultry	Poultry Sewage Wastes	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
APP	Processing Plants or Mills - Hay, Grain, or Produce	Operations, Waste Storage and Disposal	Organic/Inorganic Chemicals, Lubricants, Machinery Wastes
ARL	Animal Rangeland	Rangeland and Pasturage	Nitrate, Ammonia, Phosphate, Chloride, Pesticides, Pathogens
ASC	Bulk Agrochemical Storage-Petroleum/Chemicals	Storage-500 gallons or more	Petroleum Products, Inorganic/Organic Chemicals
ASF	Bulk Agrochemical Storage - Fertilizers	Feed Mill, Agricultural Co-op	Fertilizers

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
ASG	Bulk Agricultural Product Storage-Grain or Produce	Grain Elevator, Warehouse or Storage Site	Fungicides, Oils, Lubricants, Machinery Wastes
ASH	Livestock Production - Sheep	Livestock Sewage Wastes	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
ASP	Bulk Agrochemical Storage-Pesticides	Feed Mill, Agricultural Co-op	Pesticides
ASW	Livestock Production - Swine	Livestock Sewage Wastes	Nitrate, Ammonia, Phosphate, Chloride, Pathogens, Pharmaceuticals
COMMERCIAL LAND USE			
CAI	Airports (Active/Inactive)	Operations/Maintenance/Construction	Aircraft Fuels, Deicers, Batteries, Diesel Fuel, Chlorinated Solvents, Automobile Wastes, Heating Oil, Building Wastes, Sewage, Septage, Pathogens, Pesticides, Fertilizers
CAR	Automotive Repair Shops	Operations/Maintenance/Storage	Solvents, Metals, Automotive Waste, Oils, Gasoline
CAW	Abandoned/Improperly Closed Wells	Storage/Disposal	Organic/Inorganic Chemicals, Brines, Waste Oil, Treated Sewage Effluent, Storm Water Runoff, Process Waste Water, Metals, Pathogens, Nitrate
CBS	Automotive Body Shops	Operations/Maintenance	Paints, Solvents
CBY	Boat Yards/Marinas	Operations/Maintenance	Gasoline, Diesel Fuels, Septage, Wood Treatment Chemicals, Paints, Varnishes, Automotive Wastes, Solvents, Building Wastes
CCG	Camp Grounds-Unsewered	Untreated Domestic Wastewater	Septage, Gasoline, Pesticides, Organic/Inorganic Chemicals
CCE	Cemeteries	Operations/Maintenance	Leachate, Arsenic, Pesticides, Fertilizers
CCW	Car Washes	Unsewered, Without Total Recycling System	Soaps, Detergents, Waxes, Organic/Inorganic Chemicals
CCY	Construction/Demolition Yard/Staging Areas	Storage/Maintenance	Gasoline, Diesel Fuels, Wood Treatment Chemicals, Paints, Varnishes, Automotive Wastes, Solvents, Building Wastes, Explosives, Oil
CDC	Dry Cleaning Shops	Operations/Maintenance	Chlorinated Solvents, Organic/Inorganic Chemicals
CFA	Fuel Storage Tanks - Above Ground	Non-Service Station Tanks	Gasoline, Diesel Fuel, Organic/Inorganic Chemicals
CFB	Fuel Storage Tanks - Below Ground	Non-Service Station Tanks	Gasoline, Diesel Fuel, Organic/Inorganic Chemicals
CFC	Funeral Homes/Crematories	Operations	Biohazard Waste, Organic/Inorganic Chemicals, Septage
CFR	Furniture Repair/Refinishing	Operations	Paints, Solvents, Organic Chemicals

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
CGC	Golf Courses	Operations/Maintenance	Fertilizers, Pesticides, Gasoline, Automotive Wastes, Batteries, Septage
CHG	Historic Gasoline Service Stations	Above/Below Ground Storage Tanks/Operations	Gasoline, Oils, Solvents, Automotive Wastes, Septage
CHM	Home Manufacturing	Operations/Maintenance/Storage	Paints, Solvents, Organic/Inorganic Chemicals
CHN	Hospitals/Nursing Homes - Unsewered	Wastewater Discharge to Septic Tank/Leach Field	Biohazard Waste, Organic/Inorganic Chemicals, Septage, Radiological Waste
CHW	Hardware/Lumber/Parts Stores	Operations/Storage	Pesticides, Fertilizers, Organic/Inorganic Chemicals
CLD	Laundromats - Unsewered	Wastewater Discharge	Detergents, Soaps, Septage
CPP	Photo Processing Laboratories	Operations/Storage	Organic/Inorganic Chemicals
CPR	Printing Shops	Operations/Storage	Solvents, Inks, Dyes, Organic/Inorganic Chemicals
CPS	Paint Stores	Storage	Paint, Solvents
CRL	Research Laboratories	Operations/Maintenance/Storage	Biohazard Waste, Radiological Materials and Waste, Metals, Organic/Inorganic Chemicals
CRY	Railroad Yards and Tracks	Operations/Maintenance/Storage	Diesel Fuel, Pesticides, Organic/Inorganic Chemicals
CSS	Gasoline Service Stations	Above/Below Ground Storage Tanks/Operations	Gasoline, Oils, Solvents, Automotive Wastes, Septage
CST	Commercial Septic Tanks/Leachfields/Leachpits/Cesspools	Storage/Disposal	Septage, Septic Effluent, Pathogens, Nitrate, Ammonia, Chloride
CVS	Veterinary Facilities	Operations/Maintenance	Biohazard Waste, Organic/Inorganic Chemicals, Septage, Radiological Waste
INDUSTRIAL LAND USE			
IAS	Asphalt Plants	Production/Storage	Petroleum Derivatives
ICC	Cement/Concrete Plants	Operations/Maintenance/Storage	Organic/Inorganic Chemicals, Oils, Natural Gas, Propane,
ICE	Communications Equipment Manufacturers	Production/Maintenance/Storage	Solvents, Organic/Inorganic Chemicals, Oils, Waste Oils, Metals
ICL	Chemical Landfills	Storage/Disposal	Leachate of Organic/Inorganic Chemicals, Acids, Bases, Metals, Solvents, Gasoline, Diesel Fuel, Pesticides, PCBs

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
ICP	Chemical Production Plants	Production/Maintenance/Storage	Organic/Inorganic Chemicals, Solvents, Oils, Metals
IEE	Electronic/Electrical Equipment Manufacturers	Production/Maintenance/Storage	Solvents, Organic/Inorganic Chemicals, Oils, Waste Oils, Metals, Acids, Bases
IFM	Furniture and Fixture Manufacturers	Production/Maintenance/Storage	Paints, Solvents, Organic/Inorganic Chemicals
IFW	Foundry/Smelting Plants	Production/Maintenance/Storage	Organic/Inorganic Chemicals, Metals, Solvents, Acids, Bases, Oils
IGO	Gas/Oil Wells - Active/Abandoned/Test, Wells Geothermal and Industrial	Production	Oil, Natural Gas, Organic/Inorganic Chemicals, Acids, Bases, Drilling Wastes
IHD	Historic Dumps/Landfills	Storage/Disposal	Leachate of Organic/Inorganic Chemicals, Acids, Bases, Metals, Solvents, Gasoline, Diesel Fuel, Pesticides, PCB's, Automotive Wastes
IHM	Historic Mining Operations	Production Waste/Storage	Metals, Inorganic Chemicals, Acids, Bases, Radiological Materials
IMI	Primary Metal Industries	Steel/Metal Works, Rolling/Wire Mills	Metals, Inorganic Chemicals, Acids, Bases
IMO	Mining Operations (Surface And Subsurface)	Production Waste/Storage	Metals, Inorganic Chemicals, Acids, Bases, Radiological Materials
IMP	Metal Plating/Processing Facilities	Operations/Maintenance/Storage	Organic/Inorganic Chemicals, Acids, Bases, Metals
IMW	Machine/Metal Working Shops	Operations/Maintenance/Storage	Cutting Oils, Metals, Solvents, Organic/Inorganic Chemicals, Detergents
IOG	Oil/Gas Pipelines	Transport	Oils, Gasoline, Volatile Organic Chemicals, Natural Gas, Propane
IPL	Plastics Manufacturing/Molder	Operations/Maintenance/Storage	Solvents, Oils, Organic/Inorganic Chemicals, Acids, Bases
IPM	Paper Mills	Operations/Maintenance/Storage	Acids, Metals, Organic/Inorganic Chemicals
IPP	Petroleum Production/Refining/ Bulk Plants	Operations/Maintenance/Storage	Oils, Gasoline, Diesel Fuels, Organic Chemicals, Oil Drilling/Refining Wastes
IPU	Public Utilities	Power Generating Stations	PCBs, Solvents, Diesel Fuel, Propane, Natural Gas, Oil, Acids, Bases, Organic/Inorganic Chemicals, Metals
IRG	RCRA Waste Generators - Other	Storage/Disposal	Organic/Inorganic Chemicals, Solvents, Metals, PCB's, Acids, Bases, Radiological Materials
IRW	Radioactive Waste Disposal Sites	Storage/Disposal	High and Low Level Radiological Wastes
ISD	Sumps/Dry Wells	Storage/Disposal	Storm Water Runoff, Organic/Inorganic Chemicals, Solvents, Process Wastewater, Pesticides, Oils

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
ISF	Superfund Sites	Storage/Disposal	Organic/Inorganic Chemicals, Solvents, Metals, PCBs, Acids, Bases, Radiological Materials
ISM	Primary Wood Industries	Saw Mills, Planers, Wood Treatment	Organic/Inorganic Chemicals, Metals, Solvents
IST	Stone, Tile, Glass Manufacturing	Operations/Maintenance/Storage	Solvents, Oils, Metals, Organic/Inorganic Chemicals
ITS	Treatment/Storage/Disposal Ponds/Lagoons	Treatment/Storage	Organic/Inorganic Chemicals, Metals, Acids, Bases, Sewage
ITT	Transport/Distribution, Warehouses, Truck Terminals	Operations/Maintenance/Storage	Gasoline, Diesel Fuels, Automotive Wastes, Metals, Organic/Inorganic Chemicals, Acids, Bases
IUD	Unregulated Dumps/Excavated Sites, Snow Dumps	Storage/Collection/Disposal	Organic/Inorganic Chemicals, Automotive Wastes, Oil, Gasoline, Runoff from Adjacent Sites
IUI	Underground Injection (UIC) Wells	Storage/Disposal	Organic/Inorganic Chemicals, Brines, Waste Oil, Treated Sewage Effluent, Storm Water Runoff, Process Wastewater, Metals, Pathogens, Nitrate
IUR	Utility/Transportation Right of Ways, major transportation corridor	Power Lines, Gas/Oil Pipelines	Pesticides, Gasoline, Diesel Fuels, Automotive Wastes, Organic/Inorganic Chemicals, PCBs, Sewage, Metals, Storm water Runoff, Pathogens
MUNICIPAL/RESIDENTIAL LAND USE			
MHM	Highway/Road Maintenance Yards	Operations/Maintenance/Storage	Gasoline, Diesel Fuels, Solvents, Road Salt, Asphalt, Pesticides, Automotive Wastes,
MHR	Highway Rest Areas	Operations/Maintenance/Storage/Disposal	Automotive Wastes, Septage, Gasoline, Diesel Fuels, Pesticides
MIN	Incinerators - Commercial or Municipal	Operations/Disposal	Metals, Organic/Inorganic Chemicals
MLF	Municipal Waste Landfills	Storage/Disposal	Leachate, Organic/Inorganic Chemicals, Pesticides, Metals, Oils
MMF	Military Facilities	Operations/Maintenance/Storage/Disposal	Gasoline, Aircraft Fuels, Diesel Fuels, Automotive Wastes, Metals, Organic/Inorganic Chemicals, Explosives, Radiological Materials, Pesticides, Sewage/Septage, Oils, Solvents, Fertilizers, Batteries, Deicers
MMP	Motor Pools	Operations/Maintenance/Storage/Disposal	Gasoline, Diesel Fuel, Oils, Waste Oils, Automotive Waste, Batteries, Metals
MPS	Sewage Pump Stations	Operations/Storage	Sewage, Pathogens, Nitrate, Metals, Organic/Inorganic Chemicals
MPW	Polluted Surface Water Sources	Naturally Occurring/Anthropogenic	Sewage, Pathogens, Nitrate, Metals, Acids, Bases, Organic/Inorganic Chemicals
MRF	Recycling Facilities	Operations/Storage/Disposal	Metals, Organic/Inorganic Chemicals, Pesticides, Automotive Wastes, Oils
MRP	Primary Road, Highway, or Arterial	Public Street, Thoroughfare, Highway, or Main Road	Gasoline, Diesel Fuels, Metals, Storm Water Runoff, Hazardous Materials, Radiological Materials

APPENDIX A: POTENTIAL SOURCES OF CONTAMINATION

Map Code	Land Use	Description	Contaminants of Concern*
MSC	Schools - Unsewered	Wastewater Discharge to Septic Tank/Leach Field	Septage, Septic Effluent, Pathogens, Nitrate, Ammonia, Chloride
MSD	Storm Drainage Collection Areas or Outlets-Unlined	Storage/Disposal	Runoff, Pesticides, Fertilizer, Pathogens, Nitrate, Phosphate, Oil
MSL	Sewer Lines	Transport	Sewage, Pathogens, Nitrate, Metals, Organic/Inorganic Chemicals
MSP	Wastewater Seepage/Retention Ponds (Unlined/Lined)	Storage/Disposal	Sewage Effluent, Nitrate, Ammonia, Pathogens, Organic/Inorganic Chemicals, Pesticides
MSS	Sewage Effluent/Sludge Land Application Areas	Storage/Disposal	Sewage/Sewage Sludge, Nitrate, Pathogens, Organic/Inorganic Chemicals, Metals
MST	Sewage Treatment Plants	Operations/Maintenance/Storage/Disposal	Sewage, Sewage Sludge, Metals, Pathogens, Organic/Inorganic Chemicals
MSW	Solid Waste Transfer Stations	Storage/Disposal	Metals, Organic/Inorganic Chemicals, Pesticides, Automotive Wastes, Oils
MWP	Water Treatment Plants and Water Supply Wells	Operations/Maintenance/Storage/Disposal	Organic/Inorganic Chemicals, Chlorine
RSF	Single Family Residences - Unsewered	Wastewater Discharge to Septic Tank/Leach Field or Cesspool	Septage, Pathogens, Nitrate, Ammonia, Chloride, Heavy Metals, Household Pesticides, Herbicides, Cleaning Agents and Solvents, Fuels

* Contaminants of Concern include substances that are commonly, but not always, associated with the Contaminant Source listed in column 2.
Table based on Appendix K from the Source Water Assessment & Protection Program Report Template, July 2004: https://www.env.nm.gov/wp-content/uploads/2017/04/AppendixK.pdf

Appendix B

Appendix B

Contaminants of Concern

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
VOLATILE ORGANIC CHEMICALS			
Benzene	0.005	AAP, APP, CAI, CAR, CBS, CBY, CCY, CDC, CHW, CHM, CHN, CSY, CPP, CPR, CPS, CRL, CRY, CUS, CVS, ICC, ICE, ICL, ICP, IEE, IFW, IFM, IHD, ILS, IMI, IMW, IMP, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITS, ITT, IUD, IUI, IUR, MMF, MMP, MSW	Anemia; decrease in blood platelets; nervous system disorders; immune system depression; increased risk of cancer
Carbon Tetrachloride	0.005	AAP, APP, CAI, CDC, CHM, CHN, CHW, CPP, CPR, CRL, CUS, CVS, ICE, ICL, ICP, IEE, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITS, ITT+, IUD, MLF, MMF, MMP, MSC, MSW	Liver problems; kidney; lung damage; increased risk of cancer
Ortho-Dichlorobenzene	0.6	CAR, CBS, CBY, CCY, CDC, CFR, CHM, CHW, CPP, CPR, CPS, CRL, CRY, CUS, ICE, ICP, ICL, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITS, ITT, IUD, MHM, MMF, MMP, MSC	Liver, kidney, nervous system or circulatory problems
Para-Dichlorobenzene	0.075	ACS, AFI, AFN, AHC, AHF, ASC, ASP, CAR, CDC, CPP, CHW, CPP, CPR, CPS, CRL, CRY, CUS, ICL, ICP, ILS, IMP, IMW, IPL, IPP, IPU, IRG, ISF, ITS, ITT, MMF, MMP, MSC	Eye, respiratory, gastrointestinal tract irritation; anemia; skin lesions; liver, kidney, spleen damage; blood changes
1, 2-Dichloroethane	0.005	ACS, AFI, AFN, AHC, AHF, ASC, ASG, ASP, CFR, CHN, CPP, CPR, CRL, CUS, CVS, ICL, ICP, IEE, IFM, ILS, ITT, IMW, IPL, IPP, IRG, ISD, ISF, IUD, MMF, MSC	Nervous system disorders; lung, kidney, liver, circulatory, gastrointestinal effects; increased risk of cancer
1,1-Dichloroethene	0.007	CPP, CPR, CRL, CUS, ICP, ICL, IHD, ILS, IMW, IPL, IPM, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, MSC	Liver, kidney damage; increased risk of cancer; fetal toxicity
Cis-1, 2-Dichloroethene	0.07	AAP, CAI, CAR, CBS, CCY, CFR, CHG, CHM, CPP, CPR, CPS, CRL, CRY, CSS, CSY, ICP, ICL, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MMF, MMP, MSP, MST	Nervous system disorders; liver, circulatory system damage
Trans-1, 2-Dichloroethene	0.1	AAP, CAI, CAR, CBS, CCY, CFR, CHG, CHM, CPP, CPR, CPS, CRL, CRY, CSS, CSY, IEE, IFM, ICP, ICL, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MMF, MMP, MSP, MST	Nervous system disorders; liver, circulatory system damage
Dichloromethane	0.005	AAP, APP, ACS, AFI, AFN, AHC, AHF, ASC, ASG, ASP, CAI, CAR, CBS, CBY, CCE, CCY, CFC, CFR, CHN, CHW, CHM, CPP, CPR, CPS, CRY, CRL, CSS, CUS, CVS, ICC, ICE, ICP, ICL, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITS, ITT, IUD, MHM, MMF, MMP, MSC, MSP, MSW	Nervous system, liver, blood damage; increased risk of cancer

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
1,2-Dichloropropane	0.1	ACS, AFI, AFN, AHC, AHF, ASC, ASG, ASP, CAW, CPP, CPR, CRL, CUS, ICL, ICP, IHD, ILS, IPM, IPP, IRG, ISD, ISF, ISM, ITT, IUD, IUI, MLF, MSP	Liver, kidney, adrenal glands, bladder, gastrointestinal tract, respiratory tract damage; increased risk of cancer
Ethylbenzene	0.7	CAI, CFR, CHM, CRL, CUS, ICC, ICP, ICL, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MSC, MSP	Eye, liver, kidney, central nervous system damage; respiratory irritation
Chlorobenzene	0.005	CAR, CBS, CDC, CHW, CHM, CPP, CPR, CRL, CUS, ICP, ICL, IEE, IHD, ILS, IMI, IMP, IMW, IPL, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, MMF, MSC, MSP	Liver, kidney, central nervous system damage
Styrene	0.1	CHM, CPP, CPR, CRL, CUS, ICC, ICP, ICL, IEE, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MSP	Liver, kidney, circulatory problems; nerve damage; increased risk of cancer
Tetrachloroethene	0.005	AAP, APP, CAI, CAR, CBS, CCY, CDC, CHM, CHN, CHW, CPP, CPR, CRL, CRY, CSS, CSY, CUS, CVS, ICC, ICL, ICP, IEE, IHD, ILS, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MMF, MMP, MSC, MSP, MWP	Liver, kidney, circulatory problems; nerve damage; increased risk of cancer
Toluene	1	AAP, APP, CFR, CHW, CHM, CHN, CPP, CPR, CRL, CUS, CVS, ICC, ICP, ICL, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, MMF, MSC, MSP, MWP	Nervous system, liver, kidney damage
1,2,4-Trichlorobenzene	0.07	CRL, CUS, ICL, ICP, IHD, ILS, IPM, IPP, IRG, ISD, ISF, ISM, ITS, IUD	Liver, kidney, adrenal gland changes
1,1,1-Trichloroethane	0.2	AAP, APP, CAR, CAI, CBS, CBY, CCY, CDC, CFR, CHM, CHN, CHW, CPP, CPR, CRL, CUS, CVS, ICP, ICL, IEE, IFM, IHD, IHM, ILS, IMI, IMO, IMP, IMW, IPM, IPP, IRG, ISD, ISF, ISM, ITS, ITT, IUD, MHM, MMF, MMP, MSC, MSP, MWP	Liver, nervous system, circulatory problems
1,1,2-Trichloroethane	0.005	AAP, CDC, CPP, CPR, CRL, CUS, ICP, ICL, IEE, IFW, IHD, ILS, IMI, IMP, IMW, IPL, IPP, IRG, ISD, ISF, ITS, IUD, MSP	Liver, kidney, gastrointestinal tract, immune system problems; lung damage; increased risk of cancer

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Trichloroethene	0.005	AAP, AFM, APP, CAI, CAR, CBS, CBY, CFR, CHG, CHM, CHW, CPP, CPR, CRL, CRY, CSY, CUS, ICE, ICL, ICP, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, ITS, ITT, IUD, IUI, MHM, MMF, MMP, MSC, MSP	Liver damage; increased risk of cancer
Vinyl Chloride	0.002	CRL, ICP, ICL, IEE, IHD, IMI, IMP, IMW, IPL, IPP, IRG, ISF, IST, ITT, IUD,	Liver, nervous system damage; increased risk of cancer
Xylenes (Total)	10	AAP, APP, ASC, CAI, CAR, CBS, CBY, CCY, CFR, CHM, CHN, CHW, CPP, CPR, CPS, CRL, CUS, CVS, IAS, ICC, ICL, ICP, IEE, IFM, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITT, IUD, MHM, MMF, MSC, MSP	Central nervous system, liver, kidney damage
SYNTHETIC ORGANIC CHEMICALS: PESTICIDES			
Alachlor	0.002	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CCE, CCG, CGC, CHW, CRL, CRY, CUS, ICL, ICP, IHD, ILS, IPP, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHM, MHR, MMF, MPR, MSC, MSD, MSP	Eye, skin irritation; liver, kidney, spleen, nose, eye damage; increased risk of cancer
Aldicarb	0.003	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAW, CGC, CHW, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IRG, ISD, ISF, ITS, ITT, IUD, MPR, MPW, MSC, MSP	Gastrointestinal, central nervous system, eye problems
Aldicarb Sulfone	0.003	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAW, CGC, CHW, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IRG, ISD, ISF, ITS, ITT, IUD, MPR, MPW, MSC, MSP	Gastrointestinal, central nervous system, eye problems
Aldicarb Sulfoxide	0.003	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAW, CGC, CHW, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IRG, ISD, ISF, ITS, ITT, IUD, MPR, MPW, MSC, MSP	Gastrointestinal, central nervous system, eye problems
Atrazine	0.003	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CAI, CAW, CCG, CCE, CFC, CGC, CHW, CRL, CRY, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHD, MHM, MLF, MMF, MPR, MPW, MSC, MSD, MSP, RMS	Cardiovascular system, kidney, adrenal gland damage; increased risk of cancer
Carbofuran	0.04	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAI, CAW, CCE, CCG, CGC, CHW, CPL, CRL, CST, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHR, MLF, MMF, MPR, MSC, MSD, MSP, RMS	Central nervous system, reproductive system damage

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Chlordane	0.002	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAI, CAW, CBY, CCY, CRL, CST, CUS, ICP, ICL, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MLF, MMF, MPR, MRF, MSC, MSD, MSP, RMS	Central nervous system, blood disorders; liver, kidney, heart, lung, spleen, adrenal gland damage; increased risk of cancer
2, 4-Dichlorophenoxyacetic acid (2,4-D)	0.07	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CAI, CAW, CCE, CCG, CCY, CGC, CHW, CRL, CRY, CST, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MHR, MLF, MMF, MPR, MPW, MSC, MSD, MSP	Nervous system, kidney, liver damage
Dalapon	0.2	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CAI, CAW, CCE, CCG, CCY, CGC, CHW, CRL, CRY, CSY, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHD, MHM, MHR, MLF, MMF, MPR, MPW, MSC, MSD, MSP, RMS	Kidney changes
Dibromochloropropane	0.0002	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAI, CAW, CCE, CGC, CHW, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MMF, MSC, MSD, MSP	Kidney, liver, reproductive system damage; increased risk of cancer
Dinoseb	0.007	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CHW, CRL, ICL, ICP, IHD, IRG, ISD, ISF, ITT, IUD	Reproductive system problems
Diquat	0.02	ACS, ADC, AFI, AFN, AHC, AHF, ARL, ASC, ASG, ASP, CAW, CGC, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IPU, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MMF, MPW, MSD, MSP	Cataracts
Endothall	0.1	ACS, ADC, AFI, AFN, AHC, AHF, ARL, ASC, ASG, ASP, CAI, CAW, CBY, CCE, CCG, CCY, CGC, CHW, CPL, CRL, CRY, CST, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MHR, MLF, MMF, MPR, MPW, MSC, MSD, MSP	Stomach, intestinal problems
Endrin	0.002	ACS, ADC, AFI, AFN, AHC, AHF, ARL, ASC, ASG, ASP, CAW, CRL, CRV, CRY, CST, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHM, MMF	Central nervous system problems; liver damage
Ethylene Dibromide (EDB)	0.00005	ACS, ADC, AHC, APP, ASC, ASG, ASP, CAI, CAW, CFR, CHW, CPP, CPR, CPS, CRL, CUS, ICL, ICP, IFM, IHD, ILS, IPL, IPP, IRG, ISD, ISF, ITS, ITT, IUD, MMF, MSP	Liver, stomach, adrenal gland, reproductive system, respiratory, nervous system, heart, kidney damage; increased risk of cancer

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Glyphosate	0.7	ACS, ADC, AFI, AFN, AHC, AHF, AHF, ARL, ASC, ASP, CAI, CAW, CCE, CCG, CCY, CGC, CHW, CPL, CRL, CRY, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, IUD, IUI, IUR, MHM, MHR, MLF, MMF, MPR, MPW, MSC, MSD, MSP, RMS	Respiratory problems; kidney, reproductive system damage
Heptachlor	0.0004	CAI, CCY, CGC, CPL, CRL, CRV, CRY, ICE, ICL, ICP, IHD, IPP, IPU, ISF, ITT, IUD, IUR, MHM, MMF, MSC	Central nervous system, liver damage; increased risk of cancer
Heptachlor Epoxide	0.0002	CAI, CCY, CGC, CPL, CRL, CRV, CRY, ICE, ICL, ICP, IHD, IPP, IPU, ISF, ITT, IUD, IUR, MHM, MMF, MSC	Central nervous system, liver damage; increased risk of cancer
Hexachlorobenzene	0.001	ACS, ADC, ASC, ASG, ASP, CPP, CPR, CRL, CUS, ICL, ICP, IHD, ILS, IMW, IPL, IPP, IRG, ISF, ITS, ITT, IUD, MMF	Skin lesions; nerve, liver, kidney damage; reproductive system problems; endocrine gland tumors; increased risk of cancer
Hexachlorocylopentadiene	0.05	CRL, CUS, ICL, ICP, IHD, ILS, IPL, IPP, IRG, ISF, ITS, ITT, IUD	Gastrointestinal problems; liver, kidney, heart damage
Lindane	0.0002	ACS, ADC, ADF, AFI, AFL, AFN, AHC, ARL, ASC, ASP, CCY, CHW, CPP, CPR, CRL, CVS, ICL, ICP, IHD, IPM, IPP, IRG, ISF, ISM, ITS, ITT, IUD, MHM, MMF, MSC, MSP	Liver, kidney damage; pulmonary problems
Methoxychlor	0.04	ACS, ADC, ADF, AFI, AFL, AFN, AHC, AHF, ASC, ASG, ASH, ASP, ASW, CBY, CCG, CGC, CHW, CRL, CUS, ICL, ICP, IHD, ILS, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUR, MHD, MHR, MMF, MPR, MSC, MSD	Central nervous system, gastrointestinal tract problems; liver, kidney, heart damage
Oxamyl (Vydate)	0.2	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CAW, CCE, CGC, CHW, CRL, ICL, ICP, IHD, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHM, MLF, MMF, MSC, MSP	Central nervous system problems
Pentachlorophenol	0.001	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CBY, CCY, CFR, CHW, CRL, CRY, ICL, ICP, IFM, IHD, IPM, IPP, IPU, IRG, ISF, ISM, ITT, IUD, MHM, MLF, MMF	Central nervous system damage, liver, kidney, reproductive system damage; increased risk of cancer

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Picloram	0.5	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CAI, CAW, CCE, CCG, CCY, CGC, CHW, CPL, CRL, CRY, ICL, ICP, IHD, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHD, MHM, MHR, MLF, MMF, MPR, MSC, MSD, MSP, RMS	Central nervous system, liver damage
Simazine	0.004	ACS, ADC, AFI, AFN, AHC, ARL, ASC, ASP, CAI, CAW, CBY, CCG, CCE, CCY, CGC, CHW, CPL, CRL, CRY, CSY, ICL, ICP, IHD, IPP, IPU, IRG, ISD, ISF, ITS, ITT, IUD, IUI, IUR, MHD, MHM, MHR, MLF, MMF, MPR, MPW, MSC, MSD, MSP	Reproductive system, blood, kidney, liver, thyroid damage; gene mutation; increased risk of cancer
2,3,7,8-TCDD (Dioxin)	3x10-8	CAI, CRL, ICL, ICP, IEE, IHD, IPP, IPU, ISF, IUD, IUR, MIN, MMF, MSW	Reproductive system problems; birth defects; increased risk of cancer
Toxaphene	0.003	ACS, ADC, AFI, AFL, AFN, APF, ARL, ASC, ASP, CRL, ICL, ICP, IHD, IPP, ISF, IUD	Central nervous system, thyroid problems; liver, kidney degeneration; increased risk of cancer
2,4,5-TP (Silvex)	0.05	ACS, ADC, ARL, ASC, ASP, CBY, CCE, CGC, CRL, CRY, ICL, ICP, IHD, IPP, IPU, ISF, ITT, IUD, IUR, MHM, MLF, MMF	Liver, kidney damage; central nervous system problems
Benzo (a) pyrene	0.0002	AFM, CAI, CAR, CBS, CCY, CFC, CRL, CRY, IAS, ICC, ICL, ICP, IFW, IHD, IMI, IMP, IPL, IPP, IPU, IRG, ISF, IST, ITT, MFS, MHM, MIN, MLF, MMF, MMP, MSC	Anemia; immune system depression; reproductive, developmental problems; increased risk of cancer
Di (2-ethylhexyl) adipate	0.4	AAP, CAI, CAR, CBY, CCY, CHW, CPS, CRL, CST, ICL, ICP, IHD, IMI, IMP, IMW, IPL, IPP, IPU, IRG, ISF, ITS, ITT, IUD, MIN, MLF, MMF, MMP, MSL, MSP, MSS, MST	Liver, reproductive system damage; increased risk of cancer
Di (2-ethylhexyl) phthalate	0.006	AAP, APP, CHM, CHW, CPP, CPR, CRL, CSY, ICE, ICL, ICP, IEE, IHD, IMP, IMW, IPL, IPP, IRG, ISF, IST, ITT, IUD, MHM, MIN, MLF, MMF, MRF, MSW	Liver, reproductive system damage; increased risk of cancer
Polychlorinated Biphenyls (PCB's)	0.0005	ACS, ASC, CAI, CCY, CHM, CRL, CRY, CST, CSY, ICL, ICP, IEE, IHD, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, ISM, ITS, IUD, IUR, MHM, MIN, MLF, MMF, MSS, MST, MSW	Skin problems, thymus gland, reproductive system, immune system problems; liver function changes; increased risk of cancer
INORGANIC CHEMICALS			

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Antimony	0.006	CRL, CSY, ICL, ICP, IEE, IFW, IHD, IMI, IMP, IPL, IPP, IRG, ISF, IST, IUD, MIN, MLF, MSW	Blood changes; increased risk of cancer
Arsenic	0.010	AAP, ACS, ADC, AFI, AFN, AHC, APP, ASC, ASP, CAI, CAR, CBS, CCE, CCY, CFC, CGC, CHM, CHN, CPP, CPR, CRL, CRV, CSY, CVS, ICL, ICP, IEE, IHD, IMI, IMP, IMW, IPM, IPP, IRG, ISF, ISM, IUD, IPU, MLF, MMF, MSC, MSW	Skin damage; circulatory problems; increased risk of cancer
Asbestos	7 MLF (million fibers/Liter)	CAI, CAR, CBS, CBY, CCY, CHM, CHN, CHW, CRL, CRV, CRY, CSY, ICC, ICL, ICP, IHD, IHM, IMI, IMO, IMW, IPU, IRG, ISF, IST, ITT, IUD, MHD, MHM, MIN, MLF, MMF, MMP, MSC, MSW, MWP	Lung disease, increased risk of cancer
Barium	2	CAI, CAR, CAW, CBS, CCY, CFR, CHM, CHN, CHW, CPP, CPR, CRL, CRV, CRY, CSY, CVS, ICC, ICL, ICP, IEE, IFW, IFM, IGO, IHD, IHM, IMI, IPL, IPM, IPP, IPU, IRG, ISF, ISM, IST, ITT, IUD, IUI, IUR, MHM, MIN, MLF, MMF, MMP, MSC, MSW	Gastrointestinal problems; high blood pressure
Beryllium	0.004	CRL, CSY, ICL, ICP, IEE, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPP, IPU, IRG, IRW, ISF, IST, IUD, MIN, MLF, MMF, MSW	Lung, bone damage; increased risk of cancer
Cadmium	0.005	AAP, APP, CAI, CAR, CBS, CBY, CCY, CHG, CHM, CHW, CPP, CPR, CPS, CRL, CRY, CSS, CSY, ICC, ICE, ICL, ICP, IEE, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, ISM, IST, ITT, IUD, IUR, MHM, MIN, MLF, MMF, MMP, MSC, MSP, MSS, MST, MSW, MWP	Gastrointestinal problems; kidney, liver, bone, blood damage
Chromium	0.1	CPP, CPR, CRL, CSY, ICC, ICL, ICP, IEE, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPP, IPU, IRG, ISF, IST, ITS, ITT, IUD, MIN, MLF, MMF, MPW, MSC, MSP, MSS, MST	Skin problems; liver, kidney, circulatory, nerve damage.
Copper	1.3 TT** Action Level	AAP, ACS, ADC, AHC, APF, APP, ASC, ASP, CAR, CBS, CCY, CHM, CHN, CHW, CPP, CPR, CRL, CRY, CST, CSY, CVS, ICL, ICP, IEE, IFM, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, ISM, IST, ITS, ITT, IUD, MIN, MLF, MMF, MSP, MSS, MST, MSW	Gastrointestinal problems; liver, kidney damage; anemia
Cyanide	0.2	ACS, ADC, AFI, AFN, AHC, ASC, ASP, CCY, CHN, CHW, CPP, CPR, CPS, CRL, CST, CUS, CVS, ICL, ICP, IEE, IFW, IHD, ILS, IMI, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISD, ISF, ISM, IST, ITS, ITT, IUD, MHM, MLF, MMF, MPW, MSC, MSS, MST	Thyroid problems; nerve damage

