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February 6, 2001

Mr. Richard Grice
Grand County Planning Department
125 East Center Street
Moab, Utah 84532

RE: Hydro-geology Report for Johnson's Up-On-Top Mesa, Grand County, Utah

Dear Mr. Grice
This report is written as a response to the hydro-geology questions raised in the Grand County Planning and Zoning Commission Meeting of December 6, 2000. The Planning Staff recommended the submission of a ground water geologic report or other technical evidence to demonstrate that the proposed development will have no adverse impacts on the aquifer.

Sear Brown has compiled and reviewed numerous studies, reports and plans regarding the Hydro-geology around the vicinity of this project. The information we were able to obtain is as follows:

Drinking Water Source Protection Plan
George White Wells No. 4 and No. 5
Grand Water and Sewer Service Agency, Moab Utah
Sunrise Engineering
December 29, 1999

Drinking Water Source Protection
R309-113
Department of Environmental Quality
Division of Drinking Water
State of Utah
July 26, 1995

Source Protection Users Guide
Department of Environmental Quality
Division of Drinking Water
State of Utah
October 1998

Recharge Areas and Quality of Ground Water for the Glen Canyon and Valley-Fill Aquifers, Spanish Valley Area, Grand and San Juan Counties, Utah
U.S. Geological Survey
1997

Geology and Water Resources of the Spanish Valley Area
Grand and San Juan Counties, Utah
Technical Publication No. 32
State of Utah
Department of Natural Resources
1971

Ground-Water Conditions in the Grand County Area, Utah with Emphasis on the Mill Creek-Spanish Valley Area.
Technical Publication No. 100
State of Utah
Department of Natural Resources
1990

Copies of this information has been included as supplement to this report in the Appendix.

The Drinking Water Source Protection Plan for George White Wells No. 4 and No. 5 was the only completed source protection plan available. There are two other well protection plans in progress and we were unable to obtain mapping for one of the plans. The existing George White plan appears to be more inclusive than any other mapping we have seen. We therefore feel our recommendations in this letter are conservative. Portions of the proposed development falls within Zone 2 of the George White plan and will need to conform with those requirements. A Drinking Water Source Protection Zone 2 has the following definition:

> Zone 2 - The area within a 250 day ground-water time of travel to the well head or margin of the spring collection area. The Public Water System should prevent the future location of "pollution sources" within Zone 2, unless the potential pollution source agrees to implement design or operating standards which prevent discharges to the groundwater.

"Pollution Source" has the following definition:

> Pollution Source - Point source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to the following: Storage facilities that store liquid forms of extremely hazardous substances, septic tanks, drain fields, Class V underground injection wells, landfills, open dumps, land filling of sludge and septage, manure piles, salt piles, pit privies, drain lines, and animal feeding operations with more than ten animal units.

None of the land uses proposed for Jouhson's-Up-On-Top Mesa development are defined as "Pollution sources".

The State of Utah Drinking Water Source Protection Rules R309-113 also identifies "Potential Contamination Sources"

> Potential Contamination Source – Any facility or site which employs an activity or procedure which may potentially contaminate ground water. A pollution source is also a potential contamination source.

A checklist of Potential Contamination Sources is given in the State of Utah Source Protection Users Guide. It lists 58 potential contamination sources, three of those sources are included in the Johnson's Up-On-Top Meas. A copy of this list follows:

POTENTIAL CONTAMINATION SOURCES

NUMBER	DESCRIPTION	PRESENCE
1	Active and abandoned wells	No
2	Agricultural pesticide, herbicide, and fertilizer storage, use, filling, and mixing areas	No
3	Airport maintenance and fueling sites	No
4	Animal feeding operations with more than ten animal units	No
5	Animal watering troughs located near unfenced wells and springs that attract livestock	No
6	Auto washes	No
7	Beauty salons	No
8	Boat builders and refinishers	No
9	Chemical reclamation facilities	No
10	Chemigation wells	No
11	Concrete, asphalt, tar, and coal companies	No
12	Dry cleaners	No
13	Farm dump sites	No
14	Farm maintenance garages	No
15	Feed lots	No
16	Food processors, meat packers, and slaughter houses	No
17	Fuel and oil distributors and storers	No
18	Furniture strippers, painters, finishers, and appliance repairers	No
19	Grave yards, golf courses, parks, and nurseries	No
20	Heating oil storers	No
21	Industrial manufacturers: chemicals, pesticides, herbicides, paper and leather products, textiles, rubber, plastic, fiberglass, silicone, glass, pharmaceutical, and electrical equipment, etc.	No
22	Industrial waste disposal/impoundment areas and municipal wastewater treatment plants, landfills, dumps, and transfer stations	No
23	Junk and salvage yards	No
24	Laundromats	No
25	Machine shops, metal platers, heat treaters, smelters, annealers, and descalers	No
26	Manure piles	No
27	Medical, dental, and veterinarian offices	No
28	Mortuaries	No
29	Mining operations	No
30	Muffler shops	No
31	Pesticide and herbicide storers and retailers	No
32	Photo processors	No
33	Print shops	No
34	Radiological mining operations	No
35	Railroad yards	No

NUMBER	DESCRIPTION	PRESENCE
36	Research laboratories	No
37	Residential pesticide, herbicide, and fertilizer storage, use, filing, and mixing areas	Yes
38	Residential underground storage tanks	No
39	Salt and sand-salt piles	No
40	Sand and gravel mining operations	No
41	School vehicle maintenance barns	No
42	Sewer lines	Yes
43	Single-family septic tank/drain-field systems	No
44	Sites of reported spills	No
45	Small engine repair shops	No
46	Stormwater impoundment sites and snow dumps	Yes
47	Subdivisions using subsurface wastewater disposal systems (large and individual septic tank/drain field systems)	No
48	Submersible pumps used to pump wells	No
49	Taxi cab maintenance garages	No
50	Tire shops	No
51	Toxic chemical and oil pipelines	No
52	Vehicle chemical supply storers and retailers	No
53	Vehicle dealerships	No
54	Vehicle quick lubes	No
55	Vehicle rental shops	No
56	Vehicle repair, body shops, and rust proofers	No
57	Vehicle service stations and terminals	No
58	Wood Preservers	No
		No

The table shows that three Potential Contamination Sources exist. They are: (37)Residential pesticide, herbicide and fertilizer use, (42)Sewer lines and (46)Storm water impoundment sites. The development is proposing prevention measures as recommended in the Drinking Water Source Protection Plan.

The desert environment and low density proposed will generate a very minimal amount of lawns and planted areas. The project will maintain 80% of the land as natural open space. The development does not have golf courses, agriculture orf large expanses of landscaping. Water use for irrigation will be discouraged and natural desert landscaping implemented. As a result, the use of pesticides, herbicides and fertilizers will also be minimal. We have included restrictive covenants to limit the use of these materials in the Development Agreement.

The proposed sewer lines will be constructed to State of Utah and Grand County standards, thus reducing the potential for spills and leakage. Sewer construction will be inspected and all pipes air tested prior to backfilling. All wastewater will flow through these sewer lines to the Treatment Plant in

Moab. This risk is considerably less than the risk from livestock grazing which currently exists. The proposed equestrian center has been located outside of the zone 2 source protection area.

Some isolated storm water impoundment sites will be constructed on the Mesa. These sites will be necessary to control flooding and erosion. Their potential for contaminating is rare because the drainage basins will not contain any pollution sources. Vehicular travel on the project site is discouraged as part of the total experience. Parking areas are limited and will have oil water separators built into the drainage systems.

CONCLUSION

The Johnson's Up-On-Top Mesa Project is a residential, condominium and wilderness lodge development. It will not contain point source discharges of pollutants. It is common in Drinking Water Source Protection Zone 2 boundaries to contain this type of development.

This development does not fall into the category of defined pollution sources. The developer will enter into a "Land Use Agreement" as described in the State of Utah Drinking Water Regulations R309-113-6.1.n. as part of the development agreement. This is a written agreement wherein the owner agrees not to allow location of pollution sources within Zone 2 of wells in unprotected aquifers. The restriction is binding on all heirs, successors and assigns. Land use agreements must be recorded with the property description in the county recorder's office.

Chapter 6 of the Drinking Water Source Protection Zone Plan for the George White Wells No. 4 and No. 5 gives specific directions for management of development in the protections zones. The Grand Water and Sewer Service Agency and Grand County should assess the Potential Contamination Sources and implement measures to control and regulate the sources.

FINDINGS

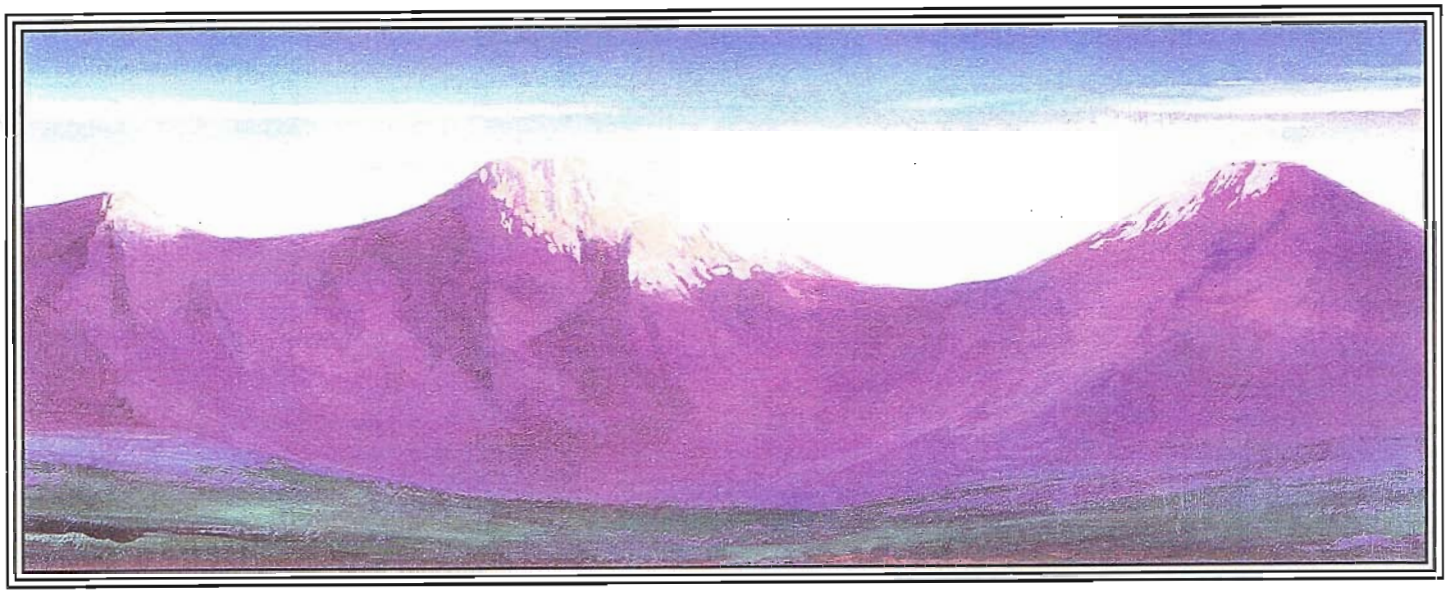
The proposed land uses and infrastructure in the Johnson's Up-On-Top Mesa development are compatible with the Zone 2 designation of the Water Source Protection Plan. The development will not contain point source discharges of pollutants. The proposed plan is in compliance with the State of Utah Water Regulations R309-113 the "Drinking Water Source Protection Plans".

Please review our findings and feel free to call with any additional comments or questions.

Sincerely,
Sear Brown

Brian Bangerter

Brian Bangerter, P.E.
Project Manager



DRINKING WATER SOURCE PROTECTION PLAN

George White Wells No. 4 and No. 5
Grand Water and Sewer Service Agency
Moab, Utah

Sunrise Project No. E8209.44
December 29, 1999

Prepared for:

Mr. Dale F. Pierson
Grand Water and Sewer Service Agency
P.O. Box 1048
Moab, UT 84532

Prepared by:

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FILLMORE, UT
MESA, AZ
AFTON, WY
SALT LAKE CITY, UT
PRESCOTT VALLEY, AZ
WASHINGTON, UT
BULLHEAD CITY, AZ

December 29, 1999

Mr. Dale F. Pierson
Grand Water and Sewer Service Agency
P.O. Box 1048
Moab, UT 84532

RE: Drinking Water Source Protection Plan
George White Wells No. 4 and No. 5
Grand Water and Sewer Service Agency (Water System No. 10023)
Sunrise Project No. E8209.44

Dear Mr. Pierson:

The Drinking Water Source Protection (DWSP) Plan for the above referenced two wells is enclosed herein. The delineation of the DWSP zones, a prioritized inventory of potential contamination sources, management strategies to protect the drinking water sources, a contingency plan and a section regarding pesticide and volatile organic chemical monitoring waiver are contained in this report and the attached appendices.

The information in this report relates only to the subject wells and should not be extrapolated or construed to apply to any other sources. The information, recommendations and conclusions provided herein apply to the subject wells as they existed at the time when this DWSP plan report was prepared.

If you have any questions, please feel free to contact us at (801) 523-0100.

Sincerely,
SUNRISE ENGINEERING, INC.

Prepared by:

Li Qi, P.E.
Project Engineer

No. 97 [illegible]
LI
QI
STATE OF UTAH

Reviewed by:

Dan L. Crawford, P.G.
Senior Hydrogeologist

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EXECUTIVE SUMMARY

This report presents a Drinking Water Source Protection (DWSP) Plan for George White Wells No. 4 and No. 5 in the Grand Water and Sewer Service Agency Water System (Water System No. 10023). In compliance with relevant Utah Division of Drinking Water rules, this report includes a delineation section, an inventory of potential contamination sources, an assessment of potential contamination source hazards, a management program for existing potential contamination sources, a management program for future potential contamination sources, an implementation schedule, a resource evaluation, a recordkeeping section, a contingency plan and a section regarding pesticide and volatile organic chemical (VOC) monitoring waivers.

As part of our identification of the source protection areas, the projected maximum pumping rate from George White Wells No. 4 and No. 5 were respectively set at 1250 and 650 gallons per minute (gpm). These pumping rates were then used to delineate the 250-day, 3-year and 15-year DWSP time of travel zones for the wells. The dimensions of the three DWSP zones, delineated basically using numerical modeling, are summarized below:

Time of Travel	Zone #	Maximum Down-gradient Distance (ft)	Maximum Up-gradient Distance (ft)	Maximum Width (ft)
250 Days	2	350	9,500	7,600
3 Years	3	350	27,000	19,100
15 Years	4	350	28,200	19,600

An inventory of existing potential contamination sources has been completed and the management programs have been developed. A management program to control or prohibit any future pollution sources to be located within the protection zones of the wells has been prepared. A contingency plan for the entire water system has also been prepared and is included in the report.

According to Utah Rule 309-113-6 (1)(v), the producing aquifer of the wells cannot be classified as a protected aquifer.

It is recommended that a use waiver for the VOC and pesticide groups be granted for George White Wells No. 4 and No. 5.

TABLE OF CONTENTS

FIGURES

APPENDICES

DRINKING WATER SOURCE PROTECTION PLAN

George White Wells No. 4 and No. 5
Grand Water and Sewer Service Agency
Moab, Utah

Sunrise Project No. E8209.44
December 29, 1999

1.0 INTRODUCTION

Sunrise Engineering, Inc. (Sunrise) has completed a Drinking Water Source Protection (DWSP) Plan for George White Wells No. 4 and No. 5 in the Grand Water and Sewer Service Agency Water System (System No. 10023) in compliance with Utah DWSP Rule R309-113. According to the State of Utah Division of Drinking Water, or DDW (1998), a DWSP plan for a single source should include a delineation section, an inventory of potential contamination sources, an assessment of potential contamination source hazards, a management program for existing potential contamination sources, a management program for future potential contamination sources, an implementation schedule, a resource evaluation, a recordkeeping section and a section regarding pesticide and volatile organic chemical (VOC) monitoring waivers. A contingency plan is required for an entire water system and submitted to the DDW concurrently with the submission of the first DWSP plan for the system.

1.1 System Information

The Grand Water and Sewer Service Agency Water System includes two existing wells, George White Wells No. 4 and No. 5, and the associated water storage and distribution facilities. Well No. 4 was brought on line to the public system in 1981 and Well No. 5 in 1992. Currently, the system supplies water to 902 connections. The system information is summarized in **Table 1**.

Table 1. Water System Information

Water System Name	Grand Water and Sewer Service Agency
Water System Number	10023
Address	P.O. Box 1048, Moab, UT 84532
Type of System	Community System, Political Subdivision

1.2 Source Information

George White Wells No. 4 and No. 5 are located approximately four miles southeast of the City of Moab, on northeastern side of Spanish Valley, at the southwestern foot of the Johnson's Up On Top

Mesa. Specifically, Well No. 4 is located at North 330 feet and East 2,280 feet from the Southwest corner of Section 23, Township 26 South, Range 22 East, Salt Lake Base and Meridian, and Well No. 5 is situated at North 1,240 feet and East 1,900 feet from the Southwest corner of Section 23, Township 26 South, Range 22 East, Salt Lake Base and Meridian.

Figure 1, consisting of portions from the U.S. Geologic Survey (USGS) 7.5-Minute Series Topographic Quadrangle Maps for Rill Creek (USGS, 1985), and Warner Lake, Utah-Grand Counties (USGS, 1985), shows the well locations. The wellhead elevations of George White Wells No. 4 and No. 5 are approximately 4,670 and 4,680 feet above mean sea level (MSL), respectively. Well No. 4 is currently equipped to produce 1,000 gallons per minute (gpm) of water, and Well No. 5 can be pumped at 600 gpm.

1.3 Designated Person

Presently, Mr. Dale F. Pierson is responsible for management of the DWSP plan for the Grand Water and Sewer Service Agency Water System. He can be contacted at (435) 259-8121. His mailing address is: Grand Water and Sewer Service Agency, P.O. Box 1048, Moab, UT 84532.

2.0 DELINEATION OF DWSP ZONES

This wellhead protection delineation is prepared in compliance with Utah DWSP Rule R309-113. Two procedures to delineate source protection areas are described in the DWSP rule: the preferred delineation procedure and the optional two-mile radius delineation procedure. Sunrise applied the preferred delineation procedure in the delineation of the following four protection zones for groundwater management purposes:

1. Zone one is called the **accident prevention zone**, consisting of an area within a 100-foot radius from the wellhead or margin of the spring collection area. No future pollution sources will be allowed to be located in this area.

2. Zone two is called the **attenuation zone**, comprising an area within a 250-day groundwater time of travel (TOT) to the wellhead or margin of the spring collection area. The public water system (PWS) should prohibit the future location of pollution sources within zone two, unless the potential pollution source agrees to implement design or operating standards which prevent discharges to the groundwater.

3. Zone three is called the **waiver criteria zone**, comprising an area within a 3-year groundwater TOT to the wellhead or margin of the spring collection area. This zone was

established to match the source monitoring waiver reevaluation period of 3 years. The waiver was designed for analysis of water samples collected from the drinking water source for VOCs and pesticides. Waivers for these two parameter groups can be issued to systems that delineate protection zones and list the potential contamination sources within these zones. Since waivers are reevaluated every three years, systems should delineate a 3-year groundwater TOT protection area around their sources on which to base their waiver.

4. Zone four is called the **remedial action zone**, comprising an area within a 15-year groundwater TOT to the wellhead or margin of the spring collection area. Its purpose is to provide protection to the drinking water source and to afford sufficient time for remediation or developing a new source in case of a contamination incident.

The following section summarizes the information required by the Utah DWSP Rule for the delineation of estimated DWSP zones including: geologic data, well construction data, aquifer data, hydrogeologic methods and calculations, and maps showing boundaries of the DWSP zones for George White Wells No. 4 and No. 5.

2.1 Geologic Data

2.1.1 General Geology and Hydrology

Local geology in the vicinity of the two wells is shown in **Figure 2**, a portion of which was modified and enlarged from the Map of the Spanish-Moab Valley area, Grand and San Juan Counties, Utah (Sumsion, 1971). The Spanish-Moab Valley area, or the Mill Creek-Pack Creek drainage basin, extends from southeast to northwest between a drainage divide along the lofty crests of the La Sal Mountains and a base level at the Meanders of the turbid Colorado River. The elongated, crag-walled structural trough that forms Spanish Valley and Moab Valley is located at the western edge of the drainage basin. Its surface has an average slope of about 120 ft/mile. The southeastern part of the trough is Spanish Valley, and the northwestern, topographically lower part in the vicinity of Moab City, is Moab Valley. Geologic structures throughout the Spanish-Moab Valley area control the drainage-basin hydrology, recharge and groundwater movement (Sumsion, 1971).

In the Spanish-Moab Valley area, Pack Creek enters Spanish Valley from the southeast, flows into Moab Valley, and joins the Colorado River at the northwestern end of the valley. Mill Creek flows west from the mountains and then northwest for 8.6 miles, parallel to Spanish Valley before entering Moab Valley where it joins Pack Creek. North Fork Mill Creek generally flows from east to west and joins Mill Creek before entering Moab Valley.

The Triassic and Jurassic Glen Canyon Group (Jkgc), consisting of the Navajo Sandstone, the Kayenta Formation, and the Wingate Sandstone, is mapped along the northeastern wall of Spanish-Moab Valley. A copy of the associated geologic descriptions is attached in **Appendix A**. The Navajo Sandstone is surficially exposed and its maximum thickness is 400 feet. The Kayenta Formation, underling the Navajo Sandstone, is composed of siltstone and sandstone. Its thickness ranges from 0 to 240 feet. The Wingate Sandstone lies at the bottom of the Glen Canyon Group and the thickness varies between 0 and 350 feet. According to Steiger and Susong (1997), the Navajo Sandstone and Wingate Sandstone can yield a substantial amount of water. Blanchard (1990) noted that the Navajo Sandstone and Wingate Sandstone are in hydraulic connection because the intervening Kayenta Formation is mostly sandstone, and all the three formations are jointed and fractured. Blanchard (1990) also showed that the direction of groundwater movement in the Glen Canyon Aquifer is generally to the west and southwest, nearly perpendicular to the eastern canyon wall of the valley. Water from the Glen Canyon Aquifer discharges to numerous springs and wells (including the subject wells) along eastern edge of Spanish Valley.

The Glen Canyon Aquifer is covered by shallow deposits of eolian sand or sandy soil northeast of Spanish Valley. These sands and soils provide storage where precipitation can quickly infiltrate and then move into the underlying Glen Canyon Aquifer. Rock formations along the margin of the Spanish-Moab Valley and its adjacent northeastern area are extensively fractured parallel to its axis. Mill Creek gains water from the Glen Canyon Aquifer in its upper reaches and loses water to the aquifer in the last 8.6 miles as it parallels Spanish Valley (Blanchard, 1990). The North Fork of Mill Creek gains water from the Glen Canyon Aquifer along its entire length (Blanchard, 1990).

The geologic structures of Spanish-Moab Valley vary along its length. The valley structure may be divided into three segments: the Moab anticline near the Colorado River, the normal Spanish Valley syncline near the central part of the valley, and the faulted Pack Creek synclinal graben near the eastern margin of the area (**Figure 2**). Along the northeastern wall of Spanish-Moab Valley, the Glen Canyon Group formations dip to southwest with the dip angles ranging from 1° to 9° (very flat bedding).

2.1.2 Well Logs

The driller's logs for George White Wells No. 4 and No. 5 are attached in **Appendix B**. The materials encountered during drilling of the wells are summarized in **Tables 2-1** and **2-2**.

Table 2-1. Materials Encountered during Drilling George White Well No. 4

Depth below Ground Surface (ft)		Description
From	To	
0	8	Red Sand
8	174	Sandstone

The driller's log for Well No. 4, **Appendix B** and **Table 2-1**, indicates that Well No. 4 was drilled through eight feet of red sand followed by 166 feet of sandstone. The total depth of the well is 174 feet below grade. Groundwater was encountered within the sandstone and the static water level was 75 feet (March 9, 1971) below ground surface (BGS). It is clear that the well taps water from the Navajo Sandstone of the upper Glen Canyon Group (Jkgc) as described in section **2.1.1**.

Table 2-2. Materials Encountered during Drilling George White Well No. 5

Depth below Ground Surface (ft)		Description
From	To	
0	10	Red Sand
10	180	Red Sandstone

Well No. 5 reflects similar subsurface conditions, 10 feet of red sand followed by 170 feet of red sandstone, as shown in **Appendix B** and **Table 2-2**. The well was drilled to 180 BGS, and groundwater was first encountered at 105 feet BGS.

2.2 Well Construction Data

George White Wells No. 4 and No. 5 were drilled to the depths of 174 and 180 feet BGS, using the cable tool and rotary drilling methods, by H.E. Beeman in 1971 and 1990, respectively. The summaries of the well construction data are presented in **Tables 3-1** and **3-2**.

Table 3-1. Well Construction Summary (George White Well No. 4)

Well Completion Date	February 25, 1971
Well Driller's Log	Refer to **Table 2-1** and **Appendix B**
Elevation of Wellhead	4,670 feet above MSL
Well Diameter	16 inches
Total Depth of Completed Well	174 feet
Length of Screened or Perforated Intervals	No perforation
Perforated Depths	N/A
Grouting Depth/Surface Seal	No Surface Seal
Depth to Static Water Level	75 ft BGS (03/09/71)
Method of Drilling	Cable Tool
Casing Type	Welded
Current Maximum Pumping Rate	1,000 gpm
Projected Maximum Pumping Rate	1,250 gpm
Maximum Well Yield	1,250 gpm
Pump Type	Submersible Deep Well Turbine, 100 HP
Installation Depth of Pump	120 feet BGS

Table 3-2. Well Construction Summary (George White Well No. 5)

Well Completion Date	April 17, 1990
Well Driller's Log	Refer to **Table 2-2** and **Appendix B**
Elevation of Wellhead	4,780 feet above MSL
Well Diameter	10 inches
Total Depth of Completed Well	180 feet
Length of Screened or Perforated Intervals	140 feet
Perforated Depths	33 to 173 feet BGS
Grouting Depth/Surface Seal	No Surface Seal
Depth to Static Water Level	75 feet BGS (Current)
Method of Drilling	Rotary
Casing Type	Welded
Current Maximum Pumping Rate	600 gpm
Projected Maximum Pumping Rate	650 gpm
Maximum Well Yield	Unknown
Pump Type	Submersible
Installation Depth of Pump	135 feet BGS

2.3 Aquifer Data Summary

As required by Utah State Rule 119-9. (4) (a) (ii), this section summarizes the saturated thickness of the water bearing unit, the hydraulic conductivity/transmissivity, assumed porosity, hydraulic gradient and groundwater flow direction.

2.3.1 Saturated Thickness of the Producing Aquifer

Well No. 4 According to the driller's well log (**Appendix B**) this well taps groundwater from the Navajo Sandstone that extends between eight feet BGS and the bottom of the well (174 feet BGS). The casing was installed from ground surface to 120 feet BGS, and the producing aquifer is a 54-foot open hole section (from 120 to 174 feet BGS).

Well No. 5 The driller's well log (**Appendix B**) indicates that groundwater was first encountered at 105 feet BGS. Although the perforated well casing interval is 140 feet, between 33 and 173 feet BGS, the perforated section above 105 feet BGS cannot be counted as part of the water-bearing layer. Therefore, the aquifer thickness was calculated as (173 – 105 =) 68 feet.

The smaller the saturated thickness of the producing aquifer used in the protection delineation, the greater the estimated TOT zones. Based on the analysis above, the saturated thickness of the producing aquifer was conservatively assumed to be 54 feet.

2.3.2 Hydraulic Conductivity/Transmissivity

Mr. Mark Jensen of the Utah DDW conducted a constant-rate-pumping test at Well No. 4 on December 14, 1993. Drawdowns versus pumping time data were recorded during the test and are attached in **Appendix C**. The static water level was 73 feet BGS before the pumping started. After a 210-minute period pumping at a pumping rate of 1,250 gpm, the water level stabilized at 84 feet BGS, which indicated a 11-foot drawdown. The time-drawdown graph was plot and is also attached in **Appendix C**. It appears that the pumping rate of 1,250 gpm, which already reached the pump capacity, was too low to stress the aquifer. The 11 feet of steady-state drawdown might result from the well loss created when groundwater entered the well from the aquifer. The thickness of water-bearing formation, Glen Canyon Group (Jkgc, refer to Section **2.1**), is up to 1,000 feet, and Well No. 4 is a partially penetrating well with a depth of 174 feet. Therefore, data obtained from the existing pumping test may not result in an analyzable time-drawdown curve.

Pumping test data from three pumping tests at Well No. 5 are also attached in **Appendix C**. These data are not analyzable for the same reasons as stated above.

Because the available pumping teat data cannot be used to determine the value of hydraulic conductivity/transmissivity, these aquifer characteristics have to be obtained or estimated based on available published literature and site-specific investigations. A groundwater condition study in the Grand County area was completed by the Utah Department of Natural Resources Division of Water Rights (Blanchard, 1990). According to this report, the estimate of hydraulic conductivity for the Navajo Sandstone in the Grand County area ranges from less than 0.4 feet/day in the northeast to about 1 feet/day in the southwest. Sunrise personnel conducted a site visit on May 26, 1999 and recently completed a Hydrogeologic Assessment/Well Siting Study (Sunrise, 1999) in this area. According to this study, the Navajo Sandstone Formation is highly fractured to the east/northeast of the subject wells. Steiger and Susong (1997) has mapped the highly fractured area (HFA) in their report, and part of this map is attached in **Appendix D**. It appears that the estimated value of hydraulic conductivity for the Navajo aquifer mentioned in Blanchard's study (1990) is too small.

The driller's log for George White Well No. 4 indicates that a pumping test was performed when the well was completed in 1971. The pumping test information required by the Utah DWSP Rule R309-113 is partially available and presented in **Table 4**.

Table 4. Pumping Test Information

Wellhead Elevation	4,670 feet above MSL
Pre-pumping Water Level	75 feet BGS
Constant Pump Rate	1,600 gpm
Time-Drawdown Data	N/A
Total Drawdown in Pumped Well	48 feet
Duration of Drawdown Test	1 hours
Recovery Test?	N/A

Because no time-drawdown data were available, we used the following empirical formula developed by Farri (1997) to estimate the aquifer transmissivity

$$T = 0.85\ SC^{1.07} \qquad (1)$$

where, T is the estimated transmissivity (m^2/ day), and SC is the specific capacity (m^2/ day) of the well. Based on the information listed in **Table 4**, SC was calculated as: (1,600 gpm / 448.8 gpm/cfs / 3.281^3 ft^3/m^3 × 86400 s/day) / (48 ft / 3.281 ft/m) = 596.1 m^2/day. T is then obtained as 792.5 m^2/day or 8,532 ft^2/day by use of equation (1).

The relationship between transmissivity and hydraulic conductivity is as follows:

$$K = T / B \qquad (2)$$

where, T is the aquifer transmissivity (feet^2/day), K is the aquifer hydraulic conductivity (feet/day) and B is the saturated thickness of the aquifer (feet). For the subject wells, B = 54 feet, and T = 8,532 ft^2/day. Thus, K is calculated as 158 feet/day.

Based on the analysis above, a conservative value of hydraulic conductivity, 158 feet/day, for the highly fractured Navajo Sandstone was used to delineate the DWSP TOT zone boundaries. If the groundwater travel distance under a given TOT extends beyond the northeastern boundary of the mapped fractured area, which is shown in **Appendix D** (Steiger and Susong, 1997), the maximum value published by Blanchard (1990), 1 foot/day, would be used to continue the delineation.

2.3.3 Direction of Groundwater Flow and Hydraulic Gradient

As related in Section **2.1.1**, the direction of groundwater movement in the Glen Canyon Aquifer is generally to the west and southwest, nearly perpendicular to the eastern canyon wall of the valley (Blanchard, 1990). In Sunrise's study (1999), the static groundwater level contours were mapped for the Spanish-Moab Valley area. This map is attached in **Appendix E**. The direction of groundwater flow in the potential recharge area in the vicinity of the subject wells was estimated to be between S55°W and S90°W. The hydraulic gradients were measured as 0.030 feet/feet (140 feet / 4,600 feet) in the S55°W direction, and 0.037 feet/feet (110 feet / 3,000 feet) in the S90°W direction.

2.3.4 Assumed Porosity

There is no specific information available on the effective porosity of the materials comprising the aquifer recharging the subject wells. Porosity values were therefore chosen from ranges published by Nielsen (1991), and Freeze and Cherry (1979). These values are summarized in **Table 5**.

Table 5. Effective Porosity Values Used in Delineation Calculation

Bedrock Material	Porosity Value Used	Published Range
Fractured Sandstone	0.20	? to 0.50
Unfractured Sandstone	0.10	0.05 to ?

2.4 Hydrogeologic Methods and Calculations

2.4.1 Hydrogeologic Method

There are several methods to determine the TOT for delineating the DWSP zones. Sunrise used a two-dimensional semi-analytical flow model (WHPA) which can offer reasonable accuracy at the least cost. This approach is accepted by the DDW if the model is applicable to the hydrogeologic setting of interest.

For a porous medium, groundwater flow is governed by Darcy's law

$$v = Q / A = K i \tag{3}$$

where, v is specific discharge (feet/day), Q is discharge rate (feet^3/day), A is area of the cross-section (feet^2), and i is hydraulic gradient (feet/feet).

The average linear velocity v_a through the portion occupied by voids in a porous medium is given by

$$v_a = v / n \tag{4}$$

where n is porosity of the material comprising the porous medium.

Conceptually, calculation of the TOT boundary can be simplified based on the following equation:

$$d = v_a t \tag{5}$$

where d is the radial distance from the well to the TOT boundary line (feet), and t is the given time of travel (e.g. 250 days, 3 years or 15 years).

The particle tracking method is often used for delineating the DWSP zones. Time related capture zones are delineated by placing a series of water particles at sequential locations along the perimeter of a small circle representing the well boundary. Individual path-lines for each of these particles are then traced using reverse tracking. The capture zone consists of the entire region enclosed by the delineated path-lines.

2.4.2 Delineation of Protection Zones within the HFA

The delineation was performed through particle tracking as computed using the semi-analytical model WHPA, which was developed by the EPA (Blandford and Huyakorn, 1991), and later modified by the International Ground Water Modeling Center in 1993. As related in Sections **2.1** and **2.3**, George White Wells No. 4 and No. 5 tap water from the highly fractured Navajo Sandstone formation. According to Freeze and Cherry (1979), if the fracture spacing is sufficiently dense, fractured media can be treated as porous media. Therefore, because we believe the HFA represents this geologic condition, the analysis of groundwater flow in the potential DWSP area of the subject wells can be carried out with WHPA, the Darcy's law based numerical model.

Input parameters required by WHPA include: well discharge rate, transmissivity, regional hydraulic gradient, effective porosity, groundwater flow direction, aquifer thickness, boundary conditions and well location. The primary input parameters for WHPA model for delineating the TOT zones are tabulated in **Table 6**.

Table 6. Parameter Values Used in WHPA Model for Down-Gradient TOT Zones

Model Parameter	Symbol	Unit	Value
Transmissivity	T	feet^2/day	8,532
Aquifer Thickness	B	feet	54
Effective Porosity	n	dimensionless	0.20
Hydraulic Gradient	i	dimensionless	0.030 and 0.037
Angle Ambient of Flow	--	degree	S55°W and S90°W
Time of Travel	t	days	250, 1095, 5475
Well No. 4 Discharge Rate	Q_1	feet^3/day / (gpm)	240,680 / (1,250)
Well No. 4 Radius	r_1	feet	0.667
Well No. 5 Discharge Rate	Q_2	feet^3/day / (gpm)	125,150 / (650)
Well No. 5 Radius	r_2	feet	0.417

The WHPA model outputs for the calculated 250-day, 3-year and 15-year TOT zones are attached in the first part of **Appendix F**.

2.4.3 Well Interference Analysis

A water right search was performed by Sunrise and many wells were identified in the down- and cross-gradient directions in vicinity of the George White Wells No. 4 and No. 5. Most of these are shallow wells tapping the unconsolidated alluvial aquifer.

According to the information obtained through the source search, conversation with the manager of Grand Water and Sewer Service Agency and field inspections, well interference is anticipated from 12 public and private wells, which are summarized in **Table 7**. The pumping rates listed in **Table 7** were obtained based on the available well logs and the permissible removals by the water rights.

