REPORT

ON

GROUND WATER RECHARGE AND MANAGEMENT PROJECT

RIO GRANDE BASIN, COLORADO

October 1997
Revised May, 1998

Prepared for
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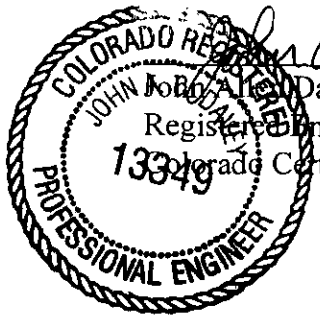
It is hereby certified that the *Report on Ground Water Recharge and Management Project - Rio Grande Basin, Colorado* was prepared by me or under my direct supervision.

Date: August 10, 1998



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EXECUTIVE SUMMARY

This project was initiated by the San Luis Valley Water Conservancy District for the purpose of collecting data that would provide a better understanding of the mechanism benefits of ground water recharge in the San Luis Valley of Colorado and to construct a major recharge structure to facilitate ground water storage with winter surface diversions. The District obtained funding assistance from the Colorado Water Conservation Board and obtained contributions consisting of equipment and drilling of monitoring wells from the Colorado State Engineer's Office and U.S.D.I. Bureau of Reclamation.

A major recharge structure to improve recharge with winter surface diversions was constructed. The facility was constructed northeast of Del Norte and is designed to receive water from the Rio Grande Canal. A map showing the location of the facility and some construction details is included as Figure E.S.-1.

Ground water levels in monitoring wells at the recharge site northeast of Del Norte were measured frequently for approximately three years. Ground water levels consistently rose during periods when surface recharge was available and declined when water was not available. Evidence was collected indicating a large portion of the ground water recharge at this site enters the artesian or confined aquifer that underlies a large portion of the San Luis Valley. Ground water level measurements at a site near the central portion of the Valley north of the Rio Grande, indicates surface recharge significantly increases water storage in the shallow unconfined aquifer.

Recharge potential in the San Luis Valley was investigated by studying aquifer properties and depths to ground water. A map was prepared that provides information that can be used as a guide by ground water users to determine the size of recharge pit and length of time recharge is necessary at their location to replace ground water pumped. This map is included as Figure E.S.-2.

The study identified numerous canal and ditch systems that divert water for the purpose of ground water recharge in the San Luis Valley. A review of depths to ground water indicated that available storage space in the under ground aquifers is not used in an optimum manner. Tasks that a water management agency could perform to improve ground water recharge were described. These tasks varied from reporting on ground water conditions to actual management of canal and ditch systems.

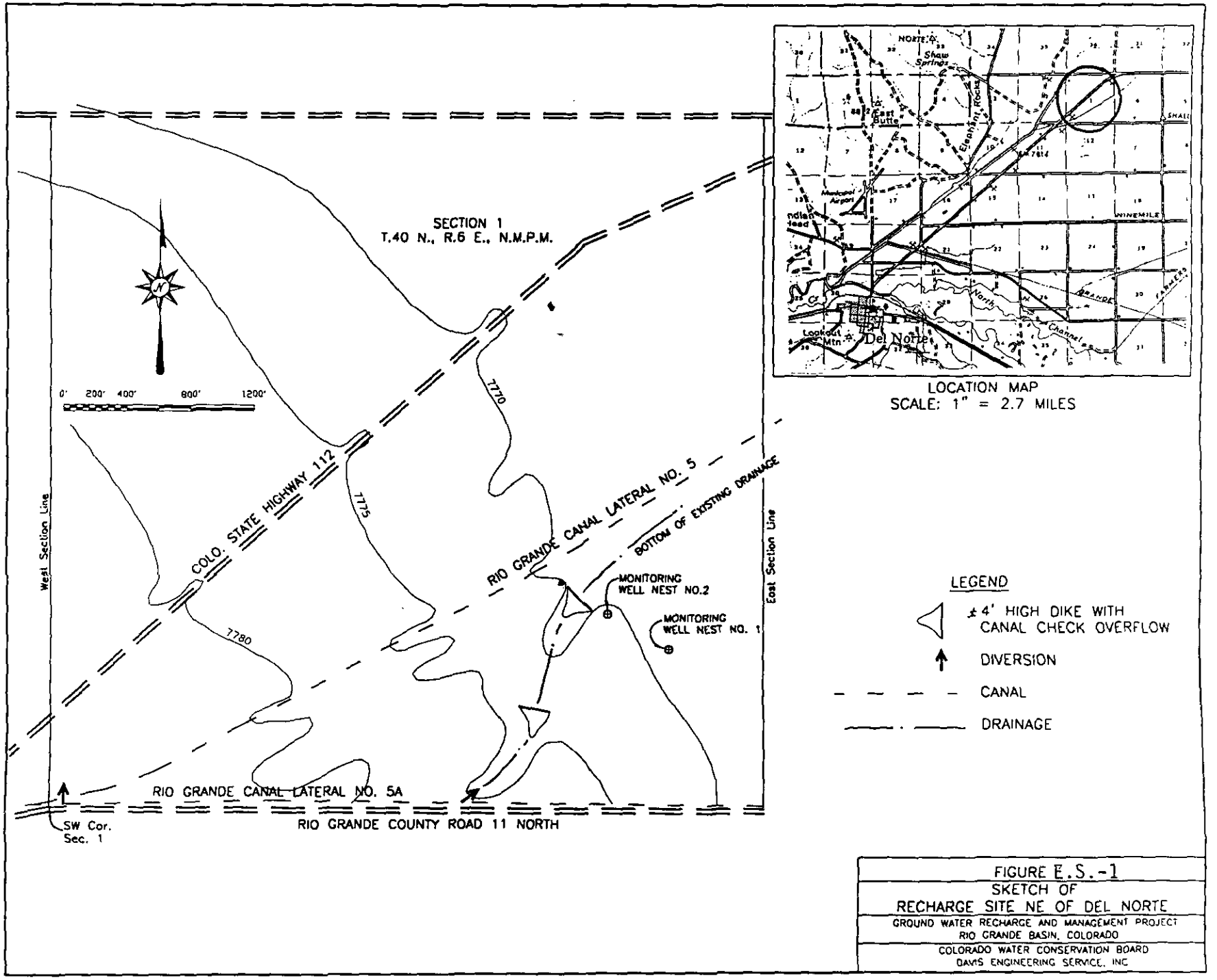

FIGURE E.S.-1
SKETCH OF
RECHARGE SITE NE OF DEL NORTE
GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO
COLORADO WATER CONSERVATION BOARD
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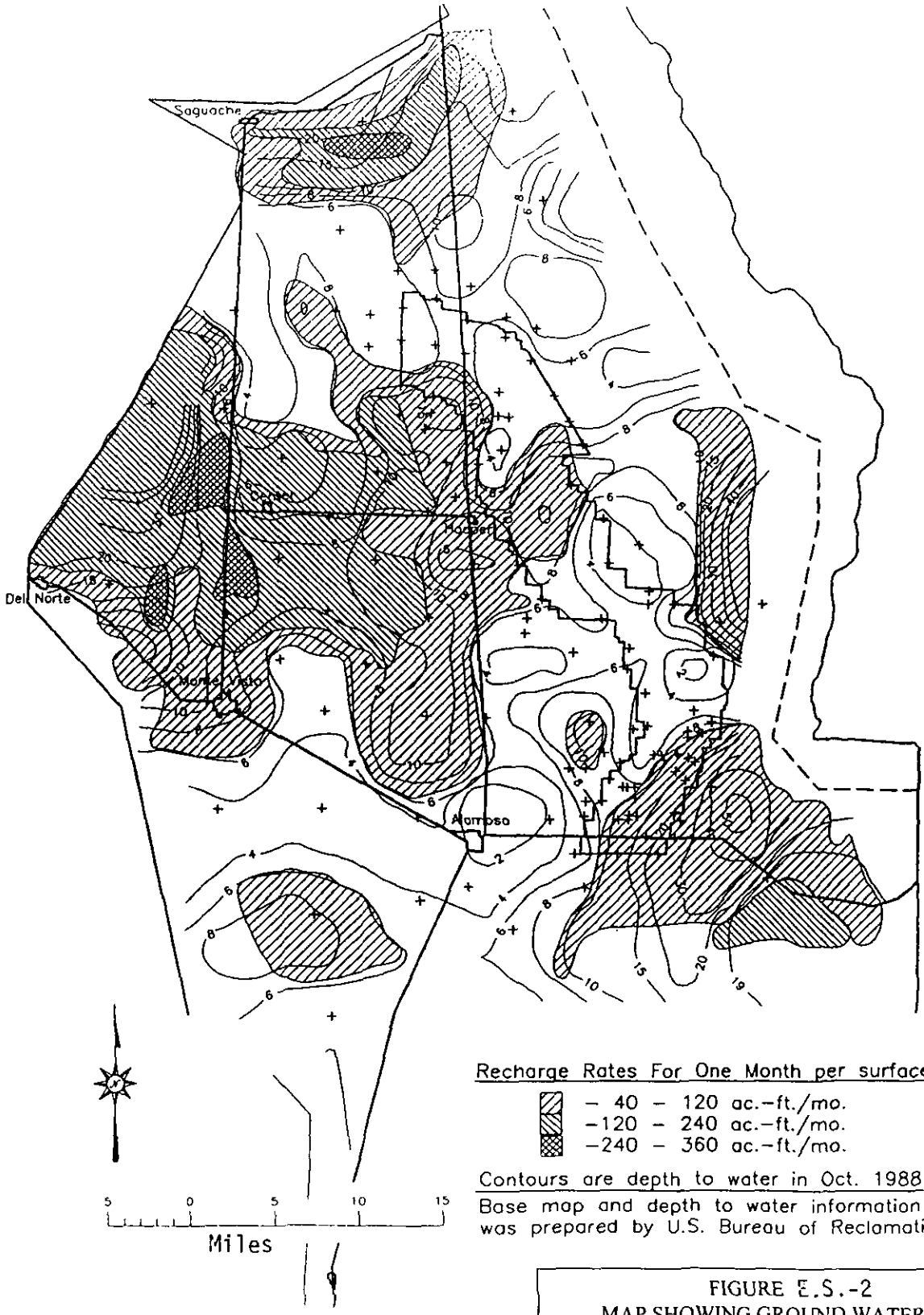

FIGURE E.S.-2
MAP SHOWING GROUND WATER RECHARGE POTENTIAL

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this project was to collect data that would provide a better understanding of the benefits of ground water recharge in the San Luis Valley of Colorado and to construct a major recharge structure to facilitate ground water storage with winter surface diversions.

1.2 LOCATION

The project is located within the boundaries of the San Luis Valley Water Conservancy District and generally encompassing the areas in the San Luis Valley traversed and irrigated by the waters of the Rio Grande. Figure 1-1 includes a map showing the boundaries of the District in the vicinity of this study. Plate 1 included in a pocket at the end of this report is a map of the District in the vicinity of this study including ditch systems, areas irrigated by the major ditch system diverting from the Rio Grande, center pivot-sprinkler locations and other hydrologically significant data.

1.3 HISTORY AND NEED

During recent years the ground water levels and pressures in the artesian aquifer system of the San Luis Valley have varied widely. Also during this period the Rio Grande Basin has, through the spilling of Elephant Butte Reservoir, eliminated a major Rio Grande Compact debt and seen the Closed Basin salvage project begin to deliver significant amounts of water to the river. These events have resulted in many people recognizing that through better water management in the San Luis Valley, more of the available water can be used by senior and junior water rights in Colorado. These water rights have been previously and continue to be curtailed in order to meet Rio Grande Compact obligations to downstream states.

One of the primary resources that can be managed to allow better utilization of surface water supplies are the underground aquifers in the San Luis Valley. By storage of surface water rights in the aquifers, the aquifers can function as under ground water storage reservoirs. The filling of the aquifers has historically occurred, but in an unplanned manner that has resulted in overfilling in some areas and under-filling in other areas. One of the objectives of this project was to assist in developing a better understanding of the dynamics of ground water recharge in the San Luis Valley and to convey this information to water users and managers to facilitate maximum water utilization and conservation.

Since elimination of the Rio Grande Compact debt, over delivery to the Compact has occurred in several individual years. These over deliveries result in credits that may be used to reduce Compact deliveries in subsequent years. However, the credits are subject to evaporation losses in Elephant Butte Reservoir. It may be possible to reduce these over deliveries and efficiently store more water in the aquifers of the San Luis Valley. This may be accomplished by means of better managed irrigation season diversions and maximizing winter ground water recharge. In many years the potential for Compact over deliveries do not become apparent until October or November which is near the end of the accounting year for the Compact. It is also near the time when ditches can be frozen shut by cold weather. During wet years and in the late fall or early winter, the aquifers could be partially refilled, thereby supplying the ground water to be withdrawn by wells during dry years.

Recharge of ground water has been difficult during November and December due to the forming of ice in diversion structures and canal laterals. Additionally, changes in irrigation practices from flood irrigation to significant numbers of center-pivot sprinkler systems that require less volume of water has made it difficult for irrigators to use large wet year flows that can occur in the spring. One of the objectives of this project was to construct a significant recharge structure specifically designed to overcome much of the icing problems and provide additional capacity to allow large diversions from the river during flood conditions.

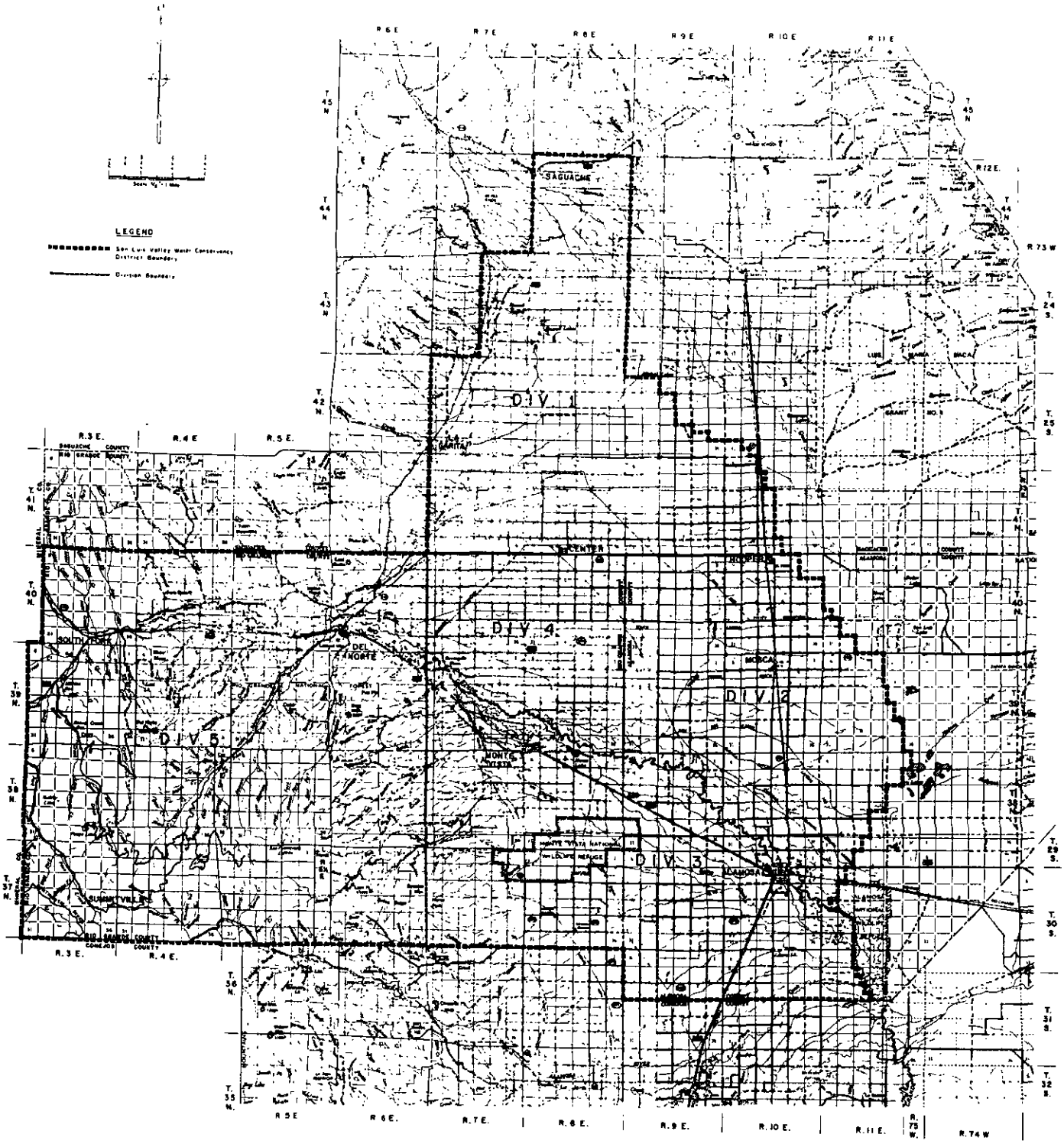

FIGURE 1-1

MAP OF SAN LUIS VALLEY
WATER CONSERVANCY DISTRICT
WITHIN VICINTY OF STUDY

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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1.4 HYDOLOGEOLOGIC SETTING

The setting for this study is a high mountain valley called the San Luis Valley. The valley is located along the Grande Rift which, from a geologic perspective, formed by tectonic movement whereby the earth's crust pulled apart creating a north-south trench. The basement rock in this trench is shallower on the west side of the valley where it is hinged and tipped downward toward the east. On the east side of the valley near the Sangre de Cristo Mountains this basement rock has dropped to depths of as much as 15,000 feet below present land surface. The downward tilting of this basement rock easterly is not uniform. In the pulling apart process, a ridge remained in the basement rock along a north-south direction near the center portion of the valley. This ridge is referred to by geologists as the Alamosa horst. The deeper down faulted sections of basement rock are called the Monte Vista graben and Baca graben. An east-west cross section of the valley from a paper by Brister and Gries (1994) is included in Figure 1-2. Figure 1-3 shows the location of the cross section in the valley.

As this trench expanded over tens of millions of years, it was filled by material eroded from the nearby mountains encompassing the valley. Significant portions of the filled material that accumulated in this trench entered from the San Juan Mountains while they were being built through volcanic activity. Several fill beds extending across this valley trench from west to east have been identified as volcanic flows. One of these flows, called ash-flow-tuffs, extend from the surface on the western side of the valley and dips downward as it extends across the entire valley. These ash-flow tuffs interbedded with sediments are found at depths of over 9,000 feet below ground surface easterly of the Town of Hooper.

The top few thousand feet of the valley fill are rocks, gravels, sands and clays deposited by erosion of the San Juan and Sangre de Cristo Mountains. Extensive erosion of these mountains occurred as the ice age ended. As recently as 20,000 years ago, the high mountain valleys were still partly clothed in glacier ice. Large stream and river flows out of the mountains carried the sands and gravels found in the alluvial fans located around the edge of the valley and carried

finer grained clays and sands into the central and eastern portions of the valley. This top few thousand feet of valley fill comprises the ground water aquifers that provide water for the thousands of wells that have been drilled and are utilized for agricultural, municipal, and domestic water supply purposes. This aquifer system includes what is commonly called the unconfined and confined aquifer. These aquifer systems are described in more detail in sections 1.4.1 through 1.4.3.

1.4.1 General Description of Aquifer System

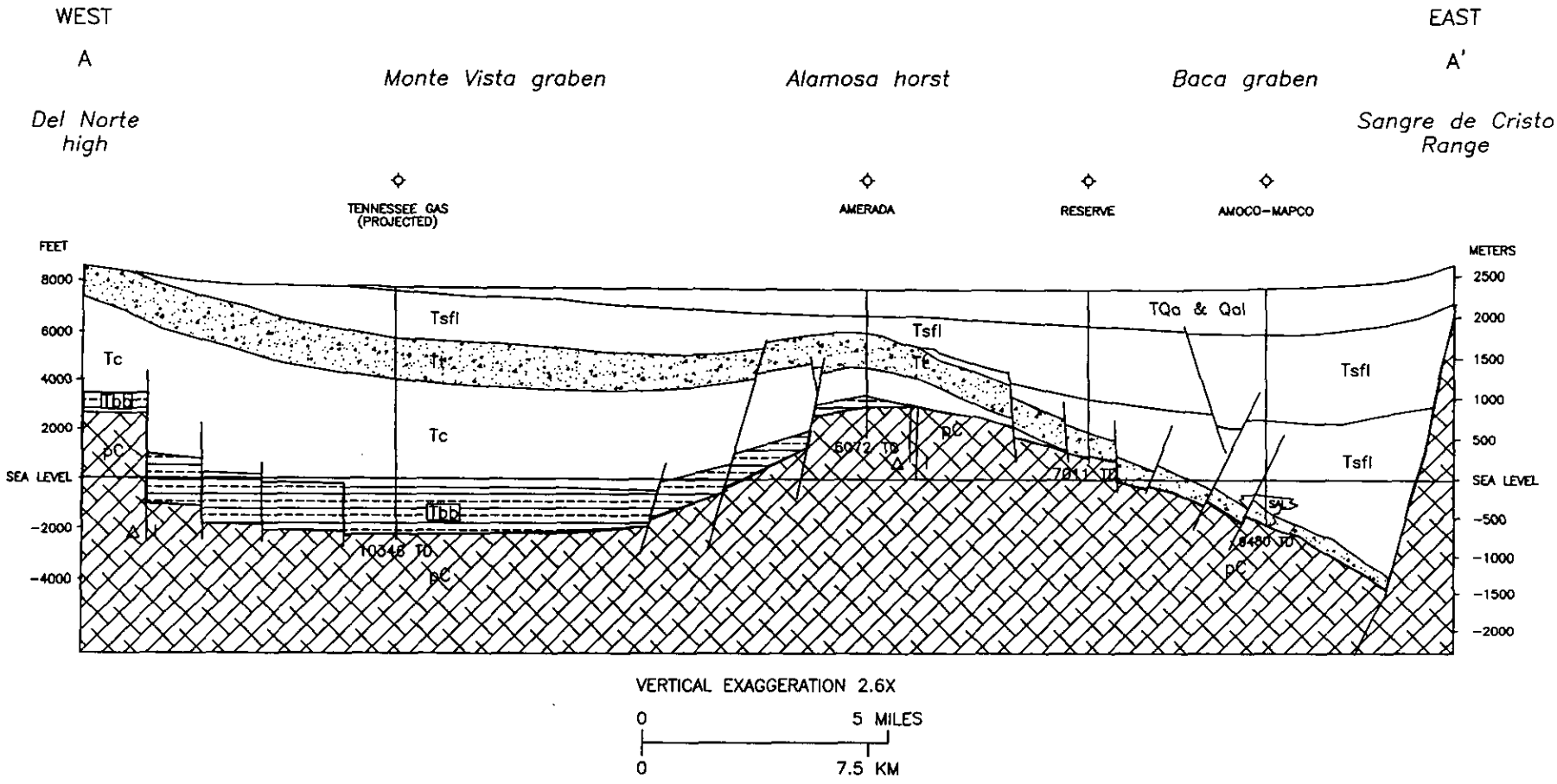
The upper few thousand feet of this aquifer consists of an unconfined (ground water table) and multiple confined (artesian) aquifers. The active and usable portion of this aquifer system is not known with certainty and may consist of as much as the top 3,000 to 4,000 feet. Below these depths the weight of overlaying alluvial fill compacts the sands, gravels and clays so yield of water to wells decreases significantly. Water quality also decreases significantly at the deeper depths due to its long resident time in contact with rock material providing an opportunity for the water to dissolve minerals. Poor quality water is also found at shallower depths near the center of the valley where ground water has resided for long periods of time in buried marsh and lake bed environments which contain organic materials.

