TOWN OF MONUMENT
WELLHEAD PROTECTION PLAN

1997

Center for Community Development and Design

University of Colorado
Colorado Springs

Center for Community Development and Design
University of Colorado at Colorado Springs

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Additional support for this research was provided by:

Colorado Wellhead Protection Program,

Colorado Department of Public Health and Environment and

The U.S. Environmental Protection Agency

and

The University of Colorado at Colorado Springs

The Center for Community Development and Design

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WELLHEAD PROTECTION PLAN

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1997

Center for Community Development and Design

University of Colorado
Colorado Springs

Community Development Monograph Series

#74

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EXECUTIVE SUMMARY

The town of Monument began developing its Wellhead Protection Plan (WHPP) in early 1995. Monument relies on groundwater for all of its drinking water and was enthusiastic about testing a wellhead protection guidebook. Using the guidebook as a template, Monument designed a WHPP tailored to the town's specific wellhead protection needs. A citizen's committee coordinated research and collected data used for assessing these needs. The goal of the final WHPP is to conserve and protect Monument's current and future groundwater resources. Some key elements of the plan are:

- Hydrogeology of the Monument area
- Monument's water supply
- Wellhead delineation
- Contaminant inventory
- The Contingency Plan
- The Management Plan

Each of the sections outlined covers different aspects of wellhead protection in Monument. Conclusions drawn from groundwater research are included in their respective sections. Recommendations based on these conclusions are incorporated into the Contingency and Management plans.

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ACKNOWLEDGEMENTS

The following people and institutions from the community of Monument and others offered their help and expertise, time and talents, in the preparation of this document. Their help has been greatly appreciated.

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Colorado Rural Water Association

Monument Public Library

Monument Tribune

Monument Public Works Department - Jerry Standard

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INTRODUCTION

A 1986 amendment to the federal Safe Drinking Water Act provided for the establishment of Wellhead Protection with the aim of protecting public groundwater supplies from contamination. Under this amendment, it is each State's responsibility to develop a program that will protect its public groundwater sources. Along with several other small communities reliant on groundwater for domestic use, Monument has developed a local groundwater protection program to complement the State's efforts.

By definition a wellhead protection area (WHPA) is the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such well or well field. The purpose of initiating a Wellhead Protection Program is to identify the WHPA and then take strategic steps to safeguard the area from contaminants so that the water supply remains safe and intact.

Therefore, the purpose of this plan is to:

- Define Roles and Duties of Local Agencies;
- Delineate the WHPA;
- Identify Potential Sources of Contamination;
- Determine Management Approaches of Contamination Threats;
- Establish Contingency Plans for Natural and Man-Made Disasters; and
- Describe Principles for Siting of New Wells.

BACKGROUND

GEOGRAPHY

The Town of Monument is a small community of about 1,200 people located in the extreme northern part of El Paso County (see vicinity map, Page 4). On the southern slope of the Palmer Divide, it is 15 miles north of Colorado Springs. The Palmer Divide is a ridge that extends eastward from the Rocky Mountains and rises to an elevation of over 7,000 feet. Major drainages on the southern slope of the divide which are important to the town of Monument include Monument, Crystal and Dirty Woman Creeks. These drainages empty into Fountain Creek, which in turn empties into the Arkansas River. The western border of the Divide area is the town of Palmer Lake. The eastern region is bordered by the Black Forest.

CLIMATE

Monument's climate is highly variable due to its altitude and situation on the Palmer Divide. Historical temperature extremes range from -40 degrees to 100+ degrees Fahrenheit. The yearly mean temperature is 55 degrees Fahrenheit.[1] Because the Divide protects Colorado Springs from severe northern storms, and Denver from upslope storms, moist air is trapped here causing more intense weather than is experienced in other areas of the Front Range.[2]

Located in a semi-arid climate Monument's average annual rainfall is 18 inches, which includes 83 inches of snowfall yearly.[3] In recent years most precipitation has occurred in the months of May and August.[4]

GROWTH & DEVELOPMENT

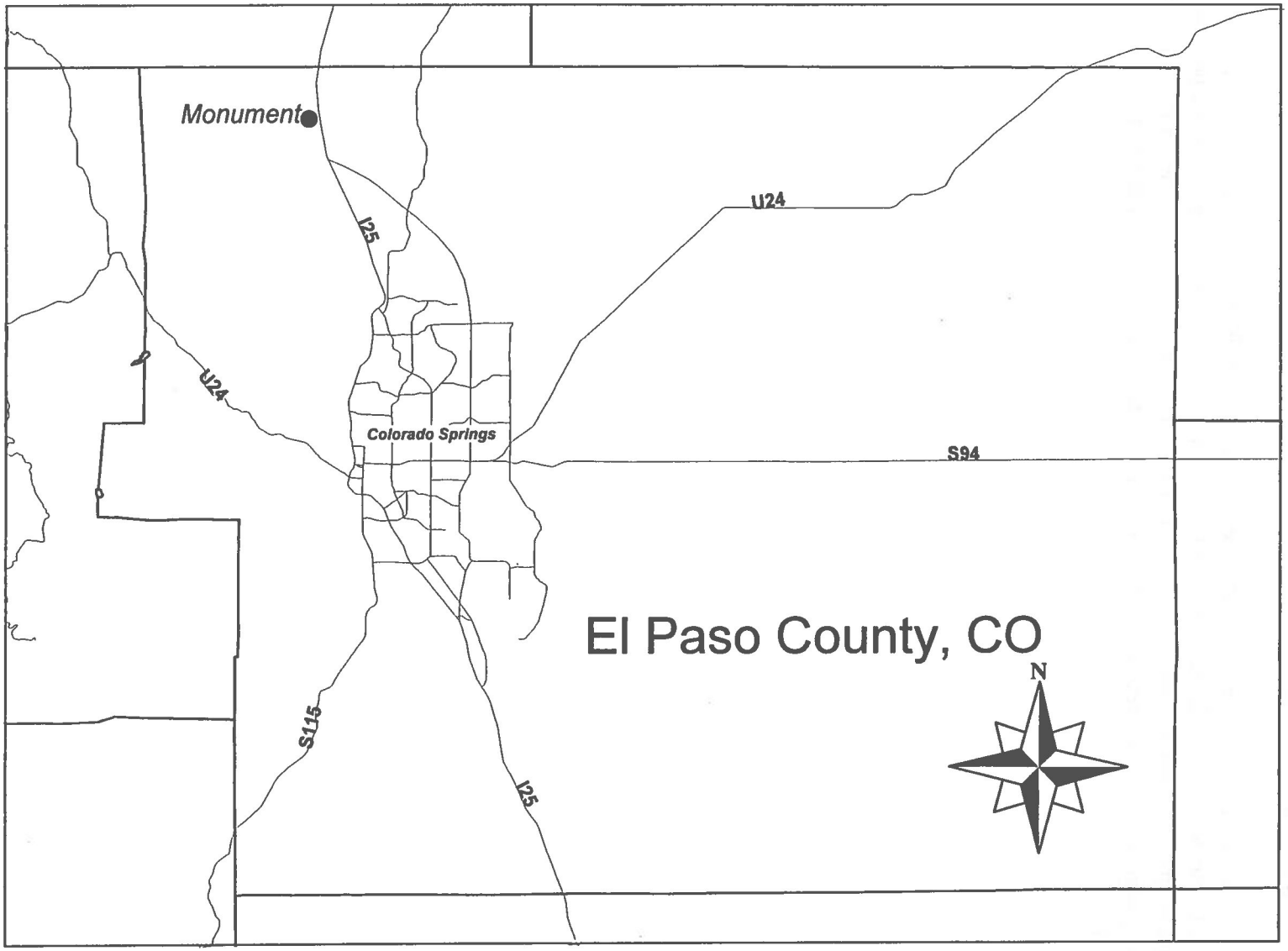
The Town of Monument supports a policy of extended growth and development consistent with its 1984 Comprehensive Plan. While this plan is being updated to include all of the Tri-Lakes area (see vicinity map) in northern El Paso County, Monument has grown to be the commercial center of this area which includes Monument, Palmer Lake and Woodmoor, located east of Interstate 25 I25. Commercial development in Monument has occurred primarily along the intersection of Colorado State Highway 105 (SH 105) and I25. Secondary commercial development occurs along Woodmoor Drive on the eastern side of I25. Here commercial development is limited to small businesses, gas stations, convenience stores, and other related businesses. A small manufacturing district exists in the southern part of town. Several strip mall centers also exist.

Between 1980 and 1995, Monument's population grew from 690 to 1,218 residents, an increase of 77 percent in 15 years. This represents an average annual growth rate of almost four percent

during this period.[5] Residential development, occurring throughout the Tri-Lakes area, has also increased Monument's physical size. From May 1985 to November 1995, annexations have added over 2,100 acres to the town, mostly in the form of residential developments.[6]

In addition to a public water system, sewage treatment is provided to the Town by a special district, the Monument Sanitation District. Special districts have the same responsibility as a municipality to abide by state and federal regulations and submit to the same monitoring and testing regulations. The sewage discharge from the Monument Sanitation District does not pose a threat.

VICINITY MAP



MONUMENT'S WATER SYSTEM

Because Monument relies solely on groundwater for its municipal supplies, adequate groundwater sources are of primary importance in the future growth and development of the town. Since the first town well was drilled in 1888, the town has been concerned about the sources, quality, and distribution of water to supply the needs of a growing population base.

In order to properly manage municipal water supplies, it is important to identify the major components of the water system and describe how they work together. By utilizing this information, the town can determine which components need backup during different emergency conditions. Long term management solutions can integrate all of the water system components and their current operation if necessary.

Figure LEOP-1 on Page 27 outlines the major components of the town's water system. Each of Monument's wells pumps directly into the distribution system. The distribution system consists of over 25 miles of pipe and serves 386 households and 91 businesses.

Customer demand determines whether water remains in the distribution system or is pumped to the storage tank northeast of town. Generally, if demand is high, (less than 45 p.s.i. [low pressure] at the booster pumping station) all water remains in the town's distribution system. If demand is low (more than 45 p.s.i. [high pressure]) surplus water is pumped to the storage tank via the booster pumping station. Only well #7 has the capability to pump directly to the storage tank, bypassing the booster pumping station.

The town's water system components are relatively independent, yet integral in their operation.