Table 7. Interferential Wells

Well	Diameter (inches)	Depth (feet)	Pumping Rate (gpm)	Location (Township 26 S, Range 22 E, SLB&M)
City of Moab	12	222	1,400	S 4 and W 848, NE Corner of Section 22
City of Moab	12	240	1,400	S 830and W 653, NE Corner of Section 22
City of Moab	14	300	1,400	S 585 and E 1,248, NW Corner of Section 23
Irrigation	12	250	1,350	S 2,000 and E 700, NW Corner of Section 23
Irrigation	12	250	1,350	N 3,000 and E 0, SW Corner of Section 23
Irrigation	12	250	1,350	N 1,800 and E 500, SW Corner of Section 23
Irrigation	12	250	1,350	N 1,200 and E 1,600, SW Corner of Section 23
I. F. Kerby	6	110	185	N 857 and E 665, SW Corner of Section 23
White Ranches	16	174	2,030	N 70 and W 820, SE Corner of Section 22
Irrigation	12	250	1,350	N 0 and E 0, N4 Corner of Section 26
Irrigation	12	250	1,350	N 4,200 and W 2,400, SE Corner of Section 26
Irrigation	12	250	1,350	N 2,900 and W 1,600, SE Corner of Section 26

Most of the wells are used seasonally and not expected to be pumped simultaneously with George White Wells No. 4 and No. 5. Conservatively, we reran the WHPA model to estimate the maximum possible interference from all these wells, although not much interference is anticipated from those seasonally used wells. The outputs for calculated 250-day, 3-year and 15-year TOT zones from WHPA are attached in the second part of **Appendix F**.

The model outputs suggest that well interference enlarged the TOT zones in the up-gradient direction, narrowed them in the lateral-gradient direction and shortened them in the down-gradient direction compared with those TOT zones modeled without well interference (**Appendix F**). Conservatively, the width and areal extent of the TOT zones were determined by overlaying the two sets of model outputs, with and without well interference, and the results are attached in the third part of **Appendix F**.

2.4.4 Delineation of Protection Zones beyond the HFA

The up-gradient extent of the 3-year TOT zone extends beyond the boundary of the highly fractured Navajo Sandstone formation. As related in Section **2.3.2**, for unfractured sandstone in this area, the

hydraulic conductivity (K) was estimated to be 1 foot/day, and the effective porosity (n) was chosen as 0.1. Because the WHPA model can handle only one K value, in the area outside the HFA boundary, the TOT distances were calculated using equation (5). This technique is a type of hydrogeologic mapping. The calculation details are listed in **Table 8**.

Table 8. Groundwater Travel Distance Calculation

Azimuth	K (ft/day)	n	i	Distance of 3-Year TOT	Distance of 15-Year TOT
S55°W	158	0.2	0.03	Travel 15,500 feet from the boundary of HFA in 654 days	Travel 15,500 feet from the boundary of HFA in 654 days
	1	0.1	0.03	Travel additional 132 feet out of the HFA in 441 days	Travel additional 1,446 feet out of the HFA in 4,821 days
S90°W	158	0.2	0.037	Travel 26,300 feet from the boundary of HFA in 900 days	Travel 26,300 feet from the boundary of HFA in 900 days
	1	0.1	0.037	Travel additional 72 feet out of the HFA in 195 days	Travel additional 1,693 feet out of the HFA in 4575 days

The calculated total distances of the 3-year TOT are 15,632 (= 15,500 + 132) feet in the S55°W direction and 26,372 (26,300 + 72) feet in the S90°W direction. The total distances of the 15-year TOT are 16,946 (15,500 + 1,446) feet in the S55°W direction and 27,993 (26,300 + 1,693) feet in the S90°W direction. The final DWSP Zones were conservatively determined by extending the calculated TOT distances for several hundred feet in both directions, and the up-gradient boundaries were generated by tracing smooth curves.

2.5 Maps Showing Boundaries of DWSP Zones

The DWSP zones for 250-day, 3-year and 15-year TOT are shown in **Figure 1**. The dimensions of Zones 2 through 4 are summarized in **Table 9**.

Table 9. Dimensions of DWSP Zones

Zone /Description	Delineation Identification	Maximum Length in Down-gradient Direction (ft)	Maximum Length in Up-gradient Direction (ft)	Maximum Width in Cross-gradient Direction (ft)
2 – Attenuation	250-Day TOT	350	9,500	7,600
3 – Waiver Criteria	3-Year TOT	350	27,000	19,100
4 – Remedial Action	15-Year TOT	350	28,200	19,600

2.6 Protected Aquifer Conditions

According to Utah Rule 309-113-6 (1)(v), for an aquifer to be classified as being under protected conditions, the following conditions must be met: (a) a natural protective layer of clay, at least 30 feet in thickness, is present above the aquifer; (b) the public water system provides data to indicate the lateral continuity of the clay layer to the extent of zone two; and (c) the well has been grouted from the ground surface to a depth of at least 100 feet and for a thickness of at least 30 feet through the protective clay layer.

Based on the evidence stated in section **2.2** and shown in the driller's logs for George White Wells No. 4 and No. 5 (**Tables 2-1**, **2-2** and **Appendix B**), the aquifer does not meet protected aquifer requirements. Therefore, according to the DDW (1998), the aquifer cannot be classified as a protected aquifer.

3.0 INVENTORY OF POTENTIAL CONTAMINATION SOURCES

A checklist of potential contamination sources (PCSs), as listed in Chapter Five of Source Protection User's Guide prepared by the DDW (1998), was completed through review of USGS topographic maps, historic aerial photographs and site inspections, and is attached in **Appendix G**.

3.1 Potential Contamination Sources

The delineated DWSP area for George White Wells No. 4 and No. 5 covers approximately 8 square miles of mountainous terrain on the northeastern side of Spanish Valley. No residential homes are located in this area. The only PCSs that were identified within the DWSP Zones 1 through 4 are two submersible pumps installed in Wells No. 4 and No. 5.

3.2 Hazard Identification

Submersible pumps may contain such harmful lubricants as petroleum products, polychlorinated biphenyl (PCB) or mercury.

3.3 Prioritized Inventory

Because the submersible pumps installed in George White Wells No. 4 and No.5 are the only PCSs within the DWSP zones of the wells, it is not necessary to complete a prioritized inventory of PCSs. The contact information of the PCSs is shown in **Table 10**.

Table 10. PCS Contacts

PCSs	Contact	Address	Telephone #
Submersible Pump Used to Pump George White Well No. 4	Dale F. Pierson	P.O. Box 1,048 Moab, UT 84532	435-259-8121
Submersible Pump Used to Pump George White Well No. 5	Dale F. Pierson	P.O. Box 1,048 Moab, UT 84532	435-259-8121

4.0 ASSESSMENT OF POTENTIAL CONTAMINATION SOURCE HAZARDS

There are four types of hazard controls. They are regulatory, best management and pollution prevention practices (BMPs), physical, and negligible quantity controls. Hazards of PCSs identified within the DWSP zones of the subject wells, as descried in Section **3.2** and **3.3**, were assessed as following category:

Negligible quality control is applicable to the submersible pumps installed in George White Wells No. 4 and No. 5. Should petroleum products, PCB, or mercury be contained in the pumps and released to groundwater, the quality is negligible compared to the volume of water pumped. Therefore, the submersible pumps are considered as adequately controlled.

This control will be reassessed on a three-year basis.

5.0 MANAGEMENT PROGRAM FOR EXISTING POTENTIAL CONTAMINATION SOURCES

Because the submersible pumps installed in George White Wells No. 4 and No. 5, the only PCSs located within the DWSP zones of the subject wells, are adequately controlled, no management programs for existing PCSs need to be developed.

6.0 MANAGEMENT PROGRAM FOR FUTURE POTENTIAL CONTAMINATION SOURCES

The 100-foot radius areas (DWSP Zone 1) around George White Wells No. 4 and No. 5 are controlled by the Grand Water and Sewer Service Agency, and no future activities that may cause subsurface contamination will be allowed within these areas. The management program for future PCSs within the entire DWSP area (DWSP Zones 2 through 4) will involve working with community, the Grand County planners and the U.S. Forest Service because the Grand Water and Sewer Service Agency does not have zoning authority for the land within these zones.

To control and prohibit future location of pollution sources within the DWSP zones where the Grand County has the zoning authority, Grand Water and Sewer Service Agency will submit a copy of the approved DWSP plan to the county planning and engineering department, and the health department. These departments can then evaluate more thoroughly any proposed land uses that may become pollution sources to the wells. It is believed that county engineers understand the importance of protecting groundwater resources and follow the U.S. Public Law 100-4: the Clean Water Act and Utah 1993 Administrative Code R317-6: Administrative Rules for Ground Water Quality Protection, when they review new land development applications. If the Clean Water Act and Rules for Ground Water Quality Protection are followed, any future pollution sources can be controlled or prohibited. Grand Water and Sewer Service Agency will also request that Grand County implement a Drinking Water Source Protection Ordinance to control and prohibit future location of pollution sources within the DWSP zones of the wells. An example of this ordinance prepared by the DDW (1998) is attached in **Appendix H**.

Furthermore, when a new development is proposed within the DWSP zones, the following will happen:

1. Grand Water and Sewer Service Agency will contact the county government to determine the type of PCS that will accompany that development.
2. The county will be made aware that the development is within the management area of the wells.
3. Each PCS will be assessed as controlled or not controlled. Individual homeowners and applicable PCSs will be added to the PCS inventory.

Most portions of the land within the DWSP zones of George White Wells No. 4 and No 5 are within the Manti-La Sal National Forest which is owned by the U.S. Forest Service. Therefore, the management program for the wells shall benefit from the environmental protection that goes along with the National Forest. Grand Water and Sewer Service Agency will coordinate with representatives of the U.S. Forest Service to prohibit future location of any potential pollution sources within the DWSP zones of the wells. It is expected that the U.S. Forest Service will not allow location of any pollution sources within the forested area.

7.0 IMPLEMENTATION SCHEDULE

Once this DWSP Plan is approved by the Utah DDW, the Grand Water and Sewer Service Agency will request that Grand County prepare and implement the Drinking Water Source Protection Ordinance. This process may take six months to one year. Coordination with representatives of the U.S. Forest Service will be on an "as-needed" basis.

8.0 RESOURCE EVALUATION

The Grand Water and Sewer Service Agency will use the existing staff to implement the DWSP plan. Therefore, no extra expense is anticipated. The other cost to implement this DWSP plan is minimal and will be funded from monthly service charges or connection fees.

9.0 RECORDKEEPING

All the records have been and will be kept in the Agency Office.

10.0 CONTINGENCY PLAN

This contingency plan focuses on the identification and possible solutions to problems that may arise in the event that groundwater protection and pollution prevention measures fail. Additionally, this plan addresses problems that the Grand Water and Sewer Service Agency Water System needs to solve in the event of water shortages or contamination incidents that may impact its ability to supply safe drinking water to its users. This emergency plan was developed in accordance with the Emergency Response Handbook prepared by the DDW (1996).

10.1 Emergency Response Plan

An emergency response plan focuses on short-term solutions for problems encountered due to accidents and natural disasters.

10.1.1 Line of Authority

Table 11 identifies personnel responsible for coordinating activities during an emergency or disaster.

Table 11. Line of Authority

Title	Contact	Telephone #
Public Relations Coordinator & Emergency Coordinator	Dale F. Pierson	(435) 259-8121
Assessment Coordinator & Crew Foreman	Dale F. Pierson	(435) 259-8121
DDW Emergency	DDW	(801) 536-4123 (801) 536-4200
Utah Pollution Prevention Coordinator	Sonja Wallace	(801) 536-4477
Utah Environmental Hotline		(800) 458-0145

According to the DDW (1996), the Emergency Coordinator would coordinate all emergency actions, water system personnel and equipment within the drinking water system. The Emergency Coordinator would also coordinate with the law enforcement, fire fighting, medical personnel and any other requests for aid, volunteer efforts, mutual assistance (other neighboring water system personnel or equipment and any contracted private assistance). The Public Relations Coordinator would be responsible for news releases to the media, issuing emergency information bulletins to the public and act as liaison between the drinking water system and general public in answering questions and addressing concerns. The Assessment Coordinator would coordinate the inspection of all physical facilities in the drinking water system to determine the degree of damage to the facility and, in coordination with the Emergency Coordinator, prioritize the repair, replacement or abandonment of any physical facilities in the system. The Crew Foreman would coordinate, supervise and schedule personnel, equipment and materials to facilitate the repair or replacement of critical facilities, which have been identified and prioritized by the Assessment and Emergency Coordinators.

10.1.2 Clarification of Emergency or Disaster

The Emergency Coordinator will classify the degree of the emergency or disaster. This will prioritize response, expedite activities and establish action level of response.

LEVEL I - NORMAL (ROUTINE): Personnel and equipment presently on duty can handle system problems. The "Emergency Control Center" will not be activated or manned.

LEVEL II - ALERT (MINOR EMERGENCY): Personnel and equipment presently on duty can handle system problems, but may require off duty or additional personnel to be put on alert, be re-routed to other than their normal working areas, or work additional shifts. The "Emergency Control Center" will be activated or manned.

LEVEL III - MAJOR EMERGENCY: Problems are somewhat beyond the capabilities of the drinking water system personnel and equipment, and may require a "Declaration of Emergency" to authorize shortcut procedures. Employees may be required to work additional shifts. Additional assistance of personnel and equipment may need to be provided by either mutual aid or private contractors. The "Emergency Control Center" will be activated or manned.

LEVEL IV - DISASTER: Problems are clearly and immediately beyond the capabilities of the drinking water system. Recovery time will exceed one week, costs will be great, large amounts of assistance of personnel and equipment by mutual aid or private contractors will be required.

Extended shifts will be needed for at least one week. A "Declaration of Emergency" will be required and the "Emergency Control Center" will be activated or manned.

10.1.3 Facility Damage Assessment

The Assessment Coordinator will determine the preliminary assessment priorities. The physical status of all physical facilities would be assessed. The need to repair, replace or abandon drinking water physical facilities is required at this point. A cost estimate including manpower and equipment will be necessary to restore the facility in order to help prioritize the repair work.

The assessment coordinator will consider the possible effects of the repairs or replacement of facilities on the integrity of the drinking water system itself after the emergency. The assessment will address the following items:

- Identification and description of separate components of entire system

    1. Source (wells)
    2. Transmission line (tank to distribution system)
    3. Storage tank
    4. Distribution system
    5. Personnel
    6. Power supply
    7. Materials and supplies
    8. Communications
    9. Present emergency plans
    10. Mutual-aid agreements and/or interconnections

- Development of disaster characteristics

    1. Flood or mudslide
    2. Earthquake
    3. Windstorm
    4. Explosion

- Estimation of water requirements

    1. Fire fighting
    2. Potable water

3. Decontamination and sanitary

- Estimation of the system capacity to meet the water requirements

  This point is a "balance point". If capacities exceed requirements, there is an estimated margin of safety and it could be expected that priorities be relaxed. If requirements exceed capacities, there is indicated urgency for improving or "upgrading" the system.

- Identification of critical system components

  These components are basis for immediate restudy for improving capacities.

10.1.4 Requirement Prioritization and Program Specification

The Emergency Coordinator, in coordination with the Assessment Coordinator, will evaluate data gathered during the damage assessment and prioritize system components for repair and replacement.

- Establishment of baseline on water quality levels
- Determination of needs and priorities

1. Allocation of water under assumed conditions for potable use and sanitary decontamination.
2. Preparation of guidelines for water allowances, priorities, rationing and time phasing of estimated water requirements.
3. Establishment of procedures for emergency treatment, pumping and distribution of water and for service stations of emergency water.

10.1.5 Implementation

The Emergency Coordinator will implement the necessary plan and notify the users of the system through the Public Relations Coordinator. Information will be released to the public in accordance with the following guidelines:

- Only the Emergency Coordinator or designated representative will speak with the media or press.
- The Emergency Coordinator will set up public meetings to routinely inform the users of the status of system improvements, progress and details.

10.2 Rationing Plans

This rationing plan establishes a course of action to be implemented when water shortages occur. These shortages may be caused by drought, seasonal overuse, contamination or accidents. This plan is broad and encompassing, highlighting the different factors that need to be considered before implementing and enforcing a water-rationing plan.

10.2.1 Personnel

Mr. Dale F. Pierson, Manager of the Grand Water and Sewer Service Agency, will be responsible for assessing supply and demand requirements and implementing a water conservation program.

10.2.2 Determination of Action Level

Based on the following factors, an "action level" will be determined to indicate the appropriate level of rationing. Environmental factors include:

- Forecast duration of shortage (short term vs. long term)
- Reason for shortage (draught, loss of storage capacity, mechanical malfunction)
- Time of the year which the shortage is forecast

Water system factors that need to be evaluated include:

- Current supply
- Current storage capacity
- Current number of connections to the system
- Current demand projections
- Current system user conservation practices

Water resources available to alleviate short-term shortages that will be investigated include:

- Emergency water supply (wells serve as backups for each other)
- Replacement mechanical equipment (spare parts)

10.2.3 Public Education

The users of the water system will be notified immediately of the current or potential water shortage problem and any rationing or conversation measures to be implemented.

10.3 Water Supply Decontamination Plans

The Grand Water and Sewer Service Agency Water System water supply decontamination includes the following steps:

1. The ongoing routine water supply decontamination is achieved through chlorinating.
2. Decontamination technical support from the Rural Water Association of Utah.

10.4 Source Development Plans

As previously described in Section **1.2**, George White Wells No. 4 and No. 5 can generally be relied upon to supply 1,600 gpm of water to the Grand Water and Sewer Service Agency Water System. Presently, water supplied by the system is barely enough to meet the demands. Therefore, Grand Water and Sewer Service Agency plans to develop a new drinking water well. Sunrise (1999) has performed a hydrogeologic study to determine the proper well location.

11.0 PESTICIDE AND VOC MONITORING WAIVERS

According to the DDW (1998), there are three types of monitoring reduction waivers for either the pesticides or volatile organic chemical (VOC) parameter group available to public water suppliers: reliably and consistently waiver, use waiver and susceptibility waiver.

A use waiver can be issued for either the pesticides or VOC parameter group if a system can verify that none of the chemicals or pesticides in these parameter groups have been used in a given protection area in the past five years. If a source does not qualify for a use waiver, the DDW will evaluate the historical laboratory results of water samples collected from the source and establish an appropriate water quality-monitoring program for VOCs and pesticides. If the laboratory results consistently show good water quality produced by the source, the DDW may consider issuing a reliably and consistently waiver. If a system does not qualify for a use waiver and a reliably and consistently waiver has not been issued, a susceptibility waiver may be issued if the drinking water source meets the requirements listed in the Chapter 11 of the Source Protection User's Guide (DDW, 1998).

A dated statement (**Appendix I**), prepared by Mr. Dale F. Pierson, Manager of Grand Water and Sewer Service Agency, indicates that none of the VOCs or pesticides listed by the DDW has or will be used, disposed of, stored, transported or manufactured within the protection zones of the wells. Therefore, a use waiver should be issued to George White Wells No. 4 and No. 5 in the Grand Water and Sewer Service Agency Water System.

12.0 REFERENCES

Blanchard, P.J., 1990. Ground-Water Conditions in the Grand County Area, Utah, with Emphasis on the Mill Creek-Spanish Valley Area. Utah Department of Natural Resources Technical Publication No. 100. U.S. Geological Survey and Utah Department of Natural Resources, Division of Water Rights.

Blandford T.N. and P.S. Huyakorn, 1991. A Modular Semi-Analytical Model for Delineation of Wellhead Protection Areas, Office of Water, Washington D.C.

Farri, P., 1997. Transmissivity in the Geothermal Euganean Basin: A Geostatistical Analysis. Journal of Ground Water, September-October, Vol. 35.

Freeze, R.A. and J.A. Cherry, 1979. *Groundwater*. Prentice-Hall, Inc., Englewood Cliffs, N.J.

Nielsen, D.M., 1991. Practical Handbook of Ground-Water Monitoring. Lewis Publisher, Inc., 121 South Main Street, Chelsea, Michigan 48118.

U.S. Geological Survey, 1986. USGS 7.5-Minute Series Topographic Quadrangle Map for Rill Creek, Utah.

U.S. Geological Survey, 1986. USGS 7.5-Minute Series Topographic Quadrangle Map for Warner, Utah.

Utah Division of Drinking Water, 1996. Emergency Response Handbook, State of Utah Department of Environmental Quality, Salt Lake City, Utah.

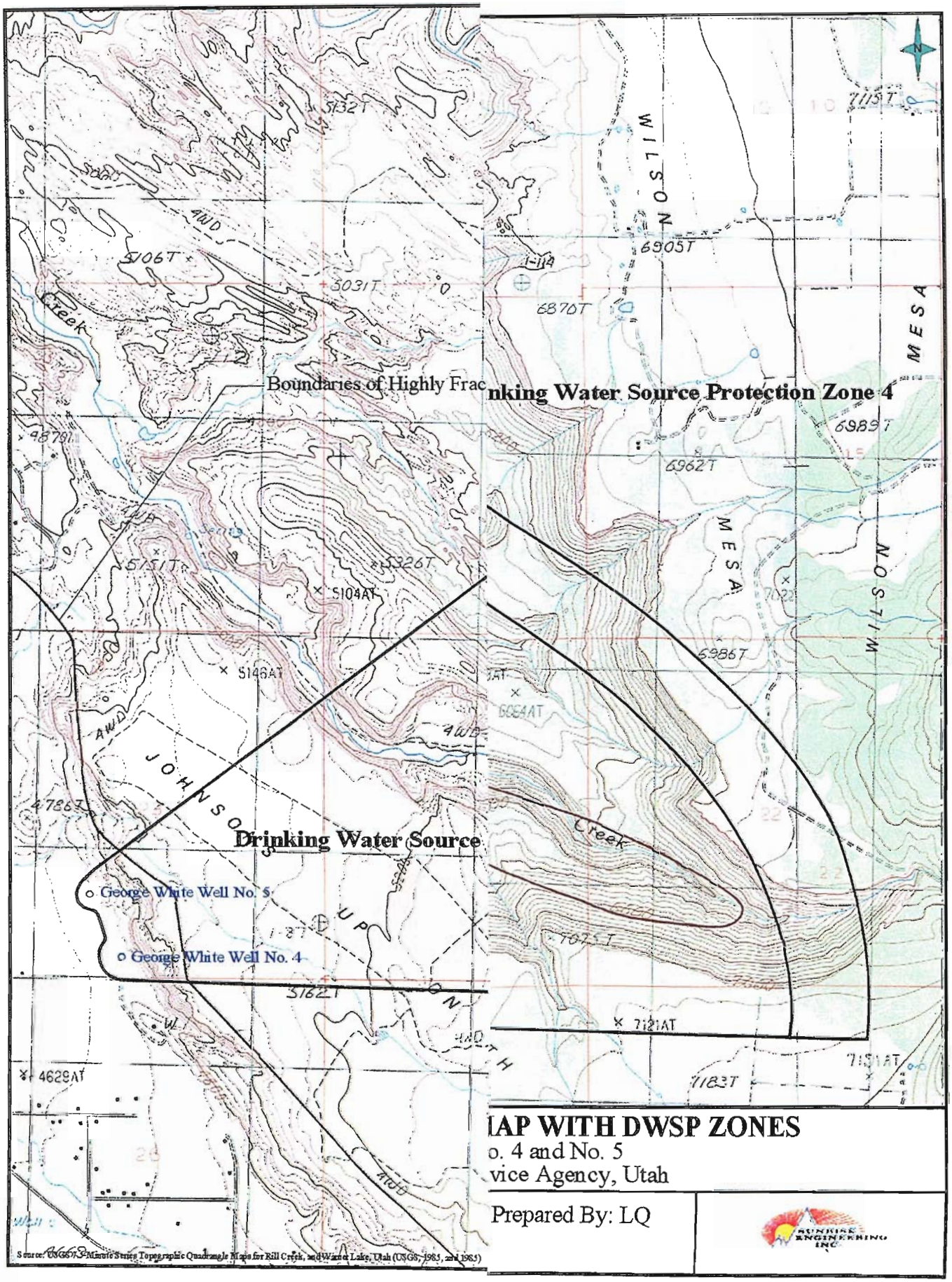
Utah Division of Drinking Water, 1998. Source Protection User's Guide, State of Utah Department of Environmental Quality, Salt Lake City, Utah.

Steiger, J.I. and D.D. Susong, 1997. Recharge Areas and Quality of Ground Water for the Glen Canyon and Valley-fill Aquifers, Spanish Valley Area, Grand and San Juan Counties, Utah. Water-Resources Investigations Report 97-4206.

Sumsion, C.T., 1971. Geology and Water Resources of the Spanish Valley Area, Grand and San Juan Counties, Utah. Utah Department of Natural Resources Technical Publication No. 32. U.S. Geological Survey and Utah Department of Natural Resources, Division of Water Rights.

Sunrise Engineering, Inc., 1999. Hydrogeologic Assessment / Well Siting Study for Spanish Valley Water and Sewer Improvement District.

FIGURES



Source: USGS 7.5-Minute Series Topographic Quadrangle Maps for Rill Creek, and Warner Lake, Utah (USGS, 1985, and 1985)

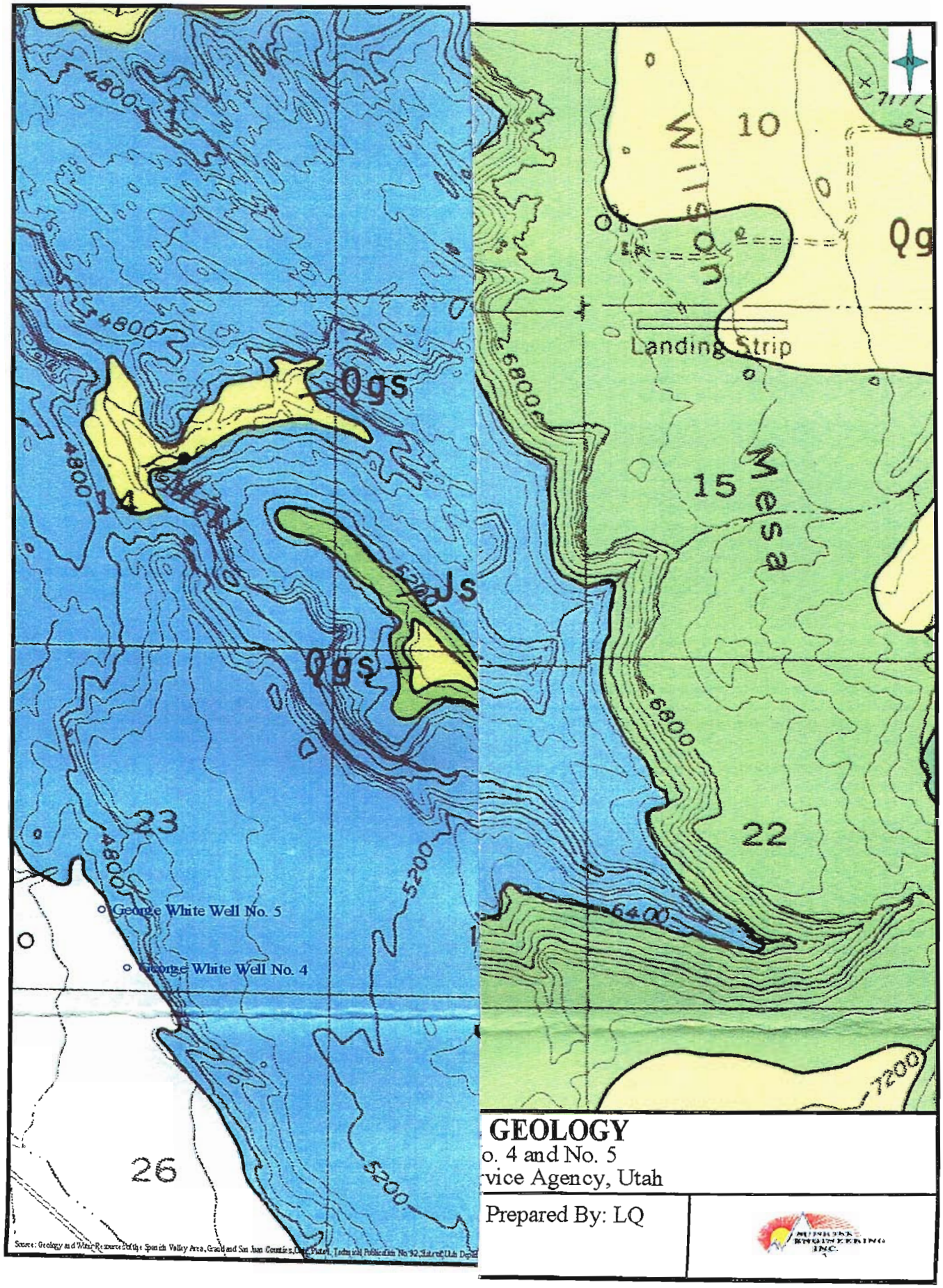
IAP WITH DWSP ZONES

o. 4 and No. 5

vice Agency, Utah

Prepared By: LQ

SUNRISE ENGINEERING INC



GEOLOGY

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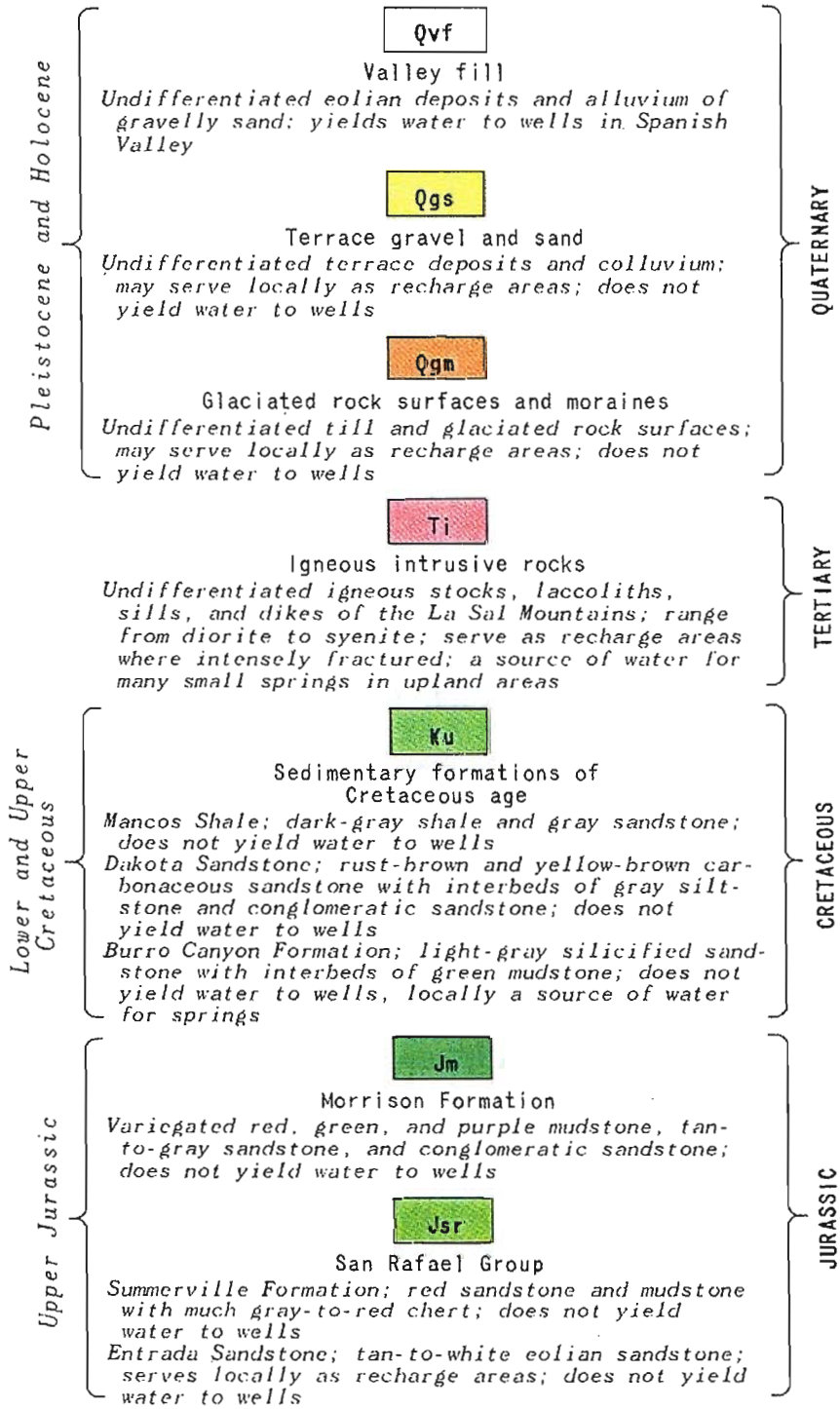
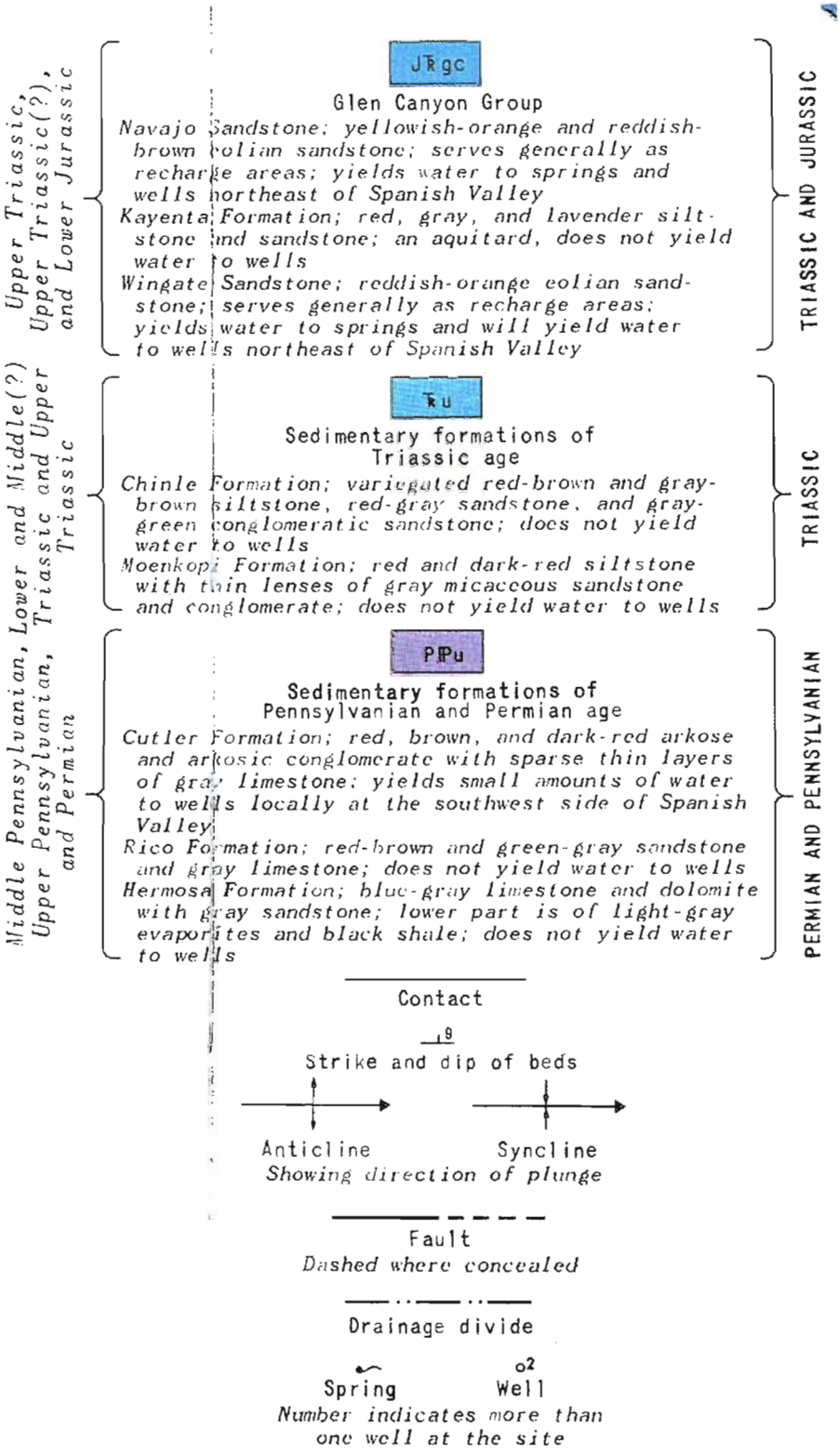
Prepared By: LQ


Qvf
Valley fill
Undifferentiated eolian deposits and alluvium of gravelly sand; yields water to wells in Spanish Valley
Qgs
Terrace gravel and sand
Undifferentiated terrace deposits and colluvium; may serve locally as recharge areas; does not yield water to wells
Qgm
Glaciated rock surfaces and moraines
Undifferentiated till and glaciated rock surfaces; may serve locally as recharge areas; does not yield water to wells
Pleistocene and Holocene
QUATERNARY
Ti
Igneous intrusive rocks
Undifferentiated igneous stocks, laccoliths, sills, and dikes of the La Sal Mountains; range from diorite to syenite; serve as recharge areas where intensely fractured; a source of water for many small springs in upland areas
TERTIARY
Ku
Sedimentary formations of Cretaceous age
Mancos Shale; dark-gray shale and gray sandstone; does not yield water to wells
Dakota Sandstone; rust-brown and yellow-brown carbonaceous sandstone with interbeds of gray siltstone and conglomeratic sandstone; does not yield water to wells
Burro Canyon Formation; light-gray silicified sandstone with interbeds of green mudstone; does not yield water to wells, locally a source of water for springs
Lower and Upper Cretaceous
CRETACEOUS
Jm
Morrison Formation
Variegated red, green, and purple mudstone, tan-to-gray sandstone, and conglomeratic sandstone; does not yield water to wells
Jsr
San Rafael Group
Summerville Formation; red sandstone and mudstone with much gray-to-red chert; does not yield water to wells
Entrada Sandstone; tan-to-white eolian sandstone; serves locally as recharge areas; does not yield water to wells
Upper Jurassic
JURASSIC

APPENDICES

Appendix A
Description of Geologic Units


Upper Triassic, Upper Triassic(?), and Lower Jurassic
JTrgc
Glen Canyon Group
Navajo Sandstone; yellowish-orange and reddish-brown eolian sandstone; serves generally as recharge areas; yields water to springs and wells northeast of Spanish Valley
Kayenta Formation; red, gray, and lavender siltstone and sandstone; an aquitard, does not yield water to wells
Wingate Sandstone; reddish-orange eolian sandstone; serves generally as recharge areas; yields water to springs and will yield water to wells northeast of Spanish Valley
TRIASSIC AND JURASSIC
Middle Pennsylvanian, Lower and Middle(?) Triassic and Upper Triassic
TRu
Sedimentary formations of Triassic age
Chinle Formation; variegated red-brown and gray-brown siltstone, red-gray sandstone, and gray-green conglomeratic sandstone; does not yield water to wells
Moenkopi Formation; red and dark-red siltstone with thin lenses of gray micaceous sandstone and conglomerate; does not yield water to wells
TRIASSIC
Upper Pennsylvanian, and Permian
PPu
Sedimentary formations of Pennsylvanian and Permian age
Cutler Formation; red, brown, and dark-red arkose and arkosic conglomerate with sparse thin layers of gray limestone; yields small amounts of water to wells locally at the southwest side of Spanish Valley
Rico Formation; red-brown and green-gray sandstone and gray limestone; does not yield water to wells
Hermosa Formation; blue-gray limestone and dolomite with gray sandstone; lower part is of light-gray evaporites and black shale; does not yield water to wells
PERMIAN AND PENNSYLVANIAN
Contact
19
Strike and dip of beds
Anticline
Syncline
Showing direction of plunge
Fault
Dashed where concealed
Drainage divide
Spring
o2
Well
Number indicates more than one well at the site

Appendix B
Driller's Well Logs

Form 115—514—1240

Examined _____

Recorded: B. C. _____ T. B. _____

Inspection Sheet _____

Copied _____

G. e White Well #4

Visited this well Oct 5 '69 Current yield 1200 gpm

#91A

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. 36724

Claim No. C5-457

Coordinate No. _____

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:

Name George M. Wyatt

Address Moab, Utah

(2) LOCATION OF WELL:

County Grand Ground Water Basin (leave blank) _____

North/South 330 feet, East/West 1280 feet from SW Corner of Section 35 T. 26S S, R. 22E E SLBM W USM (strike out words not needed)

(3) NATURE OF WORK (check): New Well ☒

Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐

If abandonment, describe material and procedure: _____

(4) NATURE OF USE (check):

Domestic ☐ Industrial ☐ Municipal ☐ Stockwater ☐

Irrigation ☒ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):

Rotary ☐ Dug ☐ Jetted ☐

Cable ☒ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☒

16" Diam. from 0 feet to 130 feet Gage .375

_____" Diam. from _____ feet to _____ feet Gage _____

_____" Diam. from _____ feet to _____ feet Gage _____

New ☒ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☐ No ☒

Type of perforator used _____

Size of perforations _____ inches by _____ inches

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

(8) SCREENS: Well screen installed? Yes ☐ No ☒

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ Set from _____ ft. to _____

Diam. _____ Slot size _____ Set from _____ ft. to _____

(9) CONSTRUCTION:

Was well gravel packed? Yes ☐ No ☒ Size of gravel: _____

Gravel placed from _____ feet to _____ feet

Was a surface seal provided? Yes ☐ No ☒

To what depth? _____ feet

Material used in seal: _____

Did any strata contain unusable water? Yes ☐ No ☒

Type of water: _____ Depth of strata _____

Method of sealing strata off: _____

Was surface casing used? Yes ☐ No ☒

Was it cemented in place? Yes ☐ No ☒

(10) WATER LEVELS:

Static level 75 feet below land surface Date 3-9-71

Artesian pressure _____ feet above land surface Date _____

LOG RECEIVED:

(11) FLOWING WELL:

Controlled by (check) Valve ☐

Cap ☐ Plug ☐ No Control ☒

Does well leak around casing? Yes ☐ No ☒

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.