1.4.2 Unconfined Aquifer System

An unconfined aquifer is defined as a saturated zone where the water level in a well penetrating it, will not rise above the shallowest adjacent ground water surface. Through out most of the area of the San Luis Valley the depth of the unconfined aquifer extends from 50 to 100 feet below land surface. However, in the southeast portion of the valley, along the outer edges of the valley and along streams and rivers flowing into the valley, the unconfined aquifer can extend to depths of hundreds of feet.

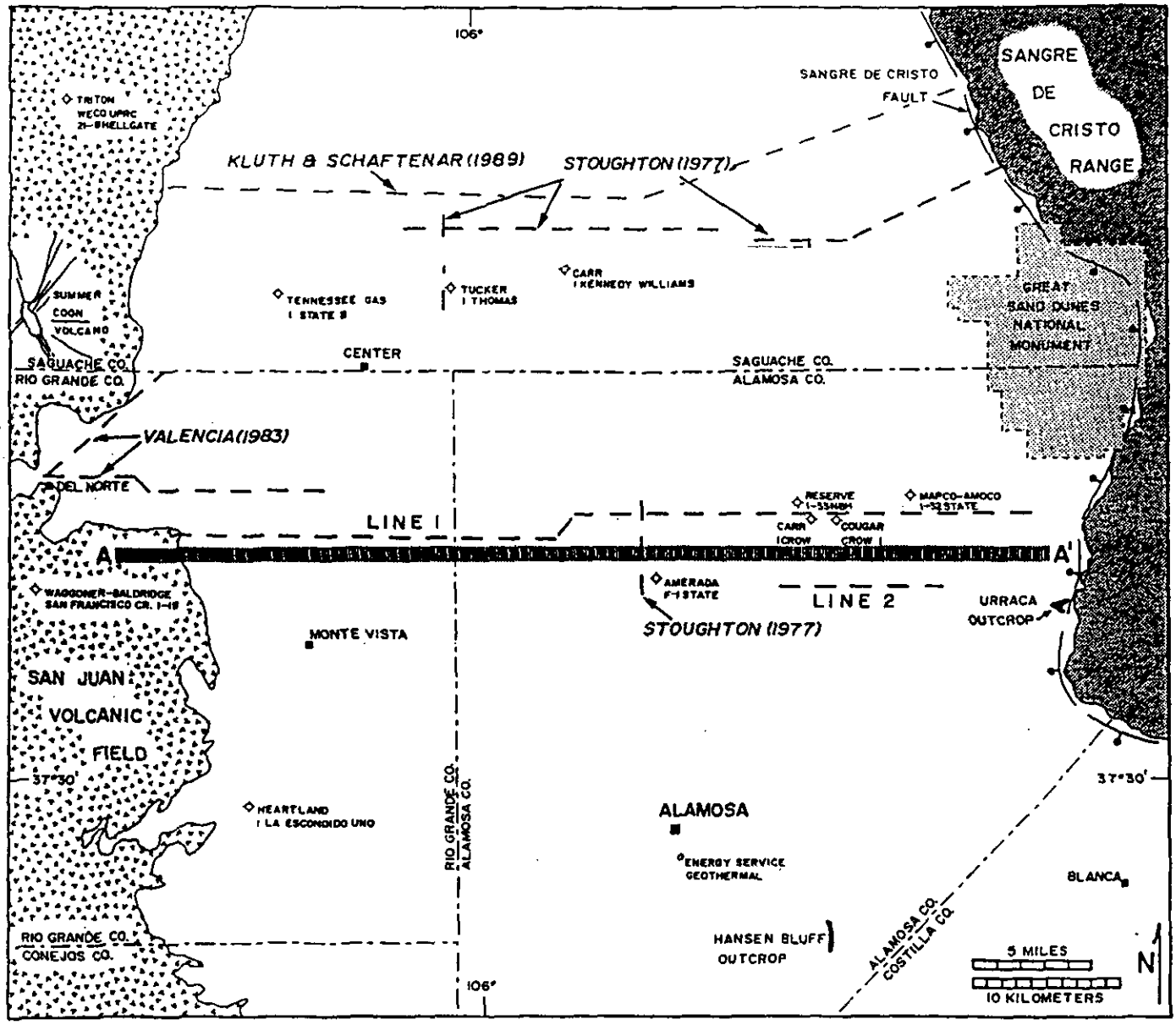
1.4.3 Confined Aquifer System

In a large portion of the San Luis Valley, a confined or artesian aquifer system is found below the unconfined aquifer. A confined aquifer is defined as a saturated zone where the water level in a well penetrating it, will rise above the shallowest adjacent ground water surface. This aquifer system is found in the valley below one or more substantial clay layer(s) and in some cases, below layer(s) of volcanic rock flow(s). A map (Emery, 1970) of the valley showing the location of the clay series below which confined conditions are commonly found is included as Figure 1-4. The water supply to the confined aquifer system enters primarily near the edge of the valley where seepage from streams, rivers and irrigation canals flow under the edges of the clay lenses. There is also likely to be some water that enters fractured volcanic rocks on the western side of the valley in areas of high precipitation and flows through these fractured layers into the valley at considerable depths.



Interpretive cross section A--A' across the San Luis Basin; location of section indicated in Symbols: TQa and Qal, Alamosa Formation (Plio-Pleistocene) and Quaternary alluvium; Tsfl, lower Santa Fe Group (Mio-pliocene); Tt, ash-flow tuffs of San Juan volcanic field (Oligocene); Tc, Conejos Formation and equivalents (Oligocene); Tbb, Blanco Basin Formation (Eocene); pC, granite-gneiss basement (Precambrian); TD, total depth. Figure modified from Gries and Brister (1989).

FIGURE 1-2
EAST - WEST CROSS SECTION OF THE VALLEY
GROUND WATER RECHARGE AND MANAGEMENT PROJECT RIO GRANDE BASIN, COLORADO
COLORADO WATER CONSERVATION BOARD DAVIS ENGINEERING SERVICE, INC.



Map of the Alamosa basin study area showing oil and gas drilling, seismic lines illustrated or discussed in this paper, and cross section A–A'.

FIGURE 1-3

LOCATION OF THE CROSS SECTION IN THE VALLEY

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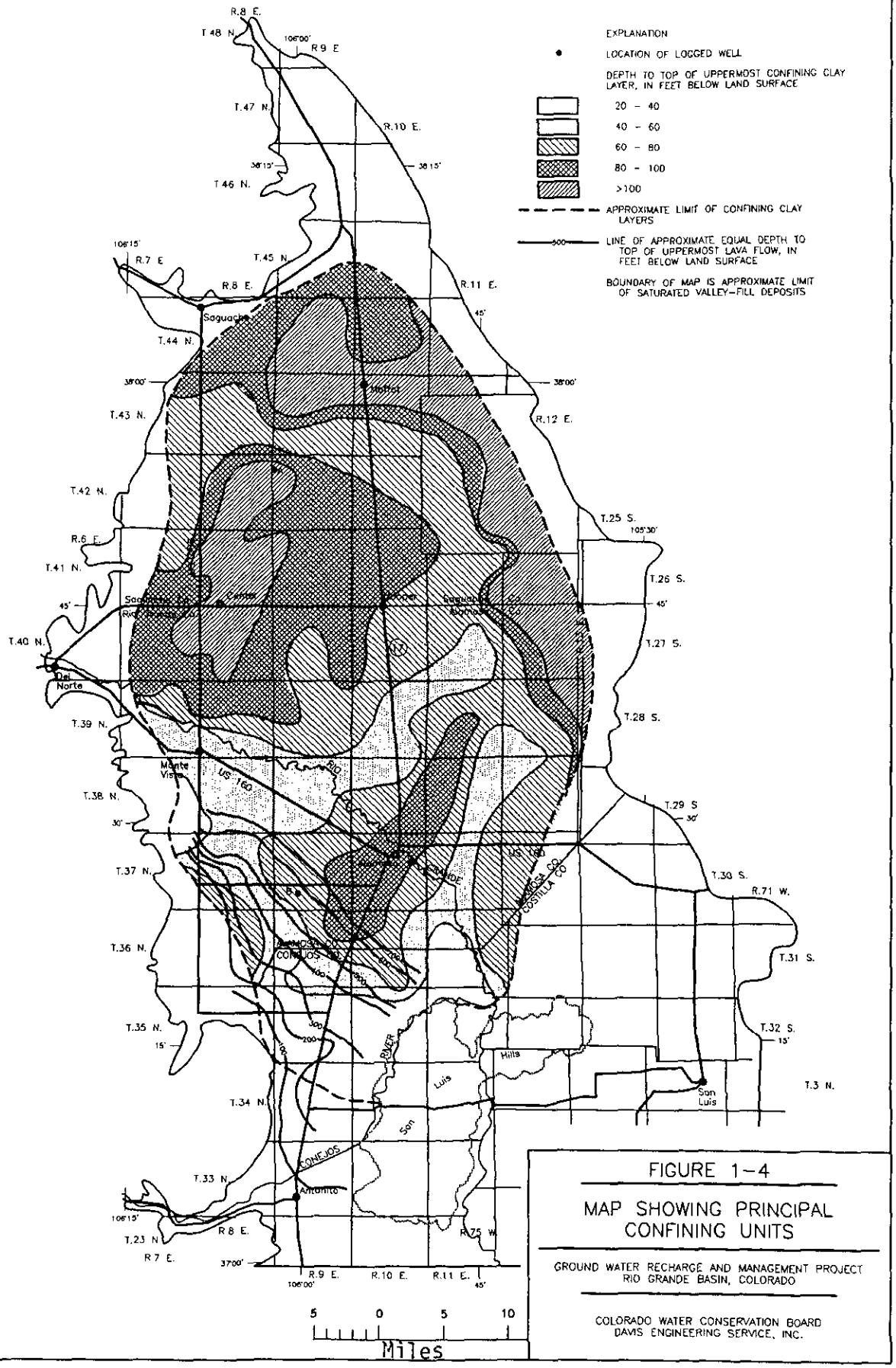

FIGURE 1-4

MAP SHOWING PRINCIPAL CONFINING UNITS

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
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MAP SHOWING DEPTH TO PRINCIPAL CONFINING UNITS,
SAN LUIS VALLEY, COLORADO

2.0 CONSTRUCT RECHARGE STRUCTURES

2.1 RECHARGE STRUCTURE NORTHEAST OF DEL NORTE

A tract of land suitable for construction of a significant ground water recharge structure located northeast of the Del Norte adjacent to the Rio Grande canal system has been obtained through agreement with the State Land Board. A copy of the letter of authorization and correspondence with State Land Board is included in Appendix A. The tract of land consists of a 345 acre area lying southeast of Colorado State Highway No. 112 in Section 1, T. 40 N., R. 6 E., N.M.P.M., Rio Grande County. A map showing the location of the recharge structures and some of the improvements is included as Figure 2-1.

Diversions from Rio Grande Canal Laterals No's. 5 and 5A were reconstructed through cooperation with the Rio Grande Canal Water Users Association. To facilitate spreading of diverted water, two berms were constructed across an existing drainage between the canal laterals. The locations of the diversions and berms are shown in Figure 2-1. Berms were constructed in cooperation with San Luis Valley Irrigation District.

Since the location of the recharge structure is a relatively short distance from the river, the structure satisfies the objective of constructing a recharge structure which was designed to overcome many of the icing problems in canal laterals resulting from running recharge water during the late fall and early winter.

A total of six ground water monitoring wells, consisting of two nests, were drilled near the principal recharge areas by a U.S.D.I. Bureau of Reclamation drilling rig and crew.

2.2 MINOR RECHARGE STRUCTURES IN CLOSED BASIN

2.2.1 Brownell Site

In the SW1/4 NW1/4, Section 29, T. 40 N., R. 9 E., N.M.P.M., Rio Grande County, the Brownell Brothers constructed a recharge pit adjacent to the South Lateral of the San Luis Valley Irrigation District. The recharge pit, when full of water, has a surface area of approximately 0.7 acres. They granted permission to the San Luis Valley Water Conservancy District to construct nearby shallow wells and to monitor changes in ground water levels. The District constructed three wells at locations as shown on a sketch of the recharge pit included as Figure 2-2.

2.2.2 Cost Share Recharge Sites

In cooperation with Rio Grande Canal Water Users Association, the San Luis Valley Water Conservation District sponsored a program whereby the District would share in the cost of constructing ground water recharge sites. The District would cost share with land owners up to 50% (not to exceed $500.00) per pond of the cost of construction of per recharge ponds. The land owner was required to have surface water rights and desire to use those rights to recharge their aquifers.

The purpose of the program was to aid San Luis Valley Water Users toward the following goals:

- Maintain proper water levels in the underground aquifers so as to facilitate conjunctive use of water.
- Aid in the wise use and distribution of scarce water resources.
- Encourage the efficient and wise use of decreed water rights.
- Demonstrate the benefits, to water users, of properly designed and installed recharge facilities.

With this program, the District cost shared on 16 recharge ponds within the Closed Basin area. The locations and land owners of each recharge pond are listed in Appendix D.

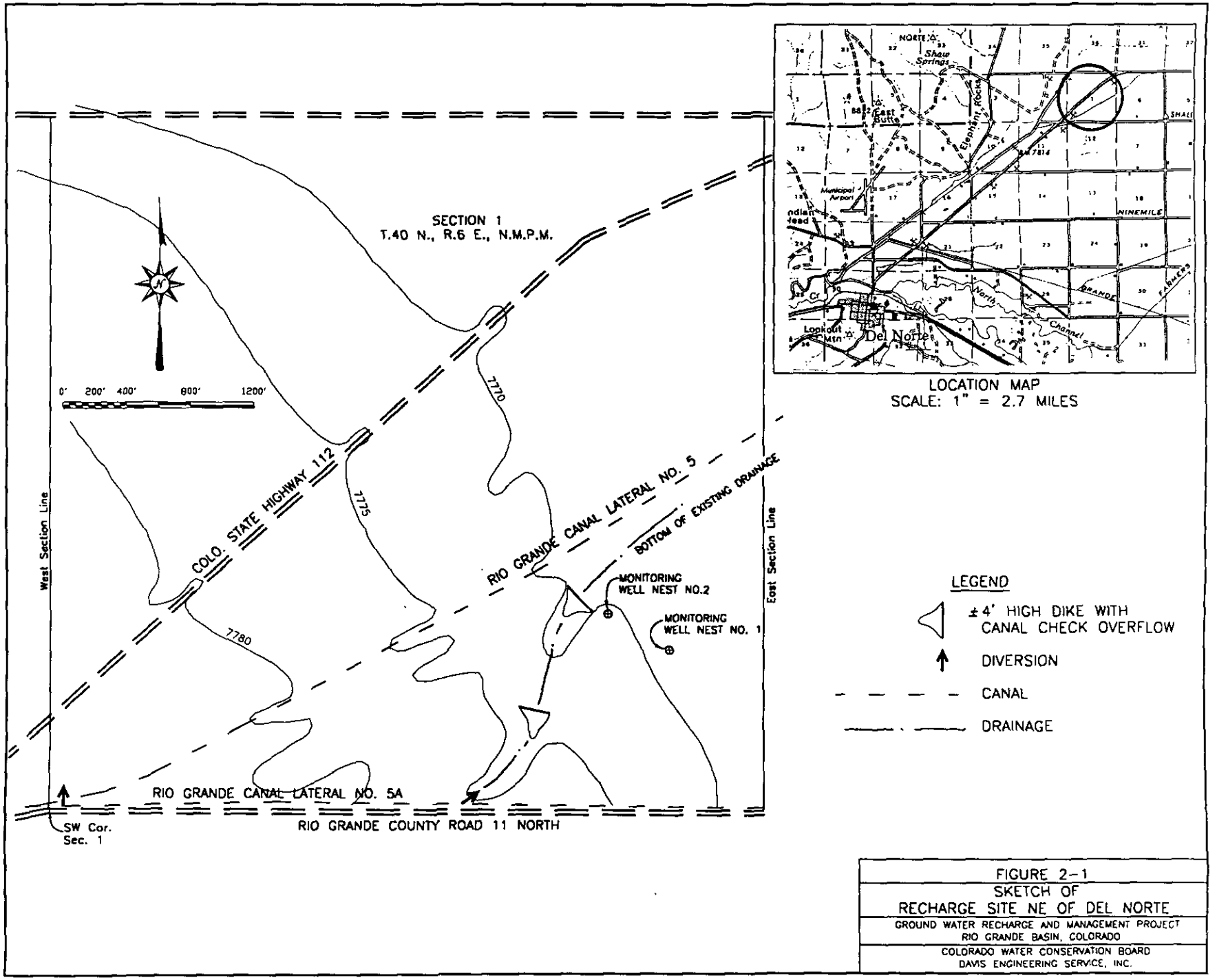

FIGURE 2-1
SKETCH OF
RECHARGE SITE NE OF DEL NORTE
GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO
COLORADO WATER CONSERVATION BOARD
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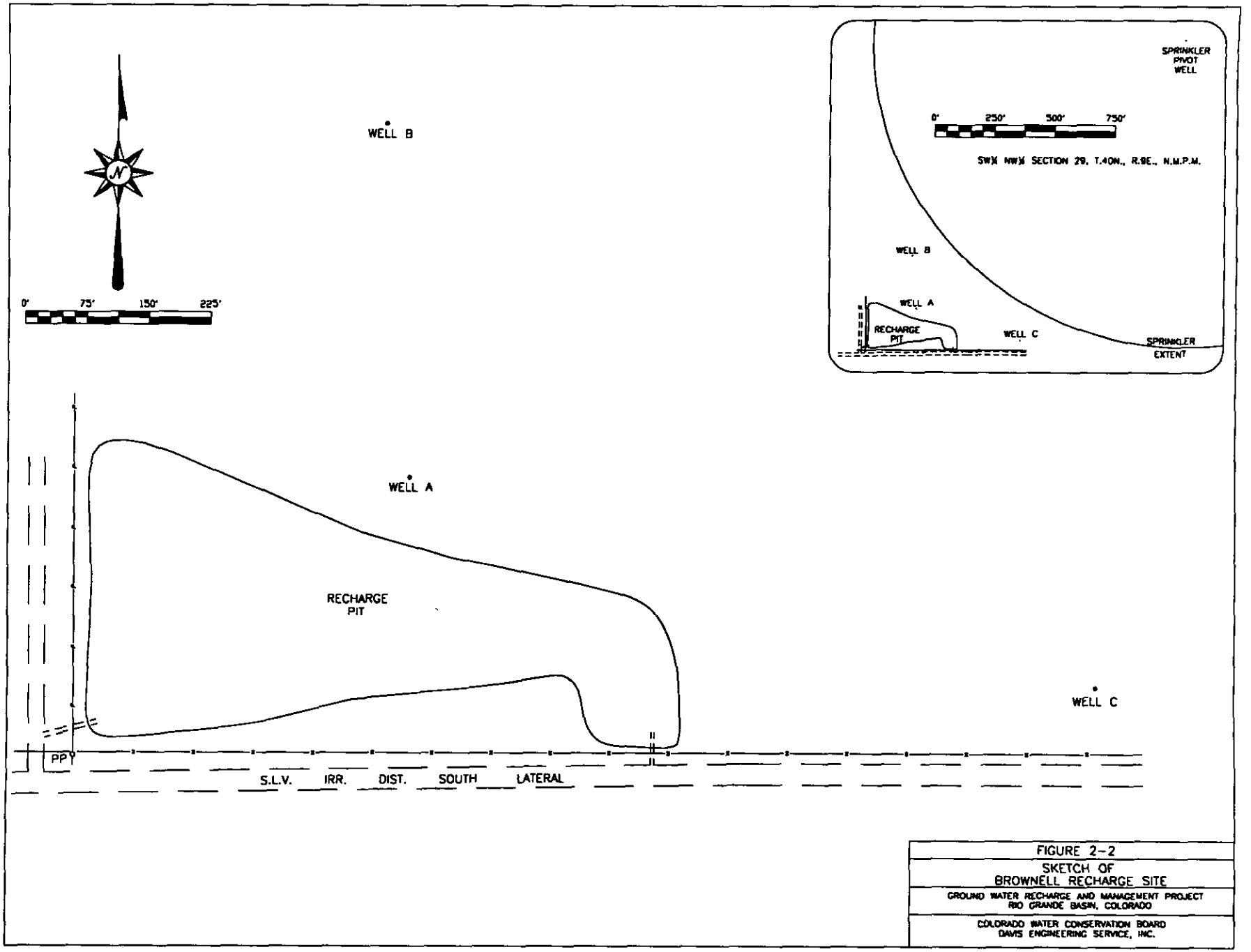

FIGURE 2-2

SKETCH OF
BROWNELL RECHARGE SITE

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
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2.3 RECHARGE STRUCTURE NORTHWEST OF MONTE VISTA NATIONAL WILDLIFE REFUGE

A ground water recharge structure was constructed west of the Monte Vista National Wildlife Refuge along the Monte Vista Canal in an attempt to correlate recharge outside of the so called "Blue Clay" with change in the confined aquifer. Sketch showing the location of the recharge structure is included as Figure 2-3.

Included on the sketch is the approximate locations of the upper most confining clay and the monitoring wells measured during the study period. Water levels in six wells were measured on a monthly basis. Two of the six wells (Abandon and #13-1-16P) are located near the canal and are believed to be outside the confining clay so they are tapping the unconfined or ground water aquifer. The remaining wells are assumed to tap the confined or artesian aquifer and the three easterly wells (#'s 14-10-16A&P, 14-14-2A and 14-23-2A) have been known to flow freely in the recent past.

A thorough investigation into the location of the westerly limit of the upper most confining clay near this site has led to the conclusion that the limit is likely to be westerly of the recharge pit. As a result, recharge from that portion of the Monte Vista Canal adjacent to the Refuge and from the recharge pit is likely to contribute primarily to the unconfined aquifer.