- A computerized well-rotation system is used to allow recovery of the water table when the deep wells (#'s 1, 2, 3, 6, 7) have been pumped to shut-off or when a well is out of service for other reasons. This system allows the remaining wells to compensate for those that are out of service. Manual overrides are common however, to coincide with work schedules.
- If the booster pumping station is out of service, well #7 can pump water directly to the storage tanks, serving residents north of SH 105.
- Water sources at varying depths and in different locations help assure the town of a permanent, if somewhat reduced, water supply when one or more wells must be removed from service for a short time.

During the summer months water usage may reach demands of 600,000 gallons per day (gpd) while winter usage averages about 300,000 gpd. The maximum yield available (potential yield) of the entire system has been estimated at 600,000 gpd, assuming no wells are out of service, and the rotation system is utilized. Increasing demand, particularly in the warmer months, equal to the potential yield of the system points to the town's reliance on present sources and the lack of water reserves for emergency needs.

The water system has proven to work adequately with any one of its three major components (storage tank, booster pumping station or one well) out of service. This is only true, however, for short periods of time and has been roughly estimated to be a period of less than one week. How adequately the partial system operates depends on which component malfunctions, how quickly the problem can be rectified, current tank level, season of occurrence, weather conditions and other factors affecting the water system at that time. Emergency situations are covered in the Contingency Plan section.

HYDROGEOLOGY

An aquifer is a body of saturated rock or sediment through which water can move easily. Aquifers are both porous (rock's ability to hold water) and permeable (ease of water flow). On the Front Range productive aquifers contain geologic materials such as sandstone, conglomerate, and bodies of sand and gravel. Compared to the rapid flow of surface water, most groundwater moves relatively slowly through underground rock. The water moves in response to differences in water pressure; water within the upper part of a saturated zone moves down the slope of the water table.[7]

The Denver groundwater basin underlies a 6,700 square mile area extending from Greeley in the north to Colorado Springs in the south, and from the Front Range in the west to near Limon in the east. Figures A and B on Pages 8 and 9 illustrate the extent and the cross sections of the aquifers found in the groundwater basin and their size in relation to each other.

The Dawson Arkose section contains the *Dawson* aquifer and is exposed at the surface or buried under a thin layer of soil in large areas of northern El Paso County. Due to lens-shaped layering, water-bearing beds may be of different thicknesses or entirely absent depending on the location of a particular well. Therefore, this aquifer, as well as the others in the basin, consists of a complex pattern of interconnected beds of permeable and relatively impermeable sediments that differ in their ability to store and transmit water. Depth to the base of this aquifer is generally between 500 and 1,000 feet, but it is 1,400 feet near Castle Rock. Well #6 at a depth of 340 feet and well #1 at a depth of 415 feet are located in this formation.

The *Denver Formation's* water-bearing layers of sandstone and siltstone occur in poorly defined irregular beds that are dispersed within relatively thick sequences of claystone and shale. The depth to base is as much as 2,000 feet near Colorado Springs. The Denver aquifer contains about 30 percent sandstone and siltstone and 70 percent claystone and shale. Well #2, at a depth of 950 feet and well #3, at a depth of 1,050 feet, are located here.

The *Arapahoe Formation* consists of a 400 to 700 foot thick series of interbedded conglomerate, sandstone, and shale. The depth to base of the aquifer is as much as 2,600 feet and in excess of 1,000 feet throughout the west-central part of the aquifer. Well #7, at an 1,800 foot depth, is located in the Arapahoe Formation. Well #8 is currently being drilled into this formation and will be completed shortly.

The *Laramie-Fox Hills* aquifer is the deepest and most extensive aquifer in the basin and underlies 6,700 square miles between Greeley and Colorado Springs. Consisting of two parts, the Laramie Formation and the Fox Hills Sandstone, composite depth ranges between 1,500 and 2,000 feet. No municipal wells for the town have been drilled into the Laramie-Fox Hills Formation.

Alluvial aquifers 20 to 100 feet thick commonly occur in the valleys of larger streams in the area (such as Monument Creek) and contain relatively young, unconsolidated sediments. Drilled at depths of 30 feet, wells #4 and #5 are located in the alluvium of Monument Creek.[8]

FIGURE A
LOCATION AND EXTENT OF BEDROCK ACQUIFERS

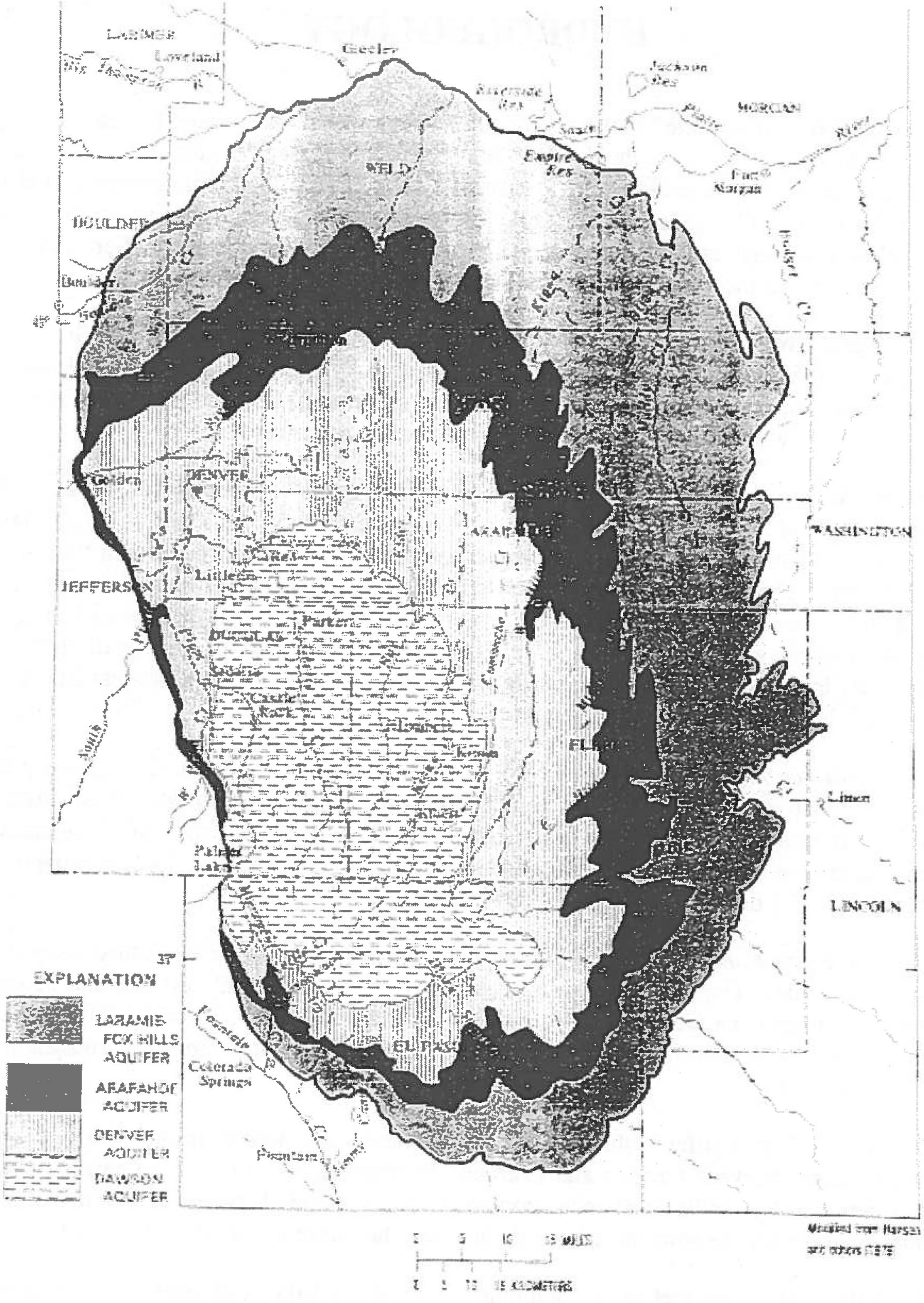
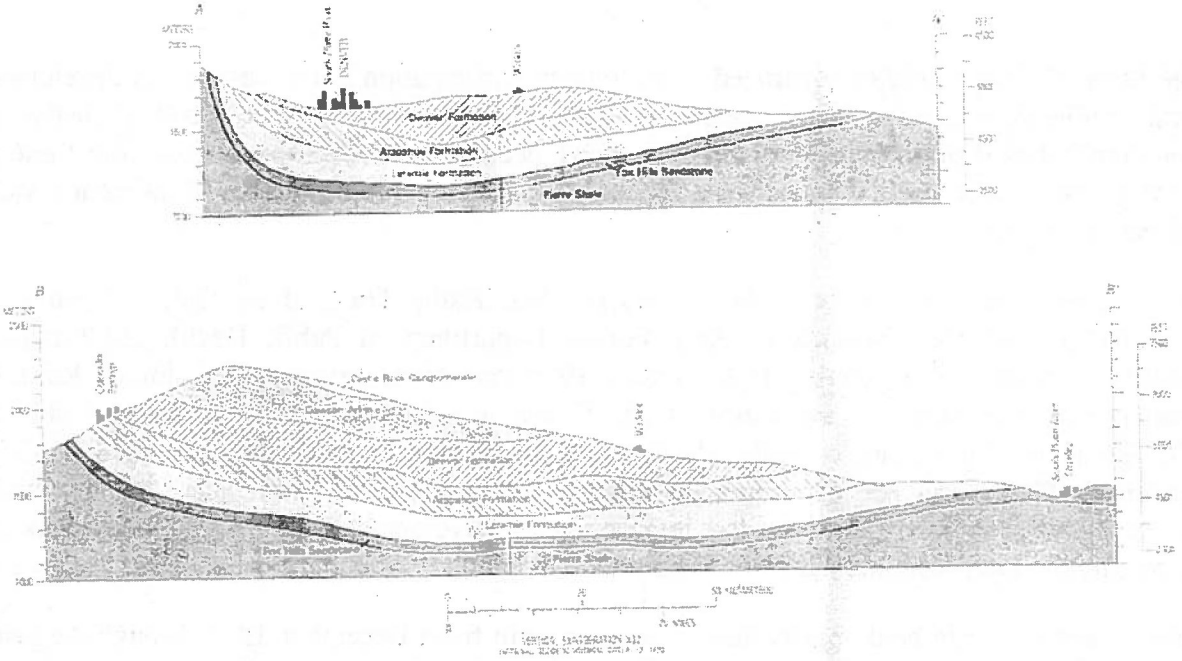


FIGURE B
GEOLOGIC SECTIONS



PUBLIC PARTICIPATION

The State of Colorado has encouraged active citizen participation in the design and development of local wellhead protection plans, believing that such involvement will result in better plans. Community-based plans build the political support necessary to develop and carry out these plans. To that end, public participation was solicited with varying results during Monument's wellhead protection project.