Was a pump test made? Yes ☒ No ☐ If so, by whom? Rhodes Brothers

Yield: 1600 gal/min. with 123 feet drawdown after 1 hours

" _____ " _____ " _____ "

" _____ " _____ " _____ "

Bailer test _____ gal/min. with _____ feet drawdown after _____ hours

Arterian flow _____ g.p.m. Date _____

Temperature of water 50 Was a chemical analysis made? No ☒ Yes ☐

(13) WELL LOG: Diameter of well 16 inches

Depth drilled 174 feet. Depth of completed well 174 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	8			X								Red Sand-Sandstone
8	174			X								

Work started Feb 1 19 71 Completed Feb 25 19 71

(14) PUMP:

Manufacturer's Name Western 1,775 RPM

Type: Deep Well Turbine H. P. 100

Depth to pump or bowls 120 feet

Well Driller's Statement:

This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name Thomas E. Beeman (Person, firm, or corporation) (Type or print)

Address Spanish Valley, Moab, Utah

(Signed) Thomas E. Beeman (Well Driller)

License No. 215 Date Feb 25 19 71

USE OTHER SIDE FOR ADDITIONAL REMARKS

#4

Form 113—3M—12-60

George White #5 (5) #91

Examined
Recorded: B. C. T. S.
Inspection Sheet
Copied

APR 23 1990

REPORT OF WELL DRILLER

STATE OF UTAH

WATER RIGHTS PRICE

Appl. No. 85-278 (A7060)
Claim No. 01-05-0241 (?)
Coordinate No.

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:

Name White Ranches Inc.
Address Route Utah 84532

(2) LOCATION OF WELL:

County Grand Ground Water Basin (leave blank)

North 1200 feet, East 680 feet from S¼ Corner of Section 23, T. 26S, R. 22E, S. L. B. M. (strike out words not needed)

(3) NATURE OF WORK (check):

New Well ☒ Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐

If abandonment, describe material and procedure:

(4) NATURE OF USE (check):

Domestic ☐ Industrial ☐ Municipal ☐ Stockwater ☒
Irrigation ☒ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):

Rotary ☒ Dug ☐ Jetted ☐
Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE:

Threaded ☐ Welded ☒

10" Diam. from 0 feet to 173 feet Gage STD
" Diam. from feet to feet Gage
" Diam. from feet to feet Gage

New ☒ Reject ☐ Used ☐

(7) PERFORATIONS:

Perforated? Yes ☒ No ☐

Type of perforator used Factory
Size of perforations 1/8 inches by 3 inches
400 perforations from 33 feet to 173 feet
perforations from feet to feet
perforations from feet to feet
perforations from feet to feet
perforations from feet to feet
perforations from feet to feet

(8) SCREENS:

Well screen installed? Yes ☐ No ☒

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to
Diam. Slot size Set from ft. to

(9) CONSTRUCTION:

Was well gravel packed? Yes ☐ No ☒ Size of gravel:
Gravel placed from feet to feet
Was a surface seal provided? Yes ☐ No ☒
To what depth? feet
Material used in seal:
Did any strata contain unusable water? Yes ☐ No ☒
Type of water: Depth of strata
Method of sealing strata off:

Was surface casing used? Yes ☐ No ☒
Was it cemented in place? Yes ☐ No ☒

(10) WATER LEVELS:

Static level feet below land surface Date
Artesian pressure feet above land surface Date

LOG RECEIVED
APR 25 1990

(11) FLOWING WELL:

Controlled by (check) Valve ☐ ☐ Plug ☐ No Control ☒
Does well leak around casing? Yes ☐ No ☒

(12) WELL TESTS:

Drawdown is the distance in feet the water level is lowered below static level.

Was a pump test made? Yes ☐ No ☒ If so, by whom?
Yield: gal./min. with feet drawdown after hours
air test 250 GPM
Bailer test gal./min. with feet drawdown after hours
Artesian flow g.p.m. Date
Temperature of water 50° Was a chemical analysis made? No ☒ Yes ☐

(13) WELL LOG:

Diameter of well 10 inches
Depth drilled 180 feet. Depth of completed well 180 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

From	To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	10			X							X	Overburden, Red Sand
10	180			X							X	Red Sand Stone
												hit water 105 ft 130 ft to 180 ft formation badly fractured.
												Packers down 70 ft with cement back to surface.

Work started Feb. 14, 1990 Completed Feb. 21, 1990

(14) PUMP:

Manufacturer's Name
Type: H. P.
Depth to pump or bowles feet

Well Driller's Statement:

This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name H. G. Beeman (Person, firm, or corporation) (Type or print)
Address 5476 S. Spanish Valley Moab, UT
(Signed) H. G. Beeman (Well Driller)
License No. 218 Date April 17, 1990

USE OTHER SIDE FOR ADDITIONAL REMARKS

#5

F.O.

Appendix C
Pumping Test Data

AQUIFER TEST DATA

Owner Grand Co. WCD Address Moab County Grand State UT

Date 6 March 1997 Company performing test ______ Measured by ______

Well No. G.W. no. 4 Distance from pumping well 0 Type of test Drawdown Test No. ______

Measuring equipment Airline, 150' long

Time Data	Water Level Data	Discharge Data	
Pump on: Date ______ Time ______ (t)	Static water level 74'	How Q measured ______	Comments on factors affecting test data
Pump off: Date ______ Time ______ (t')	Measuring point Base of motor	Depth of pump/air line ______	
Duration of aquifer test:	Elevation of measuring point ______	Previous pumping? Yes ____ No ____	
Pumping ______ Recovery ______		Duration ______ End ______	

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		Comments
		15 sec.				80								
		30				80								
		45				80								
		1 min.				80								
		15				80								
		30				80								
		45				80								
		2 min.				80								
		15				80								
		30				80								
		45				80								
		3 min.				80								
		30				80								
		4 min				80								
		30 sec.				80								
		5 min.				80								
		30				81								
		6 min.				81								~ ~~1130~~ 1060 gpm, large meter reading
		30				81								
		7 min				81								
		30 sec.				81								
		8				81								
		30				81								
		9				81								
		30 sec.				81								
		10 minutes				81								
		11 minutes				81								
		12				81								
		13				81								

AQUIFER TEST DATA

Owner _____ Address _____ County _____ State _____

Date _____ Company performing test _____ Measured by _____

Well No. _____ Distance from pumping well _____ Type of test _____ Test No. _____

Measuring equipment _____

Time Data
Pump on: Date _____ Time _____ (t.)
Pump off: Date _____ Time _____ (t')
Duration of aquifer test:
Pumping _____ Recovery _____

Water Level Data
Static water level _____
Measuring point _____
Elevation of measuring point _____

Discharge Data
How Q measured _____
Depth of pump/air line _____
Previous pumping? Yes ___ No ___
Duration _____ End _____

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'	Water level measurement	Correction or Conversion	Water level	Water level change s or s'	Discharge measurement	Rate	Comments on factors affecting test data
		14 minutes			81						with small air pump running
		15			81						
		16			81						
		17			81						With air pump disconnected reads ~ ½ foot lower elev. water level
		18			~~82~~ 81						
		19			~~82~~ 81						With air pump disconnected,
		20			82						
		21			82						Cl# air pump running reads ~ 81.5'
		22			82						
		23			82						Used air pump running
		24			82						to obtain reading
		25			82						
		26			82					1110 gpm	Large meter
		27			82						
		28			82						
		29			82						
		30			82						
		35			82						
		40			83					1150 gpm	
		45			83						
		50			83						
		55			83						Chuck paced 35 yards between the wells.
		1 hr.			83						
		10	minutes		83						
		20			83					1180 gpm	
		30			83						
		~~40~~ 2 hr.									Well shut off
		~~85~~									
		~~2 hr.~~									

AQUIFER TEST DATA

Owner Grand Co. WCD Address Moab, Utah County Grand State UT

Date 12/14/93 Company performing test RWAU, ~~Glover~~, DDV Measured by

Well No. G.W. #4 Distance from pumping well 0 Type of test Drawdown, pumping Test No.

Measuring equipment

Time Data
Pump on: Date ____ Time ____ (t)
Pump off: Date ____ Time ____ (t')
Duration of aquifer test:
Pumping ____ Recovery ____

Water Level Data
Static water level 73 feet
Measuring point ____
Elevation of measuring point ____

Discharge Data
How Q measured ____
Depth of pump/air line ____
Previous pumping? Yes ____ No ____
Duration ____ End ____

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		
						73								
			10 seconds			82								
			20			81								
			30			82								
			40			81								
			50			81								
			1 minute			81								
			10			81								
			20											
			30											
			40			81								
			50			80								
			2 minutes			80								
			2.5			80								
			3.0			80								
			3.5			80								
			4.0			80								
			4.5											
			5.0			80								
			6			80								
			7											
			8			80								
			9											
			10			81								
			11			81								
			12			81								
			13			81								
			14			81								
			15			81								

AQUIFER TEST DATA

Owner _____ Address _____ County _____ State _____

Date _____ Company performing test _____ Measured by _____

Well No. _____ Distance from pumping well _____ Type of test _____ Test No. _____

Measuring equipment _____

Time Data
Pump on: Date _____ Time _____ (t.)
Pump off: Date _____ Time _____ (t2)
Duration of aquifer test:
Pumping _____ Recovery _____

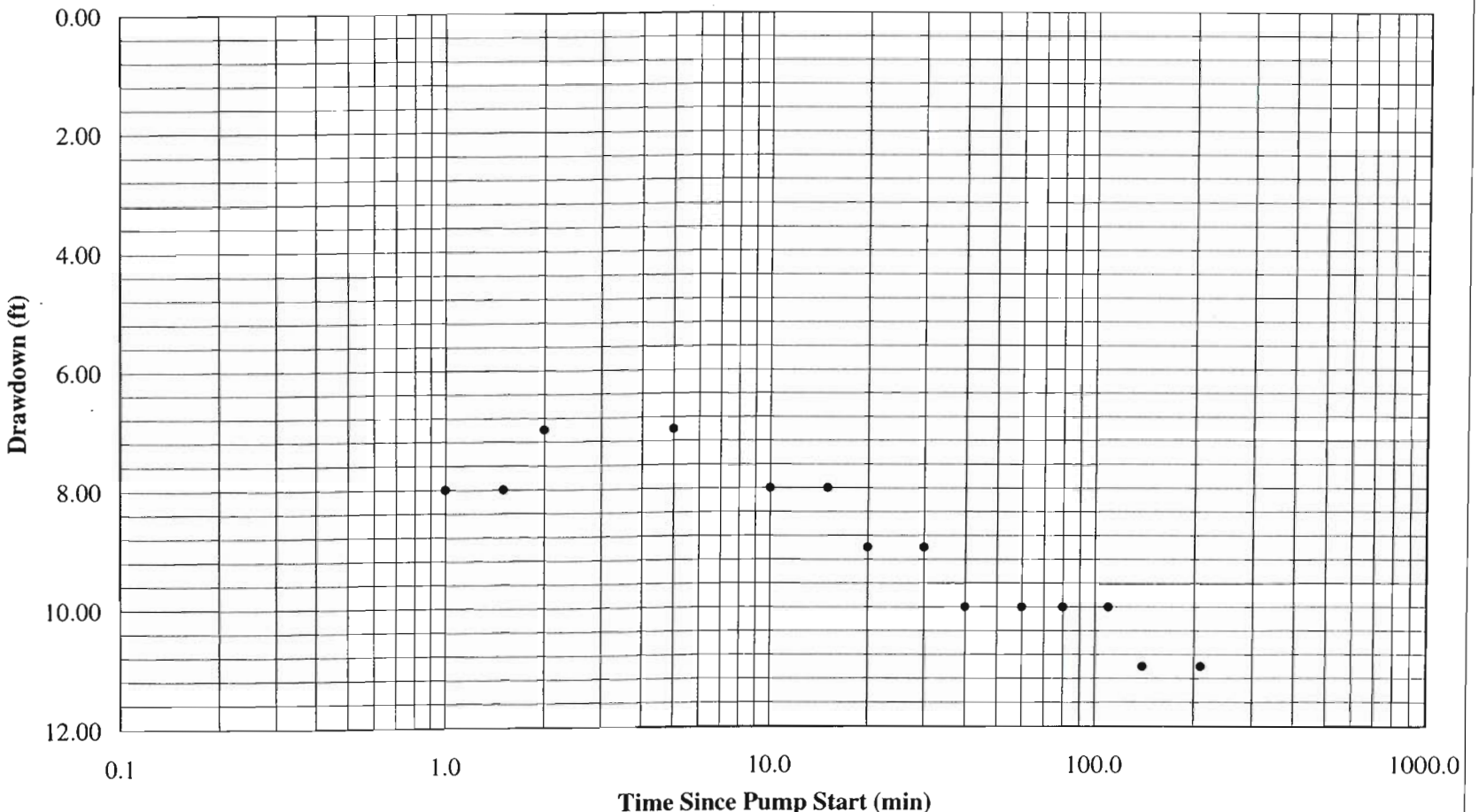
Water Level Data
Static water level _____
Measuring point _____
Elevation of measuring point _____

Discharge Data
How Q measured _____
Depth of pump/air line _____
Previous pumping? Yes ____ No ____
Duration _____ End _____

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		
		20 minutes				80								
		25				82								
		30				82								
		35												
		40				83								
		45				83								
		50												
		55												
		60				83								
		70												
		80												
		90												
		100												
		110												
		120												
		140 minutes				84					1350 gpm			52 seconds / 1000 gpm
		240				84								
		Recovery												
		10				74								
		2 minutes				75								

Time-Drawdown Curve
Pumping Test for George White Well #4



AQUIFER TEST DATA

Owner Grand Co. WCD Address _____ County _____ State _____

Date 12/13/97 Company performing test _____ Measured by _____

Well No. G.W. #5 Distance from pumping well _____ Type of test Recovery Test No. _____

Measuring equipment _____

Time Data
Pump on: Date _____ Time _____ (t)
Pump off: Date _____ Time _____ (t')
Duration of aquifer test:
Pumping _____ Recovery _____

Water Level Data
Static water level _____
Measuring point _____
Elevation of measuring point _____

Discharge Data
How Q measured _____
Depth of pump/air line _____
Previous pumping? Yes ____ No ____
Duration _____ End _____

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'	Water level measurement (114 / 116)	Correction or Conversion	Water level	Water level change s or s'	Discharge measurement	Rate	Comments
			10 Seconds		114'						Replaced air gauge then tried running test again. Still saw very little recovery when pump was turned off.
			20								
			30		114'						
			40								
			50		114						
			1 minute		114						
			10								
			20								
			30		113.5						
			40		"						
			50		"						
			2 minutes		"						
			2.5								
			3.0		113.5						
			3.5								
			4.0								
			4.5								
			5.0								
			6		113.5						
			7								
			8								
			9		113.5						
			10								
			11								
			12		113.5						
			13								
			14								
			15		113.5						
			20								

AQUIFER TEST DATA

Owner Grand County WCD Address _____ County Grand State Utah

Date 12/13/93 Company performing test DWR, RWRA, GCWCD Measured by _____

Well No. Geo. Wash #5 Distance from pumping well 0 Type of test Recovery Test No. _____

Measuring equipment Air line 173' long

Time Data
Pump on: Date ~~12/12~~ Time ~~7pm~~ (t)
Pump off: Date _____ Time _____ (t')
Duration of aquifer test:
Pumping _____ Recovery _____

Water Level Data
Static water level _____
Measuring point _____
Elevation of measuring point _____

Discharge Data
How Q measured _____
Depth of pump/air line 173'
Previous pumping? Yes ✓ No _____
Duration _____ End 19 hrs. previous

Comments on factors affecting test data
~~625~~ gpm pumping at ~~550~~ gpm measured in well house at well #4 gauge

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement (126')	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate	
12/13			10 sec.			125							
			20			125							
			30			124							
			40										
			50			124							
			~~1~~										
			1.00 min.			124							
			10			124							
			20										
			30			124							
			40			"							
			50			"							
			2 min.			124							
			2.5			124							
			3.0			124							
			3.5			124							
			4.0			"							
			4.5										
			5.0			124							
			6			124							
			7			124							
			8			124							
			9										
			10										

Air gauge did not seem to be working properly, so I stopped the test and

AQUIFER TEST DATA

37 20
114 00

18.30

Owner Grand County Address County State

Date 12/14/93 Company performing test Measured by Ken Oltman

Well No. G.W. #5 Distance from pumping well Type of test Drawdown, observation well Test No.

Measuring equipment Observation well as well no. 4 was pumped.

Time Data
Pump on: Date Time (t)
Pump off: Date Time (t')
Duration of aquifer test:
Pumping Recovery

Water Level Data
Static water level 117
Measuring point
Elevation of measuring point

Discharge Data
How Q measured
Depth of pump/air line
Previous pumping? Yes No
Duration End

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		
12-13-	000					117								
	10					118								
	20					118								
	30													
	40													
	50													
	60													
	110													
	120													
	130													
	140													
	150													
	200					118								
	230					118								
	500					118								
	501					118								
	300					118								
	1200					118								
	1500					118								
	2000					118								
	25					118								
	30					118								
	40					118								

45 - 5'
50

7 [illegible]
104 135
[illegible] [illegible]
118 123

AQUIFER TEST DATA

Owner ______ Address ______ County ______ State ______

Date ______ Company performing test ______ Measured by ______

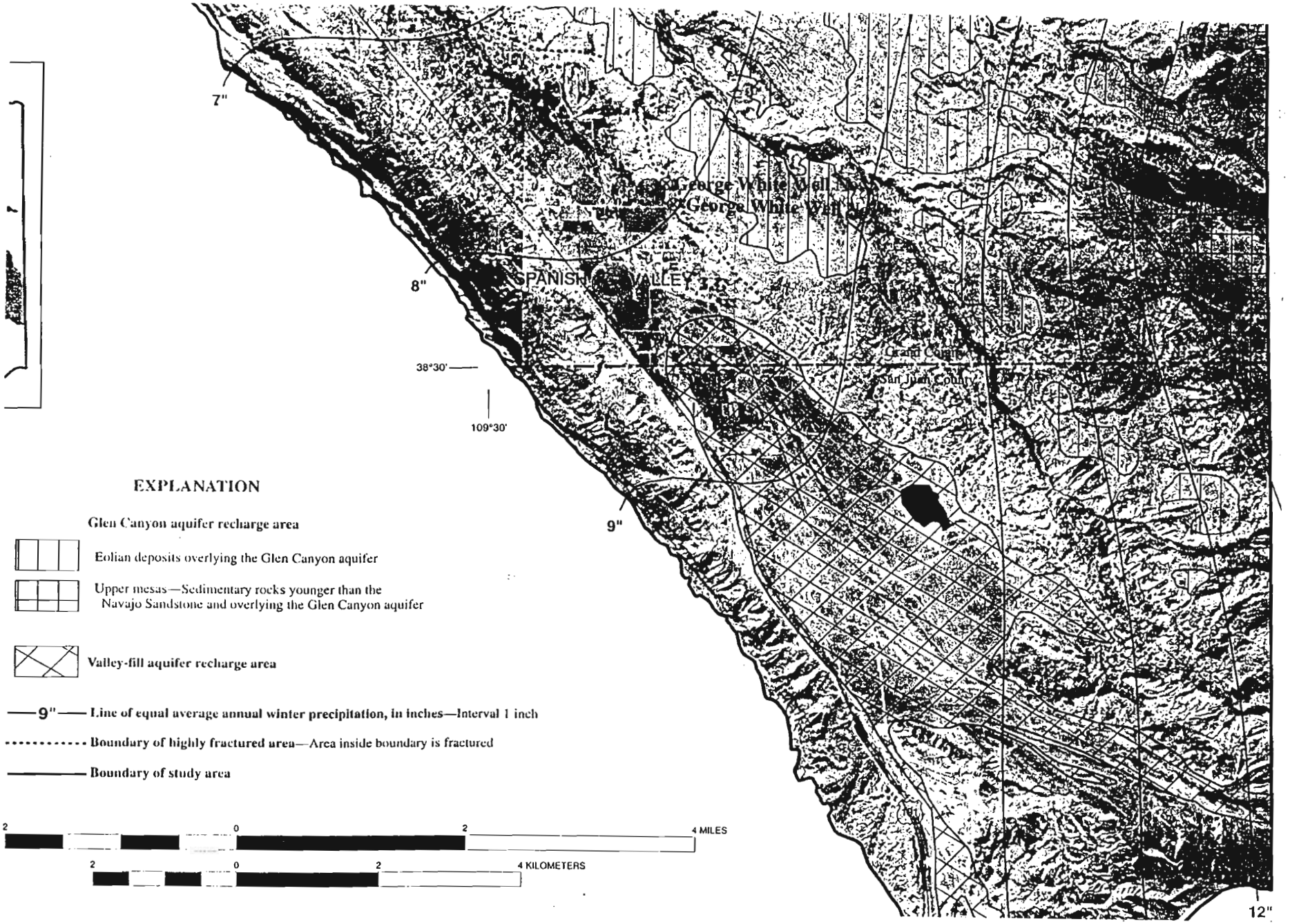
Well No. ______ Distance from pumping well ______ Type of test ______ Test No. ______

Measuring equipment ______

Time Data	Water Level Data	Discharge Data	Comments on factors affecting test data
Pump on: Date ______ Time ______ (t_0) Pump off: Date ______ Time ______ (t_0') Duration of aquifer test: Pumping ______ Recovery ______	Static water level ______ Measuring point ______ Elevation of measuring point ______	How Q measured ______ Depth of pump/air line ______ Previous pumping? Yes ____ No ____ Duration ______ End ______	

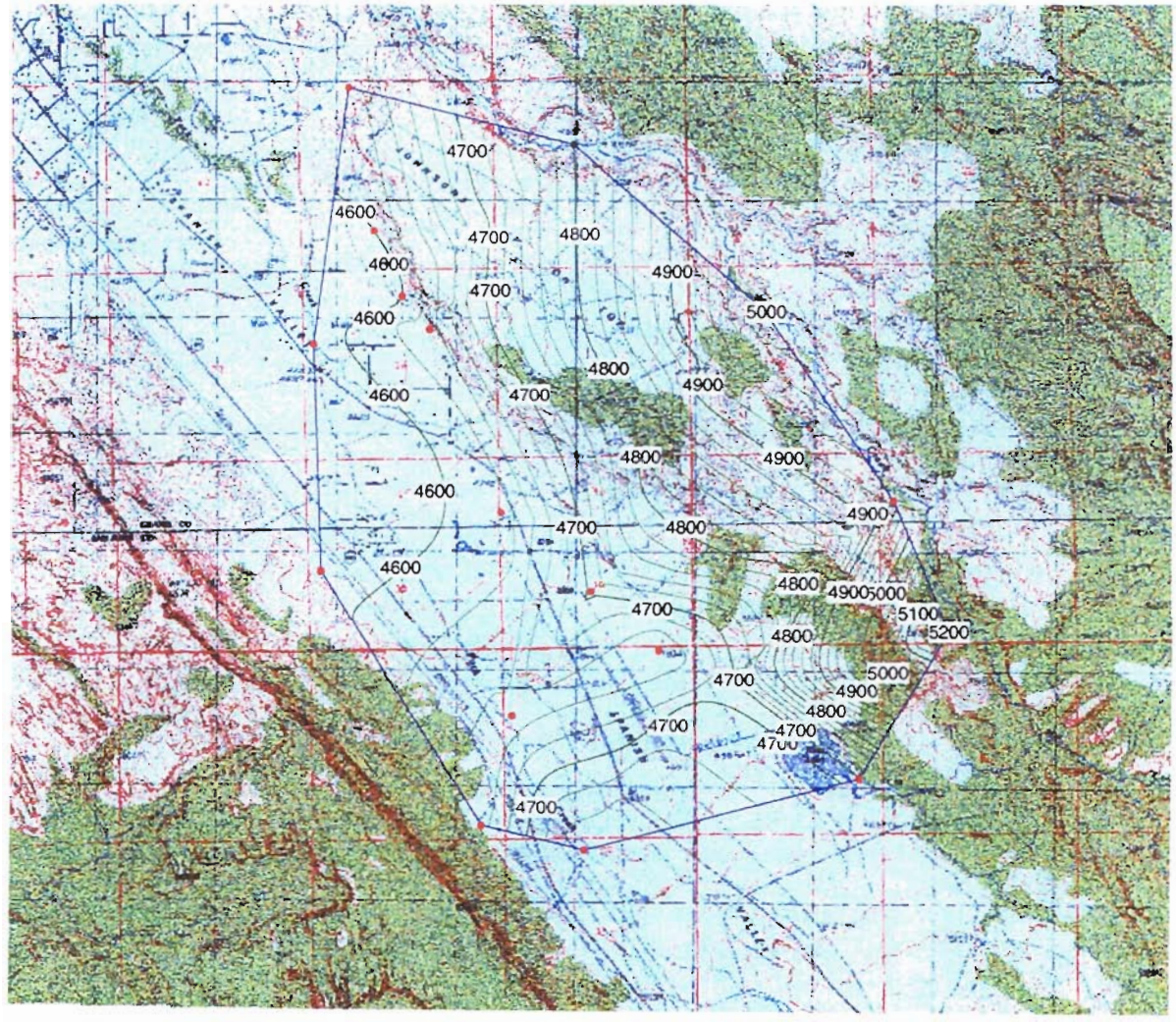
Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		
	45					118								
	50					118								
	55					118								
	60					118								
	65													
	[illegible]					[illegible]								
	[illegible]					[illegible]								

Appendix D
Map Showing the Fractured Area


7"
8"
9"
12"
George White Well No. 1
George White Well No. 2
SPANISH VALLEY
Grand County
San Juan County
38°30'
109°30'
EXPLANATION
Glen Canyon aquifer recharge area
Eolian deposits overlying the Glen Canyon aquifer
Upper mesas—Sedimentary rocks younger than the Navajo Sandstone and overlying the Glen Canyon aquifer
Valley-fill aquifer recharge area
9" Line of equal average annual winter precipitation, in inches—Interval 1 inch
Boundary of highly fractured area—Area inside boundary is fractured
Boundary of study area
2 0 2 4 MILES
2 0 2 4 KILOMETERS

Appendix E
Groundwater Level Contour Map

Groundwater Level Contour Map

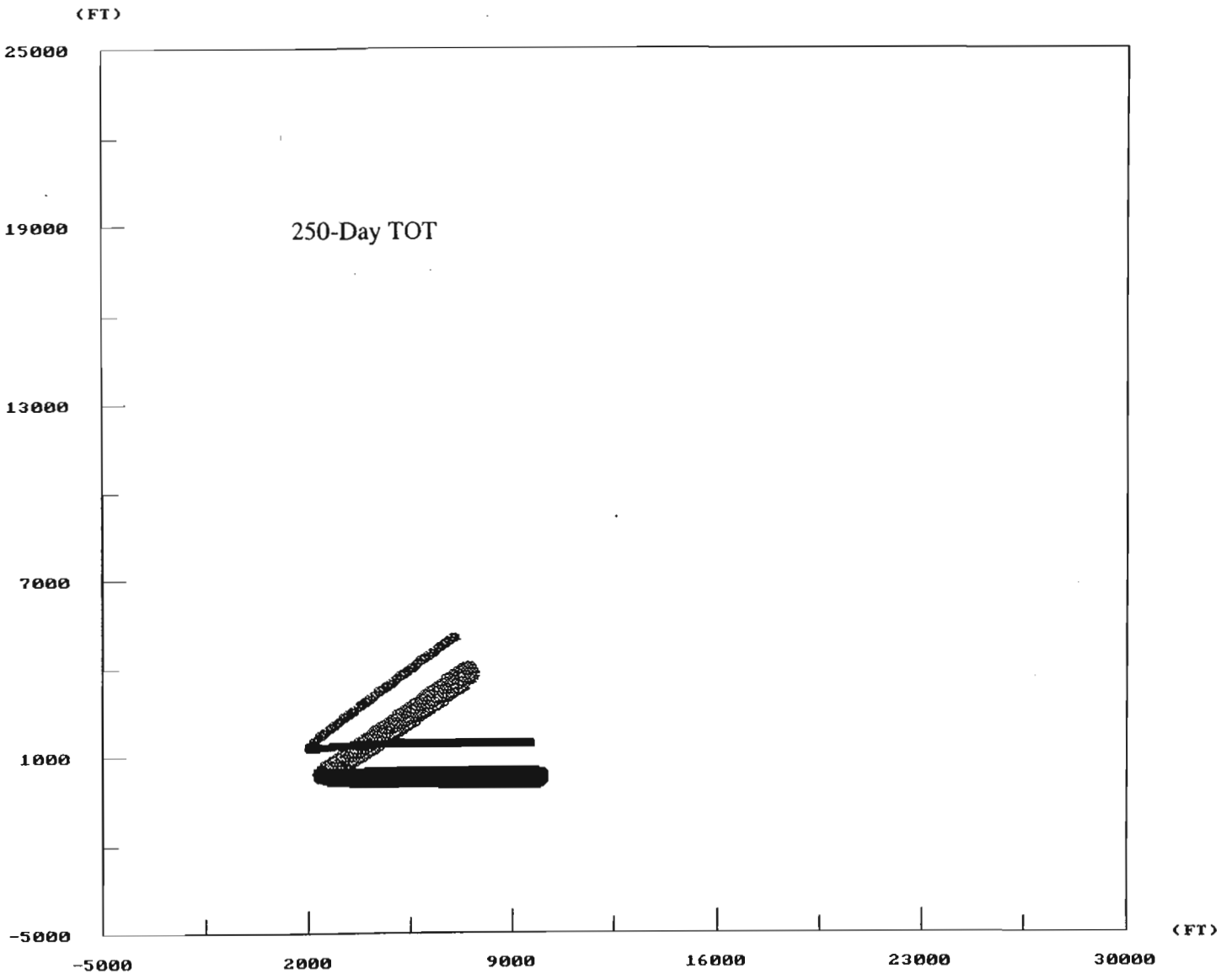


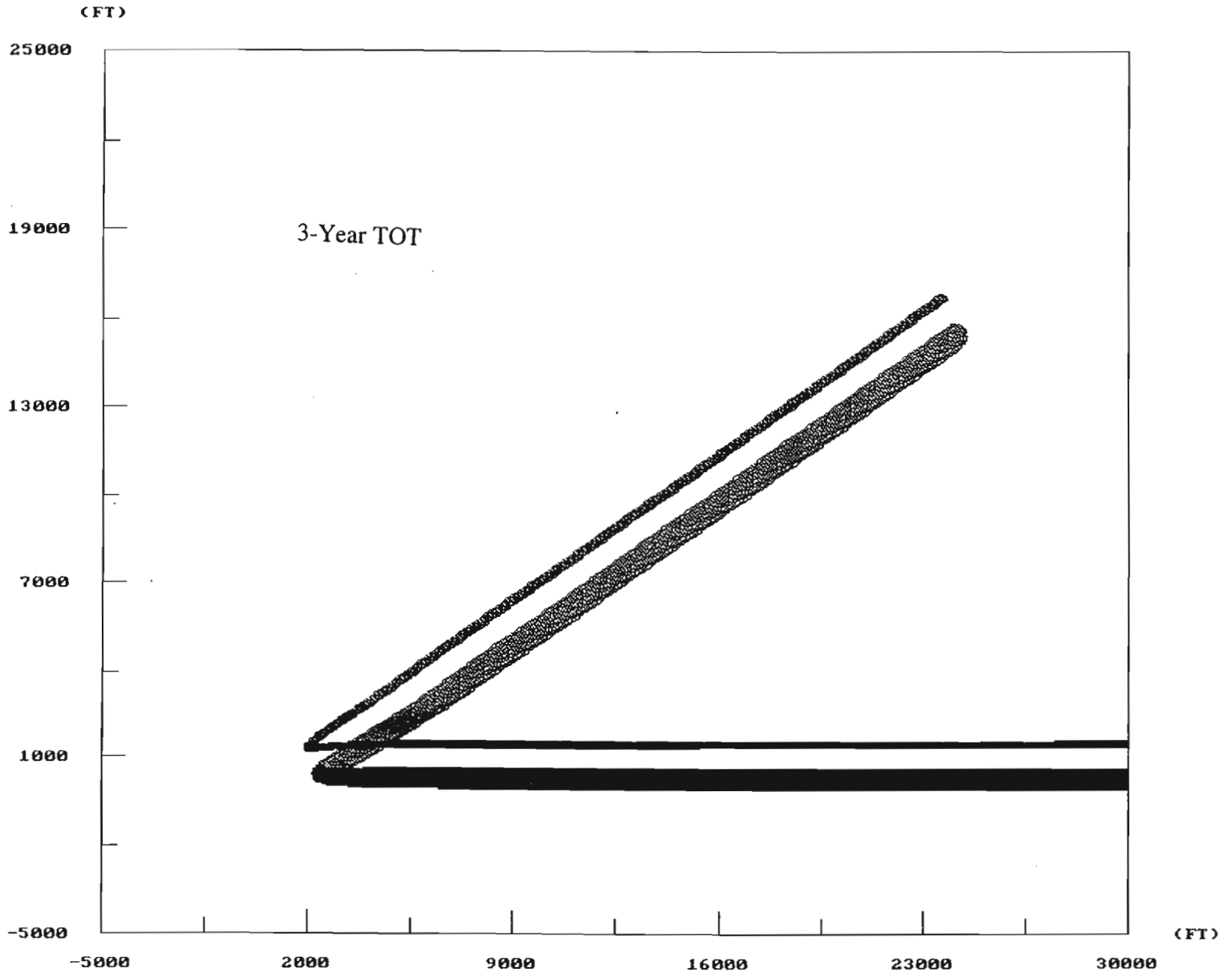
Scale: 1 inch = 1 mile

Source: Hydrogeologic Assessment / Well Siting Study
for Spanish Valley W&S mproement District (Sunrise, 1999)