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Fluoride	4	ACS, ADC, ASC, ASF, CCY, ICC, ICL, ICP, IFW, IHM, IMI, IMO, IMP, IST, IUD, MWP	Tooth mottling; bone disease
Lead	0.015 TT**	CAI, CAR, CBS, CBY, CCY, CFR, CHG, CHM, CHN, CHW, CPP, CPR, CPS, CRL, CRY, CSY, ICC, ICL, ICP, IEE, IFM, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, ISM, IST, ITS, ITT, IUD, IUR, MHD, MHM, MIN, MLF, MMF, MMP, MRF, MSC, MSP, MSS, MST, MSW, MWP, RMS	Blood, neurological development problems; kidney disease; stroke; increased risk of cancer
Mercury	0.002	AAP, ACS, ADC, AFI, AFN, AHC, APP, ASC, ASP, CAI, CAR, CBS, CBY, CCY, CFR, CHM, CHN, CHW, CPP, CPR, CRL, CRV, CRY, CST, CSY, CUS, CVS, ICE, ICL, ICP, IEE, IFM, IFW, IHD, IHM, ILS, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, ISM, IST, ITS, ITT, IUD, IUR, MHM, MIN, MLF, MMF, MPW, MRF, MSC, MSP, MSS, MST, MSW	Kidney damage
Nickel	0.1	CAI, CAR, CBS, CBY, CCY, CPP, CPR, CRL, CST, CSY, CUS, ICE, ICL, ICP, IEE, IFW, IHD, IHM, ILS, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, IST, ITS, ITT, IUD, MHM, MIN, MLF, MMF, MMP, MPW, MRF, MSC, MSP, MSS, MST, MSW	Gastrointestinal irritation; nerve, liver, kidney, reproductive system damage
Nitrate	10	AAP, ACS, ADC, ADF, AFI, AFL, AFN, AHC, AMA, AMS, AOA, APF, APP, ARL, ASC, ASF, ASH, ASW, CAI, CAW, CBB, CBY, CCE, CCG, CCW, CCY, CFC, CGC, CHG, CHN, CPL, CPP, CPR, CRL, CST, CVS, ICL, ICP, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, ISD, ISF, ISM, ITS, ITT, IUD, IUR, MHD, MHM, MLF, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MSW, MWP, RMS	Methemoglobinemia; spleen damage
Nitrite	1	AAP, ACS, ADC, ADF, AFI, AFL, AFN, AHC, AMA, AMS, AOA, APF, APP, ARL, ASC, ASF, ASH, ASW, CAI, CAW, CBB, CBY, CCG, CCE, CCW, CCY, CFC, CGC, CHG, CHN, CPL, CPP, CPR, CRL, CST, CVS, ICL, ICP, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, ISD, ISF, ISM, ITS, ITT, IUD, IUR, MHD, MHM, MLF, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MSW, MWP, RMS	Methemoglobinemia; spleen damage
Selenium	0.05	ADC, AFI, AFN, ARL, CPP, CPR, CRL, ICC, ICL, ICP, IEE, IFW, IHD, IHM, IMI, IMO, IMP, IMW, IPL, IPM, IPP, IPU, IRG, ISF, IST, IUD, MHM, MIN, MLF, MMF, MPW, MSC, MSS, MST, MSW	Peripheral nervous system, kidney, liver, circulatory system damage
Thallium	0.002	CHN, CPP, CRL, ICC, ICE, ICL, ICP, IEE, IFW, IHD, IHM, IMI, IMO, IMP, IPL, IPP, IPU, IRG, ISF, IUD, IUR, MIN, MLF, MMF, MSS, MST, MSW	Blood chemistry changes; nerve, liver, kidney, intestinal, reproductive system damage
RADIONUCLIDES			

Name of Contaminant	MCL *	Potential Contaminant Source (by Contaminant Code)***	Health Effects
Beta Particles and Photon Emitters	4 Millirems per year	CAW, CHN, CRL, IGO, IHM, IMO, IRG, IRW, ISF, MMF, MWP	Increased risk of cancer
Gross Alpha Particle Activity	15 Picocuries per Liter	CAW, CHN, CRL, IGO, IHM, IMO, IRG, IRW, ISF, MMF, MWP	Increased risk of cancer
Radium 226 and Radium 228 (Combined)	5 Picocuries per Liter	CAW, CHN, CRL, IGO, IHM, IMO, IRG, IRW, ISF, MMF, MWP	Increased risk of cancer
MICROBIOLOGICAL (Pathogenic organisms)			
Crytosporidium parvum	TT**	AAP, ADC, ADF, AFL, AMA, AMS, AOA, APF, APP, ARL, ASH, ASW, CAW, CBY, CCG, CFC, CHN, CPL, CRV, CSS, CST, CVS, ISD, ITS, IUI, IUR, MHD, MHR, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MWP, RMS	Cryptosporidiosis (a gastroenteric disease)
Giardia lambia	TT**	AAP, ADC, ADF, AFL, AMA, AMS, AOA, APF, APP, ARL, ASH, ASW, CAW, CBY, CCG, CFC, CHN, CPL, CRV, CSS, CST, CVS, ISD, ITS, IUI, IUR, MHD, MHR, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MWP, RMS	Giardiasis (a gastroenteric disease)
Legionella sp.	TT**	ADC, CBY, ITS, MPW, MSD, MSP, MWP	Legionnaire's Disease; pneumonia
Total Coliforms (Including Fecal Coliform & E coli)	5 Percent (See NOTE 1)	AAP, ADC, ADF, AFL, AMA, AMS, AOA, APF, APP, ARL, ASH, ASW, CAW, CBY, CCG, CFC, CHN, CPL, CRV, CSS, CST, CVS, ISD, ITS, IUI, IUR, MHD, MHR, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MWP, RMS	Used as an indicator that other potentially harmful bacteria may be present (see NOTE 2)
Turbidity	TT**	ADC, CBY, CCG, CCW, CCY, CGC, CPL, CRV, CRY, ICC, IHD, IHM, IMO, IPM, IUD, IUR, MHD, MHM, MHR, MIN, MLF, MMF, MPR, MPW, MRF, MSC, MSD, MSL, MSP, MSS, MST, MSW, RMS	Turbidity has no health effects but can interfere with disinfection and provide a medium for bacterial growth. It may indicate the presence of microbes
Viruses (Enteric)	TT**	AAP, ADC, ADF, AFL, AMA, AMS, AOA, APF, APP, ARL, ASH, ASW, CAW, CBY, CCG, CFC, CHN, CPL, CRV, CSS, CST, CVS, ISD, ITS, IUI, IUR, MHD, MHR, MMF, MPR, MPS, MPW, MSC, MSD, MSL, MSP, MSS, MST, MWP, RMS	Gastroenteric disease

* Values listed are in units of milligrams per liter (mg/L) and are U.S. Environmental Protection Agency (EPA) National Drinking Water Standards for the Maximum Contaminant Level (MCL), May 2009: https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf.
** Treatment Technique from EPA National Drinking Water Standards; a required process intended to reduce the level of a contaminant in drinking water.
*** Contaminant codes can be found in Appendix B of this document.
Table from Appendix L of New Mexico Environment Department Drinking Water Bureau "Source Water Assessment & Protection Program Report of New Mexico Water Utility, Public Water System #12345 (for ground water systems)" dated July 2004: https://www.env.nm.gov/wp-content/uploads/2017/04/2004-July_NM-Assessment_Template_GroundWater.pdf.
NOTE 1: No more than 5% samples total coliform-positive in a month.
NOTE 2: Fecal coliform and E. coli bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

Appendix C

PSOC Inventory and Vulnerability Analysis

Explanation: PSOC code

ADF - Livestock productions - dairy
AFL - Confine animal feeding operation
APF - Livestock production - poultry
ARL - Animal rangeland
ASF - Bulk agrochemical storage - fertilizers
ASP - Bulk agrochemical storage - pesticides
CAI - Airports
CAR - Automotive repair shops
CBS - Automotive body shop
CCE - Cemeteries
CCW - Carwash
CCY - Construction/demolition yard/staging area
CDC - Dry-cleaning shop
CFC - Funeral homes/crematories
CFR - Furniture repair/refinishing
CGC - Golf course
CHW - Hardware/lumber/parts stores
CPP - Photo-processing labs
CPR - Printing shops
CPS - Paint stores
CRL - Research labs
CRY - Railroad yards and tracks
CSS - Gasoline service station
CVS - Veterinary facilities
IAS - Asphalt plants
ICC - Concrete/cement plants
ICP - Chemical production plants
IEE - Electronic/electrical equipment manufacturing
IFM - Furniture and fixture manufacturing
IFW - Foundry/smelting
IMO - Mining operations
IMP - Metal plating/processing facility
IOG - Oil/gas pipelines
IPL - Plastics manufacturing
IPP - Petroleum production/refining/bulk plants
IPU - Public utilities
ISM - Primary wood industries
IST - Stone, tile, and glass manufacturing
IUR - Utility/transportation right of ways, major transportation corridor
MLF - Municipal waste landfill
MMF - Military facilities
MMP - Motor pool
MSP - Sewage seepage/retention
MST - Sewage treatment plant
MWP - Water treatment plants and water supply wells

ALBUQUERQUE BERNALILLO COUNTY WATER UTILITY AUTHORITY

Potential Sources of Contamination
Code List

Table C-1. PSOC Codes and Corresponding Land Use Codes

Appendix K PSOC Code	PSOC Code Description	Corresponding Land Use Code	Description
CVS	Veterinary facilities	2152	Pet shop
CSS	Gasoline service station	2531	Gas station
CSS	Gasoline service station	2532	Gas station (self serve only)
CSS	Gasoline service station	2533	Gas station (self service w/carwash)
CSS	Gasoline service station	2534	Truck stop
CSS	Gasoline service station	2535	Gas station w convenience store and/or fast food restaurant
CHW	Hardware/lumber/parts stores	2700	Building materials and hardware
CHW	Hardware/lumber/parts stores	2711	Construction materials and tools
CHW	Hardware/lumber/parts stores	2712	Hardware, paint, glass
CFC	Funeral homes/crematories	3121	Funeral homes
CFC	Funeral homes/crematories	3122	Mausoleum, crematorium
CCE	Cemeteries	3124	Cemetery
CCE	Cemeteries	3125	Pet cemetery
CVS	Veterinary facilities	3127	Pet grooming and kennel services
CDC	Dry-cleaning shop	3130	Laundry and dry cleaning
CPP	Photo-processing labs	3151	Photo studio
CPP	Photo-processing labs	3152	Photo development
CPP	Photo-processing labs	3153	Photo development (w/drive-up)
CRL	Research labs	3413	Medical labs
CRL	Research labs	3434	Research services
CVS	Veterinary facilities	3435	Veterinary facilities
CBS	Automotive body shop	3710	Auto: paint, body, upholstery
CAR	Automotive repair shops	3711	Auto repair and maintenance
CCW	Carwash	3712	Full service car wash
CCW	Carwash	3714	Self-serve car wash
CFR	Furniture repair/refinishing	3723	Furniture and upholstery repair
CAR	Automotive repair shops	3810	Bus parking/maintenance
CAR	Automotive repair shops	3811	Bus parking/maintenance

Table C-1. PSOC Codes and Corresponding Land Use Codes

Appendix K PSOC Code	PSOC Code Description	Corresponding Land Use Code	Description
MMP	Motor pool	3821	Taxi/ limo service
MMP	Motor pool	3825	Vehicle rentals
MMP	Motor pool	4110	Autos & auto equipment
ASF	Bulk agrochemical storage - fertilizers	4154	Agricultural chemicals and fertilizers
CHW	Hardware/lumber/parts stores	4170	Construction materials and supplies
CHW	Hardware/lumber/parts stores	4171	Building hardware and tools
CHW	Hardware/lumber/parts stores	4176	Lumber and general materials
CHW	Hardware/lumber/parts stores	4326	Hardware and building materials
IST	Stone, tile, and glass mfg.	5300	Wood, stone, clay, and glass mfg.
ISM	Primary wood industries	5310	Wood and lumber processing
ICC	Concrete/cement plants	5320	Concrete, plaster, and stone products
ICC	Concrete/cement plants	5322	Concrete pipe mfg.
IST	Stone, tile, and glass mfg.	5326	Stone products
ICC	Concrete/cement plants	5331	Construction cement
IST	Stone, tile, and glass mfg.	5334	Ceramic tile
IST	Stone, tile, and glass mfg.	5350	Glass and glass products
IST	Stone, tile, and glass mfg.	5351	Construction and building related glass
IST	Stone, tile, and glass mfg.	5352	Glassware and glass products mfg.
IPP	Petroleum production/refining/bulk plants	5420	Bulk Petroleum
CCY	Construction/demolition yard/staging area	5440	Construction and equipment open storage
CPR	Printing shops	5500	Printing and related industries
CPR	Printing shops	5511	Periodicals and book printing
CPR	Printing shops	5520	Commercial printing studios and other related services
CPR	Printing shops	5522	Commercial/artistic printing studios
ICP	Chemical production plants	5600	Chemical mfg. and processing
IPP	Petroleum production/refining/bulk plants	5611	Gases and fuels mfg.
IAS	Asphalt plants	5711	Paving and roofing compounds
IPL	Plastics manufacturing	5731	Plastics mfg.

Table C-1. PSOC Codes and Corresponding Land Use Codes

Appendix K PSOC Code	PSOC Code Description	Corresponding Land Use Code	Description
IEE	Electronic/electrical equipment mfg.	5830	Electrical related machinery mfg.
IEE	Electronic/electrical equipment mfg.	5831	Electric transmission equipment and tools
IEE	Electronic/electrical equipment mfg.	5834	Electrical lighting mfg.
IEE	Electronic/electrical equipment mfg.	5837	Electrical components mfg.
IEE	Electronic/electrical equipment mfg.	5838	Computer and computer components mfg.
IMP	Metal plating/processing facility	5850	Metal products mfg.
IMP	Metal plating/processing facility	5853	Construction related metal manufacturing
IFW	Foundry/smelting	5857	Wire products mfg.
IMP	Metal plating/processing facility	5858	Recycled metal mfg.
IFM	Furniture and fixture mfg.	5877	Furniture mfg.
IMO	Mining operations	5900	Mining and extractive industry related
IMO	Mining operations	5912	Metals extraction and mining
IMO	Mining operations	5921	Dimension stone extraction
IMO	Mining operations	5922	Crushed stone, sand, and gravel extraction
IMO	Mining operations	5924	Clay and refractory minerals mining
ICC	Concrete/cement plants	5925	Sand, gravel, concrete and related (including strg.)
IMO	Mining operations	5931	Coal mining
IMO	Mining operations	5941	Crude petroleum and natural gas extraction
CRY	Railroad yards and tracks	6110	Railroad transportation
CRY	Railroad yards and tracks	6114	Railroad maintenance and repair
CAI	Airports	6150	Aircraft transportation related
CAI	Airports	6152	Airports and flying fields
IUR	Utility/transportation right of ways, major transportation corridor	6160	Public right of way
IPU	Public utilities	6300	Utilities land and facilities
IPU	Public utilities	6310	Electric utility
IPU	Public utilities	6312	Electric substation
IPU	Public utilities	6313	Electric transmission line
IPU	Public utilities	6320	Gas utility related

Table C-1. PSOC Codes and Corresponding Land Use Codes

Appendix K PSOC Code	PSOC Code Description	Corresponding Land Use Code	Description
IOG	Oil/gas pipelines	6321	Gas storage and distribution facilities
MWP	Water treatment plants and water supply wells	6330	Water utilities related
MWP	Water treatment plants and water supply wells	6331	Municipal water well sites
MWP	Water treatment plants and water supply wells	6334	Water treatment facility
MST	Sewage treatment plant	6341	Treatment plant
MSP	Sewage seepage/ retention	6342	Sewage ponding site
MLF	Municipal waste landfill	6350	Solid waste disposal facilities
MLF	Municipal waste landfill	6351	Sanitary landfill
MMF	Military facilities	7543	Military bases and installations
CGC	Golf course	8220	Public golf course
CGC	Golf course	8221	Private golf course
ARL	Animal rangeland	9141	Livestock grazing
AFL	Confine animal feeding operation	9142	Livestock feeding
ADF	Livestock productions - dairy	9150	Dairy production
APF	Livestock production - poultry	9160	Poultry production related

Table C-2. Calculation of Vulnerability, Corrales Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Corrales W-1	A	—	Arroyo/drainage	1	4	4	1	3.9	23.9	Low
	B	—	Arroyo/drainage	2	4	3	2	3.8		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Park	4	3	1	2	2.7		
Corrales W-2	A	—	Major road	1	6	4	1	5.5	47.7	Moderately low
	B	—	Arroyo/drainage	2	4	3	2	3.8		
		MSD	Stormwater pond	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		MSD	Stormwater pond	1	4	2	1	3.6		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Major road	2	6	1	2	5.1		
		CGC	Golf course	1	3	1	1	2.6		
		—	Park	1	3	1	1	2.6		
Corrales W-4	B	—	Arroyo/drainage	1	4	3	1	3.7	35.9	Low
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		—	Groundwater permit, ceased - APS - Martin Luther King Elementary	1	4	1	1	3.4		
		—	Major road	2	6	1	2	5.1		

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Table C-2. Calculation of Vulnerability, Corrales Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Corrales W-4 (cont.)	D (cont.)	—	Park	3	3	1	2	2.7	35.9	Low
		—	Private well	132	4	1	5	3.6		
Corrales W-5	A	—	Arroyo/drainage	1	4	4	1	3.9	39.4	Low
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Park	1	3	3	1	2.9		
	C	—	Park	3	3	2	2	2.8		
		CFB	Storage tank, underground	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		—	Park	3	3	1	2	2.7		
		—	Major road	2	6	1	2	5.1		
Corrales W-7	D	—	Arroyo	1	4	1	1	3.4	6.9	Low
		MSD	Stormwater pond	2	4	1	2	3.5		
Corrales W-8	A	—	Major road	1	6	4	1	5.5	39.9	Low
	B	—	Major road	1	6	3	1	5.3		
	C	—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		MSD	Stormwater pond	3	4	1	2	3.5		
		—	Major road	3	6	1	2	5.1		
		RSF	Septic tank	2	8	1	2	6.7		
		—	Park	3	3	1	2	2.7		
Corrales W-9	A	—	Park	1	3	4	1	3.1	35.5	Low
	B	—	Park	1	3	3	1	2.9		
		—	Major road	1	6	3	1	5.3		
	C	—	Park	1	3	2	1	2.8		

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Table C-2. Calculation of Vulnerability, Corrales Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Corrales W-9 (cont.)	C (cont.)	IUR	Utility/transportation right of way, major transportation corridor	1	6	2	1	5.2	35.5	Low
		—	Major road	1	6	2	1	5.2		
	D	MSD	Stormwater pond	4	4	1	2	3.5		
		—	Park	8	3	1	3	2.7		
		—	Major road	1	6	1	1	5.0		

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Table C-3. Calculation of Vulnerability, Volcano Cliffs, Zamora, and Griegos Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Griegos W-1	A	—	Arroyo/drainage	1	4	4	1	3.9	69.3	Moderately low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Private well	5	4	3	3	3.8		
		RSF	Septic tank	2	8	3	2	7.0		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		AFI	Agricultural field	5	4	2	3	3.7		
		—	Major road	2	6	2	2	5.2		
		—	Private well	55	4	2	4	3.7		
	D	AFI	Agricultural field	29	4	1	4	3.6		
		—	Arroyo/drainage	2	4	1	2	3.5		
		CBS	Automotive body shop	1	8	1	1	6.6		
		IPU	Public utilities	2	4	1	2	3.5		
		—	Major road	3	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Private well	90	4	1	4	3.6		
Griegos W-3	A	AFI	Agricultural field	7	4	4	3	4.0	50.3	Moderately low
	B	AFI	Agricultural field	9	4	3	3	3.8		
		—	Private well	2	4	3	2	3.8		
	C	AFI	Agricultural field	9	4	2	3	3.7		
		—	Private well	12	4	2	4	3.7		
	D	AFI	Agricultural field	14	4	1	4	3.6		
		—	Arroyo/drainage	2	4	1	2	3.5		
		CBS	Automotive body shop	1	8	1	1	6.6		
		—	Major road	2	6	1	2	5.1		

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Table C-3. Calculation of Vulnerability, Volcano Cliffs, Zamora, and Griegos Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Griegos W-3 (cont.)	D (cont.)	—	Park	1	3	1	1	2.6	50.3	Moderately low
		RSF	Septic tank	2	8	1	2	6.7		
		—	Private well	67	4	1	4	3.6		
Griegos W-4	A	—	Arroyo/drainage	1	4	4	1	3.9	81.2	Moderate
		—	Major road	1	6	4	1	5.5		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	2	6	3	2	5.4		
		—	Private well	2	4	3	2	3.8		
	C	AFI	Agricultural field	2	4	2	2	3.6		
		—	Arroyo/drainage	1	4	2	1	3.6		
		—	Park	1	3	2	1	2.8		
		—	Private well	7	4	2	3	3.7		
		RSF	Septic tank	4	8	2	2	6.8		
		IPU	Electric utility	1	5	2	1	4.4		
		—	Major road	2	6	2	2	5.2		
	D	AFI	Agricultural field	21	4	1	4	3.6		
		—	Arroyo/drainage	1	4	1	1	3.4		
		IPU	Electric utility	2	5	1	2	4.3		
		—	Major road	4	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		RSF	Septic tank	5	8	1	3	6.7		
		—	Private well	96	4	1	4	3.6		
Volcano Cliffs W-1	A	—	Arroyo/drainage	1	4	4	1	3.9	44.5	Moderately low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		

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Table C-3. Calculation of Vulnerability, Volcano Cliffs, Zamora, and Griegos Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Volcano Cliffs W-1 (cont.)	C (cont.)	—	Major road	1	6	2	1	5.2	44.5	Moderately low
		—	Private well	1	4	2	1	3.6		
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Major road	1	6	1	1	5.0		
		—	Park	1	3	1	1	2.6		
		RSF	Septic tank	2	8	1	2	6.7		
		—	Private well	13	4	1	4	3.6		
Volcano Cliffs W-2	B	—	Arroyo/drainage	1	4	3	1	3.7	14.3	Low
	C	—	Arroyo/drainage	2	4	2	2	3.6		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		—	Private well	13	4	1	4	3.6		
Volcano Cliffs W-3	A	—	Arroyo/drainage	1	4	4	1	3.9	46.7	Moderately low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		MSD	Stormwater pond	1	4	3	1	3.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		MSD	Stormwater pond	1	4	2	1	3.6		
		—	Private well	1	4	2	1	3.6		
	D	—	Arroyo/drainage	6	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Major road	2	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		RSF	Septic tank	2	8	1	2	6.7		
		—	Private well	17	4	1	4	3.6		

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Table C-3. Calculation of Vulnerability, Volcano Cliffs, Zamora, and Griegos Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Zamora W-1	A	—	Major road	1	6	4	1	5.5	33.7	Low
	B	—	Major road	1	6	3	1	5.3		
	C	—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		—	Major road	3	6	1	2	5.1		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Park	1	3	1	1	2.6		
Zamora W-2	A	—	Arroyo/drainage	1	4	4	1	3.9	39.6	Low
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	2	4	3	2	3.8		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		—	Major road	4	6	1	2	5.1		
		—	Private well	3	4	1	2	3.5		
		—	Park	1	3	1	1	2.6		

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Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Coronado W-1	B	—	Arroyo/drainage	1	4	3	1	3.7	74.9	Moderately low
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CCW	Carwash	2	8	1	2	6.7		
		CCE	Cemetery	1	3	1	1	2.6		
		CSS	Gasoline service station	1	8	1	1	6.6		
		—	Major road	4	6	1	2	5.1		
		IMO	Mining operations - crushed stone, sand, and gravel extraction	1	6	1	1	5.0		
		IMP	Metal plating/processing facility	1	6	1	1	5.0		
		—	Park	2	3	1	2	2.7		
		—	Private well	2	4	1	2	3.5		
		CFB	Storage tank, underground	1	8	1	1	6.6		
Coronado W-2	A	—	Major road	1	6	4	1	5.5	126.9	Moderately high
		IMP	Metal plating/processing facility	1	6	4	1	5.5		
	B	—	Major road	1	6	3	1	5.3		
		IMP	Metal plating/processing facility	1	6	3	1	5.3		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		CBS	Automotive body shop	2	8	2	2	6.8		
		CAR	Automotive repair shop	3	8	2	2	6.8		
		ICC	Concrete/cement plant	2	6	2	2	5.2		

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Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Coronado W-2 (cont.)	C (cont.)	—	Landfill	1	9	2	1	7.6	126.9	Moderately high
		CFB	Storage tank, underground	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		—	Closed landfill	1	9	1	1	7.4		
		ICC	Concrete/cement plant	2	6	1	2	5.1		
		—	Major road	4	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	3	4	1	2	3.5		
		RSF	Septic tank	1	8	1	1	6.6		
		CFB	Storage tank, underground	1	8	1	1	6.6		
Walker W-1	B	—	Arroyo/drainage	2	4	3	2	3.8	56.4	Moderately low
		RSF	Septic tank	7	8	3	3	7.0		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Private well	2	4	2	2	3.6		
		RSF	Septic tank	8	8	2	3	6.9		
	D	—	Arroyo/drainage	7	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Major road	3	6	1	2	5.1		

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Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Walker W-1 (cont.)	D (cont.)	—	Private well	62	4	1	4	3.6	56.4	Moderately low
		IPU	Electric utility	1	5	1	1	4.2		
		RSF	Septic tank	58	8	1	4	6.8		
Walker W-2	B	—	Arroyo/drainage	1	4	3	1	3.7	40.1	Low
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	6	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Major road	4	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	20	4	1	4	3.6		
		RSF	Septic tank	31	8	1	4	6.8		
Walker W-3	A	CGC	Golf course	1	3	4	1	3.1	62.9	Moderately low
		—	Park	1	3	4	1	3.1		
		IPU	Electric utility	1	5	4	1	4.7		
	B	CGC	Golf course	1	3	3	1	2.9		
		IPU	Electric utility	1	5	3	1	4.5		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		MSD	Stormwater pond	1	4	2	1	3.6		
		CGC	Golf course	1	3	2	1	2.8		
		IPU	Electric utility	1	5	2	1	4.4		
		—	Park	1	3	2	1	2.8		

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Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Walker W-3 (cont.)	D	—	Arroyo/drainage	2	4	1	2	3.5	62.9	Moderately low
		MSD	Stormwater pond	2	4	1	2	3.5		
		CGC	Golf course	1	3	1	1	2.6		
		IPU	Electric utility	1	5	1	1	4.2		
		—	Major road	4	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	4	4	1	2	3.5		
Walker W-4	A	—	Major road	1	6	4	1	5.5	43.6	Low
	B	—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	1	6	2	1	5.2		
		CGC	Golf course	1	3	2	1	2.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CGC	Golf course	1	3	1	1	2.6		
		—	Major road	4	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		IPU	Electric utility	1	5	1	1	4.2		
Webster W-1	B	—	Major road	1	6	3	1	5.3	68.0	Moderately low
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CCE	Cemetery	1	4	1	1	3.4		
		CSS	Gasoline service station	1	3	1	1	2.6		

"The Vulnerability Scores were determined in Excel using additional significant digits and may not exactly match a sum of numbers in the 'PSOC' column."

Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Webster W-1 (cont.)	D (cont.)	—	Major road	3	8	1	1	6.6	68.0	Moderately low
		—	Park	4	6	1	2	5.1		
		—	Private well	66	3	1	2	2.7		
		CFB	Storage tank, underground	1	4	1	4	3.6		
		IUD	Unregulated dump	1	8	1	1	6.6		
		MWP	Water treatment plant	2	10	1	1	8.2		
		IUR	Utility/transportation right of way	1	2	1	2	1.9		
		CVS	Veterinary services	1	6	1	1	5.0		
Webster W-2	A	—	Arroyo/drainage	1	4	4	1	3.9	103.6	Moderate
		—	Major road	1	6	4	1	5.5		
		—	Park	2	3	4	2	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
		—	Park	2	3	3	2	3.0		
		CCE	Cemetery	1	3	3	1	2.9		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	1	6	2	1	5.2		
		CCE	Cemetery	1	3	2	1	2.8		
		CFC	Funeral home/crematory	1	6	2	1	5.2		
		IGO	Gas well, temporarily abandoned	1	5	2	1	4.4		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CCE	Cemetery	1	3	1	1	2.6		

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Table C-4. Calculation of Vulnerability, Coronado, Webster, and Walker Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Webster W-2 (cont.)	D (cont.)	CCW	Carwash	1	8	1	1	6.6	103.6	Moderate
		CSS	Gasoline service station	1	8	1	1	6.6		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		
		—	Private well	3	4	1	2	3.5		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		IUR	Utility/transportation right of way	1	6	1	1	5.0		

"The Vulnerability Scores were determined in Excel using additional significant digits and may not exactly match a sum of numbers in the 'PSOC' column."

Table C-5. Calculation of Vulnerability, College, Gonzales, and Duranes Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences		PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
College W-1	C	—	Arroyo/drainage	1		4	2	1	3.6	9.7	Low
	D	—	Arroyo/drainage	5		4	1	3	3.5		
		—	Park	1		3	1	1	2.6		
College W-2	A	—	Arroyo/drainage	1		4	4	1	3.9	37.6	Low
		—	Park	1		3	4	1	3.1		
	B	—	Arroyo/drainage	1		4	3	1	3.7		
		—	Park	1		3	3	1	2.9		
	C	—	Arroyo/drainage	1		4	2	1	3.6		
		—	Park	1		3	2	1	2.8		
		—	Major road	1		6	2	1	5.2		
	D	—	Arroyo	3		4	1	2	3.5		
		IPU	Electric utility	1		5	1	1	4.2		
		—	Major road	1		6	1	1	5.0		
Duranes W-2	B	—	Park	1		3	3	1	2.9	44.4	Moderately low
		—	Private well	1		4	3	1	3.7		
	C	—	Private well	5		4	2	3	3.7		
		—	Park	1		3	2	1	2.8		
	D	—	Arroyo/drainage	2		4	1	2	3.5		
		AFI	Agricultural field	7		4	1	3	3.5		
		CDC	Dry cleaning shop	1		9	1	1	7.4		
		RSF	Septic tank	2		8	1	2	6.7		
		—	Major road	3		2	1	1	1.8		
		—	Private well	96		6	1	2	5.1		

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Table C-5. Calculation of Vulnerability, College, Gonzales, and Duranes Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences		PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Duranes W-3	B	—	Park	1		3	3	1	2.9	51.6	Moderately low
	C	—	Private well	1		4	2	1	3.6		
		—	Park	1		3	2	1	2.8		
	D	AFI	Agricultural field	9		4	1	3	3.5		
		—	Arroyo/drainage	1		4	1	1	3.4		
		CSS	Gasoline service station	1		8	1	1	6.6		
		—	Major road	3		6	1	2	5.1		
		MWP	Water supply wells (out of service Water Authority wells)	1		2	1	2	1.9		
		—	Private well	63		4	1	4	3.6		
		RSF	Septic tank	1		8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1		6	1	1	5.0		
		IPU	Electric utility	1		5	1	1	4.2		
		—	Park	1		3	1	1	2.6		
Duranes W-7	B	—	Private well	3		4	3	2	3.8	48.1	Moderately low
		RSF	Septic tank	1		8	3	1	6.9		
	C	AFI	Agricultural field	3		4	2	2	3.6		
		—	Arroyo/drainage	2		4	2	2	3.6		
		—	Private well	18		4	2	4	3.7		
		RSF	Septic tank	1		8	2	1	6.8		
	D	AFI	Agricultural field	9		4	1	3	3.5		
		—	Arroyo/drainage	2		4	1	2	3.5		
		—	Park	2		3	1	2	2.7		
		RSF	Septic tank	1		8	1	1	6.6		
		—	Private well	54		4	1	4	3.6		

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Table C-5. Calculation of Vulnerability, College, Gonzales, and Duranes Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences		PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Gonzales W-1	B	—	Major road	1		6	3	1	5.3	68.9	Moderately low
	C	IPU	Electric utility	1		5	2	1	4.4		
		—	Major road	1		6	2	1	5.2		
	D	—	Arroyo/drainage	3		4	1	2	3.5		
		MSD	Stormwater pond	3		4	1	2	3.5		
		MWP	Water treatment plant	1		2	1	1	1.8		
		CAR	Automotive repair shop	2		8	1	2	6.7		
		CCW	Carwash	3		8	1	2	6.7		
		CSS	Gasoline service station	3		8	1	2	6.7		
		CGC	Golf course	1		3	1	1	2.6		
		CHW	Hardware/lumber/parts store	1		6	1	1	5.0		
		—	Major road	6		6	1	3	5.1		
		—	Park	3		3	1	2	2.7		
		—	Private well	3		4	1	2	3.5		
		CFB	Storage tank, underground	2		8	1	2	6.7		
Gonzales W-2	A	—	Park	1		3	4	1	3.1	71.3	Moderately low
	B	—	Park	1		3	3	1	2.9		
	C	—	Arroyo/drainage	1		4	2	1	3.6		
		—	Major Road	1		6	2	1	5.2		
		—	Park	2		3	2	2	2.8		
	D	AFI	Agricultural field	1		4	1	1	3.4		
		—	Arroyo/drainage	5		4	1	3	3.5		
		CAR	Automotive repair shop	2		8	1	2	6.7		
		CSS	Gasoline service station	3		8	1	2	6.7		

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Table C-5. Calculation of Vulnerability, College, Gonzales, and Duranes Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Gonzales W-2 (cont.)	D (cont.)	CHW	Hardware/lumber/parts store	1	6	1	1	5.0	71.3	Moderately low
		—	Major road	7	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	2	4	1	2	3.5		
		RSF	Septic tank	1	8	1	1	6.6		
		IPU	Electric utility	2	5	1	2	4.3		
		CFB	Storage tank, underground	1	8	1	1	6.6		
Gonzales W-3	A	CAR	Automotive repair shop	1	8	4	1	7.1	116.9	Moderate
	B	CAR	Automotive repair shop	1	8	3	1	6.9		
		CFB	Storage tank, underground	1	8	3	1	6.9		
		—	Major road	2	6	3	2	5.4		
	C	CAR	Automotive repair shop	1	8	2	1	6.8		
		CCW	Carwash	2	8	2	2	6.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		CFB	Storage tank, underground	1	8	2	1	6.8		
		—	Major road	3	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CAR	Automotive repair shop	3	8	1	2	6.7		
		CSS	Gasoline service station	4	8	1	3	6.7		
		CGC	Golf course	1	3	1	1	2.6		
		CCW	Carwash	1	8	2	1	6.8		
		—	Major road	6	6	1	3	5.1		
		—	Park	2	3	1	2	2.7		