Early in 1995 the town surveyed businesses and Ms. Kathy Trask of the Colorado Rural Water Association, with the assistance of the Colorado Department of Public Health and Environment (CDPHE), delineated the wells. In November 1995, the town, through the Colorado Rural Water Association, requested the assistance of the Center for Community Development and Design (CCDD) at the University of Colorado in Colorado Springs. With the assistance of CCDD a concerted effort was made to inform and educate the residents of Monument about groundwater issues. Emphasis was placed on the importance of developing a community plan dedicated to protecting the town's municipal wells from contamination.

Public meetings were held approximately once a month from December 1995 through August 1996 to organize the plan through its different phases. Volunteers were solicited to help with the plan through the media, personal contacts, schools and service organizations. While the number of volunteers never exceeded 10 people, these knowledgeable and dedicated residents have devoted their time and energy to a variety of tasks and the completion of this report. Table A lists all meetings held in Monument related to the formulation of this plan.

TABLE A PUBLIC MEETINGS	
Meeting Date:	**Topic:**
12/7/95	Meeting with Director of Public Works
1/11/96	Kick-Off Meeting: Citizen Task Force
2/8/96	Kick-Off Meeting: Community Participation
4/18/96	Introduction to Contingency Planning
6/27/96	Inventory of Contaminants
7/25/96	Review Inventory of Contaminants Management Plan Overview
8/15/96	Management Plan: Part I
8/19/96	Town Council Meeting: WHPP Update
8/29/96	Management Plan: Part II

DELINEATION

The purpose of delineating a WHPA around a municipal water well is simply to define the geographic area through which water flows to the well. Water may travel thousands of feet along the surface and through the subsurface to reach a well. The water can pick up contaminants anywhere along its route, from any material it contacts on or below the ground. [9]

Once contaminated, groundwater is very difficult and expensive to clean. By defining the area from which water is collected and flows to the well, the geographic area that must be protected from potential contaminants has been identified.

Characteristics of an aquifer that affect the size and shape of the final WHPA include:

- How thick it is;
- The materials it is made of and their properties;
- How porous it is; and
- How easily water can flow through it.[10]

Delineation criteria are factors affecting the likelihood of contaminants reaching a well. The United States Environmental Protection Agency (EPA) recognizes five delineation criteria:

- Distance between a point and a well;
- Aquifer drawdown;
- Time of travel for a contamination to reach a well;
- Aquifer flow boundaries; and
- Capacity of an aquifer to assimilate contaminants.[11]

The Colorado Department of Public Health and Environment (CDPHE) has selected "time of travel" (TOT) as the most appropriate factor to use in delineating a WHPA. TOT is defined as the time groundwater takes to move from a specific point to a well that is pumping at its maximum rate. The CDPHE recommends that a TOT of five years be used. This means that a contaminant entering the groundwater at the edge of the WHPA, up gradient of the well, will take five years to reach the well if it is pumping continuously.[12] However, physical processes that may reduce, disperse, or dilute the potential contaminant before it reaches the well are not taken into consideration. The agency has judged that a TOT of five years will provide adequate protection for most wells in Colorado.

Based on the criteria above, a semi-analytical model, SA 2.2, was used by the CDPHE to delineate Monument's wells. CDPHE then provided a reproduction of the WHPA overlain on a USGS base map of the area. As a result of concern about the vulnerability of the town's alluvial wells, further geologic study identified the effect of shallow bedrock layers and area topographic features, and as

a result the WHPA's for these two wells. Figure C on Page 14 shows the original (spider) maps provided by the SA 2.2 program were expanded. Figure D on Page 15 provides the enhanced version which was used to conduct the inventory of contaminants. The appendix lists all assumptions used by SA 2.2.

It is important to note that the WHPA's relating to wells #4 and #5 are considerably more extensive than for the other wells due to their particular hydrogeologic attributes. Wells #4 and #5 draw water indirectly from Monument Creek at a depth of only 30 feet. Therefore, water drawn from these wells is particularly vulnerable to any contaminant used or disposed of on the ground in the watershed of Monument Creek. By contrast, all of the other town wells draw from bedrock or sediments at depths ranging from 340 to 1,800 feet and are relatively safe from surface exposure to contaminants. Pertinent well and aquifer information can be found in Table B.

FIGURE C
Spider Map

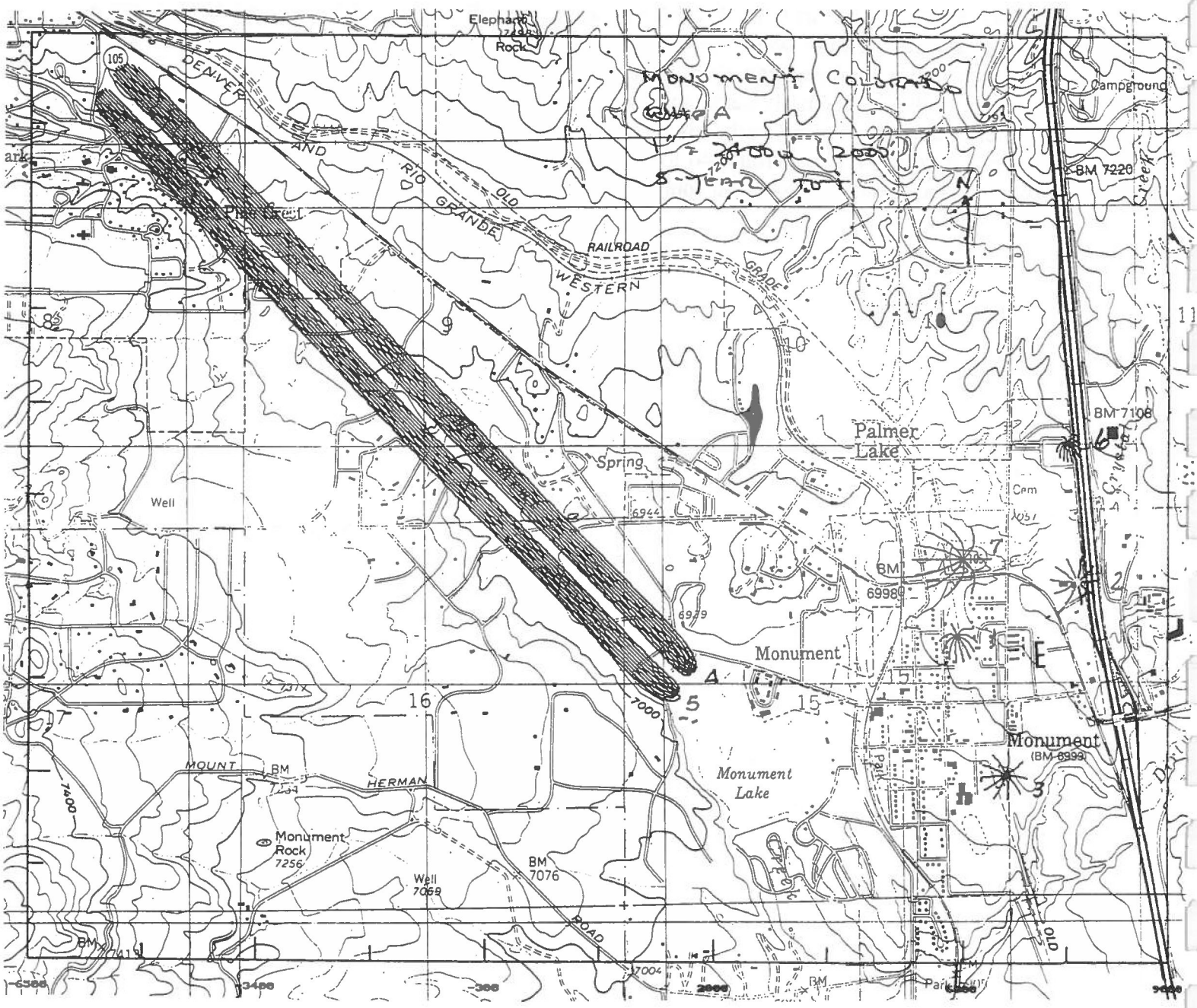
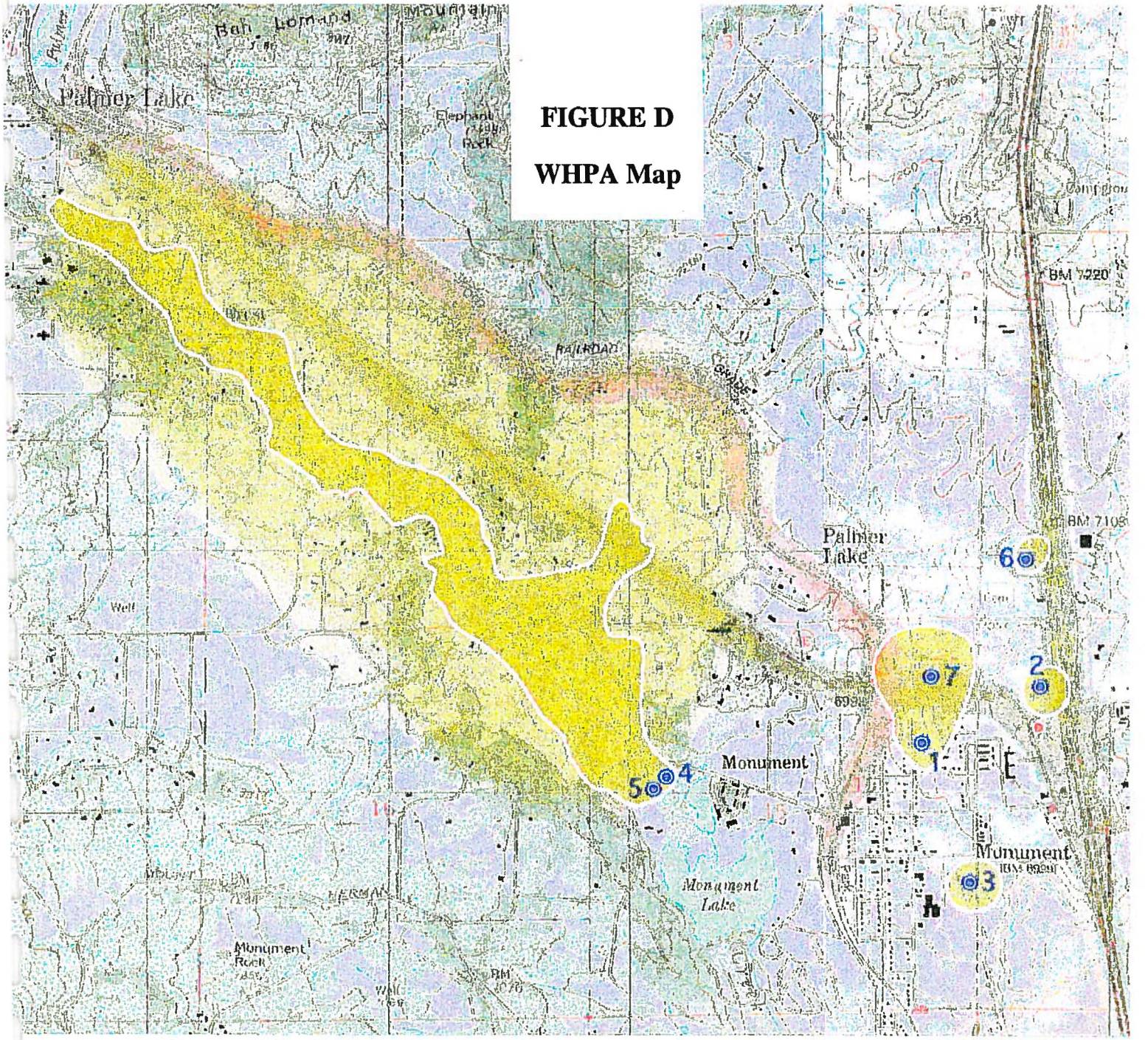