Appendix F
Model Output from WHPA

F-I
Without Well Interference


(FT)
25000
19000
13000
7000
1000
-5000
250-Day TOT
-5000
2000
9000
16000
23000
30000
(FT)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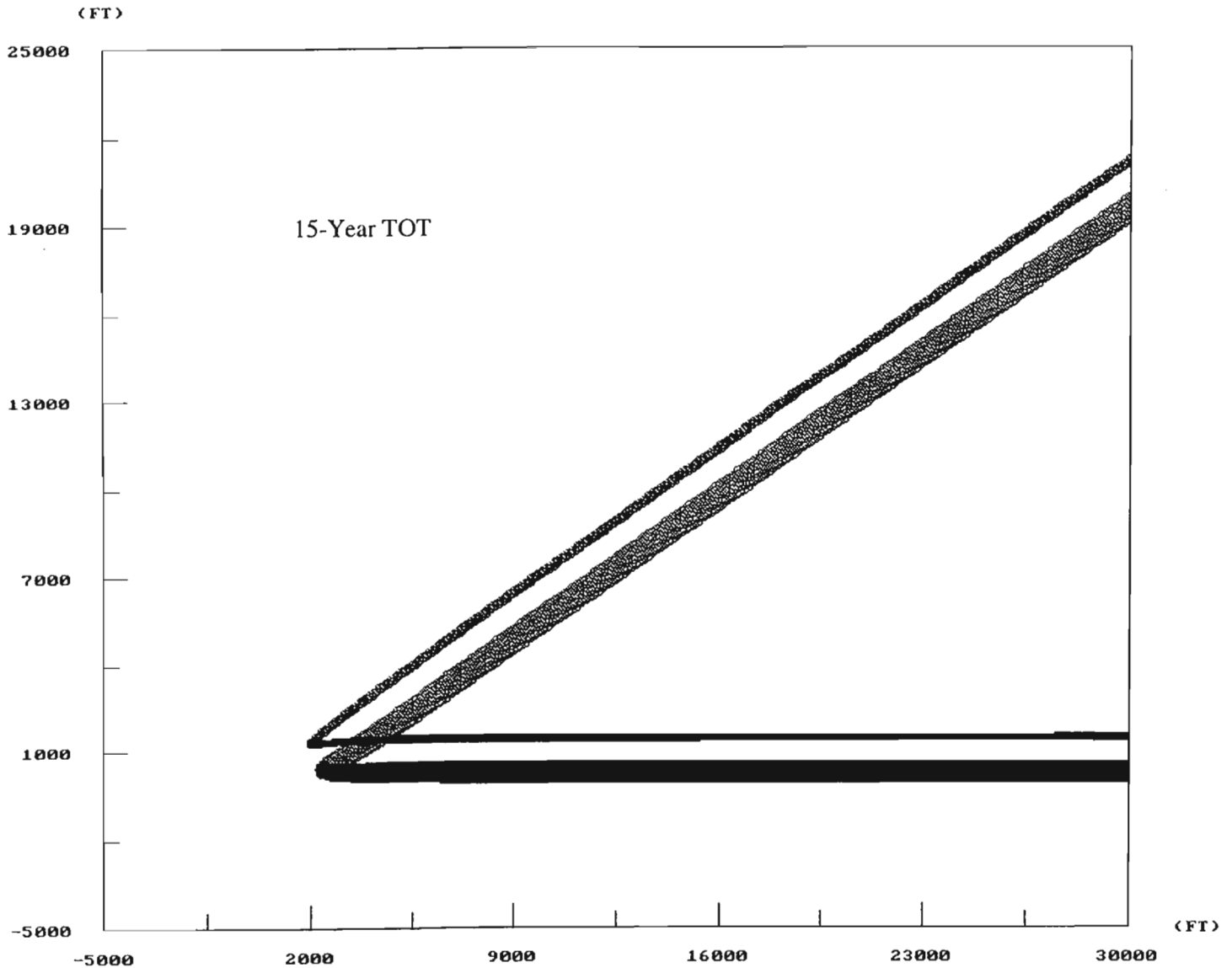
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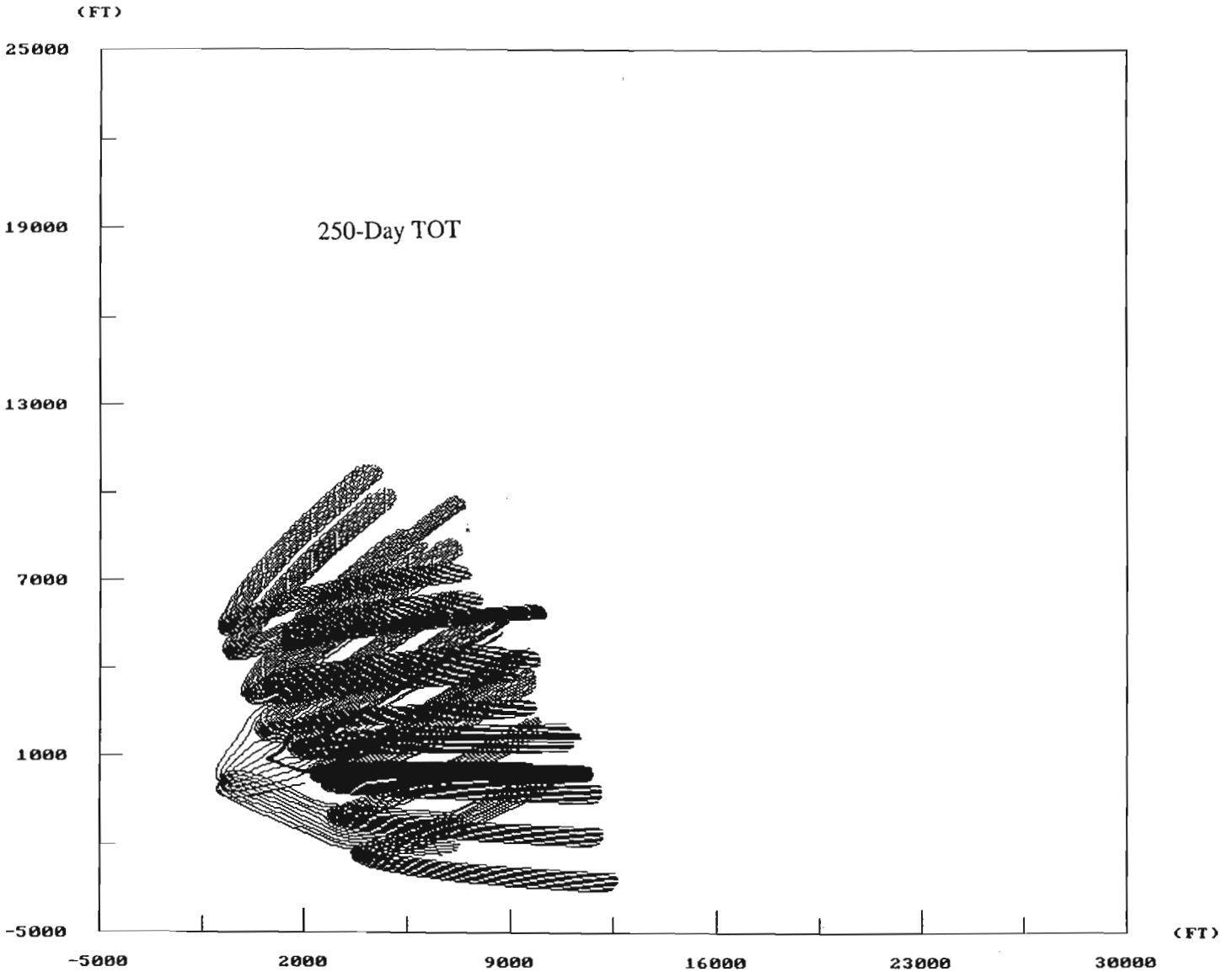
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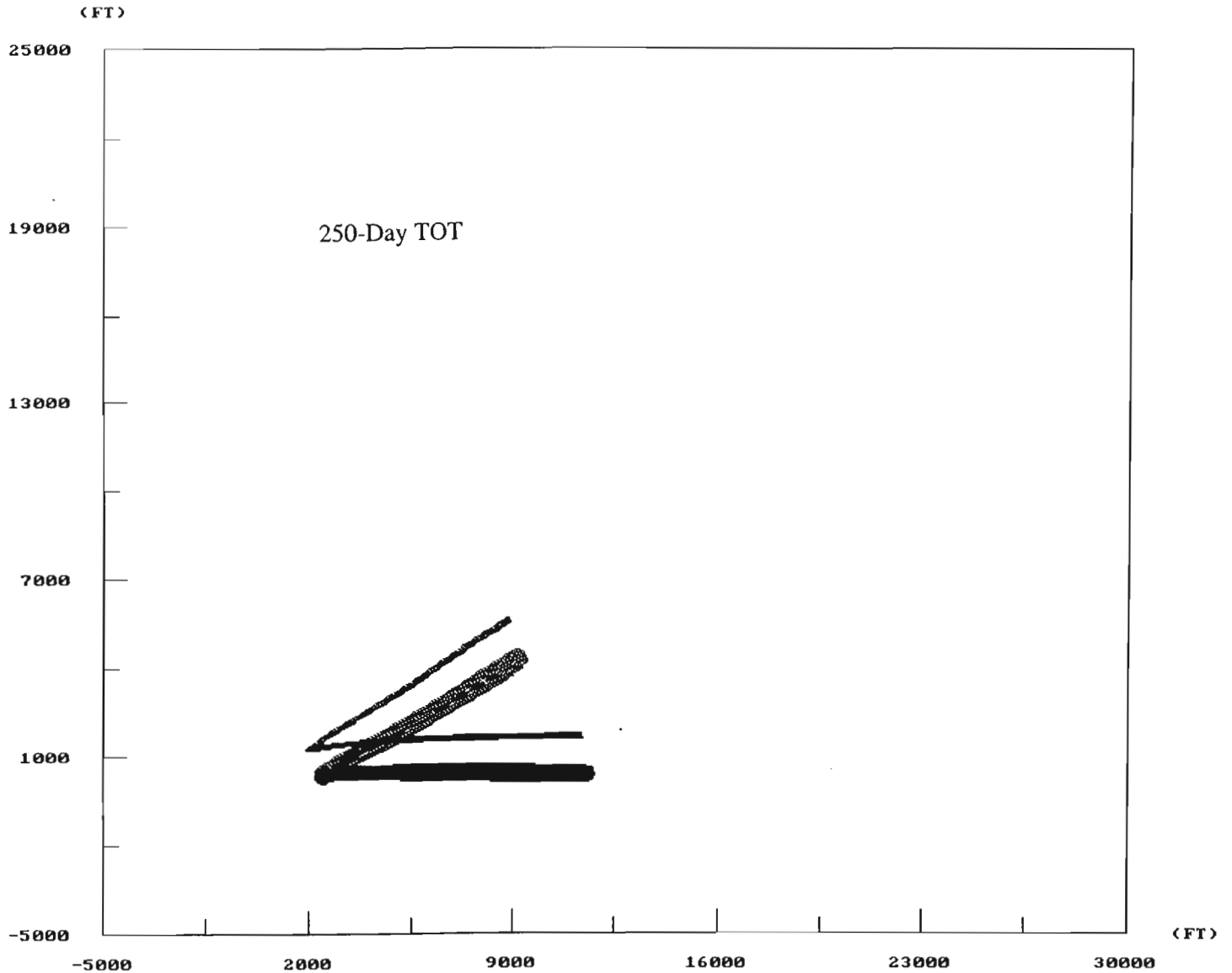
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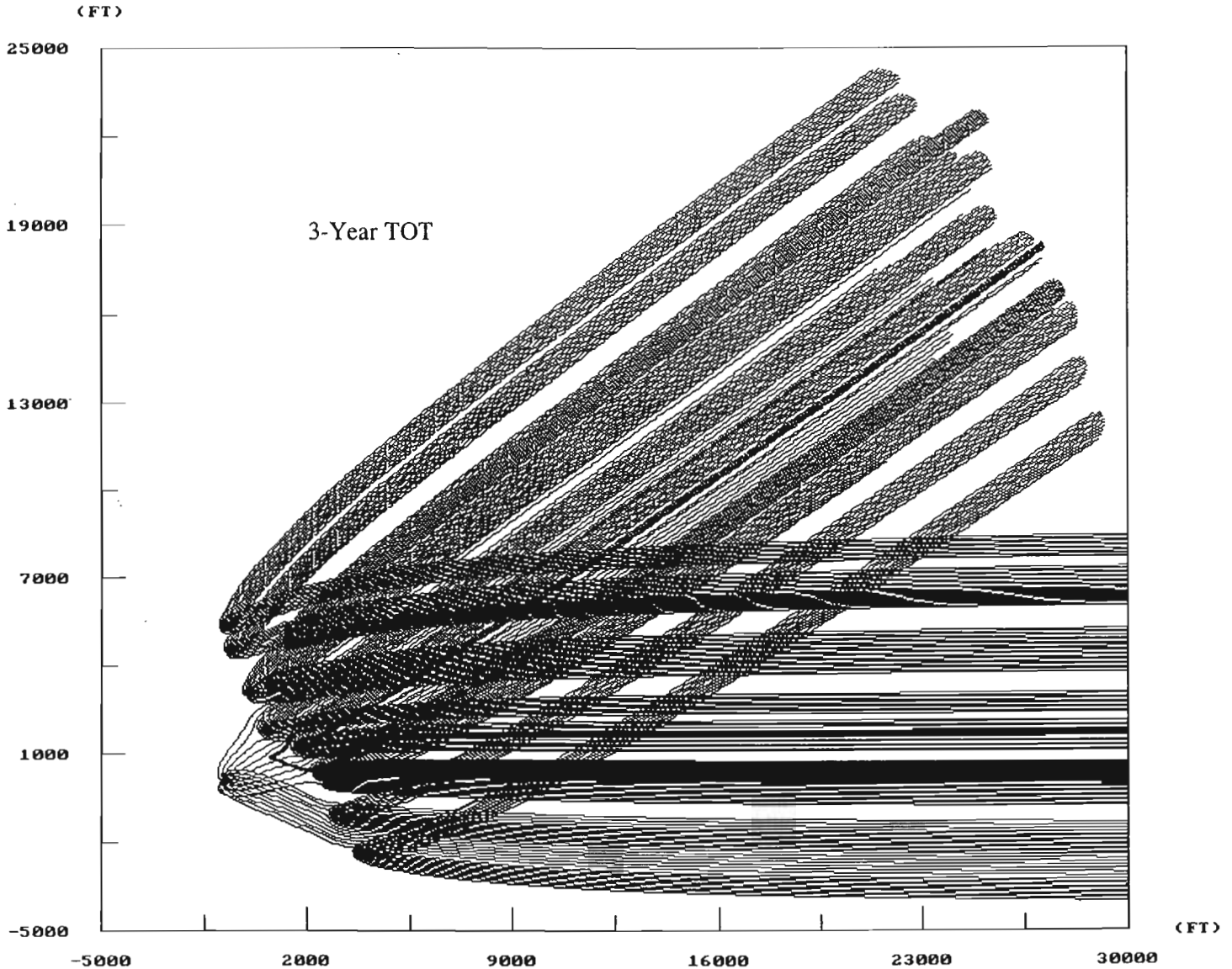
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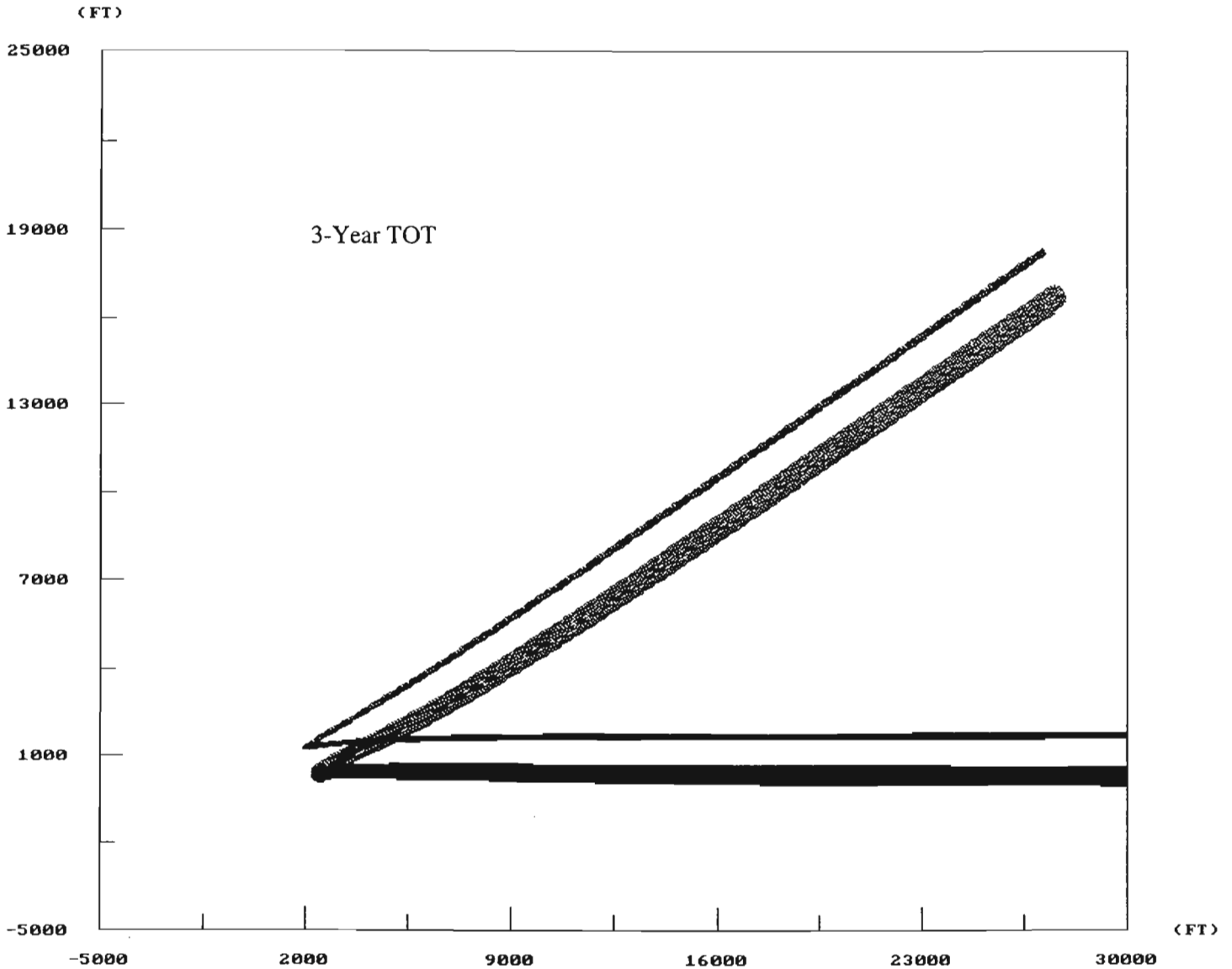
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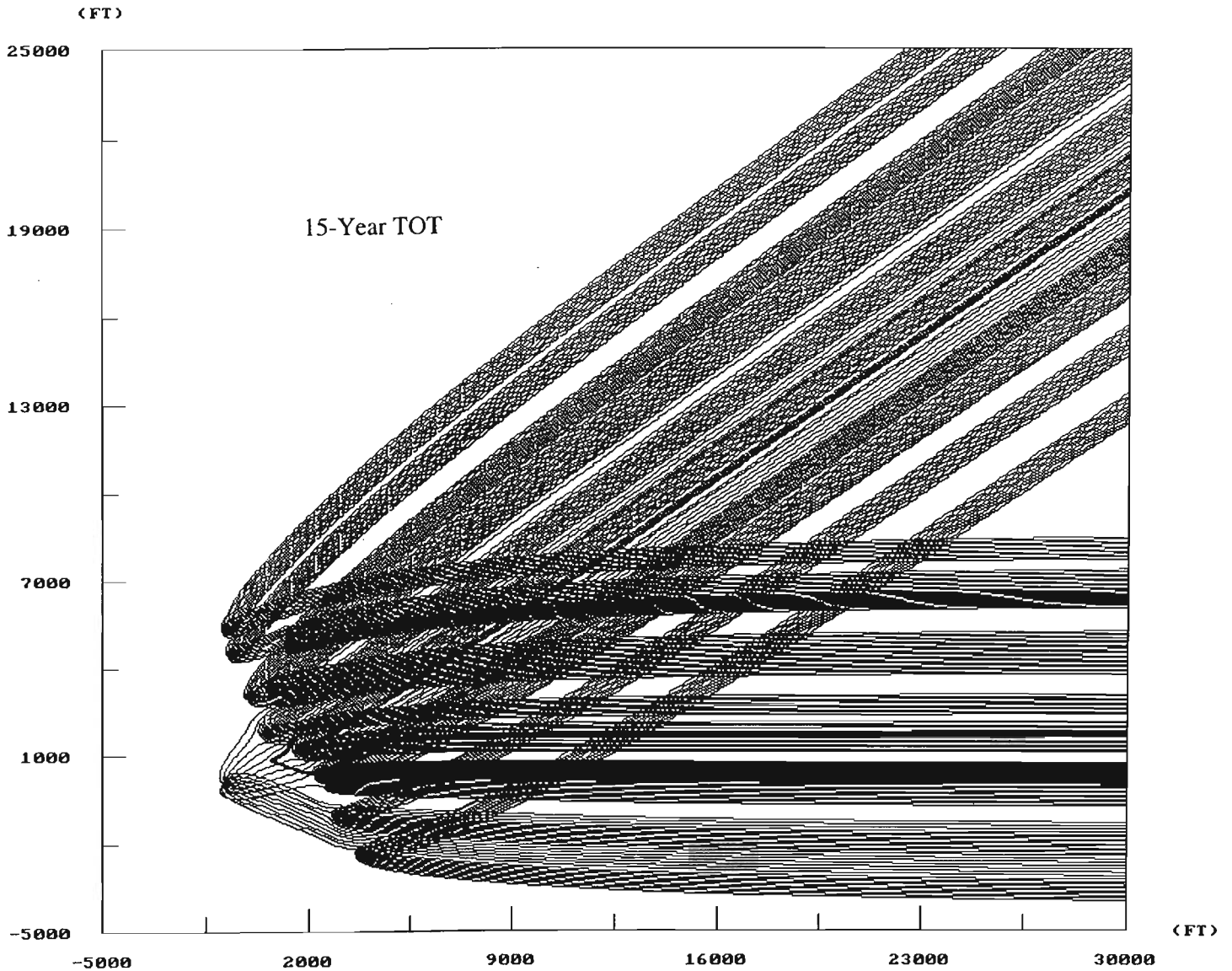
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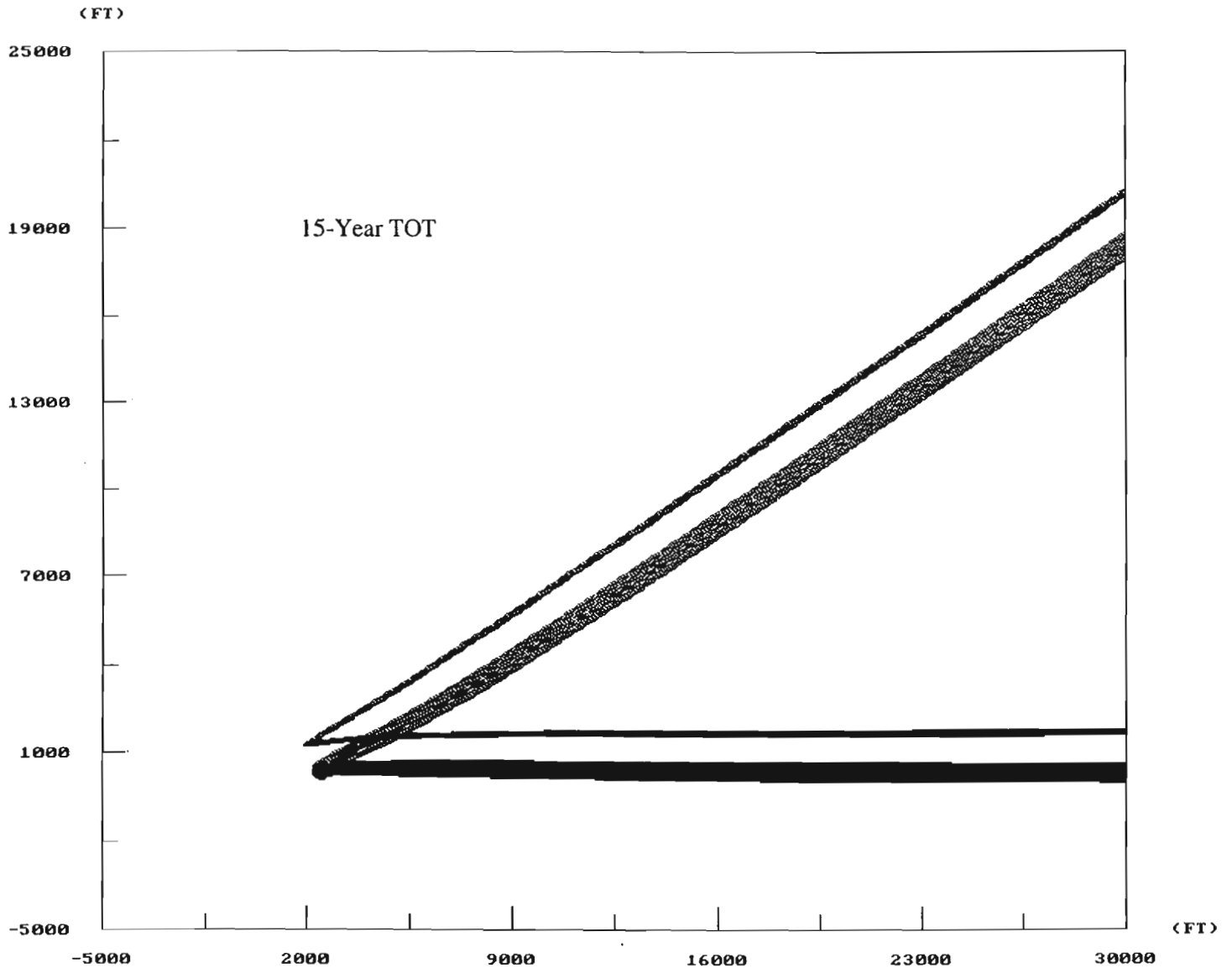
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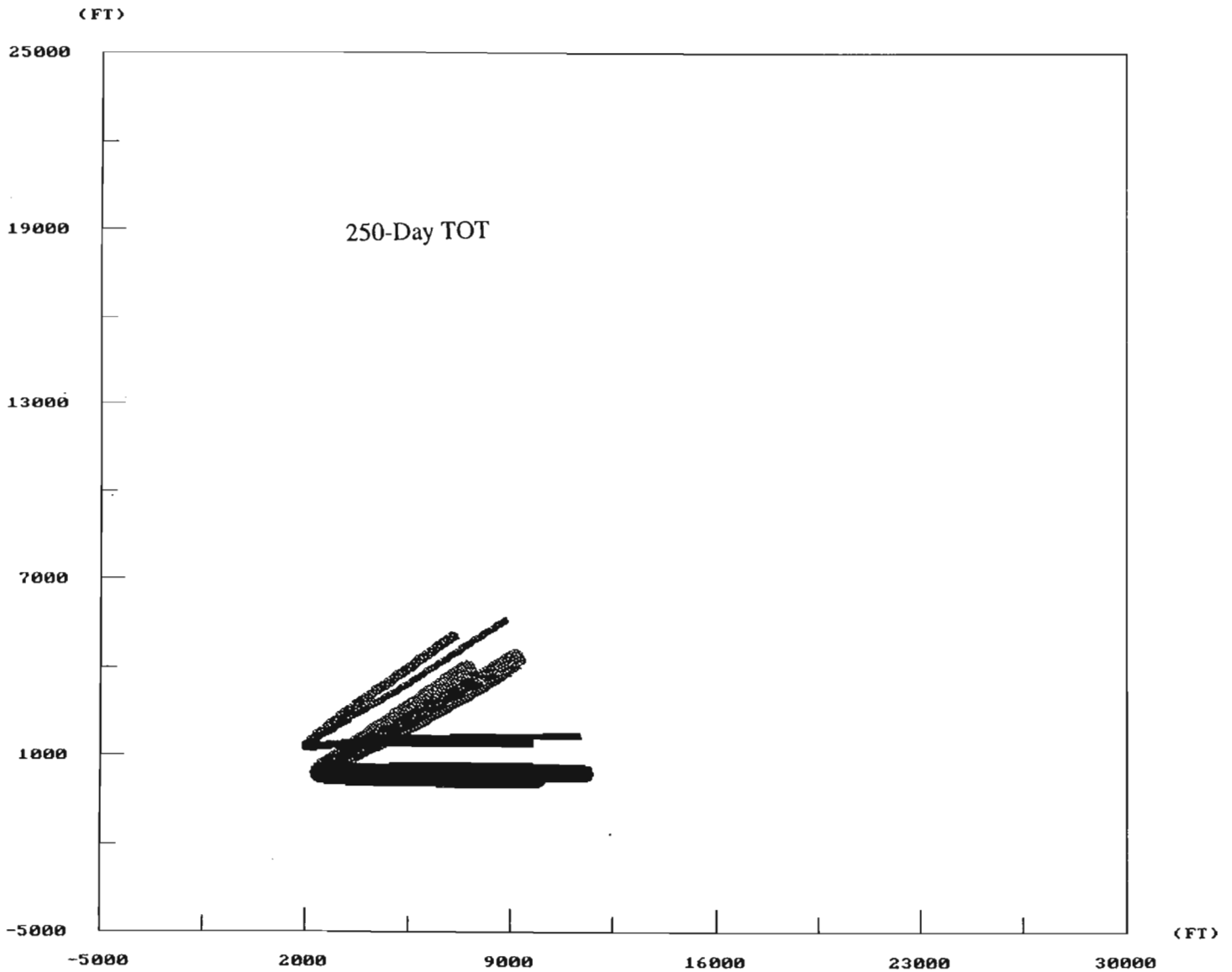
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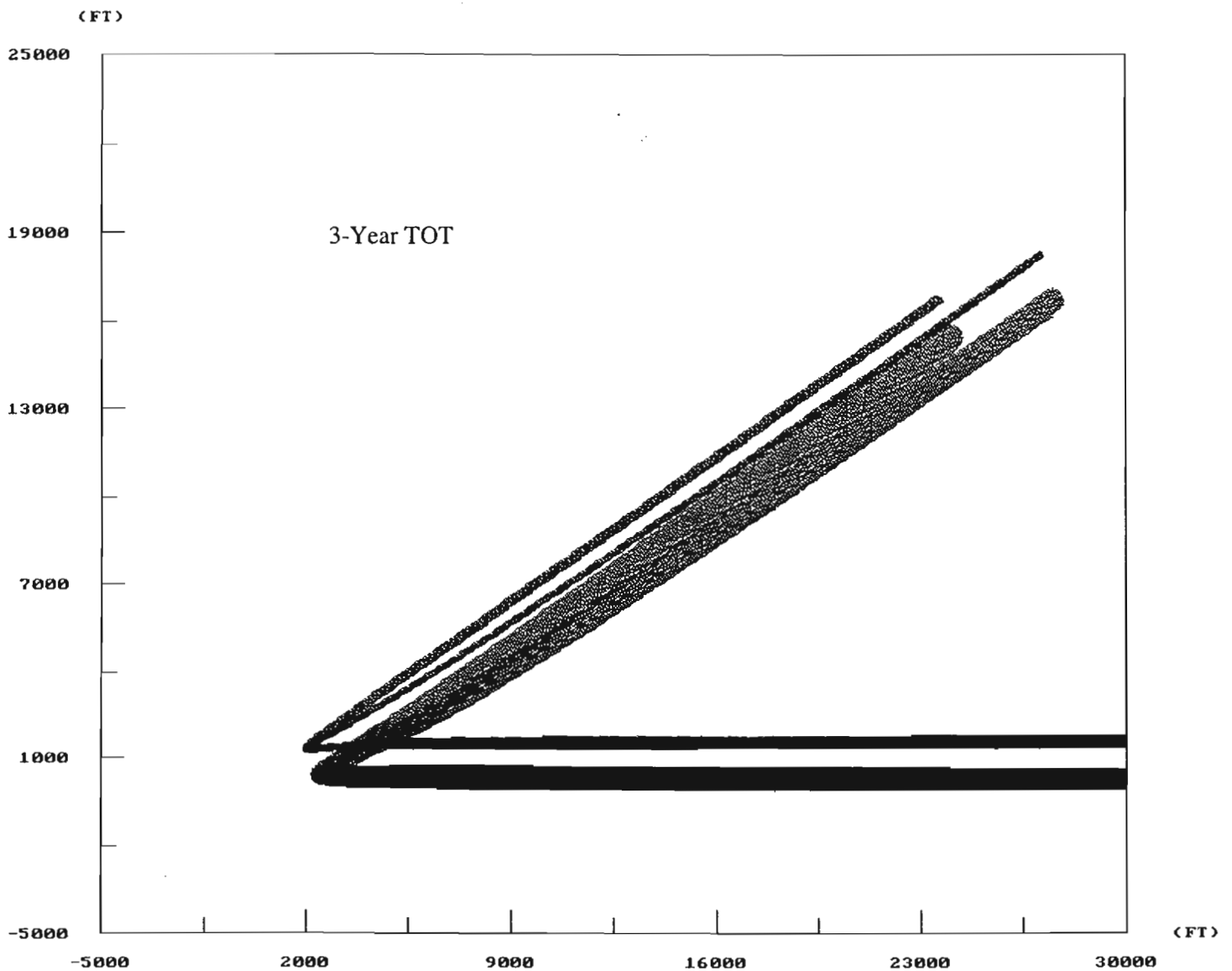
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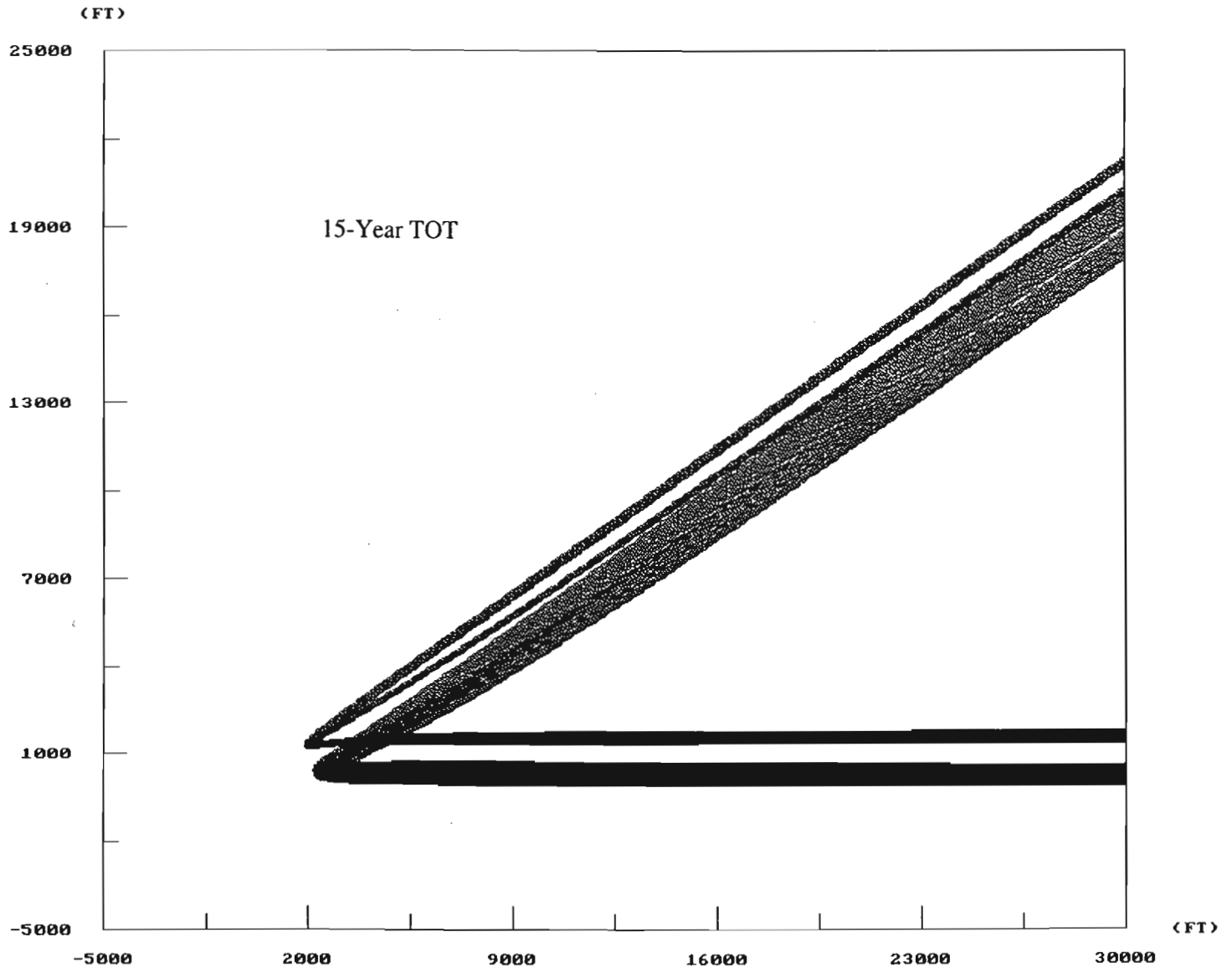
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Appendix G
Checklist of Potential Contamination Sources