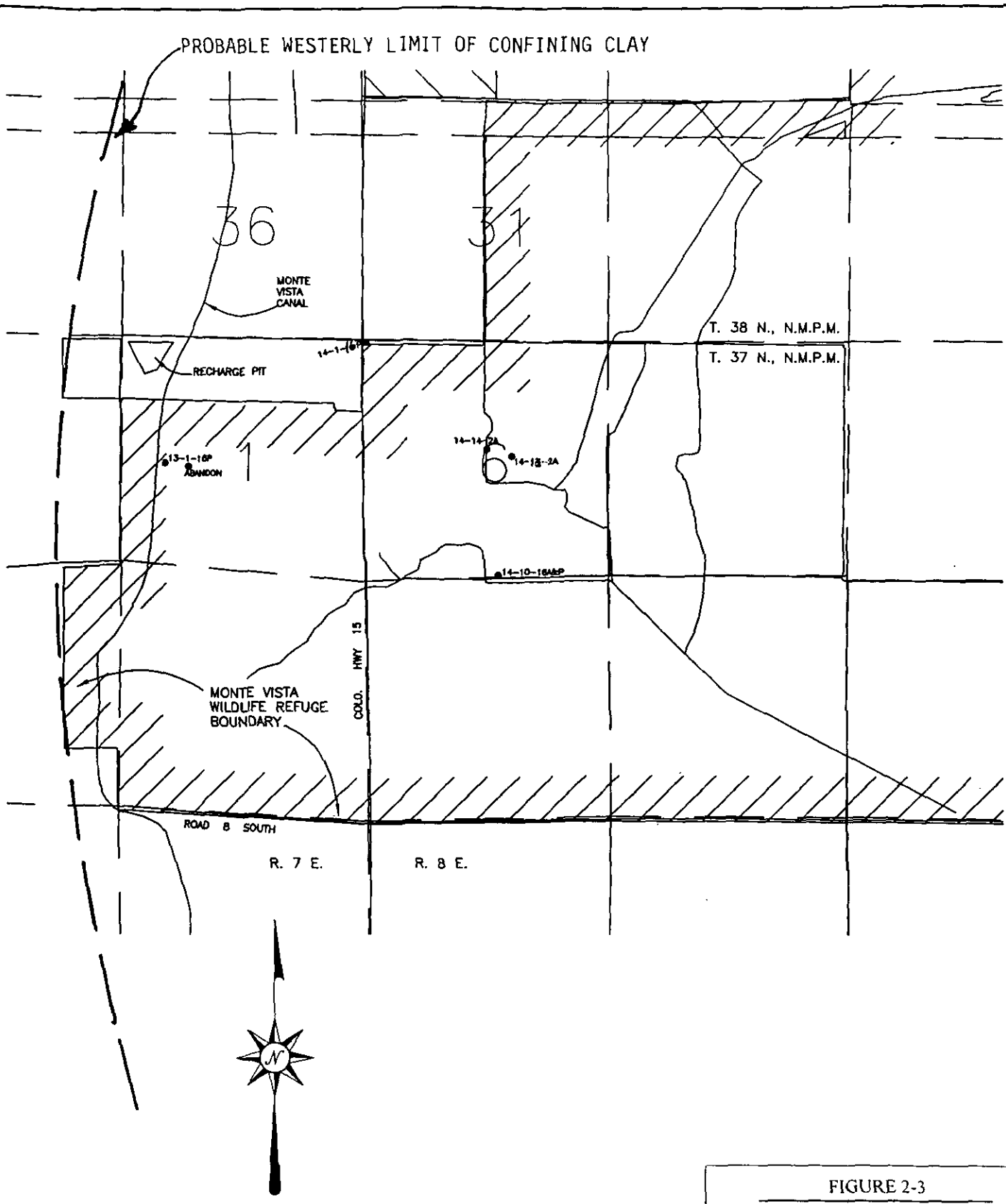

FIGURE 2-3

MONITORING WELLS AND RECHARGE SITE AT MONTE VISTA WILDLIFE REFUGE

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
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3.0 MONITORING RESULTS AT GROUND WATER RECHARGE AT SITES

3.1 WELLS USED TO MONITOR RESULTS OF GROUND WATER RECHARGE

3.1.1 Recharge Site Northeast of Del Norte

A total of six wells were drilled near the recharge site northeast of Del Norte. The wells were drilled by U.S.D.I. Bureau of Reclamation personnel through an agreement to assist local agencies such as the San Luis Valley Water Conservancy District with water management projects. The wells were grouped into two nests at the locations shown in Figure 2-1 Two wells were included in nest #1 and four wells in nest #2. Well logs and permits are included in Appendix B. Following in Table 3-1 is a tabulation showing the well designation and depth.

TABLE 3-1
Monitoring Well Depths and Designations at
Recharge Site Northeast of Del Norte

Well Designation	Depth (ft.)
Nest #1	
DH-WD-1A	44.7
DH-WD-1B	94.0
Nest #2	
DH-WD-2A	25.7
DH-WD-2B	45.5
DH-WD-2C	196.0
DH-WD-2D	84.4

In an effort to better understand the geologic relationships between the wells drilled on this site, a cross section showing the formations encountered was prepared and is presented in Figure 3-1. Well logs were prepared by a certified geologist that was on site and observed all drilling. This

cross section seems to demonstrate that there is substantial discontinuity in geologic structures that form the aquifers and it is difficult to accurately map these structures.

Ground water level hydrographs from each of the wells have been prepared. Time periods when recharge water was available have been superimposed allowing the reader to observe ground water reaction to recharge. These hydrographs are included as Figures 3-2 and 3-3. As shown in the graphs of water levels in the monitoring wells that were completed at different depths, there is a downward ground water gradient in the vicinity of both well nests. This information conforms with the descriptions of ground water conditions or modes along the edges of the valley as prepared in earlier reports (Hearne, 1988 p. 7 & 8). Diagrams of four common modes that occur within the ground water aquifers in the valley are included in Figure 3-4.

Earlier reports (Hearne, 1988 p. 7) indicate that "perched or semiperched conditions occur .... around the perimeter of the ..... basin and indicate that water is flowing from shallow to deeper aquifers of the system." The increased water levels that occur within a few days after flow through the irrigation canals and diversion to the ponds on this site clearly indicate that surface water carried from the Rio Grande is recharging the aquifer penetrated by the monitoring wells. Furthermore, the ground water slope or gradient to the east as shown by comparing water levels in the well nests at similar depths and times, indicate that ground water flow is easterly at this site.

3.1.2 Brownell Recharge Site

Three monitoring wells were drilled near the Brownell recharge site to observe ground water response to surface water diversions into the recharge pit. All wells were drilled to a depth of 20 feet below the ground surface. Well logs and permits are included in Appendix C. Water level measurements in the sprinkler pivot wells were also made. Ground water level hydrographs from each of the wells have been prepared with time periods when recharge water was available superimposed to allow the reader to observe ground water reaction to recharge. These hydrographs are included as Figures 3-5, 3-6, 3-7 and 3-8.

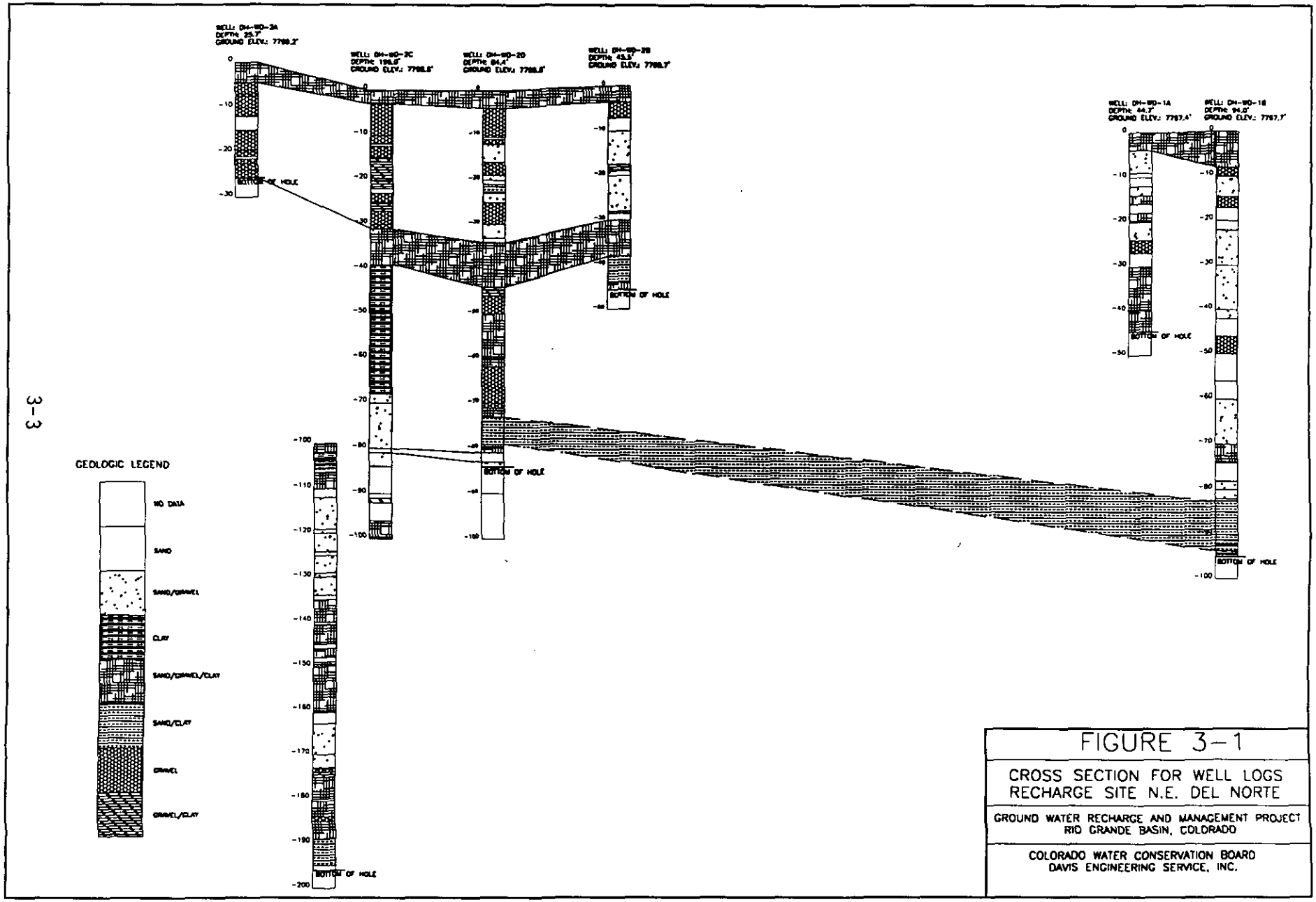

FIGURE 3-1

CROSS SECTION FOR WELL LOGS
RECHARGE SITE N.E. DEL NORTE

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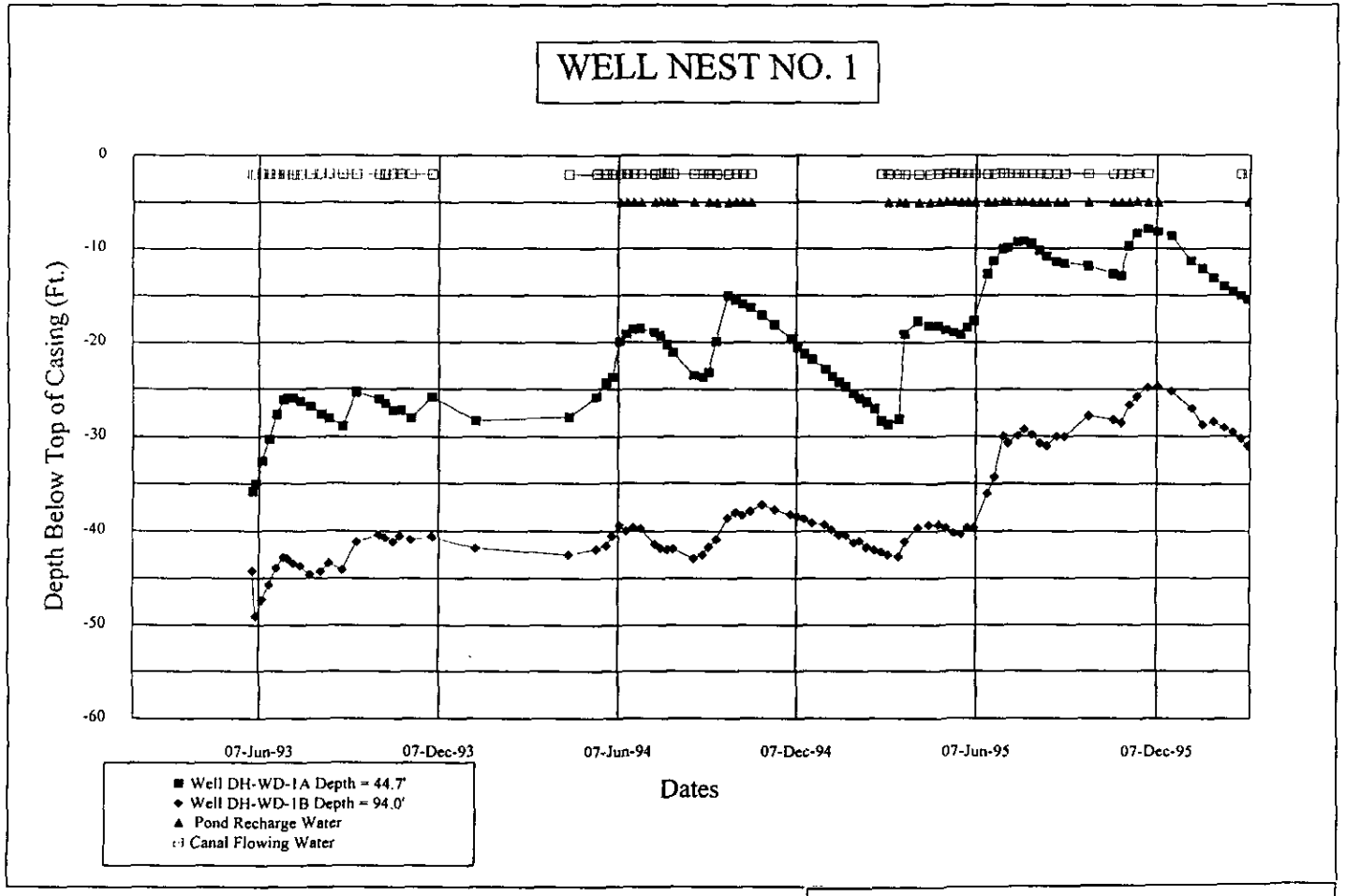

FIGURE 3-2
GROUND WATER LEVEL HYDROGRAPH
WELL NEST #1

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
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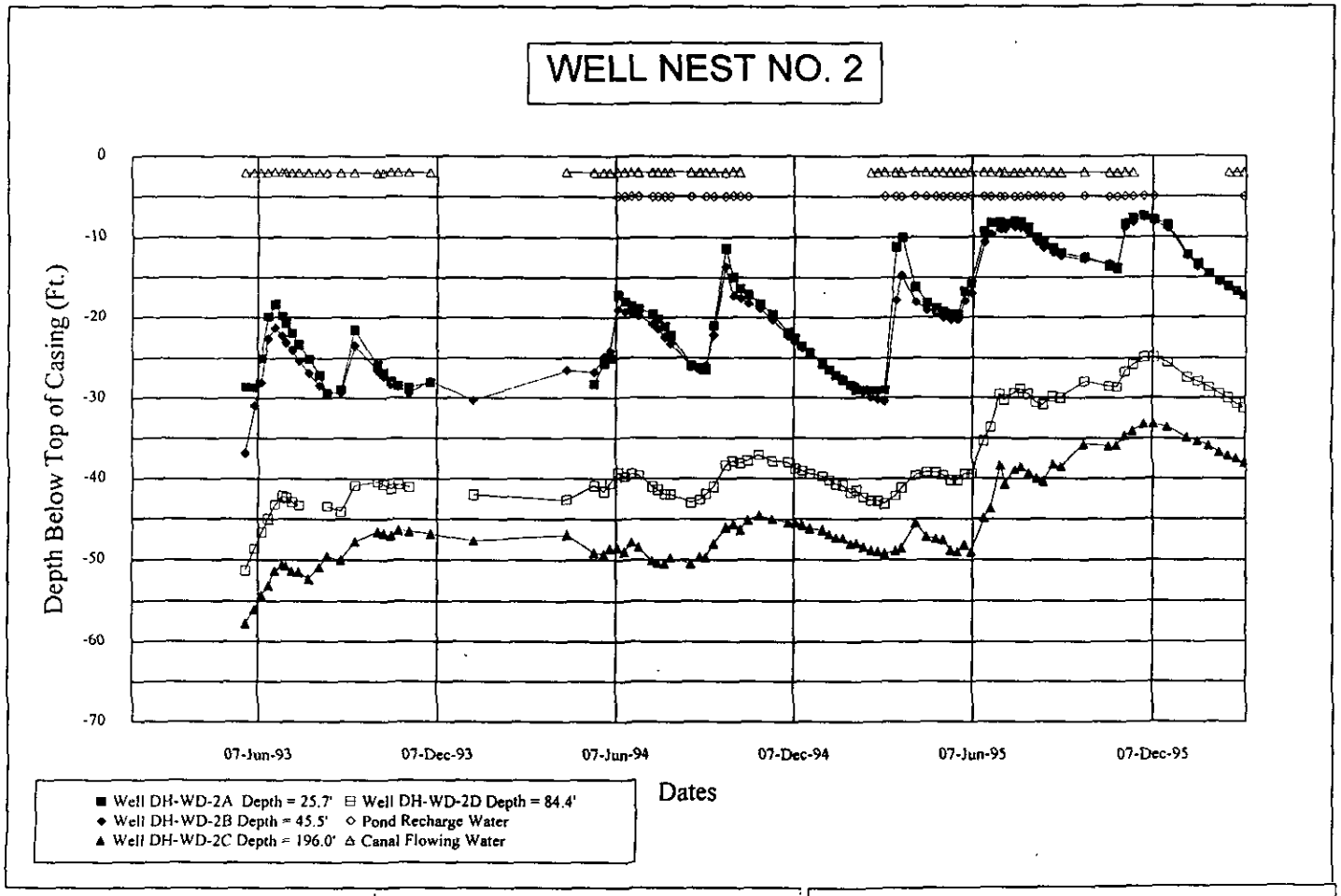

FIGURE 3-3
GROUND WATER LEVEL HYDROGRAPH
WELL NEST #2

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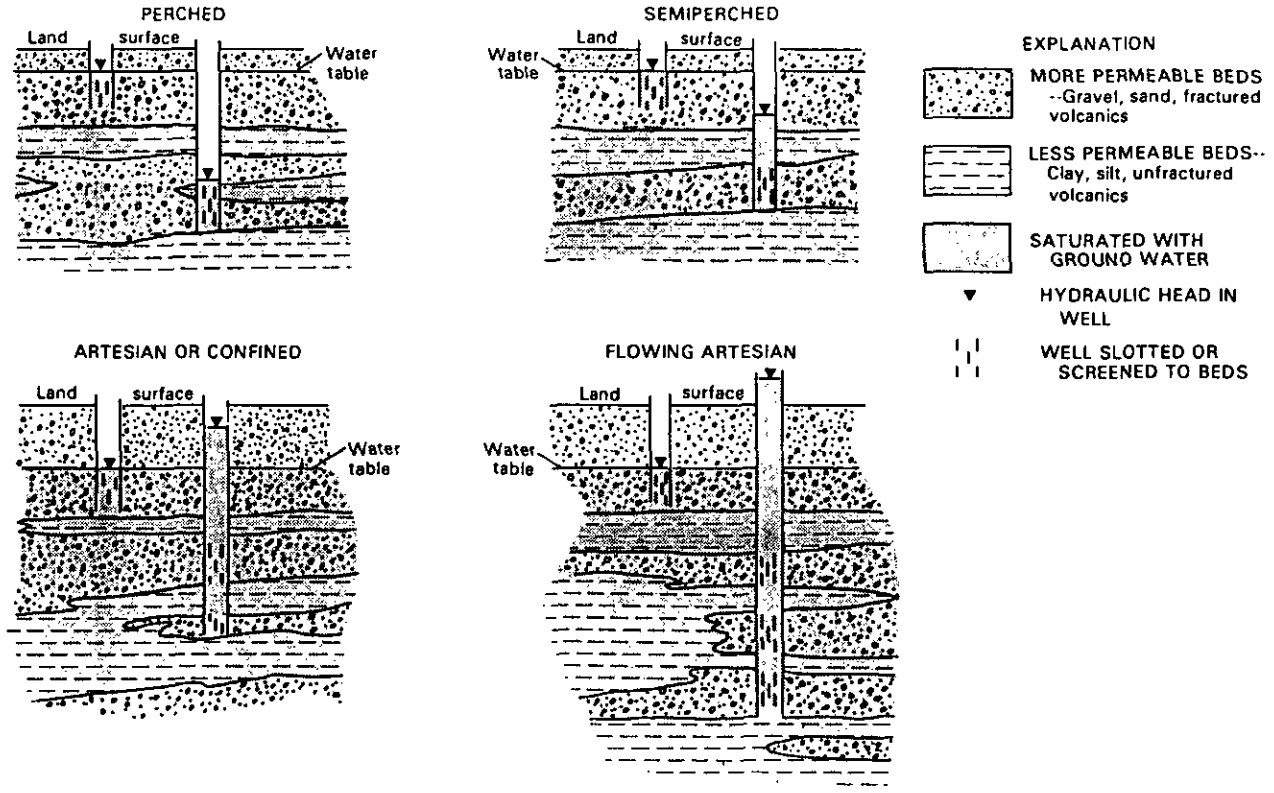

FIGURE 3-4

MODES OF OCCURRENCE OF GROUND WATER

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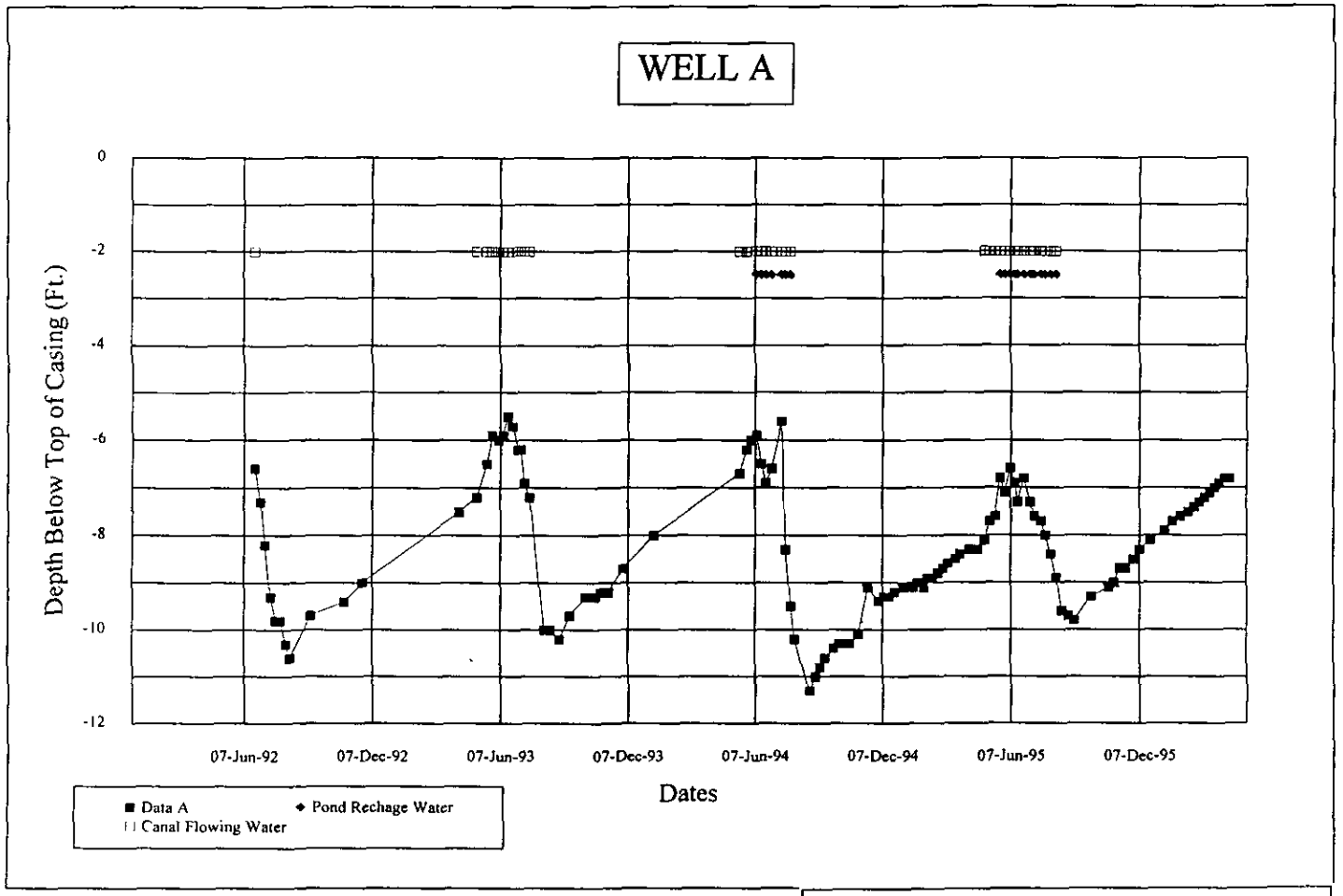