FIGURE D

WHPA Map



Summary Inventory of Potential Groundwater Contaminants for Monument, CO 4/11/96

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
5 KILOMETER

● General Features ●

- ◎3 Well (number 3)
- Wellhead Protection Area (WHPA) & Water-shed Contribution Area
- Highway Line Source
- Railroad Line Source

● Point Sources ●

(selected as areas of concern by Town of Monument)

- Underground Storage Tank
- Old Landfill

Produced by the Center for Community Development and Design, 1996

TABLE B
MUNICIPAL WELL INFORMATION PROVIDED BY TOWN OF MONUMENT AND ASSUMPTIONS PROVIDED BY CDPHE
MONUMENT, COLORADO

Well #	1	2	3	4	5	6	7
Address	506 N. Jefferson	600 SH 105	186 Beacon Lite Rd.	700 N. Monument Lake Rd.	700 N. Monument Lake Rd.	880 Beacon Lite Rd.	777 SH 105
Location	Public Works Dept.	Safeway Parking Lot	South of Beacon Lite Rd.	Southwest of town limits	Southwest of town limits	Trailer Court	On SH 105 west of I25
	NE/NE/S15-11S-67W	NW/NW/S14-11S-67W	NE/SE/S15-11S-67W	SW/NW/S15-11S-67W	SW/NW/S15-11S-67W	SW/SW/S10-11S-67W	NE/NE/S15-11S-67W
	1650' S of N line	950' S of N line	3500' S of N line	2100'S of N line	2500' S of N line	4300' S of N line	700' S of N line
	850' W fo E line	850' W of E line	6800 W of E line	2500' E of W line	800' E of W line	650" E of W line	1400' E of W line
Permit #	011349-R	11350-R-R	16543	26187-F	27188-F	13363	37502-F
Year Drilled	1911	1923, 1994	1973	1984	1984	1973	1992
Aquifer	Dawson	Denver	Denver	Alluvium	Alluvium	Dawson	Arapahoe
Depth	415	950	1050	30	30	340	1800
Confined/Unconfined	Unconfined	Confined	Confined	Unconfined	Unconfined	Unconfined	Confined
Pumping Rate (gpm)	50	91	85	75	75	20	300
Filtration	None	None	None	Pressure Filter, Iron Removal	Pressure Filter, Iron Removal	None	Pressure Filter, Iron Removal
Treatment	Chlorine	Chlorine	Chlorine	Potassium Permanganate,	Potassium Permanganate,	Bleach	Potassium Permanganate,
				Chlorine	Chlorine		Chlorine
% of Total System	10	15	15	7.5	7.5	5	40
X	6,100	7750	6800	2300	2300	7600	6200
Y	4350	5100	2500	3600	3600	7000	5400
Discharge (Ft3/d)	6584	17402	17402	8300	8300	3080	38121
Casing Radius (ft.)	1	0.67	0.36	0.37	0.37	1	1
Static Haed Level (ft.)	182	270	566	30	30	114	300
Drawdown (ft.)	100-292	290-560	104-670	21	21	71-185	300-0
Casing Perforation (ft.)	n/a	n/a	330-370	n/a	n/a	n/a	n/a
			570-650				
			770-1050				
Radius of Influence	1023	n/a	n/a	n/a	n/a	700	n/a

INVENTORY

The inventory of contaminants in the WHPA's consisted of determining what, if any, land uses and disposal practices pose a threat to the groundwater of the town. Land uses can be categorized as historical, current, or future. Historical uses are those that occurred in the past and are no longer active or operating, but could still pose a threat to current groundwater supplies because of improper use or disposal of potentially contaminating materials. Improperly sealed wells, including abandoned wells, and other punctures to the protective underground clay layers can accelerate contaminant introduction to groundwater.

Current or active land uses are, by far, the largest group of land use activities. They range from industrial and commercial to residential and municipal activities. Pesticide application in parks and on lawns and household chemical use are also considered potential groundwater threats.

Future land uses include determining what is expected for the town through: 1) evaluation of planned developments currently before the planning commission and 2) anticipating future land use based on current policies for growth and development.

All of the town's land uses were determined by specific documents, direct field observation, and soliciting input from residents and businesses through surveys. The following is a partial list of sources used and activities conducted by the WHPP volunteers to determine these land uses.

- Field observations of the wellhead protection areas.
- Library research in the local/western history sections of local public libraries.
- Database research of the Oil Inspection Section, Department of Labor and Employment.
- Surveys of business owners and residents of Monument.
- Study of aerial photography of the Monument area.
- Compilation of information on the local transportation system (i.e., railroads, state and federal highways and roads, and the State's Port-of-Entry located in Monument).
- Compilation of information regarding location of all current domestic wells, abandoned wells and monitoring wells.
- Review of Monument's current Water System Plan, Comprehensive Plan, and Local Emergency Operations Plan.
- Compilation of future developments and their locations.

Tables C, D and E contain detailed inventory results. Survey results are found in Tables F and G and have been incorporated into inventory results. Where discrepancies existed in the data, every effort was made to verify sources and reconcile the information.

TABLE C
INVENTORY OF POTENTIAL CONTAMINANTS 8/96
MONUMENT, COLORADO

POTENTIAL SOURCES OF CONTAMINATION NOT DIRECTLY AFFECTING ANY CURRENT WHPA

Source ID#	Source Form	Land Use Type	Activity Type	Location	Potential Contaminant	Active?	Owner/Operator	Source of Data	WHPA#	Survey?
1	Point	Comm	spraying, storage, solvents	137 N. Monument Lake Rd.	pesticides, etc.	Active	Monument Nurseries	obs.	n/a	yes
2	Area	Muni	municipal dump	vic. Jefferson & Santa Fe	(in)organic Chemicals, etc	Inactive	n/a	*	n/a	
4	Point	Indus	mfg. surgical implants	1051 Synthes Avenue	chemicals, oils	Active	Synthes USA	obs.	n/a	yes
5	Point	Muni	school maint. facility	36 Jefferson	oil, gas, solvents	Active	Lewis-Palmer SD #38	*	n/a	

* Director of Public Works

TABLE D
INVENTORY OF POTENTIAL CONTAMINANTS 8/96
MONUMENT, COLORADO

PROPOSED DEVELOPMENT

Source ID#	Form	Type	Type	Location (vic.)	Contaminant	Owner/Operator	Data	WHPA#
1	Point	Comm	storage units	w. side of Old Denver Rd.	improperly stored containers	to be determined	*	n/a
2	"	"	RV sales & service	North Beacon Lite Rd.	oil, gasoline, solvents	"	*	6
3	"	"	concrete batch plant	North Beacon Lite Rd.	??	"	*	6
4	"	"	outside storage lot	North Washington St.	oil, gas, solvents	"	*	4,5,7
5	"	Res	residential uses	??	herbicides, oil, fertilizers	"	*	n/a
6	"	"	"	Mitchell & McShane	"	"	*	"
7	"	"	"	Old Denver Rd. & Santa Fe	"	"	*	"
8	"	"	"	Higby & Baptist Rd. E. of I25	"	"	*	"
9	"	"	"	Baptist Rd. & I25	"	"	*	"
10	"	"	retirement center	SH 105 & Knollwood	"	"	*	"
11	"	Comm	shopping center	SH 105 & Struthers Rd.	oil, gasoline, solvents	"	*	"