Checklist of Potential Contamination Sources
Gorge White Wells No.4 and No. 5
Grand County Water and Sewer Service Agency
Moab, Utah

Source #	Potential Contamination Source	Within Zone One	Within Zone Two	Within Zone Three	Within Zone Four
1	Active and abandoned wells	None	None	None	None
2	Agricultural pesticide, herbicide and fertilizer storage, use, filling and mixing	None	None	None	None
3	Airport maintenance and fueling sites	None	None	None	None
4	Animal feeding operations with more than ten units	None	None	None	None
5	Animal watering troughs located near unfenced wells and springs that attract livestock	None	None	None	None
6	Auto washes	None	None	None	None
7	Beauty salons	None	None	None	None
8	Boat builder and refinishers	None	None	None	None
9	Chemical reclamation facilities	None	None	None	None
10	Chemigation wells	None	None	None	None
11	Concrete, asphalt, tar and coal companies	None	None	None	None
12	Dry cleaners	None	None	None	None
13	Farm dump sites	None	None	None	None
14	Farm maintenance garages	None	None	None	None
15	Feed lots	None	None	None	None
16	Food processors, meat packers and slaughter houses	None	None	None	None
17	Fuel and oil distributors and storers	None	None	None	None
18	Furniture strippers, painters, finishers and appliance repairers	None	None	None	None
19	Grave yards, golf courses, parks and nurseries	None	None	None	None
20	Heating oil storers	None	None	None	None
21	Industrial manufacturers: chemicals, pesticides, paper and leather products, textiles, rubber, plastic, fiberglass, silicone, glass, pharmaceutical and electrical equipment, etc.	None	None	None	None
22	Industrial waste disposal/improvement areas and municipal wastewater treatment plants, landfills, dumps and transfer stations	None	None	None	None
23	Junk and salvage yards	None	None	None	None
24	Laundromats	None	None	None	None
25	Machine shops, metal platers, heat treaters, smelters, annealers and descalers	None	None	None	None
26	Manure piles	None	None	None	None
27	Medical, dental and veterinarian offices	None	None	None	None
28	Mortuaries	None	None	None	None
29	Mining operations	None	None	None	None
30	Muffler shops	None	None	None	None

Checklist of Potential Contamination Sources
Gorge White Wells No.4 and No. 5
Grand County Water and Sewer Service Agency
Moab, Utah

Source #	Potential Contamination Source	Within Zone One	Within Zone Two	Within Zone Three	Within Zone Four
31	Pesticide and herbicide storers and retailers	None	None	None	None
32	Photo processors	None	None	None	None
33	Print shops	None	None	None	None
34	Radiological mining operations	None	None	None	None
35	Railroad yards	None	None	None	None
36	Research laboratories	None	None	None	None
37	Residential pesticide, herbicide and fertilizer storage, use, filling and mixing areas	None	None	None	None
38	Residential underground storage tanks	None	None	None	None
39	Salt and sand-salt piles	None	None	None	None
40	Sand and gravel mining operations	None	None	None	None
41	School vehicle maintenance barns	None	None	None	None
42	Sewer lines	None	None	None	None
43	Single-family septic tank/drain-field systems	None	None	None	None
44	Sites of reported spills	None	None	None	None
45	Small engine repair shops	None	None	None	None
46	Stormwater impoundment sites and snow dumps	None	None	None	None
47	Subdivisions using subsurface wastewater disposal systems (large and individual septic tank/drain-field systems)	None	None	None	None
48	Submersible pumps used to pump wells	2	None	None	None
49	Taxi cab maintenance garages	None	None	None	None
50	Tire shops	None	None	None	None
51	Toxic chemical and oil pipelines	None	None	None	None
52	Vehicle chemical supply storers and retailers	None	None	None	None
53	Vehicle dealerships	None	None	None	None
54	Vehicle quick lubes	None	None	None	None
55	Vehicle rental shops	None	None	None	None
56	Vehicle repair, body shops and rust proofers	None	None	None	None
57	Vehicle service stations and terminals	None	None	None	None
58	Wood preservers	None	None	None	None

Appendix H
Example of Drinking Water Source Protection Ordinance

DRINKING WATER SOURCE PROTECTION ORDINANCE

The following is an example of a source protection ordinance. Wellhead Protection Technology Transfer Centerpiece Workshop (EPA/600/K-92/015) was used as a reference. It has been changed to reflect recommendations in the Drinking Water Source Protection Rule, R309-113 of the Utah Administrative Code.

BE IT ORDAINED by the Mayor and Council of the City of _____ in Council duly assembled and it is hereby ordained by the authority of same that the following ordinance known as the Drinking Water Source Protection Ordinance is adopted and made a part of the Code of Ordinance of the City of _____, to wit:

Section 1. Short title and purpose.

(a) This ordinance shall be known as the "Drinking Water Source Protection Ordinance."

(b) The purpose of this ordinance is to insure the provision of a safe and sanitary drinking water supply for the City by the establishment of drinking water source protection zones surrounding the wellheads for all wells which are the supply sources for the City water system and by the designation and regulation of property uses and conditions which may be maintained within such zones.

Section 2. Definitions. When used in this ordinance the following words and phrases shall have the meanings given in this Section:

(a) Design standard - means a control which is implemented by a potential contamination source to prevent discharges to the ground water. Spill protection is an example of a design standard.

(b) Land management strategies - means zoning and non-zoning controls which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground-water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, written contracts and agreements, and so forth.

(c) Pollution source - means point source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure

piles, salt piles, pit privies, and animal feeding operations with more than ten animal units. The following clarify the definition of pollution source:

(1) Animal feeding operation - means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(2) Animal unit - means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(3) Extremely hazardous substances - means those substances which are identified in the Sec. 302(EHS) column of the "TITLE III LIST OF LISTS - Consolidated List of Chemicals Subject to Reporting Under SARA Title III," (EPA 560/4-91-011).

(d) Potential contamination source - means any facility or site which employs an activity or procedure which may potentially contaminate ground water. A pollution source is also a potential contamination source.

(e) Regulatory agency - means any governmental agency with jurisdiction over hazardous waste as defined herein.

(f) Sanitary landfill - means a disposal site where solid wastes, including putrescible wastes, or hazardous wastes, are disposed of on land by placing earth cover thereon.

(g) Septic tank/drain-field systems - means a system which is comprised of a septic tank and a drain-field which accepts domestic wastewater from buildings or facilities for subsurface treatment and disposal. By their design, septic tank/drain-field system discharges cannot be controlled with design standards.

(h) Wellhead - means the upper terminal of a well, including adapters, ports, seals, valves and other attachments.

Section 3. Establishment of drinking water source protection zones. There is hereby established use districts to be known as zones one, two, three, and four of the drinking water source protection area, identified and described as follows:

(a) **Zone one** is the area within a 100-foot radius from the wellhead.

(b) **Zone two** is the area within a 250-day ground-water time of travel to the wellhead, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

(c) **Zone three** (waiver criteria zone) is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

(d) **Zone four** is the area within a 15-year ground-water time of travel to the wellhead, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

Section 4. Permitted uses. The following uses shall be permitted within drinking water source protection zones:

(a) Any use permitted within existing agricultural, single family residential, multi-family residential, and commercial districts so long as uses conform to the rules and regulations of the regulatory agencies.

(b) Any other open land use where any building located on the property is incidental and accessory to the primary open land use.

Section 5. Prohibited uses. The following uses or conditions shall be and are hereby prohibited within drinking water sources protection zones, whether or not such use or condition may otherwise be ordinarily included as a part of a use permitted under Section 4 of the ordinance.

(a) **Zone one** - The location of any pollution source as defined herein.

(b) **Zone two** - The location of a pollution source unless its contaminated discharges can be controlled with design standards.

(c) **Zones three and four** - The location of a potential contamination source unless it can be controlled through land management strategies.

Section 6. Administration. The policies and procedures for administration of any source protection zone established under this ordinance, including without limitation those applicable to nonconforming uses, exception, enforcement and penalties, shall be the same as provided in the existing zoning ordinance for the City of _____, as the same is presently enacted or may from time to time be amended.

This Ordinance shall be effective as of _____ (date). All ordinances and parts or ordinances in conflict herewith shall not be and the same are hereby repealed.

ENACTED AND ADOPTED this _____ day of _____, 19__.

_____
Mayor

Attest: _____
City Clerk

Appendix I
Dated Statement Regarding VOC and Pesticide Use

Grand Water and Sewer Service Agency
P.O. Box 1048
Moab, UT 84532

I, Dale F. Pierson, of Grand Water and Sewer Service Agency verify that none of the following volatile organic chemicals (VOCs) and pesticides have been or will be used, disposed of, stored, transported, or manufactured within the protection zones of the George White Wells No. 4 and No. 5 in the Grand Water and Sewer Service Agency Water System.

VOCs

Vinyl chloride	Benzene	Carbon tetrachloride
1,2-Dichloroethane	Trichloroethylene	para-Dichlorobenzene
1,1-Dichloroethylene	1,1,1-Trichloroethane	cis-1,2-Dichloroethylene
1,2-Dichloropropane	Ethylbenzene	Monochloroethylene
o-Dichlorobenzene	Styrene	Tetrachloroethylene
Toluene	trans-1,2-Dichloroethylene	Xylenes (total)
Dichloromethane	1,2,4-Trichlorobenzene	1,1,2-Trichloroethane

Pesticides

Alachlor	Aldicarb	Aldicarb Sulfoxide
Aldicarb Sulfone	Atrazine	Carbofuran
Chlordance	Dibromochloropropane	2,4-D
Ethylene Dibromide	Heptachlor	Heptachlor Epoxide
Lindane	Methoxychlor	Polychlorinated Biphenyls
Penachlorophenol	Toxaphene	2,4,5-TP
Benzp(a)pyrene	Dalapon	Di(2-ethylhexyl)adipate
Di(2-ethylhexyl)phthalate	Dinoseb	Diquat
Endothall	Endrin	Glyphosate
Hexachlorobenzene	Hexachlorocycopentadiene	Oxamyl (Vydate)
Picloram	Simazine	2,3,7,8-TCDD (Dioxin)

(Signature)

Date 11-30-99

R309-113.
Drinking Water Source Protection
Effective July 26, 1993
Revised July 26, 1995

R309-113
Drinking Water Source Protection

R309-113-1. Authority.

Under authority of Section 19-4-104(1)(a)(iv), the Drinking Water Board adopts this rule which governs the protection of ground-water sources of drinking water.

R309-113-2. Purpose.

Public Water Systems (PWSs) are responsible for protecting their sources of drinking water from contamination. R309-113 sets forth minimum requirements to establish a uniform, statewide program for implementation by PWSs to protect their ground-water sources of drinking water. PWSs are encouraged to enact more stringent programs to protect their sources of drinking water if they decide they are necessary.

R309-113 applies to all ground-water sources of drinking water which are used by PWSs to supply their systems except sources which are under the influence of surface water and are treated in accordance with surface water treatment rules. Additionally, compliance with this rule is voluntary for existing ground-water sources of drinking water which are used by public non-community water systems.

R309-113-3. Implementation.

(1) New Ground Water Sources - Each PWS shall submit a Preliminary Evaluation Report or a Drinking Water Source Protection (DWSP) Plan in accordance with R309-113-13(2) or R309-113-7(1) for each of its new ground-water sources to the Division of Drinking Water (DDW).

(2) Existing Ground Water Sources - Each PWS shall submit a DWSP Plan in accordance with R309-113-7(1) for each of its existing ground-water sources to DDW according to the following schedule. Well fields or groups of springs may be considered to be a single source.

TABLE 1

Population Served by PWS:	Percent of Sources	DWSP Plans Due by:
Over 10,000	50% of Wells	December 31, 1995
Over 10, 000	100% of Wells	December 31, 1996
3,300 - 10,000	100% of Wells	December 31, 1997
Less than 3,300	100% of Wells	December 31, 1998
Springs and other sources	100%	December 31, 1999

(3) PWSs shall maintain all land use agreements which were established under previous rules to protect their ground-water sources of drinking water from contamination. Additionally, PWSs shall maintain land ownership and land-use agreements established under previous

rules with new owners which prohibit these new owners from locating pollution sources within protection zones.

R309-113-4. Exceptions.

(1) Exceptions to the requirements of R309-113 or parts thereof may be granted by the Executive Secretary to PWSs if: due to compelling factors (which may include economic factors), a PWS is unable to comply with these requirements, and the granting of an exception will not result in an unreasonable risk to health.

(2) Within one year of granting an exception, the Executive Secretary may prescribe a schedule by which the PWS must come into compliance with the requirements of R309-113.

R309-113-5. Designated Person.

(1) A designated person shall be appointed and reported in writing to the Executive Secretary by each PWS within 180 days of the effective date of R309-113. The designated person's address and telephone number shall be included in the written correspondence.

(2) Each PWS shall notify the Executive Secretary in writing within 30 days of any changes in the appointment of a designated person.

R309-113-6. Definitions.

(1) The following terms are defined for the purposes of this rule:

(a) "Collection area" means the area surrounding a ground-water source which is underlain by collection pipes, tile, tunnels, infiltration boxes, or other ground-water collection devices.

(b) "Controls" means the codes, ordinances, rules, and regulations currently in effect to regulate a potential contamination source.

(c) "Criteria" means the conceptual standards that form the basis for DWSP area delineation to include distance, ground-water time of travel, aquifer boundaries, and ground-water divides.

(d) "Criteria threshold" means a value or set of values selected to represent the limits above or below which a given criterion will cease to provide the desired degree of protection.

(e) "DDW" means Division of Drinking Water.

(f) "DWSP Program" means the program to protect drinking water source protection zones and management areas from contaminants that may have an adverse effect on the health of persons.

(g) "DWSP Zone" means the surface and subsurface area surrounding a ground-water source of drinking water supplying a PWS, through which contaminants are reasonably likely to move toward and reach such ground-water source.

(h) "Designated person" means the person appointed by a PWS to ensure that the requirements of R309-113 are met.

(i) "Executive Secretary" means the individual authorized by the Drinking Water Board to conduct business on its behalf.

(j) "Existing ground-water source of drinking water" means a public supply ground-water source for which plans and specifications were submitted to DDW on or before July 26, 1993.

(k) "Ground-water Source" means any well, spring, tunnel, adit, or other underground opening from or through which ground-water flows or is pumped from subsurface water-bearing formations.

(l) "Hydrogeologic methods" means the techniques used to translate selected criteria and criteria thresholds into mappable delineation boundaries. These methods include, but are not limited to, arbitrary fixed radii, analytical calculations and models, hydrogeologic mapping, and numerical flow models.

(m) "Land management strategies" means zoning and non-zoning controls which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground-water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, written contracts and agreements, and so forth.

(n) "Land use agreement" means a written agreement wherein the owner(s) agrees not to locate or allow the location of potential contamination sources within zone one of new wells in protected aquifers. The owner(s) must also agree not to locate or allow the location of pollution sources within zone two of new wells in unprotected aquifers and new springs unless the pollution source agrees to install design standards which prevent contaminated discharges to ground water. This restriction must be binding on all heirs, successors, and assigns. Land use agreements must be recorded with the property description in the local county recorder's office. Refer to R309-113-13(4).

Land use agreements for protection areas on publicly owned lands need not be recorded in the local county recorder office. However, a letter must be obtained from the Administrator of the land in question and meet the requirements described above.

(o) "Management area" means the area outside of zone one and within a two-mile radius where the Optional Two-mile Radius Delineation Procedure has been used to identify a protection area.

For wells, land may be excluded from the DWSP management area at locations where it is more than 100 feet lower in elevation than the total drilled depth of the well.

For springs and tunnels, the DWSP management area is all land at elevation equal to or higher than, and within a two-mile radius, of the spring or tunnel collection area. The DWSP management area also includes all land lower in elevation than, and within 100 horizontal feet, of the spring or tunnel collection area. The elevation datum to be used is the point of water collection. Land may also be excluded from the DWSP management area at locations where it is separated from the ground-water source by a surface drainage which is lower in elevation than the spring or tunnel collection area.

(p) "New ground-water source of drinking water" means a public supply ground-water source of drinking water for which plans and specifications are submitted to DDW after July 26, 1993.

(q) "Nonpoint source" means any conveyance not meeting the definition of point source.

(r) "PWS" means public water system.

(s) "Point source" means any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation with more than ten animal units, landfill, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(t) "Pollution source" means point source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit privies, drain lines, and animal feeding operations with more than ten animal units.

The following definitions are part of R309-113 and clarify the meaning of "pollution source:"

(i) "Animal feeding operation" means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(ii) "Animal unit" means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(iii) "Extremely hazardous substances" means those substances which are identified in the Sec. 302(EHS) column of the "TITLE III LIST OF LISTS - Consolidated List of Chemicals Subject to Reporting Under SARA Title III," (EPA 560/4-91-011). A copy of this document may be obtained from: Section 313 Document Distribution Center, P.O. Box 12505, Cincinnati, OH 45212.

(u) "Potential contamination source" means any facility or site which employs an activity or procedure which may potentially contaminate ground water. A pollution source is also a potential contamination source.

(v) "Protected aquifer" means a producing aquifer in which the following conditions are met:

(i) A naturally protective layer of clay, at least 30 feet in thickness, is present above the aquifer;

(ii) the PWS provides data to indicate the lateral continuity of the clay layer to the extent of zone two; and

(iii) the public-supply well is grouted with a grout seal that extends from the ground surface down to at least 100 feet below the surface, and through the protective clay layer.

(w) "Time of travel" means the time required for a particle of water to move in the saturated zone from a specific point to a ground-water source of drinking water.

(x) "Unprotected aquifer" means any aquifer that does not meet the definition of a protected aquifer.

(y) "Wellhead" means the physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from subsurface, water-bearing formations.

R309-113-7. DWSP Plans.

(1) Each PWS shall develop, submit, and implement a DWSP Plan for each of its ground-water sources of drinking water. These DWSP Plans may be used to support use and susceptibility waivers for pesticides and volatile organic chemicals (VOCs). For the purposes of a waiver, the plan must identify contaminants that may result from potential contamination sources

found in zones one, two, and three and management areas. Refer to Chapter Seven of the "Source Protection User's Guide." This guide may be obtained from DDW.
Required Sections for DWSP Plans - DWSP Plans must include the following seven sections:

(a) DWSP Delineation Report - A DWSP Delineation Report in accordance with R309-113-9(5) is the first section of a DWSP Plan.

(b) Potential Contamination Source Inventory and Assessment of Controls - A Prioritized Inventory of Potential Contamination Sources and an assessment of their controls in accordance with R309-113-10 is the second section of a DWSP Plan.

(c) Management Program to Control Each Preexisting Potential Contamination Source - A Management Program to Control Each Preexisting Potential Contamination Source in accordance with R309-113-11 is the third section of a DWSP Plan.

(d) Management Program to Control or Prohibit Future Potential Contamination Sources for Existing Drinking Water Sources - A Plan for Controlling or Prohibiting Future Potential Contamination Sources is the fourth section of a DWSP Plan. This must be in accordance with R309-113-12, consistent with the general provisions of this rule, and implemented to an extent allowed under the PWS's authority and jurisdiction. A land ownership map in accordance with R309-113-13-(2)(e) is required for new ground-water sources of drinking water.

(e) Implementation Schedule - Each PWS shall develop a step-by-step implementation schedule which lists each of its proposed land management strategies with an implementation date for each strategy.

(f) Resource Evaluation - Each PWS shall assess the financial and other resources which may be required for it to implement each of its DWSP Plans and determine how these resources may be acquired.

(g) Recordkeeping - Each PWS shall document changes in each of its DWSP Plans as they are continuously updated to show current conditions in the protection zones and management areas. As a DWSP Plan is executed, the PWS shall document any land management strategies that are implemented. These documents may include any of the following: ordinances, codes, permits, memoranda of understanding, public education programs, and so forth.

(2) DWSP Plan Administration - DWSP Plans shall be submitted, corrected, retained, implemented, updated, and revised according to the following:

(a) Submitting DWSP Plans - Each PWS shall submit a DWSP Plan to DDW in accordance with the schedule in R309-113-3(2) for each of its ground-water sources of drinking water.

(b) Correcting Deficiencies - Each PWS shall correct any deficiencies in a disapproved DWSP Plan and resubmit it to DDW within 90 days of the disapproval date.

(c) Retaining DWSP Plans - Each PWS shall retain on its premises a current copy of each of its DWSP Plans. DWSP Plans shall be made available to the public upon request.

(d) Implementing DWSP Plans - Each PWS shall begin implementing each of its DWSP Plans in accordance with its schedule in R309-113-7(1)(e), within 180 days after submittal if they are not disapproved by DDW.

(e) Updating DWSP Plans - Each PWS shall update its DWSP Plans as often as necessary to ensure they show current conditions in the DWSP zones and management areas, and resubmit them to DDW at least every six years.

(f) Revising DWSP Plans - Each PWS shall submit a revised DWSP Plan to DDW within 180 days after the reconstruction or redevelopment of any ground-water source of drinking water which addresses changes in source construction, source development, hydrogeology, delineation, potential contamination sources, and proposed land management strategies.

R309-113-8. DWSP Plan Review.

(1) DDW shall review each DWSP Plan submitted by PWSs and "concur," "concur with recommendations," or "disapprove" the plan.

(2) DDW may "disapprove" DWSP Plans for any of the following reasons:

(a) An inaccurate DWSP Delineation Report, a report that uses a non-applicable delineation method, or a DWSP Plan that is missing this report or any of the information and data required in it (refer to R309-113-9(5));

(b) an inaccurate Prioritized Inventory of Potential Contamination Sources or a DWSP Plan that is missing this report or any of the information required in it (refer to R309-113-10(1));

(c) an inaccurate assessment of current controls or a DWSP Plan that is missing this assessment or any of the information required in it (refer to R309-113-10(4));

(d) a missing Management Program to Control Each Preexisting Potential Contamination Source which has been assessed as "not adequately controlled" by the PWS (refer to R309-113-11(1));

(e) a missing Management Program to Control or Prohibit Future Potential Contamination Sources for Existing or New Drinking Water Sources (refer to R309-113-12 and R309-113-13(4));

(f) a missing Implementation Schedule, Resource Evaluation, Recordkeeping Section, or Contingency Report (refer to R309-113-7(1)(e)-(g) and R309-113-14).

(3) DDW may "concur with recommendations" when PWSs propose management programs to control preexisting potential contamination sources or management programs to control or prohibit future potential contamination sources for existing or new drinking water sources which appear inadequate or ineffective.

R309-113-9. Delineation of Protection Zones and Management Areas.

(1) PWSs shall delineate protection zones or a management area around each of their ground-water sources of drinking water using the Preferred Delineation Procedure or the Optional Two-mile Radius Delineation Procedure. The hydrogeologic method used by PWSs shall produce protection zones or a management area in accordance with the criteria thresholds below. PWSs may also choose to verify protected aquifer conditions to reduce the level of management controls applied in applicable protection areas.

(2) Criteria Thresholds for Ground-water Sources of Drinking Water:

(a) Preferred Delineation Procedure - Four zones are delineated for management purposes:

(i) Zone one is the area within a 100-foot radius from the wellhead or margin of the collection area.

(ii) Zone two is the area within a 250-day ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculations shall be based on this data.

(iii) Zone three (waiver criteria zone) is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculations shall be based on this data.

(iv) Zone four is the area within a 15-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculation shall be based on this data.

(b) Optional Two-mile Radius Delineation Procedure - In place of the Preferred Delineation Procedure, PWSs may choose to use the Optional Two-mile Radius Delineation Procedure to delineate a management area. This procedure is best applied in rural areas where few if any potential contamination sources are located. Refer to R309-113-6(1)(o) for the definition of a management area.

(3) Protected Aquifer Classification - PWSs may choose to verify protected aquifer conditions to reduce the level of management controls for a public-supply well which produces water from a protected aquifer(s). Refer to R309-113-6(1)(v) for the definition of a "protected aquifer."

(4) Special Conditions - Special scientific or engineering studies may be conducted to support a request for an exception (refer to R309-113-4) due to special conditions. These studies must be approved by DDW before the PWS begins the study. Special studies may include confined aquifer conditions, ground water movement through protective layers, wastewater transport and fate, etc.

(5) DWSP Delineation Report - Each PWS shall submit a DWSP Delineation Report to DDW for each of its ground-water sources using the Preferred Delineation Procedure or the Optional Two-mile Radius Delineation Procedure.

(a) Preferred Delineation Procedure - Delineation reports for protection zones delineated using the Preferred Delineation Procedure shall include the following information and a list of all sources or references for this information:

(i) Geologic Data - A summary description of the geology in the well and nearby area of the ground-water source of drinking water. This should include the formal or informal formation name(s), general rock type, grain sizes, sorting, degree of natural cementation, and description of fractures and solution cavities (size, abundance, spacing, orientation) and faults (brief description of location in or near the well, and orientation). Description of grain sizes, sorting, etc., can be obtained from surface hand samples or well cuttings; core samples and laboratory analyses are not necessary. Fractures, solution cavities, and faults should be described from surface outcrops or drill logs.

(ii) Well Construction Data - If the source is a well, the report shall include the well drillers log, elevation of the wellhead, borehole radius, casing radius, total depth of the well, depth and length of the screened or perforated interval(s), well screen or perforation type, casing type, method of well construction, type of pump, location of pump in the well, and the maximum projected pumping rate of the well.

(iii) Spring Construction Data - If the source is a spring or tunnel the report shall include a description or diagram of the collection area and method of ground-water collection.

(iv) Aquifer Data for New Wells - A summary report including the calculated hydraulic conductivity of the aquifer, transmissivity, hydraulic gradient, direction of ground-water flow, estimated effective porosity, and saturated thickness of the producing aquifer(s). The PWS shall obtain the hydraulic conductivity of the aquifer from a constant-rate aquifer test and provide the data as described in R309-106-5(6)(a). This report shall include graphs, data, or printouts showing the interpretation of the aquifer test.

(v) Aquifer Data for Existing Wells - A summary report including the calculated hydraulic conductivity of the aquifer, transmissivity, hydraulic gradient, direction of ground-water flow, estimated effective porosity, and saturated thickness of the producing aquifer(s). The PWS shall obtain the hydraulic conductivity of the aquifer from a constant-rate aquifer test using the existing pumping equipment. Aquifer tests using observation well are encouraged, but are not required. If a previously performed aquifer test is available and includes the required data described below, data from that test may be used instead. This report shall include graphs, data, or printouts showing the interpretation of the aquifer test.

If a constant-rate aquifer test is not practical, then the PWS shall obtain hydraulic conductivity of the aquifer using another appropriate method, such as data from a nearby well in the same aquifer, specific capacity of the well, published hydrogeologic studies of the same aquifer, or local or regional ground-water models. A constant-rate test may not be practical for such reasons as insufficient drawdown in the well, inaccessibility of the well for water-level measurements, or insufficient overflow capacity for the pumped water.

The constant-rate test shall:

(A) Provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours. Stabilized drawdown is achieved when there is less than 0.5 foot of change of ground-water level in the well within a six-hour period.

(B) Provide data as described in R309-106-5(6)(a)(v) through (vii).

(vi) Additional Data for Observation Wells - If the aquifer test is conducted using observation wells, the report shall include the following information for each observation well: location and surface elevation; total depth; depth and length of the screened or perforated intervals; radius, casing type, screen or perforation type, and method of construction; prepumping ground-water level; the time-drawdown or distance-drawdown data and curve; and the total drawdown.

(vii) Hydrogeologic Methods, Procedures, and Calculations - These include the hydrogeologic method used to delineate the protection zones, all applicable equations, values, and the calculations which determine the delineated boundaries of zones two, three, and four.

(viii) Map Showing Boundaries of the DWSP Zones - A 1:24,000 scale map showing the location of the ground-water source of drinking water and the boundary for each DWSP zone. Although zone one (100-foot radius around the well or margin of the collection area) need not be on the map, the boundaries for zones two, three, and four must be drawn and labeled. More detailed maps are encouraged, but are optional.

The PWS shall also include a written description of the distances which define the delineated boundaries of zones two, three, and four. These

written descriptions must include the maximum distances upgradient from the well, the maximum distances downgradient from the well, and the maximum widths of each protection zone.

(b) Optional Two-Mile Radius Delineation Procedure - Delineation Reports for protection areas delineated using the Optional Two-mile Radius Delineation Procedure shall include the following information:

(i) Map Showing Boundaries of the DWSP Management Area - A 1:24,000 scale map showing the location of the ground-water source of drinking water and the DWSP management area boundary. Although zone one (100-foot radius around the well or margin of the collection area) need not be on the map, the two-mile radius must be drawn and labeled. More detailed maps are encouraged but are optional.

(ii) Hydrogeologic Report for Potential Contamination Sources - Unless the PWS chooses the option in R309-113-9(5)(b)(iii) below, it shall submit a hydrogeologic report for each potential contamination source within zone one and the management area. This report must explain the potential for contamination to move from the contamination source to the ground-water source and its potential impact on the drinking water quality of the ground-water source.

(iii) Hydrogeologic Report Not Required - A hydrogeologic report for pollution sources within zone one and the management area is not required if these pollution sources implement design standards which prevent contaminated discharges to ground water. Additionally, a hydrogeologic report is not required for potential contamination sources if the PWS meets the requirements in R309-113-11 and 12.

(6) Protected Aquifer Conditions - If a PWS chooses to verify protected aquifer conditions, it shall submit the following additional data to DDW for each of its public-supply wells for which the protected aquifer conditions apply:

(a) Thickness, depth, and lithology of the protective clay layer;

(b) data to indicate the lateral continuity of the protective clay layer over the extent of zone two. This may include such data as correlation of beds in multiple wells, published hydrogeologic studies, stratigraphic studies, potentiometric surface studies, and so forth; and

(c) evidence that the well has been grouted or otherwise sealed through the protective clay layer in accordance with R309-106-5(5)(g) and R309-113-6(1)(v).

R309-113-10. Potential Contamination Source Inventory and Identification and Assessment of Controls.

(1) Prioritized Inventory of Potential Contamination Sources - Each PWS shall list all potential contamination sources within each DWSP zone or management area in priority order and state the basis for this order. This priority ranking shall be according to relative risk to the drinking water source. Additionally, each PWS shall identify each potential contamination source as to its location in zone one, two, three, four or in a management area and plot it on the map required in R309-113-9(5)(a)(vii) or R309-113-9(5)(b)(i).

(2) List of Potential Contamination Sources - A List of Potential Contamination Sources is found in Chapter Three of the "Source Protection User's Guide." This document may be obtained from DDW. This list may be used by PWSs as a guide to inventorying potential contamination sources within their DWSP zones and management areas.

(3) Refining, Expanding, Updating, and Verifying Potential Contamination Sources - Each PWS shall update its list of potential contamination sources to show current conditions within DWSP zones or management areas. This includes adding potential contamination sources which have moved into DWSP zones or management areas, deleting potential contamination sources which have moved out, improving available data about potential contamination sources, and all other appropriate refinements.

(4) Identification of Current Controls - The PWS shall list each of the current controls that are in effect for each potential contamination source. Refer to Appendix E of the "Source Protection User's Guide" for a list of government agencies and the programs they administer to control potential contamination sources. This guide may be obtained from DDW.

(5) Assessment of Current Controls - The PWS shall assess whether current controls are stringent enough to prevent pollution from a potential contamination source from reaching a ground-water source of drinking water.

For the purpose of meeting the requirements of R309-113, DDW will consider a PWS's assessment that a potential contamination source which is covered by a permit or approval under one of the regulatory programs listed below sufficient to demonstrate that the source is adequately controlled unless otherwise determined by the Executive Secretary. For all other state programs, the PWS's assessment is subject to review by DDW; as a result, a PWS's DWSP Plan may be disapproved if DDW does not concur with its assessment(s).

In determining if a potential contamination source is permitted or approved under these programs, the PWS should contact the state agency responsible for these programs. In the event that a potential contamination source is contacted directly, the PWS should understand that they are usually under no obligation to furnish requested information.

(a) The Utah Ground Water Quality Protection program established by Section 19-5-104 and R317-6;

(b) closure plans or Part B permits under authority of the Resource Conservation and Recovery Act (RCRA) of 1984 regarding the monitoring and treatment of ground water;

(c) the Utah Pollutant Discharge Elimination System (UPDES) established by Section 19-5-104 and R317-8;

(d) the Underground Storage Tank Program established by Section 19-6-403 and R311-200 through R311-208; and

(e) the Underground Injection Control (UIC) Program for classes I-IV established by Sections 19-5-104 and 40-6-5 and R317-7 and R649-5.

(6) Assessment Determines Source to be Adequately Controlled - If the assessment in R309-113-10(5) determines that a particular potential contamination source is adequately controlled, the PWS shall report this appraisal in the DWSP Plan and indicate that no further land management strategies will be proposed or implemented unless conditions change.

R309-113-11. Management Program to Control Each Preexisting Potential Contamination Source.

(1) PWSs shall plan land management strategies to control each preexisting potential contamination source in accordance with their authority and jurisdiction. Land management strategies must be consistent with the provisions of R309-113, designed to control potential contamination, and may be regulatory or non-regulatory. Each potential contamination source listed on the inventory required in R309-113-10(1) and assessed as "not adequately controlled" must be addressed. Land management strategies must be implemented according to the schedule required in R309-113-7(1)(e).

(2) PWSs with overlapping protection zones and management areas may cooperate in controlling a particular preexisting potential contamination source if one PWS will agree to take the lead in planning and implementing land management strategies and the remaining PWS(s) will assess the preexisting potential contamination source as "adequately controlled."

R309-113-12. Management Program to Control or Prohibit Future Potential Contamination Sources for Existing Drinking Water Sources.