FIGURE 3-5
GROUND WATER LEVEL HYDROGRAPH
WELL A

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

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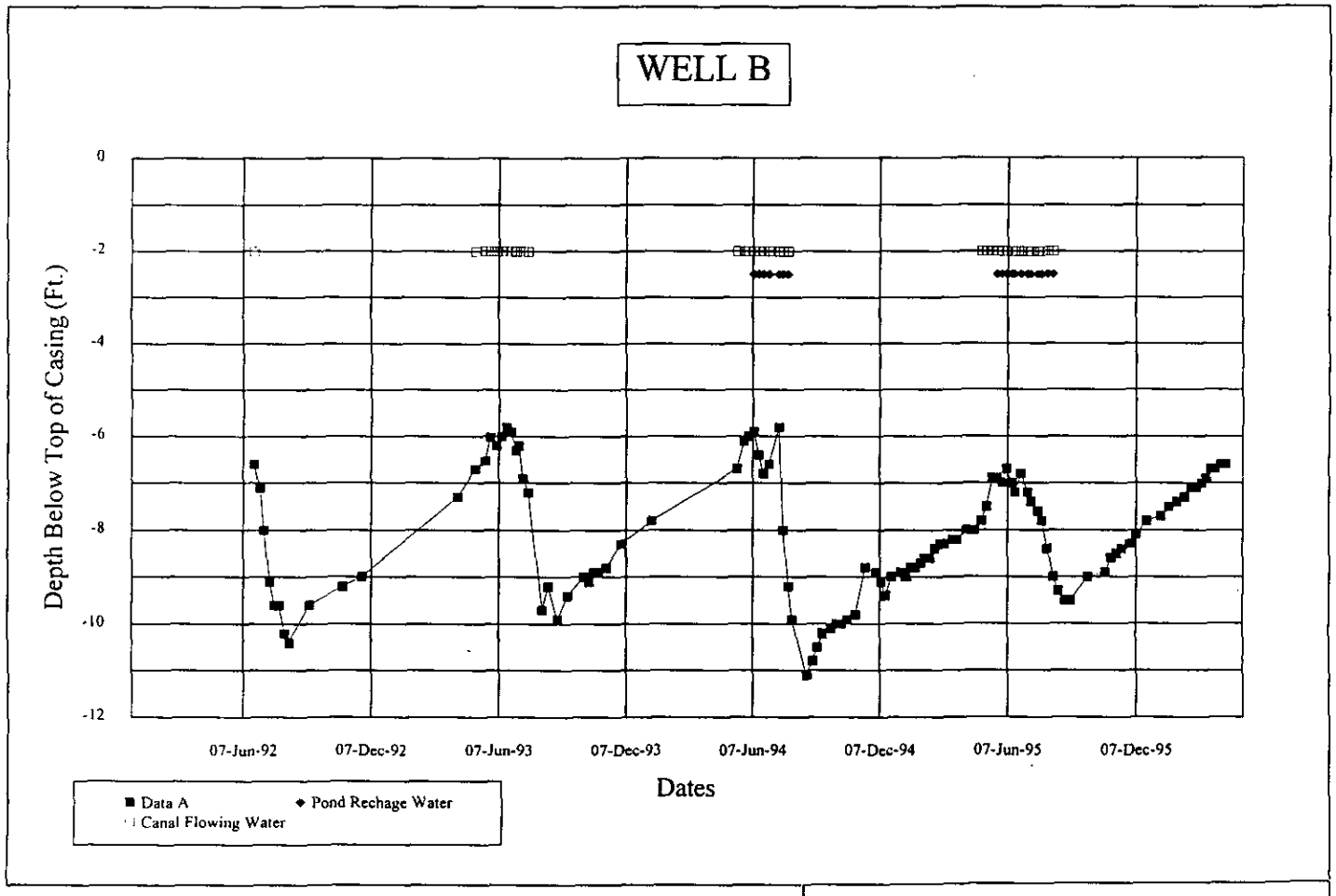

FIGURE 3-6
GROUND WATER LEVEL HYDROGRAPH
WELL B

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

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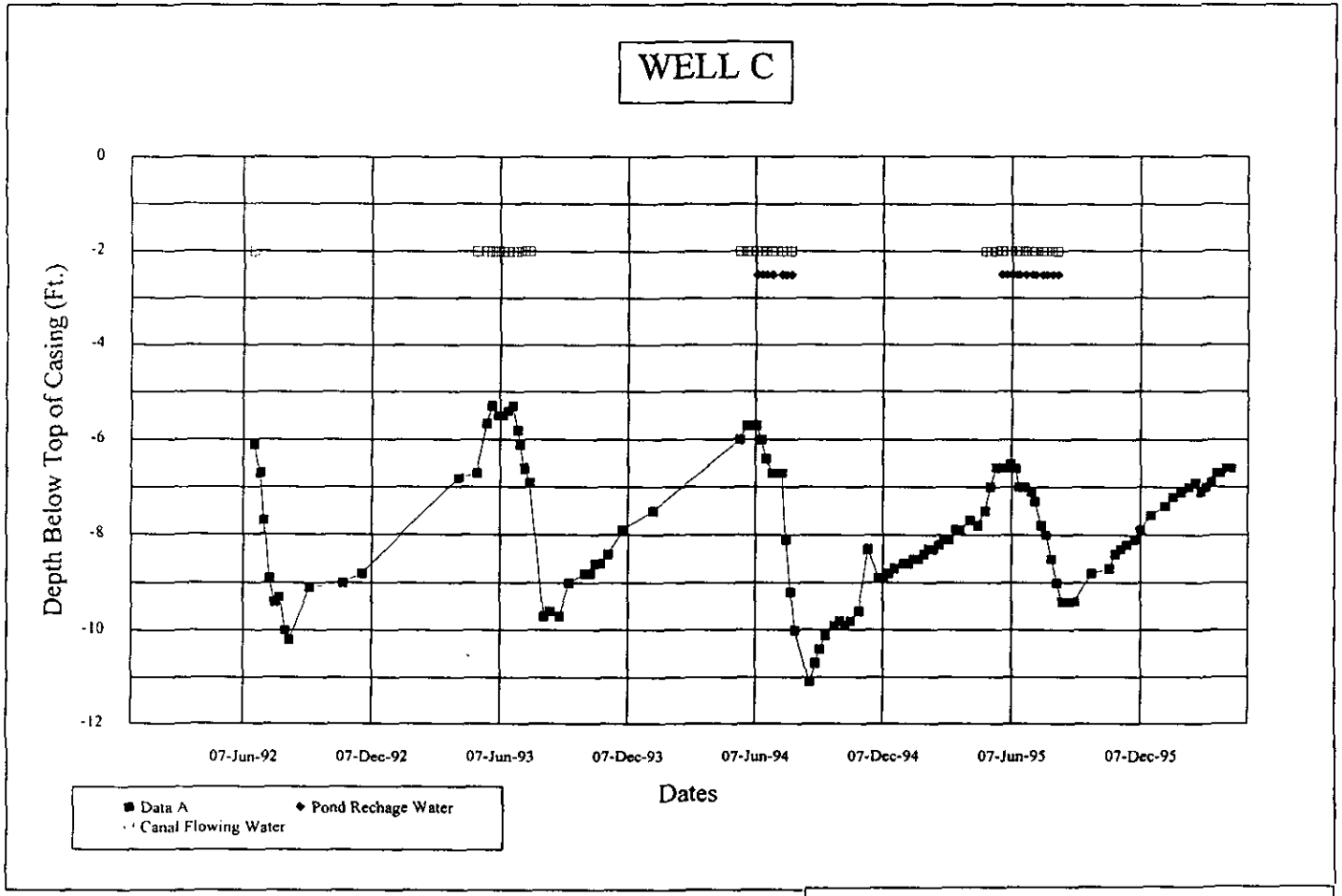

FIGURE 3-7
GROUND WATER LEVEL HYDROGRAPH
WELL C

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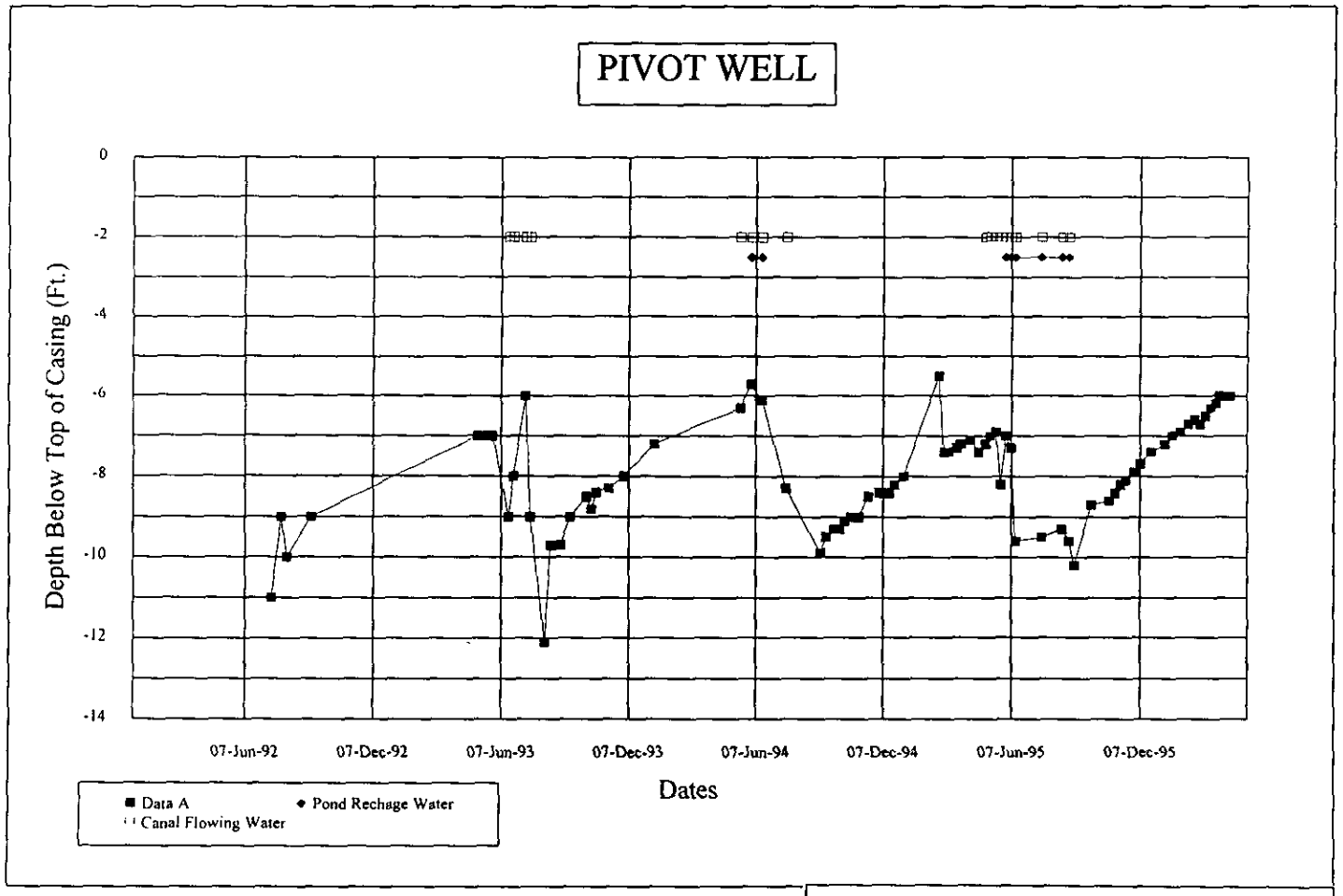

FIGURE 3-8
GROUND WATER LEVEL HYDROGRAPH
PIVOT WELL

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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3.1.3. Recharge Site Northwest of Monte Vista National Wildlife Refuge

On the Monte Vista National Wildlife Refuge, water levels of six existing wells were measured. As previously described, two of the wells appear to tap the unconfined aquifer while the remaining wells tap the confined aquifer.

For each of the wells, ground water level hydrographs have been prepared with time periods when Monte Vista Canal water was available for recharge superimposed to allow the reader to observe ground water reaction to recharge. These hydrographs are included as Figures 3-9, 3-10, 3-11, 3-12, 3-13 and 3-14.

3.2 CHANGES IN GROUND WATER LEVEL DUE TO RECHARGE

3.2.1 General

At the recharge sites northeast of Del Norte and at the Brownell site the monitoring well measurements clearly indicate that ground water levels rise within a few days after the introduction of surface water into the site. At both sites the nearby canal laterals leak into the ground water system, complicating the exact quantification of the effect of the recharge pit(s) on the ground water system.

Using the approach documented in the development of the CSU Well&Pit computer program described below, the quantity of ground water recharge is a function of site conditions, area of pit or ditch bottom inundated by water and length of time of inundation. Included on the well hydrographs in Section 3.1.1 and 3.1.2 the time of inundation of the pit(s) and nearby ditches are shown so visual correlation between changes in ground water levels and available recharge water can be made.

In both cases, an increase in ground water levels in monitoring wells following diversion of water into nearby recharge pit(s) is obvious. However, the rate of recharge during the period

when nearby irrigation wells were extensively pumped, was insufficient to prevent well water levels from declining.

3.2.2 Recharge Site Northeast of Del Norte

Because the recharge site northeast of Del Norte is located outside of the boundaries of the confined or artesian aquifer as mapped from well logs (Emery, Plate 2, 1973), there has been interest in defining the percentage of applied recharge water that reaches the confined aquifer. As can be visualized by studying changes in water levels in the nests of monitoring wells, recharge water infiltrates through surface soils into the aquifer system that comprises several leaking clay lenses that dip easterly. These clay lenses retard the downward flow and due to their dip, cause the ground water to flow easterly. In order for recharge water to enter the confined aquifer as commonly defined, the water must have leaked through the aquifer system to a depth of 100 or more feet by the time it reaches the confined aquifer boundary. Since the percentage of recharge water reaching this depth is dependent largely on the unmeasured retardance of the clay lenses and the slope of the lenses, accurate estimates of percentage of applied recharge water that accrues to the confined aquifer is beyond the scope of this study. However, the increase in water levels in the deeper wells indicate that a significant portion of recharge water has the potential of entering the confined aquifer. For example, in well nest No. 2, ground water level increases of approximately 10 feet were recorded in both the shallow 25.7 foot deep well and the 196.0 foot deep well during the time period between June and December 1995. This related change seems to indicate that nearly 100% of applied water at this site enters depths that are tributary to the confined aquifer.

An indication of where recharge water goes can be derived by displaying ground water levels in a cross section of the aquifers along a line between the nests of wells. Comparing ground water elevations between the two well nests that are approximately 440 feet apart, the ground water surface is about one foot lower in the easterly nest than the westerly nest. This elevation difference indicates a significant easterly flow of ground water.

3.2.3 Brownell Recharge Site

A general observation that is derived from comparing well hydrographs is that the cone of depression caused by the pivot well is quite flat. This conclusion is reached by noting that the drawdown in the pivot well is quite similar to those in monitoring wells located ±1,200 feet away. The ground water levels in the pivot well are more erratic that those in the monitoring wells, but this is probably due to varying lengths of time between well pumping and measurements. The relatively flat cone of depression of a well indicates a high yielding aquifer.

The rather significant improvement in ground water levels during periods outside of the time water was in the recharge pit and nearby ditch seems to indicate that recharge is arriving at the site from other sources than the ditch and recharge pit. It is presumed that the principal source is ground water flow from the west and the possibility of a small contribution from upward leakage from the underlying artesian aquifer.

Water in the recharge pit and nearby ditch clearly increase the availability of ground water at the site. The monitoring well hydrographs indicate increases in ground water levels of 1.5 to 2.0 feet during the periods when recharge water was available.

3.2.4 Recharge Site Northwest of Monte Vista National Wildlife Refuge

The recharge site northwest of the Monte Vista National Wildlife Refuge was found to be located over the confining clay so water level measurements of confined waters included in Section 3.1.3 are likely to be only an indication of general recharge to the confined aquifer in this region.

3.3 COMPARISON BETWEEN COMPUTER MODEL AND GROUND WATER LEVELS

The computer ground water model used to simulate changes in ground water levels resulting from surface recharge was developed by Colorado State University and is called herein the CSU

Well&Pit model. The model was developed through research at a recharge site on the eastern side of the San Luis Valley in the Trinchera Creek drainage and is designed to predict ground water changes from a single recharge pit rectangular in nature. At the site northeast of Del Norte, the arrangement of the recharge sites consists of at least two pits with irregular shapes and nearby canal laterals, all of which contribute recharge to an aquifer containing numerous clay lenses. These irregularities and conditions exceed the design assumptions used in the referenced model. Therefore, the use of the reference model at the recharge site located northeast of Del Norte predicting change in ground water levels was not pursued.

In order for a ground water model to be an accurate predictor of changes in ground water levels at this site, it would need to be multilayered and extensive calibration would be needed. Preparation of such a model would be an interesting academic exercise, but due to its complexity, it could not be easily used by water users. The CSU Well&Pit model when applied to this site indicates that significant recharge is possible, which is sufficient for most water users to assist them in planning their recharge facilities.

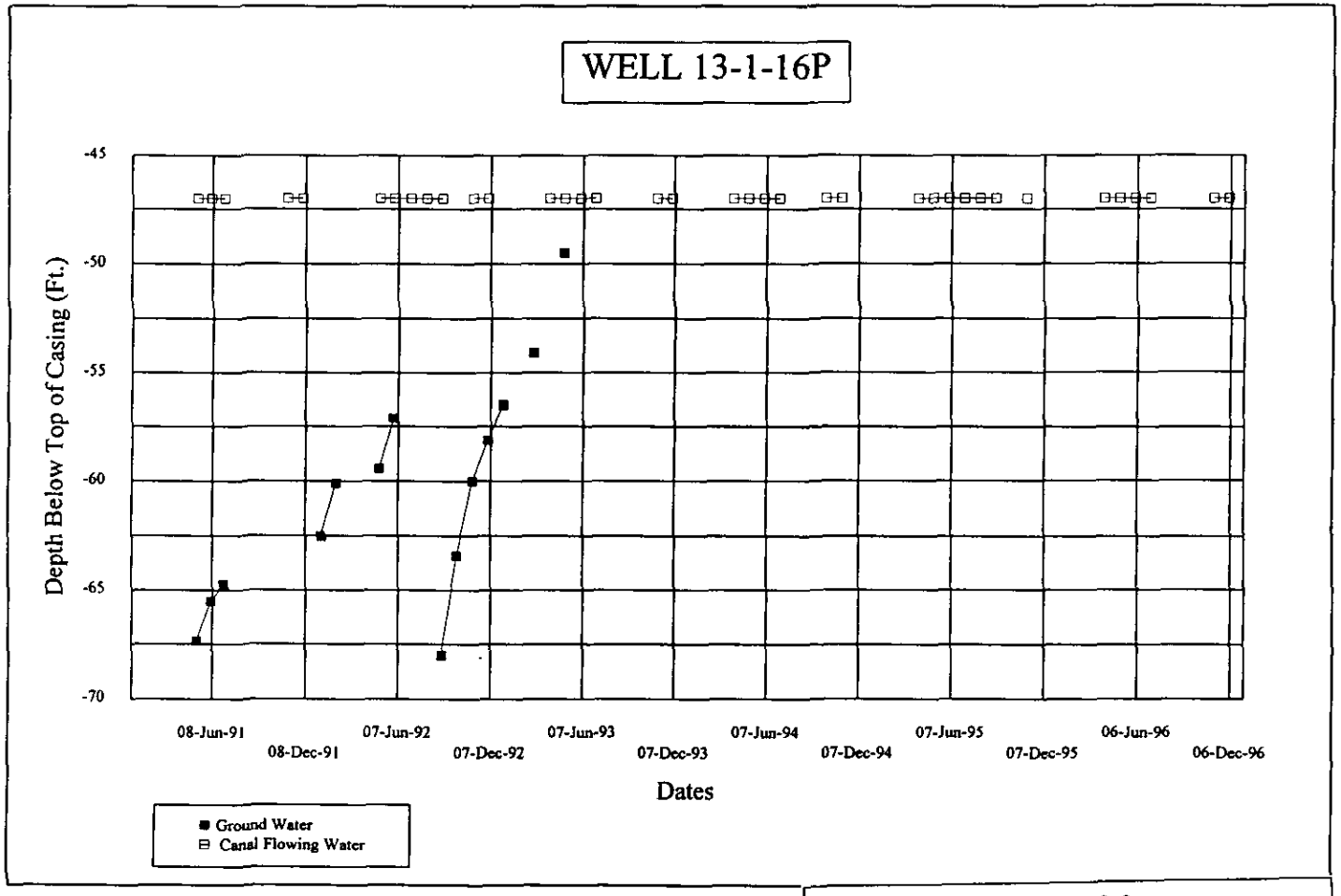

FIGURE 3-9
GROUND WATER LEVEL HYDROGRAPH
WELL 13-1-16P

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

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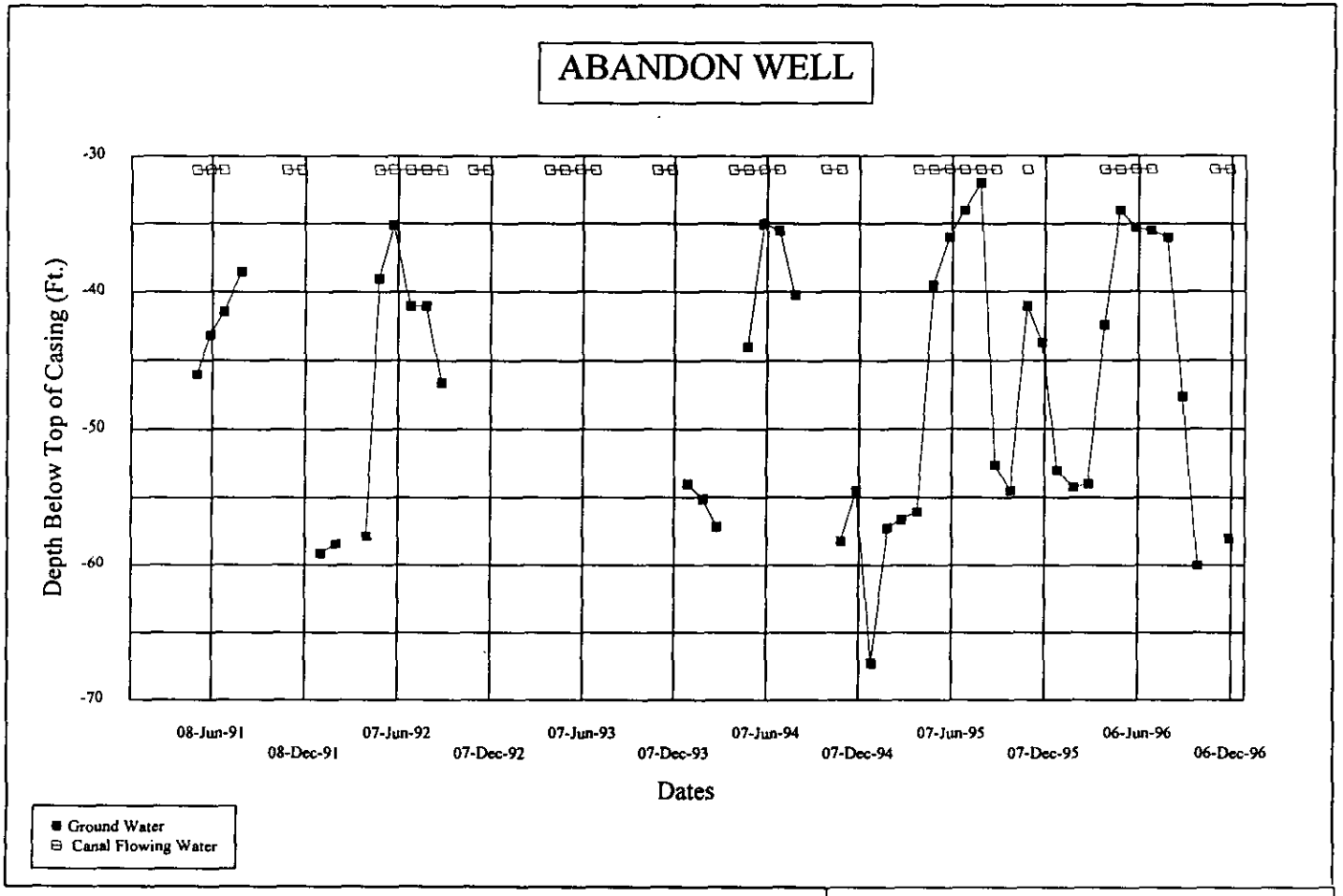