* Town of Monument, Planning Dept

TABLE E
WHPA INVENTORY BUSINESS/NON-FARM SURVEY RESPONSES 3/95, 8/96
MONUMENT, COLORADO

Survey ID #	Name	Address	WHPA #	Comments:
1	Synthes USA	1051 Synthes Ave.	n/a	mfr. of surgical implants
				chemicals & oils stored on site and
				used in processing
2	Motor Parts & Supply	SH 105 & 3rd	1,3	chemicals & oils shelved in store
3	Gerard Timmins DDS	325 2nd St.	1,3	radiographic chemicals recycled
4	Gift of Health Therapeutic Massage	212 N. Washington	1,3	
5	McDonald's of Monument	450 SH 105	1,3	1,000 gal. concrete grease trap
6	1st Class Packing & Shipping	481 SH 105 B	1,3	
7	Brown Construction	856 N. Washington	4,5,7	motor oil recycled
8	Tri-Lakes Trash	856 N. Washington	4,5,7	
9	NAVSYS Corp.	14960 Woodcarver Rd.	n/a	r&d; sewer & septic tank
10	Tom Close D.C.	240 Beacon Lite Rd.	3	xray dev. fluids; sewer
11	Tri-Lakes Realty	273 SH 105	3	
12	Brown's Gallery Antiques	155 Second St.	3	
13	Right Hemisphere Gift Shop	274 N. Washington	3	
14	Massage For Health	212 N. Washington	3	
15	Radio Shack/Tri-Lakes Electronics	481 SH 105 B	1,3	
17	Clearview Distributors	279 Beacon Lite Rd.	1,3	
18	Seelye Insurance	111 2nd St.	3	
19	Covered Treasures Bookstore	105 2nd St.	3	
20	Custom Country Homes	309 Woodworth St.	1,3	
21	Electric Propulsion Lab	1040 Synthes Ave.	n/a	gases vented to atmosphere
22	Front Range Animal Hospital	418 3rd St.	1,3	sewer used; dead animals are picked by by an approved company
23	J.J. Tracks Inc.	279 Beacon Lite Rd.	3	oils stored on site & recycled
24	Rampart Car Care Inc.	303 SH 105	1,3	oils stored on site & recycled
25	Ultimate Engineering	530 E. 8th St.	2	
26	Century 21	481 SH 105	1,3	
27	The Drug & Liquor Store	275 SH 105	2	

28	Hogan Mechanical	245 Jefferson	n/a	
29	Taco Bell	441 SH 105	1,3	Has grease traps
30	Front Range Geotechnical	341 Front St.	4,5	
31	Hansel & Gretel Inc.	481 SH 105	3	
32	Offices at 66 Second	66 2nd St.	3	
33	Children's Choice	77 3rd St.	4,5	
34	4Paws Dog Grooming	481 SH 105	1,3	
35	Law Offices	325 2nd St.	n/a	
36	Rocky Mountain Bus Sales	531 E. 8th St.	6	used oil in storage tank
37	Pankratz Studios & Gallery	366 2nd St.	3	iron oxides, carbonates stored
38	Monument Nurseries	137 N. Monument Lake Rd.	n/a	
39	Sundance Kennels	296 Spring St., Palmer Lake	4,5	
40	Palmer Lake Sanitation	#4 SH 105	4,5	did not comment on sewage backups
41	Colorado Dept. of Trans.	700 N. Washington	4,5,7	
42	7-11 Store	283 SH 105		
43	Ryder Truck Rental	19275 Beacon Lite Rd.	n/a	
44	Rocky Mountain Oil Change Center	213 SH 105	n/a	ASTs stored in sealed bsmt.
45	Town of Monument	506 N. Jefferson	1	used oil stored in concrete containment area

TABLE F WHPA INVENTORY: FARM/LARGE LOT RESIDENTIAL SURVEY RESPONSES 5/95 MONUMENT, COLORADO				
Survey ID #	**Name**	**Address**	**WHPA**	**Comments:**
1	Dawn Yadlosky	18775 Rockbrook Rd.	4,5	
2	John Drollinger	18625 Rockbrook Rd.	"	
3	Ronald Vierling	731 Hillview Rd.	"	
4	Helen Stevens	18380 Chandler	"	
5	Tom Puskas	3125 N. Monument Lake Rd.	"	2 above ground storage tanks
6	W. Ross	752 Westward Lane	"	phosphoric acid, potash, nitrogen, diazinine; oil & solvents poured in road 10-15 years ago.
7	Henry Sparks	2895 Roberts Dr.	"	
8	Jim Britt	3005 Peak View Blvd.	"	
9	James Carter	733 Westward Lane	"	
10	Carol Miller	18485 Faulkner	"	
11	Jim Pasquale	204 Rockbrook	"	

EVALUATION OF INVENTORY

Residences in the area were visually scanned for potential contaminants. Because of limited volunteer resources and well over 300 residences in Monument, personal interviews were not attempted. Normal household cleaning agents including paints and yard chemicals are assumed to be present in these areas. Residences in WHPA's #4 and #5, most of which are on septic systems, were mailed surveys in May, 1995. Response to this survey was approximately 15 percent, representing 11 residents.

Some commercial businesses and industries were interviewed and all were mailed surveys in March, 1995. All were visually scanned in July and August, 1996 and second request surveys were sent if no response had been received previously. Combined response to these surveys has been approximately 48 percent, representing 44 commercial activities.

In both cases, volunteers inspected properties through "windshield" surveys, usually at some distance, and were not encouraged to speak to property owners. Verification of potential contaminants was obtained through other sources, i.e., direct mail surveys and independent research.

Restaurants were not noted because all are connected to the town's sewer system and are regulated by the El Paso County Health Department with respect to grease trap disposal.

Offices and other uses, like the hardware store and the post office, where little or no potential pollutants were anticipated, were not inventoried.

Every attempt was made to be thorough in identifying potential contaminants to groundwater, but it is impossible to know if some properties were missed during the inventory effort. A particular threat may not have been recognized even though the property was visually inspected. The Project team did not attempt to evaluate the potential accuracy of these responses.

FINAL ANALYSIS OF INVENTORY

The final analysis of the inventory is not to pinpoint specific addresses, but instead to suggest areas of concern. As the management committee began its final evaluation of Monument's groundwater risks two themes emerged which characterized the potential threat to the community's groundwater. Rather than simply basing the final evaluation on types of pollution these themes were used as a basis for beginning the management plan.

TABLE G
HIGH RISK LAND USES[13]

RETAIL/COMMERCIAL:	gasoline, farm equipment, automotive, sales, and services, dry cleaners, photo processors, medical arts, furniture strippers, machine shops, radiator repair, printers, fuel oil distributors
INDUSTRIAL:	all forms of manufacturing and processing, research facilities
UNDERGROUND STORAGE OF:	chemicals and petroleum products
WASTE DISPOSAL:	pits, ponds, lagoons, injection wells for waste disposal, bulky waste and domestic garbage landfills, hazardous waste treatment, storage and disposal sites

THE CHARACTER OF COMMERCIAL AND BUSINESS ACTIVITY.

At the present time businesses in Monument are primarily engaged in small-town, service-oriented activities. Some light industrial activity occurs, but heavy industry is non-existent. This may not remain if the town continues to grow at its present rate, but for now Monument does not create large amounts of pollution as does its larger, more urban counterparts.

THE TYPES OF MUNICIPAL WATER WELLS.

Deep wells, which provide 85 percent of the town's water, require less aggressive management approaches than do the alluvial (shallow) wells which are more susceptible to the effects of pollution. Contaminants released on or near the ground's surface may never reach a deep well due to dispersal or dilution of the contaminant as it travels through the various underground rock layers. All of the wells are protected further by concrete grouting along the well casings.

GREATEST RISKS

Based on these distinctions and the EPA's ranking of high-risk sources of contamination (above), Monument's known sources of pollution (Inventory spreadsheets) are not considered a high risk to groundwater with the following exceptions.

1. ***Underground Storage Tanks (UST's).*** Underground storage tanks are considered high risk with respect to groundwater by the U. S. EPA because of their propensity to leak. Although this has been somewhat mitigated in recent years through more advanced tank technology and regular monitoring of underground storage tanks, leaking underground storage tanks (LUST's) still pose a considerable threat to groundwater. LUST's that are in remediation are listed in Table H. At the present time two sites are located in current WHPA's. The remainder are outside the WHPA's or entirely outside the town limits. Additionally, there are currently two other known UST sites that could affect groundwater in currently established WHPA's. Table I lists all registered underground storage tanks greater than 1,100 gallons. All UST sites affecting current WHPA's are located on the WHPA map located on Page 15

2. ***Historic Landfill.*** The old town dump could pose a problem to future WHPA's if located within the dump's area of influence. Located in the vicinity of the intersection of Jefferson and Santa Fe, little is known about the dump. However, landfills are considered high risk activities by the EPA and its location is noted in this report and on the WHPA map on Page15.

3. ***Transportation Corridors.*** State Highway 105 and the rail line runs along the northeastern border of the current alluvial WHPA's. Any accidental spill of gasoline, oil, or other hazardous material could adversely affect wells #4 and #5 depending on the extent and severity of the spill. Of the 6,050 (average volume) vehicles which pass along this highway daily, 270 are either single unit or semi-trailer trucks.[14] As growth continues, traffic and the potential for

spills can be expected to increase. Transportation corridors are noted on the WHPA map on Page 15.

Based on survey responses and field observations, commercial and industrial activities store and dispose of wastes in a manner consistent with the EPA's General Best Management Practices and currently do not warrant further investigation.[15]

TABLE H
LEAKING UNDERGROUND STORAGE TANKS - NOT CLOSED
MONUMENT, COLORADO

Source ID#	Name	Address	WHPA #	Disposition**
1	Chevron #70524 dba Amoco	1949 Woodmoor Dr.	n/a	10/90: gasoline leak affected groundwater 5/96: still in remediation
2	Chevron #70524 dba Amoco	Woodmoor Dr & I25	n/a	same as above
3	Monument Conoco	534 SH 105	1,2	5/90: groundwater contamination from LUST's 8/96: conditional approval of corrective action plan by Department of Labor and Employment
4	Nicholson Camps (now Rampart Car Care)	303 Sh 105	1,3	12/94: high levels of contamination around UST cavities 4/96: owner contracted for 2nd level site assessment
5	Total #2738	1310 W. Baptist Rd.	n/a	8/91: significant soil contamination from UST leak 11/94: conditional approval of corrective action plan by CDPHE
6	Total #2738	1310 W. Baptist Rd.	n/a	same as above
7	Woodmoor Country Club	18945 Pebble Beach Way	n/a	12/91: initial assessment indicates significant soil contamination exists

** from Oil Inspection Section records, Department of Labor and Employment. Includes first and last entries from LUST files

TABLE I
REGISTERED UNDERGROUND STORAGE TANKS (greater than 1,100 gallons)
MONUMENT, COLORADO