PWSs shall plan land management strategies to control or prohibit future potential contamination sources within each of its DWSP zones or management areas consistent with the provisions of R309-113 and to an extent allowed under its authority and jurisdiction. Land management strategies must be designed to control potential contamination and may be regulatory or non-regulatory. Additionally land management strategies must be implemented according to the schedule required in R309-113-7(1)(e).

Protection areas may extend into neighboring cities, towns, and counties. Since it may not be possible for some PWSs to enact regulatory land management strategies outside of their jurisdiction, except as described below, it is recommended that these PWSs contact their neighboring cities, towns, and counties to see if they are willing to implement protective ordinances to prevent ground-water contamination under joint management agreements.

Cities and towns have extraterritorial jurisdiction in accordance with section 10-8-15 of the Utah Code Annotated to enact ordinances to protect a stream or "source" from which their water is taken... "for 15 miles above the point from which it is taken and for a distance of 300 feet on each side of such stream..." Section 10-8-15 includes ground-water sources.

Zoning ordinances are an effective means to control potential contamination sources that may want to move into protection areas. They allow PWSs to prohibit facilities that would discharge contaminants

directly to ground water. They also allow PWSs to review plans from potential contamination sources to ensure there will be adequate spill protection and waste disposal procedures, etc. If zoning ordinances are not used, PWSs must establish a plan to contact potential contamination sources individually as they move into protection areas, identify and assess their controls, and plan land management strategies if they are not adequately controlled.

R309-113-13. New Ground-water Sources of Drinking Water.

(1) Prior to constructing a new ground-water source of drinking water, each PWS shall develop a Preliminary Evaluation Report or a DWSP Plan which demonstrates whether the source meets the requirements of this section and submit it to DDW. PWSs shall submit Preliminary Evaluation Reports or DWSP Plans and other required information in accordance with R309-106-5(2) or R309-106-6(2) to DDW concurrently; review of source protection reports and engineering specifications by DDW shall also be conducted concurrently. DDW will not grant plan approval to a PWS in accordance with R309-106-5(2) or R309-106-6(2) until the requirements set forth in this section are also met. Construction standards relating to protection zones and management areas (fencing, diversion channels, sewer lines, and grouting, etc.) are found in R309-106. After the source is constructed a DWSP Plan shall be developed, submitted, and implemented accordingly. Land use agreement requirements are also identified.

(2) Preliminary Evaluation Report for New Sources of Drinking Water - Preliminary Evaluation Reports shall cover all four zones or the entire management area. PWSs shall include the following five sections in each Preliminary Evaluation Report:

(a) Delineation Report for Estimated DWSP Zones - PWSs shall use the Preferred Delineation Procedure to delineate protection zones for new wells. The same requirements apply as in R309-113-9(5), except that the hydrogeologic data for the Preliminary Evaluation Report may be obtained from surrounding wells, published information, surface geologic mapping, or best available data.

(b) Inventory of Potential Contamination Sources and Identification and Assessment of Controls - The same requirements apply as in R309-113-10(1).

(c) Management Program to Control Each Preexisting Potential Contamination Source - The same requirements apply as in R309-113-11.

(d) Management Program to Control or Prohibit Future Potential Contamination Sources for New Drinking Water Sources in accordance with R309-113-13(4). Land use agreements obtained in conjunction with Preliminary Evaluation Reports may be notarized "letters of intent" from the owner. These letters must include the language required in a land use agreement and a statement that the owner will record a land use agreement with the county recorder's office if the source proves to be an acceptable source. A copy of the land use agreement which has been recorded with the county recorders office must be submitted to DDW and an approval letter must be issued before the PWS will be permitted to introduce the new source into its public system.

(e) Land Ownership Map - A land ownership map which includes all land within zones one and two or the entire management area.

(3) DWSP Plan for New Sources of Drinking Water - If a Preliminary Evaluation Report was developed, the PWS shall submit a DWSP Plan in accordance with R309-113-7(1) for any new ground-water source of drinking water within one year after the date of DDW's concurrence letter. In developing this DWSP Plan, PWSs shall refine the information in the Preliminary Evaluation Report by applying any new, as-constructed characteristics of the source (i.e., pumping rate, aquifer test, etc.).

(4) Management Program to Control and Prohibit Future Potential Contamination Sources for New Drinking Water Sources - PWSs shall plan land management strategies to control or prohibit future potential contamination sources within each of their DWSP zones and management areas consistent with the provisions of R309-113 and to an extent allowed under their authority and jurisdiction. Land management strategies must be designed to control potential contamination and may be regulatory or non-regulatory. Land management strategies must be implemented according to the schedule required in R309-113-7(1)(e).

Zoning ordinances are an effective means to control potential contamination sources that may want to move into protection areas. They allow PWSs to prohibit facilities that would discharge contaminants directly to ground water. They also allow PWSs to review plans from potential contamination sources to ensure there will be adequate spill protection and waste disposal procedures, etc. If zoning ordinances are not used, PWSs must establish a plan to contact potential contamination sources individually as the move into protection areas, identify and assess their controls, and plan land management strategies if they are not adequately controlled. PWSs shall enact the following restrictions:

(a) Additional Requirements for Protection Areas Delineated using the Preferred Delineation Procedure in Protected Aquifers - A PWS shall not locate a new ground-water source of drinking water where a potential contamination source exists within zone one. Additionally, the PWS shall prohibit the future location of any potential contamination sources within zone one. These restrictions shall be accomplished through zoning controls or land use agreements with the land owner(s).

(b) Additional Requirements for Protection Areas Delineated using the Preferred Delineation Procedure in Unprotected Aquifers:

(i) Zone One - The same requirements apply as in R309-113-13(4)(a).

(ii) Zone Two - PWSs shall not locate a new ground-water source of drinking water where a pollution source exists within zone two in an unprotected aquifer unless the pollution source implements design standards which prevent contaminated discharges to ground water. Additionally, PWSs shall prohibit the future location of pollution sources within zone two unless the pollution source implements design standards which prevent contaminated discharges to ground water. These restrictions shall be accomplished through zoning controls or land use agreements with the land owner(s).

(c) Additional Requirements for Management Areas Delineated using the Optional Two-Mile Radius Delineation Procedure in Unprotected Aquifers:

(i) Zone One - The same requirements apply as in R309-113-13(4)(a).

(ii) DWSP Management Area - PWSs shall not locate a new spring where a pollution source exist within a management area unless: the hydrogeologic report in R309-113-9(5)(b)(ii) verifies that it does not impact the spring; or the pollution source implements design standards which prevent contaminated discharges to ground water.

Additionally, PWSs shall prohibit the future location of any pollution source unless: the hydrogeologic report in R309-113-9(5)(b)(ii) verifies that it will not impact the ground water source; or the pollution source implements design standards which prevent discharges to ground water. These restriction shall be accomplished through zoning controls or land use agreements with the land owner(s).

(5) Sewers Within DWSP Zones and Management Areas - The Executive Secretary may permit sewer lines within DWSP zones and management areas if precautions in accordance with R309-106-5(4)(b) are taken.

R309-113-14. Contingency Plans.

PWSs shall submit a Contingency Plan which includes all sources of drinking water for their entire water system to DDW concurrently with the submission of their first DWSP Plan. Guidance for developing Contingency Plans may be found in Chapter Five of the "Source Protection User's Guide." This document may be obtained from DDW.

KEY: drinking water, environmental health
July 26, 1995 19-4-104(1)(a)(iv)

SOURCE PROTECTION

USER'S GUIDE

October 1998

STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF DRINKING WATER

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

INTRODUCTION

Protecting wells and springs is critical because they are vulnerable to contamination. The best way to protect a drinking water source is to develop and carry out a Drinking Water Source Protection (DWSP) plan. If you follow the advice in this User's Guide, it will help you gather important information about your drinking water sources and identify the potential contamination sources (PCSs) which threaten them. This information will, in turn, help you plan strategies to protect your wells and springs.

It is the responsibility of PWSs to protect their wells and springs from contamination. The purpose of the DWSP Rule is to provide the procedure for PWSs to fulfill this responsibility. The Division of Drinking Water (DDW) does not have the authority to control the activities of PCSs. However, city, town, and county governments do. Local governments can protect wells and springs from contamination by passing ordinances to control land use within protection zones. If local government is unable or unwilling to provide protection for PWSs, these protection issues may be addressed through other means, such as land ownership, land use agreements, and public education programs.

There are other reasons for establishing source protection. A quality source of drinking water is a source of community pride. Sources of drinking water are valuable community assets and protecting them protects the capital the community has invested in them. It is very difficult and usually illegal for local government to restrict a potentially polluting activity just as its development plans are made public, especially if they comply with current zoning ordinances. Source protection plans anticipate potential problems and establish a process for dealing with them.

Source Protection User's Guide

This User's Guide is divided into two parts: Part I, provides guidance for writing a Preliminary Evaluation Report for proposed new wells, springs, and tunnels; Part II, provides guidance for writing DWSP Plans for existing wells, springs, and tunnels and for new sources with PERs that have been approved within the last year.

Submittal Schedule for Proposed Wells and Springs

Submit a Preliminary Evaluation Report (PER) and construction specifications to DDW for each new well, spring, or tunnel for review and approval before construction begins. A new source is any source for which plans and specification were submitted after July 26, 1993. A refined report that meets the requirements of a DWSP plan must then be submitted to us within one year of when the PER approval letter is dated. Refer to Chapters 1& 2, for information on developing a PER for new sources.

Submittal Schedule for Existing Wells and Springs

A source protection plan must be submitted for each existing well, spring, and tunnel which is used by a PWS to supply their system except sources which are under the influence of surface water and are treated in accordance with the Surface Water Treatment Rule. Compliance with this rule is voluntary for **existing** ground-water sources of drinking water which are used by public (transient) non-community water systems. However, please be aware that this Rule does apply to non-transient, non-community water systems. Refer to Chapter 3, for information on developing a DWSP Plan for existing sources. The following table identifies the deadlines for submitting DWSP plans for *all other existing* ground-water sources of drinking water:

Population Served by PWS:	Percent of Sources:	DWSP plans Due by:
Over 10,000	50% of Existing Wells	December 31, 1995
Over 10,000	100% of Existing Wells	December 31, 1996
3,300 - 10,000	100% of Existing Wells	December 31, 1997
Less than 3,300	100% of Existing Wells	December 31, 1998
Existing Springs & Other Sources	100%	December 31, 1999

TABLE 1 - Submit DWSP plans for *existing* wells and springs according to this schedule.

Consulting Services

If you choose to employ the services of a consultant to assist you in source protection, be sure to specify that you require a plan that is written for you; demand one that is easy to understand. You should be specific about which sections you want them to write and which ones you want to write. It is especially critical that you have input in developing the management sections of the plan. Additionally, you should be able to tell exactly what you need to do to implement the plan. The implementation schedule is one of the most important sections of the DWSP plan because it is a summary list containing every land management strategy and beginning implementation date that is to be carried out by the PWS. Tables and checklist are also very important for summarizing many of the other sections of an effective DWSP plan.

The Source Protection Team

We strongly recommend that you form a source protection team to assist you in developing and carrying out the management strategies of source protection. This is because the most successful source protection programs across the United States have been planned by teams. A team will help ensure that your source protection plan works. Refer to Appendix C for information about putting a source protection team together.

Partial Reimbursement for DWSP Plans

Small PWSs serving populations less than 3,300 may be eligible for 50%, not to exceed $2,500, of the actual costs for each ground-water source of drinking water for which they prepare and submit to DDW a complete DWSP Plan. To be eligible for these funds, a small PWS must:

- Have been in existence as of the initial effective date of R309-113 (July 26, 1993);
- have more than 50 percent of the dwelling units served by the system occupied by permanent, year-round residents;
- have a median adjusted gross income that is less than the state-wide median adjusted gross income for Utah; however, if a group of small PWSs located in the same geographic area selects a single consultant who prepares and submits all their source protection plans together, and at least 50% of the systems in the group meet this income level criterion, then all systems in the group, or the group as a whole, shall be deemed to meet this criterion;
- be a community water system, or a non-transient, non-community water system that is not associated with or owned by a for-profit entity, and is not owned/operated by a federal or state government agency; and
- submit complete DWSP Plans to DDW by the due dates indicated in R309-113-3.
- Additionally, only DWSP Plans prepared for drinking water sources that were existing (approved by DDW) as of July 26, 1993 shall be eligible for these funds.

Please call DDW at (801) 536-4200, to request an application if you are eligible for these funds and would like to be partially reimbursed for your DWSP plans.

Additional Resources

We have tried to address the specific needs of PWS personnel in this *Source Protection User's Guide*. We have not tried to separate what is mandatory from what is not. If you would like to know what is mandatory, please request a copy of the Drinking Water Source Protection Rule (R309-113, Utah Administrative Code). DDW has prepared a *Standard Report Format for New Wells and Springs* and a *Standard Report Format for Existing Wells and Springs* to assist PWSs in developing PERs and DWSP Plans. We strongly advise that you follow these formats to ensure that none of the important parts of these documents are left out. Call (801) 536-4200 to request the rule or the standard report formats.

Other guidance is also available. **Wellhead Protection:** A Guide for Small Communities, (EPA/625/R-93/002) may be obtained from the Environmental Protection Agency (EPA), along with other EPA references cited later in the User's Guide. To order EPA publications, call (800) 490-9198. Internet access for ordering EPA publications is found at "http://www.epa.gov/ncepihom/index.html."

Additional Source Protection Assistance

The Rural Water Association of Utah manages a program to help PWSs develop DWSP plans. Additionally, they periodically sponsor DWSP workshops and address DWSP topics in their annual and semi-annual conventions. Contact Ken Orton at (800) 649-0821.

The Utah Geological Survey may be able to help some communities with delineating their protection zones. Contact Mark Jensen at (801) 536-4199, if you would like to request this assistance.

The U.S. Geological Survey may be able to help some communities in various aspects of delineating protection zones. Contact Jerry Spangler at (801) 975-3394.

Part I

PRELIMINARY EVALUATION REPORTS FOR PROPOSED NEW GROUND WATER SOURCES

Use this part of the User's Guide to develop a Preliminary Evaluation Report for proposed new wells, springs, and tunnels. Remember that this report must be reviewed and approved before you begin constructing these sources. Preliminary Evaluation Reports must be refined to meet the requirements of Drinking Water Source Protection plans within one year of their approval date. Part II, contains the guidance to develop Drinking Water Source Protection Plans.

CHAPTER 1 - THE PRELIMINARY EVALUATION REPORT

A Preliminary Evaluation Report (PER) is required for all new wells, springs, and tunnels which are used as sources of drinking water by public water systems (PWSs) except for replacement wells and sources which are under the direct influence of surface water. The PER and the Engineering Plans and Specifications should be submitted concurrently allowing for concurrent review. The Division of Drinking Water (DDW) will not grant approval to begin construction, and subsequently, to use a source until both of these documents are reviewed and approved.

Replacement Wells

A PER is not required for proposed wells, if the PWS receives written notification from DDW that the well is classified as a replacement well. The PWS must submit a letter requesting that the well be classified as a replacement well and include documentation to show that the following definition and conditions are met: Replacement well means a public-supply well drilled for the sole purpose of replacing an existing public-supply well which is impaired or made useless by structural difficulties and in which the following conditions are met:

- The proposed well location shall be within a radius of 150 feet from an existing ground-water supply well, as defined in R309-113-6(1)(j); and
- the PWS provides a copy of the replacement application approved by the State Engineer (refer to Section 73-3-28 of the Utah Code Annotated).

If a proposed well is classified as a replacement well, the PWS is still required to submit: A Drinking Water Source Protection (DWSP) Plan in accordance with R309-113-13(6); and the Outline of Well Approval Process (refer to R309-204-6(5)).

PERs are Due Before the Source is Developed

One of the purposes of the source protection program is to ensure that PWSs will have the ability to protect their proposed new wells and springs *before* they are constructed. Because of this, PERs and construction specifications must be submitted to DDW before a new source is constructed. A detailed description of what to include in a PER is included in *The Standard Report Format for New Wells and Springs*, call us at 536-4200, if you would like to request a copy of this document. It is very important that the PER be approved before construction begins. ***PWSs take an enormous risk if they drill a well or develop a spring before its PER is approved. The money that has been invested in the construction cost of a new source may be lost if a subsequent review of the PER reveals that it cannot be approved.***

If a new public source of drinking water is being planned for a system, approval from DDW and a permit from the Division of Water Rights (DWR) is required. ***It is very important to obtain <u>both</u> an approval from DDW and a permit from DWR <u>before</u> the well is drilled.*** R309-113-13(1) states: "PWSs shall submit PERs and Engineering Plans and Specifications to DDW concurrently; review by DDW shall also be conducted concurrently. DDW will not grant plan approval to a PWS

in accordance with R309-204-6(5) until the requirements set forth in this section are met." A new source development rule (R309-204-6(5)) became effective on January 1, 1998, and replaced the old one in R309-106-5(2).

Purpose of Preliminary Evaluation Reports

PERs and Drinking Water Source Protection (DWSP) Plans are the primary means for PWSs to use to protect their sources of drinking water from contamination. These documents should not be developed just to meet the "letter of the law" required by the Rule. ***They should be working documents that will be used on a regular basis by the PWS. The DWSP plan should be written as a "how-to" handbook for a water system to protect their sources of drinking water now and in the future.*** They should be logical and the protection strategies should be easily understood.

Drinking Water Source Protection Plans

The PER must be refined to meet the requirements of a Drinking Water Source Protection (DWPS) Plan within one year of the date of the PER approval letter. Additional sections and specific information regarding the properties of the source and any changes to the protection zones must be included in the DWSP. Part II, of this guide will give you the specific information required to develop the DWSP plan.

Delineation Procedure for New Wells

The Preferred Delineation Procedure must be used to delineate protection zones for new wells.

Protected and Unprotected Aquifers

New wells are no longer classified as *deep* or *shallow*. The Rule now classifies them as being in *protected* or *unprotected* aquifers. New wells in protected aquifers are required to have land use agreements for zone one (refer to Chapter 4, for an explanation of protection zones). New wells in unprotected aquifers are required to have land use agreements for zones one and two. This is because unprotected aquifers are more vulnerable to contamination. Land use agreements assure that land owners are willing to safeguard your water sources by agreeing not to locate uncontrolled PCSs or pollution sources within specified areas.

To be classified as a well in a protected aquifer the following conditions must be met:

1. A naturally protective layer of clay, at least 30 feet in thickness, is present above the aquifer;

2. the PWS provides data to indicate the lateral continuity of the clay layer throughout the extent of zone two; and

3. the public-supply well is grouted with a grout seal that extends from the ground surface down to at least 100 feet below the surface, and through the protective clay layer.

Required Sections of a PER

An explanation of each section of a PER follows:

The Delineation Report (refer to Chapter 4) - The delineation report describes the protection zones and the scientific procedures which are used to define them. Because there is no specific information available from the proposed well, such as an aquifer test, the best available data may be used to determine the protection zones. The zones should be developed keeping in mind that they may change when more specific information about the aquifer is available after the well is drilled and tested.

The Inventory of Potential Contamination Sources (refer to Chapter 5) - The inventory is a prioritized list of all of the PCSs within the protection area. DDW cannot approve a source for public use if there are uncontrolled PCSs in Zone 1 of a well in a protected aquifer or if there are uncontrolled PCSs in zone 1 or pollution sources that cannot be controlled by design standards in Zone 2 of a well or spring in an unprotected aquifer.

Sewer lines that have at least five feet of suitable soil under them are permitted if they are set back at least 10 feet from the well and are specially constructed within zone one in accordance with R309-204-6(4). Suitable soils contain adequate sand/silt/clay to act as an effective effluent filter within its depth for the removal of pathogenic organisms and fill the voids between coarse particles such as gravel, cobbles, and angular rock fragments.

Sewer lines that have unsuitable soil within five feet under them must be set back from the well or spring at least 300 feet and be specially constructed within zones one and two in accordance with R309-204-6(4). Unsuitable soil is defined as soil that is so large grained that it will not treat wastewater, is saturated by seasonal ground water, or is bedrock.

Land Ownership Map And List - A land ownership map which includes all land within zones one and two or the entire management area is required. Additionally, a list which exclusively identifies the land owners in zones one and two or the management area and specifies the zone or management area in which they own land is required. A land ownership map and list are not required if ordinances are used to protect these zones.

Land Use Agreements, Letters Of Intent, Or Zoning Ordinances - Land use agreements are required in zone one for wells in protected aquifers. They are also required in zones one and two for wells in unprotected aquifers and for springs. Land use agreements must be in writing wherein an owner agrees not to locate uncontrolled PCSs within zone one. Additionally, an owner must agree not to locate pollution sources in zone two unless design standards are implemented to prevent contaminated discharges. Any restrictions must be binding on all heirs, successors, and assigns and must be recorded with the property description in the local county recorder's office. This provision applies even if the land owner and the PWS are the same person. Copies of this recording must be submitted to DDW.

Land use agreements on publicly owned lands need not be recorded in the county recorder's office. However, a written statement from the administrator is required. This statement must contain the same information for land use agreements that is described above.

Two examples of land use agreements follow. The first is for a well in an unprotected aquifer:

1. I(we), the undersigned landowner(s), acknowledge the Drinking Water Source Protection Plan for the Greenville, Utah, Big Well. We agree not to locate or allow the location of any uncontrolled potential contamination sources, as defined in R309-113-6(1)(u) of the Utah Administrative Code, within zone one. We also agree not to locate or allow the location of any pollution sources, as defined in R309-113-6(1)(t) of the Utah Administrative Code, within zone two unless design standards are implemented to prevent contaminated discharges. This agreement is binding on all heirs, successors, and assigns.

The second is for a spring in an unprotected aquifer:

2. The U. S. Forest Service acknowledges the Drinking Water Source Protection Plan for the Greenville, Utah, Bounty Spring. We understand that protection areas are delineated for this spring and agree not to allow any potential contamination sources, as defined in R309-113-6(1)(u) of the Utah Administrative Code, to be located within zone one. We also agree not to allow any pollution sources, as defined in R309-113-6(1)(t) of the Utah Administrative Code, within the two-mile radius management area unless design standards are implemented to prevent contaminated discharges or unless a hydrogeologic report shows that discharges will not affect the spring.

Letters of Intent to Record a Land Use Agreement - Notarized *letters of intent* from the land owner(s) may be used when initially submitting a PER. These letters must include the language required in a land use agreement and a statement that, *the owner(s) will record a land use agreement in the county recorder's office if the source proves to be an acceptable source.* A copy of the land use agreement which has been recorded in the county recorders office must be submitted to DDW and an approval letter must be issued before the PWS will be permitted to introduce the new source into its public system.

Zoning Ordinances - Zoning ordinances may be used in place of land use agreements if they contain the same restrictions as land use agreements. In other words, uncontrolled PCSs must be restricted from zone one for wells in protected and unprotected aquifers. Pollution sources that cannot be controlled by design standards must be restricted from zone two for wells and springs in unprotected aquifers. It is the responsibility of the PWS to cite and quote references and interpret the zoning ordinance to substantiate these restrictions. Please do not send a zoning ordinance and expect DDW to do this research.

Waivers (only required if you want to maintain or apply for waivers) - You must submit verification that certain pesticides and VOCs are not used within zones one, two, and three

to be eligible for a Use Waiver for a new well. These pesticides and VOCs are identified in the *Water Quality Maximum Contaminant Levels, Rule R309-103 Summary*. Guidance for obtaining these waivers is included in Chapter 11. If pesticides and VOCs are used within zones one, two, and three, you may be eligible for a Susceptibility Waiver; however, you can only apply for Susceptibility Waivers in the DWSP plan that is due within one year after the PER is approved.

CHAPTER 2 - CHECKLIST FOR LOCATING AND DEVELOPING A NEW DRINKING WATER SOURCE

In addition to finding water, there are other things to consider when locating a well.

To Do Before Construction

☐ **Preliminary Evaluation Report**

☐ **Delineation Report** - The expertise of a ground-water professional is usually required to develop a delineation report. This report will provide the public water system (PWS) with a map that delineates the four protection zones required by the Drinking Water Source Protection Rule (R309-113 of the Utah Administrative Code). It will also report whether the well is in a protected or an unprotected aquifer.

Is the well located in a protected aquifer?

Consideration: If a new well is located in a protected aquifer, land use agreements that restrict uncontrolled potential contamination sources (PCSs) are only needed in zone one. If the well is located in an unprotected aquifer, land use agreements that restrict pollution sources, unless they can be controlled by design standards, are also needed in zone two.

Consideration: Protected aquifer status is the most important consideration when the Division of Drinking Water evaluates the system's eligibility for a pesticide and/or VOC susceptibility reduced monitoring waiver.

☐ **Inventory of Potential Contamination Sources** - An inventory which includes any facility or site which employs an activity or procedure which may potentially contaminate ground water. Further, for it to be a PCS, a hazardous substance is usually associated with the processes used at the facility. This includes use, storage, manufacture, transportation, and disposal of hazardous substances. They may be chemical, biological, or radiological.

Are there uncontrolled PCSs within zone one?

Consideration: A new well cannot be approved if there are uncontrolled PCSs within zone one.

Are there uncontrolled pollution sources within zone two?

Consideration: If a new well is located in an unprotected aquifer, it cannot be approved if there are uncontrolled pollution sources within zone two.

Are there sewer lines within zones one and two?

Consideration: Sewer lines that have at least five feet of suitable soil under them are permitted if they are set back at least 10 feet from the well and are specially

constructed within zone one in accordance with R309-204-6(4). If there are unsuitable soil conditions (ground water or bedrock) within 5 feet under any sewer lines they must be set back at least 300 feet from the well and be specially constructed within zone two.

Are there any PCSs on the inventory that may be impossible to control?

Consideration: Even though, public water systems may work with existing PCSs through memoranda of agreement, best management practices, and public education, etc., some may still be so difficult to control that the PWS may want to consider a different location for the well.

□ **Land Ownership Map** - A land ownership map which includes all land within zones one and two is required. Additionally, include a list which exclusively identifies the land owners in zones one and two or the management area, the parcel(s) of land which they own, and the zone(s) in which they own land. A land ownership map and list are not required if ordinances are used to protect these areas.

□ **Land Use Agreements, Letters of Intent, or Zoning Ordinances** - Land use agreements which meet the requirements of the definition in R309-113-6(1)(n) is required. Zoning ordinances which are already in effect or letters of intent may be substituted for land use agreements; however, they must accomplish the same level of protection that is required in a land use agreement. Letters of intent must be notarized, include the same language that is required in land use agreements, and contain the statement that "the owner agrees to record the land use agreement in the county recorder's office, if the source proves to be an acceptable drinking water source." The PWS shall not introduce a new source into its system until copies of all applicable recorded land use agreements are submitted to DDW.

Will the land owners within zone one (and zone two, if the well is in an unprotected aquifer) sign land use agreements? If the land owners will not sign land use agreements, are zoning restrictions possible?

Consideration: ***A new well cannot be approved without the necessary land use agreements or zoning restrictions.***

□ **Waivers** - A use waiver for the pesticide and/or VOC parameter groups may be issued if the chemicals in these parameter groups have not been used, disposed, stored, transported, or manufactured within zones one, two, and three for the past five years. Additionally, initial sampling must indicate that none of the chemicals within these parameter groups are present.

If a use waiver is not possible, the PWS may consider applying for a susceptibility waiver when the Drinking Water Source Protection Plan is submitted.

Are pesticides and VOCs used within zone three?

Consideration: Pesticide and VOC use waivers cannot be issued if pesticides and VOCs are used within zone three within the past five years.

- ☐ **Engineering Plans and Specifications** - Engineering plans and specifications governing well drilling must be prepared and submitted to the Engineering Section. The PER must be prepared and submitted to the Special Services Section. A letter which covers the approval of both the engineering plans and specifications and the PER must be received by the PWS before well drilling commences.

To Do During Construction

- ☐ **Grouting Inspection during Well Construction** - An engineer from DDW, or a district engineer from the Department of Environmental Quality, or an authorized representative of the State Engineer's Office shall be contacted at least three days before the anticipated beginning of the well grouting procedure (see R309-204-6(6)(i). The well grouting procedure shall be witnessed by one of these individuals or their designee.

To Do After Construction

The following applicable information must be submitted after the source is constructed in order for the PWS to obtain an Operation Permit which allows them to introduce a source into the system:

- ☐ A copy of the "Report of Well Driller";
- ☐ a copy of the letter certifying that the well was grouted in accordance with the well drilling specifications and the requirements of the R309-204;
- ☐ a copy of the pump test including the yield vs. drawdown test as described in R309-204-6(10)(b);
- ☐ a copy of the chemical analyses required by R309-204-4(5);
- ☐ documentation indicating that the water system owner has a right to divert water for domestic or municipal purposes from the well source;
- ☐ a copy of the complete plans and specifications covering the well equipment and diversion piping necessary to introduce the water form the well into the distribution system;
- ☐ a bacteriological analysis of the water obtained from the well after the installation of permanent equipment, disinfection, and flushing; and
- ☐ if *letter of intent* was submitted, then a copy of the recorded *land use agreement* must be submitted.

Part II

DRINKING WATER SOURCE PROTECTION PLANS

Use this part of the Source Protection User's Guide to develop Drinking Water Source Protection plans. The schedule for submitting plans is in the introduction. A concise description of what needs to be in each section of a plan is in the *Standard Report Format for Existing Wells and Springs*. Call us at 536-4200, to request a copy of this report.

CHAPTER 3 - THE DRINKING WATER SOURCE PROTECTION PLAN

A Drinking Water Source Protection (DWSP) plan is required for each well, spring, and tunnel which is used as a source by a public water system (PWS). There are two exceptions: 1) sources which are under the direct influence of surface water and are treated in accordance with the Surface Water Treatment Rule, and 2) compliance with this rule is voluntary for existing sources which are used by transient non-community water systems. Transient non-community systems must still submit and meet the requirements for Preliminary Evaluation Reports (PERs) and DWSP plans for any new sources that are developed. Also, be aware that source protection is required for non-transient, non-community systems. Additionally, PERs for new wells, springs, and tunnels must be refined to meet the requirements for DWSP plans within one year of the PER approval letter date. The submittal schedules for these source protection documents are found in the Introduction of this User's Guide. DWSP plans are briefly described below; a detailed description is in the *Standard Report Format for Existing Wells and Springs.* Call us at 536-4200, to request a copy of this document.

Purpose of Drinking Water Source Protection Plans

DWSP Plans are the primary means for PWSs to use to protect their sources of drinking water from contamination. These plans should not be developed just to meet the "letter of the law" required by the Rule. ***They must be working documents that will be used on a regular basis by the PWS. The DWSP plan should be written as a "how-to" handbook for the water system to protect their sources of drinking water now and in the future.*** They should be logical and easily understood. The implementation schedule is one of the most important sections of the DWSP plan because it is a summary list containing every land management strategy and beginning implementation date that is to be carried out by the PWS.

Required Sections of DWSP Plans

A brief explanation of each section of a DWSP plan follows:

The Delineation Report (refer to Chapter 4) - The delineation report describes the protection zones and the scientific procedures which are used to define them.

The Inventory of Potential Contamination Sources (refer to Chapter 5) - The inventory is a prioritized list of all of the PCSs within the protection area.

The Assessment of Potential Contamination Source Hazards (refer to Chapter 6) - The assessment allows you to determine which PCSs are adequately controlled and which are not.

The Management Program for Existing Potential Contamination Sources (refer to Chapter 7) - The program you develop to control each of the PCSs within your protection area.

The Management Program for Future Potential Contamination Sources (refer to Chapter 8) - The program you develop to control PCSs that may want to move into your protection areas.

The Implementation Schedule (refer to Chapter 9) - A summary list of the land management strategies you have identified in your management programs and the date you will begin to implement each of them.

The Resource Evaluation (refer to Chapter 9) - An assessment of the financial and other resources that you estimate will be required to carry out your DWSP plan. It also includes an evaluation of how you plan to acquire these resources.

The Recordkeeping Section (refer to Chapter 9) - A section of the plan for you to document the implementation of each land management strategy you identify in the Implementation Schedule. Documents may include zoning ordinances, codes, permits, memoranda of understanding, public education programs, land use agreements, etc.

The Contingency Plan (refer to Chapter 10) - A plan submitted concurrently with your first DWSP plan. It may address emergencies, rationing, cleanup, and new source development.

Pesticide and VOC Waivers (refer to Chapter 11) - Explains use and susceptibility monitoring waivers for pesticides and VOCs.

The remaining chapters and appendices of this User's Guide will help you ensure that each section of your DWSP plan is complete and fulfills the requirements of the DWSP Rule.

CHAPTER 4 - THE DELINEATION REPORT

A drinking water source protection area is the surface and subsurface area surrounding a well, spring, or tunnel through which contaminants are likely to move toward and contaminate the source. Hydrogeologic methods are available to define these drinking water source protection areas. These methods rely on scientific procedures to identify reasonably accurate source protection areas. Once source protection areas are delineated, the public water system (PWS) can focus their attention on inventorying potential contamination sources (PCSs) and strategies to control them.

Drinking Water Source Protection Zones

Two procedures to delineate source protection areas are described in Utah's DWSP Program: the Preferred Delineation Procedure and the Optional Two-Mile Radius Delineation Procedure. Thresholds for four zones are established by the Preferred Procedure:

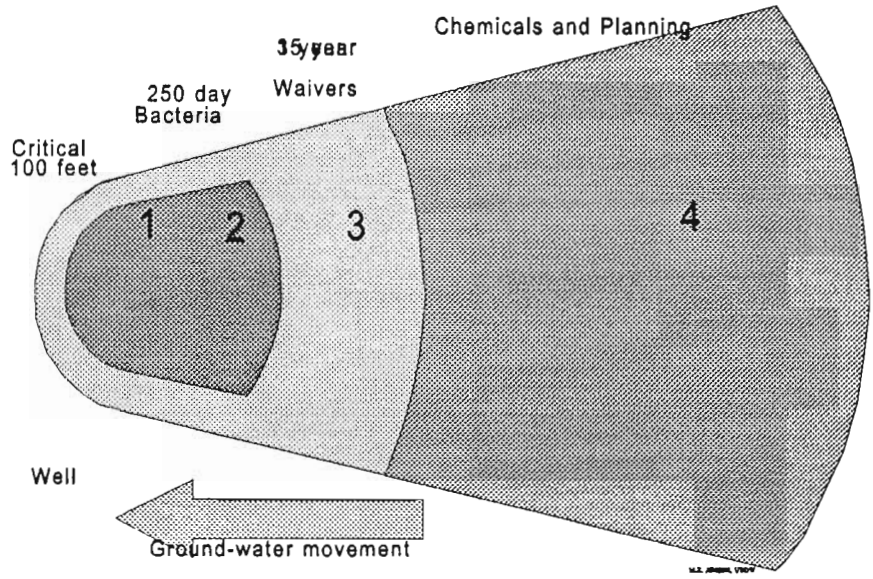
- *Zone One* is the area within a 100-foot radius from the wellhead or margin of the collection area.

- *Zone Two* is the area within a 250-day ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

- *Zone Three* (waiver criteria zone) is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. Zone three is a three year time-of-travel zone because use and susceptibility waivers must be renewed every three years. Refer to Chapter 11, for more information about waivers.

- *Zone Four* is the area within a 15-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

If the aquifer test or driller's log indicate a layer within the producing aquifer(s) with higher ground-water velocity, then time-of-travel calculations must be based on that layer.



The Optional Two-Mile Radius Delineation Procedure is best applied in remote areas where no PCSs threaten the ground water. This is because it is usually impractical to manage an area this large if there are very many PCSs located in it. **Additionally, the two-mile radius delineation procedure cannot be used for new wells.** One protection zone and a management area are established by the Optional Two-Mile Radius Delineation Procedure:

- *Zone One* is the area within a 100-foot radius from the well or margin of the collection area.
- *For Wells the DWSP Management Area* is the area outside the 100-foot radius and within the two-mile radius of a well. Land may be excluded from the DWSP management area at locations where it is more than 100 feet lower in elevation than the total drilled depth of the well.

- *For Springs and Tunnels the DWSP Management Area* is all land at elevations equal to or higher than, and within a two-mile radius of, the spring or tunnel collection area. The DWSP management area also includes all land lower in elevation than, and within 100 horizontal feet of, the spring or tunnel collection area. The elevation datum to be used is the point of water collection. Land can be excluded from the DWSP management area at locations where it is separated from the ground-water source by a surface drainage which is lower in elevation than the spring or tunnel collection area.

The Preferred Delineation Procedure

The Delineation Report which is developed using the preferred procedure includes a description of the geology in the area of the water source, construction and aquifer data, and a description of the hydrogeologic methods which were used. This information is then used to determine the boundaries of the source protection area. Refer to the *Standard Report Formats for Existing or New Wells and Springs* for more information.