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Table C-5. Calculation of Vulnerability, College, Gonzales, and Duranes Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Gonzales W-3 (cont.)	C (cont.)	—	Private well	23	4	1	4	3.6	116.9	Moderate
		RSF	Septic tank	2	8	1	2	6.7		
		IPU	Electric utility	2	5	1	2	4.3		
		CFB	Storage tank, underground	2	8	1	2	6.7		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Santa Barbara W-1	B	CBS	Automotive body shop	1	8	3	1	6.9	141.3	Moderately high
		MMP	Motor pool	1	8	3	1	6.9		
	C	CBS	Automotive body shop	3	8	2	2	6.8		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		MMP	Motor pool	1	8	2	1	6.8		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		MSD	Stormwater pond	2	4	1	2	3.5		
		CBS	Automotive body shop	7	8	1	3	6.7		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		—	Contamination plume - Fox & Associates Albuquerque	1	10	1	1	8.2		
		CFR	Furniture repair and manufacturing	2	7	1	2	5.9		
		CSS	Gasoline service station	2	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	5	6	1	3	5.1		
		—	Hazardous waste facility - Safety Kleen - Albuquerque	1	6	1	1	5.0		
		CFB	Storage tank, underground leaking (LUST)	2	8	1	2	6.7		
		—	Major road	4	6	1	2	5.1		
		IMP	Metal processing facility	1	9	1	1	7.4		
		—	North Diversion Channel	1	4	1	1	3.4		
		—	Park	2	3	1	2	2.7		
		CPR	Printing shop	2	7	1	2	5.9		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Santa Barbara W-1 (cont.)	D (cont.)	—	Private well	2	4	1	2	3.5	141.3	Moderately high
		IPU	Electric utility	1	5	1	1	4.2		
		IST	Stone, tile, and glass manufacturing	3	7	1	2	5.9		
		CFB	Storage tank, underground	3	8	1	2	6.7		
Vol Andia W-1	A	—	Arroyo/drainage	1	4	4	1	3.9	103.0	Moderate
	B	—	Arroyo/drainage	1	4	3	1	3.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	2	8	1	2	6.7		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		
		—	Major road	8	6	1	3	5.1		
		IMP	Metal processing facility	1	9	1	1	7.4		
		—	North Diversion Channel	1	4	1	1	3.4		
		CPR	Printing shop	2	7	1	2	5.9		
		—	Private well	2	4	1	2	3.5		
		IPU	Electric utility	2	5	1	2	4.3		
		CRL	Research laboratory	1	6	1	1	5.0		
		—	Groundwater permit, terminated - Albuquerque Six-Plex Theatre	1	4	1	1	3.4		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-1 (cont.)	D (cont.)	CFB	Storage tank, underground	2	8	1	2	6.7	103.0	Moderate
		CVS	Veterinary services	1	6	1	1	5.0		
		RSF	Septic tank	1	8	1	1	6.6		
Vol Andia W-2	A	—	Arroyo/drainage	1	4	4	1	3.9	91.6	Moderate
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	2	4	3	2	3.8		
		—	Park	1	3	3	1	2.9		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Park	1	3	2	1	2.8		
		—	Major road	2	6	2	2	5.2		
		CVS	Veterinary services	1	6	2	1	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CBS	Automotive body shop	1	8	1	1	6.6		
		CAR	Automotive repair shop	3	8	1	2	6.7		
		CCW	Carwash	2	8	1	2	6.7		
		CSS	Gasoline service station	3	8	1	2	6.7		
		—	Major road	5	6	1	3	5.1		
		—	Park	3	3	1	2	2.7		
		CPP	Photo-processing laboratory	2	7	1	2	5.9		
		CPR	Printing shop	1	7	1	1	5.8		
		CFB	Storage tank, underground	2	8	1	2	6.7		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-3	A	—	Arroyo/drainage	1	4	4	1	3.9	132.4	Moderately high
	B	—	Arroyo/drainage	3	4	3	2	3.8		
		—	Park	1	3	3	1	2.9		
		—	Major road	1	6	3	1	5.3		
		CPP	Photo-processing laboratory	1	7	3	1	6.1		
	C	—	Arroyo/drainage	3	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		CRL	Research laboratory (medical laboratory)	1	6	2	1	5.2		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		—	Contamination plume - Fox & Associates Albuquerque	1	10	1	1	8.2		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	5	6	1	3	5.1		
		IMP	Metal processing facility	1	9	1	1	7.4		
		—	North Diversion Channel	1	4	1	1	3.4		
		—	Park	6	3	1	3	2.7		
		CPR	Printing shop	1	7	1	1	5.8		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-3 (cont.)	D (cont.)	—	Private well	5	4	1	3	3.5	132.4	Moderately high
		CRL	Research laboratory (medical lab)	1	6	1	1	5.0		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Vol Andia W-4	A	—	Arroyo/drainage	1	4	4	1	3.9	134.5	Moderately high
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	1	6	2	1	5.2		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		CCW	Carwash	1	8	2	1	6.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		IPU	Electric utility	1	5	2	1	4.4		
		MMP	Motor pool	1	8	2	1	6.8		
	D	—	Arroyo/drainage	1	4	1	1	3.4		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	5	8	1	3	6.7		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	3	8	1	2	6.7		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CSS	Gasoline service station	2	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-4 (cont.)	D (cont.)	—	Major road	4	6	1	2	5.1	134.5	Moderately high
		CPR	Printing shop	1	7	1	1	5.8		
		—	Private well	1	4	1	1	3.4		
		CRL	Research laboratory	1	6	1	1	5.0		
		CFB	Storage tank, underground	4	8	1	2	6.7		
		MMP	Motor pool	1	8	1	1	6.6		
Vol Andia W-5	A	—	Arroyo/drainage	1	4	4	1	3.9	121.2	Moderately high
		IMP	Metal processing facility	1	9	4	1	7.9		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		IMP	Metal processing facility	1	9	3	1	7.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	2	6	2	2	5.2		
		—	North diversion channel	1	4	2	1	3.6		
		CPR	Printing shop	1	7	2	1	6.0		
		—	Private well	1	4	2	1	3.6		
		IMP	Metal processing facility		9	2	1	7.6		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CSS	Gasoline service station	3	8	1	2	6.7		
		—	Major road	7	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		CPP	Photo-processing laboratory	1	7	1	1	5.8		
		CPR	Printing shop	1	7	1	1	5.8		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-5 (cont.)	D (cont.)	—	Private well	1	4	1	1	3.4	121.2	Moderately high
		RSF	Septic tank	3	8	1	2	6.7		
		IPU	Electric utility	1	5	1	1	4.2		
		—	Groundwater permit, terminated - Albuquerque Six-Plex Theater	1	4	1	1	3.4		
		—	North Diversion Channel	1	4	1	1	3.4		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Vol Andia W-6	A	—	Contamination plume - Digital/Hewlett Packard	1	10	5	1	8.8	144.7	Moderately high
	B	—	Contamination plume - Digital/Hewlett Packard	1	10	5	1	8.8		
	C	—	Contamination plume - Digital/Hewlett Packard	1	10	5	1	8.8		
		—	Major road	2	6	2	2	5.2		
		CBS	Automotive body shop	1	8	2	1	6.8		
	D	—	Contamination plume - Digital/Hewlett Packard	1	10	5	1	8.8		
		—	Abatement site - Compaq/Digital	1	6	1	1	5.0		
		—	Arroyo/drainage	3	4	1	2	3.5		
		CFB	Storage tank, underground	4	8	1	2	6.7		
		CBS	Automotive body shop	5	8	1	3	6.7		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	3	8	1	2	6.7		
		IEE	Electronic/electrical equipment manufacturing	2	9	1	2	7.5		

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Table C-6. Calculation of Vulnerability, Vol Andia and Santa Barbara Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Vol Andia W-6 (cont.)	D (cont.)	CSS	Gasoline service station	2	8	1	2	6.7	144.7	Moderately high
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		
		—	Major road	6	6	1	3	5.1		
		CPR	Printing shop	1	7	1	1	5.8		
		IPU	Electric utility	1	5	1	1	4.2		
		CRL	Research laboratory	1	6	1	1	5.0		
		CVS	Veterinary services	1	6	1	1	5.0		
		MMP	Motor pool	1	8	1	1	6.6		
		—	Groundwater permit, terminated - Former Digital Equipment Corporation	1	4	1	1	3.4		
		—	Voluntary remediation site - First Federal Bank @ Digital	1	10	1	1	8.2		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Leyendecker W-1	A	—	Major road	1	6	4	1	5.5	72.0	Moderately low
		—	Park	1	3	4	1	3.1		
	B	—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	CDC	Dry-cleaning shop	1	9	2	1	7.6		
		—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CSS	Gasoline service station	4	8	1	2	6.7		
		—	Major road	3	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		RSF	Septic tank	1	8	1	1	6.6		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Leyendecker W-2	A	—	Major road	1	6	4	1	5.5	69.6	Moderately low
	B	—	Major road	2	6	3	2	5.4		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service station	3	8	1	2	6.7		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Leyendecker W-2 (cont.)	D (cont.)	RSF	Septic tank	1	8	1	1	6.6	69.6	Moderately low
		CFB	Storage tank, underground	2	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Leyendecker W-3	A	—	Major road	1	6	4	1	5.5	83.0	Moderate
	B	—	Major road	1	6	3	1	5.3		
		—	Private well	1	4	3	1	3.7		
	C	—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	1	8	1	1	6.6		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CCW	Carwash	2	8	1	2	6.7		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CGC	Golf course	1	3	1	1	2.6		
		MMP	Motor pool	1	8	1	1	6.6		
		—	Major road	5	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	1	4	1	1	3.4		
		CFB	Storage tank, underground	1	8	1	1	6.6		
Leyendecker W-4	A	—	Major road	1	6	4	1	5.5	81.3	Moderate
	B	CGC	Golf course	1	3	3	1	2.9		
		—	Major road	2	6	3	2	5.4		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Leyendecker W-4 (cont.)	C	MSD	Stormwater pond		4	2	1	3.6	81.3	Moderate
		CGC	Golf course	1	3	2	1	2.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CGC	Golf course	1	3	1	1	2.6		
		CSS	Gasoline service station	3	8	1	2	6.7		
		—	Major road	4	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Ponderosa W-2	B	—	Major road	1	6	3	1	5.3	84.1	Moderate
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CFA	Storage tank facility, aboveground (AST)	1	8	2	1	6.8		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		CCW	Carwash	1	8	2	1	6.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ponderosa W-2 (cont.)	D	—	Arroyo/drainage	3	4	1	2	3.5	84.1	Moderate
		MSD	Stormwater pond	1						
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	5	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	1	4	1	1	3.4		
		IPU	Electric utility	1	5	1	1	4.2		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		CVS	Veterinary Services	1	6	1	1	5.0		
Thomas W-1	A	CHW	Hardware/lumber/parts store	1	6	4	1	5.5	76.6	Moderately low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		CSS	Gasoline service station	2	8	3	2	7.0		
		—	Major road	2	6	3	2	5.4		
		CFB	Storage tank, underground	1	8	3	1	6.9		
	C		Arroyo/drainage	1	4	2	1	3.6		
		CSS	Gasoline service station	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	CSS	Gasoline service station	1	8	1	1	6.6		
		MMP	Motor pool	1	8	1	1	6.6		
		—	Groundwater permit, active - Bear Canyon Recharge Demonstration Project	1	2	1	1	1.8		
		—	Arroyo/drainage	4	4	1	2	3.5		
		—	Major road	3	6	1	2	5.1		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Thomas W-1 (cont.)	D (cont.)	RSF	Septic tank	1	8	1	1	6.6	76.6	Moderately low
		—	Park	2	3	1	2	2.7		
Thomas W-4	A	—	Arroyo/drainage	1	4	4	1	3.9	61.0	Moderately low
		—	Major road	1	6	4	1	5.5		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		—	Park	1	3	2	1	2.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		—	Park	1	3	1	1	2.6		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Groundwater permit, active - Bear Canyon Recharge Demonstration Project	1	2	1	1	1.8		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	4	6	1	2	5.1		
		MMP	Motor pool	1	8	1	1	6.6		
Thomas W-5	A	—	Arroyo/drainage	1	4	4	1	3.9	98.9	Moderate
		—	Major road	1	6	4	1	5.5		
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Thomas W-5 (cont.)	C	—	Arroyo/drainage	2	4	2	2	3.6	98.9	Moderate
		CFB	Storage tank, underground leaking (LUST)	1	8	2	1	6.8		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
		—	Private well	1	4	2	1	3.6		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	CCW	Carwash	2	8	1	2	6.7		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	4	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		RSF	Septic tank	2	8	1	2	6.7		
		CFB	Storage tank, underground	1	8	1	1	6.6		
		CVS	Veterinary services	1	6	1	1	5.0		
Thomas W-6	A	—	Major road	1	6	4	1	5.5	81.7	Moderate
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	2	6	3	2	5.4		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
		—	Private well	3	4	2	2	3.6		
		CFB	Storage tank, underground	1	8	2	1	6.8		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Thomas W-6 (cont.)	C (cont.)	CFB	Storage tank, underground leaking (LUST)	1	8	2	1	6.8	81.7	Moderate
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		
		—	Private well	1	4	1	1	3.4		
		CFB	Storage tank, underground	1	8	1	1	6.6		
Thomas W-7	A	—	Arroyo/drainage	2	4	4	2	3.9	35.5	Low
	B	—	Arroyo/drainage	2	4	3	2	3.8		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	3	4	2	2	3.6		
		—	Park	1	3	2	1	2.8		
		—	Major road	1	6	2	1	5.2		
	D	—	Major road	4	6	1	2	5.1		
		—	Private well	1	4	1	1	3.4		
		—	Park	1	3	1	1	2.6		
Thomas W-8	A	—	Major road	1	6	4	1	5.5	42.5	Low
		—	Park	1	3	4	1	3.1		
	B	—	Major road	1	6	3	1	5.3		
		—	Park	2	3	3	2	3.0		
	C	—	Major road	1	6	2	1	5.2		
		—	Park	2	3	2	2	2.8		

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Table C-7. Calculation of Vulnerability, Leyendecker, Thomas, and Ponderosa Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Thomas W-8 (cont.)	D	—	Arroyo/drainage	3	4	1	2	3.5	42.5	Low
		—	Carwash	1	8	1	1	6.6		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Charles W-1	A	—	Park	1	3	4	1	3.1	96.8	Moderate
	B	—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	CBS	Automotive body shop	1	8	2	1	6.8		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		CFB	Storage tank, underground	1	8	2	1	6.8		
		IPU	Electric utility	1	5	2	1	4.4		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo	3	4	1	2	3.5		
		CAR	Automotive repair shop	6	8	1	3	6.7		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	6	6	1	3	5.1		
		—	Park	2	3	1	2	2.7		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		
		CVS	Veterinary services	1	6	1	1	5.0		
Charles W-2	A	—	Arroyo/drainage	1	4	4	1	3.9	66.1	Moderately low
		—	Major road	2	6	4	2	5.5		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	2	6	3	2	5.4		
	C	—	Arroyo/drainage	3	4	2	2	3.6		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Charles W-2 (cont.)	C (cont.)	—	Major road	5	6	2	3	5.3	66.1	Moderately low
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	—	Arroyo/drainage	6	4	1	3	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		—	Brownfield - Winrock Town Center	1	4	1	1	3.4		
		—	Major road	7	6	1	3	5.1		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Park	3	3	1	2	2.7		
		IPU	Electric utility	2	5	1	2	4.3		
Charles W-3	B	CHW	Hardware/lumber/parts store	1	6	3	1	5.3	61.3	Moderately low
	C	CAR	Automotive repair shop	2	8	2	2	6.8		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		—	Major road	2	6	2	2	5.2		
		CVS	Veterinary services	1	6	2	1	5.2		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		CAR	Automotive repair shop	5	8	1	3	6.7		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	7	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		IPU	Electric utility	1	5	1	1	4.2		
Charles W-4	A	—	Major road	1	6	4	1	5.5	53.1	Moderately low
	B	—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	1	4	2	1	3.6		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Charles W-4 (cont.)	C (cont.)	—	Major road	2	6	2	2	5.2	53.1	Moderately low
		—	Park	2	3	2	2	2.8		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		—	Brownfield - Winrock Town Center	1	4	1	1	3.4		
		CSS	Gasoline service station	1	8	1	1	6.6		
		—	Major road	5	6	1	3	5.1		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Park	5	3	1	3	2.7		
Charles W-5	B	—	Arroyo/drainage	1	4	3	1	3.7	114.8	Moderate
		—	Major road	2	6	3	2	5.4		
	C	CAR	Automotive repair shop	1	8	2	1	6.8		
		—	Major road	3	6	2	2	5.2		
		—	Private well	1	4	2	1	3.6		
	D	—	Arroyo/drainage	6	4	1	3	3.5		
		CBS	Automotive body shop	2	8	1	2	6.7		
		CAR	Automotive repair shop	3	8	1	2	6.7		
		CCY	Construction/demolition yard/staging area	1	6	1	1	5.0		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		CSS	Gasoline service station	5	8	1	3	6.7		
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		
		—	Major road	6	6	1	3	5.1		
		MMP	Motor pool	2	8	1	2	6.7		
		—	Park	4	3	1	2	2.7		
		IPU	Electric utility	2	5	1	2	4.3		
		IST	Stone, tile, and glass manufacturing	1	7	1	1	5.8		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Charles W-5 (cont.)	D (cont.)	CFB	Storage tank, underground	1	8	1	1	6.6	114.8	Moderate
		CFB	Storage tank, underground leaking (LUST)	2	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
		—	Voluntary remediation site - Thriftway - Wright Gallery	1	10	1	1	8.2		
Love W-1	A	—	Major road	1	6	4	1	5.5	69.5	Moderately low
	B	—	Park	1	3	3	1	2.9		
		—	Major road	1	6	3	1	5.3		
		CFC	Funeral home/crematory	1	6	3	1	5.3		
	C	CFC	Funeral home/crematory	1	6	2	1	5.2		
		CSS	Gasoline service station	2	8	2	2	6.8		
		—	Park	1	3	2	1	2.8		
		—	Major road	2	6	2	2	5.2		
		CFB	Storage tank, underground	2	8	2	2	6.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		—	Park	3	3	1	2	2.7		
		CSS	Gasoline service station	3	8	1	2	6.7		
		IPU	Public utilities	1	4	1	1	3.4		
		—	Major road	4	6	1	2	5.1		
Love W-3	A	—	Park	1	3	4	1	3.1	78.2	Moderately low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		CGC	Golf course	1	3	3	1	2.9		
		—	Major road	2	6	3	2	5.4		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	1	4	2	1	3.6		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Love W-3 (cont.)	C (cont.)	CGC	Golf course	1	3	2	1	2.8	78.2	Moderately low
		—	Major road	2	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CFC	Funeral home/crematory	1	6	1	1	5.0		
		CGC	Golf course	1	3	1	1	2.6		
		CSS	Gasoline service station	4	8	1	2	6.7		
		—	Major road	3	6	1	2	5.1		
		MMF	Military facilities	1	9	1	1	7.4		
		—	Park	3	3	1	2	2.7		
		CFB	Storage tank, underground	2	8	1	2	6.7		
Love W-4	A	—	Arroyo/drainage	1	4	4	1	3.9	119.0	Moderately high
		CGC	Golf course	1	3	4	1	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		CGC	Golf course	1	3	3	1	2.9		
		—	Major road	2	6	3	2	5.4		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CAR	Automotive repair shop	1	8	2	1	6.8		
		CGC	Golf course	1	3	2	1	2.8		
		CSS	Gasoline service station	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Love W-4 (cont.)	D (cont.)	CBS	Automotive body shop	1	8	1	1	6.6	119.0	Moderately high
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		CGC	Golf course	1	3	1	1	2.6		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		CSS	Gasoline service station	1	8	1	1	6.6		
		—	Major road	4	6	1	2	5.1		
		MMF	Military facilities	1	9	1	1	7.4		
		—	Park	3	3	1	2	2.7		
		—	Private well	1	4	1	1	3.4		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary services	4	6	1	2	5.1		
Love W-6	C	—	Major road	1	6	2	1	5.2	74.5	Moderately low
		RSF	Septic tank	1	8	2	1	6.8		
	D	—	Arroyo/drainage	1	4	1	1	3.4		
		CBS	Automotive body shop	2	8	1	2	6.7		
		CAR	Automotive repair shop	4	8	1	2	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service tank	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	4	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	1	4	1	1	3.4		
		IPU	Electric utility	1	5	1	1	4.2		
		CFB	Storage tank, underground	1	8	1	1	6.6		
		CVS	Veterinary services	1	6	1	1	5.0		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Love W-7	A	—	Arroyo/drainage	1	4	4	1	3.9	109.0	Moderate
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		CPP	Photo-processing laboratory	1	7	2	1	6.0		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	2	8	1	2	6.7		
		CAR	Automotive repair shop	4	8	1	2	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service station	3	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		
		—	Major road	5	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		CPP	Photo-processing lab	2	7	1	2	5.9		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		

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Table C-8. Calculation of Vulnerability, Charles and Love Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Love W-8	A	—	Arroyo/drainage	1	4	4	1	3.9	89.5	Moderate
		—	Major road	2	6	4	2	5.5		
	B	—	Arroyo/drainage	2	4	3	2	3.8		
		—	Major road	3	6	3	2	5.4		
		—	Park	1	3	3	1	2.9		
		IPU	Public utilities	1	4	3	1	3.7		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	3	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
		IPU	Public utilities	1	4	2	1	3.6		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CBS	Automotive body shop	3	8	1	2	6.7		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		
		RSF	Septic tank	1	8	1	1	6.6		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		CVS	Veterinary services	2	6	1	2	5.1		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Atrisco W-1	A	AFI	Agricultural field	1	4	4	1	3.9	86.9	Moderate
	B	AFI	Agricultural field	2	4	3	2	3.8		
		—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
		—	Private well	3	4	3	2	3.8		
	C	AFI	Agricultural field	3	4	2	2	3.6		
		—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Private well	4	4	2	2	3.6		
	D	AFI	Agricultural field	20	4	1	4	3.6		
		—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	2	4	1	2	3.5		
		CBS	Automotive body shop	2	8	1	2	6.7		
		CCE	Cemetery	1	3	1	1	2.6		
		—	Closed landfill	1	9	1	1	7.4		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		—	Major road	3	6	1	2	5.1		
		IMP	Metal processing facility	1	9	1	1	7.4		
		—	Private well	31	4	1	4	3.6		
		RSF	Septic tank	6	8	1	3	6.7		
Atrisco W-2	A	—	Arroyo/drainage	1	4	4	1	3.9	127.0	Moderately high
		—	Private well	1	4	4	1	3.9		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		AFI	Agricultural field	1	4	3	1	3.7		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Atrisco W-2 (cont.)	B	IPU	Electric utility	1	5	3	1	4.5	127.0	Moderately high
	C	AFI	Agricultural field	4	4	2	2	3.6		
		—	Arroyo/drainage	4	4	2	2	3.6		
		MSD	Stormwater pond	1	4	2	1	3.6		
		—	Drainage	1	4	2	1	3.6		
		IPU	Electric utility	1	5	2	1	4.4		
		—	Major road	1	6	2	1	5.2		
		—	Private well	1	4	2	1	3.6		
	D	AFI	Agricultural field	12	4	1	4	3.6		
		—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	3	4	1	2	3.5		
		CBS	Automotive body shop	3	8	1	2	6.7		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		CCE	Cemetery	1	3	1	1	2.6		
		CFR	Furniture repair and manufacturing	2	7	1	2	5.9		
		CSS	Gasoline service station	3	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	4	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	121	4	1	5	3.6		
		RSF	Septic tank	6	8	1	3	6.7		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		
		CVS	Veterinary facilities	1	6	1	1	5.0		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Atrisco W-3	A	—	Arroyo/drainage	1	4	4	1	3.9	114.9	Moderate
	B	—	Arroyo/drainage	1	4	3	1	3.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CSS	Gasoline service station	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
		IPU	Electric utility	1	5	2	1	4.4		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	AFI	Agricultural field	3	4	1	2	3.5		
		—	Arroyo/drainage	7	4	1	3	3.5		
		MSD	Stormwater pond	2	4	1	2	3.5		
		CAR	Automotive repair shop	1	8	1	1	6.6		
		CBS	Automotive body shop	3	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		CFR	Furniture repair and manufacturing	2	7	1	2	5.9		
		CSS	Gasoline service station	4	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	2	6	1	2	5.1		
		—	Major road	2	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		CPR	Printing shop	1	7	1	1	5.8		
		CVS	Veterinary facilities	1	6	1	1	5.0		
		—	Private well	20	4	1	4	3.6		
		IPU	Electric utility	2	5	1	2	4.3		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Atrisco W-4	A	—	Arroyo/drainage	1	4	4	1	3.9	129.4	Moderately high
		—	Private well	1	4	4	1	3.9		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Private well	1	4	3	1	3.7		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		MSD	Stormwater pond	1	4	2	1	3.6		
		CFR	Furniture repair and manufacturing	1	7	2	1	6.0		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
		—	Private well	3	4	2	2	3.6		
	D	AFI	Agricultural field	2	4	1	2	3.5		
		—	Arroyo/drainage	6	4	1	3	3.5		
		MSD	Stormwater pond	2	4	1	2	3.5		
		CBS	Automotive body shop	3	8	1	2	6.7		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		CCY	Construction and open equipment storage	1	6	1	1	5.0		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	2	7	1	2	5.9		
		CHW	Hardware/lumber/parts store	3	6	1	2	5.1		
		—	Major road	2	6	1	2	5.1		
		CSS	Gasoline service station	3	8	1	2	6.7		
		—	Park	1	3	1	1	2.6		
		—	Private well	14	4	1	4	3.6		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Atrisco W-4 (cont.)	D (cont.)	CFB	Storage tank, underground leaking (LUST)	2	8	1	2	6.7	129.4	Moderately high
		CFB	Storage tank, underground	1	8	1	1	6.6		
		IMP	Metal plating/processing facility	1	6	1	1	5.0		
Leavitt W-1	A	—	Park	1	3	4	1	3.1	36.8	Low
	B	—	Park	1	3	3	1	2.9		
	C	—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	1	4	1	1	3.4		
		MSD	Stormwater pond	2	4	1	2	3.5		
		—	Groundwater permit, ceased - APS - Ann Binford Elementary School	1	4	1	1	3.4		
		—	Major road	4	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		
		RSF	Septic tank	1	8	1	1	6.6		
		—	Private well	5	4	1	3	3.5		
Leavitt W-2	A	—	Park	1	3	4	1	3.1	27.4	Low
	B	—	Park	1	3	3	1	2.9		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		—	Groundwater permit, ceased - APS - Ann Binford Elementary School	1	4	1	1	3.4		
		—	Major road	1	6	1	1	5.0		
		—	Park	5	3	1	3	2.7		
		—	Private well	5	4	1	3	3.5		

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Table C-9. Calculation of Vulnerability, Leavitt and Atrisco Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Leavitt W-3	A	—	Park	1	3	4	1	3.1	41.6	Low
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Park	1	3	3	1	2.9		
		MSD	Stormwater pond	1	4	3	1	3.7		
	C	—	Park	1	3	2	1	2.8		
		—	Arroyo/drainage	2	4	2	2	3.6		
		MSD	Stormwater pond	2	4	2	2	3.6		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		MSD	Stormwater pond	4	4	2	2	3.6		
		—	Major road	2	6	1	2	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	22	4	1	4	3.6		

"The Vulnerability Scores were determined in Excel using additional significant digits and may not exactly match a sum of numbers in the 'PSOC' column."

Table C-10. Calculation of Vulnerability, Yale and Burton Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Burton W-1	A	—	Park	1	3	4	1	3.1	62.8	Moderately low
	B	—	Park	1	3	3	1	2.9		
	C	CGC	Golf course	1	3	2	1	2.8		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
		—	Private well	1	4	2	1	3.6		
	D	CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CGC	Golf course	1	3	1	1	2.6		
		—	Major road	1	6	1	1	5.0		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
		—	Park	6	3	1	3	2.7		
		—	Private well	3	4	1	2	3.5		
Burton W-2	A	—	Major road	1	6	4	1	5.5	78.8	Moderately low
	B	—	Major road	1	6	3	1	5.3		
	C	—	Major road	2	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	1	4	1	1	3.4		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CBS	Automotive body shop	1	8	1	1	6.6		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Burton W-2 (cont.)	D (cont.)	CFB	Storage tank, underground	2	8	1	2	6.7	78.8	Moderately low
		—	Major road	3	6	1	2	5.1		
		—	Park	9	3	1	3	2.7		
		—	Private well	3	4	1	2	3.5		
		CVS	Veterinary services	1	6	1	1	5.0		
Burton W-3	A	—	Arroyo/drainage	1	4	4	1	3.9	123.3	Moderately high
		—	Major road	1	6	4	1	5.5		
		—	Park	1	3	4	1	3.1		
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	CAR	Automotive repair shop	1	8	2	1	6.8		
		CDC	Dry-cleaning shop	1	9	2	1	7.6		
		—	Major road	3	6	2	2	5.2		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CBS	Automotive body shop	1	8	1	1	6.6		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		—	Major road	7	6	1	3	5.1		
		—	Park	2	3	1	2	2.7		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Burton W-3 (cont.)	D (cont.)	—	Private well	2	4	1	2	3.5	123.3	Moderately high
		CPP	Photo-processing laboratory	1	7	1	1	5.8		
		CPR	Printing shop	2	7	1	2	5.9		
		CRL	Research laboratory	1	6	1	1	5.0		
		CVS	Veterinary services	1	6	1	1	5.0		
Burton W-4	A	CGC	Golf course	1	3	4	1	3.1	80.8	Moderate
	B	CGC	Golf course	1	3	3	1	2.9		
	C	CFA	Storage tank facility, aboveground (AST)	1	8	2	1	6.8		
		CGC	Golf course	1	3	2	1	2.8		
		—	Private well	2	4	2	2	3.6		
	D	CAI	Airport - ABQ International Sunport	1	8	1	1	6.6		
		CAR	Automotive repair shop	3	8	1	2	6.7		
		CGC	Golf course	1	3	2	1	2.8		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	3	6	1	2	5.1		
		IMP	Metal processing facility	1	9	1	1	7.4		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
		—	Park	4	3	1	2	2.7		
		—	Private well	3	4	1	2	3.5		
Burton W-5	A	—	Arroyo/drainage	1	4	4	1	3.9	111.4	Moderate
		—	Park	1	3	4	1	3.1		
		—	Major road	2	6	4	2	5.5		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Burton W-5 (cont.)	B	—	Arroyo/drainage	1	4	3	1	3.7	111.4	Moderate
		CAR	Automotive repair shop	1	8	3	1	6.9		
		—	Major road	2	6	3	2	5.4		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		CPP	Photo-processing laboratory	1	7	2	1	6.0		
		CFB	Storage tank, underground	1	8	2	1	6.8		
		—	Major Road	4	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CBS	Automotive body shop	2	8	1	2	6.7		
		CAR	Automotive repair shop	9	8	1	3	6.7		
		CCW	Carwash	1	8	1	1	6.6		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		CSS	Gasoline service station	1	8	1	1	6.6		
		—	Major road	3	6	1	2	5.1		
		—	Park	3	3	1	2	2.7		
		IPU	Electric utility	1	5	1	1	4.2		
		MFF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
Yale W-1	B	—	Major road	1	6	3	1	5.3	93.7	Moderate
	C	—	Major road	5	6	2	3	5.3		
		CFB	Storage tank, underground	1	8	2	1	6.8		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CBS	Automotive body shop	1	8	1	1	6.6		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Yale W-1 (cont.)	D (cont.)	CAR	Automotive repair shop	3	8	1	2	6.7	93.7	Moderate
		CCE	Cemetery	1	3	1	1	2.6		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CSS	Gasoline service station	3	8	1	2	6.7		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		
		—	Major road	8	6	1	3	5.1		
		—	Park	3	3	1	2	2.7		
		CPP	Photo-processing lab	1	7	1	1	5.8		
		—	Private well	169	4	1	5	3.6		
		IPU	Electric utility	2	5	1	2	4.3		
		CRL	Research laboratory (medical laboratory)	1	6	1	1	5.0		
		—	Groundwater permit, terminated - Yale Auto Sale Site	1	4	1	1	3.4		
		CFB	Storage tank, underground	3	8	1	2	6.7		
Yale W-2	A	—	Private well	1	4	4	1	3.9	100.2	Moderate
		—	Park	1	3	4	1	3.1		
	B	—	Park	2	3	3	2	3.0		
	C	CAR	Automotive repair shop	1	8	2	1	6.8		
		CCW	Carwash	1	8	2	1	6.8		
		—	Major road	1	6	2	1	5.2		
		CFB	Storage tank, underground	1	8	2	1	6.8		
		—	Park	3	3	2	2	2.8		
		MMP	Motor pool	1	8	2	1	6.8		
	D	—	Arroyo/drainage	3	4	1	2	3.5		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Yale W-2 (cont.)	D (cont.)	CBS	Automotive body shop	1	8	1	1	6.6	100.2	Moderate
		CAR	Automotive repair shop	3	8	1	2	6.7		
		CCW	Carwash	2	8	1	2	6.7		
		CCE	Cemetery	1	3	1	1	2.6		
		CFB	Storage tank, underground leaking (LUST)	1	8	1	1	6.6		
		—	Major road	3	6	1	2	5.1		
		—	Park	10	3	1	3	2.7		
		—	Private well	3	4	1	2	3.5		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary services	1	6	1	1	5.0		
Yale W-3	A	—	Major road	1	6	4	1	5.5	100.6	Moderate
		—	Park	1	3	4	1	3.1		
	B	—	Major road	1	6	3	1	5.3		
		—	Park	1	3	3	1	2.9		
	C	—	Arroyo/drainage	3	4	2	2	3.6		
		CFC	Funeral home/crematory	1	6	2	1	5.2		
		—	Major road	2	6	2	2	5.2		
		—	Park	1	3	2	1	2.8		
	D	—	Arroyo/drainage	1	4	1	1	3.4		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CAR	Automotive repair shop	2	8	1	2	6.7		
		—	Groundwater permit, ceased - Contract Carriers	1	4	1	1	3.4		

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Table C-10. Calculation of Vulnerability, Yale and Burton Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Yale W-3 (cont.)	D (cont.)	—	Contamination plume - BNSF Albuquerque	1	10	1	1	8.2	100.6	Moderate
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	8	6	1	3	5.1		
		—	Park	2	3	1	2	2.7		
		—	Private well	167	4	1	5	3.6		
		IPU	Electric utility	1	5	1	1	4.2		
		CRL	Research laboratory (medical laboratory)	2	6	1	2	5.1		
		CFB	Storage tank, underground	2	8	1	2	6.7		
		IUR	Utility/transportation right of way	1	6	1	1	5.0		

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Table C-11. Calculation of Vulnerability, Ridgecrest Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ridgecrest W-1	A	IMP	Metal processing facility	1	9	4	1	7.9	191.6	High
	B	CBS	Automotive body shop	2	8	3	2	7.0		
		CAR	Automotive repair shop	1	8	3	1	6.9		
		IEE	Electronic/electrical equipment manufacturing	1	9	3	1	7.7		
		—	Major road	1	6	3	1	5.3		
		MMF	Military facilities - Kirtland Air Force Base	1	10	3	1	8.5		
		IMP	Metal processing facility	1	9	3	1	7.7		
		IST	Stone, tile, and glass manufacturing	1	7	3	1	6.1		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CBS	Automotive body shop	3	8	2	2	6.8		
		IPP	Bulk petroleum	1	8	2	1	6.8		
		CCY	Construction and open equipment storage	1	6	2	1	5.2		
		CDC	Dry-cleaning shop	1	9	2	1	7.6		
		CFR	Furniture repair and manufacturing	1	7	2	1	6.0		
		CHW	Hardware/lumber/parts store	1	6	2	1	5.2		
		IMP	Metal processing facility	2	9	2	2	7.6		
		CRL	Research laboratory	1	6	2	1	5.2		
		MMF	Military facilities - Kirtland Air Force Base	1	10	2	1	8.4		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CBS	Automotive body shop	7	8	1	3	6.7		
		CAR	Automotive repair shop	9	8	1	3	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	2	7	1	2	5.9		

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Table C-11. Calculation of Vulnerability, Ridgecrest Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ridgecrest W-1 (cont.)	D (cont.)	CSS	Gasoline service station	3	8	1	2	6.7	191.6	High
		CHW	Hardware/lumber/parts store	3	6	1	2	5.1		
		—	Major road	3	6	1	2	5.1		
		IMP	Metal processing facility	3	9	1	2	7.5		
		—	Private well	3	4	1	2	3.5		
		CFB	Storage tank, underground	4	8	1	2	6.7		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
Ridgecrest W-2	A	CBS	Automotive body shop	1	8	4	1	7.1	152.1	Moderately high
	B	—	Arroyo/drainage	1	4	3	1	3.7		
		CAR	Automotive repair shop	1	8	3	1	6.9		
		CBS	Automotive body shop	1	8	3	1	6.9		
		CHW	Hardware/lumber/parts store	1	6	3	1	5.3		
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CAR	Automotive repair shop	4	8	2	2	6.8		
		—	Brownfield - Luna Lodge	1	4	2	1	3.6		
		CFR	Furniture repair and manufacturing	1	7	2	1	6.0		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		CBS	Automotive body shop	12	8	1	4	6.8		
		CAR	Automotive repair shop	7	8	1	3	6.7		
		CCW	Carwash	2	8	1	2	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	3	7	1	2	5.9		
		CSS	Gasoline service station	4	8	1	2	6.7		

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Table C-11. Calculation of Vulnerability, Ridgecrest Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ridgecrest W-2 (cont.)	D (cont.)	CGC	Golf course	1	3	1	1	2.6	152.1	Moderately high
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	5	6	1	3	5.1		
		IMP	Metal processing facility	6	9	1	3	7.5		
		IST	Stone, tile, and glass manufacturing	1	7	1	1	5.8		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
		—	Park	1	3	1	1	2.6		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		CVS	Veterinary facilities	1	6	1	1	5.0		
Ridgecrest W-3	B	CAR	Automotive repair shop	1	8	3	1	6.9	134.0	Moderately high
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CBS	Automotive body shop	1	8	2	1	6.8		
		CAR	Automotive repair shop	2	8	2	2	6.8		
		CDC	Dry-cleaning shop	2	9	2	2	7.6		
		—	Major road	1	6	2	1	5.2		
		—	Park	1	3	2	1	2.8		
		CVS	Veterinary services	2	6	2	2	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CBS	Automotive body shop	11	8	1	4	6.8		
		CAR	Automotive repair shop	18	8	1	4	6.8		
		CCW	Carwash	2	8	1	2	6.7		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		CSS	Gasoline service station	3	8	1	2	6.7		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		

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Table C-11. Calculation of Vulnerability, Ridgecrest Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ridgecrest W-3 (cont.)	D (cont.)	—	Major road	5	6	1	3	5.1	134.0	Moderately high
		IMP	Metal processing facility	1	9	1	1	7.4		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
		—	Park	2	3	1	2	2.7		
		CPP	Photo-processing laboratory	1	7	1	1	5.8		
		CFB	Storage tank, underground	4	8	1	2	6.7		
		CVS	Veterinary facilities	1	6	1	1	5.0		
Ridgecrest W-4	B	—	Major road	1	6	3	1	5.3	82.2	Moderate
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
		—	Private well	1	4	2	1	3.6		
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	6	8	1	3	6.7		
		CAR	Automotive repair shop	14	8	1	4	6.8		
		CCW	Carwash	2	8	1	2	6.7		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		—	Major road	5	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		—	Private well	3	4	1	2	3.5		
		CFB	Storage tank, underground	1	8	1	1	6.6		