Source ID#	Owner Name	Location Name/Address	# Tanks Registered	WHPA #	In Town Limits?	Removed From Ground?**
000190	Southland Corp.	7-11 #20308 283 SH 105	6	3	yes	
001134	Rich & Sheryl Sidell	Monument Plaza Texaco 581 SH 105	5	1,2	yes	
001354	Unknown	Warren Langer 745 County Line Rd.	1	n/a	no	
002309	Lewis-Palmer SD #38	Lewis-Palmer SD #38 146 Jefferson St.	3	n/a	yes	
002310	Lewis-Palmer SD #38	Lewis-Palmer SD #38 1300 Higby Rd.	1	n/a	no	yes
004005	Amoco Oil Co.	Woodmoor Automotive 1949 Woodmoor Drive	8	n/a	no	
004315	Conoco Inc.	Conoco Fuel Stop #06400 534 SH 105	12	1,2	yes	
004894	Wilmar/Cornerstone Real Estate	Wilmar/Cornerstone Real Estate 341 Front St.	2	n/a	yes	yes
005379	Woodmoor Country Club	Woodmoor Country Club 18945 Pebble Beach	2	n/a	no	yes
005498	Century Bank of Colo. Springs	Price Truck Sales 19275 Beacon Lite Rd.	2	n/a	yes	yes
005580	Total Petroleum Inc.	Total #2738 1310 W. Baptist Rd.	5	n/a	no	
006445	Colo. Dept. of Highways	CDOH - Monument SH 105	2	n/a	yes	yes
006834	Howard Cloud/Nicholson Camps	Phillips 66 SS 3rd St. & SH 105	3	n/a	yes	yes
008658	Woodmoor/Monument Fire Dist	Woodmoor/Monument Fire Dist 1855 Woodmoor Drive	2	n/a	no	yes
001079	Lewis-Palmer SD #38	Lewis-Paler Transportation 146 Jefferson St.	1	n/a	yes	
000007	Rampart Car Care Center	Rampart Car Care Center 303 SH 105	4	1,3	yes	
000700	U.S. West Business Resources	US West 1466 SH 105	1	n/a	no	yes

** Oil Inspection Section records indicate that UST's have been removed at these locations.

THE CONTINGENCY PLAN

The Contingency Plan (Plan) for the Wellhead Protection Program addresses the problems the Town of Monument (the Town) must contend with if contamination or disruption of the Town's water supply should occur. In addition to addressing the needs of the Wellhead Protection Plan, the Contingency Plan follows basic procedures found in the Town's Local Emergency Operations Plan (LEOP). Because it is to be used in conjunction with this plan, it is somewhat repetitive.

The essential elements of this plan include:

- Identification & development of short- and long-term water supplies;
- Definition of an emergency response framework;
- Identification of the parties responsible for implementing the emergency response plans and coordinating actions; and
- Estimation of the financial cost of responding to an emergency and of replacing affected components of the water system on a short- or long-term basis.

WATER SYSTEM COMPONENTS

The physical characteristics of the components are presented in Table LEOP-1 and the major components of the Town's water system are schematically diagrammed in Figure LEOP-1.

The Town currently pumps water from seven (7) wells to a Storage Tank located north of town. An eighth well (well #8) will come on-line in mid-1997 near the corner of 2nd and Beacon Light. Water quality among the Town's wells varies considerably and iron removal is required for water withdrawn from wells #4, #5, and #7. As needed, water is then gravity fed from the Storage Tank to Town for distribution. Pressure is maintained either by the pumping wells or by the storage tank gravity feed. Emergency water, when needed above the pumping rate generated by the active wells, is drawn from the Storage Tank. However, when the volume of water in the tank is reduced to produce a Condition Red (see Annex Page D-4 of the LEOP), Emergency Ordinance 89 goes into effect and public water use restrictions are implemented.

As can be seen in Table LEOP-1, the current maximum water production rate for the Town's water system is ~700 gallons per minute (gpm). However, due to intermittent well outages for equipment or well maintenance, the average water production rate is approximately 500 gpm. Once well #8 comes on line, the Town's water production capacity is anticipated to increase by approximately 36 to 50 percent.

During the summer months, water usage may reach demands of 0.6 million gallons per day (MGD) or 417 gpm. Winter usage averages less than 0.3 MGD or 208 gpm. The winter demand should be considered the Town's current necessary water demand.

TABLE LEOP-1

SUMMARY OF CHARACTERISTICS OF THE MAJOR WATER SYSTEM COMPONENTS[a]
TOWN OF MONUMENT

Component	Function	Comments
Well 1	Groundwater Extraction	Aquifer accessed: Denver/Dawson. Withdraws groundwater from 415 feet (ft) below ground surface (bgs). Production rate: 50 gallons per minute (gpm). No treatment required.
Well 2	Groundwater Extraction	Aquifer accessed: Denver/Dawson. Withdraws groundwater from 1,000 ft bgs. Production rate: 91 gpm. No treatment required.
Well 3	Groundwater Extraction	Aquifer accessed: Denver/Dawson. Withdraws groundwater from 1,000 ft bgs. Production rate: 85 gpm. No treatment required.
Well 4	Groundwater Extraction	Aquifer accessed: Alluvial. Withdraws groundwater from 30 ft bgs. Production rate: 75 gpm. Iron removal required.
Well 5	Groundwater Extraction	Aquifer accessed: Alluvial. Withdraws groundwater from 30 ft bgs. Production rate: 75 gpm. Iron removal required.
Well 6	Groundwater Extraction	Aquifer accessed: Denver/Dawson. Withdraws groundwater from 330 ft bgs. Production rate: 20 gpm. No treatment required.
Well 7	Groundwater Extraction	Aquifer accessed: Arapaho. Withdraws groundwater from 1,800 ft bgs. Production rate: 300 gpm. Iron removal required. Water pumped directly to Storage Tank.
Well 8 (under construction)	Groundwater Extraction	Aquifer accessed: Arapaho. Will withdraw groundwater from ~1,800 ft bgs. Projected production rate: 250 - 300 gpm. Treatment requirements unknown.
Storage Tank	Water storage & distribution	Concrete tank; 1,000,000 gallon capacity.
Booster Station	Deliver water from wells 1-6 to Storage Tank	Electrical pumps, variable rate.

[a] See Figure LEOP-1 for locations of components.

FIGURE LEOP-1

Schematic Diagram of the Town of Monument's Water System

Prepared by Matrix Remedial Technologies, Inc.

(Drawing Not To Scale)

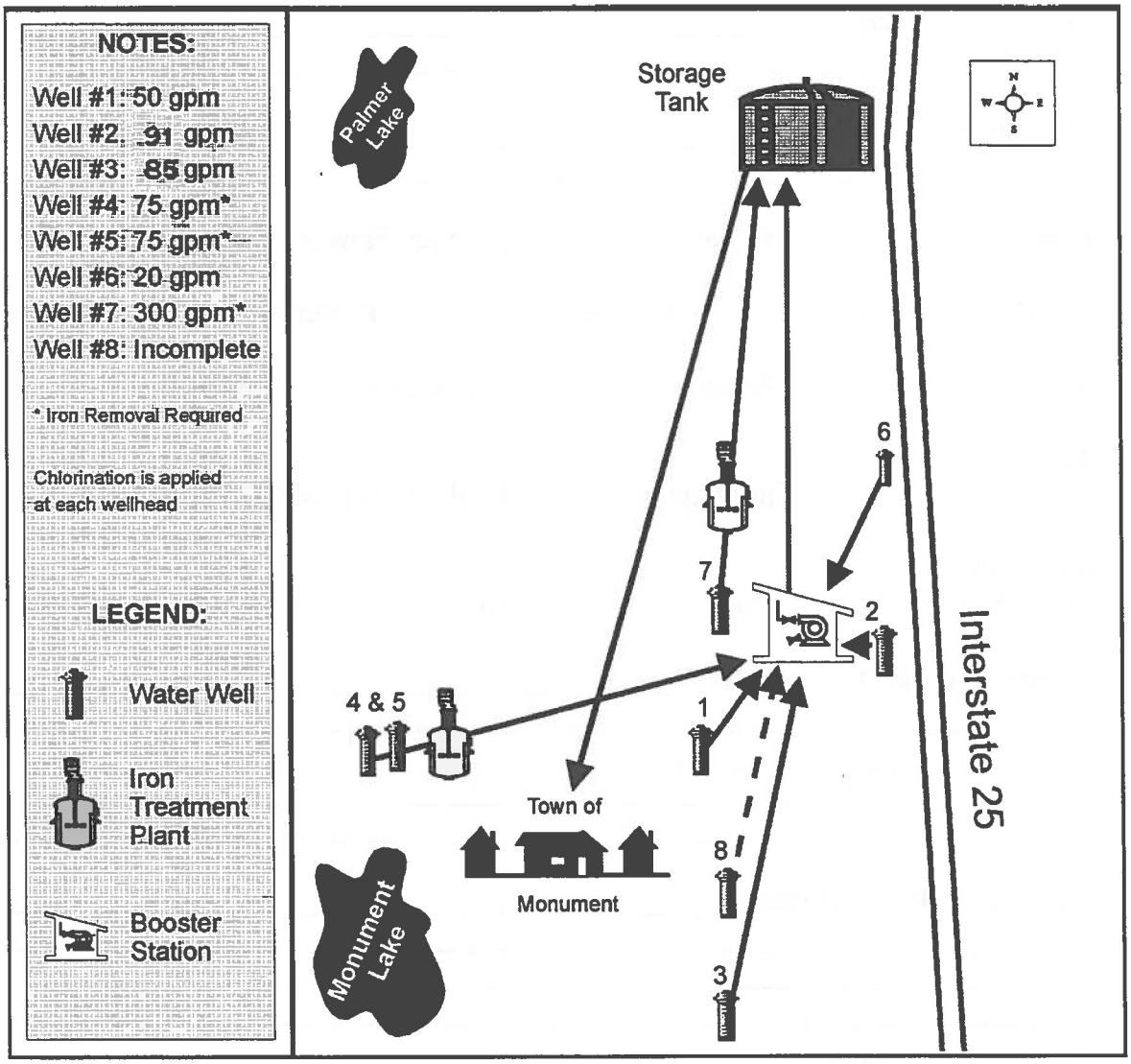


FIGURE LEOP-2

SAMPLE

EMERGENCY REPORTING FORM

Emergency Identification:

1. Person or Department calling emergency _____
_____

2. Location of emergency _____
_____

3. Condition at scene _____
_____

ESCAPING WATER: ___ Seepage ___ Free-Flowing ___ Gushing

FLOODING: ___ Roads ___ Intersections ___ Property ___ Buildings

EROSION: ___ Banks ___ Foundations

ELECTRICAL POWER: ___ Interruptions ___ Total loss of power

CHANGE(S) IN WATER QUALITY: ___ Taste ___ Odor ___ Color ___ Clarity

4. Briefly describe the situation: _____
_____
_____
_____
_____

5. Assistance already available: _____
_____
_____
_____
_____

CRITICAL WATER SYSTEM COMPONENTS

The Town's water system components are independent yet integral in their operation. Therefore, while the system works well together, system integrity can be maintained even though one part may become temporarily inoperable or removed from service. Indeed, as mentioned above, periodic well outages occur intermittently, and the water system has worked adequately during those times.