FIGURE 3-10
GROUND WATER LEVEL HYDROGRAPH
ABANDON WELL

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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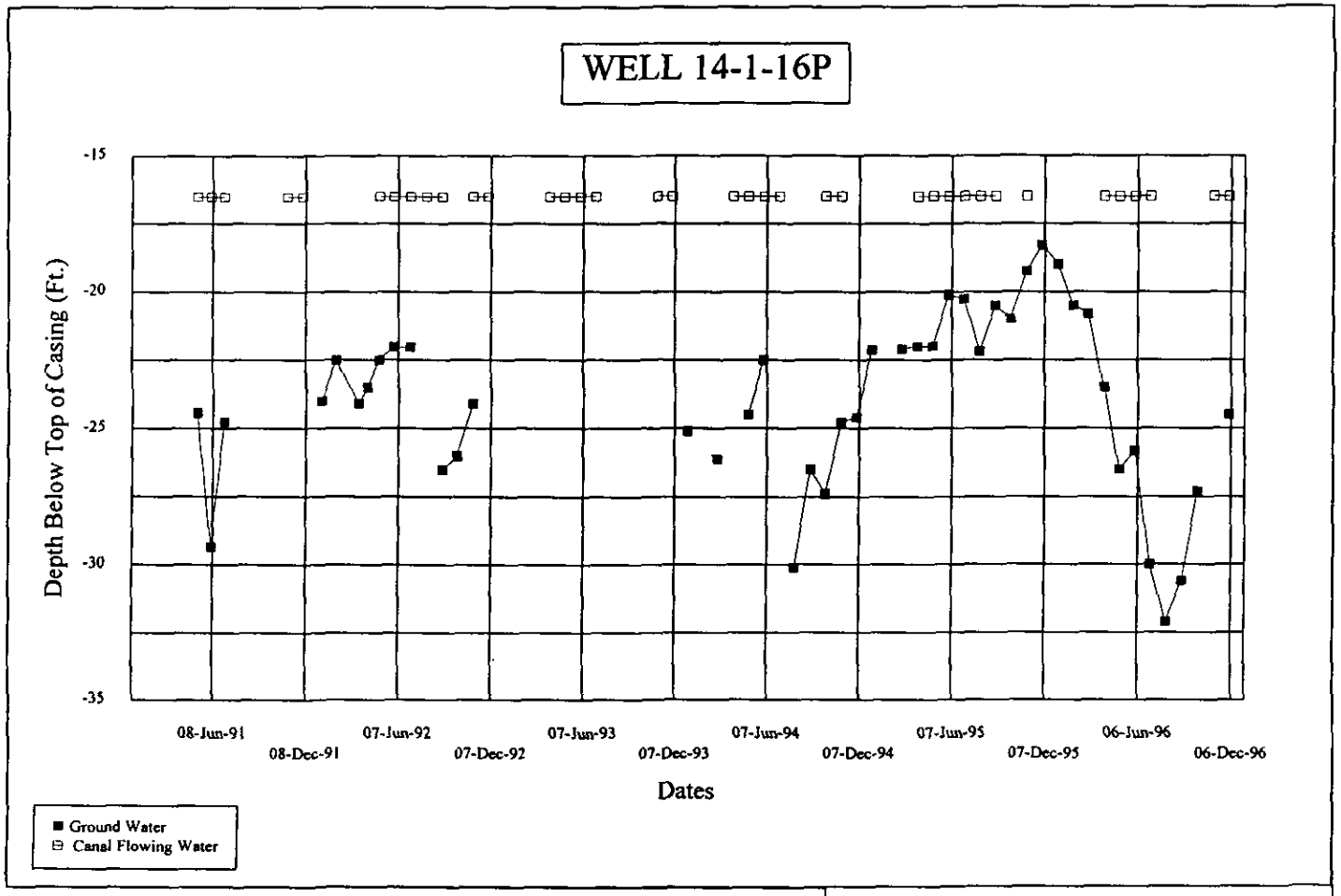

FIGURE 3-11
GROUND WATER LEVEL HYDROGRAPH
WELL 14-1-16P

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
DAVIS ENGINEERING SERVICE, INC

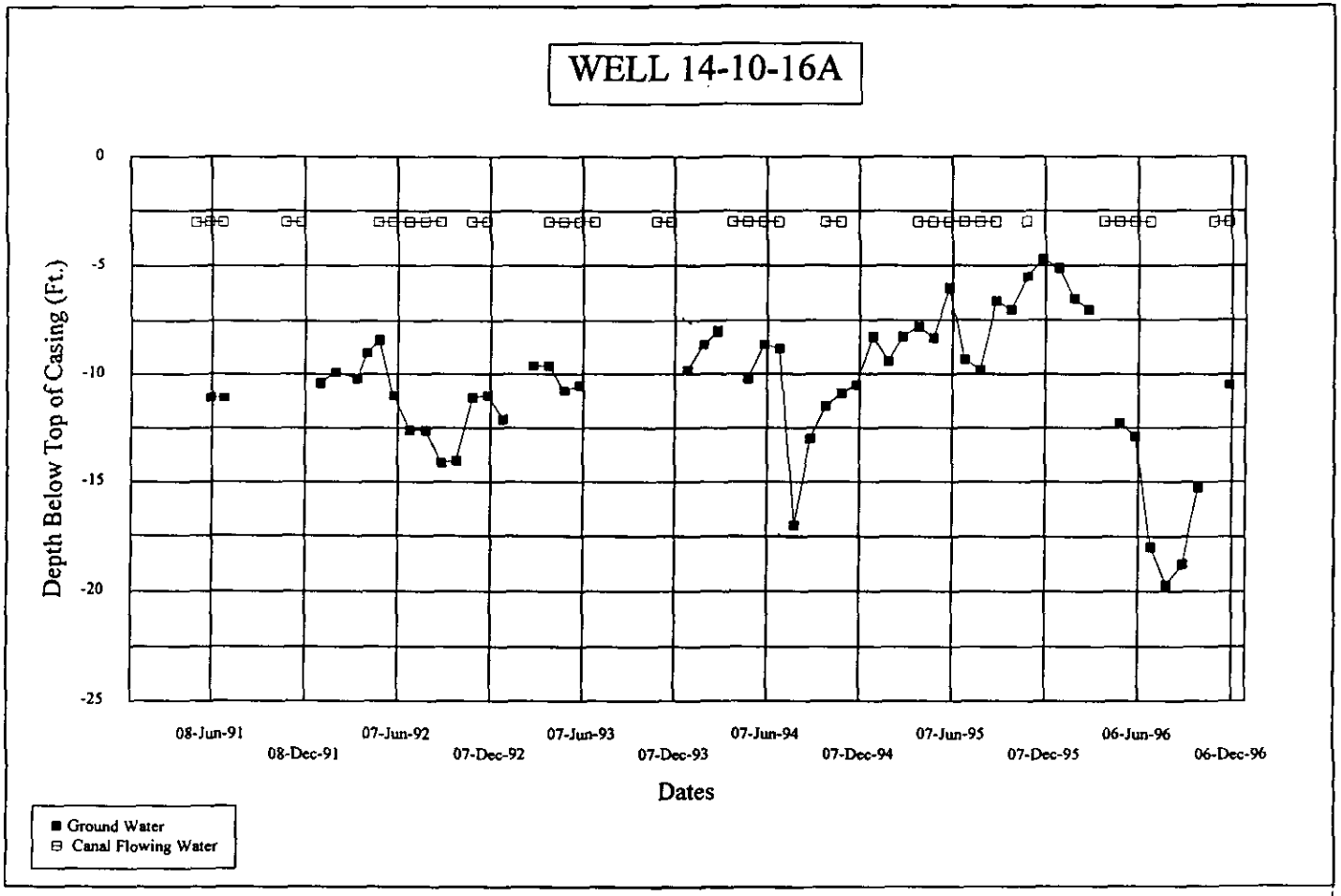

FIGURE 3-12
GROUND WATER LEVEL HYDROGRAPH
WELL 14-10-16A

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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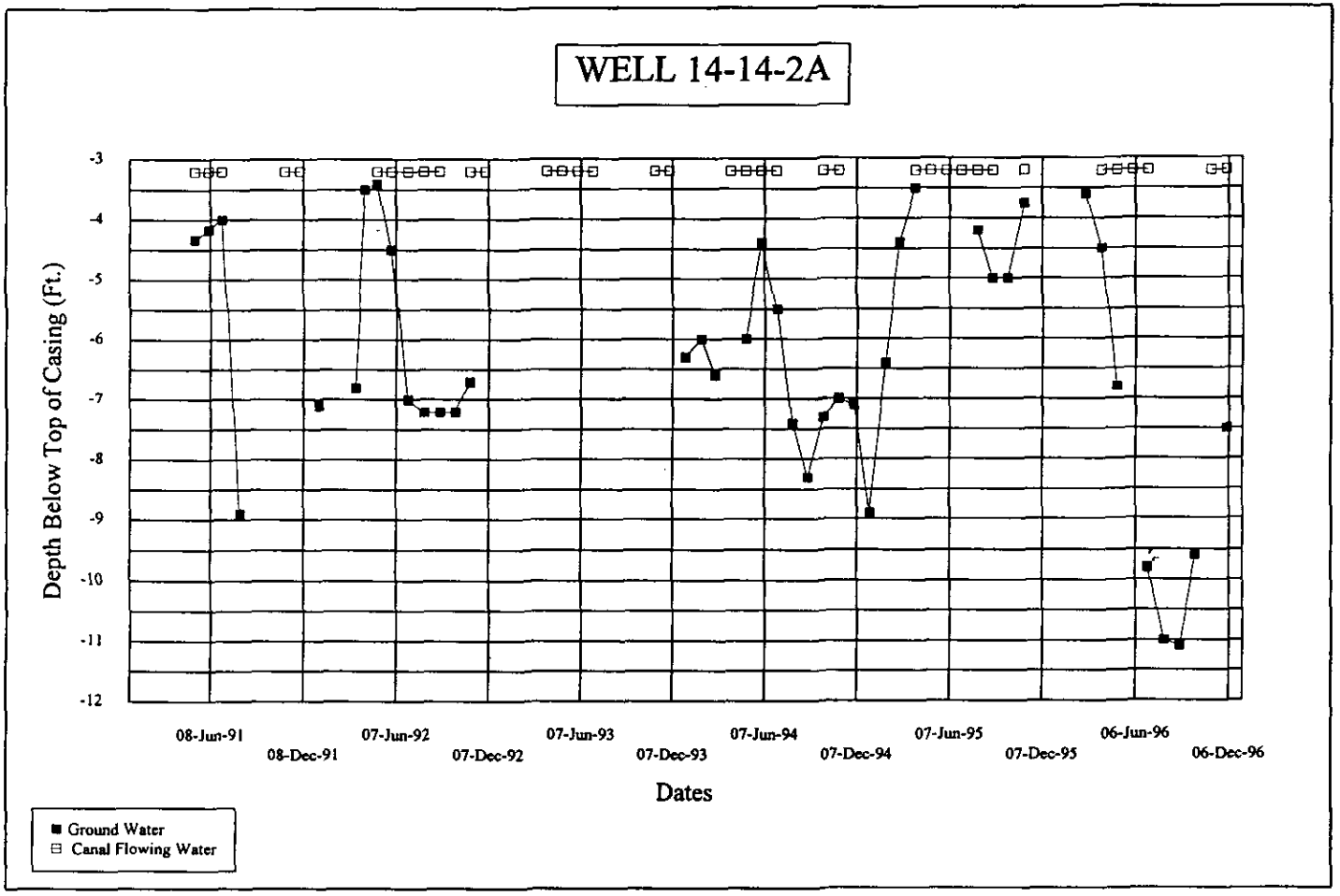

FIGURE 3-13
GROUND WATER LEVEL HYDROGRAPH
WELL 14-14-2A

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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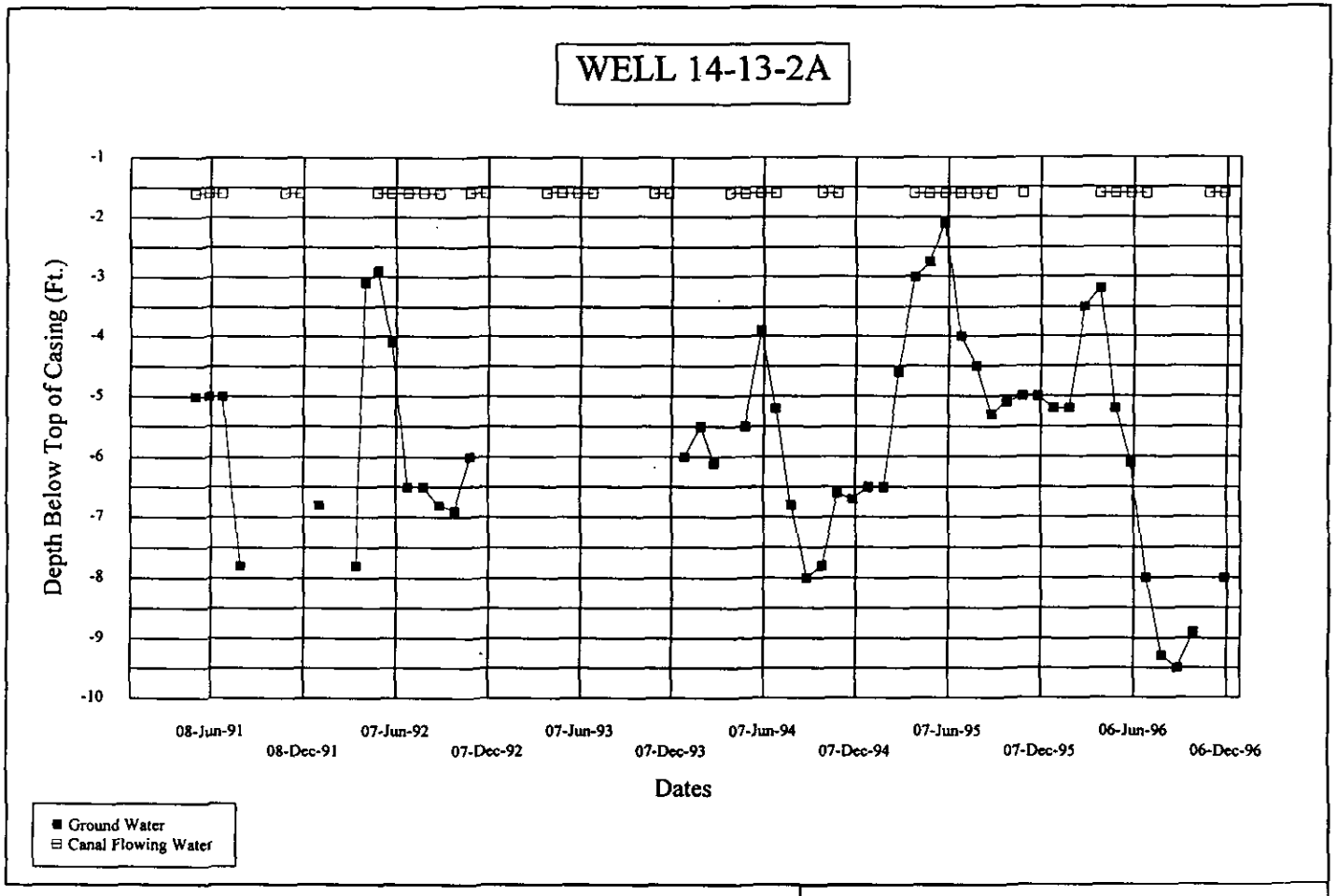

FIGURE 3-14
GROUND WATER LEVEL HYDROGRAPH
WELL 14-13-2A

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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4.0 DATA CONCERNING EXTENT OF GROUND WATER RECHARGE

4.1 Change In Unconfined Storage In Western Portion of Closed Basin

In the San Luis Valley, the largest example of a ground water aquifer being used as a reservoir is located north of the Rio Grande in the intensively farmed area outlined on the map included as Figure 4-1. Into this area, several hundred thousand acre feet of water from the Rio Grande is diverted through major canal systems that were built during the 1880's and 1890's. Before construction and use of the canals, depth to ground water near the center of the outlined area was reported to be 50 to 100 feet (Powell, 1958, Pgs. 56-57). After several years of diversion of irrigation water into this area and resulting seepage into the ground water, levels were raised in most areas to less than 15 feet below ground surface. Raising the ground water table is essentially the same as filling a reservoir.

During the drought of the 1950's, many wells were drilled into this shallow unconfined aquifer. Water was withdrawn with pumps and used to supplement river water for irrigation. This was the first major withdrawal of water from this underground reservoir. This artificially filled aquifer had become a functioning reservoir that could be filled with seepage from canals and flood irrigation, then withdrawn through wells during periods of river water shortages.

To better understand the continuing change in ground water levels in the most active portion of the Closed Basin, a calculation and charting of the approximate change in shallow ground water or unconfined aquifer storage has been performed since about 1981 by the author. This process included calculating the annual changes in ground water storage based on approximately 26 Rio Grande Water Conservation District (RGWCD) monitoring wells located in the highly irrigated area shown on Figure 4-1. The dark triangles on the map in Figure 4-1 represent locations of monitoring wells in which depth to water level below ground surface has been measured. The study area encompasses approximately 335,000 acres. The period of the calculating and charting

begin in 1975 at which time the RGWCD constructed and began monitoring a sufficient number of wells to make the process meaningful.

The method of computing the change in ground water storage was in accordance with the Thiessen mean method whereby a polygon is constructed around each observation well, with the assumption that the change in water level throughout the area of the polygon is the same as the change in the well within the polygon. This method was used in Geological Survey Water-Supply Paper 1379 by W. J. Powell. The chart of the change in unconfined aquifer storage is included as Figure 4-2. The change in storage was plotted as zero at the beginning of the study period in 1975, with monthly changes plotted thereafter.

A combination of drought and lack of attention to river water diverted into the area resulted in significant depletion of the underground reservoir in the late 1970's, with the apparent low point in 1978. When storage in this reservoir reached these very low levels and well pumps began sucking air rather than water, the need to better manage diverted river water became apparent. This better management included filling or recharge of the underground reservoir at historical locations and times. Since 1977, knowledge and understanding of how filling of the reservoir or recharge can be accomplished has improved significantly. During 1996, a severe drought occurred and declines in the ground water levels occurred, but it does not appear that levels similar to those experienced in the late 1970's are likely.

4.2 ESTIMATES OF RECHARGE THROUGH CANAL AND DITCH COMPANIES

Since the west central portion of the Closed Basin, as outlined in Figure 4.1, is the most utilized portion of the unconfined aquifer within the District, this area has been the focus of estimates of recharge through canal and ditch companies. The primary sources of water to this area is water diverted from the Rio Grande, carried by canals into the area, and natural inflow.

The major canals and ditches that carry water into the subject area included Rio Grande, San

Luis Valley Irrigation District and the San Luis Valley canals, the Prairie and Billings ditches. A tabulation of diversions by these systems is included in Appendix E. The average diversions for the time period 1950 through 1994 were 273,000 acre feet per year. The amount of natural inflow from the mountains to the west was calculated by Phil Emery in his analysis of the hydrology of the Valley to be approximately 23,000 acre feet per year. However, there is not sufficient data currently available to document annual inflows from the mountains to the west.

To demonstrate and understand the correlation between ground water levels and Rio Grande diversions into the Closed Basin, a graph of the diversions versus change in aquifer storage was prepared for the time period 1976 to 1989. The change in aquifer storage calculations are presented in Section 4.1. The graph is included as Figure 4-3. A point for each year was plotted. Each point represents the intersection of the total diversion, which is plotted on the horizontal axis, and the change in unconfined aquifer storage, which is plotted on the vertical axis, for each respective year. By using linear regression, a trend line was plotted through the points. The data used to plot the graph is included in Appendix E.

A quick review of the graph in Figure 4-3 indicates that there is a direct relationship between canal and ditch diversions into the Closed Basin and change in unconfined aquifer storage. Further, the intersection of the trend line with the horizontal zero change line indicates that diversions totaling approximately 270,000 acre feet per year results in a zero change in unconfined aquifer storage assuming no material change in inflows from the surrounding mountains. Since required diversions of ±270,000 acre feet per year approximately equal actual average diversions of 273,000 acre feet per year, it indicates that storage in the aquifer should remain relative stable over the long term assuming no material change in inflows from the surrounding mountains and no material increase in ground water withdrawals. The change in unconfined aquifer storage chart in Figure 4-2 supports this conclusion showing maintenance of storage over the long term, although there have been dramatic changes from year to year during the study period.

Of this ±273,000 acre feet of diversions and ±23,000 acre feet of natural inflow to the Closed

Basin from the west, in addition to recharge of the unconfined aquifer, portions are lost to evaporation and used to recharge the deeper confined aquifer and directly irrigate crops.

Through extensive investigations of canal and ditch company records by Harlan W. Erker in 1978, he concluded that recharge to the unconfined aquifer in the Closed Basin under the San Luis Valley, Rio Grande, San Luis Valley Canals and the Prairie and Billings Ditches averaged 140,000 acre feet per year.

Since the vast majority of water for irrigated acres in the referenced study area is obtained from wells and applied through center-pivot sprinklers, an estimate of irrigation demand for these sprinklers will be approximately equal to recharge needed to sustain to the shallow aquifer. This assumes that there is no long term change in ground water storage. To estimate total irrigation demand or consumptive use for these sprinklers, it is necessary to assume an average crop consumptive use and obtain a sprinkler count together with average area irrigated per sprinkler . A crop consumptive use of 1.3 acre feet of water per irrigated acre was used in the referenced report by Erker and subsequent information support this value. From a map of sprinkler locations prepared by Rio Grande Water Conservation District, the number of sprinklers in the study area is estimated at 1283. Estimated area irrigated per sprinkler is 130 acres. The estimate of required ground water recharge in the study area is (1283 sprinklers x 130 acres/sprinkler x 1.3 acre feet/ acre) = 216,827 acre feet per year. By comparing the crop consumptive use in the study area of 216,827 acre feet per year to Erker's recharge estimate of 140,000 acre feet per year, it appears that either Erker's estimate is quite low or recharge enters the area from other unmeasured sources.

An effort to measure total recharge in the study area from ditches, canals and recharge structures was made, however it became apparent that the accuracy of such a measurement would be questionable. Although numerous canal/ditch loss measurements were made, it became apparent that loss values were highly variable. As a minimum, water loss through seepage from ditch/canals vary due to the following factors:

* Underlying soil conditions, particularly permeability of soil.
* Wetted perimeter, i.e. losses vary depending on width of ditch channel and depth of flow.
* Time since channel was cleaned.
* Depth to ground water below channel.
* Length of time channel has been carrying water, i.e. often the longer a channel carries water, the less seepage occurs.
* Evaporation from water surface which varies depending on time of year.

In conclusion, it appears the best measurement of ground water recharge may be derived indirectly. By measuring the change in ground water levels in the area of interest and comparing changes to quantity of water imported as recharge, an estimate of needed imported water to maintain ground water levels can be made. Although the quantity of recharge is not derived, the quantity of water needed to accomplish the recharge is derived.