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Table C-11. Calculation of Vulnerability, Ridgecrest Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Ridgecrest W-5	A	—	Major road	1	6	4	1	5.5	140.6	Moderately high
	B	—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CBS	Automotive body shop	1	8	2	1	6.8		
		CAR	Automotive repair shop	4	8	2	2	6.8		
		CCW	Carwash	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	3	4	1	2	3.5		
		CFA	Storage tank facility, aboveground (AST)	1	8	1	1	6.6		
		CBS	Automotive body shop	8	8	1	3	6.7		
		CAR	Automotive repair shop	13	8	1	4	6.8		
		CCW	Carwash	3	8	1	2	6.7		
		CDC	Dry-cleaning shop	1	9	1	1	7.4		
		IEE	Electronic/electrical equipment manufacturing	1	9	1	1	7.4		
		CFR	Furniture repair and manufacturing	1	7	1	1	5.8		
		CSS	Gasoline service station	1	8	1	1	6.6		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	4	6	1	2	5.1		
		—	Park	4	3	1	2	2.7		
		—	Private well	4	4	1	2	3.5		
		IPU	Electric utility	1	5	1	1	4.2		
		CFB	Storage tank, underground	3	8	1	2	6.7		
		MMF	Military facilities - Kirtland Air Force Base	1	10	1	1	8.2		
		—	Voluntary remediation site - Triple S, Inc. (Kerr McGee Number #6007)	1	10	1	1	8.2		

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Table C-12. Calculation of Vulnerability, Lomas Wells

Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Lomas W-1	B	—	Arroyo/drainage	1	4	3	1	3.7	77.2	Moderately low
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	2	4	2	2	3.6		
		—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	4	4	1	2	3.5		
		CBS	Automotive body shop	5	8	1	3	6.7		
		CAR	Automotive repair shop	4	8	1	2	6.7		
		CCW	Carwash	2	8	1	2	6.7		
		CCY	Construction and open equipment storage	2	6	1	2	5.1		
		—	Major road	5	6	1	3	5.1		
		—	Park	1	3	1	1	2.6		
		IPU	Electric utility	1	5	1	1	4.2		
		MMP	Motor pool	1	8	1	1	6.6		
		IST	Stone, tile, and glass manufacturing	1	7	1	1	5.8		
		CFB	Storage tank, underground	3	8	1	2	6.7		
Lomas W-5	B	CAR	Automotive repair shop	1	8	3	1	6.9	77.0	Moderately low
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CBS	Automotive body shop	1	8	2	1	6.8		
		CCW	Carwash	1	8	2	1	6.8		
		—	Major road	1	6	2	1	5.2		
	D	—	Arroyo/drainage	5	4	1	3	3.5		
		CBS	Automotive body shop	6	8	1	3	6.7		
		CAR	Automotive repair shop	5	8	1	3	6.7		

Table C-12. Calculation of Vulnerability, Lomas Wells
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Well	Buffer Zone	PSOC Code	PSOC/SOC Description	Number of Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Sum	Vulnerability Score	Vulnerability Ranking
Lomas W-5 (cont.)	D (cont.)	CCW	Carwash	1	8	1	1	6.6	77.0	Moderately low
		CCY	Construction and open equipment storage	2	6	1	2	5.1		
		CHW	Hardware/lumber/parts store	1	6	1	1	5.0		
		—	Major road	4	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		CFB	Storage tank, underground	2	8	1	2	6.7		
Lomas W-6	B	—	Arroyo/drainage	1	4	3	1	3.7	83.3	Moderate
		—	Major road	1	6	3	1	5.3		
	C	—	Arroyo/drainage	1	4	2	1	3.6		
		CBS	Automotive body shop	1	8	2	1	6.8		
		—	Major road	2	6	2	2	5.2		
	D	—	Arroyo/drainage	2	4	1	2	3.5		
		MSD	Stormwater pond	1	4	1	1	3.4		
		CBS	Automotive body shop	8	8	1	3	6.7		
		CAR	Automotive repair shop	5	8	1	3	6.7		
		CCW	Carwash	3	8	1	2	6.7		
		CCY	Construction and open equipment storage	2	6	1	2	5.1		
		CSS	Gasoline service station	2	8	1	2	6.7		
		—	Major road	2	6	1	2	5.1		
		—	Park	2	3	1	2	2.7		
		IST	Stone, tile, and glass manufacturing	1	7	1	1	5.8		
		CFB	Storage tank, underground	2	8	1	2	6.7		

Appendix D

Contamination Site Summaries

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List of Acronyms and Abbreviations

1,4-D	1,4-dioxane
AEHD	Albuquerque Environmental Health Department
amsl	above mean sea level
AOC	Area of Concern
AST	aboveground storage tank
AT&SF	Atchison, Topeka, and Santa Fe Railway
BFF	Bulk Fuels Facility
bgs	below ground surface
BNSF	Burlington Northern Santa Fe Railway Company
BTEX	benzene, toluene, ethyl benzene, and xylenes
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
City	City of Albuquerque
CME	Corrective Measures Evaluation
County	Bernalillo County
DCA	dichloroethane
DCE	dichloroethene
DCM	dichloromethane
DNAPL	dense non-aqueous phase liquid
DOE	Department of Energy
DP	Discharge Permit
EDB	ethylene dibromide
EDC	ethylene dichloride
EPA	United States Environmental Protection Agency
FAP	Fruit Avenue Plume
GEA	General Electric Aviation
GWQB	Groundwater Quality Bureau
HP	Hewlett-Packard
HWB	Hazardous Waste Bureau
ICE	internal combustion engine
ISBD	in situ biodenitrification

JP-4	jet propellant 4
JP-8	jet propellant 8
KAFB	Kirtland Air Force Base
LA	Los Angeles
LNAPL	light non-aqueous phase liquid
LSA	Limited Site Assessment
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NPL	National Priorities List
ONRT	Office of Natural Resources Trustee
OSE	Office of the State Engineer
PAHs	polycylclic aromatic hydrocarbons
PCE	tetrachloroethene
PNM	Public Service Company of New Mexico
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SNL	Sandia National Laboratories
SVE	soil vapor extraction
SWPA	Source Water Protection Area
TA	Technical Area
TAVG	Technical Area V Groundwater
TAG	Tijeras Arroyo Groundwater
TCA	trichloroethane
TCE	trichloroethene
µg/L	micrograms per liter
UNM	University of New Mexico
USGS	United States Geological Survey VOC volatile organic compound
Water Authority	Albuquerque Bernalillo County Water Utility Authority

Environmental Sites in Albuquerque, New Mexico

Albuquerque Bernalillo County Water Utility Authority

Groundwater Source Water Assessment

As part of the Groundwater Source Water Assessment, the Albuquerque Bernalillo County Water Authority (Water Authority) identified known sites of groundwater contamination throughout the City of Albuquerque (City) and Bernalillo County (County). Not all groundwater contamination sites identified during the study fall within the delineated source water protection areas (SWPAs) for Water Authority supply wells, but are sites that are of critical importance for ensuring the safety of the groundwater drinking water resource now, and into the future. This document includes detailed summaries for 24 of the sites identified, and an additional 9 sites are listed for Water Authority awareness. These 9 sites are not within the service area or upgradient of a well field, but could become key sites to be aware of for future operations and decisions.

1. Kirtland Air Force Base Bulk Fuels Facility Spill

***Responsible Party*:** U.S. Air Force
***New Mexico Environment Department (NMED) Oversight*:** Hazardous Waste Bureau (HWB)
Site Status: Resource Conservation and Recovery Act (RCRA) Permitted Facility – Site Investigation and Interim Measures

The Kirtland Air Force Base (KAFB) Bulk Fuels Facility (BFF) Site, located in the southeast part of Albuquerque, was designated a corrective action site in November 1999 when fuel was observed seeping to the surface around a bulk fuel off-loading rack on KAFB. Efforts to investigate and begin remediation of the fuel contamination at the surface in the vadose zone, and in the groundwater, have been intermittent since the site's discovery (EA, 2018). Several estimates for fuel amounts that leaked at the off-loading rack area over a period of decades have been provided, and the January 2017 Resource Conservation and Recovery Act (RCRA) Facility Investigation Report states that it is not possible to estimate the volume of fuel released. The decades-long leak resulted in contamination of both soil and groundwater with the primary contamination being the benzene, toluene, ethyl benzene, and xylenes (BTEX) constituents, and ethylene dibromide (EDB), a lead-scavenger additive in the aviation gas that was once stored in the BFF. Jet propellant 4 (JP-4) and 8 (JP-8) were also stored in the BFF, with contamination distinguished from the aviation gas by the lack of EDB in its composition. The furthest extent of contamination from the site is approximately 3,600 feet upgradient of the nearest production well.

Contamination at the BFF Site is described in three parts: the vadose zone (surface, near surface and deep soils), the light non-aqueous phase (LNAPL) plume, and the dissolved phase EDB plume (Sundance, 2017). Surface contamination was found near the former offloading rack and associated pipelines and facilities. Contamination in the vadose zone consists primarily of jet fuel in its concentrated and slightly weathered and degraded forms, with mixes of unknown amounts of aviation gas, JP-4 and JP-8. The LNAPL plume consists primarily of the BTEX compounds, with currently unknown amounts of aviation gas. The concentrated LNAPL plume remains mostly below the KAFB property, with some encroachment below the adjacent Veterans Administration Hospital property. The dissolved phase EDB plume is approximately 1 ½ miles long and a quarter mile wide and extends beyond the northern boundary of the KAFB.

KAFB contractors mobilized three separate times since the leak was discovered to remove surface soils to a depth of approximately 20 feet below ground surface (bgs). Contaminated soils were removed from the surface near the former off-loading rack and associated pipelines in 1999, 2010, and 2014, resulting in 3000 cubic yards of contaminated soil removed and taken to a permitted disposal facility (Sundance, 2017).

Vadose zone investigations began in 2000 and continue today with regular sampling of soil gas concentrations in historically observed vapor footprints in the vadose zone, from the land surface to approximately 450 bgs. (Sundance, 2017). Soil vapor extraction (SVE) of contamination in the vadose zone began in earnest in 2003 with the installation of four manifold internal combustion engine (ICE) units that were in operation until 2012. At this time, the Air Force's contractor added 3 additional ICE units temporarily to SVE in another area of concern at the site. By 2013, the ICE units were removed and replaced with a catalytic oxidizer unit which was in operation from 2013 to 2015 (Sundance, 2017). It is estimated that 775,000 equivalent-gallons of soil vapor were removed or biodegraded during the 12 years of operation of the SVE systems.

The LNAPL plume was discovered in 2007 by a KAFB contractor during the initial testing of one of the earlier monitoring wells. The percentage composition of the LNAPL for each of the fuel products has not yet been determined, but the maximum floating product measured at the site was just over 4 feet in 2010, just as the regional groundwater table began rising (Sundance, 2017).

Dissolved phase plume mass is currently being addressed by a pump and treat system which started with one extraction well in 2015 and has since been expanded to four wells. The accompanying groundwater treatment system, which treats water through granulated activated carbon and a sand filter, has the capacity to treat up to one million gallons per day; however, based on the volume of groundwater treated in 2017, it is currently only being used to treat just over half a million gallons per day (EA, 2018).

The BFF Site is currently regulated by the NMED Hazardous Waste Bureau and is in an interim-measures phase of a corrective action. Current plans for the site are to enter the corrective measures evaluation phase by 2018 or 2019 (Sundance, 2017).

2. Kirtland Air Force Base Nitrate Plumes

***Responsible Party*:** U.S. Air Force
***NMED Oversight*:** Ground Water Quality Bureau (GWQB), Remediation Oversight Section
Site Status: Stage 2 Abatement Plan

In a letter dated July 2, 1999, the Assessment and Abatement section of the NMED GWQB required KAFB to submit a Phase I Abatement Plan to address nitrate contaminated groundwater. The KAFB nitrate plumes are regulated under a single site designation of ST-105; though it is possible that KAFB site WP-026 (Sewage Lagoons and Golf Course Main Pond) is also a contributing source to the nitrate groundwater contamination. In the case of site WP-026, the NMED HWB provides regulatory oversight. Further complicating the conceptual site model, KAFB has separated the nitrate concentrations into a total of four, separately-mapped plumes of nitrate: Plume 1, Plume 2, Plume 4, and Plume 5.

There are two impacted aquifers at ST-105; the depth to the perched aquifer ranges between 197 and 416 feet bgs and the regional aquifer occurs at a depth ranging from 109 to 627 feet bgs (AFCEC, 2015). Plumes 1 and 2 are in the regional aquifer and Plume 4 is specific to nitrate concentrations measured in the perched aquifer at the site. The current KAFB conceptual site model for the nitrate plumes (AFCEC, 2014) states that the perched aquifer is in communication with the regional aquifer, as perched groundwater percolates and migrates down to the regional aquifer. The perched aquifer is located within the central and eastern portions of KAFB and generally flows to the southeast. Regional aquifer groundwater flow is typically to the north (AFCEC, 2015). The nearest Water Authority supply wells are Ridgecrest W-1 and Ridgecrest W-2, located approximately 1.9 and 2.1 miles from the northernmost edge of the nitrate plume, respectively.

Groundwater monitoring of the nitrate contamination began in September 2001 under an NMED-approved Stage 1 Abatement Plan. In April 2002, KAFB submitted an Interim Stage 2 Abatement Plan that included plans for hydraulic containment and mass removal of nitrate-contaminated groundwater near KAFB water supply well KAFB-7 and for continued groundwater monitoring. As part of the plan, KAFB converted their water supply well KAFB-7 to be used as an extraction well; and extracted water was conveyed through a water transmission pipeline to the Golf Course Main Pond where it was used for irrigation of the KAFB Golf Course. Well KAFB-7 was used for interim abatement until 2009 when KAFB submitted a revised Stage 2 Abatement Plan requesting No Further Action, citing that the nitrate was not a result of KAFB activities. Additionally, KAFB stopped use of KAFB-7 as abatement for ST-105 and re-equipped the well for gravity-fed injection of treated water, as part of the KAFB BFF jet fuel leak project (KAFB, 2015). No record of the required annual reports for the site were found after the January 2015 submittal.

In a 2014, KAFB submitted an *Investigation Report, SWMU ST-105, Nitrate Characterization*, to the NMED. As part of the nitrate investigation, a contractor to KAFB was tasked with identifying the extent of the nitrate plume(s) detected at ST-105 and any potential sources of the nitrate. Potential sources identified by KAFB include: former septic tank leach fields and Old Acid Waste Line Outfall at Sandia National Laboratories (SNL) Technical Areas II and IV; sewage effluent leaking from a Water Authority sewer line; and WP-026 sewage lagoons and the Golf Course Main Ponds. Since the 2015 long-term monitoring annual report (KAFB, 2015), the Water

Authority has completed leak-detection surveys of the full length of sewage lines located on KAFB. In 2017, the U.S. Geological Survey (USGS) started conducting a nitrate study to look at nitrate concentrations across KAFB and within Tijeras arroyo, using several analytical suites that include personal care products, artificial sweeteners, compound-specific isotope analysis, and general chemistry to identify nitrate sources. The study is ongoing and the Water Authority has not received any data or preliminary findings from the study.

3. Digital Equipment Corporation Facility Chlorinated Volatile Organic Compound Release

***Responsible Party*:** Hewlett-Packard
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Administrative Consent Order

The former Digital Equipment Corporation manufacturing facility located at 5600 Jefferson Street Northeast in Albuquerque is the source of a chlorinated volatile organic compounds (VOCs) (primarily tetrachloroethene [PCE] and 1,1,1-trichloroethane [TCA]) groundwater plume and vadose zone contamination, first detected in soil samples in January 1990. Local groundwater flow is in the southeast direction which increases the risk of contamination to Vol Andia W-6 and which has had historical detections of 1,1-dichloroethene (DCE), a degradation byproduct of TCA.

Multiple environmental investigations have been conducted for the site which is owned by Hewlett-Packard (HP) Company (Weston, 2014). The affected soil was removed, and a groundwater treatment system operated between 1991 and 2009 (Weston, 2014). In 2013, NMED approved the site's long-term plan which called for the abandonment of 14 site groundwater monitoring wells and for semiannual sampling to occur between January 2013 and March 2015. The groundwater monitoring well plugging and abandonment was completed on May 31, 2014, and the four remaining monitoring wells were most recently sampled in March and April 2015 (Weston, 2015).

The only organic compound detected during the spring 2015 sampling events was 1,1-DCE which was detected in all four of the remaining site monitoring wells at concentrations ranging between

2.1 and 11.0 micrograms per liter (µg/L) from samples collected by Weston and split-sampled with NMED.

The closest Water Authority production well to the site is Vol Andia W-6 and the well is sampled on a quarterly basis (Weston, 2014) for VOCs. The contaminant 1,1-DCE has historically been detected at Vol Andia W-6 with concentrations ranging between 0.20 and 0.31 µg/L. The U.S. Environmental Protection Agency (EPA) primary drinking water standard for 1,1-DCE is currently 7 µg/L; however, the current New Mexico Water Quality Control Commission (NMWQCC) groundwater standard is 5 µg/L

Active remediation at the site was terminated in 2009 when HP stopped the pump-and-treat system and abandoned all extraction, injection, and all but four groundwater monitoring wells. Following years of monitoring, HP submitted a request for closure to NMED July 2015, citing technical infeasibility as the justification for closure. The NMED objected the claim of technical infeasibility in an August 6, 2016, letter which included the Water Authority's comments and concerns as an enclosure. As part of the objection, NMED requested that HP submit a plan for continuing groundwater monitoring at the former Digital site. In response, HP submitted a plan dated October 2016 for groundwater remediation by monitored natural attenuation (MNA). Since the submittal of the MNA plan, the NMED has required HP to evaluate if a vapor intrusion is occurring at onsite buildings.

Additionally, the NMED is working with HP to sample groundwater monitoring wells for 1,4-dioxane (1,4-D), a contaminant associated with the types of activities at the former Digital site. Water Authority sampling at the Vol Andia Storage Tank 2 detected 1,4-D at a concentration of 0.11 µg/L; 1,4-D is an emerging contaminant expected to be listed as a toxic pollutant in the revised New Mexico groundwater standards.

4. Sandia National Laboratories, Tijeras Arroyo Groundwater Areas of Concern

Responsible Party: Department of Energy (DOE)
***NMED Oversight*:** HWB

Site Status: DOE is investigating three groundwater areas of concern (AOCs) under the Correction Action Program in the NMED RCRA permit: Burn Site Groundwater AOC – ongoing site investigation and monitoring; Technical Area-V Groundwater (TAVG) AOC – ongoing treatability study and groundwater monitoring; and Tijeras Arroyo Groundwater (TAG) AOC – Current Conceptual Model and Corrective Measures Evaluation in NMED review.

The Burn Site Groundwater AOC is in a remote area of the Manzanita Mountains on KAFB. Groundwater at the Burn Site is in fractured bedrock at depths ranging between 100 to 327 feet bgs. Nitrate is the contaminant of concern for the site with concentrations greater than the EPA maximum contaminant level (MCL) of 10µg /L. The maximum concentration of nitrate in groundwater was measured in 2017 at a concentration of 45 µg /L (SNL 2018). There are currently 12 groundwater monitoring wells for the site; and DOE will be installing additional wells prior to starting the evaluation of corrective measures for the site. The nearest downgradient Water Authority supply well is approximately 7.1 miles to the northeast of the Burn Site Groundwater AOC.

The TAVG AOC is located in the central portion of KAFB. At the site, groundwater occurs in the regional aquifer at a depth of approximately 500 feet bgs. The contaminants of concern for the site are nitrate and trichloroethene (TCE). The maximum concentration of nitrate is 12 µg /L and the TCE maximum measured concentration is 17 µg /L, both in excess of their respective EPA MCLs of 10 µg /L and 5 µg /L. At the TAVG AOC, the DOE is conducting a treatability study of the effectiveness of in-situ bioremediation. The pilot scale test was completed in May 2018 and a full-scale test began in October 2018; it will include bioaugmentation and two years of performance monitoring.

The TAG AOC covers roughly 1.82 scare miles within the northern portion of KAFB. The groundwater monitoring network consists of 31 monitoring wells. An additional 71 groundwater monitoring wells have been installed by KAFB and the City of Albuquerque in the surrounding area. There is a perched groundwater aquifer in the area of the TAG AOC, occurring at a depth of approximately 330 feet bgs. The thickness of the perched zone ranges from 7 to 20 feet. The regional aquifer is present at around 520 feet bgs. The current conceptual model suggests that the water in the perched aquifer is largely created by man-made activities, including recharge from sewage septic systems, landscape watering, and wastewater outfalls.

The TAG AOC perched aquifer contaminant of concern is nitrate with concentrations as high as 26 µg /L, and the nitrate plume in the perched aquifer is roughly 280 acres in size. Contamination of the regional aquifer is limited to the far southeastern corner of the AOC. The nearest Water Authority water supply well is Ridgecrest 1, located approximately 2 miles to the north.

The three groundwater AOCs are regulated under a Compliance Order on Consent signed by the NMED, DOE, and Sandia Corporation in 2004 (NMED, 2004).

5. Fruit Avenue Plume Superfund Site

Responsible Party: Unknown, listed on the National Priorities List ( )
NMED Oversight**:** GWQB, Superfund Oversight Section
Site Status: Record of Decision

The Fruit Avenue Plume (FAP) Superfund site is one of three Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) NPL sites (a.k.a. “Superfund sites”) in the Water Authority service area and consists of groundwater contaminated by chlorinated solvents located in downtown Albuquerque (EPA, 2017a). The suspected sources for the chlorinated solvent plume consisting of PCE, TCE and related degradation byproducts, including cis-1,2-DCE, and trans-1,2-DCE, are several historical drycleaners previously located in downtown Albuquerque that have since been demolished.

The FAP Superfund site was discovered in 1989, when the Coca-Coca facility’s well was found to be contaminated. Following the discovery, the City launched an investigation to find the source of contamination and found chlorinated solvent contamination in the groundwater upgradient of the Coca-Cola well (EPA, 2001). Later, contaminated soil in the shallow and deeper subsurface was discovered below properties that once belonged to the Elite Cleaners and Sunshine Laundry, located at 514 Third Street; this is now a parking lot for the Wells Fargo Bank building in downtown

Albuquerque at Second Street and Roma Avenue (EPA, 2001). Underground storage tanks were removed from the area of the former properties in 1989.

The Record of Decision (ROD) for the FAP Superfund site selected the pump-and-treat method to remediate contaminated groundwater, established groundwater use restrictions, and required groundwater monitoring (EPA, 2001). In 2007, the ROD was modified to include MNA for the groundwater contamination, extending the timeframe for site cleanup by a couple of decades. In 2017, the ROD was amended to formally establish MNA as the final remedy for the site, following approximately twelve years of groundwater extraction and treatment (ARS, 2017). In addition, regulatory oversight was transferred from the EPA Region 6 office to the NMED Superfund Oversight Section.

6. Los Angeles Landfill

Responsible Party: City of Albuquerque
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Stage 2 Abatement

The Los Angeles (LA) Landfill is a former municipal landfill that was operational between 1978 and 1983 by the City. The 77-acre landfill is located at 4300 Alameda Boulevard, Albuquerque, New Mexico (NM) and is currently being remediated under a State 2 Abatement Plan that was modified in January 2014. It is estimated that 2.2 million tons of waste were placed at the LA Landfill. Current abatement activities at the site include (AEHD, 2018):

- Landfill Gas Monitoring, Collection, and Flare Treatment: A total of 41 perimeter and 16 interior landfill gas wells are used to continuously extract gases from within the landfill waste. Landfill gases are monitored at three different depths by the Albuquerque Environmental Health Department (AEHD) at the nearby Alameda Business Park West and around the landfill itself.
- Soil Vapor Extraction: Ten soil vapor extraction (SVE) wells installed to two separate depths under the landfill waste are used to treat VOC contaminated soil vapor. Six air

injection wells are also part of the system, in order create a vapor barrier between landfill waste and groundwater to limit potential for further groundwater contamination.

- Groundwater Pump-and-Treat System: Four groundwater extraction wells, an air stripper, and two injection wells are used to extract, treat, and reinject treated water in order to abate PCE contaminated groundwater at the site. Water is discharged (reinjected) at the site according to DP-1468.

Contaminants of concern at the LA Landfill site include PCE, TCE, DCE, and dichloromethane (DCM). Currently, PCE is the only contaminant detected in groundwater at concentrations greater than the NMWQCC groundwater standard of 5 µg/L. In January 2014, AEHD submitted a modified Stage 2 Abatement Plan request to NMED GWQB. The request proposed continued operation of the landfill gas removal and soil vapor extraction systems and requested that operation of the groundwater pump-and-treat system be suspended (AEHD, 2014). In May 2014, the NMED approved the request with the requirement that the pump-and-treat system be operated based on concentrations of contaminants in groundwater. Per the NMED approval, the pump-and-treat system should be operated a minimum of two weeks out of every 6-month period, with the option to reassess after two years.

The nearest Water Authority wells are Coronado W-1 and W-2, located east (cross-gradient) of the LA Landfill site. These wells are approximately 1 to 1.4 miles away from the easternmost edge of the PCE groundwater plume. Groundwater flow at the LA Landfill is generally to the south-southeast. The nearest downgradient Water Authority well is Vol Andia W-6 located approximately 2 miles to the south.

7. Mountain View Nitrate Plume

Responsible Party: Unknown; site under Office of Natural Resources Trustee (ONRT)
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Annual Monitoring and in situ bioremediation pilot tests

The Mountain View Nitrate plume is located near 6501 Broadway Boulevard Southeast, Albuquerque, NM. In 2007, the New Mexico ONRT submitted a Natural Resources Restoration

Plan for the South Valley Superfund Site to address damages to natural resources stemming from contamination at the South Valley Superfund Site. The Mountain View site covers approximately 2-square miles in the South Valley of Albuquerque, NM. Soil and groundwater were impacted with organic solvents, metals, pesticide, and VOCs. The ONRT Natural Resources Restoration Plan is specific to groundwater nitrate contamination; all other contaminants are being addressed under the South Valley Superfund Site (Section 9). The suspected source of nitrate contamination at the Mountain View Site is over-fertilization of a farm that operated from sometime after World War II until the early 1970s. The nitrate plume was first discovered in 1961, and there is no viable responsible party for the contamination (ONRT, 2007).

Remediation of nitrate contamination is being achieved through operation of an in situ biodenitrification (ISBD) system and MNA. Remediation via ISBD involves injection of a food source, such as soybean oil, to stimulate native bacterial growth. Treated effluent is discharged under a permit with the GWQB, DP-1179. Groundwater monitoring occurs on an annual basis. Groundwater generally flows to the east at the Mountain View site.

8. AT&SF Albuquerque Superfund Site

Responsible Party: Atchison, Topeka, and Santa Fe Railway (AT&SF) Company
***NMED Oversight*:** GWQB, Superfund Oversight Section
Site Status: Record of Decision, semi-annual groundwater monitoring

The AT&SF Albuquerque Superfund site is located at 3300 2nd Street Southwest in Albuquerque, NM. Soil and groundwater contamination at the AT&SF Superfund site is a result of the use of creosote and oil mixtures to manufacture pressure-treated wood products such as railroad ties, bridge timbers, and road crossing materials from 1908 to 1972 (EPA, 2010). The AT&SF Superfund site was listed on the CERCLA NPL in December 1994. There was a Record of Decision (ROD) issued for the site by the EPA in June 2002 that listed the contaminants of concern for the site and the remediation goals for both soil and groundwater for each contaminant.

The contaminants of concern include polycyclic aromatic hydrocarbons (PAHs), benzene, carbazole, dense nonaqueous-phase liquid (DNAPL), neutrally buoyant nonaqueous-phase liquid, and zinc. Most of the contamination occurs as DNAPL, which slowly dissolves into the groundwater, followed by sorption to soil particles in the aquifer matrix (EPA, 2010). Both free-phase and residual phase DNAPLs are present in the aquifer. There is also an aqueous contaminant plume where only dissolved contaminants are present in the groundwater. The analytical results from groundwater monitoring indicate that the dissolved-phase impacts are local and stable (TRC Environmental Corporation, 2017). PAHs and zinc are primarily present in the unsaturated soil; however, most of the contaminants were removed in the 1999 removal efforts (EPA, 2002). Additionally, the site has a modified groundwater remediation goal for carbazole (0.4 µg/L) that was established with the EPA in 2010 (TRC Environmental Corporation, 2017).

The AT&SF Superfund site is located near 2nd Street and Rio Bravo Boulevard in Albuquerque; and the nearest Water Authority supply wells (the Leavitt, Atrisco, Yale, and Burton Wells) are at least 3 miles away from the plume. The 89-acre site was divided into two parcels: a northern parcel of 62 acres and a southern parcel of 27 acres (EPA, 2010). The northern 62-acre parcel was removed from the NPL in 2011 and the remaining 27-acre southern parcel is regulated by the Superfund Oversight Section of the NMED GWQB. Soil excavation and stabilization has occurred at the site to remove contaminants, control erosion, and eliminate the potential for further contamination. There is a groundwater treatment system for extraction of DNAPL and treated water is reinjected at the site. Additionally, there is a private well drilling moratorium enforced by the New Mexico Office of the State Engineer (OSE) at the site, until remediation goals for groundwater are met. Groundwater monitoring has occurred on a semi-annual basis since 2015 (TRC Environmental Corporation, 2017). The site is expected to have its second 5-year review conducted in 2018.

9. South Valley Superfund Site

Responsible Party: Univar and General Electric Aviation
***NMED Oversight*:** GWQB, Superfund Oversight Section
Site Status: Remediation Plan

The South Valley Superfund Site is located just west of Interstate-25 near the intersection of Broadway Boulevard and Woodward Road in Albuquerque, NM, and covers an area of 1-square-mile. The South Valley Superfund Site is divided into two operable units: the Univar Site and the Air Force Plant 83 Site. The Univar Site was the location for various industrial and commercial purposes for nearly 50 years. The Air Force Plant 83 Site was used for manufacturing purposes; this site was purchased by General Electric Aviation (GEA) in 1984 (EPA, 2012) and is now referred to as the GEA operable unit.

In 1978, VOCs were discovered in groundwater, and in 1981 the site was listed on the NPL. The site has soil and groundwater contamination, and the primary contaminants of concern are dichloroethane (DCA), DCE, PCE, TCE, TCA, and 1,4-D. At the GEA operable unit, a deep zone groundwater remediation system began operation in March 1996 to target VOCs in the portion of the aquifer below 4,900 feet above mean sea level (amsl). A second groundwater remediation system to target the shallow groundwater in the portion of the aquifer above 4,900 feet amsl began operation in 1994 (NMED, 2014). Contaminants of concern at the GEA operable unit are DCA, DCE, PCE, and TCE.

At the Univar operable unit, the soil vapor extraction and groundwater remediation systems were shut down in 2006. Since January 2008, Univar has been conducting quarterly groundwater monitoring for VOCs and 1,4-D. As of 2016, the only contaminant of concern at the Univar operable unit is 1,4-D (Univar, 2016).

Depth to water across the South Valley Superfund site ranges from 70 to 165 feet bgs. Typical groundwater flow is to the east-southeast. The nearest Water Authority supply well to the contamination plume is Yale W-2, located about 1.6 miles northeast (upgradient) of the plume. There are no Water Authority supply wells downgradient of the South Valley Superfund Site.

10. Chava Trucking

Responsible Party: Chava Trucking Company
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Settlement Agreement

The Chava Trucking contamination site is located at 6313 State Road 47 in Albuquerque, NM. Petroleum hydrocarbons were released at the site, impacting both soil and groundwater. The groundwater plume covers an area of approximately 15 acres and the groundwater flow direction is generally to the east.

The nearest Water Authority supply wells are in in the Atrisco, Burton, Leavitt, and Yale well fields that range from 4.5 to 7 miles north of the site. No Water Authority wells are downgradient from the site.

11. Chevron Asphalt Plant

Responsible Party: Western Refining (formerly Chevron USA, Inc.)
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Closed

The Chevron Asphalt Plant contamination site is located at 2050 South 2nd Street Southeast in Albuquerque, NM. In the late 1980s, light non-aqueous phase liquid (LNAPL) was discovered floating on the groundwater, and remediation was required at the site by a settlement agreement with the NMED. Site investigation activities determined that both soil and groundwater were impacted by the LNAPL release, and the area of contamination was estimated to be less than one acre. Remediation at the site included soil vapor extraction, soil excavation, and LNAPL recovery. The site was closed in January 2013 following a demonstration that soil concentrations were below the NMED soil screening levels and that groundwater concentrations had been reduced to below NMWQCC groundwater standards.

The nearest Water Authority supply well is Yale W-3 in the Yale well field located just over 1 mile northeast of the site. There are no Water Authority wells downgradient of the site.

12. Former Chevron Bulk Fuels Terminal

Responsible Party: Conoco Phillips
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Hydrocarbon Remediation Agreement

The former Chevron Bulk Fuels Terminal site is located at 3200 Broadway Southeast in Albuquerque, NM. A leaking underground storage tank is the source of contamination and resulted in the release of petroleum hydrocarbons. Both soil and groundwater have been impacted by the release at this site. Contaminated soil has been excavated and removed from the site and periodic groundwater monitoring for MNA is ongoing.

The nearest Water Authority supply well to the contamination plume is Yale W-2, which is located approximately 1.6 miles northeast of the groundwater contamination plume. There are no Water Authority wells downgradient of the site.

13. Fox and Associates

Responsible Party: Fox and Associates of New Mexico, Inc.
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Stage 2 Abatement Plan Proposal

The Fox and Associates contamination site is located at 3412 Bryn Mawr Drive Northeast, Albuquerque, NM. Both soil and groundwater are contaminated at the site, and there is not currently an estimate of the extent of contamination at the site. The contaminant of concern is TCE, and the direction of groundwater flow in this area is generally to the east.

An SVE system operated at the site from 2009 to 2012 and additional site investigation was required by NMED to define the extent of groundwater contamination. The site has been inactive, and a work plan for file review and collection of soil vapor and groundwater samples was submitted to the NMED in December 2017. The work plan is currently in NMED review.

The site is centered between Vol Andia W-3 and Santa Barbara W-1. It is not currently known how close groundwater contamination extends to these wells, as additional site investigation is required. However, given that the site is located less than 200-feet away from the outermost protection area zone (Zone D) for Santa Barbara W-1, it is likely that the contamination extends into the source water protection area of this well. The site is approximately 580 feet from Zone D, the outermost extent of the source water protection area, for Vol Andia W-3.

14. Laun-Dry Supply Company, Inc.

Responsible Party: Laun-Dry Supply Company, Inc.
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Stage 2 Abatement Plan Proposal

The Laun-Dry Supply Company, Inc. contamination site is located at 1503 12th Street Northeast. The property has served as a laundry and dry-cleaning supply distribution facility. Two above-ground storage tanks (ASTs), one 3,500 gallons and the other 500 gallons, were used to store PCE and are believed to be the sources of soil and groundwater contamination. Additional suspected sources include possible drum leaks, known spills during solvent handling, and releases from rail car unloading hoses. In 2003, a Phase II Limited Site Assessment (LSA) was conducted, during which time soil and groundwater samples were collected. The Phase II LSA detected PCE and TCE in both soil and groundwater; and in 2004, NMED required Laun-Dry to submit a Stage 1 Abatement Plan. Since 2004, numerous soil vapor, soil, and groundwater investigations have been completed with ongoing semi-annual groundwater monitoring. The contaminants of concern are the chlorinated solvents PCE and daughter products TCE, cis-1,2-DCE, and trans-1,2-DCE. The direction of groundwater flow in this area is generally to the east.

In August 2016, Laun-Dry submitted a Stage 2 Abatement Plan proposal for the site. The proposal included institutional controls in the form of an OSE restriction to drilling in the vicinity of the site; installation of permeable reactive barriers with emplacement of fluids and/or slurries with the potential to add amendments and bioaugmentation; long-term monitoring; and MNA in areas with low concentrations of solutes still in excess of groundwater standards. The Stage 2 Abatement Plan was presented to the public, opened for comment in May 2017, and was conditionally approved by NMED on July 21, 2017. As part of the conditional approval, NMED is requiring Laun-Dry to install and sample additional groundwater monitoring wells in order to compete delineation of the TCE plume.

The Water Authority well fields nearest to the Laun-Dry site are the Duranes, Atrisco, Yale, and Santa Barbara well fields. The closest well is Duranes W-3 located approximately 1.5 miles northwest of the plume. There are no water supply wells directly downgradient from the plume.