However, of the Town's wells, well #7, with a production rate of 300 gpm, equal to almost one-half of the entire system potential, is a critical well. Any disaster that leads to extended disruption of pumping from this well or results in contamination of the well's groundwater would have severe consequences for the Town's water supply. Similarly, if a disaster was to disrupt the function of the Storage Tank, the Town's ability to store and distribute water would be considerably impaired. Finally, any disaster which disrupted the function of the booster station would impair the Town's ability to distribute water.

VULNERABILITY ANALYSIS

The vulnerability of the Town's water supply to natural and/or man-made disasters (including drought or overuse) was evaluated to allow the Town to assess the probability of each situation and evaluate its potential effect on the water system. Table LEOP-2 summarizes the identified potential disasters and evaluates their potential effects on the Town's overall water supply. Table LEOP-3 summaries the vulnerability analysis for selected disasters on the Town's individual wells.

As can be seen in Table LEOP-2, the highest disaster ratings for the overall water system are considered to be related to lightning, drought, ice/snow storms, wildfires, and railroad/truck spills. Of those disasters, only a drought or a railroad/truck spill could potentially inflict a long-term impact.

With respect to the individual wells (Table LEOP-3), the alluvial wells #4 and #5 have been identified as the wells with the highest potential for impact by various disaster scenarios. This is because the wells withdraw groundwater from shallow depths and because the combined wellhead protection area for those wells encompasses the largest area in the Town. As a consequence, wells #4 and #5, in addition to well #7, require the highest degree of consideration with respect to wellhead protection during disasters.

ALTERNATIVE WATER SOURCES

Short-term emergency water can be obtained from the Storage Tank or from any wells that may be inactive at the time of the emergency. For more extended emergencies, it is possible to tie into the Woodmoor Water & Sanitation District No. 1 System for emergency water. This could be accomplished by installing a fire hose under Interstate 25 to connect the two water systems. Also, it is possible to tie into the Forest View Water System via an out-of-service 4-inch line at North

Monument Lake Road. Both lines would have to be chlorinated prior to use.

TABLE LEOP-2

OVERALL VULNERABILITY OF THE TOWN OF MONUMENT'S WATER SUPPLY[a]

Type of Disaster	Probability	Potential Effect on Water Supply	Duration of Effect	Disaster Rating (1-5)
Natural:				
Lightning	5	Low Supplies	Short Term	4
Drought	3	Low Supplies	Short or Long Term	3
Flood	3	Contamination	Short Term	3
Ice/Snow Storm	4	Low Supplies	Short Term	3
Wind	5	Low Supplies	Short Term	2
Earthquake	1	Low Supplies	Short Term	1
Tornado	2	Low Supplies	Short Term	2
Wildfires	3	Low Supplies	Short Term	3-4
Man-Made:				
Explosion	1	Low Supplies	Short Term	1
Industrial Spill	3	Contamination	Short or Long Term	2
Railroad/Truck Spill	3	Contamination	Short or Long Term	3
Vandalism	3	Contamination Low Supplies	Short Term	2
Power Outage	5	Low Supplies	Short Term	2
Epidemic	1	Contamination	Short or Long Term	2

[a] A value of "1" = Low Probability or Disaster Rating;
A value of "5" = High Probability or Disaster Rating.

TABLE LEOP-3

VULNERABILITY ANALYSIS FOR INDIVIDUAL WELLS OF THE TOWN OF MONUMENT[a]

	Well Number							
Type of Disaster	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8[b]**
Vandalism	M	M	M	H	H	M	M	M
Railroad/Truck Spills	L	L	L	H	H	L	L	L
Industrial Spills	L	L	L	H	H	L	L	L
UST Leaks	L	L	L	H	H	L	L	L
Waste Disposal	L	L	L	H	H	L	L	L
High Density Residential Impacts	L	L	L	H	H	L	L	L
Medium Density Residential Impacts	L	L	L	H	H	L	L	L
Low Density Residential Impacts	L	L	L	H	H	L	L	L
Institutional Impacts	L	L	L	H	H	L	L	L
Retail/Commercial Impacts	L	L	L	H	H	L	L	L
Floods	L	L	L	H	H	L	L	L

[a] L = Low; M = Medium; H = High.

[b] Well currently under construction.

Finally, under extreme emergency situations, water could be withdrawn from Monument Lake, Palmer Lake, and Lake Woodmoor. However, water from those reservoirs could only be used for

non-drinking water uses unless the water is first passed through a chlorination system. The El Paso County Office of Emergency Management would coordinate the procurement of alternative water sources for the Town in short-term water emergency situations.

EMERGENCY RESPONSE PLANS

This section of the Contingency Plans establishes a system for emergency response. This emergency response plan defines the step-by-step procedures that will be followed and in what order they are to take place after a disaster has occurred. These basic steps, patterned after the Town's Local Emergency Operation Operations Plan, are as follows:

Emergency Identification: The disaster must be identified and notification made. Figure LEOP-2 presents a sample Emergency Reporting Form that could be used to document a disaster incident.

Notification of Key Response Personnel: Initial disaster notification should be made, if possible, to the following:

Public Works Director PUBLIC WORKS SHOP	Jerry Standard	188 Lincoln	481-2472 481-2436
Town Manager TOWN HALL	Paul Mannino	18850 Augusta Dr.	481-3140 481-2954
Police Chief POLICE DEPARTMENT	Allen Karn	108 Adams	481-2835 481-3253
Mayor	Marlin Sibell	231 Front Street	481-3382

Incident Control: After notification, control of the disaster will be assigned to the above personnel (the Public Works Director will lead the Key Response Personnel in a water emergency) or their designee(s) and they will establish the Emergency Operation Center (EOC). The EOC will typically be established in the Auditorium of the Town Hall (166 Second Street).

Public Communications: All public relations & media events will be handled by the EOC.

Contamination Assessment/Remedial Measures: All assessments and remedial measures related to water contamination will be made or implemented under the direction of the EOC.

Water-Use Restrictions: In the event of a disaster, the Town of Monument has the authority to issue restrictions for the use of water. Those restrictions will be made public as soon as possible using radio public service announcements, local cable channel advertisements, and door-to-door notifications by local law enforcement officials.

SHORT TERM PLANS

Besides the potential threats of water contamination from railroad/truck and industrial spills and epidemics and the potential impacts to the Town's water supply due to an extended drought, all other possible threats to the Town's wellheads are considered to exert short-term impacts (Table LEOP-2). Therefore, as addressed in the Alternative Water Sources section, the Town of Monument has considered contingencies for short-term impacts and believes it can maintain a quality water supply for delivery to its customers for short periods of time. The short-term contingencies include:

- Withdrawing emergency water from the Storage Tank;
- Putting inactive wells on-line; and
- Tying into the water supplies of the Woodmoor Water & Sanitation District No. 2 or the Forest View Systems.

In addition, tankers containing potable water can be brought in from other areas to supply drinking water. Finally, portable water treatment plants could be brought in to treat Monument Lake water. The exact actions taken for each incident will be determined by the EOC.

In the event of a chemical spill adjacent to or within the confines of a specific wellhead protection area, emergency responses will be enacted to stop any migrating chemicals from reaching the relevant wellhead(s) or protection area(s). Those responses shall typically include free-product recovery and the installation of chemical barriers. In some cases, it may be necessary to install subgrade barriers as soon as possible after the spill incident to protect the wellhead(s) or protection area(s).

Because the combined wellhead protection area for wells #4 and #5 has the greatest areal extent and because much of the area is adjacent to the railroad line and a major roadway, this protection area has the highest potential to be impacted by a chemical spill. The measures required to protect this wellhead protection area will depend on the location of a chemical spill and the nature of the released chemicals.

The nearest local emergency response teams with the capability to respond to accidents involving hazardous materials (i.e., explosives, chemicals, petroleum products) are at the Air Force Academy and in Colorado Springs. Due to the proximity of the Air Force Academy team, when time is of the essence, the Town should request the assistance of that response team. The El Paso County Office of Emergency Management will be called on to assist the Town in a water emergency.

LONG TERM PLANS

As indicated above, the Town considers most potential threats to the Town's water supply as short term in nature. However, in consideration of the possibility of a long-term threat of water contamination resulting from spills, the Town may need to consider the development of an

alternative water source, possibly deeper or in a different area. This approach would entail considerable expense and therefore, require an appreciable level of planning and the approval of the Town's electorate.

On the other hand, certain contaminants can be removed from affected groundwater supplies prior to its delivery to consumers. This could be accomplished by installing and operating aboveground water-treatment plants to treat affected well-waters. Alternatively, certain organic groundwater contaminants (such as the organic residues of gasoline, diesel fuel and waste oils) can be removed from groundwater in situ (i.e., in the ground) prior to reaching wellheads. This approach would involve the installation and operation of a remedial system in a location that is strategically selected to allow sufficient in situ groundwater treatment before it is removed from the ground at the wellhead. However, the costs for both aboveground and in situ (in ground) groundwater treatment systems can be prohibitive and would require considerable planning and Town approval.

COST

The actual cost of short-term contingency operations are anticipated to be minimal. Most emergency operation costs would be equal to, or slightly more, than the normal costs associated with the day-to-day operation of the Town's water system. Other expenses, such as cleanup or construction, could be considerable depending on the nature of the problem. However, those expenses may be reimbursed to the Town through insurance and liability claims.

The long-term costs for emergency contingencies cannot be determined at this time. Emergency funding for incidences that require large amounts of money may be available through the State or Federal Government.

THE MANAGEMENT PLAN

THE PROBLEM

Monument relies on alluvial wells for part of its drinking water. These wells, by virtue of their hydrogeology, are difficult to protect from contamination. In addition, these and the town's other municipal wells, are situated close to major transportation corridors, (I25, SH105 and rail lines). Accidental or deliberate spills along these transportation corridors into Monument's principal drainage, Monument Creek, could cause extensive contamination to Monument's alluvial wells, forcing closure for at least a short-term period. It is important to note that many groundwater clean-ups have taken over 30 years to complete.