Having an accurate preferred delineation may save you time and money as you complete further phases of your DWSP plan. The DWSP Rule does not require that ground-water professionals be certified; however, the delineation report is best completed by someone that is knowledgeable and has experience with ground water. The information required in it can be very technical, and hydrogeologic consulting services are recommended. Appendix A contains a list of consultants that may be able to help you. If you choose to employ a consultant to delineate your protection area, use the same care you would use in obtaining the services of any other professional firm. Also refer to R309-113-9(5)(a).

Delineation Reports for the Optional Two-Mile Radius Delineation Procedure

You should be able to develop the delineation report for the optional two-mile radius delineation procedure without the assistance of a hydrogeologic consultant, unless a hydrogeologic report is necessary for any of the PCSs within Zone one or the management area. The management area must be plotted on a map showing the location of the ground-water source of drinking water and the DWSP management area boundary. The base map shall be a 1:24,000-scale (7.5-minute series) topographic map, such as is published by the U.S. Geological Survey. Although zone one (100-foot radius around the well or margin of the collection area) need not be on the map, the complete two-mile radius must be drawn and labeled. More detailed maps are optional and may be submitted in addition to the map required above.

You have two options to address any PCSs located within the two-mile radius:

- The first is to assume that these PCSs could contaminate your ground-water source, then plan and implement land management strategies to control them.

- Otherwise, you must submit the hydrogeologic report for each PCS, as required in R309-113-9(5)(b)(ii). The purpose of this report is to determine if it is possible for a particular PCS to contaminate your well, spring, or tunnel. Hydrogeologic reports can be commissioned by

owners of PCSs to determine their potential to contaminate. If a report proves there is no potential to contaminate, there is no need to plan or implement control strategies.

CHAPTER 5 - THE INVENTORY OF POTENTIAL CONTAMINATION SOURCES

The inventory of potential contamination sources identifies the facilities within your protection zones that could possibly contaminate drinking water unless you plan and implement a protection program. Once you have an inventory of PCSs, it must be prioritized from the PCS that poses the greatest risk to the one that poses the least risk. Additionally, the location of each PCS must be identified and plotted on a map.

Potential Contamination Source Definition

Potential contamination source (PCS) means any facility or site which employs an activity or procedure which may potentially contaminate ground water. Further, for it to be a PCS, a hazardous substance is usually associated with the procedures employed at the facility. This includes use, storage, manufacture, transportation, and disposal of hazardous substances. They may be chemical, biological, or radiological. List only PCSs that are currently located within your protection zones; **don't list possible future PCSs, they are covered in Chapter 8.**

Survey Methods

Windshield, door-to-door, mail, and telephone surveys are some of the different types of surveys available to help you compile a complete inventory. Any reasonable survey method or combination of methods is acceptable. Use the type of survey that will meet your needs. However, be sure to use a survey form to conduct the survey. The Division of Drinking Water has one you may request at 536-4200, or you may design your own.

Surveys are designed by combining a number of discrete steps, including designing the survey, obtaining a list of contacts, mailing the survey or telephoning the contacts, following up on responses to the survey, and finally, tabulating and interpreting the results. Although windshield surveys may be time consuming, one study found that they identified the highest percentage of total sources among the source inventory methods that were used. Door-to-door surveys are ideal for gathering detailed inventories; although, it is usually necessary to train a service group, such as Retired Senior Volunteer Program (RSVP) members, to conduct the survey because of the large number of homes and businesses that usually need to be contacted.

Potential Contamination Source Inventory

Using your survey form and the following list as a guide, compile your list of PCSs. If you find other potentially contaminating activities that are not on this list, be sure to include them also:

1. Active and abandoned wells
2. Agricultural pesticide, herbicide, and fertilizer storage, use, filling, and mixing areas
3. Airport maintenance and fueling sites
21. Industrial manufacturers: chemicals,

4. Animal feeding operations with more than ten animal units

5. Animal watering troughs located near unfenced wells and springs that attrac livestock

6. Auto washes

7. Beauty salons

8. Boat builders and refinishers

9. Chemical reclamation facilities

10. Chemigation wells

11. Concrete, asphalt, tar, and coal companies

12. Dry cleaners

13. Farm dump sites

14. Farm maintenance garages

15. Feed lots

16. Food processors, meat packers, and slaughter houses

17. Fuel and oil distributors and storers

18. Furniture strippers, painters, finishers and appliance repairers

19. Grave yards, golf courses, parks, and nurseries

20. Heating oil storers

22. Industrial waste disposal/impoundmen areas and municipal wastewater treatment plants, landfills, dumps, an transfer stations

23. Junk and salvage yards

24. Laundromats

25. Machine shops, metal platers, heat treaters, smelters, annealers, and descalers

26. Manure piles

27. Medical, dental, and veterinarian offices

28. Mortuaries

29. Mining operations

30. Muffler shops

31. Pesticide and herbicide storers and retailers

32. Photo processors

33. Print shops

34. Radiological mining operations

35. Railroad yards

36. Research laboratories

48. Submersible pumps used to pump

37. Residential pesticide, herbicide, and fertilizer storage, use, filing, and mixing areas

38. Residential underground storage tank

39. Salt and sand-salt piles

40. Sand and gravel mining operations

41. School vehicle maintenance barns

42. Sewer lines

43. Single-family septic tank/drain-field systems

44. Sites of reported spills

45. Small engine repair shops

46. Stormwater impoundment sites and snow dumps

47. Subdivisions using subsurface wastewater disposal systems (large and individual septic tank/drain-field systems)

wells

49. Taxi cab maintenance garages

50. Tire shops

51. Toxic chemical and oil pipelines

52. Vehicle chemical supply storers and retailers

53. Vehicle dealerships

54. Vehicle quick lubes

55. Vehicle rental shops

56. Vehicle repair, body shops, and rust proofers

57. Vehicle service stations and terminals

58. Wood preservers

Data Bases

Data bases maintained by various agencies may also help you identify PCSs within your protection zones. These data bases may contain valuable information about PCSs within your protection zones. Other sources of information include old and new telephone books, assessors' maps and records, city business licenses, and aerial photographs. Other data bases may be available, these are some that we know about:

- *State Geographic Information Database (SGID)*: The Utah Automated Geographic Reference Center maintains this data base. It can tell you the locations of abandoned mines, CERCLA sites, RCRA sites, SARA Title III sites, underground storage tanks, class V injection wells, coal deposit sites, ground water permit sites, toxic release inventory sites, etc. There is a fee to obtain this information. This office is located in the State Office Building, 450 N Main, SLC, UT, and can be contacted at 538-3163.

- *Local Emergency Planning Committees*: These committees maintain information about toxic substances that are stored or used at PCS facilities. SARA Title III requires these committees to maintain information about toxic chemicals that are stored, used, or manufactured at these facilities above certain threshold amounts. The information they maintain is available to the public upon request. Local Emergency Planning Committees may also be able to furnish you with Material Safety Data Sheets (MSDSs). These information sheets provide information about the properties and health effects of the toxic chemicals used at these sites. If they can't furnish you with the specific MSDSs you need, the chemical manufacturer is required to provide them to you upon request. MSDSs are also available on the Internet, one site is located at "http://MSDS.PDC.CORNELL.EDU/issearch/msdssrch.htm." Refer to appendix E for a list of the Local Emergency Planning Committees in Utah.

- *The Division of Water Rights*: This division of state government maintains information about the locations of wells that have been drilled in Utah. Additionally, they maintain files containing the Report of Well Driller for these wells. This division is located at 1636 W North Temple, SLC, UT, and can be contacted at 538-7240.

- *The Department of Community and Economic Development*: This department publishes the *Directory of Business and Industry*. It contains listings for business and manufacturing firms that have more than ten employees. These listings are classified by a "standard industrial code." This department is located at 324 S State, SLC, UT, and can be contacted at 538-8700.

Even if information from data bases is readily available, the listings will only identify facilities that have complied with requirements to file notification or obtain permits. Other inventory approaches must be used to identify unpermitted facilities.

Point and Nonpoint Sources of Contamination

Point sources of pollution are usually easy to inventory because they are visible and discrete; nonpoint sources are diffuse and often hard to trace to their sources. Another characteristic of nonpoint source pollution is that it is usually not adequately controlled by rules or regulations. Since many of these types of potential sources are unregulated, your effort should be focused on locating and inventorying them so effective control measures can be planned. Following are some examples of both point and nonpoint PCSs that are usually not adequately controlled and are often difficult to locate and inventory:

- Petroleum and other toxic chemicals that are stored underground for certain uses or below certain threshold quantities.

- Petroleum and other toxic chemicals that are stored above ground.

- Light industry processes that store and use toxic chemicals, but do not produce a "waste stream." The storage and use of these chemicals by light industry also increases the potential for accidental spills involving transfers from one container to another or leaks caused by

rupture or corrosion of containers. Small spills or leaks in the same area over a long period of time have been linked to major contamination problems.

- On-site wastewater disposal systems (septic tanks/drain-fields) have controls on their construction and site locations, but very few controls on their maintenance or what is actually disposed in them. Improper disposal of toxic chemicals in septic systems have been sources of major contamination incidents. Despite efforts to regulate their placement and use, septic systems still represent the largest reported cause of ground-water contamination resulting in disease outbreaks in the United States.

- Water wells and other types of wells that have been improperly constructed, maintained, repaired, or abandoned may provide a conduit which can contaminate aquifers used for drinking water sources.

- Under certain geologic conditions, some pesticides applied to the land can leach to ground water even from normal application procedures.

- Pesticides may enter ground water through irrigation wells connected to chemigation systems unequipped with check valves to prevent back-siphonage of chemicals into the wells. When check valves are used at the wellhead to protect aquifers, they should be routinely tested and adequately maintained to ensure their integrity.

- Small but repeated pesticide spills over long periods of time in the same location by bulk handlers have been identified as significant sources of contamination.

- Fertilizers leaching into the ground water and increasing nitrate to high levels have been associated with methemoglobinemia ("blue-baby syndrome") in infants.

Hazards

Identifying potential sources of contamination is meaningless unless steps are taken to further identify the specific hazards employed at each facility. This information gathering step may be completed as the survey is carried out or you may choose to make a personal contact at a later time with a representative of the PCS. Hazardous substances may be chemical, biological, or radiological. They are usually labeled and display one or more of the following properties:

- Ignitable - capable of burning or causing a fire
- Corrosive - capable of eating away materials and destroying living tissue
- Explosive - capable of causing an explosion or releasing poisonous vapors when exposed to air, water, or other chemicals
- Toxic - capable of poisoning someone, either immediately (acutely toxic) or over a long period of time (chronically toxic)
- Radioactive - capable of damaging and destroying cells

Telephone contact is appropriate for some personal interviews to gather information about the hazards used certain PCSs; a site visit is valuable to help you understand the hazards at certain other facilities. There should be a place on your survey form to document hazard information. The personal interview is a critical step in the information gathering process. Don't try to avoid it by sending letters or by thinking that you understand the potential hazards at a particular potential contamination facility. This information must be accurate in order for control strategies to effectively prevent contamination. Also, a personal interview is an excellent opportunity for you to convey the idea that both the PWS and the PCS should be working toward the same ground-water protection goals. Do your best to avoid adversarial relationships because uncooperative PCS personnel may defeat some of your source protection goals.

The Priority Order

The list of PCSs is arranged in priority order to help direct your resources to activities that are the highest risk to your well or spring. Although, you must explain the basis for the way you prioritize the inventory, your judgement is usually all that is necessary to arrange this list into a priority order. **Managing Ground Water Contamination Sources in Wellhead Protection Areas - A Priority Setting Approach**, (EPA 570/9-91-023) or some other priority setting guidelines may be used to establish an order if, in your judgement, there are circumstances that require a more precise order.

Identify and Plot Location

The location of each actual PCS must be identified in the inventory (zone 1-4 or the management area) and be plotted on the delineation map.

Inventory Maintenance

Maintaining a list of PCSs is a continuous effort. This list should be updated often enough to ensure that it reflects current conditions in your protection areas. This includes adding PCSs that have moved into your protection areas, deleting sources that have moved out, and updating the data you are gathering to improve your knowledge about the potential sources in your protection areas.

There are four types of hazard controls: Regulatory, best management/pollution prevention, physical, and negligible quantity controls. PWSs are not required to plan and implement land management strategies for PCS hazards that are assessed as *adequately controlled*. Hazards that are assessed *adequately controlled* must be reassessed periodically to ensure that conditions do not worsen without your knowledge. A reassessment date must be established according to the instructions which follow.

Any hazard that is **not** assessed as *adequately controlled* will be considered to be *not adequately controlled*. Additionally, if the hazards at a PCS cannot be identified, the PCS must be assessed as *not adequately controlled*. Many PCS hazards have no controls and must to be assessed as *not adequately controlled*. Refer to Chapter 7, for a discussion about planning land management strategies for these PCSs. It is usually redundant to identify more than one hazard control; therefore, only one hazard control should be identified for each hazard. The instructions for assessing each type of control must be followed exactly or the assessment will be considered to be incomplete. Refer to Appendix D, for a list of government agencies and the programs they administer to control PCSs.

Regulatory Controls

Regulatory controls are the codes, ordinances, rules, and regulations, that are in effect to regulate a PCS hazard. The following six steps are required to assess a hazard as adequately controlled by a regulatory control:

1. Identify the enforcement agency.
2. Quote and/or cite specific references in the regulation, rule, or ordinance which pertain to controlling this hazard.
3. Explain how this regulatory control will prevent ground-water contamination.
4. Verify that this PCS hazard is actually being regulated by the enforcement agency.
5. Assess the hazard as *adequately controlled* and indicate that no further land management strategies will be planned and implemented unless conditions change.
6. Set a date to reassess this control.

Best Management and Pollution Prevention Practices

Identify the best management and pollution prevention practices that are currently being used by the PCS to control the hazardous substances at the facility. The following five steps are required to assess a hazard as adequately controlled by best management/pollution prevention practices:

1. List the best management /pollution prevention practice which are being used to control this hazard.
2. Indicate that PCS management is willing to continue the use of these best management/pollution prevention practices to prevent ground-water contamination.

3. Explain how these best management/pollution prevention practices will prevent ground-water contamination.
4. Assess the hazard as *adequately controlled* and indicate that no further land management strategies will be planned and implemented unless conditions change.
5. Set a date to reassess this control.

Physical Controls

Physical controls are man-made structures and impoundments, such as spill protection, that are in place to prevent a hazard from entering the ground water. The following four steps are required before you can assess a hazard as adequately controlled by a physical control:

1. Identify the physical control(s) which has been constructed to control this hazard.
2. Explain how these controls prevent contamination.
3. Assess the hazard as *adequately controlled* and indicate that no further land management strategies will be planned and implemented unless conditions change.
4. Set a date to reassess this control.

Negligible Quantity Controls

Negligible quantity controls refer to the amount or toxicity of a hazardous substance that is used by a PCS at their facility. It means that the risk of ground-water contamination is so negligible that it is not worth the time and effort to plan land management strategies to control it. The following four steps are required before you can assess a hazard as adequately controlled by a physical control:

1. Identify the hazardous substance and the quantity that is being used, disposed, stored, or transported.
2. Explain why this amount should be considered a negligible quantity.
3. Assess the hazard as *adequately controlled* and indicate that no further land management strategies will be planned and implemented unless conditions change.
4. Set a date to reassess this control.

Once you have separated the *adequately controlled* PCSs from the *not adequately controlled* PCSs, you can begin to plan land management strategies for the ones that are *not adequately controlled*. You need to plan land management strategies for each one of these. The next chapter discusses The Management Plan for Existing PCSs.

CHAPTER 7 - THE MANAGEMENT PROGRAM FOR EXISTING POTENTIAL CONTAMINATION SOURCES

The Rule requires that land management strategies be planned for potential contamination source (PCS) hazards that are *not adequately controlled.* Public water systems (PWSs) have complete discretion to choose the land management strategies that will work best for them. The Division of Drinking Water (DDW) understands that these are local problems that require local solutions. We will not disapprove a plan because we disagree with management strategies. We may offer suggestions, but the PWS must be responsible to make the final decisions about the land management strategies it implements.

Regulatory and Non-regulatory Land Management Strategies

Land management strategies may be either regulatory or non-regulatory. Some examples of regulatory land management strategies are zoning and subdivision ordinances, site plan reviews, design and operating standards, and source prohibitions. Some examples of non-regulatory land management strategies are public education programs, purchase of property or development rights, household hazardous waste collection programs, ground-water monitoring, water conservation programs, memoranda of understanding, and written contracts and agreements. Refer to **Wellhead Protection Programs:** Tools For Local Governments, (EPA 440/6-89-002) for more information.

Don't make the mistake of thinking that the most effective land management strategies will always be regulatory. Remember that regulations usually require enforcement and there are many activities that are very difficult to enforce. These include pesticide and fertilizer application, waste disposal in septic tanks, the use and disposal of household hazardous waste, etc. Public education programs and memoranda of understanding which identify specific BMPs are much more effective in addressing these types of activities.

Best Management Practices for Commercial, Industrial, and Agricultural PCSs

Commercial, industrial, and agricultural PCSs that have been assessed as *not adequately controlled* should be contacted and informed that they are within the system's source protection zones. The PWS should provide them with a list of general best management practices (BMPs) that apply to their standard operational procedures. Explain that following these BMPs is the first step in preventing drinking water contamination. DDW can provide general BMPs for the following facilities: Dry cleaners, metal finishers, print shops, vehicle maintenance, and use of pesticides and fertilizers. More facilities will be added to this list, so check with us at (801) 536-4200, from time to time to see what is available.

The next step is to persuade PCSs to develop their own facility specific BMPs. Each PCS's goal should be to prevent hazardous chemicals from coming in contact with the ground. Suggest the following procedure: Identify each hazardous chemical used at the facility which could contaminate ground water; draw a separate flow chart for each chemical which details its flow through the facility; and finally, identify the critical points in the flow charts where each chemical could potentially come

in contact with the ground and subsequently enter the ground water and contaminate it. This can usually be accomplished with a simple drawing and a few questions:

- How is it received and checked into inventory?
- Where is it stored?
- How is it used at the facility?
- Is there a waste stream from it that must be disposed?
- If so, how is it disposed?

Once they have identified the critical points where chemicals could be spilled or deposited on the ground, the next step is fairly simple: Develop a list of BMPs for each hazardous chemical to prevent it from being spilled or deposited on the ground. An employee training program to implement the facility specific BMPs is the last and most important step of this process. Additionally, the PCS should post their facility specific BMPs in work areas and share them with the water system so they can be documented in the recordkeeping section of the source protection plan. A memorandum of agreement which lists the BMPs and is signed by both the PWS and the PCS is also very important so that what is expected from each party is clearly understood.

Additionally, you may request a fact sheet from DDW by calling 536-4200, which explains pollution prevention programs. Pollution prevention programs are very similar to BMPs, and are another common sense approach in preventing ground water contamination.

Residential PCSs

Residential PCSs may be more effectively addressed using a different approach. You may be able to address them collectively through public education programs. Bill stuffers, newspaper or newsletter articles, and workshops provide an effective vehicle for these public education programs. The critical topics for residential PCSs include pesticide and fertilizer application, use and disposal of household hazardous waste, and proper use and maintenance of septic tank/drain-field systems. We have developed fact sheets for each of these topics that you may request at 536-4200.

Information Sheets

Appendix G lists the PCS information sheets that are available from DDW. Refer to this material for guidance in identifying current controls and assessing them. It also contains suggestions about best management and pollution prevention practices. DDW can supply you with some fill-in-the-blank forms to help you record and organize the information you gather about each PCS. Please call 536-4200 to request this material.

CHAPTER 8 - THE MANAGEMENT PROGRAM FOR FUTURE POTENTIAL CONTAMINATION SOURCES

The Rule requires that a program be established to manage potential contamination sources (PCSs) that may want to locate within your protection zones some time in the future. This management program must be consistent with the provisions of the Rule to an extent allowed under your authority and jurisdiction. This may be a local program that establishes a process to identify PCSs that can control their contamination and those PCSs that cannot. Those that can and will control their contamination should be allowed to locate within protection areas and those that cannot should not be permitted.

Minimum Requirement for a Controlling Future PCSs

The PWS must establish and write into their plan the following process to fulfill the minimum requirement for controlling future PCSs:

1. Contact each PCS as it locates within your protection zones,
2. add it to the inventory of potential contamination sources,
3. identify and assess its controls, and
4. plan and implement land management strategies, if it is not adequately controlled.

Planning and Zoning Ordinances

The intent of the Rule is that you address such issues as: What if a subdivision, recreational facility, mining, or logging company wanted to locate or operate in your protection areas. We recommend that you address these issues by examining land ownership and future potential uses. Then you can pursue appropriate land management strategies depending on whether the land is public or privately owned. If you don't seek to address these issues now they will be much more difficult to address as future intended land uses are made known by various developers.

Adopting zoning ordinances is the most effective way to control future PCSs. Zoning ordinances allow you to:

- Control subdivision development and industrial growth at desirable levels,
- conduct site plan reviews,
- evaluate design and operating standards,
- ensure adequate spill protection and waste disposal procedures, and
- prohibit facilities that would discharge contamination to your aquifer.

Refer to Appendix F, for an example of a Source Protection Zoning Ordinance.

Authority and Jurisdiction

The Rule requires that land management strategies be planned which are consistent with its provisions and to an extent allowed under the authority and jurisdiction of the PWS. Cities, towns, and counties have the authority to pass and enforce zoning ordinances to control potential contamination. Some PWSs are owned by municipal governments and some are not. However, even those that are owned by municipal government may have protection zones that extend outside of their boundaries. Many PWSs lack the authority or jurisdiction to pass and enforce zoning ordinances within their protection zones. Planning and carrying out effective land management strategies may be difficult under these circumstances but in most situations it is still possible. Consider the following solutions:

- Protecting our drinking water should be an objective of all local governments. Because of this, the city, town, or county outside of your jurisdiction may be willing to pass zoning ordinances to protect your sources of drinking water. Draft a protection strategy and discuss it with them in one of their meetings. They may ask you to work with their planner to develop an ordinance that is agreeable to all concerned.

- Section 10-8-15 of the Utah Code gives cities and towns the extraterritorial authority to enact ordinances to protect a stream or source from which their drinking water is taken,... "for 15 miles above the point from which it is taken and for a distance of 300 feet on each side of such stream..." Class I cities (greater than 100,000 population) are granted authority to protect their entire watersheds. Section 10-8-15 applies to ground-water sources of drinking water.

Subdivisions

Many subdivisions provide a water supply for their development through a public water system. They must also meet the requirements of source protection. Since subdivision developers own the land, they should provide for source protection to an extent required by the Rule. This includes providing setbacks and open spaces to provide a buffer area free of PCSs. Additionally, public education programs relating to the household use of pesticides and fertilizers, household hazardous waste, and disposal practices in septic tank/drain-field systems may be required.

CHAPTER 9 - THE IMPLEMENTATION SCHEDULE, RESOURCE EVALUATION & RECORDKEEPING SECTIONS

Following are guidelines to help you complete the Implementation Schedule, Resource Evaluation, and Recordkeeping sections of your plans.

Implementation Schedule

The Implementation Schedule is a summary list of land management strategies which identifies a beginning implementation date for each one. This summary list contains all of the land management strategies that you have identified in the management programs for both existing and future potential contamination sources (PCSs). Each *not adequately controlled* PCS hazard must be addressed. The Rule requires that land management strategies be implemented according to this schedule.

Resource Evaluation

This section allows you to evaluate the financial and other resources you need to plan and carry out your Drinking Water Source Protection Plan. It also helps you assess the resources you will need to acquire before it can be implemented. Do you have adequate staff support? Will community volunteers help make up any resources you are lacking? Do you need to increase your fees or water rates? The Resource Evaluation may be as brief or as detailed as you choose.

Recordkeeping

The implementation of each land management strategy that you have listed in the Implementation Schedule must be documented in this section of the plan. You can do this by inserting copies of zoning ordinances, public education program materials, permits, memoranda of agreements, contracts, and notes for record, etc., into this section of the plan.

CHAPTER 10 - THE CONTINGENCY PLAN

Contingency Plans should focus on the identification and possible solution of problems that may arise in the event that the Drinking Water Source Protection (DWSP) plan fails. Additionally, Contingency Plans address problems public water systems (PWSs) need to solve in the event of water shortages or contamination incidents that may impact their ability to supply safe drinking water to the public. Contingency planning includes emergency response, rationing, remediation, and new source development plans. Prior planning helps PWSs avoid crisis planning during emergency situations. Refer to Guide To Ground-Water Supply Contingency Planning For Local And State Governments, (EPA 440/6-90-003) for more information.

PWSs shall submit a Contingency Plan that includes all sources of drinking water for the entire water system to DDW concurrently with the submission of their first DWSP Plan.

There are four possible parts to Contingency Plans: 1. Emergency Response; 2. Rationing; 3. Remediation; and 4. Source Development Plans. PWSs should coordinate their contingency plans with plans developed in accordance with SARA Title III by local Emergency Planning Committees. *Guidelines for developing the four possible parts of a Contingency Plan are discussed in the remainder of this chapter. Since these guidelines may not apply to every PWS or every emergency situation, each PWS should design a contingency plan that specifically addresses their needs.*

Emergency Response Plans

Emergency response planning focuses on short-term solutions to likely problems the PWS may encounter because of accidents and natural disasters. The solutions will likely require the mobilization of resources for repairing the physical structure of the water system and sampling or issuing a "boil order" to assure that water is safe to drink. Please refer to the Emergency Response Handbook, available from DDW at 536-4200, for detailed guidelines on emergency response planning.

Rationing Plans

Rationing plans establish a course of action to be implemented when water shortages occur. These shortages may be caused by drought, seasonal overuse, contamination, or accidents. Plans should contain clearly defined, step-by-step procedures that assure the public a sufficient water supply for basic hygienic and culinary needs. Consider the following:

1. Each PWS should determine the "action level" caused by a water shortage which will initiate their rationing plan. An "action level" is the critical point of water shortage that signals a PWS to implement their rationing plan.

2. List the positions and administrative duties of each person in the chain-of-command responsible for implementing the rationing plan.

3. Determine the resources available to the water system in dealing with water shortages. The following should be assessed: alternate water supplies; emergency water supply equipment; replacement equipment; technical assistance; and communication equipment.

4. Develop a step-by-step procedure for implementing the conservation measures to be taken.

5. Identify the public education, follow-through, and compliance actions to be taken to ensure consumers are following the rationing directives.

6. Determine how consumers and the media will be kept informed of the status of the emergency situation and the augmentation of the rationing plans.

Water Supply Decontamination Plans

The technology is available for reducing some contaminants in drinking water to acceptable levels. The most common example of this approach is disinfection to remove microbiological contamination. Another example is air stripping to remove volatile organic compounds, such as solvents. As contamination continues to threaten drinking water sources throughout the country, new remediation technology is being developed. Water system management should keep up on what is currently available in the field of remediation technology. After protection zones have been delineated around each wellhead and spring collection area, and PCSs have been inventoried, it is recommended that the PWS identify the technology available to remediate each specific potential contaminant. There is only one alternative to not remediating a contaminated water supply and that is to abandon the drinking water source.

Source Development Plans

Developing new water supply sources is an important enterprise for a growing public drinking water system. It is also an important enterprise for any water system in the event their present sources are compromised due to contamination or water shortages. In evaluating source development, the following are important considerations:

1. Identify all undeveloped sources of water that have a potential for future development as drinking water sources. Start by listing backup wells and springs currently in the system, then list wells and springs which are abandoned, but could possibly be reclaimed and redeveloped. Finally, list potential springs and new well sites along with possible surface sources. PWSs may want to keep this information confidential to prevent others from filing a claim on a water right first. This information need not be submitted to DDW with the Contingency Plan.

   Proposed alternative sources may draw from the same aquifer as an existing water source that could potentially be lost to contamination. Therefore, when identifying potential alternative water supply sources for future development, the PWS should, if possible, first identify sources from different aquifers. If sources in a different aquifer are not possible, it is preferable to identify sources which would draw from parts of the aquifer up gradient from existing sources.

2. Determine the probable production of each of these sources and the percentage of your current and projected needs that would be supplied by each potential source.

3. List the steps required to obtain ownership and water rights for each potential new source. PWSs may be granted water rights based on anticipated water demand.

4. Determine the approximate protection zones around each potential new well or spring. Consider purchasing land or development rights, and enacting protective ordinances or land use agreements to protect the water source within the protection zones.

5. Inventory all PCSs within each approximate protection zone which may affect the quality of the drinking water now or in the future.

6. Identify the microbiological, chemical, and radiological quality of each potential drinking water source. Ensure that all parameters are below established maximum contaminant levels (MCLs).

7. Estimate when each new drinking water source will need to be introduced into the system to meet projected supply requirements.

8. Determine the financial resources that may be required for each drinking water source development project. List possible sources of revenue.

9. List the positions and administrative duties of each person responsible for implementing the drinking water source development plan.

10. Submit a Preliminary Evaluation Report to DDW concurrently with engineering plans and specifications before construction begins on any new ground-water source of drinking water.

CHAPTER 11 - PESTICIDE & VOC MONITORING REDUCTION WAIVERS

Certain monitoring waivers can potentially save Utah's public water systems (PWSs) a substantial amount of money each year. Systems currently pay about $875 per sample for pesticide group analysis, $190 per sample for Volatile Organic Chemical (VOC) group analysis, and $190 per sample for unregulated group analysis. Reduced monitoring waivers for these parameter groups can be issued to systems based on their Source Protection Program.

Types of Monitoring Reduction Waivers

Three types of monitoring waivers are available to PWSs. They are: reliably and consistently, use, and susceptibility. The criteria for establishing a reliably and consistently waiver is set forth in R309-104. The criteria for use and susceptibility waivers follows.

If a source's DWSP plan is due according to the schedule in R309-113-3, and is not submitted to the Division of Drinking Water (DDW), its use and susceptibility waivers for the VOC and pesticide parameter groups will expire unless an exception (refer to R309-113-4) for a new due date has been granted. Additionally, current use and susceptibility waivers for the VOC, pesticide and unregulated parameter groups will expire upon review of a DWSP plan, if these waivers are not addressed in the plan.

Use Waivers

If the chemicals within the VOC and/or pesticide parameter group(s) have not been used within the past five years within zones one, two, and three, the source may be eligible for a use waiver. To qualify for a VOC and/or pesticide use waiver, a PWS must complete the following two steps:

1. List the chemicals which are used, disposed, stored, transported, and manufactured at each potential contamination source within zones one, two, and three where the use of the chemicals within the VOC and pesticide parameter groups are likely; and

2. submit a dated statement which is signed by the system's designated person that none of the VOCs and pesticides within these respective parameter groups have been used, disposed, stored, transported, or manufactured within the past five years within zones one, two, and three.

Susceptibility Waivers

If a source does not qualify for use waivers, and if reliably and consistently waivers have not been issued, it may be eligible for susceptibility waivers. Susceptibility waivers tolerate the use, disposal, storage, transport, and manufacture of chemicals within zones one, two, and three as long as the PWS can demonstrate that the source is not susceptible to contamination from them. To

qualify for a VOC and/or pesticide susceptibility waiver, a PWS must complete the following three steps:

1. Submit the monitoring results of at least one applicable sample from the VOC and/or pesticide parameter group(s) that has been taken within the past five years. A non-detectable analysis for each chemical within the parameter group(s) is required;

2. submit a dated statement from the designated person verifying that the PWS is confident that a susceptibility waiver for the VOC and/or pesticide parameter group(s) will not threaten public health; and

3. verify that the source is developed in a protected aquifer, as defined in R309-113-6(1)(v), and have a public education program which addresses proper use and disposal practices for pesticides and VOCs which is described in the management sections of the DWSP plan.

Special Waiver Conditions

Special scientific or engineering studies or best management practices may be developed to support a request for an exception to paragraph R309-113-15(4)(c) due to special conditions. These studies must be approved by DDW before the PWS begins the study. Special waiver condition studies may include:

- geology and construction/grout seal of the well to demonstrate geologic protection;
- memoranda of agreement which addresses best management practices for VOCs and/or pesticides with industrial, agricultural, and commercial facilities which use, store, transport, manufacture, or dispose of the chemicals within these parameter groups;
- public education programs which address best management practices for VOCs and/or pesticides;
- contaminant quantities;
- affected land area; and/or
- fate and transport studies of the VOCs and/or pesticides which are listed as hazards at the PCSs within zones one, two, and three, and any other conditions which may be identified by the PWS and approved by DDW.

Pesticide and VOC Parameter Groups

We have not included the actual listing of these parameter groups in the User's Guide because they are subject to change. These pesticides and VOCs are identified in the *Water Quality Maximum Contaminant Levels, Rule R309-103 Summary*. You may request a copy from us, a 536-4200. Contact "http://ace.ace.orst.edu/info/extoxnet/" on the Internet to help you convert the chemical names of pesticides to commercial names.

Protect Your Waivers

Once a PWS is granted *use* or *susceptibility* waivers it should take steps to ensure that it will not loose these waivers in the future. Protection areas should be guarded against new PCSs moving into protection areas and using or misusing VOCs or pesticides within the parameter groups.

Appendices

SUPPLEMENTAL GUIDANCE FOR DEVELOPING SOURCE PROTECTION PLANS

APPENDIX A - CONSULTING GROUND-WATER PROFESSIONALS

The DWSP Rule does not require that a consultant generate the delineation report, however, the delineation work must be completed by someone that is knowledgeable and has experience with ground water. The information required in the report is quite technical and consulting services are recommended. This appendix contains a list of consultants that have asked to be included; it is not intended to be an endorsement of their capabilities. Additionally, it is not a complete listing of all of the consultants doing this type of work for public water systems in Utah. If you choose to employ a consultant to delineate your protection area, use the same care you would use in obtaining the services of any other professional firm. For other persons or companies who may be qualified to provide these delineations consult listings, such as telephone books, under the headings of hydrologists, geologists, hydrogeologists, engineers-environmental, engineers-geological, and engineers-geotechnical.

Firm	Address	Phone
Access Environmental Services, Inc.	1217 East 8725 South Sandy, UT 84094	561-8279
Alpha Engineering and Surveying	987 N Main St #1 Cedar City, UT 84720	586-0852
Paul B. Anderson Consulting Geologist	807 E South Temple Salt Lake City, UT 84102	364-6613
Aquifer Science, Inc. Gary Colgan	3322 E Joyce Drive Salt Lake City, UT 84109	484-8423
Barnett Intermountain Water Consulting	106 W 500 S #101 Bountiful, UT 84010	292-4662
Bingham Engineering	5160 Wiley Post Way Salt Lake City, UT 84116	532-2520
Bulloch Brothers Engineering	36 N 300 W Cedar City, UT 84720	586-9592
CH2M Hill	4001 S 700 E #700 Salt Lake City, UT 84107-2122	281-2426
Dames & Moore	127 S 500 E #300 Salt Lake City, UT 84102	521-9255
Delta Geotechnical Consultants	466 W Lawndale Drive South Salt Lake, UT 84115	487-7754
ERM - Rocky Mountain, Inc	102 W 500 S #650 Salt Lake City, UT 84101	595-4800
Earth Fax Engineering	7324 S 1300 E Midvale, UT 84047	561-1555
Eckhoff, Watson & Preator	3995 S 700 E Murray, UT 84107	261-0090
Environmental & Engineering Solutions John Carter	PO Box 280 Mendon, UT 84325	435-753-6062
EnviroSearch International	2319 Foothill Drive #180 Salt Lake City, UT 84108-1488	801-461-0888

Firm	Address	Phone
Dr. Craig Forster (aquifers in mountainous terrain, fractured-rock aquifers, and special studies)	University of Utah 135 S 1460 E Room 719 Salt Lake City, Utah 84112-0111	581-3864
Franson-Noble & Associates	P.O. Box 606 American Fork, UT 84003	756-0309
Geo Consultants	580 N Main Cedar City, UT 84720	586-8089
Scott Goodwin, P.E.	267 S 500 W Richfield, UT 84701	896-4814
Preston L. Hafen Consulting Geologist	115 S Main Veyo, UT 84782	574-2760
Hansen Allen & Luce	6771 S 900 E Midvale, UT 84047	566-5599
JBR Environmental Consultants Inc	8160 S Highland Drive #A4 Sandy, UT 84093	943-4144
Bruce N. Kaliser Hydrogeologist	2951 Nila Way Salt Lake City, UT 84124	272-2720
Kleinfelder Ken Adams	2749 E Parley's Way #100 Salt Lake City, UT 84109	466-6769
LarWest Engineering	1770 N Research Parkway #130 North Logan, UT 84341	753-0153
Mayo and Associates	710 E 100 N Lindon, UT 84042	785-2385
Montgomery Watson Engineers	4525 S Wasatch #200 Holliaday, UT 84117	272-1900
North American Mine Services, Inc. Brian Vinton	497 N Main Kaysvile, UT 84037	569-7014 546-6453
R B & G Engineering	1435 W 820 N Provo, UT 84601	374-5771
Reed W. Mower Hydrologist	PO Box 67 Fairview, UT 84629	427-9447
Jack R. Rogers, Geologist LASR Geo Consulting	P.O. Box 1103 Castle Dale, UT 84513	381-5359
Rosenberg & Associates Robert Oliver	649 Red Rock Road St. George, UT 84770	634-1792
SHB Agra Inc	4137 S 500 W Murray, UT 84107	266-0720
Scott Clark - Geologist SHC Consulting	279 West 100 South Logan, UT 84321	(435) 752-6897

Firm	Address	Phone
Secor International	4001 S 700 E #250 Salt Lake City, UT 84107-2178	266-7100
Shick International Inc Engineering Consulting Services	3010 First Commerce Center 175 W 200 S Salt Lake City, UT 84101	359-3012
Strata Consultants	330 S 300 E #200 Salt Lake City, UT 84111-2525	355-0633
Tahoma Companies Gary F. Player, Principal Geologist	444 S Main St #C7 Cedar City, UT 84720	865-0161
Terracon Consultants Western, Inc.	92 W 3900 S #100 Salt Lake City, UT 84107	266-2100
Wall Engineering Lynn Wall, P.E.	55 South Main #2 P.O. Box 39 Fillmore, UT 84631	743-6800 743-4214
Weston Engineering, Inc.	P.O. Box 682007 Park City, UT 84068	467-9866 (800) 784-9866
Wilding Engineering	12411 S. Fort St. Draper, UT 84020	(801) 553-8112

APPENDIX B - GUIDANCE FOR GROUND-WATER PROFESSIONALS

Delineation of Drinking Water Source Protection Zones

This guidance is intended for experienced ground-water professionals that are performing delineation work for public water systems (PWSs). Requirements for delineation reports are specified in Section 9 of the Drinking Water Source Protection (DWSP) Rule (R309-113-9, Utah Administrative Code) and in the *Standard Report Formats for New and Existing Wells and Springs*. Call us at 536-4200 to request these documents. Many subjects discussed in this section are not explicitly explained in the DWSP Rule, but are generally accepted hydrogeologic standards or policies of the Division of Drinking Water (DDW).