15. NuStar Albuquerque Terminal

Responsible Party: NuStar Energy
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Stage 2 Abatement Plan

NuStar Albuquerque Terminal is in the South Valley of Albuquerque, NM, along State Road 47. Groundwater contamination includes both diesel and gasoline. The extent of groundwater contamination is an estimated 15 acres. Abatement activities at the site include LNAPL recovery and MNA. The groundwater flow direction at the NuStar site is generally east-southeast.

The Water Authority well fields for Leavitt, Atrisco, and Yale are the nearest wells, approximately 5 miles north of the site. There are no Water Authority supply wells downgradient from this site.

16. Rek Chem

Responsible Party: Rek-Chem
NMED Oversight**:** GWQB, Remediation Oversight Section
Site Status: Stage 1 Abatement Plan for site investigation

The Rek Chem contamination site is located at 105 Dale Street Southeast in Albuquerque. Illegal dumping of hazardous chemicals resulted in contamination of groundwater at the site. There is a total of four groundwater monitoring wells at the site with an outstanding NMED requirement for an additional site investigation. The contaminant of concern at the site is TCE and groundwater flow is generally to the east.

The nearest Water Authority well fields are the Leavitt, Atrisco, and Yale wells, all of which are approximately 4.5 miles north of the plume. There are not Water Authority wells downgradient of the site.

17. Sparton Technologies

Responsible Party: Sparton Technology, Inc.
***NMED Oversight*:** HWB
Site Status: Remediation under a Consent Decree

The former Coors Road Plant of Sparton Technology, Inc. (Sparton) is located at 9621 Coors Boulevard Northwest, Albuquerque, NM. Site investigations determined that both soil and groundwater were impacted with chlorinated solvents. The contaminants of concern at the site are TCE, TCA, DCE, and chromium. Additionally, an emerging contaminant of concern at the site is 1,4-D. Samples for 1,4-D were collected in February and May 2017, and the results were reported to the NMED on June 20, 2017 (S.S. Papadopulos & Associates, 2017); the results from those two sampling events were not available at the time of this summary. Off-site and on-site (source) containment systems are operational at the site, and the remediation system includes discharge of treated water into four, rapid infiltration ponds located in the Calabacillas Arroyo. Discharge of treated water is being directed under Discharge Permit (DP) 1184. The DP expired on October 18, 2017, and a renewal application was submitted to the NMED on May 4, 2017. Depth to water at the Sparton site is estimated to be between 68 and 134 feet bgs.

The plume is approximately 1.8 miles southeast of Corrales W-8 which is the closest water supply well to the site. Corrales W-2 is located 2.5 arroyo miles upgradient of the infiltration gallery on the southern bank of the Calabacillas Arroyo.

18. Petroleum Releases at 3209 Broadway Blvd SE, Albuquerque, NM

Responsible Party: Texaco, Inc.; Western Refining
***NMED Oversight*:** GWQB, Remediation Oversight Section and Petroleum Storage Tank Bureau
Site Status: Closed

There have been a number of petroleum contamination events at 3209 Broadway Boulevard Southeast reported from 1988 to 2007 by multiple industrial fuel vendors who owned the site including Texaco, Inc. (Texaco-San Jose) and Western Refining Albuquerque Bulk Fuel Terminal.

This facility was investigated as part of the South Valley National Priorities List (NPL) sites in the area and was determined to not be included as an NPL site because the contaminants of concern were petroleum products. The first reported fuel release at the site was reported in 1988 and was followed with a statement of No Further Action required by the state in 1989 (Bernalillo County, 2015). A leaking underground storage tank at the site was reported in May 1992 and referred to NMED GWQB in 1999, when the site was owned by Texaco, Inc. (Bernalillo County, 2015). Underground storage tanks were removed from the site, including two 550-gallon tanks for used oil and one 4000-gallon tank for unleaded fuel (Bernalillo County, 2015).

In 2007, Western Refining reported a release of petroleum from a comingle pipeline at the bulk fuel terminal (Bernalillo County, 2015). Both groundwater and soil were impacted, and the contamination includes both diesel and gasoline products (petroleum hydrocarbons). The contamination plume was estimated to be 50-acres in groundwater and moving eastward (Bernalillo County, 2015). Soil excavations occurred at the site to remove contaminated soil media, and the site was listed as closed in 2012 with NMED (Bernalillo County, 2015). The releases by both Texaco, Inc. and Western Refining achieved closure with NMED GWQB in 2012.

Groundwater flow at the site is generally to the east and southeast, and depth to groundwater ranges from 70 to 160 feet bgs at the site.

The nearest Water Authority well to the contamination site is Yale W-2, about 1.6 miles northeast of the contamination. There are no Water Authority wells downgradient of this site.

19. University of New Mexico Well 5

Responsible Party: University of New Mexico
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Voluntary Stage 1 Abatement Plan

The University of New Mexico (UNM) Well No. 5 was a supply well for UNM until the late 1990s, when it was taken off-line due to concentrations of TCE that exceeded the MCL (5 µg/L) (Faris, 2018). There were numerous investigative efforts by UNM to identify the source of contamination, primarily through soil vapor assessments, but a source was never identified (Faris, 2018). Suspected sources included improper disposal from the old Civil Engineering building on campus, a dry well in the Chemistry building, a former Department of Transportation laboratory, and other off-site parties (Faris, 2018). UNM installed seven groundwater monitoring wells and Superfund investigated the site; however, Superfund was unable to rank this site to a NPL (Faris, 2018). The contamination plume is estimated to cover approximately 20 acres. Depth to groundwater in the area is approximately 300 feet, and groundwater flow is to the north-northeast. Concentrations of TCE have been the highest (around 15 µg/L) at MW-2 near Lomas Parking Garage on campus. Sentinel wells (MW-7 and MW-8) installed to identify contaminate migration toward UNM's only supply well, UNM Well No. 7, have consistently low concentrations of TCE ranging from 1-2 µg/L (Faris, 2018).

The investigation has indicated that low levels of TCE are in the shallow aquifer and hydraulically isolated from the deeper sections of the aquifer that produce UNM's drinking water (UNM, 2018). UNM is currently following a Voluntary Stage 1 Abatement Plan, and semiannual groundwater monitoring at the site is ongoing. If concentrations of TCE increase or UNM Well No. 7 is threatened, a Stage 2 Abatement Plan will be required for cleanup.

The nearest Water Authority well is Yale W-1, which is approximately 0.7 miles southwest of the plume. Burton W-3 is also nearby and is approximately 1 mile southeast of the plume. Both Yale

W-1 and Burton W-3 are upgradient of the plume. The nearest downgradient Water Authority well is Santa Barbara W-1 located roughly 2 miles to the northeast.

20. West Central Avenue Site

Responsible Party: Unknown, under investigation for multiple parties
***NMED Oversight*:** GWQB, Superfund Oversight Section
Site Status: Site Assessment ongoing, recommended for Hazard Ranking System

The West Central Avenue contamination site is located at 1503 Central Avenue Northeast, Albuquerque, NM. The contamination plume has affected both soil and groundwater in the area. The primary contaminants of concern are TCE, PCE, cis-1,2-DCE, and trans-1,2-DCE.

The source of contamination at this site is unknown and investigations are ongoing. According to the Site Reassessment Report (NMED, 2017), multiple parties in the area, both current and historical, are being investigated, including the Bell Trading Post property (1503 Central Avenue Northwest); Indian Silver Craft, Inc. (1701 Central Avenue Northwest); Kelly's Transmission Exchange (1816 Central Avenue Southwest); and Park Avenue Cleaners (1004 Park Avenue Southwest). This site was discovered as a result of groundwater monitoring for the Fruit Avenue Plume (FAP) Superfund site in the area. TCE was detected at FAP monitoring wells west of the FAP site. Additional sampling for soil gas and groundwater contamination in the area instigated an investigation by NMED.

The West Central Avenue site was recommended for EPA's Hazard Ranking System by the NMED GWQB Superfund Oversight Section in 2017, based on the monitoring results in the Site Reassessment Report (NMED, 2017). Sampling for soil gas, vapor intrusion, and groundwater contamination has been ongoing and will be expanded with additional soil vapor and groundwater monitoring wells. TCE and PCE were detected in soil vapor samples, and TCE has been detected in FAP groundwater monitoring wells. VOCs were not detected at the two groundwater monitoring wells (WCA-1, WCA-2) installed near the site in March 2017 (NMED, 2017). Groundwater is approximately 40 feet bgs and generally flows to the east.

The groundwater plume is located in the downtown Albuquerque area and between the Duranes, Atrisco, and Yale well fields. The nearest wells are Duranes W-3 and Atrisco Wells 3 and 4, which are about 1.5 to 2 miles northwest and southwest of the plume, respectively, and are upgradient of the plume.

21. PNM Person Generating Station

Responsible Party: Public Service Company of New Mexico (PNM)
***NMED Oversight*:** HWB
Site Status: RCRA Permitted Facility; Post-closure Care Permit

The PNM Person Generating Station contamination site is located on the northeast corner near the intersection of Broadway Boulevard and Rio Bravo Boulevard at 701 Electric Avenue Southeast. PNM operated the Person Generating Station from 1952 to 1986 with regular operation of four, oil-fired electric generating units from 1957 to 1981, and intermittent operation until 1986; followed by deactivation of power facilities in 1993 (NMED, 2013). The site included an unlined well, which has since been removed and covered, that was used from 1976 to 1983 for on-site disposal of waste oils, greases, paints, paint thinners, turpentine, kerosene, a water-trisodium phosphate mixture, and solvents containing TCE and TCA (NMED, 2013).

Both soil and groundwater have been contaminated at this site. Soil remediation included excavation of contaminated soils from the unlined well area and the installation and operation of a soil vapor extraction (SVE) from 1995 to 2003 to remove soil contaminants (NMED, 2013). The corrective action system for groundwater includes a groundwater monitoring well network, groundwater extraction wells (five), and a groundwater pump-and-treat system to remediate contaminated groundwater (NMED, 2013). Contaminants of concern in groundwater at the site include PCE and 1,1-DCE. Treated groundwater is discharged to the UNM Championship Golf Course irrigation lagoons under groundwater discharge permit (DP-1006) from the NMED GWQB (NMED, 2013); DP-1006 was renewed in March 2015 and expires on March 9, 2020. There are monthly samples of the influent and effluent from the two granulated activated carbon units in the groundwater treatment system, and results are reported to NMED on a semi-annual basis (NMED, 2013). Depth to groundwater ranges from 120 to 200 feet bgs at the site.

The nearest Water Authority wells are in the Yale well field and located about 3 miles north of the groundwater plume.

22. Yale Landfill

Responsible Party: City of Albuquerque
NMED Oversight**:** Not currently regulated; site monitoring by AEHD
Site Status: Monitoring

The closed Yale Landfill is located between University Boulevard Southeast and Yale Boulevard Southeast, just west of the Albuquerque International Sunport. The Yale Landfill was in operation by the City from 1948 to 1965 and is estimated to contain 1.9 million cubic yards of waste (City of Albuquerque, 2018). There is a network of 52 landfill gas monitoring wells that have been sampled regularly since 2003 (City of Albuquerque, 2018). Interior landfill gas monitoring wells have measured methane concentrations as high as 51%, and perimeter landfill gas monitoring wells have not exceeded more than 5% methane. Regulated VOCs that have been detected in the landfill gas, soil gas, and groundwater, include chlorofluorocarbons, chlorinated compounds, and petroleum hydrocarbons (Intera, 2014). There is a network of eight groundwater monitoring wells for the Yale Landfill that have been monitored annually since 1989 for organics, inorganics, metals, and field parameters (Intera, 2014). Concentrations of PCE have been detected in monitoring wells at Yale Landfill since 1988 (Intera, 2014). Yale MW-4 has concentrations of PCE ranging from 8-10 µg/L, and Yale MW-9 has concentrations of PCE around 4 µg/L.

Monitoring for landfill gas occurs on a quarterly basis and groundwater monitoring occurs annually. Constituents monitored in groundwater include PCE, TCE, DCE, DCM, chloride, and total dissolved solids (Intera, 2014). The AEHD analyzes the concentrations of contaminants of concern for the site; and any trends of increasing concentrations of landfill gas or groundwater contamination will require changes to the monitoring plan or an initiation of remediation activities. Groundwater at the site ranges from 179 to 425 feet bgs depending on well location. Groundwater flow direction is to the north-northeast. The City established a buffer of 500 feet from the landfill boundary. Building projects and development projects within the buffer zone are reviewed by AEHD for landfill gas impacts.

The nearest Water Authority well to the contamination plume is Yale W-2, approximately 1.6 miles north of the plume. Burton W-4 is roughly 1 mile northeast of the plume. Both Burton W-4 and Yale W-2 are downgradient of the site. Water Authority Yale W-2 has had historical detections of PCE.

23. Phillips 66 Bulk Terminal

Responsible Party: Conoco Phillips
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Administrative Compliance Order

The Phillips 66 Bulk Terminal contamination site is located at 6356 State Road 47. The primary contaminants of concern are ethylene dichloride (EDC), diesel, and BTEX. Contamination has affected both the soil and the groundwater in the area. An updated remediation plan and a pilot test for an in situ chemical oxidation is ongoing at the site, along with semiannual groundwater monitoring. Groundwater is approximately 80 feet bgs and flows to the east.

The Leavitt, Atrisco, and Yale Wells are the nearest, but are all about 5 miles from the plume. All of the wells lie north of the plume and the groundwater flow direction is to the east.

24. BNSF Albuquerque

Responsible Party: Burlington Northern Santa Fe (BNSF) Railway Company
***NMED Oversight*:** GWQB, Remediation Oversight Section
Site Status: Voluntary Stage 1 Abatement

The BNSF Albuquerque contamination plume is located between Copper Avenue Northeast and Iron Avenue Southeast, and 1st Street Southwest and Edith Boulevard Southeast in Albuquerque, NM. A release of diesel resulted in contamination of both soil and groundwater. The site is currently being remediated under an NMED approved Voluntary Stage 1 Abatement Plan, and additional site investigation is required. Groundwater at the site ranges from 35 to 90 feet bgs and flows generally to the east.

The nearest Water Authority well is Yale W-3 which is located approximately 0.9 miles to the east and downgradient from the site.

25. Important Contamination Sites Outside of the Water Authority's Service Area

The remaining contamination sites of interest in this study lie outside of the Water Authority's service area. However, these sites remain of interest to the Water Authority because they affect the shared groundwater resource that contributes to Albuquerque's drinking water supply. The Water Authority intends to monitor progress and remediation activities at the following sites:

- South Valley Dairy Contamination Site
- Cal Main Eggs
- Western Terrace No. 3
- Karler Packing (former)
- Gulton Industries
- Carnuel nitrate plume
- Price's Dairy (Former)
- McCatharn Dairy
- Sandia National Laboratory sites
  - Mixed Waste Landfill
  - Chemical Waste

26. Characteristics of Contaminants and Related Concerns

Table 1 summarizes the contaminants of concern identified at each of the contamination sites discussed and listed in this document. Contaminants with only a secondary drinking water standard (e.g., chloride) were not included in the table, nor were DNAPL and LNAPL, as those are included as individual constituents with occurrences in soil and groundwater.

Table 1 Contaminants of Concern Summary

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
1,2-dichloroethane	5	70	Manufactured chemical not found naturally in the environment. Most commonly used in the production of vinyl chloride which is used to make a variety of plastic and vinyl products, such as PVC pipes, furniture and automobile upholstery, wall coverings, housewares, and automobile parts. It is also used as a solvent. Historically, 1,2-dichloroethane was added to leaded gasoline. Occurrence in the environment includes air, soil, and water. It readily evaporates into air and persists once it is in groundwater (ATSDR, 2011a)	Increased risk of cancer	EDC, Ethylene dichloride

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
1,1-dichloroethene (DCE)	7	5	Industrial chemical used to make certain plastics (e.g., food wrap) and packaging materials. Also used to make flame-retardant coatings for fiber and carpet backings, as well as in piping, steel pipe coating, and adhesives. Occurrence in environment in air, water, and soil. DCE readily evaporates into the air from soil and water (ATSDR, 2011b).	Liver problems	1,1-dichloroethylene
1,4-dioxane	NE	Expected to be listed as toxic pollutant	Synthetic industrial compound used in the manufacturing of other chemicals. Used as a stabilizer in certain chlorinated solvents (particularly TCA), paint strippers, greases, and waxes. Also a trace contaminant in food supplements, cosmetics, detergents, and shampoos. 1,4-dioxane is also produced in the manufacturing of polyethylene terephthalate (PET). Occurrence in the environment in air, water, and soil. It does not adsorb to soil particles and therefore readily transports to groundwater where it migrates rapidly (ATSDR, 2015a).	Classified as "likely carcinogenic to humans" by EPA (EPA, 2017b)	1,4-D, dioxan, glycol ethylene ether

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
1,1,1-trichloroethane	200	60	A synthetic chemical that is slightly soluble in water. It was often used as a solvent to dissolve other substances such as glues and paints. 1,1,1-trichloroethane was widely used to remove oil or grease from manufactured parts. It used to be found in the home as an ingredient to products, such as post cleaners, glues, and aerosol sprays. The chemical was banned from use in the United States after January 1, 2002, due to the fact that it affects the ozone layer. However, until 2012, it was possible to produce 1,1,1-trichloroethane for export. Spills, improper disposal, industrial emissions, and consumer use can release 1,1,1-trichloroethane into the environment. Contaminated water from landfills and hazardous waste sites can impact soil, surface water, and groundwater. Most of the chemical will evaporate into air. While it will degrade in soil and groundwater, it is unknown how long it typically persists (ATSDR, 2015b).	Liver, nervous system, or circulatory problems	TCA, methyl chloroform, methyltrichloromethane, trichloromethyl methane, and trichloromethane

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Trichloroethylene	0.005	0.1	A solvent commonly used to clean metal parts and used to make the refrigerant HFC-134a. TCE can occur in the environment in the air, soil, and water, at places where it is produced or used. It readily breaks down in the air and very slowly degrades in soil and water. Removal of TCE typically occurs as evaporation to the air. Once in groundwater, TCE persists for long periods of time, since it cannot evaporate and does not degrade (ATSDR, 2016).	Liver problems, increased risk of cancer	TCE
Benzene	5	100	A manufactured chemical and naturally occurring compound. Used by some industries to manufacture other chemicals used to make plastics, resins, and nylon and synthetic fibers. It is also used to make lubricants, dyes, detergents, drugs, and pesticides. Benzene is a component of crude oil, gasoline, and cigarette smoke. Natural sources include volcanic eruptions and forest fires. The primary source of benzene in the environment is industrial processes. Benzene can occur in the air, water, and soil (ATSDR, 2015c).	Anemia and increased risk of cancer	N/A

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Ethylbenzene	700	750	Industrial chemical that is also naturally occurring. It is found in manufactured products such as carpet glues, varnishes, paints, tobacco products, inks, insecticides, and paints. It is also commonly used to manufacture styrene. Natural sources include coal tar and petroleum. Ethylbenzene moves readily into the air from soil and water. Degradation of ethylbenzene can occur in soil and surface water, breaking down through reactions with naturally occurring compounds. It can migrate to groundwater from soil (ATSDR, 2015d).	Liver or kidney problems	N/A

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Ethylene dibromide	0.05	0.1	An industrial chemical added to pesticides and gasoline. It is primarily a man-made chemical but can also naturally occur in the ocean in trivial amounts. Historically, ethylene dibromide was used in soil to kill insects and worms that impact fruit, vegetable, and grain crops. It was also used to kill fruit flies. The EPA discontinued most of these uses in 1984. It was also used as an additive to leaded gasoline to improve fuel efficiency. Current uses include treatment of logs for termites and beetles, control of moths in beehives, and preparation of dyes and waxes. Sources of ethylene dibromide in the environment include manufacturing uses and leaks at waste sites. It will evaporate into the air but may also occur in soil and groundwater. Ethylene dibromide persists once in groundwater (ATSDR, 2015e).	Problems with liver, stomach, reproductive system, kidneys, increased risk of cancer	EDB, 1,2-dibromoethane, glycodibromide, bromofume
Methylene chloride	5	100	A solvent used in a wide variety of industries and applications including adhesives, paint and coating products, pharmaceuticals, metal cleaning, chemical processing, and aerosols. It can also be found in pesticides and is used in the manufacturing of photographic film. Methylene chloride in the environment is primarily in air, and it does not easily dissolve into water (ATSDR, 2014b).	Liver problems, increased risk of cancer	DCM, dichloromethane

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Nitrate/Nitrite	1,000 (nitrite measured as nitrogen)	1×10^4 (Nitrate NO_3 as N)	Nitrate and nitrite are naturally occurring ionic species that are part of the Earth's natural nitrogen cycle. Nitrite is readily oxidized to form nitrate, and nitrate is generally stable in the environment. Nitrate may be reduced to nitrite through biological processes involving plants, microbes, etc. In industry, nitrate is used in inorganic fertilizers. Additional uses include commercial nitrate and nitrite food preservation and the production of munitions and explosives. Nitrate and nitrite naturally occur in soil and waters. The principal source of nitrate in soil and water is as an end product of vegetable and animal decomposition. Nitrate and nitrite may also be released into the air, soil, and water in areas where inorganic fertilizer is produced or used. Human and animal wastes are important sources of ammonia which is readily oxidized to nitrite in aerobic environments. Nitrate and nitrite have been detected in surface waters and groundwater. Releases of nitrate and nitrite can occur as a result of agricultural runoff, and discharges from septic systems and municipal waste water treatment facilities (ATSDR, 2015f).	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	N/A

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Polycyclic Aromatic Hydrocarbons (PAHs)	0.2 (benzo(a)pyrene)	30 (total naphthalene plus monomethyl-napthalenese)	PAHs are a group of chemicals that generally occur as complex mixtures instead of single compounds. They are formed during the incomplete burning of coal, oil, gas, wood, garbage or other organic substances like tobacco and charbroiled meat. There are over 100 PAHs which can occur naturally or be manufactured as individual compounds for research purposes. A few PAHs are used in medicines and to make dyes, plastics, and pesticides. Others are contained in asphalt used in road construction. PAHs can also be found in crude oil, coal, coal tar pitch, creosote, and roofing tar. They can occur in the environment in air, soil, and water. PAHs enter the environment mostly as releases to air from volcanoes, forest fires, residential wood burning, and exhaust from automobiles and trucks. They can also be released from industrial plants and hazardous waste sites. Migration of PAHs in the environment is dependent on the individual PAH properties and how easily they dissolve in water and evaporate into air. PAHs can potentially breakdown into longer lasting compounds. Breakdown in soil and groundwater can occur as the result of microorganisms (ATSDR, 2015g).	Reproductive difficulties; increased risk of cancer	Acenaphthene, acenaphthylene, anthracene, benz[a]anthracene, benzo[a]pyrene, benzo[e]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[j]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-c,d]pyrene, phenanthrene, pyrene

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Tetrachloroethene (PCE)	5	20	A manufactured chemical used for dry cleaning and metal degreasing. It is also a starting material for the manufacturing of other chemicals and may occur in consumer products. PCE can be released to the air, soil, and water wherever it is produced or used. It breaks down very slowly in air and evaporates quickly from water into air. PCE can migrate through soil to groundwater. It is slow to breakdown in both soil and water (ATSDR, 2014a).	Liver problems, increased risk of cancer	Perchloroethylene, PCE, perc, tetrachloroethene, and perchlor

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Toluene	1,000	750	Manufactured chemical and naturally occurring compound. Toluene used in the manufacturing of paints, paint thinners, lacquers, adhesives, and rubber. It is also used in the product of benzene, nylon, plastics, and polyurethane, and the synthesis of trinitrotoluene (TNT). Toluene is produced in the making of gasoline and other fuels from crude oil, and it is a byproduct of making coke from coal. Toluene is naturally occurring in crude oil and in the tolu tree. Occurrence of toluene in the environment includes air, soil, and water. It is most commonly found in the air as the result of auto emissions in areas of high vehicular traffic. Toluene readily evaporates into the air from water and soil. Releases of toluene to soil and groundwater can occur as the result of solvent and petroleum products spills, from leaking underground storage tanks, and the disposal of toluene-containing products at landfills. Biodegradation of toluene in groundwater can occur under anaerobic conditions (ATSDR, 2015h).	Nervous system, kidney, or liver problems	N/A

Name of Contaminant	EPA MCL (µg/L) (EPA, 2009)	New Mexico Groundwater Standard (µg/L) (NMAC 20.6.2.3103)	Description	Health Effects	"Also known as"
Xylenes	$1x10^4$	620	Xylenes is being used generally to refer to the three isomers (m-, o-, and p-xylene). It is primarily a synthetic chemical, but also occurs naturally in petroleum, coal tar, and as the result of forest fires. Xylenes are primarily used as a solvent in printing, rubber, and leather industries. It is also widely used as a cleaning agent, a thinner for paint, and in varnishes. Xylenes are found in small amounts of airplane fuel and gasoline. Xylene is a liquid and therefore can migrate into soil and water. It readily evaporates into the air from soil and water and is broken down by sunlight within a couple of days. Once in groundwater, xylenes can persist until broken down through biodegradation (ATSDR, 2007).	Nervous system damage	Xylene, total xylenes, xylol, and dimethylbenzene

ATSDR Agency for Toxic Substances & Disease Registry
MCL Maximum contaminant level
mg/L milligrams per liter
µg/L micrograms per liter
N/A Not applicable
NE Not established
NMAC New Mexico Administrative Code
PVC polyvinyl chloride

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Albuquerque Bernalillo County
Water Utility Authority

Surface Water Source Water Assessment

August 2018

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List of Acronyms and Abbreviations

ac-ft	acre-feet
ac-ft/yr	acre-feet per year
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
cfs	cubic feet per second
City	City of Albuquerque
County	Bernalillo County
DBS&A	Daniel B. Stephens & Associates
DWP	Drinking Water Project
EMNRD	Energy, Mineral, and Natural Resources Department
GIS	Geographic Information System
MRGCD	Middle Rio Grande Conservancy District
MS4	Municipal Separate Storm Sewer System
NDC	North Diversion Channel
NM	New Mexico
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
OSE	Office of the State Engineer
PLSS	Public Land Survey System
POD	Point of Diversion
PSOC	Potential Source of Contamination
RAPP	Rivers and Aquifers Protection Plan
RM	River Mile
SJC	San Juan-Chama
SWA	Source Water Assessment
SWPA	Source Water Protection Area
USACE	United States Army Corps of Engineers
Water Authority	Albuquerque Bernalillo County Water Utility Authority
WQPPAP	Water Quality Protection Policy and Action Plan

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Executive Summary

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) began updating the 2009 Water Quality Protection Policy and Action Plan (WQPPAP) in 2018. As part of the 2018 update, the WQPPAP was renamed the Rivers and Aquifers Protection Plan (RAPP) to better represent both the surface water and groundwater comprising the drinking water supply sources for the Water Authority. The Surface Water Source Water Assessment (SWA) follows the general methodology outlined in the New Mexico Environment Department (NMED) guidance document *Source Water Assessment & Protection Program Report of Water Utility, for Surface Water Systems* (NMED, 2014). As part of the assessment, the Water Authority defined Source Water Protection Areas (SWPAs), built an inventory of Potential Sources of Contamination (PSOCs), and analyzed surface water source susceptibility to contamination.

Susceptibility is determined through analysis of a source water's vulnerability to contamination, a function of the types and number of occurrences of PSOCs, and the water source's sensitivity to contamination (e.g., mitigation measures to prevent or control impacts to the source). For this Surface Water Source Water Assessment (SWA), the Water Authority defined three SWPAs: 1) San Juan-Chama (SJC) Drinking Water Project (DWP) diversion; 2) Cochiti Reservoir; and 3) Abiquiu Reservoir. These SWPAs were further divided into three buffer zones for a more detailed analysis of PSOCs, their proximity to the source, and the source's vulnerability.

The buffer zones are designated as Zone A, Zone B, and Zone C and extend outward from the source (river or reservoir) with the outermost zone boundary set to half a mile from the source. A fourth zone, Zone D, is also included in this assessment; and it represents the watershed for the three SWPAs, extending from the headwaters in southern Colorado to the SJC DWP diversion in Albuquerque, New Mexico (NM). The SJC DWP diversion SWPA is specific to the river, beginning 500 feet downstream of the diversion and extends 15 river miles (RMs) upstream of the diversion; the SWPA is further divided into 1-RM segments for ease of analysis and discussion. The two reservoir SWPAs, Cochiti and Abiquiu, are delineated using 2016 water levels in aerial imagery.

For source water assessments, PSOCs are defined as any possible sites or events that could, under any circumstance and time frame, lead to contamination of a water system's sources. For this Surface Water SWA, multiple resources were used to identify PSOCs within the SWPAs. The primary source of data was the NMED's source water protection atlas geodatabase, known as *EnviroMap*, which provides information on sites that are registered with the state. Additional data resources included the Office of the State Engineer; New Mexico Energy, Mineral, and Natural Resources; New Mexico Department of Transportation; Middle Rio Grande Conservancy District; the Albuquerque Metropolitan Arroyo Flood Control Authority; and the U.S Geological Survey.

Vulnerability

A source's vulnerability to contamination is based on an inventory of the type, number, and proximity of PSOCs to a water source. For this assessment, the Water Authority used three factors to analyze a source's vulnerability: PSOC Risk, Proximity to Source, and PSOC occurrence. The PSOC Risk is a combination of the probability of occurrence for a given PSOC type and the severity of impact for that PSOC type. Each PSOC was assigned a Proximity to Source value depending on its occurrence in Zone A, Zone B, or Zone C for a given SWPA; Zone D was not evaluated for surface water sources. Finally, the PSOC Count represents the total number of occurrences for each PSOC type by zone for a given SWPA.

The PSOC Risk, Proximity to Source, and PSOC Count were weighted and summed to achieve an overall vulnerability score that was divided evenly to be ranked as low, moderately low, moderate, moderately high, or high. The vulnerability rankings for the Water Authority SJC DWP diversion SWPA range from low to high, with the high ranking occurring at RM 10-11. The high vulnerability ranking at RM 10-11 was driven by the occurrence of a National Pollution Discharge Elimination System (NPDES) permit in that reach; this NPDES permit is for the Bernalillo Waste Water Treatment Plant. Cochiti Reservoir has a vulnerability ranking of low, and Abiquiu Reservoir is ranked as moderate.

Sensitivity

Sensitivity is an evaluation of a source's infrastructure. It is meant to capture a utility's ability to implement mitigation measures to prevent or control contamination impacts to a source. Sensitivity was applied uniformly to a SWPA and follows the NMED guidance rankings of low, moderately low, moderate, moderately high, and high. Both the SJC DWP diversion and Abiquiu SWPAs have sensitivity rankings of moderate, due largely to the infrastructure in place to stop flow, if needed, in the event of a release of contamination to the surface water SWPA. Cochiti

Reservoir has a sensitivity ranking of moderately high due to the lack of infrastructure at the reservoir (no way to stop or mitigate flow to the reservoir).

Susceptibility: Vulnerability and Sensitivity Combined

Once the vulnerability and sensitivity rankings were determined for the SWPAs, they were combined to determine the source's susceptibility. In the case of the SJC DWP diversion SWPA, a susceptibility ranking was assigned for each individual RM segment. Each of the reservoir SWPAs, Cochiti and Abiquiu, has its own susceptibility ranking. There were no surface water sources ranked higher than "moderately high" for susceptibility. The highest susceptibility rankings identified in this study occurred along the river, upstream of the SJC DWP diversion, in four RM segments (RM 0-1, RM 7-8, RM 9-10, and RM 10-11). Table ES-1 summarizes the susceptibility scores for this Surface Water SWA.

The susceptibility rankings for the surface water SWPAs were evaluated by the Water Authority in order to make recommendations, with the goal of reducing moderately high susceptibility rankings and maintaining moderately low susceptibility rankings. The scope of the recommendations in this assessment includes ordinance and policy actions, such as incentives to promote the removal of septic systems and the connection to sanitary sewer service. The Surface Water SWA also identifies areas of continued collaboration and cooperation with the City, County, and NMED to prevent impacts to surface water sources. Key areas for collaboration include notification coordination with NMED and Emergency Response teams in the Middle Rio Grande when spills or accidents occur. Additionally, the assessment recommends that the Water Authority, as well as the City and County, and the NMED build and continuously update a robust database with current land use, site data, and permits, so that thorough and robust source water assessments can occur statewide.

Future updates to the Surface Water SWA should consider using high water levels to define river and reservoir polygons. Land-use data should also be incorporated into future assessments for completeness of the PSOC inventory, and therefore, a more robust vulnerability assessment. Finally, future updates to this assessment should consider the addition of Heron Reservoir to the SWPAs evaluated.

Table ES-1. Susceptibility Rankings by Source

Source	Vulnerability	Sensitivity	Susceptibility
SJC DWP Diversion			
RM –500 ft–0	Low	Moderate	Moderately low
RM 0–1	Moderately high		Moderately high
RM 1–2	Moderate		Moderate
RM 2–3	Moderate		Moderate
RM 3–4	Moderate		Moderate
RM 4–5	Moderately low		Moderate
RM 5–6	Moderately low		Moderate
RM 6–7	Moderate		Moderate
RM 7–8	Moderately high		Moderately high
RM 8–9	Moderately low		Moderate
RM 9–10	Moderately high		Moderately high
RM 10–11	High		Moderately high
RM 11–12	Moderate		Moderate
RM 12–13	Moderate		Moderate
RM 13–14	Moderately low		Moderate
RM 14–15	Low		Moderately low
Reservoirs			
Abiquiu Reservoir	Moderate	Moderate	Moderate
Cochiti Reservoir	Low	Moderately high	Moderate

1. Introduction

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) began updating the 2009 Water Quality Protection Policy and Action Plan (WQPPAP) in 2018. The 2018 update to the WQPPAP included renaming the document the Rivers and Aquifers Protection Plan (RAPP) to better represent the surface water and groundwater comprising the drinking water supply sources for the Water Authority. As part of the RAPP, the Water Authority is completing source water assessments for both surface water and groundwater. The Surface Water Source Water Assessment (SWA) identifies Source Water Protection Areas (SWPAs) at the point of diversion for the San Juan-Chama (SJC) Drinking Water Project (DWP), Cochiti Reservoir, and Abiquiu Reservoir, in order to determine the surface water source susceptibility to contamination. In order to assess susceptibility to contamination, this Surface Water SWA inventoried Potential Sources of Contamination (PSOCs), infrastructure, and hydrogeology.

Sources of information reviewed as part of this Surface Water SWA included data from the New Mexico Environment Department (NMED) online geodatabase and mapping tool (*EnviroMap*); City of Albuquerque (City) databases on land use and landfills (active and closed); Bernalillo County (County) septic tank locations; and New Mexico Office of the State Engineer (OSE) wells. Details of the data sources used and data quality issues identified are discussed in further detail in Section 4.2 of this document. As the assessment was performed, information from Water Authority staff, NMED bureaus, and City and County counterparts increased the overall quality and completeness of the assessment by ensuring the use of updated and site-specific information.

The result of this Surface Water SWA is the assignment of susceptibility rankings for 15 river miles upstream of the Water Authority diversion point for the SJC DWP, and for two upstream reservoirs, Cochiti and Abiquiu. These rankings and the findings of this Surface Water SWA will support the Water Authority in moving forward with its source water protection planning and with implementing policies and actions to ensure the protection of surface water sources, now and into the future. One of the best ways to ensure safe drinking water and maximize management of our drinking water sources is to protect against potential contamination. The recommendations in this Surface Water SWA encourage the continued collaboration of the Water Authority, City, County, and NMED, as well as the public and other state and local agencies, for the implementation of source water protection measures.

This Surface Water SWA was developed through the collaboration of Daniel B. Stephens and Associates (DBS&A), a contractor to the NMED; the NMED Drinking Water Quality Bureau's Source Water Protection Program; and the Water Authority. The methodology for assessing susceptibility for surface water as presented in this document is based on the guidance document developed by the NMED titled *Source Water Assessment & Protection Program Report of Water Utility, for Surface Water Systems* (NMED, 2004).

2. Surface Water Sources

There are three surface water study areas analyzed in this Surface Water Source Water Assessment (SWA). Figure 1 shows the Water Authority surface water sources on a watershed scale. One is a diversion off the Rio Grande located within the Albuquerque urban area; the other two are surface water reservoirs upstream of the diversion. Those study areas are identified as follows:

- San Juan-Chama (SJC) Drinking Water Project (DWP) diversion
- Cochiti Reservoir
- Abiquiu Reservoir

Currently, SJC DWP water is used as the Water Authority's surface water source. Cochiti and Abiquiu Reservoirs are important reservoirs along the Rio Grande and Rio Chama, respectively, affecting water quality at the SJC DWP point of diversion to the drinking water treatment plant; therefore, these reservoirs are analyzed in this SWA.