Further difficulty in the effective management of the town's water system lies in the fact that part of the alluvial WHPA's are located outside the town's boundaries making protection efforts more complicated from a regulatory standpoint. And finally, Monument's growth and development in the last decade appears to be outpacing the town's ability to protect and secure additional water sources. The town relies heavily on its present sources and possesses few water reserves for emergency needs or continued growth at its present rate. While this issue does not directly relate to the WHPP, its relevance is significant in locating future groundwater sources.

THE GOAL

Based on these issues the goal of the Monument WHPP is to **CONSERVE AND PROTECT MONUMENT'S CURRENT AND FUTURE GROUNDWATER RESOURCE.**

THE MANAGEMENT PLAN

Many regulatory and non-regulatory, technical and non-technical tools exist to help communities effectively manage their water supplies. Rather than rely on one management tool, the town has decided to direct management of the WHPA's utilizing a combination of management resources. This combination of methods was chosen because the WHPA's cover multiple jurisdictions and because both commercial and residential developments have already occurred in parts of all of the WHPA's.

1. ***Reduce dependence on all alluvial wells with suggested elimination within five years.*** (POLICY) Because deep wells require less aggressive management due to their hydrogeologic features, their extended use as a municipal water source is considered to be preferable to the utilization of alluvial water sources. Future water sources should be re-evaluated with respect

to this reduction/elimination policy and alternatives suggested as the town investigates its options with respect to procuring additional water sources.

2. ***Prohibit all high-risk land uses in all alluvial WHPA's in Monument.*** (REGULATORY) High-risk activities include all industrial uses; underground storage of chemicals, gasoline, etc.; waste disposal; and retail/commercial activity. Monument should adopt the EPA's high-risk activities (Table G, page 23) as a prohibited uses list within their zoning ordinance.

3. ***Discourage all high-risk land uses in all alluvial WHPA's outside Monument's jurisdiction.*** (QUASI-REGULATORY) Jurisdictions outside Monument where WHPA's are located include parts of the town of Palmer Lake and unincorporated El Paso County. The Town of Monument should request review of all proposed development in these areas and discourage high-risk land uses in sensitive areas. (See Table G, page 23) *Note*: Discouraging the development of certain land uses within the alluvial WHPA's will not necessarily eliminate unwanted development from occurring in the future.

4. ***Encourage large-lot residential zoning in the alluvial WHPA's outside the town's jurisdiction.*** (QUASI-REGULATORY) Some development has already occurred in these areas, but it has been primarily limited to large-lot development (1 to 5 acres). Further development will be difficult, if not impossible, to impede or eliminate. By encouraging large-lot development, a low-to-moderate groundwater pollution risk, the town can help protect the WHPA's outside its own jurisdiction. *Note*: Encouraging certain land uses will not necessarily result in the development of those land uses in the future.

5. ***Support (and monitor as necessary) all regulations of other agencies now in effect which protect groundwater.*** (ADMINISTRATIVE, NON-REGULATORY) Various federal, state, and county regulations and policies are already in effect which help to protect groundwater. For instance, the El Paso County Health Department sponsors periodic hazardous waste collection which reduces the accumulation of hazardous materials within WHPA's and the community at large. The El Paso County Health Department is also responsible for the monitoring of individual sewage disposal systems (septic tanks). The town should request periodic updates of maintenance and sampling records to ensure that these systems, primarily in alluvial WHPA's, are properly maintained. The State of Colorado requires that underground storage tanks be registered and that leaking underground storage tanks be removed from service. Contaminated surface water, groundwater and soils must be removed in accordance with State regulations. All of the results of these and other groundwater protection systems should be coordinated by the Public Works Director to help monitor the quality of Monument's groundwater. All of these systems, when efficiently coordinated, can be used as an early warning system of potential groundwater threats.

6. ***If a threat continues to be perceived, other, more extensive measures will be pursued to protect all wells.*** (REGULATORY) Monument, like other Colorado municipalities, has other tools at its disposal with which to manage groundwater. These include more extensive land use prohibitions throughout the Town's WHPA's, the establishment of watershed protection areas, drainage requirements and nitrogen loading standards in current subdivision regulations,

as well as the additional regulation of UST's, and special permitting for certain land uses. These tools will require further research and investigation to determine their appropriateness for Monument should the measures suggested in this plan not be effective in preventing pollution of the groundwater resource.

7. ***A long-term public education effort should be reinstated to inform the general public about groundwater issues.*** (POLICY) In issues of social and environmental concern, education can be a very effective tool and can be used to achieve this plan's goals. Short, informative articles about groundwater are now being mailed to residents in the Public Works Department Newsletter. In addition, informative booklets have been distributed to school children at a local elementary school. Ongoing groundwater programs at area schools or on-site at the wells and updating the inventory of contaminants yearly with citizen help are a few suggestions for educating the public. Other educational sources can be found in the Wellhead Protection Guidebook, a copy of which will be furnished to the town. Education ultimately can result in pollution prevention and it is a far more cost-effective measure than mitigation or remediation.

8. ***Strengthen the Contingency Plan*** by:

   a. Including home, business and pager numbers for key personnel so that contact with these members can be assured in case of an emergency.

   b. For long-term water contamination problems, pursue the feasibility of 1) installation and operation of above-groundwater treatment facilities and, 2) emergency funding by State and Federal entities, as suggested in the Contingency Plan.

ACTION PLAN

The following action plan condenses this report into actions that can be undertaken by the community now.

- Re-evaluate future water sources with respect to reduction of dependence on alluvial wells due to their vulnerability to contamination. Reserve a certain number of taps from Well #8 to begin relieving dependency on alluvial wells.
- Adopt the EPA's high-risk activities as a prohibited uses list within the Monument zoning ordinance (Table G).
- Notify El Paso County and Palmer Lake about Monument's WHPP, and the need for cautious use decisions in WHPA's 4 and 5.
- Request that all proposed developments within WHPA's #4 and #5 be submitted to the Town of Monument for review and comment so that new development does not endanger Monument's groundwater.
- Set up a review system within the Public Works Department which monitors groundwater issues in Monument. These would include regular reports about registration of UST's, ongoing remediation efforts for LUST's, and septic system monitoring by El Paso County.
- Develop a long-term community education program to inform the community about groundwater protection.
- Investigate State and Federal assistance that may be available in case of a long-term water emergency.
- Establish an annual wellhead protection plan review program.

CONCLUSION

This management plan is the result of a comprehensive examination of Monument's groundwater issues. It identifies the town's groundwater sources and land areas surrounding these sources where pollutants can adversely affect groundwater. Potential contaminants in the community have been identified and evaluated. The plan addresses the current and future needs of the community with respect to the quality of the town's groundwater resources. In addition, emergency conditions have been examined. Most of the measures suggested in this plan require little or no cost and will result in extensive benefits for residents of the town. All of these solutions are administratively straightforward, cost-efficient, and most will be supervised by the Director of Public Works.

All of these methods can, and should, be used in conjunction with other tools—those suggested here or the incorporation of newer, more effective management methods as they are devised. Because unexpected outcomes can occur, the implementation of this plan should be monitored according to state and federal guidelines for its effectiveness and modified as necessary every year.

ABBREVIATIONS, ACRONYMS, GLOSSARY

CDPHE	Colorado Department of Public Health and Environment
EPA	Environmental Protection Agency
GPD	Gallons Per Day
GPM	Gallons Per Minute
I25	Interstate 25
LEOP	Local Emergency Operations Plan
LUST	Leaking Underground Storage Tank
MGD	Million Gallons / Day
P.S.I.	Pounds Per Square Inch
QUASI	Semi
SD	School District
SH	State Highway
TOT	Time of Travel
Tri-Lakes	The towns of Monument, Palmer Lake, Woodmoor
U.S.	United States
USGS	United States Geological Survey
UST	Underground Storage Tank
WHPP	Wellhead Protection Plan
WHPA	Wellhead Protection Area

ENDNOTES:

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[1] Eddy Woodruff, Monument Weather Watcher. Interview August 5, 1996.

[2] Von Ahlefeldt, Judy. Thunder, Sun & Snow: The History of Colorado Black Forest, Century One Press, Colorado Springs, 1979.

[3] USGS Professional Paper 1257 - Bedrock Aquifers in the Denver Basin, Colorado - A Quantitative Water-Resources Appraisal.

[4] Eddy Woodruff, Monument Weather Watcher. Interview August 5, 1996.

[5] Pikes Peak Area Council of Governments, 1996.

[6] Town of Monument, July , 1996.

[7] Physical Geology: Earth Revealed. David McGeary & Charles C. Plummer, Wm. SS. Brown, 1992.

[8] USGS Professional Paper 1257 - Bedrock Aquifers in the Denver Basin, Colorado - A Quantitative Water-Resources Appraisal. S.G. Robson, U.S. Government Printing Office, 1987.

[9] Weber, George, Colorado Guidebook to Community Wellhead Protection Planning. Center for Community Development & Design, University of Colorado, Colorado Springs. Draft September, 1996

[10] Ibid.

[11] Ibid.

[12] Ibid.

[13] U.S. EPA Office of Research and Development Office of Water, 1993; p.57.

[14] 1995 Traffic Data, Colorado Department of Transportation.

[15] Handbook: Groundwater & Wellhead Protection. Table 9-3, "General Best Management Practices". Office of Research & Development, Office of Water, U.S. EPA, September, 1994.

LIST OF PUBLICATIONS CONT.

Economic and Community Development Assistance Directory for Small Communities in Colorado	1988
Great Plains Reservoirs Multiple Use Development Feasibility	1989
Water Treatment Needs & Options for Crowley County	1989
North End Neighborhood Policy Plan	1989
Neighborhood Planning in Colorado Springs: A Guide for Residents	1989
Forest Fringe Development Impacts on Large Mammals in El Paso and Teller Counties	1989
Adolescent Pregnancies: Reducing Numbers, Serving Needs: The Views of Teens and Young Adults	1990
Child Care Patterns & Preferences: A Survey of El Paso County Parents & Providers	1990
Survey of Business Needs in Southeast Colorado	1990
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Colorado Communities Youth Activities Program: An Evaluation	1991
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UCCS Child Care Demand Survey	1994
Teller County Parks and Recreational Advisory Board Organizational Planning Guide	1994
Teller County Growth Attitudes Project	1996

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