A DWSP delineation report may be disapproved if the report is inaccurate or is missing any of the required information. When delineating the Source Protection zones, you must use the best data that is reasonably available. Protection zones must be accurate, but the cost of determining them should not be prohibitively expensive for the PWS.

References or Sources of Hydrogeologic Information

The sources for the hydrogeologic data in the delineation report must be documented. Documentation of your work is standard scientific/professional practice, and the delineation work must be documented in case the public water supplier receives inquiries concerning the delineation.

Aquifer Thickness (saturated thickness of the producing aquifer(s))

A generally accepted hydrogeologic method to determine aquifer thickness is to use the screened or perforated interval in the well. Another method is to use the thickness of aquifer layers adjacent to the screened interval as shown on the geologic log or Report of Well Driller. When only limited data are available, the aquifer thickness should not be extended below the depth of the well. If available, geologic logs of nearby wells, geologic cross sections, or other data may be used to demonstrate a greater aquifer thickness. If a well only partially penetrates the aquifer, use applicable interpretation and delineation methods.

Fine-grained layers (such as clay and silt) are generally not considered part of a producing aquifer. If the aquifer is confined, the confining layer(s) and all layers above or below it are not part of the producing aquifer. The producing aquifer will generally not include the complete saturated interval shown in the well.

Maximum Pump Rate

The maximum anticipated pump rate for the well must be used for determining the protection zones. Using average values for the pump rate will not give accurate results, because it does not take into account the effects of drawdown such as the higher near well ground-water velocities created by the change in the potentiometric surface.

Effective Porosity of the Producing Aquifer

When estimating effective porosity of the aquifer use only the lithology of the producing aquifer; do not use an average of all lithologies described in the Report of Well Driller log. Reports published by the Utah Division of Water Rights, the Utah Geological Survey, or the U.S. Geological Survey often list porosity values determined for specific aquifers. If these are not available for the area of your well, porosity may be estimated from textbooks or other reports. Values for effective porosity should not exceed 30% unless there is direct evidence, such as laboratory analyses, that demonstrate a higher value.

Hydraulic Gradient and Ground Water Flow Direction

If hydraulic gradient or flow direction change through the extent of the protection zones, adjustments must be made in the calculations. If the protection zones include a change from an alluvial aquifer to bedrock, this change must also be considered in the delineation.

A cone of depression develops in the potentiometric surface around most pumping wells. Because the hydraulic gradient in the cone of depression is significantly steeper than the regional hydraulic gradient, you can not use the ground-water velocity equation ($v=Ki/n$) for ground-water velocity to wells. Delineations completed in this manner will underestimate ground-water velocity near the well, and will yield inaccurate protection zones.

Hydraulic Conductivity and Aquifer Testing

A constant rate aquifer test is required for every new well. A constant rate aquifer test is also required for all existing wells, unless the necessary data can be obtained from previously-run aquifer test. Aquifer tests to determine hydraulic conductivity and transmissivity must be conducted and interpreted properly to obtain meaningful results. Each aquifer test should be designed, conducted, and interpreted by an experienced ground-water professional.

Delineation reports may be disapproved if the aquifer test is conducted improperly or the interpretation method is not appropriate for the test or aquifer environment. Graphs, field data, and printouts showing the interpretation of the aquifer test must be included in the delineation report. Requirements for aquifer tests are explained in two sections of the Utah Rules for Public Drinking Water Systems:

- Source Development chapter, Well Development section (R309-204-6(10)(b)), and
- Drinking Water Source Protection chapter, Delineation of Protection Zones section (R309-113-9(5)).

If the tested well is pumping from an alluvial aquifer, the values determined from the aquifer test can only be used in the alluvial aquifer. If the well is located near bedrock and the protection zones reach into bedrock areas, then adjustments must be made in the hydraulic conductivity where the ground water is moving through bedrock.

Many books and professional papers have been written that discuss aquifer testing and ground-water hydraulics. A few of these publications include:

Dawson, K.J., and Istok, J.D., 1991, Aquifer Testing: Design and Analysis of Pumping and Slug Tests: Lewis Publishers, Chelsea, Michigan, 344 p.

Driscoll, F.G., 1986, Groundwater and Wells, second edition: Johnson Division, St. Paul, Minnesota, 1089 p.

Kruseman, G.P., and deRidder, N.A., 1994, Analysis and Evaluation of Pumping Test Data, Second Edition: International Institute for Land Reclamation and Improvement, The Netherlands, 377 p.

Lohman, S.W., 1979, Ground-water hydraulics: U.S. Geological Survey Professional Paper 708, 70 p.

Nelson, Dennis, 1995, How to prepare for your aquifer test: Pipeline, Drinking Water Program, Oregon Health Division, v. 10, issue 3, p. 1-4.

Osborne, P.S., 1993, Suggested Operating Procedures for Aquifer Pumping Tests: Ground Water Issue, U.S. Environmental Protection Agency, 23 p.

Rovey, C. W., II, and Cherkauer, D.S., 1995, Scale dependency of hydraulic conductivity measurements: Ground Water, v. 33, no. 5, p. 769-780.

Stallman, R.W., 1983, Aquifer-test design, observation, and data analysis: Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Chapter B1, 26 p.

Walton, W.C., 1970, Ground Water Resource Evaluation: McGraw-Hill Book Co., New York, 664 p.

Walton, W.C., 1987, Groundwater Pumping Tests: Lewis Publishers, Chelsea, Michigan, 201 p.

During an aquifer test, water level readings should be taken at the proper intervals from the pumping well and available observation wells. An example of time intervals for water level readings is shown in Table 1. This example may need to be modified for different testing methods, or hydrogeologic or well characteristics. Recovery tests may yield better data than the pumping portion of the test.

Table 1. Example aquifer-test time intervals for recording water level in wells.

Time Since Pumping Started	Time Interval
0 - 2 minutes	10 seconds
0 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 - 60 minutes	5 minutes
1 - 2 hours	10 minutes
2 - 8 hours	30 minutes
8 - 24 hours	1 hour
1 - 4 days	4 hours
4 days - end of test	1 day

If the constant-rate aquifer test does not work or is not practical to run, you may use another appropriate method to determine hydraulic conductivity. If hydraulic conductivity is determined from a nearby well or a published report, the values must be for the same aquifer. If the aquifer test does not work or cannot be conducted, explain in your report why you cannot use the aquifer test to determine aquifer parameters. The best method to determine hydraulic conductivity of an aquifer is an aquifer test. Other methods include specific capacity, drill-stem tests, slug tests, and laboratory tests.

Ground-Water Boundaries

Ground-water boundaries may also be used in delineation. Topographic divides and surface-water divides are not always ground-water divides. If a topographic divide is used in a delineation as a ground-water divide, evidence for the ground-water divide must be explained in the delineation report. Geologic structure and stratigraphy may be important in determination of ground-water divides.

Well Fields

In some situations it is useful to group nearby wells together as one source for delineation of protection zones. A group of wells may be considered a well field if two or more wells are located very close together, the wells are producing from the same aquifer, and there is significant well interference between the wells.

Fractured Bedrock Aquifers

If the aquifer is in fractured or faulted bedrock, then the delineation must account for these structures. Hydrogeologic mapping in the field is often necessary to determine fracture location, orientation, density, and aperture. Most ground-water models are designed for areally extensive homogeneous aquifers, and may yield inaccurate results in fractured bedrock areas (Wisconsin Geological and Natural History Survey, 1991). If you use a ground-water model in a fractured rock aquifer, you must explain why the fractured aquifer can be modeled as a homogeneous porous medium.

Ground-Water Models

There are many different ground-water models available, from simple analytical equations to complex numerical computer models. The DWSP Rule does not specify one model or method for delineation, but the method must be accurate and appropriate for the aquifer setting. The choice of hydrogeologic methods should be based on the type and complexity of the aquifer setting, limitations of the ground-water model, surrounding wells, and nearby PCSs. Before choosing and applying a ground water model, the scientist must have a good concept of the ground-water environment, and must understand the assumptions and limitations of the model.

The simple ground-water velocity equation (v=Ki/n) cannot be used for pumping wells. This equation does not include calculations for the increase in the ground-water gradient near the well (in the cone of depression), and the protection zones would therefore be inaccurately small.

Interference Between Wells

Interference between pumping wells affects the size and shape of protection zones. When other pumping wells are located nearby, interference between wells must be a part of the delineation in order to calculate accurate protection zones. Some of the analytical and numerical computer models can model interference between wells.

References and Suggested Reading

General Ground Water References

Fetter, C.W., Jr., 1988, Applied Hydrogeology: Merrill Publishing Company, Columbus, Ohio, 592 p.

Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Prentice-Hall, Inc., New Jersey, 604 p.

Heath, R.C., 1989, Basic Ground-Water Hydrology: U.S. Geological Survey Water-Supply Paper 2220, 84 p.

Todd, D.K., 1980, Groundwater Hydrology, second edition: New York, John Wiley, 535 p.

Delineation of Protection Zones

Bair, E.S., Springer, A.E., and Roadcap, G.S., 1991, Delineation of Traveltime-Related Capture Areas of Wells Using Analytical Flow Models and Particle-Tracking Analysis: Ground Water, v. 29, no. 3, p. 387-397.

Bureau of Economic Geology, The University of Texas at Austin, 1991, Wellhead Protection Strategies for Confined-Aquifer Settings: U.S. EPA Office of Ground Water and Drinking Water, 168 p.

Forster, C.B., Lachmar, T.E., and Oliver, D.S., 1997, Comparison of models for delineating wellhead protection areas in confined to semiconfined aquifers in alluvial basins: Ground Water, v. 35, no. 4, p. 689-697.

Kawecki, M.W., 1995, Meaningful interpretation of step-drawdown tests: Ground Water, v. 33, no. 1, p. 23-32.

Pettyjohn, W.A., Practical Approaches to the Delineation of Wellhead Protection Areas: Ground Water Protection Council, Oklahoma City, 56 p. plus appendix.

U.S. Environmental Protection Agency, 1993, Guidelines for Delineation of Wellhead Protection Areas: Office of Water, Washington, D.C., EPA document 4405-93-001.

van der Heijde, Paul, and Beljin, M.S., 1988, Model Assessment for Delineating Wellhead Protection Areas: U.S. EPA Office of Ground Water Protection, 33 p. plus appendices.

van der Heijde, Paul K.M., and Elnaway, O.A., 1993, Compilation of Ground-Water Models: U.S. EPA Office of Research and Development, 87 p. plus appendices.

Walton, W.C., 1988, Practical Aspects of Ground Water Modeling, third edition: National Water Well Association, Worthington, Ohio, 588 p.

Wisconsin Geological and Natural History Survey, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: U.S. EPA Office of Ground Water and Drinking Water, Washington, D.C., 144 p.

Wuolo, R.W., Dahlstrom, D.J., and Fairbrother, M.D., Wellhead protection area delineation using the Analytic Element Method of ground-water modeling: Ground Water, v. 33, no. 1, p. 71-83.

Specialized Studies

Greene, E.A., and Rahn, P.H., 1995, Localized anisotropic transmissivity in a karst aquifer: Ground Water, v. 33, no. 5, p. 806-816.

Kreamer, D.K., Hodge, V.F., Rabinowitz, I., and others, 1996, Trace element geochemistry in water from selected springs in Death Valley National Park, California: Ground Water, v. 34, no. 1, p. 95-103.

Larkin, R.G., and Sharp, J.M., Jr., 1992, On the relationship between river-basin geomorphology, aquifer hydraulics, and ground-water flow direction in alluvial aquifers: Geological Society of America Bulletin, v. 104, p. 1608-1620.

APPENDIX C - THE SOURCE PROTECTION TEAM

Community involvement is the primary characteristic of a successful Drinking Water Source Protection (DWSP) program; organizing a source protection team helps get the community involved. Members of the source protection team should then seek to involve the rest of the community at even greater levels. Team members should represent the various interests of the community. Public water system (PWS) personnel, local governmental representatives, health department personnel, community residents, and industrial, agricultural, and commercial representatives, etc. should be members of the team.

Source Protection Team Responsibilities

A team leader should be appointed by the PWS or chosen by the team. This person should have organizational and consensus-building skills and have the support of the other team members and the community.

Once the source protection team is established, its members should determine their long-term goals. These should include defining a protection area, inventorying PCSs, and determining management approaches. After the long-term goals are established, they should be broken down into short-term tasks and assigned to members of the team.

Source Protection Team Functions

Many PWSs use a source protection team for the planning process and then disband it. However, since source protection is not static and is never really complete, it is a good idea to keep a source protection team active as long as protecting ground water is an objective of your system. With the experience team members acquire during the planning process they will be valuable resources in working with both existing and new PCSs, continuing community education programs, and following through to ensure that management approaches are effectively implemented.

Suggestions for the Team to Help with Delineation

The source protection team may want to collect certain data and information about the ground-water source and the producing aquifer. The collection of this information will be valuable to your own technical staff, and may save you the money a consulting firm would charge if it were to collect this data for you.

- *Geologic Data* - Any geologic data that may have been collected when choosing the site for the well, during drilling and development of the well, and that the PWS may have acquired since the well was drilled.

- *Aquifer Test* - Provide data and results from pumping or aquifer tests performed using the well. Your consultant will probably need to conduct an aquifer test at the well site to determine aquifer properties such as hydraulic conductivity and transmissivity. An

experienced person should conduct and interpret the test; however, the source protection team members may be able to assist.

- *Well Data* - Some or all of this data is probably stored in your system's files. It includes the Report of Well Driller and well construction data. If you don't have your Report of Well Driller, it can probably be obtained from the Utah Division of Water Rights, located at 1636 W. North Temple, Salt Lake City, Utah. The Division of Water Rights also has regional offices in different parts of Utah.

- *Pump Data* - Again, this information is probably in your system files. It includes the model, type, make, series, and rating of your pump along with its installation date.

Here are a few ideas to further involve the community:

- Announce all of the meetings of the source protection team and report its progress in your local newspaper.

- Train a service group, such as Retired Senior Volunteer Program (RSVP) members, a Boy Scout troop, or a school science class, etc., to compile information for the plan.

- Some counties in have organized Water Quality Task Forces through their County Extension Service. Contact your County Extension Agent if you would like to request the assistance of these folks in developing various parts of your DWSP plan.

- Educate the community or appropriate segments of the community concerning subjects, such as the use and disposal of household hazardous waste, the use and maintenance of septic tank systems, disposal of used oil, etc.

- Some people in the community may come forward with information about historic potential contamination sites if they read or hear about your source protection objectives.

APPENDIX D - STATE, LOCAL, AND FEDERAL AUTHORITIES

State Agencies

The Division of Water Quality

Ground Water Quality Protection Rule - R317-6, Utah Administrative Code (UAC) - The Ground Water Quality Protection Rule establishes a permit system to regulate contaminated discharges to ground water. Any contamination source that discharges contaminants to ground water must obtain a permit from the Division of Water Quality. The Ground Water Quality Protection Rule contains five sections: 1. ground water quality standards; 2. ground water classification; 3. protection levels; 4. ground water classification procedures; and 5. ground water discharge permit system.

Underground Injection Control Rule - R317-7, UAC - The Underground Injection Control Rule regulates the subsurface emplacement of fluids through bored, drilled, or driven wells; or through dug wells, where the depth of the dug well is greater than the largest surface dimension. Examples of underground injection wells include floor drains in service stations that discharge into sumps dug into the ground or drilled wells into which wastewater or other fluids are discharged.

This rule establishes a permit system to regulate underground injection wells. The Underground Injection Control Rule contains five parts: 1. classification of injection wells; 2. prohibition of unauthorized injection; 3. permit requirements; 4. technical requirements; and 5. hazardous waste injection restrictions.

Class II underground injection wells are regulated by the Division of Oil, Gas and Mining.

Utah Pollutant Discharge Elimination System Rule - R317-8, UAC - The Utah Pollutant Discharge Elimination System (UPDES) program requires permits for the discharge of pollutants from any point source into waters of the State. The program also applies to owners or operators of any treatment works treating domestic sewage.

Large Underground Wastewater Disposal System Rule - R317-5 of the UAC - The Large Underground Wastewater Disposal System Rule applies to large underground disposal systems for domestic wastewater discharges which exceed 5,000 gallons per day (gpd) and all other domestic wastewater discharges not covered under the definition of an "Individual wastewater disposal system." Usually these systems should not be designed for over 15,000 gpd. In general, it is not acceptable to dispose of industrial wastewater in an underground disposal system.

The Division of Solid and Hazardous Waste

Hazardous Waste Rules - Resource Conservation and Recovery (RCAC) - R315-1 through R315-15 and R315-50, UAC - The Hazardous Waste rules provide for "cradle-to-grave" management of substances classified as hazardous wastes. Their objective is to prevent contamination of the environment, which includes ground water, and potential adverse effects on human health. These

rules also identify those solid wastes which are subject to regulation as hazardous wastes and to notification, transportation, and disposal requirements. Facilities that treat, store, or dispose of hazardous waste are regulated by this rule.

Solid Waste Permitting and Management Rules (Landfills) - R315-301 through R315-320, UAC - The Solid Waste Permitting and Management Rules are promulgated under the authority of the Solid and Hazardous Waste Act, Chapter 6 of Title 19, to protect human health, to prevent land, air and water pollution, and to conserve the state's natural, economic and energy resources by setting minimum performance standards for the proper management of solid wastes originating from residential, commercial, agricultural, and other sources.

The Division of Environmental Response and Remediation

Underground Storage Tank Rules - R311-200 through R311-211, UAC - The Underground Storage Tank Rules protect ground water resources by preventing and detecting leaks and spills from underground storage tanks. Sites that are contaminated by leaking underground storage tanks must be cleaned up. Also, a fund has been established in the state to make sure that owners and operators of underground storage tanks can pay for correcting the problems they create if their underground storage tanks leak.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA commonly called Superfund) - Section 19-6-301 through Section 19-6-325 of the Utah Code Annotated - The Hazardous Substances Mitigation Act authorizes the executive director of the Department of Environmental Quality to regulate hazardous substances releases by making rules consistent with the substantive requirements of CERCLA, to establish the requirements for remedial investigation studies and remedial action plans.

40 CFR Part 300 of the Code of Federal Regulations - The National Oil and Hazardous Substances Pollution Contingency Plan establishes the organizational structure and specifies the procedures for remediating pollution when oil or hazardous substances are discharged or released into the environment.

SARA Title III - 40 CFR part 355 of the Code of Federal Regulations - SARA Title III provides early comprehensive emergency planning for responding to potential releases of toxic chemicals.

Facilities must notify the local emergency planning committee (refer to Appendix C for local emergency planning committees in Utah) when an "extremely hazardous substance" is present in an amount greater than the appropriate "threshold planning quantity." These facilities are required to prepare or have available a material safety data sheet (MSDS) for each hazardous chemical and submit it to the appropriate local emergency planning committee.

This regulation requires public access to information submitted to local emergency planning committees. Each emergency response plan, MSDS, inventory form, toxic chemical release form,

and follow-up emergency release notification is to be made available to the general public during normal working hours at the location designated for the local emergency planning committee.

The Division of Water Rights

Water Well Rule - R655-4, UAC - The Water Well Rule assists in the orderly development of underground water, insures that minimum construction standards are achieved in the drilling and repairing of water wells, **prevents pollution of aquifers within the state**, prevents wasting of flowing wells, obtains accurate records of well drilling operations, and insures compliance with the state engineer's authority for appropriating water.

Abandoned Water Wells - R655-4-12, UAC - These requirements are part of the Water Well Rule. When any well is temporarily removed from service, the top of the well shall be sealed with a water-tight cap or seal. If the well is temporarily abandoned during construction, it shall be assumed that the well is permanently abandoned after 90 days. Any well that is to be permanently abandoned shall be completely filled in such a manner as to prevent vertical movement of water within the borehole as well as preventing the annular space surrounding the well casing from becoming a conduit for possible contamination of the groundwater supply.

The Division of Oil, Gas, and Mining

Oil, Gas and Mining; Abandoned Mine Reclamation - R643, UAC - The Abandoned Mine Reclamation Rule establishes land and water eligibility requirements, reclamation project objectives and standards, and project selection factors. These provisions apply to all reclamation projects to be carried out with money from the Account and administered by the Division. Lands and water are eligible for reclamation activities if:

- They were mined or affected by mining processes;
- They were mined prior to August 3, 1977, and left or abandoned in either an unreclaimed or inadequately reclaimed condition; and
- There is no continuing responsibility for reclamation by the operator, permittee, or agent of the permittee under statutes of the state or federal government, or the state as a result of bond forfeiture. Bond forfeiture will render lands or water ineligible only if the amount forfeited is sufficient to pay the total cost of the necessary reclamation. In cases where the forfeited bond is insufficient to pay the total cost of reclamation, additional moneys from the Account may be sought.

Oil, Gas and Mining; Non-Coal - R647, UAC - The Non-Coal Rule establishes land and water eligibility requirements for non-coal reclamation. Non-coal lands and water are eligible for reclamation if:

- They were mined or affected by mining processes;

- They were mined prior to August 1977, and left or abandoned in either an unreclaimed or inadequately reclaimed condition;

- There is no continuing responsibility for reclamation by the operator, permittee, or agent of the permittee under statutes of the state or federal government or the state as a result of bond forfeiture. Bond forfeiture will render lands or water ineligible only if the amount forfeited is sufficient to pay the total cost of the necessary reclamation. In cases where the forfeited bond is insufficient to pay the total cost of reclamation, additional moneys from the Account may be sought;

- The reclamation has been requested by the Governor;

- The reclamation is necessary for the protection of the public health and safety or all coal related reclamation has been accomplished; and

- Moneys allocated to the Division are available for the work.

Oil, Gas and Mining; Coal - R645, UAC - The Coal Rule applies to coal exploration and coal mining and reclamation operations.

Oil, Gas and Mining; Oil and Gas - R649, UAC - The Oil and Gas Rule applies to all lands in the state in order to conserve the natural resources of oil and gas in the state, to protect human health and the environment, to prevent waste, to protect the correlative rights of all owners and to realize the greatest ultimate recovery of oil and gas.

Class II Injection Wells - R649-5, UAC - These requirements are part of the Oil and Gas Rule. Class II injection wells must be completed and operated to prevent pollution or damage to any Underground Source of Drinking Water. The application for injection must include evidence that the proposed injection will not initiate fractures in overlying strata that could allow the injected fluid to enter the fresh water strata. The application must also include a review of all wells within a one-half mile radius of the injection well to determine that a conduit does not exist for fluids to move up or down the well bore to enter other strata. The casing of the injection well must be pressure tested before use, and thereafter the well must be tested at least once every five years, or the pressure may be monitored during injection operations.

The Department of Agriculture

Pesticide Control Rule - R68-7 of the UAC - The Pesticide Control Rule requires that pesticide application be consistent with the label for that pesticide and that pesticide application not violate the restrictions on the use of that pesticide.

Local Health Departments

Section 26A-1-114-(1)(a) of the Utah Code authorizes local health departments to "enforce state and local laws, regulations, and standards relating to public health and sanitation." Cities, towns, and counties are encouraged to enact local ordinances in conjunction with their source protection programs. Local health departments can strengthen local protection programs since they can enforce the ordinances relating to public health and sanitation.

Individual Wastewater Disposal Systems (Septic Tank/Drain-fields) - R317-501, UAC - These rules apply to individual wastewater disposal systems for domestic wastewater discharges which do not exceed 5,000 gallons per day. Plans, specifications, and a site evaluation are required to be submitted to the local health department having jurisdiction for review and approval prior to construction of these systems. Construction standards apply to the building sewer, septic tank, and drain-field. Isolation distances are required to protect wells, springs, surface water, and any other waters that might be affected by the pollutants discharged by individual wastewater disposal systems.

The site evaluation reports information about the proposed location of the system, such as, soil percolation rates, soil classifications, and distances to ground water and bedrock. A final inspection by a registered sanitarian from the local health department is required to ensure the system is constructed as per plans and specifications prior to backfilling the system.

Scavenger Waste Disposal - R317-550, UAC - The Scavenger Waste Disposal Rule pertains to the collection, storage, transportation, and disposal of all wastes by liquid scavenger operators and requires that they be accomplished in a sanitary manner. It also requires these processes do not create a public health hazard or nuisance, or adversely affect the quality of the waters of the State.

Vault and Earthen Pit Privies - R317-560, UAC - The Vault and Earthen Pit Privy Rule permits privies as a substitute for water closets, for temporary or limited use in remote locations where provisions for water supply or wastewater disposal pose a significant problem. The intended primary use of vault and pit privies in this rule is for facilities such as labor camps, semi-developed and semi-primitive recreational camps, temporary mass gatherings, and other approved uses. Potable water under pressure may or may not be available.

Requests for the use of vault privies or earthen pit privies shall be evaluated on a case-by-case basis by the local health department having jurisdiction and must receive the written approval of the local health officer or his designated representative prior to the installation of such devices.

Federal Requirement

Under the Federal Safe Drinking Water Act Amendments of 1986, any department or agency of the federal government having jurisdiction over any potential source of contaminants within drinking water source protection zones or management areas identified by a State Drinking Water Source Protection Program, is subject to, and must comply with, all requirements of the State's Program. This includes the payment of reasonable charges and fees levied in connection with the

management or remediation of potential sources of ground-water contamination within drinking water source protection zones or management areas.

APPENDIX E - LOCAL EMERGENCY PLANNING COMMITTEES

SARA Title III requires Local Emergency Planning Committees to maintain information about toxic chemicals that are stored, used, or manufactured at potential contamination sources above certain threshold amounts. The information they maintain is available to the public upon request. They may also be able to furnish you with Material Safety Data Sheets (MSDSs) for the chemicals at the PCSs within their county. MSDSs can also be obtained on the Internet at "http://MSDS.PDC.CORNELL.EDU/issearch/msdssrch.htm"

When hazardous material spills occur on roads and highways within your protection zones, the chairperson of your local emergency planning committee will take charge of coordinating emergency response. You should contact this committee, provide them with a map of your protection zones, and ask them to notify you if there is a spill so you can provide them with important information about your well or spring. Your DWSP plan contains hydrogeologic information that is a valuable resource in emergency response decisions. This information includes:

- What is the approximate time of travel from the spill to your well or spring,
- direction of ground-water flow, and
- whether the aquifer is protected or unprotected.

LOCAL EMERGENCY PLANNING COMMITTEES FOR COUNTIES

County	Chairperson	Address	Phone
Beaver	Dale R. Maples	PO Box 391 Beaver, UT 84731	(435) 438-2862
Box Elder	Sherry Vasa	250 American Way MS B-3640 Brigham City, UT 84302	(435) 734-6006
Cache	Jeff Peterson	50 W 200 N Suite D Logan, UT 84321	(435) 750-7493
Carbon	Dennis Dooley	120 E Main Price, UT 84501	(435) 636-3290
Daggett	Don Williams	PO Box 429 Manilla, UT 84046	(435) 784-3582
Davis	Brian Law	PO Box 618 Farmington, UT 84025	(801) 451-4129
Duchesne	Georg Adams	PO Box 298 Duchesne, UT 84021	(435) 738-1181
Emery	Bryant Anderson, Acting	PO Box 417 Castle Dale, UT 84513	(435) 381-5374
Garfield	Chris Hatch, Acting	PO Box 370 Panguitch, UT 84759	(435) 676-2678
Grand	Doug Squire	125 E Center	(435) 259-8115

County	Chairperson	Address	Phone
		Moab, UT 84532	
Iron	Dave Bentley	PO Box 622 Cedar City, UT 84720	(435) 586-6511
Juab	Gary Corbin, Acting	PO Box 133 Nephi, UT 84648	(435) 623-1349
Kane	Dave Owens	76 N Main Kanab, UT 84741	(435) 644-2551
Millard	Forrest Roper	Star Route Box 50 Fillmore, UT 84631	(435) 743-5302
Morgan	Terry Turner	Courthouse, PO Box 886 Morgan, UT 84050	(435)845-4048
Piute	Cordell Peterson	PO Box 145 Junction, UT 84740	(435) 577-2893
Rich	Dan Ames	109 N 200 E Laketown, UT 84038	(435) 946-2907
Salt Lake	Dennis Stanley	440 S 300 E SLC, UT 84111	(801) 535-5969
San Juan	Rick Bailey	PO Box 9 Monticello, UT 84535	(435) 587-3225
Sanpete	Bevin Blackham	185 N 400 E Fairview, UT 84629	(435) 283-4021
Sevier	Jim Porter	180 N Main Richfield, UT 84701	(435) 896-4890
Summit	Al Cooper	110 Zermat Strasse (Summit Park) Park City, UT 84098	(435) 649-9439
Tooele	Harrry Shinton	47 S Main Tooele, UT 84047	(435) 882-3335
Unitah	Clay Johnson	PO Box 307 Vernal, UT 84078	(435) 789-0920
Utah	Coy Porter	80 S 300 W Provo, UT 84601	(801) 379-6321
Wasatch	Kent J. Berg, Acting	805 W 100 S Heber City, UT 84032	(435) 654-1661
Washington	Dean Cox	197 E Tabernacle St George, UT 84770	(435) 673-4824
Wayne	Vicky Taft	PO Box 313 Bicknell, UT 84715	(435) 836-2831
Weber	Max V. Jackson	363 W Independence Harrisville, UT 84404	(801) 782-4100

LOCAL EMERGENCY PLANNING COMMITTEES FOR CITIES

City	Chairperson	Address	Phone
Sandy	Andrew Glad	9010 S 150 E Sandy, UT 84070	(801) 568-2930
West Valley City	John Evans	3699 Constitution Blvd West Valley, UT 84119	(801) 963-3337

APPENDIX F - DRINKING WATER SOURCE PROTECTION ORDINANCE

The following is an example of a source protection ordinance. Wellhead Protection Technology Transfer Centerpiece Workshop (EPA/600/K-92/015) was used as a reference. It has been changed to reflect recommendations in the Drinking Water Source Protection Rule, R309-113 of the Utah Administrative Code.

BE IT ORDAINED by the Mayor and Council of the City of _____ in Council duly assembled and it is hereby ordained by the authority of same that the following ordinance known as the Drinking Water Source Protection Ordinance is adopted and made a part of the Code of Ordinance of the City of _____, to wit:

Section 1. Short title and purpose.

(a) This ordinance shall be known as the "Drinking Water Source Protection Ordinance."

(b) The purpose of this ordinance is to insure the provision of a safe and sanitary drinking water supply for the City by the establishment of drinking water source protection zones surrounding the wellheads for all wells which are the supply sources for the City water system and by the designation and regulation of property uses and conditions which may be maintained within such zones.

Section 2. Definitions. When used in this ordinance the following words and phrases shall have the meanings given in this Section:

(a) Design standard - means a control which is implemented by a potential contamination source to prevent discharges to the ground water. Spill protection is an example of a design standard.

(b) Land management strategies - means zoning and non-zoning controls which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground-water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, written contracts and agreements, and so forth.

(c) Pollution source - means point source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit

privies, and animal feeding operations with more than ten animal units. The following clarify the definition of pollution source:

(1) Animal feeding operation - means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(2) Animal unit - means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(3) Extremely hazardous substances - means those substances which are identified in the Sec. 302(EHS) column of the "TITLE III LIST OF LISTS - Consolidated List of Chemicals Subject to Reporting Under SARA Title III," (EPA 560/4-91-011).

(d) Potential contamination source - means any facility or site which employs an activity or procedure which may potentially contaminate ground water. A pollution source is also a potential contamination source.

(e) Regulatory agency - means any governmental agency with jurisdiction over hazardous waste as defined herein.

(f) Sanitary landfill - means a disposal site where solid wastes, including putrescible wastes, or hazardous wastes, are disposed of on land by placing earth cover thereon.

(g) Septic tank/drain-field systems - means a system which is comprised of a septic tank and a drain-field which accepts domestic wastewater from buildings or facilities for subsurface treatment and disposal. By their design, septic tank/drain-field system discharges cannot be controlled with design standards.

(h) Wellhead - means the upper terminal of a well, including adapters, ports, seals, valves and other attachments.

Section 3. Establishment of drinking water source protection zones. There is hereby established use districts to be known as zones one, two, three, and four of the drinking water source protection area, identified and described as follows:

(a) **Zone one** is the area within a 100-foot radius from the wellhead.

(b) **Zone two** is the area within a 250-day ground-water time of travel to the wellhead, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

(c) **Zone three** (waiver criteria zone) is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

(d) **Zone four** is the area within a 15-year ground-water time of travel to the wellhead, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer.

Section 4. Permitted uses. The following uses shall be permitted within drinking water source protection zones:

(a) Any use permitted within existing agricultural, single family residential, multi-family residential, and commercial districts so long as uses conform to the rules and regulations of the regulatory agencies.

(b) Any other open land use where any building located on the property is incidental and accessory to the primary open land use.

Section 5. Prohibited uses. The following uses or conditions shall be and are hereby prohibited within drinking water sources protection zones, whether or not such use or condition may otherwise be ordinarily included as a part of a use permitted under Section 4 of the ordinance.

(a) **Zone one** - The location of any pollution source as defined herein.

(b) **Zone two** - The location of a pollution source unless its contaminated discharges can be controlled with design standards.

(c) **Zones three and four** - The location of a potential contamination source unless it can be controlled through land management strategies.

Section 6. Administration. The policies and procedures for administration of any source protection zone established under this ordinance, including without limitation those applicable to nonconforming uses, exception, enforcement and penalties, shall be the same as provided in the existing zoning ordinance for the City of _____, as the same is presently enacted or may from time to time be amended.

This Ordinance shall be effective as of _____(date). All ordinances and parts or ordinances in conflict herewith shall not be and the same are hereby repealed.

ENACTED AND ADOPTED this _____ day of _____, 19__.

_____
Mayor

Attest: _____
City Clerk

APPENDIX G - POTENTIAL CONTAMINATION SOURCE FACT SHEETS

General information about potential contamination sources (PCSs) is contained in the Fact Sheets listed below. They are intended to be used to provide information about PCSs and to make general best management and pollution prevention practice recommendations. They are **not** intended to be used as a "cookbook" for source protection. Public water systems may find them helpful in getting started; however, best management and pollution prevention strategies should be tailored to fit the specific situations at each PCS. *You are encouraged to develop well thought out protection strategies that will effectively protect the quality of your drinking water.*

The following *Potential Contamination Source Fact Sheets* are available from the Division of Drinking Water. Call 536-4200 to request copies:

Dry Cleaning

Fertilizer

Household Hazardous Waste

Metal Finishers

Pesticides

Pollution Prevention

Printing Shops

Septic Tank/Drain-field Systems

Vehicle Maintenance & Repair