In 2008, the Water Authority's SJC DWP came online providing surface water, in addition to the Water Authority's groundwater supply wells. The SJC DWP is a U.S. Bureau of Reclamation transbasin water diversion from the San Juan River Basin (tributary to the Colorado River) to the Rio Grande Basin. Water diverted from three tributaries (Navajo River, Little Navajo River, and Rio Blanco) is imported into the Rio Grande through a series of tunnels discharged to Willow Creek and flowing into Heron Reservoir, located on the Rio Chama, where it is allocated to SJC contractors. From Heron Reservoir, water flows southeast via the Rio Chama through Abiquiu Reservoir until it reaches the Rio Grande. The confluence of the Rio Chama and the Rio Grande is located approximately 5 miles north of Espanola, New Mexico (NM) (30 miles north of Santa Fe, NM). The Water Authority SJC DWP diversion is located on the Rio Grande in Bernalillo County, roughly a quarter mile south of the Alameda Boulevard Northwest/Highway 528 bridge.

Diversions for the SJC DWP can occur anytime during the year, as long as streamflow exceeds the minimum allowable amount; total diversions cannot exceed 1,350,000 acre-feet in any 10-year period. The Water Authority may divert up to 96,400 acre-feet per year (ac-ft/yr) providing that return flow to the Rio Grande is equal to at least half of the total diversion at all times, and river flows are no less than 200 cubic feet per second (cfs) (65 cfs SJC water and 135 cfs native Rio Grande water) at the point of diversion. The Water Authority receives its allotment of SJC DWP diverted water from the outlet of Heron Reservoir and releases SJC water to Abiquiu Reservoir where the Water Authority has 170,900 acre-feet (ac-ft) of storage capacity.

3. Source Water Protection Areas

For surface water sources, the Source Water Protection Area (SWPA) consists of buffer zones around reservoirs and on either side of rivers, streams, and canals, for use in identifying potential contamination from sources. Per New Mexico Environment Department (NMED) guidance (NMED, 2004), the Surface Water Source Water Assessment (SWA) includes the watershed delineated up to the headwaters, from all points of diversion and intake. From the watershed scale, the assessment further divides the surface water system into smaller SWPAs for a focused analysis of potential impacts to surface water. For this Surface Water SWA, the SWPAs include:

- San Juan-Chama (SJC) Drinking Water Project (DWP) diversion – This SWPA begins 500 feet downstream of the intake and extends 15 miles upstream.
- Cochiti Reservoir – This SWPA includes the extent of the reservoir as defined by the United States Army Corps of Engineers (USACE) Reservoir Summary for Cochiti Reservoir (USACE, 2018).
- Abiquiu Reservoir – This SWPA includes the extent of the reservoir as defined by the USACE Reservoir Summary for Abiquiu Reservoir (USACE, 2018).

Each SWPA was further divided into four zones for analysis purposes:

- Zone A: 0 to 200 feet from each reservoir or stream bank
- Zone B: 200 to 500 feet from each reservoir or stream bank
- Zone C: 500 to 2,640 feet from each reservoir or stream bank
- Zone D: 2,640 feet from each reservoir or stream bank to the boundary of the watershed

Figure 1 provides a watershed-level view of the SWPAs. Figures 2 and 3 show the four buffer zones for the SJC DWP diversion SWPA. Figure 2 illustrates the delineation of Zones A through C and Figure 3 is the watershed scale (Zone D). Figures 4 and 5 show each reservoir SWPA with Zones A through C delineated.

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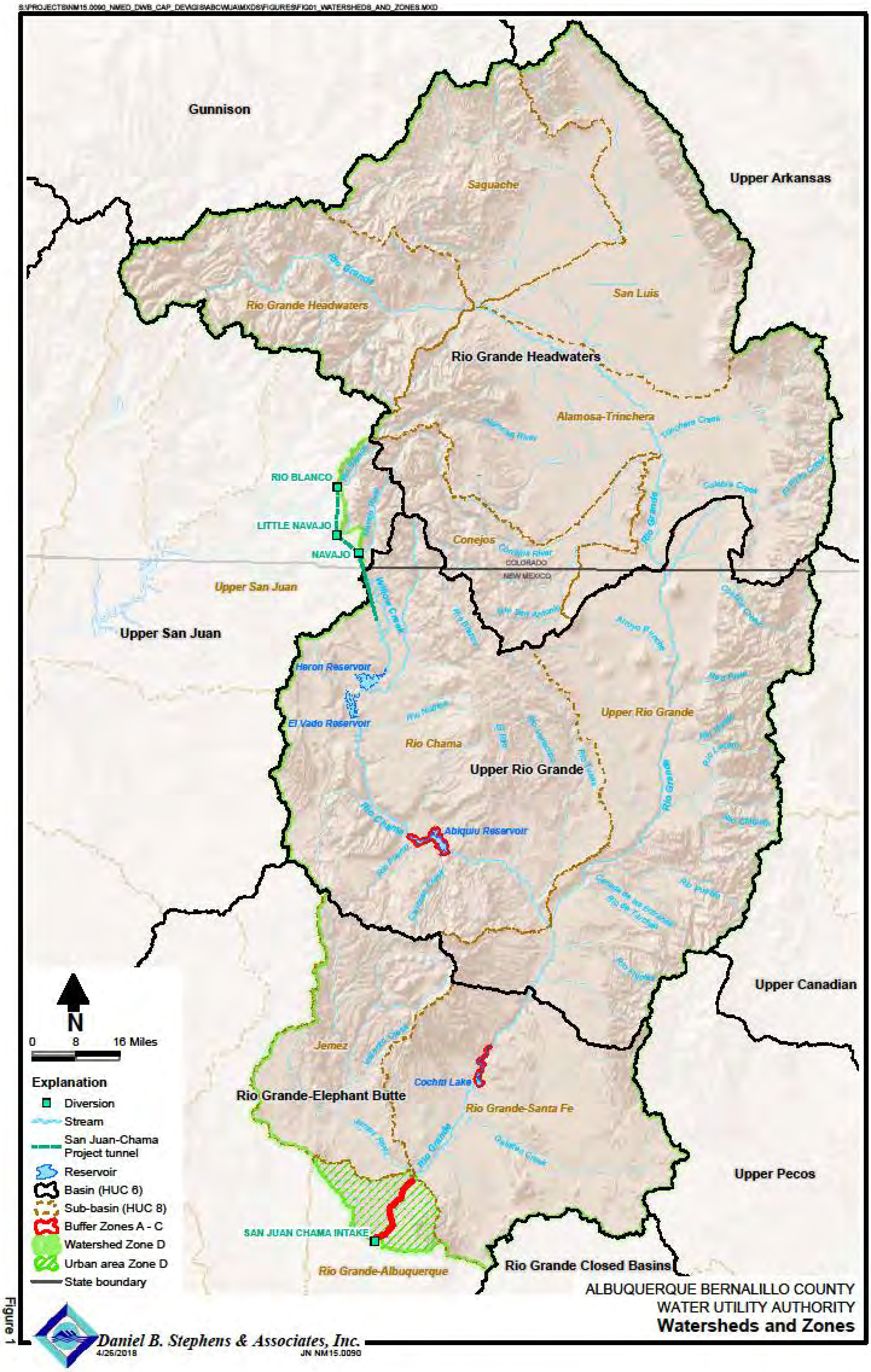
Figure 1. Watersheds and Zones



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3.1 Zones A through C

For rivers, NMED guidance in the *New Mexico Source Water and Wellhead Protection Toolkit* (NMED, 2013) recommends that the SWPA begins 500 feet downstream of the intake and extends 10 miles upstream. In this Surface Water SWA, the river SWPA was extended to 15 miles upstream of the SJC DWP diversion. By extending the river SWPA, the assessment encompasses the entire upstream urban area, and therefore, captures the increased likelihood of contamination due to PSOCs associated with urban areas, such as urban runoff, roads, industrial, and commercial sources.

In order to define the river SWPA zones A through D, a site-specific dataset was created by digitizing the stream channel upstream of the SJC DWP diversion. An aerial photograph dated June 17, 2015, was used to identify the river center line beginning 500 feet south of the SJC DWP diversion and extending 15 miles upstream. Once the center line was defined, buffers for Zones A through C begin at the edge of the river polygon; and the center line is used to determine river miles upstream from the SJC DWP diversion.

In order to define the SWPA zones for the two reservoirs analyzed in this assessment, it was necessary to define the extent of the reservoir using a known height of water. The available satellite imagery for the Cochiti and Abiquiu reservoirs shows a significant amount of variability in water levels, over time. Polygons for the reservoirs were digitized based on the water levels visible on 2016 aerial photography, since the 2016 aerial photography was the most recent photography available at the time of the assessment. The buffers for Zones A through C for both reservoirs start from the edge of each reservoir polygon.

The ArcGIS “Multiple Ring Buffer” tool was used to generate the buffers around the river and reservoir features for Zones A through C.

3.2 Zone D

The Watershed Zone D includes the entire Rio Grande Basin above the SJC DWP diversion, as well as a small portion of the headwaters of the Colorado River and the Upper San Juan Basin where SJC DWP water originates. As the SJC DWP water is diverted and transported downstream to the Water Authority intake, the water crosses multiple hydrologic basins; consequently, the watershed-scale portion of this assessment, Zone D, includes the following basins (Figure 1):

- Rio Grande Headwaters
- Upper Rio Grande
- A portion of the Upper San Juan
- A portion of the Rio Grande-Elephant Butte basin

For this Surface Water SWA, Zone D was not assigned zone-specific rankings. Instead, Zone D was evaluated for types of PSOCs existing in the watershed and the associated number of occurrences.

4. Potential Sources of Contamination

4.1 Definition and Description

For source water assessments, Potential Sources of Contamination (PSOCs) are defined as any possible site or event that could, under any circumstance and time frame, lead to contamination of a water system's sources. Not all features identified as PSOCs pose the same level of risk. Depending on the type of PSOC, some pose little to no contamination risk, while others may pose an imminent threat.

Section 4.2 provides a more complete description of data sources, methodologies for analysis, and data quality issues associated with the PSOC inventory. The PSOC types identified in this assessment have been grouped into categories, along with the types of contaminants that are generally associated with each category type (Table 1a and 1b).

Potential contamination from the types of land uses identified in this assessment could be the result of many uses, including manufacturing, waste disposal, and/or accidental spills. Fertilization of green spaces, such as parks, is another PSOC type in this study due to the potential release of nitrate to surface waters during runoff events. Table 2a summarizes the PSOC occurrences by zone for the San Juan-Chama (SJC) Drinking Water Project (DWP) diversion Source Water Protection Area (SWPA) and Table 2b summarizes the PSOC occurrences by zone for both Abiquiu and Cochiti reservoirs.

Figures 2 through 6 show the SWPA and PSOCs by zone for the river SWPA Zones A through C; SJC DWP diversion SWPA Zone D; Cochiti Reservoir SWPA Zones A through C; Abiquiu Reservoir SWPA Zones A through C; and the Watershed Zone D that encompasses the river and reservoir SWPAs, respectively. Table 3 summarizes the types and occurrences of PSOCs in the Watershed (Zone D).

4.2 PSOC Data Sources

Multiple resources were used to identify PSOCs within the SWPAs analyzed in this assessment. New Mexico Environment Department (NMED) maintains an interactive web map called

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Table 1a. PSOC Types and Associated Contaminants

PSOC Category [a]	Acute Health Concerns								Chronic Health Concerns									Aesthetic Concerns
	Microorganisms	Nitrate/nitrite	Pesticides	SVOCs	VOCs	Arsenic	Lead	Ammonia/nitric acid	Herbicides	Pesticides	VOCs	Non-Metal Inorganic Compounds	Metals - Primary Drinking Water	Radionuclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
Oil and gas facilities				X	X	X					X					X	X	X
Pipeline companies				X	X			X	X		X	X	X			X	X	X
Electrical companies				X	X		X	X	X		X	X	X			X	X	X
Gas companies					X			X	X		X	X	X			X	X	X
Water and sewage companies - utilities	X	X		X	X	X		X			X	X	X			X	X	X
Parks, lawns, and grounds maintenance		X	X						X	X					X	X	X	X
Campgrounds		X														X	X	X
Septic tanks/systems cleaning/repairing	X	X														X	X	X
Landfills		X		X	X			X			X	X	X			X	X	X
Pet care/veterinary	X	X						X								X		X
Groundwater remediation sites		X		X	X	X					X	X	X			X	X	X
Groundwater discharge permits																X	X	X
Surface water permits																X	X	X
Land Uses																		
Agricultural fields/farming/irrigated cropland	X	X	X					X	X	X					X	X	X	X
Commercial/industrial/transportation land use		X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Stormwater		X	X	X	X				X	X	X				X	X	X	X

Table 1a. PSOC Types and Associated Contaminants

PSOC Category [a]	Acute Health Concerns								Chronic Health Concerns									Aesthetic Concerns
	Microorganisms	Nitrate/nitrite	Pesticides	SVOCs	VOCs	Arsenic	Lead	Ammonia/nitric acid	Herbicides	Pesticides	VOCs	Non-Metal Inorganic Compounds	Metals - Primary Drinking Water	Radionuclides	Turbidity	Other Inorganic Compounds	Other Organic Compounds	Secondary Drinking Water Contaminants
Natural features																X	X	X
Road miles	X	X	X	X	X			X	X	X	X	X			X	X	X	X
Mining															X	X	X	X
Military		X	X	X	X	X		X	X	X	X	X	X		X	X	X	X

[a] See table 2b for PSOC types included in each category
PSOC Potential Source of Contamination
SVOC Semi-volatile organic compound
VOC Volatile organic compound

Table 1b. Grouping of PSOC Types into PSOC Categories

Oil and Gas Facilities	*Commercial/Industrial/Transportation Land Use*
AST facility	Airport - Albuquerque International Sunport
Automotive body shop	Carwash
Automotive repair shop	Concrete/cement plants
Bulk petroleum	Construction and open equipment storage
Gas well, temporarily abandoned	Dry-cleaning shop
Gasoline service station	Electronic/electrical equipment manufacturing
Gasoline service tank	Funeral home/crematory
Storage tank, LUST	Furniture repair and manufacturing
Storage tank, underground	Hardware/lumber/parts store
Pipeline Companies	Hazardous waste facility - Safety Kleen - Albuquerque
Oil/gas pipeline	Metal processing facility
Electrical Companies	Motor pools - RT 66 Enterprises and Aragon Inc.
Electric utility	Paint store
Utility/transportation right of way	Photo-processing laboratory
Gas Companies	Primary wood industries (wood, stone, clay and glass manufacturing)
Utility/transportation right of way	
Water and Sewage Companies - Utilities	Printing shop
Private well	Research laboratory (medical laboratory)
Water supply well	Stone, tile, and glass manufacturing
Water treatment plant	Utility/transportation right of way
Parks, Lawns, and Grounds Maintenance	*Natural Features*
Cemetery	Arroyo
Golf course	Drainage
Park	Drainage canals, ditches, or acequias - unlined
Agricultural Fields/Farming/Irrigated Cropland	*Road Miles*
Campgrounds	Major road
Septic Tanks/Systems Cleaning/Repairing	*Surface Water Permits*
Septic tank	NPDES permit: City of Bernalillo/WWTP-001
Landfills	NPDES permit: City of Rio Rancho No. 3
Closed landfill	*Mining*
Unregulated dump	Mining operations - crushed stone, sand, and gravel extraction
Pet Care/Veterinary	
Veterinary services	*Military*
Stormwater	Military facilities - Kirtland Air Force Base
North Diversion Channel	
Street storm drain	
Stormwater pond	
Groundwater Remediation Sites	*Groundwater Discharge Permits*
Brownfield - Luna Lodge	Groundwater discharge permit: City of Rio Rancho Reuse Project
Brownfield - Winrock Town Center	

Table 1b. Grouping of PSOC Types into PSOC Categories

Contamination plume - BNSF Albuquerque	Groundwater permit, active - Bear Canyon Recharge Demonstration Project
Contamination plume - Digital/Hewlett Packard	
Contamination plume - Fox & Associates Albuquerque	Groundwater permit, ceased - APS - Martin Luther King Elementary
Voluntary remediation site - First Federal Bank @ Digital	Groundwater permit, ceased - APS - Ann Binford Elementary School
Voluntary remediation site - Thriftway - Wright Gallery	
Voluntary remediation site - Triple S, Inc. (Kerr McGee Number #6007)	Groundwater permit, ceased - Contract Carriers
	Groundwater permit, terminated - Albuquerque Six-Plex Theatre
	Groundwater permit, terminated - Former Digital Equipment Corporation
	Groundwater permit, terminated - Yale Auto Sale Site

APS Albuquerque Public Schools
AST Aboveground Storage tank
BNSF Burlington Northern Santa Fe Railway
LUST Leaking Underground Storage Tank
NPDES National Priorities Discharge Elimination System
PSOC Potential Source of Contamination
RT 66 Route 66
WWTP Wastewater Treatment Plant

Table 2a. PSOC Occurrence by Zone, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use [b]	Description	Occurrences	Total PSOC Occurrence per Mile
–500 ft–0	B	A	Drainage canal, ditch, or acequia - unlined	2	26
		—	Private well	2	
	C	—	Private well	22	
0–1	A	M	Major road	1	48
		A	Drainage canal, ditch, or acequia - unlined	1	
		—	Private well	1	
	B	A	Drainage canal, ditch, or acequia - unlined	3	
		—	Street storm drain	1	
		—	Private well	4	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	4	
		—	Private well	32	
1–2	A	—	Private well	1	47
	B	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	1	
		—	Private well	10	
	C	A	Drainage canal, ditch, or acequia - unlined	3	
		A	Agricultural fields	4	
		—	Private well	27	
2–3	A	—	North Diversion Channel	1	10
	B	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	1	
	C	A	Drainage canal, ditch, or acequia - unlined	3	
		A	Agricultural fields	2	
		—	Private well	2	
3–4	A	A	Drainage canal, ditch, or acequia - unlined	1	61
	B	A	Drainage canal, ditch, or acequia - unlined	2	
		—	Private well	1	
		M	Septic tank	2	
	C	A	Drainage canal, ditch, or acequia - unlined	3	
		A	Agricultural fields	7	
		—	Private well	23	
		M	Septic tank	22	
4–5	A	—	Private well	1	9
	C	A	Drainage canal, ditch, or acequia - unlined	6	
		C	Railroad yards and tracks	1	
		M	Septic tank	1	
5–6	B	A	Drainage canal, ditch, or acequia - unlined	1	42

Table 2a. PSOC Occurrence by Zone, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use [b]	Description	Occurrences	Total PSOC Occurrence per Mile
5–6 (cont.)	C	A	Drainage canal, ditch, or acequia - unlined	3	
		A	Agricultural fields	9	
		—	Private well	16	
		M	Septic tank	13	
6–7	A	—	Arroyo	1	49
	B	A	Drainage canal, ditch, or acequia - unlined	4	
		—	Private well	3	
		M	Septic tank	3	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	7	
		—	Private well	12	
		M	Septic tank	18	
7–8	A	A	Drainage canal, ditch, or acequia - unlined	1	32
	B	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	4	
		—	Private well	3	
		M	Septic tank	2	
	C	A	Drainage canal, ditch, or acequia - unlined	2	
		A	Agricultural fields	3	
		—	Private well	6	
		M	Septic tank	10	
8–9	A	—	Arroyo	2	5
		M	NPDES Permit - City of Rio Rancho No. 3	1	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		—	Private well	1	
9–10	A	—	Arroyo	1	24
	B	A	Drainage canal, ditch, or acequia - unlined	1	
		—	Private well	2	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		—	Arroyo	1	
		A	Agricultural fields	4	
		—	Private well	7	
		M	Septic tank	7	
10–11	A	—	Arroyo	1	65
		M	NPDES Permit - City of Bernalillo/WWTP-001	1	
	B	A	Drainage canal, ditch, or acequia - unlined	2	
		A	Agricultural fields	1	
		—	Private well	1	

Table 2a. PSOC Occurrence by Zone, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use [b]	Description	Occurrences	Total PSOC Occurrence per Mile
10–11 (cont.)	B	M	Septic tank	12	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	10	
		—	Private well	6	
		M	Septic tank	30	
11–12	A	—	Arroyo	1	54
		M	Major road	1	
		—	Private well	3	
	B	A	Drainage canal, ditch, or acequia - unlined	2	
		—	Private well	28	
	C	A	Drainage canal, ditch, or acequia - unlined	1	
		A	Agricultural fields	4	
		—	Private well	14	
12–13	A	—	Private well	2	30
	B	—	Private well	2	
	C	A	Drainage canal, ditch, or acequia - unlined	2	
		A	Agricultural fields	2	
		C	Golf course	1	
		—	Private well	17	
		M	Septic tank	4	
13–14	A	—	Arroyo	1	8
	B	A	Drainage canal, ditch, or acequia - unlined	2	
		A	Agricultural fields	2	
	C	A	Agricultural fields	3	
14–15	C	A	Drainage canal, ditch, or acequia - unlined	1	9
		A	Agricultural fields	8	

- [a] If a zone is not listed, no PSOCs were identified in that zone.
- [b] A = Agricultural, C = Commercial, M = Municipal/residential

Table 2b. PSOC Occurrence by Zone, Abiquiu and Cochiti Reservoirs

Reservoir	Buffer Zone	Land Use [a]	Description	Occurrences	Total PSOC Occurrence per Reservoir
Abiquiu	A	—	Arroyo	28	63
		C	Campground - unsewered	1	
		—	Private well	10	
	B	—	Private well	6	
		M	Septic tank	2	
	C	—	Private well	4	
		M	Major road	1	
		M	Septic tank	11	
Cochiti	A	—	Arroyo	19	23
		—	Private well	1	
	B	C	Campground - unsewered	2	
	C	—	Private well	1	

Table 3. PSOC Types and Counts in Watershed (Zone D)

PSOC Type	Count
Superfund site	3
Aboveground Storage Tank (AST) sites	65
Solid waste facility	5
Abatement sites	13
Brownfields	14
Hazardous waste facilities	1
Groundwater permits	*222*
Active	81
Ceased	16
Defunct	1
Denied	1
DP pending	3
Inactive	9
Terminated	44
Transferred liquid waste	64
Withdrawn	3
Underground Storage Tank (UST) sites	173
NM leaking UST site	60
CO leaking UST site	19
Landfill entrance	8
NPDES permit	44
Voluntary remediation site	18
Major uranium deposit	2
Minor mines (produced)	14
Uranium occurrences (no production)	278
Asbestos mineral occurrence	4
Petroleum pool map	18
Private wells	2,048
Oil and gas wells	495

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Figure 2. Potential Sources of Contamination, San Juan-Chama Drinking Water Diversion

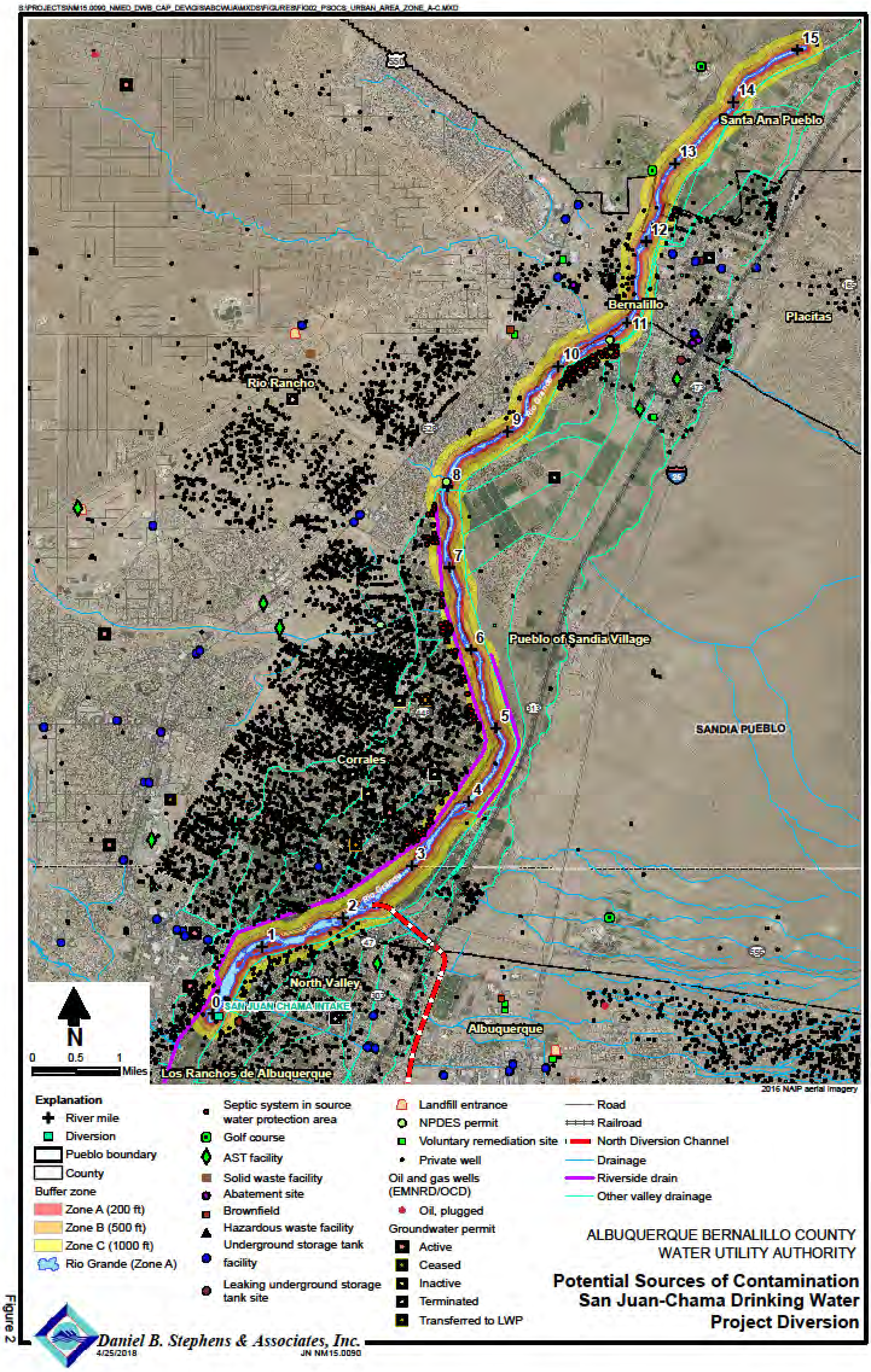

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Figure 3. Potential Sources of Contamination, Watershed Zone D

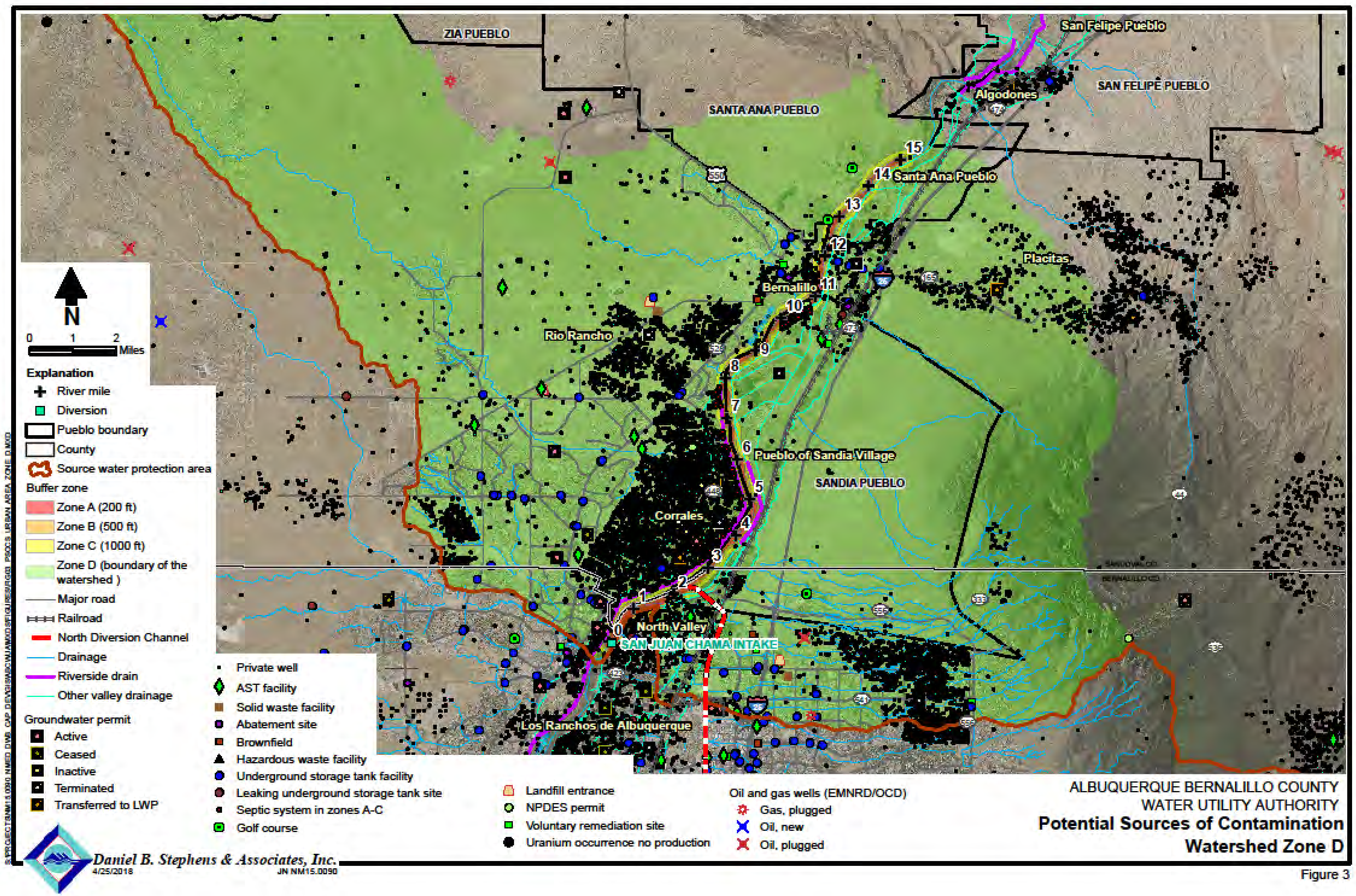

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Figure 4. Potential Sources of Contamination, Cochiti Reservoir

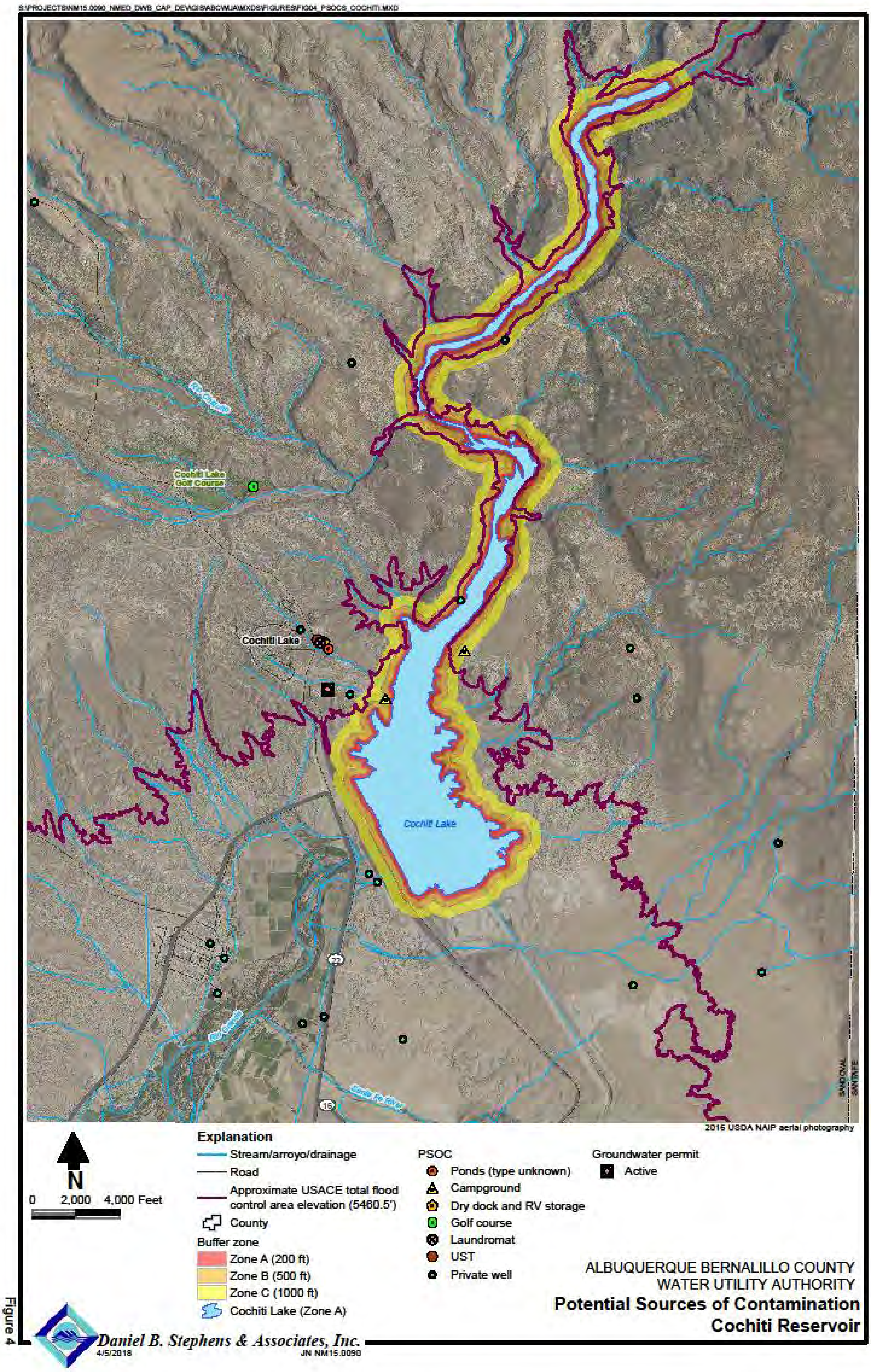

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Figure 5. Potential Sources of Contamination, Abiquiu Reservoir