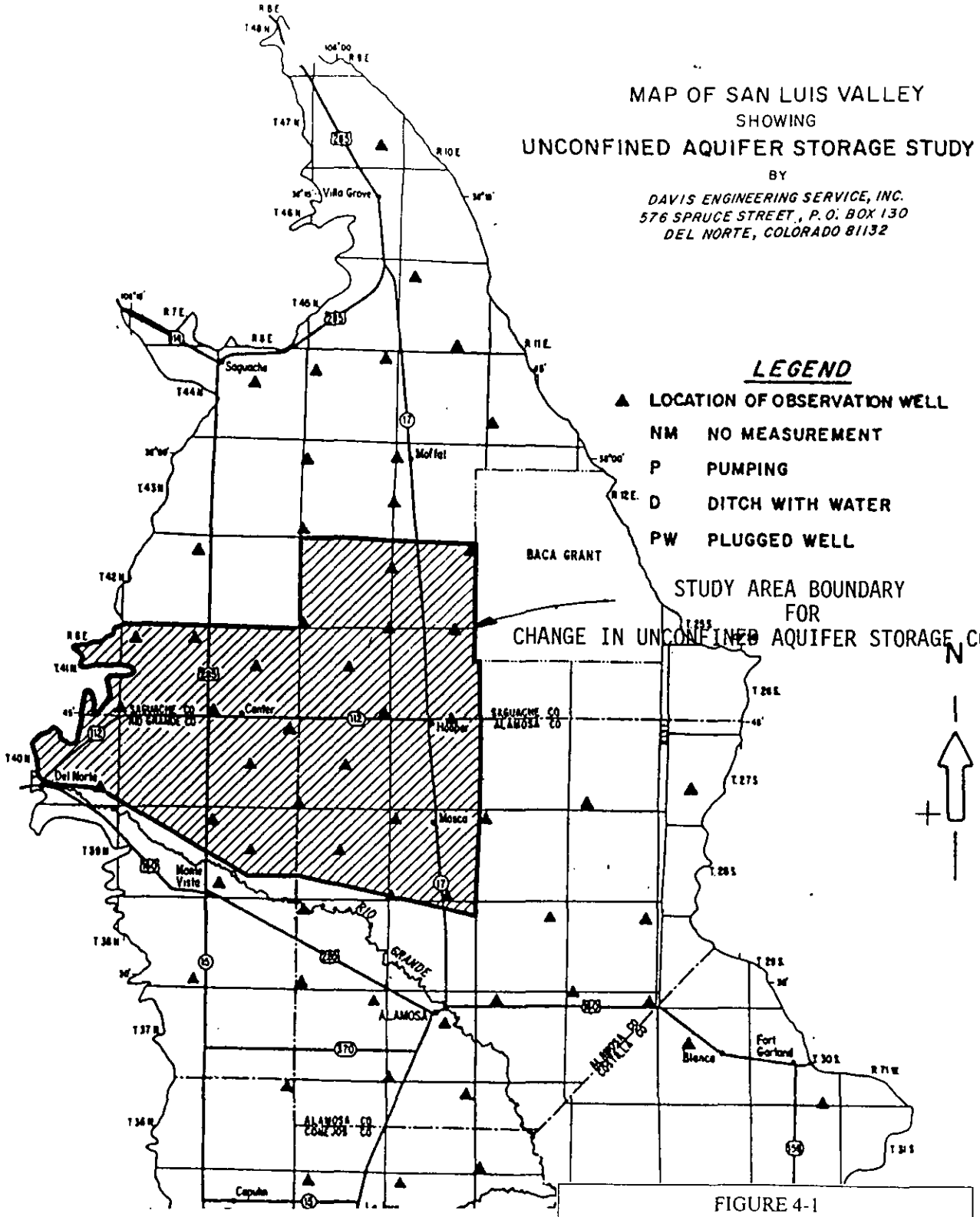
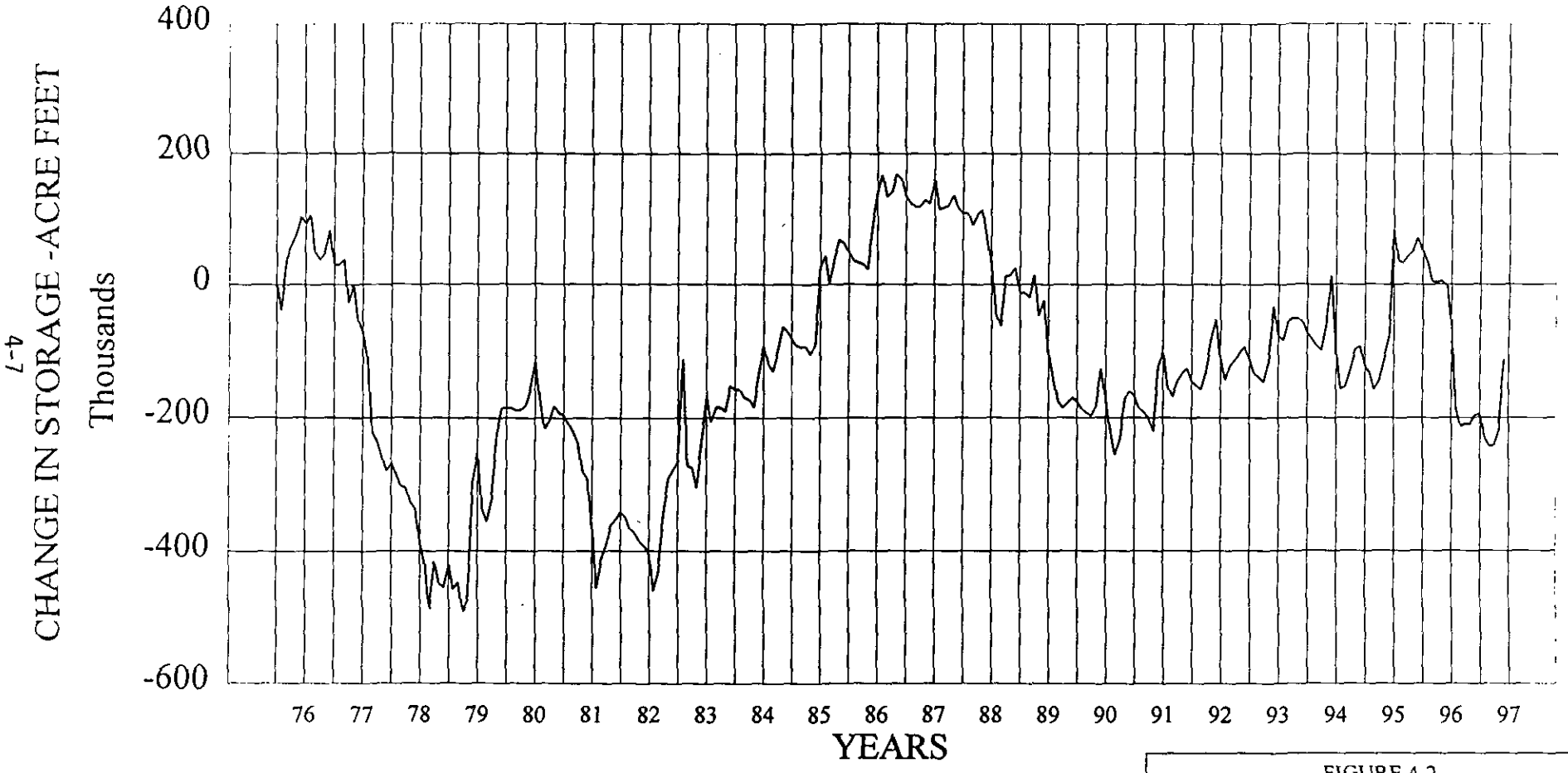


FIGURE 4-1
MAP OF UNCONFINED AQUIFER
STUDY AREA

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
DAVIS ENGINEERING SERVICE, INC

CHANGE IN UNCONFINED AQUIFER STORAGE
WEST CENTRAL SAN LUIS VALLEY



DRAFT - July 14, 1997

FIGURE 4-2
CHART OF CHANGE IN
UNCONFINED AQUIFER STORAGE

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
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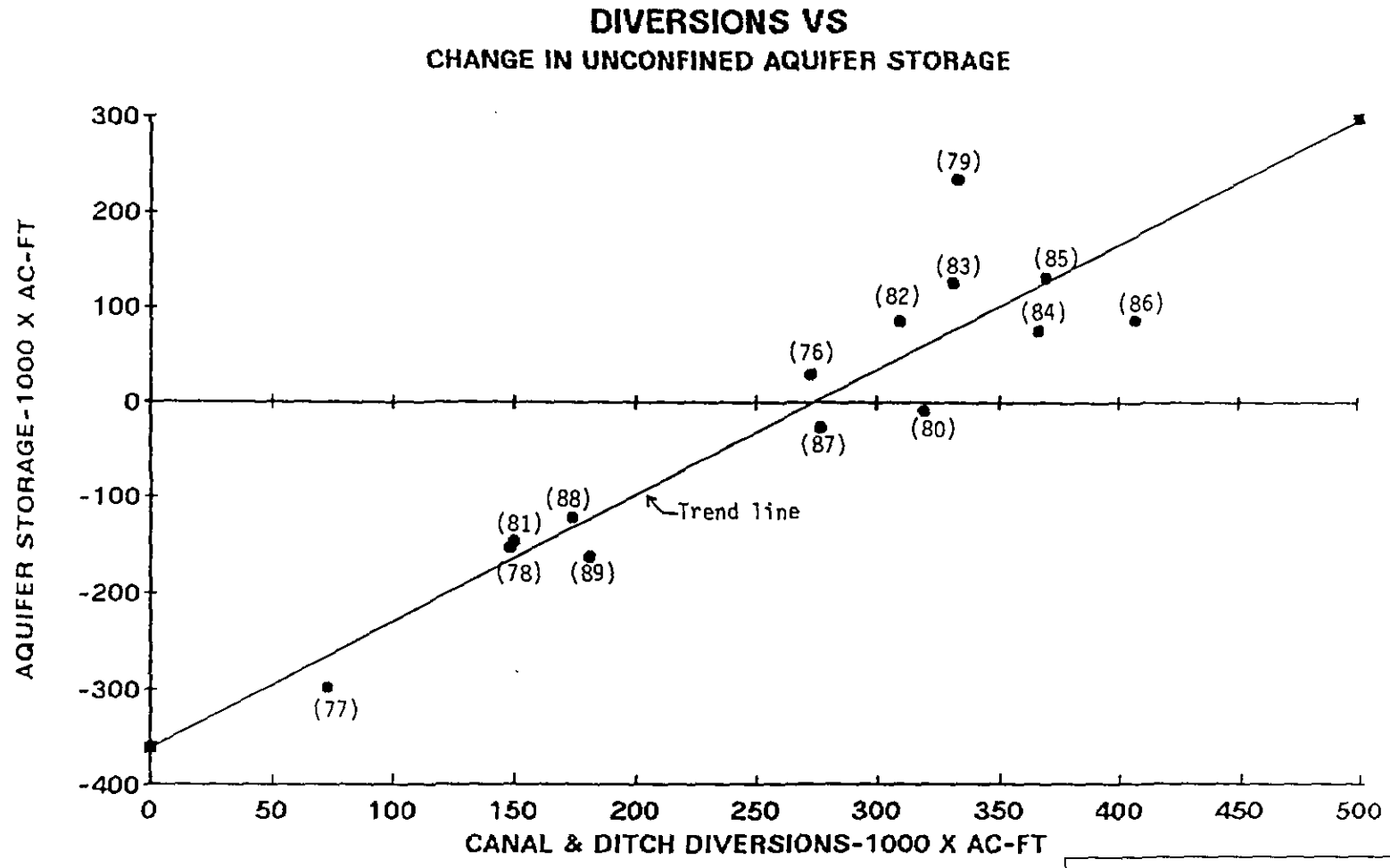


FIGURE 4-3
GRAPH OF DIVERSIONS VS CHANGE IN UNCONFINED AQUIFER STORAGE

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
DAVIS ENGINEERING SERVICE, INC

5.0 DYNAMICS OF GROUND WATER RECHARGE IN SAN LUIS VALLEY

5.1 RECHARGE POTENTIAL

To obtain an indication of areas within the SLVWCD where ground water recharge can be accomplished most efficiently, numerous runs of a computer ground water model used to simulate changes in ground water levels resulting from surface recharge were made. The computer model was developed by Colorado State University and is called herein the CSU Well&Pit model. As previously explained, the model was developed through research at a recharge site on the eastern side of the San Luis Valley in the Trinchera Creek drainage and is designed to predict ground water changes from a single recharge pit rectangular in nature.

Basic input to this computer model include recharge rate based on soil permeability, aquifer transmissivity, specific yield and depth to ground water. The depth to ground water was obtained from a map compiled by U.S.D.I. Bureau of Reclamation. Values for the remaining parameters were obtained for numerous locations from the following published sources:

Soil permeability:	U.S.D.A. Soil Conservation Service "Soil Survey of Saguache - Rio Grande and Alamosa County Area, Colorado" (Three publications).
Aquifer transmissivity:	Plate 3, "Map Showing Transmissivity of the Unconfined Aquifer, San Luis Valley, Colorado; Colorado Water Resources Circular 18 "Water in the San Luis Valley, South-Central Colorado" by P. A. Emery, R. J. Snipes, J. M. Dumeyer and J. M. Klein, U. S. Geological Survey, 1973.

Specific yield or

Storage coefficient: Page 8, Colorado Water Resources Circular 29 "Analog Model of the San Luis Valley, South-Central Colorado" by P. A. Emery, E. P. Patten, Jr. and J. E. More, U. S. Geological Survey, 1975.

Numerous runs of the referenced computer model were made assuming a pit one acre in size and recharge for 30 days with the rate being adjusted so the ground water mound formed did not reach the elevation of the bottom of the recharge pit. Using this method maximum recharge rates for a one month (30 day) period were derived. The information was plotted on a map included as Figure 5.1. Although this information would be more useful if updated periodically, it can be used as a guide by ground water users to determine the size of recharge pit and length of time recharge is necessary at their location to replace ground water pumped. For example, if a ground water user is located in the Town of Center, the probable recharge rate is 120 to 240 acre feet per month (average = 180 acre feet per month). Assume water consumptively used on quarter = 150 acre feet per year. Assume recharge water is available for 20 days per year.

$$\text{Required pit size} = \frac{150 \text{ ac. ft./yr.}}{180 \text{ ac. ft./yr./ac.}} \times \frac{30 \text{ days/yr.}}{20 \text{ days/yr.}} = 1.25 \text{ acres}$$

Since many localized variables can influence the recharge rate, Figure 5.1 should be used only as a guide. A few of the localized variables that can significantly effect recharge rates are different soils than the generalized information indicates, sealing of the recharge pit with silt and localized ground water mounding due to nearby canals and ditches.

5.2 POSSIBLE INTEGRATED WATER MANAGEMENT PLAN

There are numerous canal systems that divert water for the purpose of ground water recharge in the San Luis Valley. Review of depths to ground water indicate that available storage space in the under ground aquifers is not used in an optimum manner. Therefore, a management program could be useful to ground water users, however there are challenges involved because canal

systems have historically operated as independent entities using water rights with different priorities.

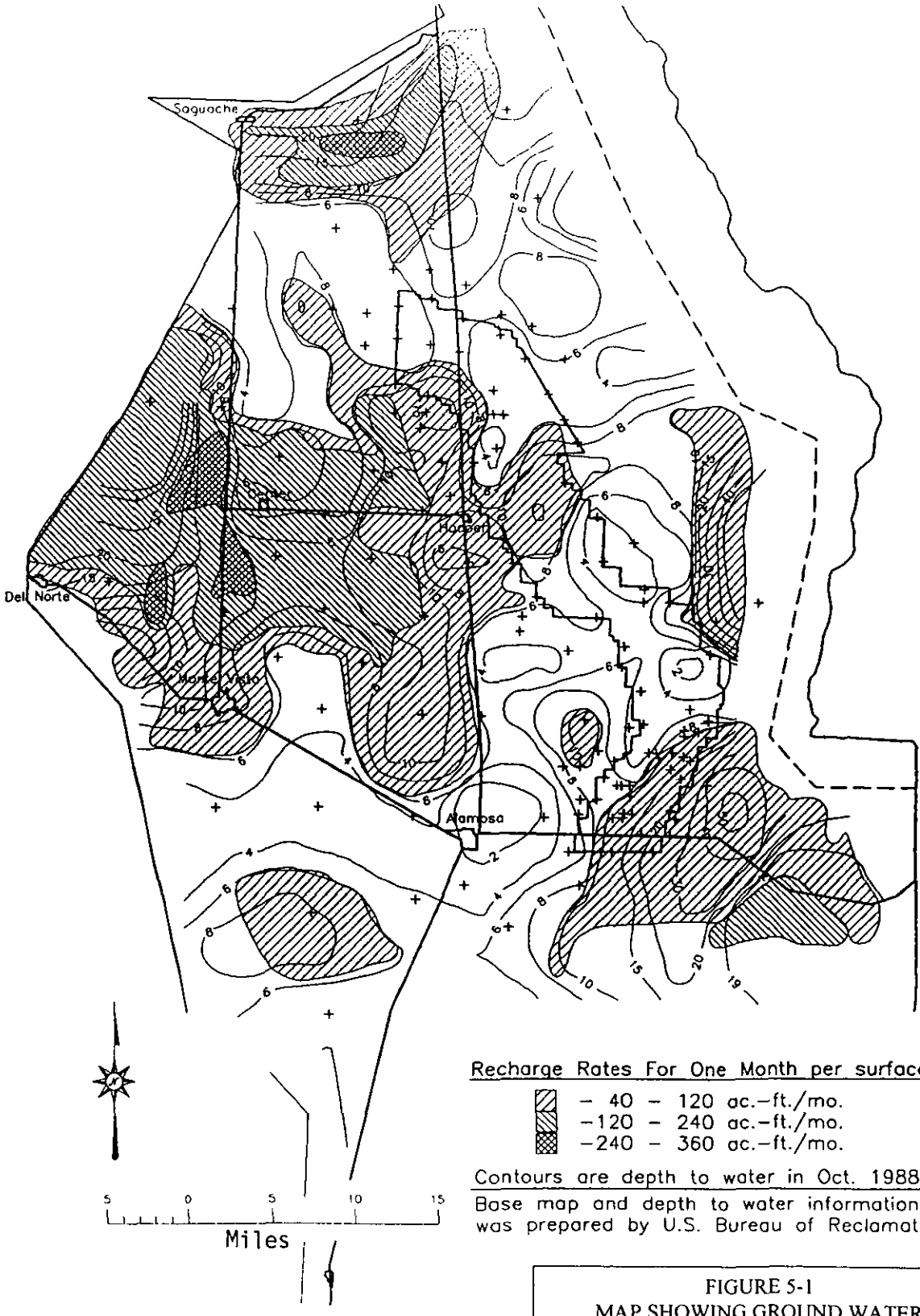
On the Rio Grande, the Rio Grande Water Users Association has been formed to further the common interests of surface water users on that river. In many cases these surface water users are also ground water users for the conjunctive use of these water rights has been a focus of many of the members.

A water management agency could be formed to provide different levels of assistance to water users depending on the responsibility assigned during the formation. Each increasing level would involve water users releasing more of their independence and be more challenging to form. For example, the responsibility of the agency could encompass any one of the following tasks or a combination thereof:

① Monitor ground water levels in aquifers in specified areas and provide frequent reports to member canal systems concerning ground water level conditions. Recommend water management decisions within individual member canal systems.

② Perform task 1 above plus maintain and construct recharge facilities within a area or district including numerous member canal systems and possibly drain systems.

③ Perform tasks 1 and 2 plus include responsibility for operating, maintaining and financing numerous canal systems. It could include cooperation of several canal systems to deliver water to regions where ground water recharge is needed regardless of the water rights priority of the canal system used, i.e. making maintenance of ground water levels the top priority in water right management. Temporary or permanent changes in the way water rights could be used would be required by Water Court.



Recharge Rates For One Month per surface acre

- 40 - 120 ac.-ft./mo.
- 120 - 240 ac.-ft./mo.
- 240 - 360 ac.-ft./mo.

Contours are depth to water in Oct. 1988

Base map and depth to water information was prepared by U.S. Bureau of Reclamation.

FIGURE 5-1
MAP SHOWING GROUND WATER RECHARGE POTENTIAL

GROUND WATER RECHARGE AND MANAGEMENT PROJECT
RIO GRANDE BASIN, COLORADO

COLORADO WATER CONSERVATION BOARD
DAVIS ENGINEERING SERVICE, INC

6.0 REFERENCES

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APPENDIX A

STATE LAND BOARD LEASE INFORMATION

AND

ARCHAEOLOGICAL SURVEY REPORT

FOR

RECHARGE SITE NORTHEAST OF DEL NORTE

CARLSON, HAMMOND & PADDOCK
ATTORNEYS AT LAW

JOHN UNDEM CARLSON
(1940-1992)
MARY MEAD HAMMOND
WILLIAM A. PADDOCK

MELANIE KOPPERUD BACKES
LEE H. JOHNSON
PETER C. FLEMING

1700 LINCOLN STREET, SUITE 3900
DENVER, COLORADO 80203

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November 19, 1992

Mr. William J. Killip, II
Special Projects Manager
State Board of Land Commissioners
1313 Sherman Street
Denver, Colorado 80203

Re: San Luis Valley Water Conservancy District

Dear Bill:

I am writing on behalf of the San Luis Valley Water Conservancy District (the "District") to request permission to use a portion of the state lands in Section 1, Township 40 North, Range 6 East, for the purpose of conducting a groundwater recharge project. Enclosed is a completed permit application and an application fee of $100.00. Please consider this letter as part of and a supplement to the application.

By letter to you dated March 31, 1992, John U. Carlson requested permission for the District to enter upon the above described state lands for the purpose of conducting an investigation of those lands for their suitability to the proposed project. By letter dated April 30, 1992, the Board of Land Commissioners granted the District permission to enter the lands and conduct the investigation. That investigation is now completed and the District desires to move forward with the proposed project.

Enclosed is a letter from John Allen Davey, the engineer for the District, which explains the scope of the proposed groundwater recharge project. Also enclosed is a sketch of the proposed project facilities prepared by Mr. Davey. Please consider these items as part of and supplements to the application. They also constitute the findings of the District's investigation conducted pursuant to the earlier permission to enter the land, and are submitted in compliance with the April 30 letter.

The initial phase of the proposed project will be to reactivate two existing diversions from Lateral Nos. 5 and 5A of the Rio Grande Canal, and to run some recharge water through those laterals into the drainage area. Then, after observing the recharge rate and verifying that the soils in the area are appropriate for the proposed recharge project, the next phase of the proposed project is to construct the additional diversions and small dams as indicated on the enclosed sketch.

The water to be used for the recharge project is water decreed to the Rio Grande Canal in Case Nos. W-3979 and 79CW91, Water Division No. 3, State of Colorado. The District and the Rio Grande Canal Water Users Association are entering into an Agreement allowing the District to use its laterals for this recharge project. As indicated in Mr. Davey's letter, the rate of flow through either of the laterals could vary from less than 1.0 c.f.s. to 20 c.f.s. In most years, the recharge will occur in the Spring and in late Fall. Beyond some slight erosion and silt deposition, Mr. Davey has concluded that the pasture land will be enhanced as a result of the proposed recharge project. I understand that the District has spoken to the State lessee of this land and that he does not object to the project.

Please call me if you have any questions or would like further information. Thank you for your consideration of this application.