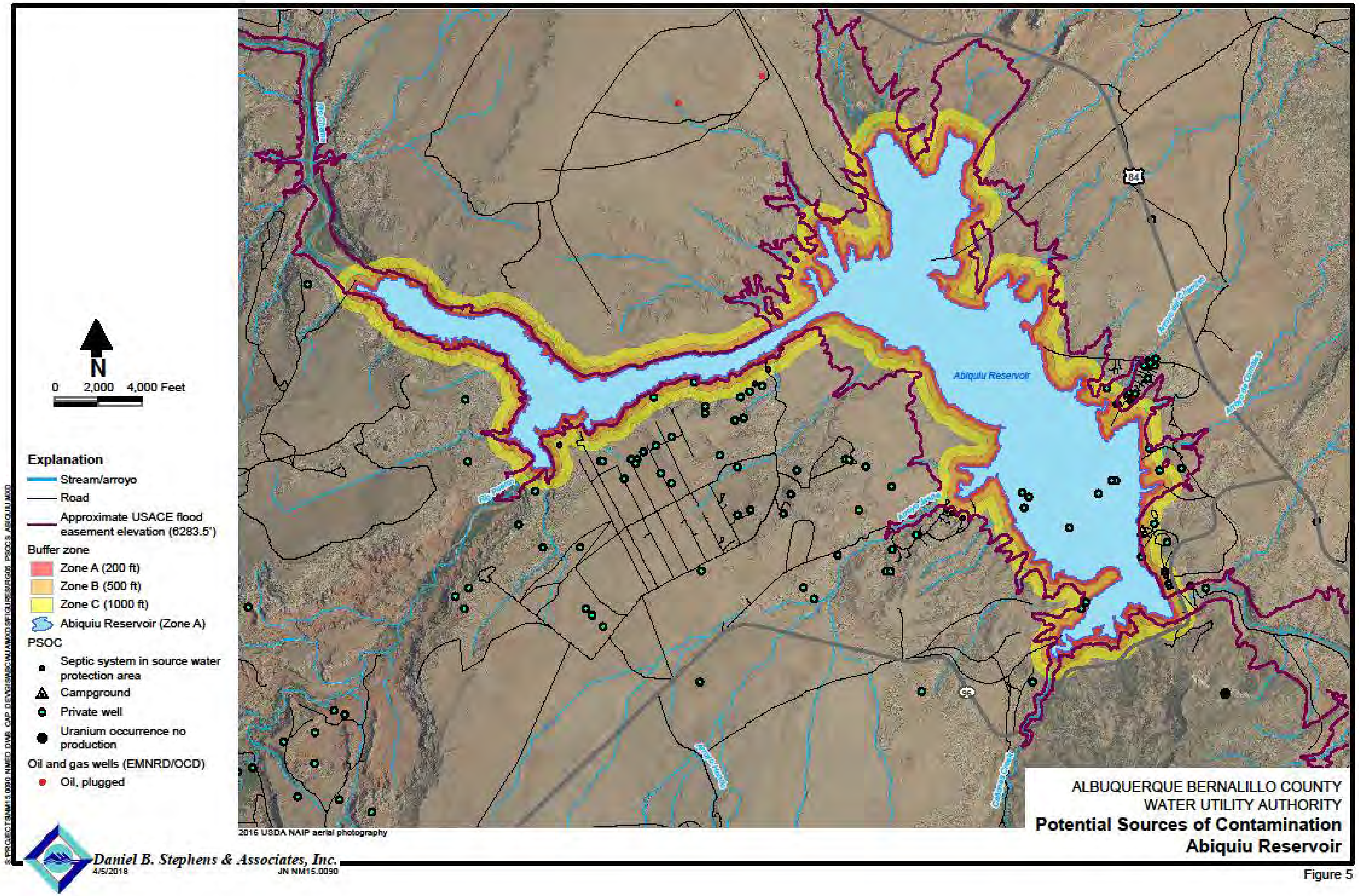

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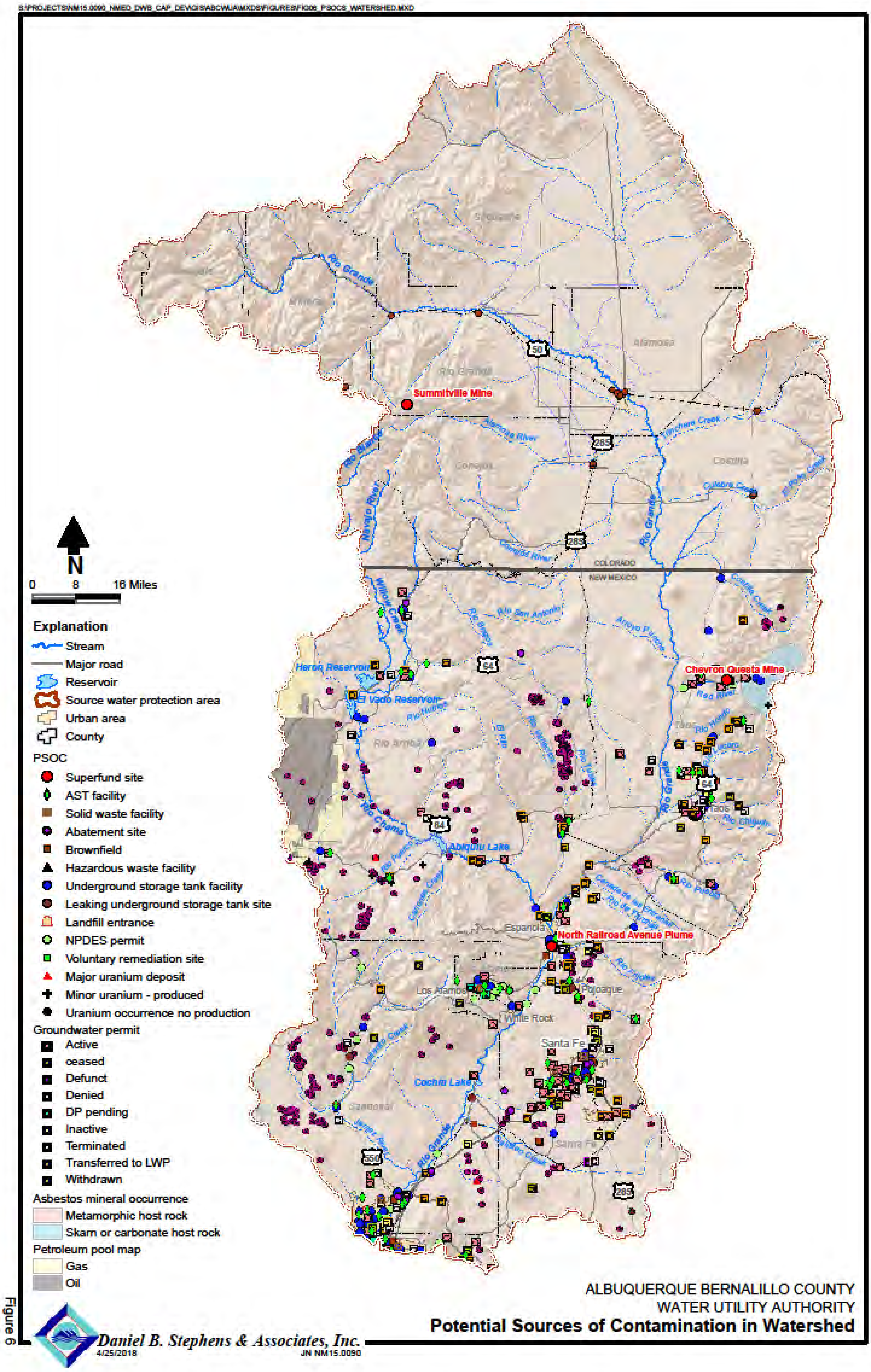
Figure 6. Potential Sources of Contamination in Watershed



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EnviroMap which provides information on sites that are registered with the state, such as wastewater discharge permits. The Geographic Information System (GIS) data underlying the web-based map were provided by NMED and were used to map the PSOCs in the study area.

In addition to the inventory of PSOCs from the NMED's *EnviroMap*, this Surface Water Source Water Assessment (SWA) also includes the following information and data sources:

- New Mexico Office of the State Engineer (OSE) permitted wells;
- Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) mapped drainages;
- Roads and railroads from the New Mexico Department of Transportation (NMDOT) GIS database; and
- Oil and gas wells from New Mexico's Energy, Mineral and Natural Resources Department (EMNRD).

Each of these datasets and how the data was used in the assessment are described in detail below.

4.2.1 NMED EnviroMap

The NMED's *EnviroMap*, formerly known as the Source Water Protection Atlas geodatabase, served as the primary source of data for this study for the identification of PSOCs. This geodatabase includes PSOCs for locations subject to permitting or registration by the State. The *EnvrioMap* geodatabase contains data on the locations of aboveground and underground storage tanks, animal feeding operations, abatement sites, brownfields, hazardous waste facilities, groundwater discharge permits, voluntary remediation sites, major uranium deposits and mines, asbestos mineral occurrences, petroleum pools (e.g., underground resource of oil and/or gas), and more. *EnviroMap* data was supplemented by other sources described in the following subsections.

4.2.2 Private Wells

Figure 7 shows the locations of registered/permitted wells at the watershed scale. This study used the NM OSE "Point of Diversions" (POD) GIS layer dated September 12, 2017, that represents

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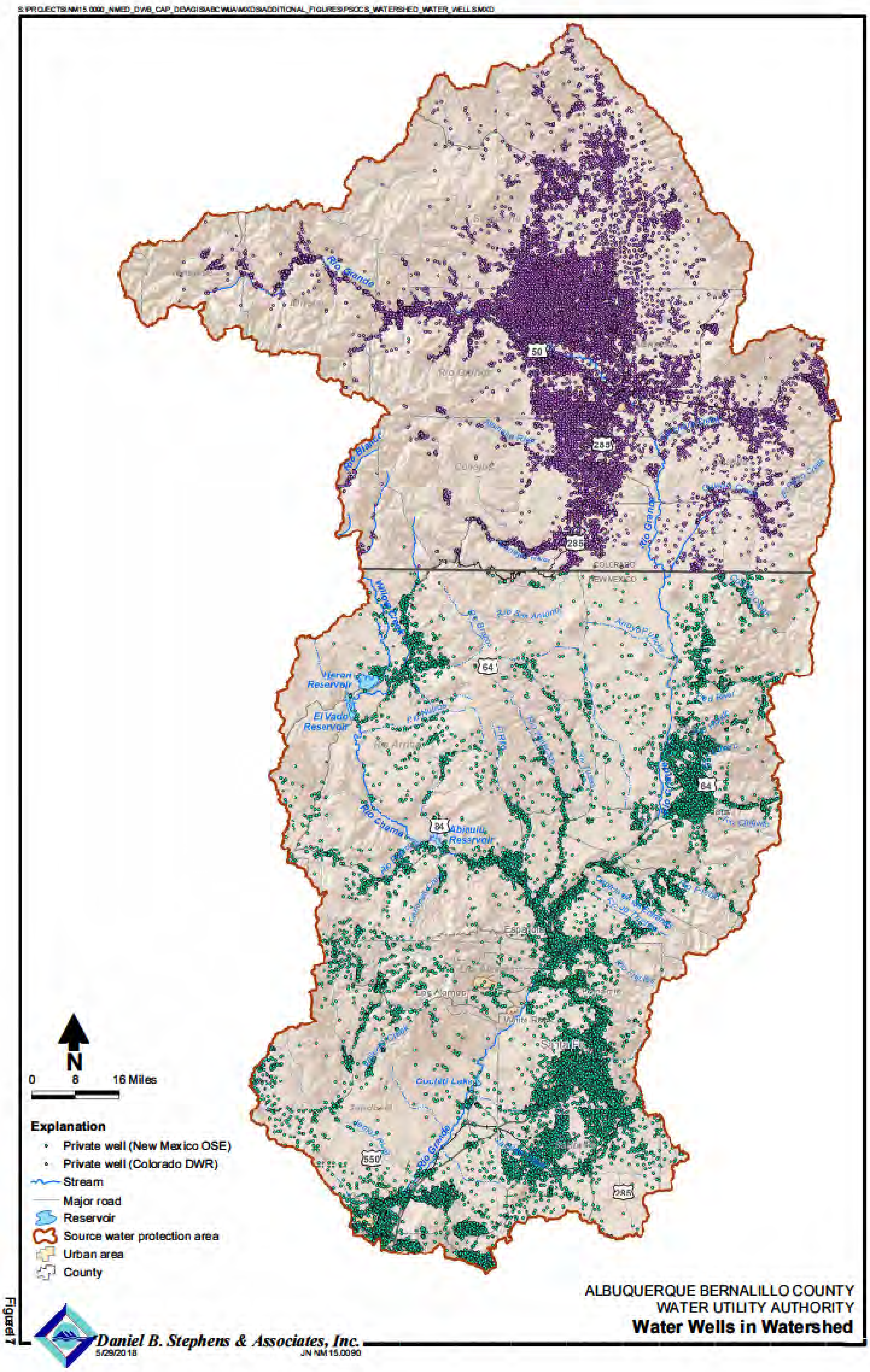
Figure 7. Water Wells in Watershed



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wells that are registered with the OSE. This data is maintained by OSE and updates are made frequently.

The original well data was extracted from the OSE Water Administration Technical Engineering Resource System (W.A.T.E.R.S) database, and then geo-located. The PODs have varying degrees of locational accuracy depending on the data submitted with permit applications, and many have not been validated. Additionally, there may be small diameter wells (2.38 inches in diameter) throughout the study area that are not in the OSE database. Permits for small diameter wells were not required by the state until 1956; in 1987, the County began requiring permits for these wells. Some location coordinates (presumably for older wells) were derived from Public Land Survey System (PLSS) information and only had township, range, and section information listed in the OSE database. For wells without specific PLSS location descriptions, including in which quarter of a section the well is located, wells were plotted in the middle of a section.

Some wells had specific PLSS location descriptions that described the quarter, of the quarter, of the quarter, of the section, and were plotted accordingly on the maps. More recent wells in the database may be global positioning system (GPS)/survey located and plot to more accurate locations on the maps. For this reason, there are many instances on the maps where multiple wells occur in the same location in the GIS data and only one point is visible. The selection tool in ArcGIS was used to select every point within a particular buffer zone to ensure all wells plotting to the same location were identified for the analysis. The resulting selected record count in the attribute table was used as the count for the zone in the PSOC table. For this study, the Water Authority did not differentiate between the multiple types of POD categories (domestic, irrigation, monitoring, etc.) and instead identified the OSE PODs as “private wells” on maps and in the tables.

Wells located in Colorado are included on the watershed-scale maps and are from Colorado’s Decision Support Systems, a water management system developed by the Colorado Water Conservation Board and the Colorado Division of Water Resources for each of Colorado’s major water basins. Only points with the status of “Well Constructed,” “Well Replaced,” and “Well Abandoned” were included on the watershed maps.

4.2.3 Arroyos/Drainages

This study used the 2014 linear drainage shapefile from Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) (Figure 8). It contains the location of hard and soft-lined channels, dikes, selected crossings, and selected storm drains within the AMAFCA district. Whole arroyo segments were counted in each buffer zone that they intersected. Riverside drains and other valley drainages from the Middle Rio Grande Conservancy District (MRGCD) were also used; the MRGCD data used was dated December 14, 2012. The contributing stormwater watersheds for the North Diversion Channel (NDC) drainage in Albuquerque are identified in Figure 8; however, those watersheds were not included in the development of the urban area (river SWPA) Zone D. Instead of assessing the individual watersheds shown in Figure 8, this assessment accounts for potential impacts from these watersheds, in the scoring of the NDC drainage as a PSOC in the SJC DWP diversion SWPA zones.

4.2.4 Major Transportation Corridors

For this study, transportation corridors categorized as PSOCs were taken from a GIS dataset of major roads from the NMDOT dated 2014. The metadata notes that the data are a vector representation of the state's public road system, which includes all interstates, interchange ramps, U.S. routes, state routes, business loops, and frontage roads. Additionally, it may include county highways and local roads functionally classified as "Collector" or higher (FL which is the abbreviation for Federal Aid Local); Bureau of Indian Affairs (BIA) roads; Federal Park roads (FP); Federal Wildlife (FW); or U.S. Forest Service roads (FS). This dataset was used to count the "major roads" listed in the PSOC tables.

4.2.5 Septic Tanks

Septic systems locations were estimated from aerial imagery. In order to digitize septic tanks, it was assumed that in areas where sanitary sewer is not available, a septic system is in use. Sanitary sewer systems exist for the Albuquerque, Rio Rancho, and Bernalillo areas, but are sparse in the Corrales and Sandia Pueblo areas. Septic locations were digitized for Zones A through C of the river SWPA only. Figure 9 shows known locations of sanitary sewer, the basis for digitizing septic systems for this assessment.

Figure 8. North Diversion Channel and Riverside Drainages

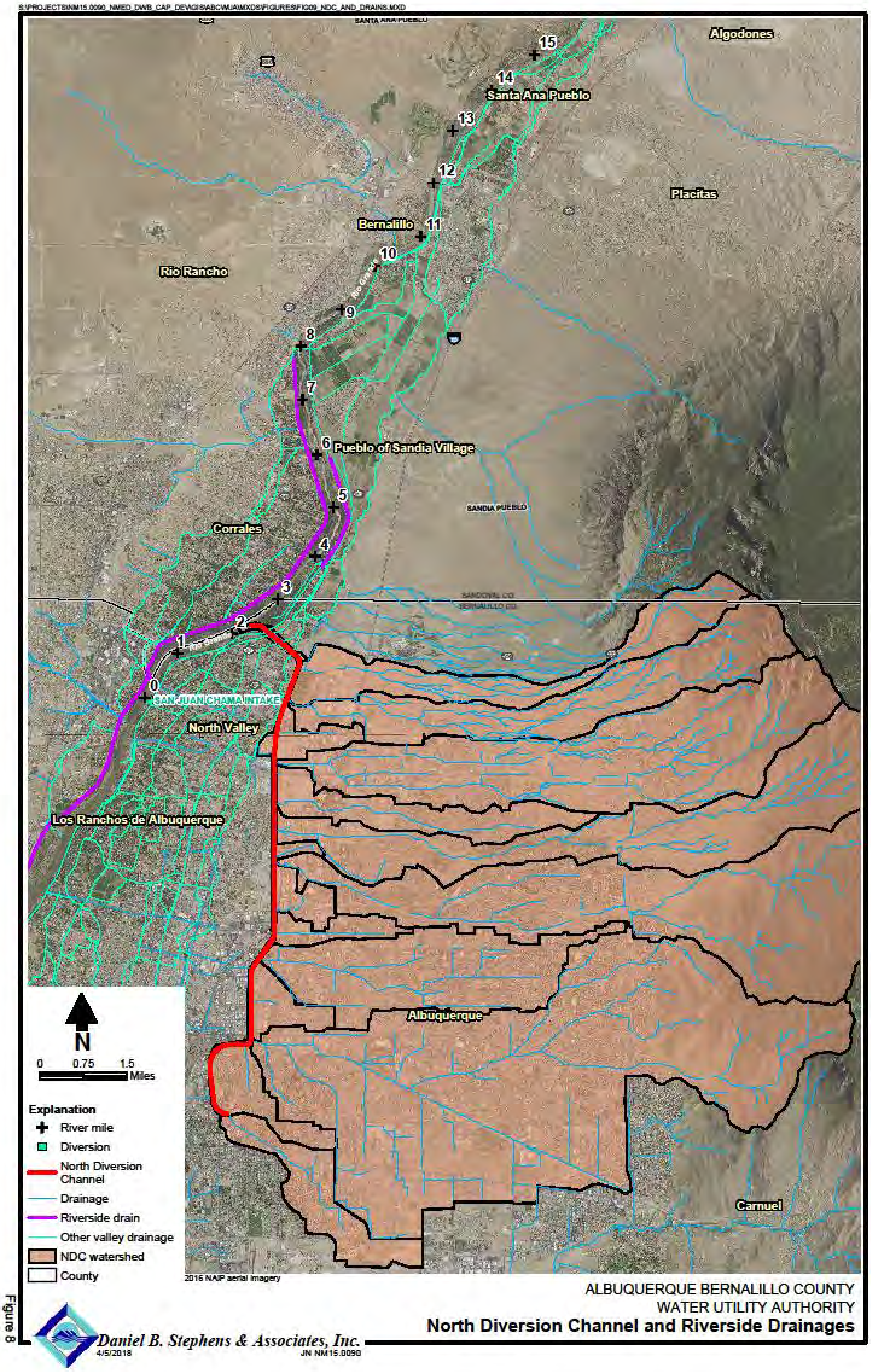

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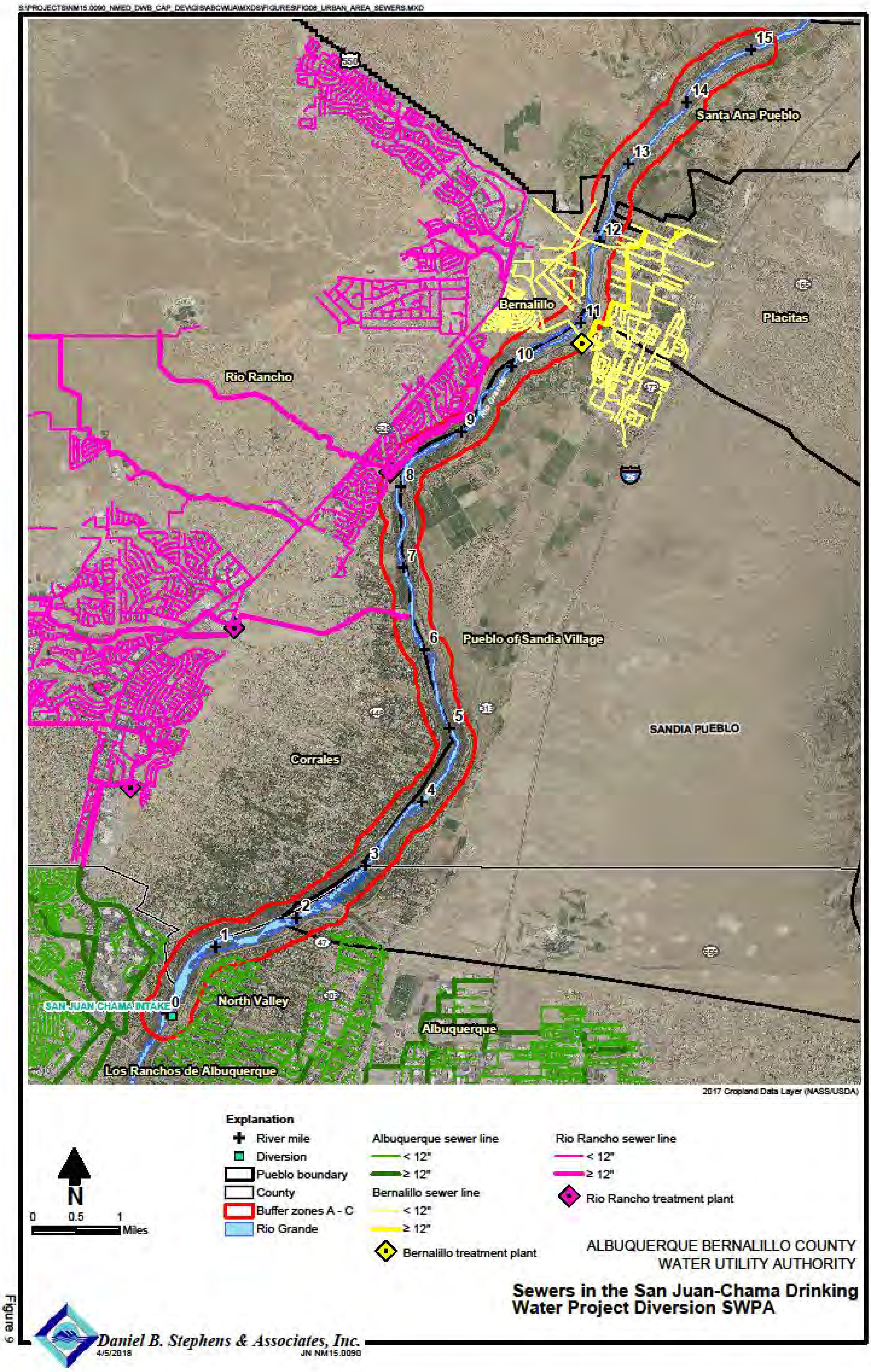
Figure 9. Sewers in the San Juan-Chama Drinking Water Project Diversion SWPA



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4.2.6 Oil and Gas Wells

The dataset used for oil and gas wells in New Mexico originated from EMNRD. It contains both inactive and active energy production wells, such as oil, gas, and carbon dioxide producing wells, as well as injection and salt water disposal wells. The data quality was last evaluated in May 2015. After EMNRD reviewed and edited the data in 2015, it was found that 95% of the wells were located within 30' of the top hole location data.

Locations for oil and gas wells in Colorado were taken from data from the Colorado Oil and Gas Conservation Commission. Figure 10 shows the locations of oil and gas wells identified in this assessment.

4.3 Watershed PSOCs

Zone D, the watershed, was not analyzed nor was it assigned susceptibility rankings. However, the Water Authority qualitatively looked at PSOCs and events that could occur at the watershed scale and potentially impact the Water Authority surface water sources. Included in that evaluation are potential impacts from wildfires, and oil and gas production activities, which are discussed in more detail in the following subsections.

4.3.1 Forest Fire Considerations

Large wildfires, fires greater than 100 acres in size in forested areas and 300 acres in grasslands, can pose a significant threat to water supplies. Post-fire concerns include risk of damaging-floods, debris flows, and impacts to water quality serving as a drinking water supply and aquatic habitat. The quality of surface water can be evaluated in terms of physical, chemical, and biological characteristics. Depending on the fuel type and condition of the watershed, fires can burn at low severity, where mostly ground fuels (e.g., grasses, shrubbery, etc.) are burned. High severity fires can also occur where stands of timber are completely consumed, and soils are burned so severely that hydrophobicity (the act of repelling rather than absorbing water) becomes a concern. High severity fires in watersheds can produce serious flooding, sediment deposition in reservoirs and

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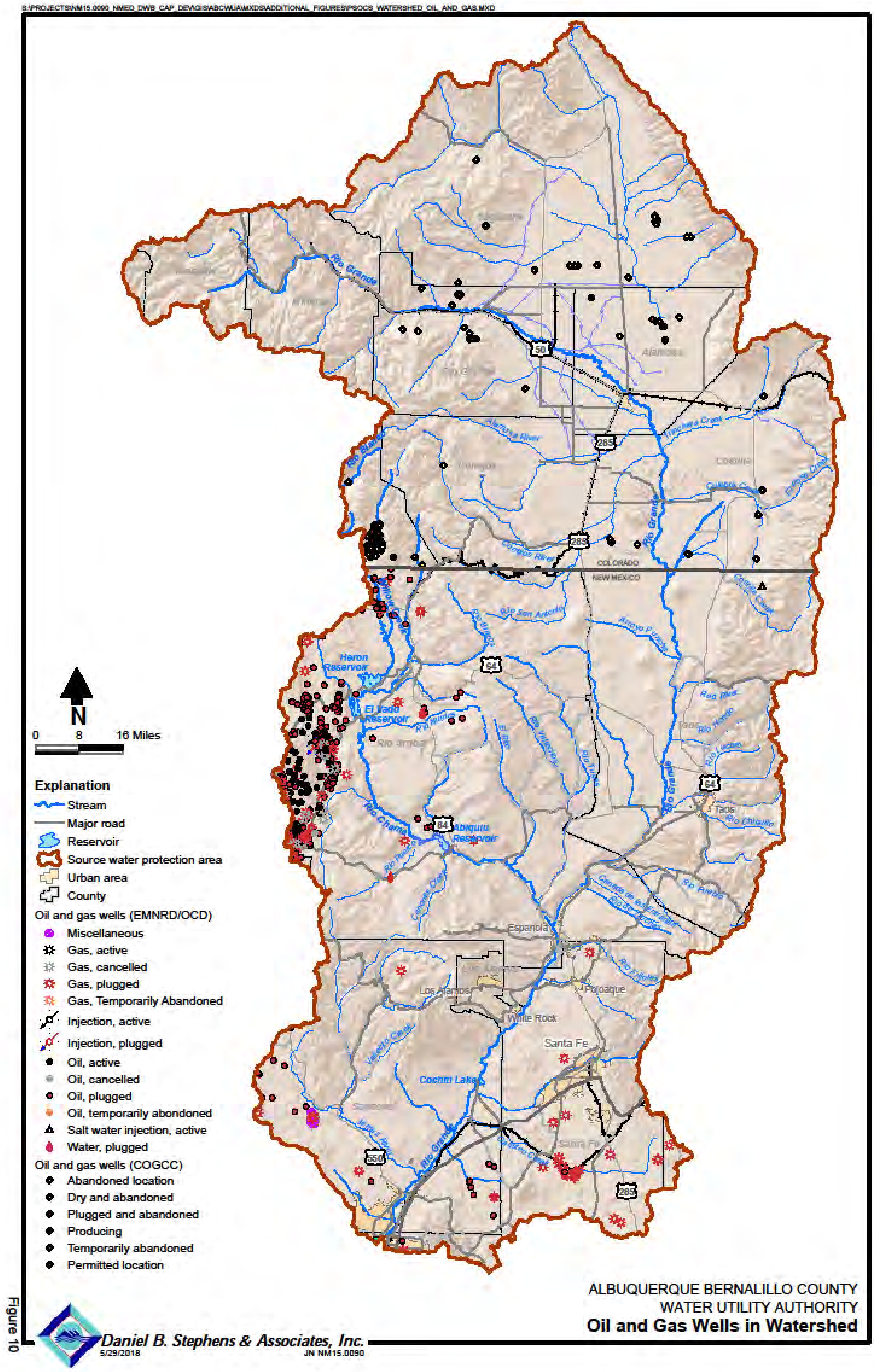
Figure 10. Oil and Gas Wells in Watershed



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streams, increased peak flows downstream, and ash and debris flows. Increased ash and sediment loads increase pretreatment processing needs (and costs) and can result in curtailment of surface water diversions until sediment loading returns to pre-event conditions. High sediment loads can damage reservoirs, requiring repairs to sediment control infrastructure, if present, and may require sediment removal or reservoir replacement, if sediment loads are extreme.

Chemical impacts to surface water bodies from wildfires include impacts to the type and quantity of nutrients (especially dissolved carbon), as well as the turbidity and total suspended solids (TSS) entering surface water sources. Fallout radionuclides (cesium-137, plutonium-238, plutonium-239/240, and strontium-90) dioxins/furans, cyanide, polychlorinated biphenyls (PCBs), and certain metals are also typically present in floods originating in burn areas. Additionally, studies suggest that nutrient loads, specifically phosphorus and nitrogen, increase after wildfires. Dissolved oxygen declines significantly during ash and debris flows and can have substantial impacts to biological communities, including populations of algae, macroinvertebrates, and fish. The magnitude of changes to water chemistry depends on several factors including the fire severity and duration, as well as the slope of the watershed terrain and the amount and intensity of precipitation during post-fire rain events (EPA, 2013). Effects to chemical characteristics of surface water sources tend to be the greatest soon after a fire, during a “first flush” storm event. Monsoon precipitation events can produce intense rainfall, and therefore, generate spikes in various chemical constituents. Rapid snowmelt conditions may also result in changes in water quality.

For the Water Authority, the watershed areas around reservoirs, and the upstream, undeveloped Rio Grande watershed areas are the most at risk for wildfire. Additionally, wildfires occurring in the Upper San Juan Basin could pose a risk to the transbasin diversion structures (i.e., the Azotea tunnel). Increased sediment and debris loads from wildfires above the diversions could obstruct the Azotea tunnel and associated infrastructures and result in problems for the delivery of San Juan-Chama water to users, including the Water Authority, in the Rio Grande basin.

4.3.2 Oil and Gas Considerations

Oil and gas activities have been a significant component of the economy for New Mexico, with development booms and busts ranging from the San Juan Basin in the northwestern corner of the state to the Permian Basin in the southeastern part of the state. New Mexico is currently ranked as one of the nation's top producing states for oil and gas – a ranking driven primarily by development of oil and gas resources in the Permian Basin. There is the potential for a shifting landscape of oil and gas development in New Mexico in response to the constant and rapid evolution of technical developments in the oil and gas industry, such as horizontal drilling coupled with hydraulic fracturing. Currently, oil and gas activities are focused in the regions where there are plentiful and economic resources: the San Juan and Permian Basins.

Oil and gas could potentially impact both surface water and groundwater quality, depending on the location and type of activity. The types of potential impacts to surface water stemming from oil and gas production can be fit into three general categories: 1) spills and releases of produced water and chemicals from hydraulic fluids; 2) erosion from surface disturbances; and 3) altered surface water flows from surface water or groundwater withdrawals. Impacts can range in frequency and severity, depending on the combination of hydraulic fracturing water cycle activities, as well as local- and regional-scale factors (EPA, 2016).

Oil and gas was assessed as part of this Surface Water SWA for the three SWPAs identified across Zones A through C. The watershed evaluation was more qualitative and focused on identifying the location of oil and gas activities to support regional discussions of oil and gas ordinances. Figure 10 shows the permitted oil and gas wells at the watershed-scale evaluated in this assessment. The majority of oil and gas wells are concentrated along the western edge of the watershed and the wells are mostly abandoned. The nearest active oil well to Heron Reservoir, where diversion of SJC DWP occurs, is approximately 12 miles to the southwest. Active oil and gas wells are roughly 5 miles, or more, to the west of the Rio Chama. Numerous abandoned oil and gas wells near Rio Blanco, Navajo River, and Willow Creek indicate past productivity in this region, but no current activity.

State, local, and federal agencies have some established regulatory mechanisms for protecting source water from most of these potential impacts. For example, the federal Safe Drinking Water Act (SDWA) requires the development and implementation of source water protection programs at the state level, and by water providers like the Water Authority. As part of the Water Authority's source water protection plan, existing and potential impacts to source water from oil and gas have been evaluated within the watershed. Additionally, the federal Clean Water Act requires controlling point source discharges and controlling stormwater

The Water Protection Advisory Board (WPAB) has recommended that the Mid-Region Council of Governments create a multi-disciplinary advisory board to create a template for an oil and gas ordinance that can be used region-wide to guide oil and gas activities and to take actions to protect surface water sources. There are no immediate or imminent concerns or risks to Water Authority sources from oil and gas exploration or production. The findings of this Surface Water SWA support the continued, proactive, and multi-agency approach to develop ordinances and permitting requirements at the City and County level, as well as regionally, to ensure the continued protection of the Water Authority source waters.

5. Susceptibility Analysis

The susceptibility of surface water sources for the Water Authority drinking water supply was evaluated by calculating a susceptibility ranking for each of the three Source Water Protection Areas (SWPAs). This ranking represents a combination of a surface water SWPA's infrastructure and the identified Potential Sources of Contamination (PSOCs) within Zones A through C of the SWPA. This section describes in detail how each of the vulnerability and sensitivity scores were determined, along with a description of how the Water Authority assigned the concluding susceptibility rankings. The susceptibility ranking for a SWPA provides the Water Authority with a qualitative method for identifying priorities and recommendations for the protection of the system's resources, and for Water Authority operational planning purposes.

The susceptibility analysis utilized by the Water Authority is based on the New Mexico Environment Department (NMED) Source Water Protection guidance document titled *Source Water Assessment & Protection Program Report of Water Utility, for Surface Water Systems* (NMED, 2004). The guidance document outlines a general approach for ranking PSOCs, determining vulnerability scores, generation of sensitivity scores, and then the method for ranking the susceptibility of sources. Due to the wide variety of PSOC types in the study areas and the complexity of the regulatory environment for the PSOC types and sites, the Water Authority further refined the NMED guidance methodology to create more objective approaches for vulnerability and sensitivity scores. Specifics on the Water Authority approach are detailed in the sections that follow.

5.1 Vulnerability Assessment

The vulnerability ranking is based on an inventory of the type, number, and proximity of PSOCs near a water source. This ranking is a weighted combination of three factors: 1) PSOC Risk, 2) Proximity to Source, and 3) PSOC Count. Weights are assigned to each factor as a percentage, with weights for the three factors adding up to 100 percent. After being weighted, the three factors are summed; and the source is assigned a vulnerability ranking of low, moderately low, moderate, moderately high, or high based on that sum.

5.1.1 Vulnerability Factor 1: PSOC Risk

Each type of PSOC was assessed for risk and the risk score was then used to assess each SWPA's vulnerability. The PSOC risk factor has two sub-components:

1. *Probability of occurrence*: Considers the likelihood of a contamination event of this PSOC type occurring. This accounts for site regulatory status, engineering controls, etc.

2. *Severity of impact*: A function of the type of contaminant that would impact the water source. This accounts for contaminant properties (e.g., solubility) and regulatory standards (e.g., emerging contaminant vs. a contaminant with a defined standard). For example, contamination from agricultural runoff is likely less severe than contamination from a National Pollutant Discharge Elimination System (NPDES) permit.

Scores for each sub-component are assigned on a scale of 1 to 5. The two sub-component scores are then summed into an overall PSOC Risk score which ranges from 2 to 10. Table 4 demonstrates how each type of PSOC was evaluated for assigning both the probability of occurrence and severity of impact scores. Table 5 provides the risk scores for individual PSOC types and shows the ranking for each sub-component to produce the PSOC Risk score.

Table 4. Sub-Component Scores for PSOC Risk

	PSOC Risk Factor Sub-Component Score				
Probability of Occurrence	1 *Unlikely to occur*	2 →	3 →	4 →	5 *Likely to occur*
	Railroad, campground	Private wells	Agricultural fields, golf course	Stormwater runoff	NPDES permits
Severity of Impact	1 *Low impact*	2 →	3 →	4 →	5 *High impact*
	Private wells	Agricultural fields, golf course	Septic systems	Stormwater runoff	NPDES permits

Table 5. PSOC Risk Score by PSOC Type

Description	PSOC Risk Factor Score		
	Probability of Occurrence	Severity of Impact	Sum
Agricultural fields	3	2	5
Arroyo	4	3	7
Campground - unsewered	1	1	2
Drainage canal, ditch, or acequia - unlined	4	3	7
Golf course	3	2	5
Major road	4	3	7
North Diversion Channel	4	4	8
NPDES permit - City of Bernalillo/WWTP-001	5	5	10
NPDES permit - City of Rio Rancho No. 3	5	5	10
Private well	2	1	3
Railroad yards and tracks	1	3	4
Septic tank	3	3	6
Street storm drain	4	4	8

5.1.2 Vulnerability Factor 2: Proximity to Source

The proximity of a PSOC to a source is another factor in the vulnerability scoring and ranges from 1 to 5 depending on the location of the PSOC. This range of Proximity to Source scores (ranging from 1 to 5) was maintained to be consistent with the Groundwater Source Water Assessment (SWA) approach, even though a score of 1, Zone D (watershed scale), was not applicable for surface water. Therefore, in the case of the Surface Water SWA, the Proximity to Source score is a range of 2 to 5 based on the location of the PSOC:

- 1: Zone D (this score is only applicable to groundwater)
- 2: Zone C
- 3: Zone B
- 4: Zone A
- 5: Known contamination

5.1.3 Vulnerability Factor 3: PSOC Count

A score from 1 to 5 is assigned for PSOC Count based on the number of occurrences for a PSOC type per zone:

- 1: 1 PSOC
- 2: 2 to 4 PSOCs
- 3: 5 to 10 PSOCs
- 4: 11 to 20 PSOCs
- 5: 21 or more PSOCs

5.1.4 Calculating the Vulnerability Ranking

After scores for each of the three main factors of PSOC Risk, Proximity to Source, and PSOC Count were determined, each factor was weighted for the vulnerability scoring:

- PSOC Risk: 80 percent
- Proximity to Source: 15 percent
- PSOC Count: 5 percent.

For each surface water source, the total of these three, weighted main factors were summed to provide a PSOC value for each PSOC type per zone. The PSOC values for each source were added together to provide an overall vulnerability score for each source using the following equation:

$$Vulnerability\ Score = 0.8(PSOC\ Risk) + 0.15(Proximity\ to\ Source) + 0.05(PSOC\ Count)$$

All PSOC values per source were added together to provide a vulnerability score for each water source. The vulnerability scores for the Water Authority's surface water sources ranged from 10.4 (river mile [RM] 14–15) to 52.8 (RM 10–11). This range was divided into five rankings to give the scale for vulnerability that is summarized in Table 6.

Table 6. Vulnerability Ranking Assignment

Vulnerability score	0–15	15.1–25	25.1–40	40.1–50	>50
Vulnerability ranking	Low	Moderately low	Moderate	Moderately high	High

Tables 7a and 7b show the calculations, vulnerability score, and corresponding vulnerability rankings for the river and two reservoir SWPAs. Tables 8a and 8b summarize the vulnerability scores and rankings by source.

5.2 Sensitivity Assessment

Sensitivity is an evaluation of a source's infrastructure. The NMED guidance document suggests a range of sensitivity rankings of low, moderately low, moderate, moderately high, or high, for both surface water and groundwater sources. However, in the case of surface water sources, the minimum sensitivity ranking possible is limited to moderate because surface water sources are subject to receiving contaminants from runoff associated with rainfall events. The sensitivity score for surface water sources considers infrastructure construction (e.g., the ability to withdraw water at different levels within a reservoir or the ability of a diversion to be shut off during unfavorable conditions) and the level of control the Water Authority has over the contributing area (e.g., access restrictions versus public recreation access). Sensitivity of each of the Water Authority's surface water sources is discussed in the following subsections.

5.2.1 San Juan-Chama (SJC) Drinking Water Project (DWP) Diversion

Construction on the SJC DWP began in 2004 and finished in 2008; therefore, the diversion infrastructure is between 10 and 14 years old. The surface diversion on the Rio Grande consists of an adjustable diversion dam and intake structure; it can maintain 3.75 to 4.25 feet of water in the intake structure for typical operations.

The diversion is secured and site access is limited to authorized Water Authority personnel. A fence extends around the diversion site, preventing public access. Operators at the drinking water plant have the ability to shut off the diversion during unfavorable conditions. For example, the Water Authority voluntarily shuts down intake at the diversion during stormwater events with flows

Table 7a. Calculation of Vulnerability, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
–500 ft–0	B	A	Drainage canal, ditch, or acequia - unlined	2	7	3	2	6.2	12.1	Low
		—	Private well	2	3	3	2	3.0		
	C	—	Private well	22	3	2	5	3.0		
0–1	A	M	Major road	1	7	4	1	6.3	44.9	Moderately high
		A	Drainage canal, ditch, or acequia - unlined	1	7	4	1	6.3		
		—	Private well	1	3	4	1	3.1		
	B	A	Drainage canal, ditch, or acequia - unlined	3	7	3	2	6.2		
		—	Street storm drain	1	8	3	1	6.9		
		—	Private well	4	3	3	2	3.0		
	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0		
		A	Agricultural fields	4	5	2	2	4.4		
		—	Private well	32	3	2	5	3.0		
1–2	A	—	Private well	1	3	4	1	3.1	30.0	Moderate
	B	A	Drainage canal, ditch, or acequia - unlined	1	7	3	1	6.1		
		A	Agricultural fields	1	5	3	1	4.5		
		—	Private well	10	3	3	3	3.0		
	C	A	Drainage canal, ditch, or acequia - unlined	3	7	2	2	6.0		
		A	Agricultural fields	4	5	2	2	4.4		
		—	Private well	27	3	2	5	3.0		
2–3	A	—	North Diversion Channel	1	8	5	1	7.2	31.0	Moderate
	B	A	Drainage canal, ditch, or acequia - unlined	1	7	3	1	6.1		
		A	Agricultural fields	1	5	3	1	4.5		

Table 7a. Calculation of Vulnerability, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
2–3 (cont.)	C	A	Drainage canal, ditch, or acequia - unlined	3	7	2	2	6.0	31.0	Moderate
		A	Agricultural fields	2	5	2	2	4.4		
		—	Private well	2	3	2	2	2.8		
3–4	A	A	Drainage canal, ditch, or acequia - unlined	1	7	4	1	6.3	39.4	Moderate
	B	A	Drainage canal, ditch, or acequia - unlined	2	7	3	2	6.2		
		—	Private well	1	3	3	1	2.9		
		M	Septic tank	2	6	3	2	5.4		
	C	A	Drainage canal, ditch, or acequia - unlined	3	7	2	2	6.0		
		A	Agricultural fields	7	5	2	3	4.5		
		—	Private well	23	3	2	5	3.0		
		M	Septic tank	22	6	2	5	5.4		
4–5	A	—	Private well	1	3	4	1	3.1	17.8	Moderately low
	C	A	Drainage canal, ditch, or acequia - unlined	6	7	2	3	6.1		
		C	Railroad yards and tracks	1	4	2	1	3.6		
		M	Septic tank	1	6	2	1	5.2		
5–6	B	A	Drainage canal, ditch, or acequia - unlined	1	7	3	1	6.1	24.8	Moderately low
	C	A	Drainage canal, ditch, or acequia - unlined	3	7	2	2	6.0		
		A	Agricultural fields	9	5	2	3	4.5		
		—	Private well	16	3	2	4	2.9		
		M	Septic tank	13	6	2	4	5.3		
6–7	A	—	Arroyo	1	7	5	1	6.4	39.5	Moderate

Table 7a. Calculation of Vulnerability, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
6–7 (cont.)	B	A	Drainage canal, ditch, or acequia - unlined	4	7	3	2	6.2	39.5	Moderate
		—	Private well	3	3	3	2	3.0		
		M	Septic tank	3	6	3	2	5.4		
	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0		
		A	Agricultural fields	7	5	2	3	4.5		
		—	Private well	12	3	2	4	2.9		
		M	Septic tank	18	6	2	4	5.3		
7–8	A	A	Drainage canal, ditch, or acequia - unlined	1	7	4	1	6.3	43.7	Moderately high
	B	A	Drainage canal, ditch, or acequia - unlined	1	7	3	1	6.1		
		A	Agricultural fields	4	5	3	2	4.6		
		—	Private well	3	3	3	2	3.0		
		M	Septic tank	2	6	3	2	5.4		
	C	A	Drainage canal, ditch, or acequia - unlined	2	7	2	2	6.0		
		A	Agricultural fields	3	5	2	2	4.4		
		—	Private well	6	3	2	3	2.9		
		M	Septic tank	10	6	2	3	5.3		
8–9	A	—	Arroyo	2	7	5	2	6.5	24.0	Moderately low
		M	NPDES Permit - City of Rio Rancho No. 3	1	10	5	1	8.8		
	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0		
		—	Private well	1	3	2	1	2.8		

Table 7a. Calculation of Vulnerability, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
9–10	A	—	Arroyo	1	7	5	1	6.4	41.5	Moderately high
		—	Private well	2	3	3	2	3.0		
	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0		
		—	Arroyo	1	7	2	1	6.0		
		A	Agricultural fields	4	7	2	2	6.0		
		—	Private well	7	3	2	3	2.9		
		M	Septic tank	7	6	2	3	5.3		
10–11	A	—	Arroyo	1	7	5	1	6.4	52.8	High
		M	NPDES Permit - City of Bernalillo/WWTP-001	1	10	5	1	8.8		
	B	A	Drainage canal, ditch, or acequia - unlined	2	7	3	2	6.2		
		A	Agricultural fields	1	5	3	1	4.5		
		—	Private well	1	3	3	1	2.9		
		M	Septic tank	12	6	3	4	5.5		
	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0		
		A	Agricultural fields	10	5	2	3	4.5		
		—	Private well	6	3	2	3	2.9		
		M	Septic tank	30	6	2	5	5.4		
11–12	A	—	Arroyo	1	7	5	1	6.4	38.3	Moderate
		M	Major road	1	7	4	1	6.3		
		—	Private well	3	3	4	2	3.1		
	B	A	Drainage canal, ditch, or acequia - unlined	2	7	3	2	6.2		
		—	Private well	28	3	3	5	3.1		

Table 7a. Calculation of Vulnerability, SJC DWP Diversion

River Mile	Buffer Zone [a]	Land Use	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
11–12 (cont.)	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0	38.3	Moderate
		A	Agricultural fields	4	5	2	2	4.4		
		—	Private well	14	3	2	4	2.9		
12–13	A	—	Private well	2	3	4	2	3.1	28.9	Moderate
	B	—	Private well	2	3	3	2	3.0		
	C	A	Drainage canal, ditch, or acequia - unlined	2	7	2	2	6.0		
		A	Agricultural fields	2	5	2	2	4.4		
		C	Golf course	1	5	2	1	4.4		
		—	Private well	17	3	2	4	2.9		
		M	Septic tank	4	6	2	2	5.2		
13–14	A	—	Arroyo	1	7	5	1	6.4	21.5	Moderately low
	B	A	Drainage canal, ditch, or acequia - unlined	2	7	3	2	6.2		
		A	Agricultural fields	2	5	3	2	4.6		
	C	A	Agricultural fields	3	5	2	2	4.4		
14–15	C	A	Drainage canal, ditch, or acequia - unlined	1	7	2	1	6.0	10.4	Low
		A	Agricultural fields	8	5	2	3	4.5		

Table 7b. Calculation of Vulnerability, Cochiti and Abiquiu Reservoirs

Reservoir	Buffer Zone	PSOC Code	Description	Occurrences	PSOC Risk (80%)	Proximity to Source (15%)	PSOC Count (5%)	PSOC Value	Vulnerability Score	Vulnerability Ranking
Abiquiu	A	—	Arroyo	28	7	5	5	6.6	34.4	Moderate
		C	Campground - unsewered	1	2	4	1	2.3		
		—	Private well	10	3	4	3	3.2		
	B	—	Private well	6	3	3	3	3.0		
		M	Septic tank	2	6	3	2	5.4		
	C	—	Private well	4	3	2	2	2.8		
		M	Major road	1	7	2	1	6.0		
		M	Septic tank	11	6	2	4	5.3		
Cochiti	A	—	Arroyo	19	7	5	4	6.6	14.5	Low
		—	Private well	1	3	4	1	3.1		
	B	C	Campground - unsewered	2	2	3	2	2.2		
	C	—	Private well	1	3	2	1	2.8		

Table 8a. Vulnerability Scores and Rankings, SJC DWP Diversion

River Mile	Vulnerability Score	Vulnerability Ranking
–500 ft–0	12.1	Low
0–1	44.9	Moderately high
1–2	30.0	Moderate
2–3	31.0	Moderate
3–4	39.4	Moderate
4–5	17.8	Moderately low
5–6	24.8	Moderately low
6–7	39.5	Moderate
7–8	43.7	Moderately high
8–9	24.0	Moderately low
9–10	41.5	Moderately high
10–11	52.8	High
11–12	38.3	Moderate
12–13	28.9	Moderate
13–14	21.5	Moderately low
14–15	10.4	Low

Table 8b. Vulnerability Scores and Rankings, Cochiti and Abiquiu Reservoirs

Reservoir	Vulnerability Score	Vulnerability Ranking
Abiquiu	34.4	Moderate
Cochiti	14.5	Low

greater than 300 cubic feet per second (cfs) at the North Diversion Channel (NDC) discharge point, located upstream of the diversion. This is done to minimize wear and tear on the water treatment plant by allowing for the “first flush” of sediment-laden water to pass before resuming diversion of river water. The diversion site is well maintained, regularly inspected, and in compliance with federal and state requirements.

The 15-mile stretch immediately upstream of the diversion is highly urbanized. Consequently, there is a limited riparian corridor increasing the potential for runoff and sedimentation. In the area near the diversion, the City and County maintain networks of dirt and paved recreational trails for public use. The immediate proximity of paved roads and commercial properties make the 15-mile stretch of river north of the diversion more prone to flash flooding and surface runoff.

There is some telemetry in place to notify the Water Authority of fluctuating water levels on the Rio Grande, but there is not a formalized notification system between the Water Authority and upstream stakeholders to notify of a contamination event.

The diversion itself is well constructed and maintained. Operators of the treatment plant have the ability to shut down the intake during unfavorable surface water conditions by using existing telemetry stations and notification systems with local and state agencies. However, the river miles upstream of the diversion are not restricted and have a known predisposition to flash flooding, as well as a high potential for runoff. As a result, the river SWPA is assigned a sensitivity ranking of moderate.

5.2.2 Cochiti Reservoir

Cochiti Reservoir is located in Sandoval County, NM and is within the boundaries of the Pueblo of Cochiti Nation. It is a flood and sediment control reservoir that is not used as a water source for the Water Authority; Cochiti reservoir is not used for storage of SJC water. However, since the SJC water passes through Cochiti Reservoir, it is possible that the reservoir can impact water quality for the Water Authority’s SJC surface water source. Cochiti Reservoir is located approximately 40 river miles upstream of the SJC DWP diversion. Cochiti Reservoir is managed by the U.S. Army Corps of Engineers (USACE) and is used for flood and sediment control of the

Rio Grande (USACE, 2018). Recreation is another significant use for Cochiti Reservoir, and boats and motorized watercraft are allowed in the reservoir.

The sensitivity ranking for Cochiti Reservoir is moderately high. While the reservoir serves to mitigate flood and sediment issues, public access with motorized vessels is permitted. Furthermore, surface water passes through this reservoir with no ability to prevent, slow, or divert contamination from entering the reservoir or continuing downstream.

5.2.3 Abiquiu Reservoir

Abiquiu Reservoir is a USACE managed reservoir located in Rio Arriba County, NM on the Rio Chama River (USACE, 2018). It takes approximately two days for water to travel in stream from Abiquiu Reservoir to the SJC DWP diversion. The reservoir was designed for flood and sediment control and is used by the Water Authority for storage of SJC water. The Water Authority has 170,900 acre-feet (ac-ft) of storage capacity at Abiquiu Reservoir.

Abiquiu Reservoir is open to the public for recreation and includes a campground. Boats and motorized vessels are allowed. According to EMNRD (2018), popular water sports on the lake include “boating, swimming, water skiing, jet skiing, river running, windsurfing, kayaking, and fishing.”

The sensitivity ranking for Abiquiu Reservoir is moderate. Diversions into Heron Reservoir, and thus into Abiquiu Reservoir, can be controlled or prevented if conditions are unfavorable or if a major contamination event occurs. However, it is possible for contamination originating in the Upper Rio Grande watershed above Abiquiu to enter the reservoir. Once in the Rio Chama, the river water passes into Abiquiu Reservoir, and operators have little-to-no ability to prevent, slow, or divert contamination, if it were present, from continuing downstream. Additionally, there is currently no mechanism to mitigate the risk of this being a public access lake with motorized watercraft allowed.

5.2.4 Summary Sensitivity Rankings

Table 9 summarizes the sensitivity rankings for the three surface water sources analyzed in this Surface Water SWA.

Table 9. Sensitivity Rankings

	SJC DWP Diversion	Cochiti Reservoir	Abiquiu Reservoir
Sensitivity Ranking	Moderate	Moderately high	Moderate

5.3 Susceptibility Ranking

The ultimate goal of this Surface Water SWA is to assess the surface water sources for their susceptibility to contamination. This assessment and the resulting susceptibility rankings will be used to inform decisions, coordinate between Water Authority divisions, and to develop policies and actions to protect surface water sources for now, and into the future. In order to determine a surface water source's susceptibility ranking, this study overlays the results of the vulnerability ranking with the source's sensitivity ranking, following the matrix shown in Table 10.

Table 10. Susceptibility Ranking Matrix

		Sensitivity Ranking				
		High	Moderately High	Moderate	Moderately Low	Low
Vulnerability Ranking	High	High	High	Moderately high	Moderately high	Moderate
	Moderately High	High	Moderately high	Moderately high	Moderate	Moderate
	Moderate	Moderately high	Moderately high	Moderate	Moderate	Moderately low
	Moderately Low	Moderately high	Moderate	Moderate	Moderately low	Moderately low
	Low	Moderate	Moderate	Moderately low	Moderately low	Low

While the susceptibility analysis cannot predict how or when a release of contamination may occur, it does identify conditions and areas of focus for the Water Authority in source water protection planning. Table 11 summarizes the susceptibility rankings for each surface water source. Figure 11 illustrates the susceptibility rankings by river mile for the SJC DWP diversion SWPA. Figure 12 graphically compares susceptibility ranking by color, with total PSOC count per SWPA and SWPA vulnerability rankings.

Table 11. Susceptibility Rankings by Source

Source	Vulnerability	Sensitivity	Susceptibility
SJC DWP Diversion			
RM –500 ft–0	Low	Moderate	Moderately low
RM 0–1	Moderately high		Moderately high
RM 1–2	Moderate		Moderate
RM 2–3	Moderate		Moderate
RM 3–4	Moderate		Moderate
RM 4–5	Moderately low		Moderate
RM 5–6	Moderately low		Moderate
RM 6–7	Moderate		Moderate
RM 7–8	Moderately high		Moderately high
RM 8–9	Moderately low		Moderate
RM 9–10	Moderately high		Moderately high
RM 10–11	High		Moderately high
RM 11–12	Moderate		Moderate
RM 12–13	Moderate		Moderate
RM 13–14	Moderately low		Moderate
RM 14–15	Low		Moderately low
Reservoirs			
Abiquiu Reservoir	Moderate	Moderate	Moderate
Cochiti Reservoir	Low	Moderately high	Moderate

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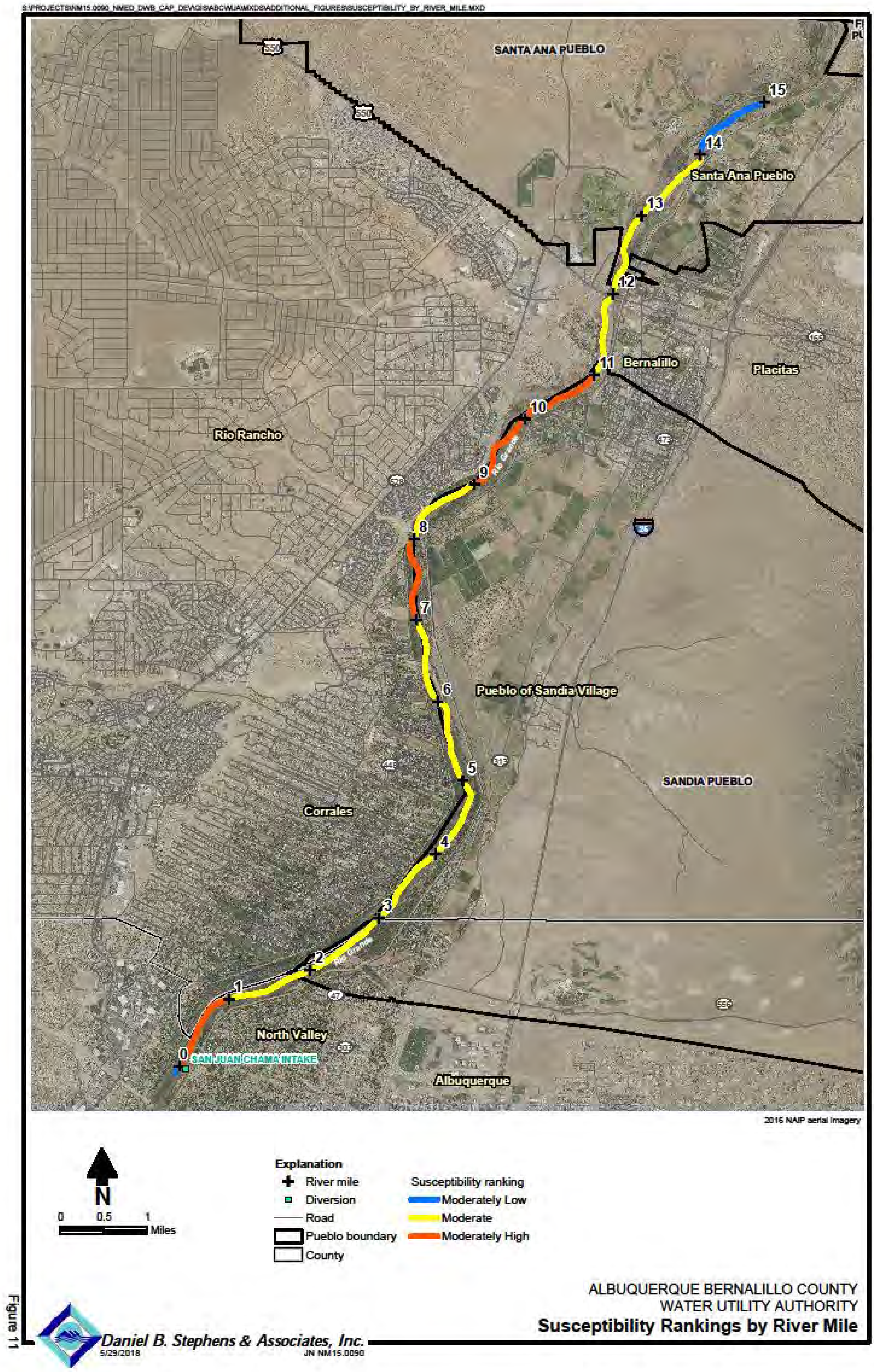
Figure 11. Susceptibility Rankings by River Mile



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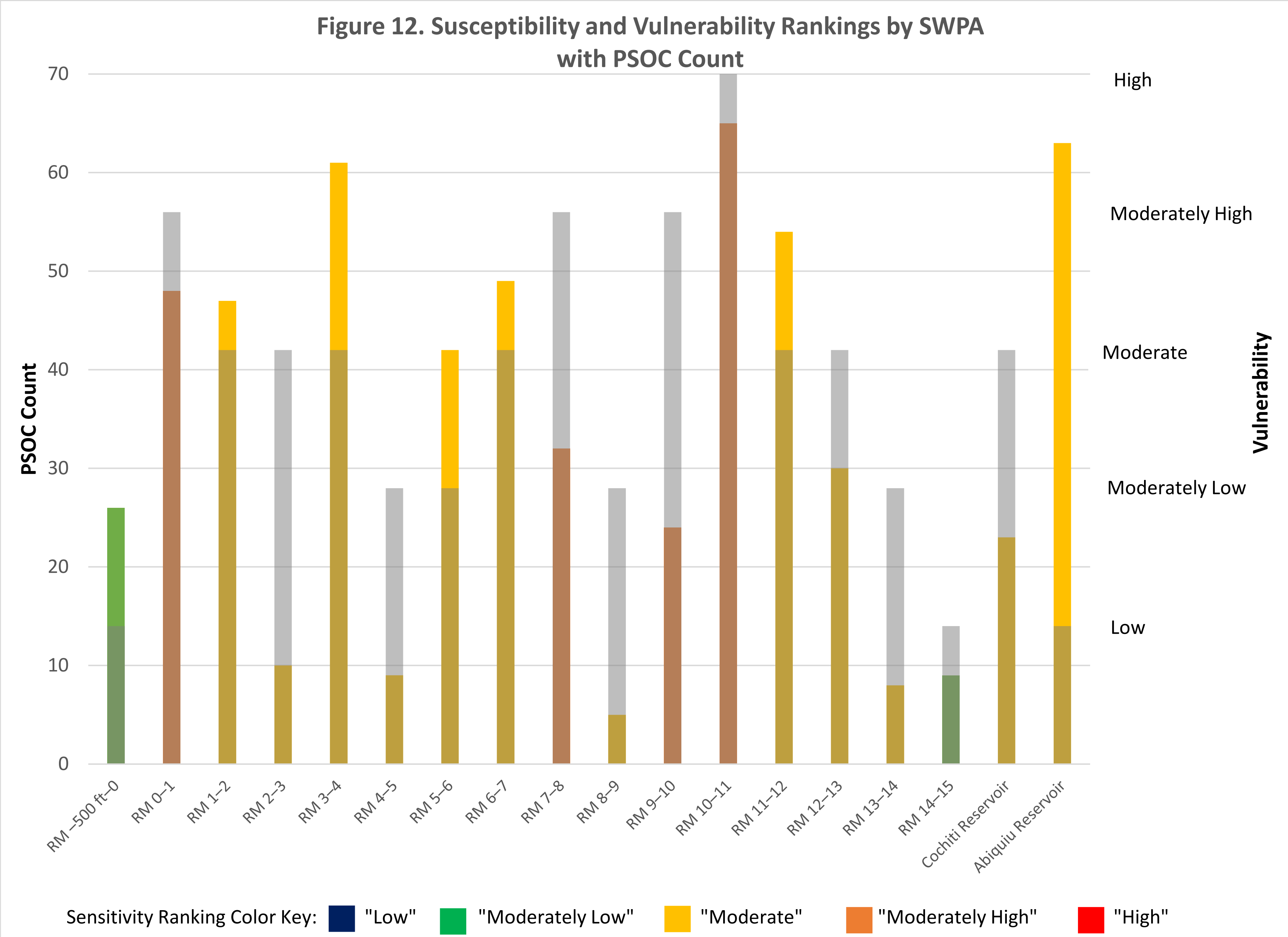
Figure 12. Susceptibility and Vulnerability Rankings by SWPA with PSOC Count
PSOC Count
70
60
50
40
30
20
10
0
High
Moderately High
Moderate
Moderately Low
Low
Vulnerability
RM –500 ft–0
RM 0–1
RM 1–2
RM 2–3
RM 3–4
RM 4–5
RM 5–6
RM 6–7
RM 7–8
RM 8–9
RM 9–10
RM 10–11
RM 11–12
RM 12–13
RM 13–14
RM 14–15
Cochiti Reservoir
Abiquiu Reservoir
Sensitivity Ranking Color Key:
"Low"
"Moderately Low"
"Moderate"
"Moderately High"
"High"

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6. Conclusions

Surface water collects on the ground, and therefore, is capable of receiving water resulting from runoff and surface flows from tributaries and channels. This inherent nature of surface water bodies, combined with the proximity to urban development, makes surface water sources generally more susceptible to contamination than groundwater. Tributaries and channels flow directly into surface water sources like rivers and reservoirs, providing a mechanism for transporting sediment, urban runoff contaminants, and debris into the surface water bodies. Unless the surface water source is equipped with infrastructure, such as flood and sediment control, there are no options for preventing contamination from impacting the source.

In contrast, groundwater sources require a well to pump and extract water from the ground, and therefore, have the infrastructure to respond to impacts to the aquifer. Moreover, there can be intervening features on the ground surface (e.g., concrete pads, parking lots, etc.) that limit infiltration of contamination on the surface down to groundwater; and the aquifer itself may have barriers to flow if laterally continuous layers of low-permeability (clay) are present. The fundamental differences between surface water and groundwater mean that surface water generally has a higher susceptibility to contamination relative to groundwater. However, the type, magnitude, and persistence of surface water contamination is markedly different than groundwater.

Figure 12 illustrates the number of Potential Sources of Contamination (PSOCs) counted by river mile (RM) and reservoir; and each bar has been color-coded to show the resulting susceptibility ranking for that source. No surface water sources in this assessment are ranked higher than “moderately high” for susceptibility to contamination. The highest susceptibility ranking of “moderately high” occurred along the river, upstream of the San Juan-Chama (SJC) Drinking Water Project (DWP) diversion and includes: RM 0-1, RM 7-8, RM 9-10, and RM 10-11. The moderately high susceptibility ranking for these reaches of the river is driven largely by the unlimited public access to the river, presence of street storm drains, and the occurrences of PSOCs across all three buffer zones. Additionally, RM 10-11 is where the City of Bernalillo has a National Pollutant Discharge Elimination System (NPDES) permit (WWTP-001) for discharging waste water treatment effluent into the river. The street storm drains and NPDES permit are two of the highest scoring PSOCs in the vulnerability methodology.

The lowest susceptibility ranking is “moderately low,” occurring at RM -500 feet to 0 feet and RM 14-15. The “moderately low” ranking for RM -500 to 0 feet reflects that this reach of the river is where the Water Authority has its diversion, and therefore, there is infrastructure to control diversion of surface water into the drinking water treatment plant. Additionally, this reach of the river has fencing and access control as part of the Water Authority’s operation of the diversion. The limited access to the river, combined with diversion infrastructure, means this reach has a lower sensitivity to contamination despite being within urban development. The RM 14-15 segment has a “moderately low” susceptibility ranking due to the low occurrence of PSOCs in the segment, and the PSOCs all occur in buffer Zone C, the furthest from the source.

The two reservoirs analyzed in this assessment, Abiquiu and Cochiti, both scored a “moderate” susceptibility ranking. In the case of Abiquiu, the “moderate” ranking reflects the fact that diversions from the reservoir are controllable; and therefore, there is a mechanism for mitigating the risk of contamination. This ability to stop flow in the case of a contamination event offsets the relatively higher vulnerability score for Abiquiu, due to the presence of PSOCs including arroyos, private wells, and septic tanks. In comparison, the Cochiti reservoir has a susceptibility ranking of “moderate” because of the low PSOC occurrence and the fact that the only PSOCs identified are low-scoring arroyos. Cochiti does not have any infrastructure to control diversions, and therefore, cannot achieve a susceptibility score lower than moderate.

The watershed zone was not assigned a susceptibility score, though it is an important consideration when looking at surface water sources and their susceptibility to contamination. The watershed is somewhat accounted for in the PSOC Risk scores assigned to PSOC types such as drainages, arroyos, and acequias.

Wildfires can pose a serious impact to surface water sources depending on the location and severity of the fire. Catastrophic wildfires are more likely to result in flooding, increased peak flows in rivers, and debris flows which could translate into increased costs for downstream drinking water supplies. The higher the severity of the wildfire, the more likely sediment load will increase and, in the case of the Water Authority, cause an interruption in the diversion of surface water for use in the drinking water supply. Wildfire studies, like Loomis et al. (2003) have shown that frequent, low-intensity fires, through the application of prescribed burns, reduce the severity of wildfires, and therefore, reduces the overall sediment load. Source water protection planning, combined with forest management measures, are mechanisms for mitigating risks from wildfires for the watershed and surface water drinking water sources.

There are no occurrences of oil and gas wells within the SWPAs analyzed in this assessment. On a watershed scale, there are some active oil and gas wells on the western extent of the watershed, more than 5 miles away from either a river or reservoir. The oil and gas wells in close proximity to the SJC DWP diversions on the Rio Blanco, Navajo River, and Willow Creek have been abandoned; and there are no permitted, active wells. There is no activity within the Albuquerque Basin, and therefore, no imminent threat to surface water quality. Consequently, there is time for proactive development of legislation and ordinances on a local and regional scale to protect drinking water sources.

The susceptibility rankings for each of the sources evaluated in this assessment can be used to inform Water Authority operations and planning. Additionally, these rankings can be used to coordinate between agencies in the region to develop policies and to take actions that are protective of source water.

7. Recommendations

The actual susceptibility of the surface water drinking water sources depends on a number of factors, including distance from the surface water source, and both known and unknown potential sources of contamination. In the case of surface water, susceptibility was evaluated by river mile extending from 500 feet downstream of the San Juan-Chama (SJC) Drinking Water Project (DWP) diversion point and ending 15 river miles upstream of the diversion. Two additional surface water sources were included in this assessment: Cochiti Reservoir and Abiquiu Reservoir. The goal of the recommendations listed below are to decrease "moderately high" susceptibility rankings and maintain "moderately low" susceptibility rankings.

7.1 Monitoring

No changes are recommended to the current monitoring program for surface water. The Water Authority has an existing Emergency Response Plan that includes protocols in the event of a release to surface water upstream of the diversion; and it is recommended that this plan continue to be followed and updated as needed.

7.2 Ordinance and Policy Actions

The following are specific policies and/or actions that are recommended for the Water Authority to initiate or endorse for source water protection. These recommendations are consistent with the approved and final policies of the Rivers and Aquifers Protection Plan (RAPP).

- Consider incentives to promote the removal of septic systems and the connection to sanitary sewer service.

- Endorse source protection from oil and gas activities and continue participating in regional committees, such as the Policy Implementation Committee and the Mid-Region Council of Governments where oil and gas issues and considerations are discussed.

7.3 Agency Coordination

The Water Authority's surface water source extends upstream of the diversion through the City and County, and therefore, requires close coordination with these agencies. Additionally, several of the Potential Sources of Contamination (PSOCs) identified in this assessment are regulated and overseen by the New Mexico Environment Department (NMED). The following are specific coordination efforts recommended for the Water Authority, City, County, and NMED:

- Support the County in their efforts to bring septic systems up-to-date and into compliance with Ordinance Division 10 Sections 42-419 through 42-517.

- Coordinate with the NMED to receive updates and information on stream impairment reviews and designations upstream of the diversion.

- Coordinate with NMED and Emergency Response teams in the Middle Rio Grande to receive notifications and response updates for spills and accidents. As part of the emergency response to releases to surface water, create an organizational chart for water quality responses to include at least one source water protection team member. The source water protection team member would be tasked with tracking short- and long-term regulatory response and cleanup in coordination with both the Compliance and Operations Divisions.

- Continue to support the Municipal Separate Storm Sewer System (MS4) permittees in their efforts to find and eliminate illicit discharges to stormwater outlets and to protect stormwater quality, especially in areas that discharge to the North Diversion Channel (NDC) above the diversion.

- Encourage the County and upstream communities to consider implementing the "Fire Wise Communities" national program that provides tools to teach community members how to adapt to living with wildfire, including property damage mitigation tools to reduce the risk of life and property loss from catastrophic wildfires in populated areas.

- Support state legislative funding for the NMED to build and continuously update a robust database with current land use, site data, and permits.

- Continue to support river sampling activities through the Water Authority's cooperative agreement with the United States Geological Survey (USGS).

7.4 Source Water Protection Outreach

By engaging communities, along with business owners and operators, the Water Authority can proactively work towards preventing future impacts to surface water. The following outreach efforts are recommended for the Water Authority:

- Partner with the City and County to provide information to business owners and operators on best practices at industrial and commercial properties, including dry cleaners, gas stations, auto body shops, and manufacturing plants.

- Partner with the City and County on Community Cleanup Days with opportunities for household hazardous waste disposal and prescription take-back stations. The City and County already have a program for hosting cleanup days, and the Water Authority can support promoting these events through bill inserts and the Water Authority newsletter.

- Partner with the City and County on continuing and potentially broadening public awareness campaigns that promote source water protection, along with the role of individuals and the actions they can take (e.g., pet waste removal).

7.5 Future Surface Water Assessment Considerations

This Surface Water Source Water Assessment (SWA) defines the river and reservoir polygons, and therefore buffer zones, using aerial photography from a range of dates. Future updates to this assessment should consider using high-water levels for the reservoirs and river flood stages, to define the area from which to measure buffer zones and PSOC proximity. By using the high-water levels for the surface water sources, the assessment can account for the range of water levels that may occur between assessment updates.

The current Surface Water SWA does not utilize land-use categories, and therefore, may not have all potential PSOC types captured for the river miles extending upstream of the diversion. Future updates should incorporate land-use data to more completely assess surface water source susceptibility. Additionally, future assessments should be expanded to include Heron Reservoir, where the Water Authority receives San Juan-Chama (SJC) Drinking Water Project (DWP) diversions; and El Vado Reservoir, where SJC water passes through on its way downstream to Abiquiu Reservoir for storage.

Future SWAs for surface water should consider analyzing flow and residence times for surface water sources. Additionally, Rio Grande and Rio Chama flows could affect the rate at which contamination moves through the system, as well as deposition and dilution of contaminants downstream.

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