Sincerely,

Melanie Kopperud Backes

Melanie Kopperud Backes

MKB:ab
Enclosures
cc: Floyd Getz
Allen Davey
Billy Martinez

APPLICATION NO. _____

USE _____

TO THE STATE BOARD OF LAND COMMISSIONERS, DENVER, COLORADO

Application is hereby made by the undersigned on the 19th day of November 19 92 to lease the following described land situated in the county of Rio Grande

No. of Acres	Subdivision of Section	Section	Township	Range
	N/A	One	40 North	6 East

APPLICANTS WILL ANSWER THE FOLLOWING QUESTIONS, AND THE ANSWERS WILL BE CONSIDERED A PART OF THIS APPLICATION:

Renewal of Lease No. N/A Expiration Date N/A

What rental per acre do you offer? Negotiable Term of lease desired 10 years

For what purpose is the land wanted? To conduct a groundwater recharge project

General Description: Existing irrigation ditch laterals would be utilized to conduct recharge water into drainage area. Monitoring wells and small dams would be constructed to assist in groundwater recharge.

Nature of improvements or structures to be placed on land? Monitoring wells and small dams.

What utilities and facilities are required? (roads, streets, power, sewer, water, etc.) No additional

Will any use of the land create any nuisance to surrounding area? (fire, smoke, noise, fumes, waste dumps, etc.) No

Any objectionable or dangerous storage of explosives, chemicals, refuse? No

Any special conditions desired? No

Name of Applicant(s) San Luis Valley Water Conservancy District

835 1st Avenue, P.O. Box 43

City Monte Vista State CO Zip 81144

Phone: (719) 852-2315

Subscribed and sworn before me the 19th day of November 1992

My commission expires December 10 1992

Annette M. Butt

Notary Public

FEES TO ACCOMPANY APPLICATION:

$100.00

FOR OFFICE USE ONLY

Fees $ _____

Receipt # _____

CIVIL & MINING ENGINEERING
WATER, SEWER & DRAINAGE
ENGINEERING STUDIES
U. S. MINERAL SURVEYS
WATER RESOURCE STUDIES
LAND AND MINE SURVEYING
DRAFTING & REPRODUCTION

REGISTERED IN:
COLORADO
NEW MEXICO
UTAH

DAVIS ENGINEERING SERVICE, Inc.

576 SPRUCE STREET - P.O. BOX 130
DEL NORTE, COLORADO 81132
PHONE 719-657-3304

September 16, 1992

Mr. John U. Carlson, Attorney at Law
Carlson, Hammond & Paddock
1700 Lincoln Street, Suite 3900
Denver, Colorado 80203

Re: San Luis Valley Water Conservancy District
Ground Water Recharge Project

Dear John:

Enclosed is a sketch showing proposed ground water recharge facilities on State Land Board property in Section 1, T.40N., R.6E., N.M.P.M. As I visualize the project, with the cooperation of the Rio Grande Canal, the District would reactivate the existing diversion on Lateral No. 5A located near the mid-point of the south line of the section hopefully this fall. I think it would then be useful to run some water into the drainage extending northeast and observe the recharge rate to verify that the soil is appropriate for the proposed project.

If the limited ground water recharge test on the property is favorable, I will recommend that the additional diversions and small dams be constructed so the entire project can be operated. The proposed construction will also included proposed monitoring well nests located approximately as shown on the sketch. The actual number and location of monitoring wells and small dams may vary slightly from those shown on the drawing as a result of details developed during final design.

I estimate that flow through any one of the diversions could vary from less than 1 c.f.s. to as much as 20 c.f.s. depending on availability of water and the capability of the site to accept recharge water. In most years, I expect the total period of time that water will be available for recharge will be less than two months and will occur in the spring and late fall. There may be some slight erosion and silt deposition immediately downstream of the diversion structures, but beyond these impacts, I expect the pasture to be enhanced as a result of coincidental irrigation. There will also be limited soil excavation and fill associated with the construction of the small dams.

It is my understanding that the District has asked you to submit a request to the State Land Board seeking permission to use their property for recharge purposes in the previously mentioned Section 1. The information in this letter and the enclosed sketch is provided to assist you in preparing such a request. If you have questions or need more information, please contact me.

Sincerely yours,
Davis Engineering Service, Inc.

Allen

John Allen Davey, P.E.

cc: Floyd Getz w/encl.

encl: as noted above

SKETCH OF PROPOSED

GROUND WATER RECHARGE FACILITIES

IN

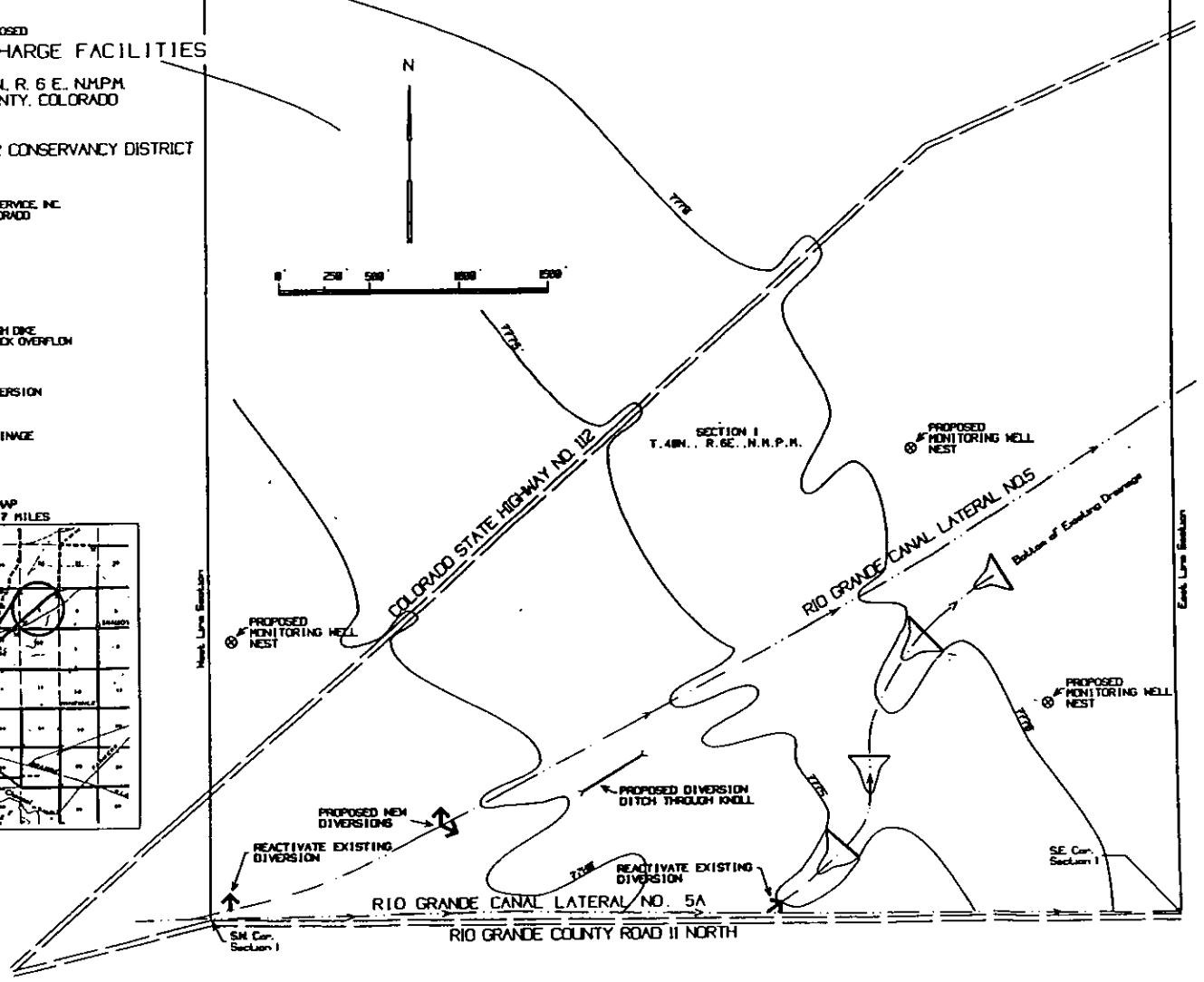
SECTION 1, T. 40 N., R. 6 E., N.M.P.M.
RIO GRANDE COUNTY, COLORADO

FOR

SAN LUIS VALLEY WATER CONSERVANCY DISTRICT

BY

DAVIS ENGINEERING SERVICE, INC.
DEL NORTE, COLORADO



CARLSON, HAMMOND & PADDOCK, L.L.C.
ATTORNEYS AT LAW

MARY MEAD HAMMOND
WILLIAM A. PADDOCK
LEE H. JOHNSON
PETER C. FLEMING
K. GWEN BEACHAM

1700 LINCOLN STREET, SUITE 3900
DENVER, COLORADO 80203-4539

JOHN UNDEM CARLSON
(1940-1992)

TELEPHONE (303) 861-9000
TELECOPIER (303) 861-9026

September 18, 1996

Via Hand Delivery

William J. Killip, II
Special Projects Manager
State Board of Land Commissioners
620 Centennial Building
1313 Sherman Street
Denver, Colorado 80203

Re: San Luis Valley Water Conservancy District

Dear Bill:

I am writing to follow up on our telephone conversation last week. As you requested, I enclose a copy of the proposed lease sent to you by Melanie Backes on February 8, 1994. I have updated that proposed lease to correct the dates and the name of the party who will sign on behalf of the San Luis Valley Water Conservancy District (the "District"), and to expand the project description.

I thought it might be helpful if I provide you with some background on this recharge project. The District includes substantially all of Alamosa and Rio Grande Counties and portions of Saguache and Mineral Counties. Much of the lands in the District located north of the Rio Grande are in the area referred to as the "closed basin." It is called "closed" because the surface streams that flow into this area do not naturally flow to the Rio Grande. The closed basin is a very highly-productive agricultural area that contains one of the largest concentrations of center pivot irrigation systems in the United States, if not the world. The majority of those center pivot irrigation systems are supplied with water from wells taping the unconfined aquifer of the closed basin. The unconfined aquifer is a shallow aquifer ranging from tens of feet thick at its edges to approximately 100 feet thick in the central area of the closed basin. The State Land Board has a number of wells that depend upon this aquifer. The District's recharge project is an effort to help sustain and replenish the water supply in the unconfined aquifer for the benefit of water users within the District who rely upon the unconfined aquifer.

The unconfined aquifer of the closed basin is unique in that it is essentially an artificial aquifer that has been filled by and is now replenished largely by the efforts of man. In the U.S.G.S.'s 1956 study entitled "Ground Water Resources of San Luis Valley, Colorado," it is reported that prior to the construction of the large irrigation canals bringing

water from the Rio Grande, water levels in the unconfined aquifer were 50 to 100 feet below ground surface. In the 1880's and 1890's, a number of large canals were constructed to bring irrigation water from the Rio Grande into the closed basin. As a consequence of this importation of water from the Rio Grande, the unconfined aquifer was filled, and in some years has water levels within five or fewer feet of the land surface. It is this imported water that recharges the unconfined aquifer and provides much of the groundwater for the agricultural lands in the closed basin. The water supply for the State Land Board's lands, like that of other water users in the closed basin, is dependent upon continual recharge of the closed basin to sustain the water supply.

The 1950's, 60's, and 70's, were a prolonged period of drought in the San Luis Valley. This was combined with initiation of administration under the Rio Grande Compact beginning in 1968. The effect of the drought and compact administration was to reduce the importation of water into the closed basin. At the same time, a large number of wells were constructed to supplement the limited surface water supplies. The result was a substantial decline in the groundwater levels in the unconfined aquifer of the closed basin. In some instances, wells simply sucked air because the water level decline had been so great. This decline in groundwater levels was documented by the U.S.G.S. in its 1985 Atlas HA-683 by Thomas M. Crouch.

The agricultural users in the closed basin were understandably alarmed by the groundwater level declines and at the threat it posed to their livelihood. Accordingly, the water users have been working diligently to increase the amount of recharge to the unconfined aquifer to ensure a reliable supply of water for their wells. As part of the basin-wide effort to encourage recharge, the District obtained a grant from the Colorado Water Conservation Board (the "CWCB") to assist farmers with recharge projects and for the development of recharge facilities. The recharge facilities on the State Land Board's lands are part of this program and were developed with funds available under the grant from the CWCB and are intended to permit the District to study recharge.

The District does not own or control the water rights that provide water to this recharge facility. Instead, the water for recharge is delivered by the Rio Grande Canal Company from its Lateral No. 5 that runs through the State Land Board's land. Some of the water delivered may be from the Rio Grande Canal Company under its own priorities, and the remainder is water delivered through the Rio Grande under the winter recharge decree of the Rio Grande Water Users Association. Due to natural variations in the water supply, there is no assurance that any specific amount of water will be delivered to this facility in any year. The water that is delivered under the priorities of the Rio Grande Canal occurs

only during the irrigation season and only if the Rio Grande Canal needs to recharge at this location. Recharge water may also be delivered during November and December under the water rights of the Rio Grande Water Users Association if the Rio Grande has complied with its separate obligation under the Rio Grande Compact and the canal does not freeze. In many years, it is not physically possible to run recharge after late November due to ice.

The District receives no compensation for this recharge program. Operation of the program is funded by the CWCB grant and the District's tax revenues. This project is part of an overall effort to ensure the long-term viability of the agricultural economy in the closed basin by ensuring a reliable supply of water to unconfined aquifer wells, including those of the State Land Board located on adjacent lands. The District is simply acting in its governmental capacity to promote the practice of groundwater recharge in an effort to preserve the water supply necessary to sustain the agricultural economy.

Attached to the enclosed lease is a sketch map of the recharge facilities. As you can see, they involve a minimal intrusion on the State Land Board's land. The facilities consist of several additional diversions from the Rio Grande Canal Lateral No. 5 as it traverses the land, the placement of several small berms in a drainage on the property to back up water delivered from the Rio Grande Canal, and the installation of several sets of monitoring wells to observe the effect of the groundwater recharge program. These activities have little impact on the existing grazing lease on the property. The delivery of water to the land probably improves the livestock grazing and certainly improves the water supply for the wells of the State Land Board located on adjacent lands.

The enclosed lease is patterned on the similar lease between the State Board of Land Commissioners ("State Land Board") and the Central Colorado Water Conservancy District, Lease No. S-40036. The principal differences between this lease and the lease with the Central Colorado Water Conservancy District are that the term of the lease is only for ten years and there is no rental payment based upon the annual quantity of water delivered for recharge. Given the nature of this project, the fact that the District is not paid for its recharge program, and the direct benefit to the wells of the State Land Board, I believe you can understand why the District does not believe a per acre-foot rent is feasible. Other than those two changes, I believe that the enclosed lease is substantially the same as Lease No. S-40036.

I would appreciate it if you would review the lease and let me know if you have any questions. If the Board would like to discuss this further or would like a technical presentation regarding the recharge program, the District's engineer, Mr. Allen Davey, and

its Manager, Ms. Carol Redding, would be pleased to meet with the Board at a time of the Board's choosing to discuss the program.

As you know, the District previously constructed improvements on the property pursuant to its agreements with the State Land Board. The District wishes to continue the operation of this recharge facility because of its benefits to all water users in the San Luis Valley, including the State Land Board. Your prompt review of this proposed lease would be greatly appreciated.

Yours very truly,

Bill Paddock

William A. Paddock

Enclosure

cc: Robert Mailander, w/o enc.
Keith Holland, w/o enc.
Carol Redding, w/enc.
Allen Davey, w/o enc.

WAP:jdf-2109

ARCHAEOLOGICAL SURVEY OF THE SLV WATER CONSERVANCY DISTRICT MONITORING WELLS

A Report Presented To

Davis Engineering Service, Inc.

Del Norte, Colorado

by

Kerry Marie Kramer, Project Director

and

John Allen Peterson

Archaeological Research, Inc.

332 Michigan

Pueblo, Colorado 81004

April 6, 1993

INTRODUCTION

A cultural resources survey was conducted on 37 acres of State-owned grassland located approximately 6 miles Northeast of Del Norte, Colorado, adjacent to Colorado State Highway No. 112. The survey was commissioned by Davis Engineering Service, Inc. of Del Norte, Colorado for the San Luis Valley Water Conservancy District. The purpose of the survey was to locate and evaluate cultural resource sites for compliance with Section 106 of the National Register of Historic Places. During the course of 100% survey, no cultural resource sites were found.

The cultural resource survey was conducted on three 10-acre parcels which surround three well-sites proposed to be drilled to provide for ground water recharge facilities. The original survey contract was amended to include the survey of an additional 7 acres of drainage. The project includes proposed 4 ft. high dikes across the bottom of an existing drainage southwest of proposed monitoring well #2. Davis Engineering Service, Inc., working for the San Luis Valley Water Conservancy District and in conjunction with the Bureau of Land Management plans to drill these 3 wells and to construct the dikes.

The project area is located in the southeast quarter of Section 1, T40N, R6E, (New Mexico Principle Meridian) of the Del Norte Quadrangle in Rio Grande County, Colorado.

The survey was conducted by Kerry Marie Kramer on March 30, 1993.

SAN LUIS WATER CONSERVANCY DISTRICT

MONITORING WELLS

The project area is located in the San Luis Valley in south central Colorado between two major mountain ranges, the Sangre de Cristo range of the Southern Rocky Mountains and the San Juan Mountains. The Rio Grande River is the major drainage for this Valley with the Alamosa River and the Conejos River as it tributaries. The Rio Grande moves through New Mexico and Texas and eventually into the Gulf of Mexico. The Rio Grande River runs through Del Norte, 6 miles south of the project area. The San Luis Valley is historically home for sheep ranching and potato farming.

Prior to and following the development of the Colorado Plateau region during the Miocene-Pliocene Uplift, volcanic activity occured during the creation of the San Juan Mountains and in the San Luis Valley area formed the Rio Grande Rift, a north-south split in the earth. This Valley is the largest intermontane basin in Colorado and contains approximately 13,000 feet of gravel, sand, clay and volcanic deposits on top of the original valley floor.

REGULATORY BACKGROUND

Cultural resources are tangible expressions of human cultural diversity, both present and past. As such, they are an important part of the nation's heritage and have been singled out for protection in legislation at every level of government. In the words of the National Historic Preservation act of 1966 (NHPA), "...the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people" (Public Law 89-775 as amended).

The Federal government has taken the lead in the protection of cultural resources, with legislation protecting sites on public land dating back to the Antiquity Act of 1906 (Public

legislation protecting sites on public land dating back to the Antiquity Act of 1906 (Public Law 59-209). Various other legislative efforts were enacted, culminating in the 1966 NHPA, one of the most comprehensive pieces of historic preservation legislation in the world. One of the unique aspects of this act, in contradistinction to earlier, more specific legislation, is that it required protection of resources not only on Federal land, but also land affected by Federal action, that is, Federal funding or permits.

The National Environmental Preservation Act also requires a consideration of the cultural environment but it is rarely invoked in the protection of cultural resources. The NHPA and other Federal antiquities legislation, such as the Archaeological Resources Protection Act of 1980, also have important implications for the protection of archaeological resources.

As noted above, the NHPA is invoked by the presence of Federal land or the involvement of Federal funding or permits (such as Bureau of Reclamation permits or Environmental Protection Agency funds). The NHPA creates the National Register of Historic Places (NRHP), a list of "districts, sites, buildings, structures, and objects significant in American history" and the Advisory Council for Historic Preservation, a government agency which oversees historic preservation. Section 106 of the NHPA states that the ACHP must be afforded the chance to comment when any cultural resources eligible for inclusion on the NRHP are present in an area affected by Federal agency actions or actions funded or permitted by federal agencies.

In the state of Colorado, historical, prehistorical and archaeological resources are protected by act of the legislature in 1973. The Colorado Historical Society Office of Archaeology and Historic Preservation is vested with the authority to administer the act. The State of Colorado reserves to itself title to all historical, prehistorical and archaeological resources in all lands, rivers, lakes, reservoirs, and other areas owned by the State or

any of it political subdivisions. The Society is empowered to issue or deny permits for the investigation, excavation, gathering, or removal from the natural state of any historical, prehistorical and archaeological resources within the State, and have issued regulations pursuant to that requirement.

In effect, both state and Federal codes, as currently interpreted, generally require a complete archaeological survey to be undertaken in conjunction with projects which fall under their purview, particularly in previously unsurveyed areas in regions where cultural resources are expected.

TOPOGRAPHY / SOILS / VEGETATION / FAUNA

The topography of the project area is nearly level, sloping very gently in some areas. Elevation on the project site is 7770 ft. with very gentle sloping into a drainage which runs southwest from the project area. Soils in the project area are Dunul-Platoro-Graypoint association and are well drained to excessively drained, moderately coarse textured to medium textured, cobbly soils that are 10 to 40 inches deep over gravel and cobbles. These soils are formed in alluvium with vegetation including rabbitbrush, blue grama, Indian rice-grass, and snakeweed. Average annual precipitation is 7 inches with 90-105 frost-free days. No current or recent use of the land is apparent. While this is traditional grazing land, no evidence of grazing use was found except for the very de-composed and brittle partial skeleton of a cow, suggesting grazing had not occurred on this property for some time.

Skeletal material of small wildlife dotted the landscape of the project area. Small rodent skeletons and some bird skeletal material was observed on survey as well as a deer head and hide that washed down the drainage after the diversion gate at the canal lateral No. 5A was opened. A jackrabbit was observed in the project area.

LITERATURE REVIEW

A file search of archaeological resources was conducted on March 29, 1992 at the Colorado Office of Archaeology and Historic Preservation. The search included NMPM, T40N, R6E, Sec.1 and NMPM, T 40N, R7E, Sec. 6. No cultural resource surveys have been previously conducted in Section 1. The closest survey areas are east and south of the project area in T40N, R7E, S13; T40N, R7E, S18; T40N, R7E, S6; T40N, R7E, S33; and T40N, R5E, S33 where 55 acres of cultural survey were completed by the Department of the Air Force with no cultural resources found.

The following presents a summary of the archaeological data and analysis available for the San Luis Valley at this time.

CULTURAL HISTORY

Most cultural resources survey work in South-central Colorado has been conducted in the mountain regions of the San Juan range or the Southern Rocky Mountains where much of these lands are owned by the National Forest Service. Little survey work has been completed for the entire San Luis Valley and only a few sites are known for the entire region. The Valley is best known for its Paleo-Indian sites.

PALEO-INDIAN

Clovis Period: The Magna site at the northern edge of the San Luis Valley revealed mammoth bones, teeth and ivory, with cut marks but without evidence of stone tools. A Sandia point was located nearby as well as a bi-face which resembled European Upper Paleolithic traditions. Without association, this site has not been dated and remains questionable as to its Paleo-Indian affiliation.

Folsom Period: Several Folsom period sites have been recovered in the San Luis

Medano Springs Ranch in northeast Alamosa County have exposed numerous Folsom materials.

The remains of 5 Bison antiquus and 22 Folsom artifacts in a sand dune at the Linger site are dated to 9,885 ±140 B.P. and 8,480 ±85 B.P. The Zapata site revealed a partial human skullcap, possibly of Folsom age. The Cattle Guard dune site included Folsom points, channel flakes, gravers, flake knives, and abraders as well as partial bison remains.

ARCHAIC

Early Archaic: The use of local basalt distinquishes the Rio Grande assemblage of projectile points, scraping and cutting tools and ground stone from the general early Archaic Culture assemblages found in the Colorado mountain regions including those commonly found in the San Luis Valley. These Early Archaic assemblages are commonly found near the Rio Grande River in the San Luis Valley. Renaud, working in the SLV identified other more complex site types such as campsites, workshops, lookouts and rockshelters as Early Archaic. In addition, Early Plains Archaic hearths in the San Luis Valley have revealed radiocarbon dates of 5370-4800 B.C. and seasonal use of the Valley by these groups has been suggested.

Rio Grande point types resemble Bajada-like projectile points (6 of which have been collected by the San Luis Valley Archaeological Project) from the early phase of the Oshara Tradition and they resemble Pinto Basin points which also were collected in the Closed Basin. Magic Mountain Apex Complex Early Archaic projectile point types have also been found in the SLV.

Middle Archaic: Continued occupation of the San Luis Valley occurred during the Middle Archaic as demonstrated by point types and radiocarbon dates from that period. San Luis

Archaic as demonstrated by point types and radiocarbon dates from that period. San Luis Valley Rio Grande points of this period resemble San Jose points of the Oshara Tradition (two of which have been collected by the San Luis Archaeological Project). Two sites and two isolated finds in Saguache County revealed points similar to points from west-central Colorado, Apex Phase points from the Magic Mountain Site, McKean points from Wyoming, and Great Basin/Uncompahgre Plateau Elko points. Hearth radio-carbon dates between 2740 and 1470 B.C. from west-central Colorado, along with data from the Grand River Institute survey suggest a Middle Archaic occupation of the San Luis Valley by Plains groups who used a McKean tool complex of Duncan, Hanna, Mallory side-notched, and McKean lanceolate points. Evidence exists for use of the northern San Luis Valley by both Plains Archaic and Archaic Picosa groups.

FORMATIVE STAGE

Evidence for Formative Stage occupation in the San Luis Valley has been found along the Rio Grande. Pueblo I-IV ceramic wares including utilitarian wares and Northern Rio Grande ceramics have been located throughout the Valley and in the Great Sand Dunes. Also the Woodland tradition is well represented in Northeast Saguache County with corner-notched projectile points and rockshelter corn remains.

PROTOHISTORIC-HISTORIC PERIOD:

Radiocarbon dates of 1520--1760 A.D. from hearths with associated artifacts suggest that the Plains Indians may have used the San Luis Valley on a seasonal basis. Late prehistoric and protohistoric ceramics have been found in Saguache County. This period of sites are difficult to identify and the number of sites are limited.

As demonstrated above, contextual data for the archaeological record of the San Luis Valley is available but not extensive. The records indicate occupations for Paleo-Indian, Middle and Late Archaic, Formative Period and to a very limited degree, the Proto-Historic and Historic. However, the lack of data is most likely due a lack of survey work in this region rather than a lack of sites.

Early Archaic sites have been found close to the Rio Grande River with Rio Grande projectile points as well as associated artifactual materials. Also, use of the Valley by Plains Archaic and Archaic Picosa groups is suggested. Because aborigines were most likely living at the band level, while seasonally gathering and hunting throughout the mountains and valleys, Archaic activity sites would most likely be encountered in the project area. The proximity of the project area to La Garita and San Juan Mountains where utilization of rich biotic resources coupled with proximity to the permanent water of the Rio Grande River further indicate the potential for Archaic sites.

Intrusion into the area by Pueblo Indians, possibly for reasons of trade, is also suggested with evidence of Pueblo ceramics along the Rio Grande during the Formative Period. Isolated finds of Pueblo ceramics may be encountered, but it is doubtful that evidence for a horticultural, sedentary permanent lifestyle would be found.

Proto-historic and Historic Plains Indians sites cannot be ruled out. While most of the evidence for these sites is northeast of the project area, in Saguache County, this may be due to a lack of survey in other parts of the San Luis Valley.

FIELD METHODOLOGY

Surface inspection of the project area was conducted consistent with standards of the Colorado State Archaeologist. Survey transects no wider than 30 meters were made, and in most areas transect intervals were 15 meters. No artifacts were collected. Archival

research and reporting were conducted according to recommendations by the Colorado State Archaeologist. No subsurface inspection was conducted.

Mr. Allen Davey of Davis Engineering, Inc. had staked out the 10 acre parcels surrounding the three well pads. Using the southeast and southwest corner markers of Well Pad #3 as boundary markers, transects were made from southeast to northwest and back again until the entire project area was visually inspected for surface materials. The same procedure was followed for Well Pad #1 and #2, with long transects being conducted where the two parcels are contiguous.

The drainage area had not been staked and the decision to survey it was made at the time of survey. After discussing with Mr. Davey the approximate length of the dikes to be placed across the drainage, Ms. Kramer surveyed a 7.2 acre area, extending 40 meters on each side of the center of the drainage. Unfortunately, about an hour prior to the survey of the drainage, the ditch company opened a headgate off lateral #5A and flooded the drainage. 15 meters at the center of the drainage was underwater at the time of the survey. In order to provide a complete survey, a zig-zag transect pattern was adopted between the water's edge and the exterior drainage boundary, providing 100% coverage of the drainage area.

RESULTS

ISOLATED FINDS

No cultural resource sites were discovered during the course of this survey. Two isolated finds were discovered and these are:

Isolated Find #1:

Pieces of purple opaque 1/2 inch thick, depression-era glass. 10-15 broken pieces resembling a short pedestal bowl. 30 meters east of western boundary line of well site #3.

Isolated Find #2:

1/4 in thick metal stake embedded upright in ground with 5 inches protruding; rolled at the top. 120 meters north from SE corner stake, 5 meters west from eastern boundary line of well site #3.

Disturbance on the project areas appears to be due to the access to the property via the road which runs parallel to Lateral Ditch #5. This road on the northwest bank of the ditch provides easy access to the property northwest of the ditch. Cans, paper, plastic, etc. were scattered in places near the edge of the road. These isolated finds do not indicate evidence of historical sites on the property.

RECOMMENDATIONS

The standards and guildlines of the Colorado State Office of Archaeology and Historic Preservation were followed during the course of this cultural resource survey. Based on a review of existing reports and site recordings, expectations for site discovery were considered low for the area, and in fact, no cultural resource sites were found during the

survey. Only 2 historical isolated finds were located.

In the event of discovery of cultural resource materials during well excavation and dike construction, work should stop immediately in the vicinity of these materials and the Office of the Colorado State Archaeologist should be notified immediately. With this stipulation, we recommend cultural resource clearance for this project.

BIBLIOGRAPHY

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Gunnerson, James H., Archaeology of the High Plains. Cultural Resource Series, Colorado State Office, Bureau of Land Management, Denver, CO., 1987

Guthrie, Mark R., Powys Gadd, Renee Johnson, Joseph J. Lischka, Colorado Mountains Prehistoric Context. State Historical Society of Colorado, 1984

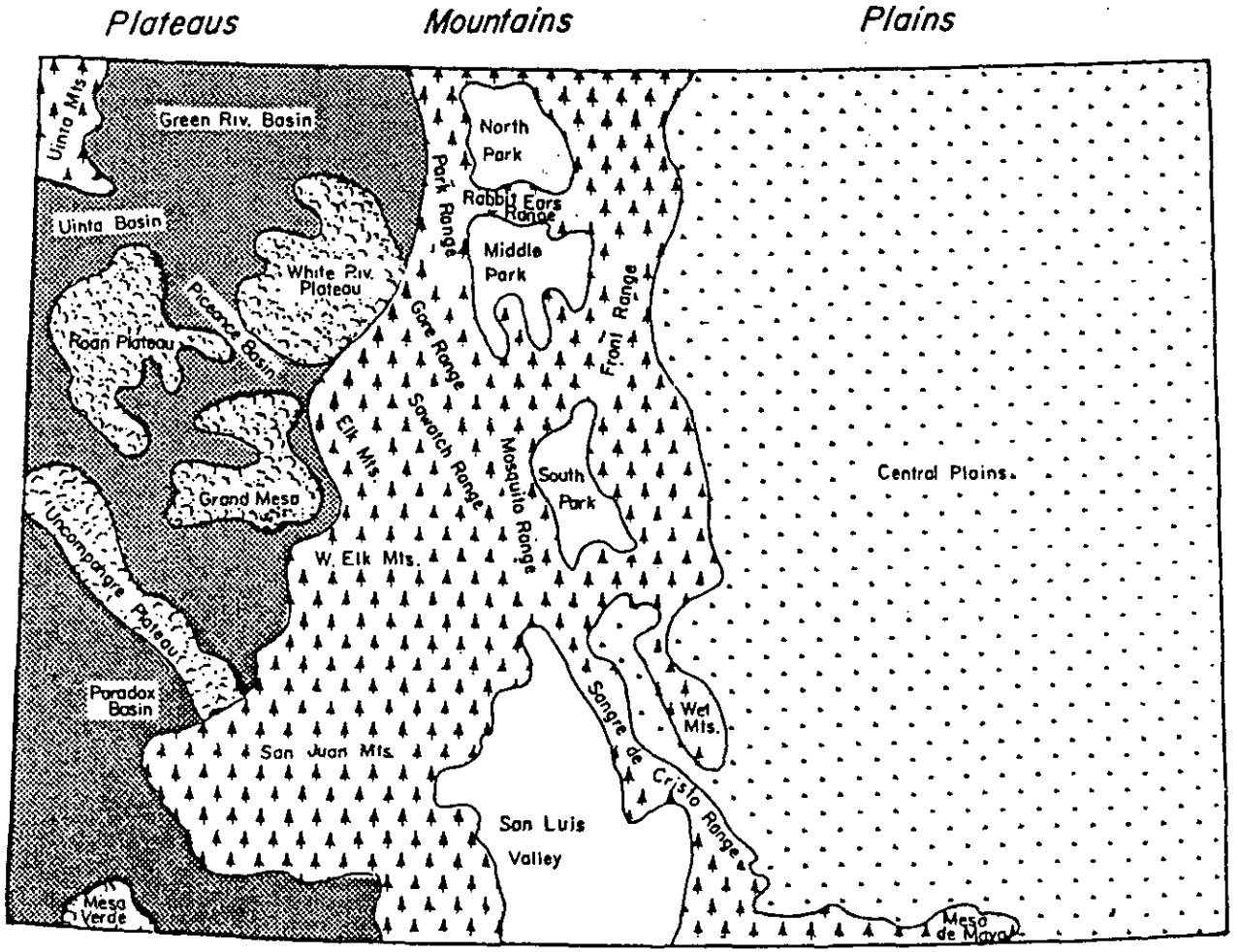


Figure 3-1 *Topographic areas of Colorado. (After Chronic and Chronic 1972.)*

(After E. Steve Cassells, 1983)

SKETCH OF PROPOSED

GROUND WATER RECHARGE FACILITIES

IN

SECTION 1, T. 40 N., R. 6 E., N.M.P.M.
RIO GRANDE COUNTY, COLORADO

FOR

SAN LUIS VALLEY WATER CONSERVANCY DISTRICT

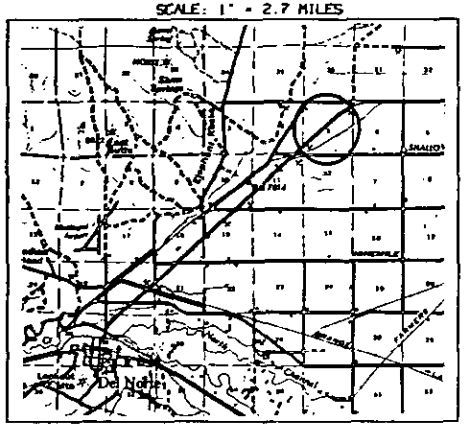
BY

DAVIS ENGINEERING SERVICE, INC.
DEL NORTE, COLORADO

LEGEND

- PROPOSED 4' HIGH DIKE WITH CANAL CHECK OVERFLOW
- PROPOSED DIVERSION
- DITCH OR DRAINAGE

LOCATION MAP
SCALE: 1" = 2.7 MILES



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0 250 500 1000 1500

SECTION 1
T.40N., R.6E., N.M.P.M.

WELL SITE #3

PROPOSED MONITORING WELL NEST

IF#2

IF#1

COLORADO STATE HIGHWAY NO. 112

RIO GRANDE CANAL LATERAL NO.5

Bottom of Existing Drainage

WELL SITE #2

PROPOSED MONITORING WELL NEST

PROPOSED MONITORING WELL NEST

WELL SITE #1

PROPOSED DIVERSION DITCH THROUGH KNOLL

PROPOSED NEW DIVERSIONS

REACTIVATE EXISTING DIVERSION

REACTIVATE EXISTING DIVERSION

RIO GRANDE CANAL LATERAL NO. 5A

RIO GRANDE COUNTY ROAD 11 NORTH

SW. Cor. Section 1

SE. Cor. Section 1

West Line Section

East Line Section

SURVEY BOUNDARY

APPENDIX B

PERMITS AND LOGS FOR WELLS

AT

RECHARGE SITE NORTHEAST OF DEL NORTE

RJ-5-Rev. 76

COLO DO DIVISION OF WATER RESOURCE
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

PERMIT APPLICATION FORM

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

FOR: ( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
( ) A PERMIT TO INSTALL A PUMP

( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.

STREET P.O. Box 43

CITY Monte Vista, Colorado (State) 81144 (Zip)

TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County

SE ¼ of the SE ¼, Section 1

Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0

Average annual amount of ground water to be appropriated (acre-feet): 0

Number of acres to be irrigated: 0

Proposed total depth (feet): 44.7

Aquifer ground water is to be obtained from:

Unconfined

Owner's well designation DH-WD-1A

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1)
( ) LIVESTOCK (2)
( ) COMMERCIAL (4)
( ) INDUSTRIAL (5)
( ) IRRIGATION (6)
( ) MUNICIPAL (8)
( ) OTHER (9) _____

DETAIL THE USE ON BACK IN (11)

(4) DRILLER

UC Regional Drill
Name Bureau of Reclamation

Street 505 Marquette NW, Suite 1313

City Albuquerque, New Mexico (State) 87102-2162 (Zip)

Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____

Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

APPLICATION APPROVED

PERMIT NUMBER _____

DATE ISSUED _____

EXPIRATION DATE _____

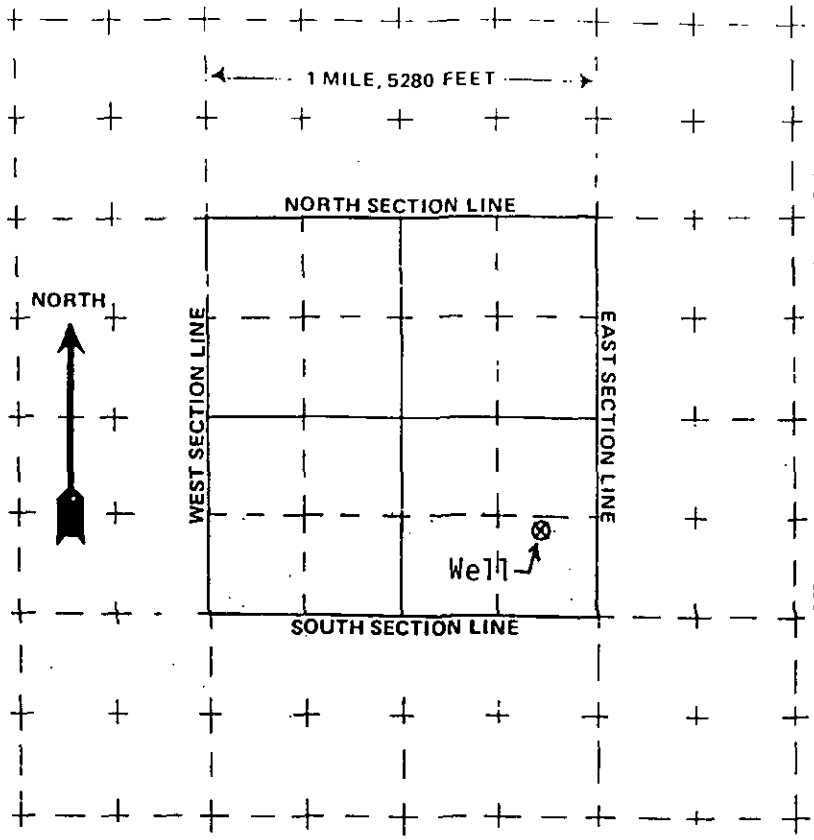
_____
(STATE ENGINEER)

BY _____

B-2

I.D. _____ COUNTY _____

THE LOCATION OF THE PROPOSED WELL and the area on which the water will be used must be indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)

An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) THE WELL MUST BE LOCATED BELOW by distances from section lines.

1194 ft. from south (north or south) sec. line

717 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640 . Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 34.7 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 34.7 ft. to 44.7 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: **Household use and domestic wells must indicate type of disposal system to be used.**

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WO-1A

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-26-93 FINISHED: 05-26-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 33.6 (7733.80) 05-26-93

PROJECT: SAN LUIS VALLEY GROWTH. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 44.7
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7767.4
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: S Cole

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW; D. KRAKE, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-44.7 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-44.7 AIR

DRILLERS NOTES:
NONE

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY. MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
HOLE WAS DRILLED TO 43.7 FT. TRIPPED HAMMER AND SOUNDED HOLE AT 44.7 FT. INSTALLED 3 INCH I.D., 3-1/2 IN. O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. ZONE OF INFLUENCE IS FROM 44.7 TO 34.7 FT. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN FROM 44.7 TO 31.4 FT. BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 34.7 TO +3.0 FT. HOLE CAVED FROM 31.4 TO 21.0 FT. CEMENT FROM 21.0 FT. TO 0.0 FT. WITH A DENSITY OF 7 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7770.4 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7770.4. LOCATED

DEPTH / FLD CLASS/LITH / ELEVATION | BEOL UNIT SYMBL

SC
7763.4

10
20
30
40
BOTTOM OF HOLE
50

QTsa

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 44.7: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 4.0: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

4.0 - 9.0: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, AND MEDIUM TO COARSE GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

9.0 - 12.0: SAND, WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM TO COARSE GRAINED CLEAN SAND, WITH TRACE OF IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

12.0 - 14.0: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

14.0 - 16.0: GRAVEL, COBBLES, BOULDERS, SAND AND LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND, AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

16.0 - 18.0: SAND:
CLEAN MEDIUM TO COARSE GRAINED SAND; DRY.

18.0 - 20.0: GRAVEL, COBBLES, BOULDERS, SAND AND LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND, AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); MOIST.

20.0 - 24.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); MOIST.

24.0 - 27.0: GRAVEL, COBBLES, BOULDERS WITH SAND AND CLAY:
PREDOMINANTLY CLEAN IGNEOUS GRAVEL WITH TRACE OF MEDIUM TO COARSE GRAINED SAND AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

27.0 - 30.0: SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
PREDOMINANTLY MEDIUM GRAINED SAND, WITH TRACE OF IGNEOUS GRAVEL AND CLAY, MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-D-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO. -MO-1A

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-26-93 FINISHED: 05-26-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 33.6 (7733.80) 05-26-93

PROJECT: SAN LUIS VALLEY GNDWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 44.7
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7767.4
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

IN SECTION 1, T.40 N., R.6 E., N.M.P.M. RIO GRANDE COUNTY, COLORADO. 717 FEET FROM EAST SECTION LINE, 1194 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:
BEGINNING OF SHIFT

DATE 1993	HOLE DEPTH	WATER DEPTH
05-26	44.7	34.0

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-27	7736.8
05-28	7736.8

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); MOIST.

30.0 - 44.7: GRAVEL, COBBLES, BOULDERS, SAND AND LEAN CLAY: APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET. WATER ENCOUNTERED AT 34.0 FT.

STRATIGRAPHY:

0.0 - 44.7 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

COMMENTS:

DRAWING NO. 40-0-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
PIEZO. = PIEZOMETER
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

WRJ-5-Rev 76

COLORADO DIVISION OF WATER RESOURCES
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

PERMIT APPLICATION FORM

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

FOR: ( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
( ) A PERMIT TO INSTALL A PUMP
( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.
STREET P.O. Box 43
CITY Monte Vista, Colorado (State) 81144 (Zip)
TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County
SE ¼ of the SE ¼, Section 1
Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0
Average annual amount of ground water to be appropriated (acre-feet): 0
Number of acres to be irrigated: 0
Proposed total depth (feet): 93.1
Aquifer ground water is to be obtained from:
Unconfined
Owner's well designation DH-WD-1B

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1)
( ) LIVESTOCK (2)
( ) COMMERCIAL (4)
( ) INDUSTRIAL (5)
( ) IRRIGATION (6)
( ) MUNICIPAL (8)
( ) OTHER (9) _____
DETAIL THE USE ON BACK IN (11)

(4) DRILLER

UC Regional Drill
Name Bureau of Reclamation
Street 505 Marquette NW, Suite 1313
City Albuquerque, New Mexico (State) 87102-2162 (Zip)
Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____
Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

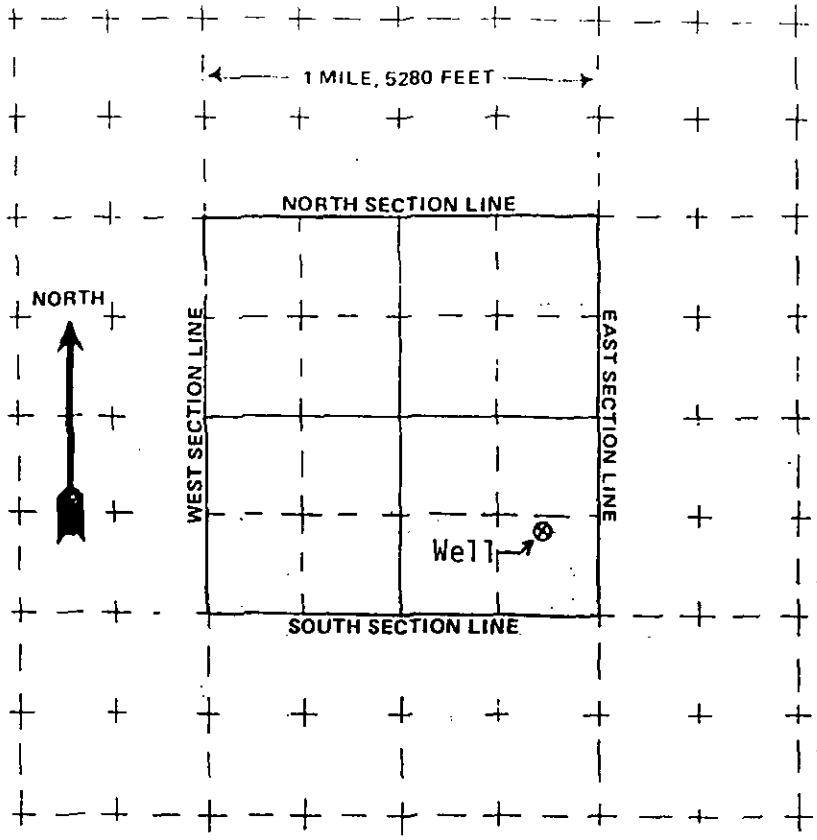
APPLICATION APPROVED

PERMIT NUMBER _____
DATE ISSUED _____
EXPIRATION DATE _____

_____
(STATE ENGINEER)

BY _____
B-6
I.D _____ COUNTY _____

which the water will be used mu. ...e indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)
An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) TH... VELL MUST BE LOCATED BELOW by distances from section lines.

1178 ft. from south (north or south) sec. line

726 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640 . Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 83.1 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 83.1 ft. to 93.1 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: Household use and domestic wells must indicate type of disposal system to be used.

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE NO DH-WD-18

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-20-93 FINISHED: 05-25-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 48.3 (7719.40) 05-28-93

PROJECT: SAN LUIS VALLEY GROWTH. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 94.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7767.7
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW; D. KRAKE, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-94.0 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-94.0 AIR

DRILLERS NOTES:
DRILLED TO 58.7 FT. WHEN EXHAUST AIR STOPPED, BUT HAMMER STILL WORKING. TRIPPED RODS AND HAMMER TO FIND THE BIT PLUGGED. CLEANED OUT, HOOKED IT TO AIR AND STILL NOT WORKING PROPERLY. DIS-ASSEMBLED HAMMER TO FIND SEVERAL PEBBLES BLOCKING PORTS IN CHECK VALVE GUIDE.

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY, MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
HOLE WAS DRILLED TO 94.0 FT. SOUNDED HOLE AFTER TRIPPING HAMMER AT 79.5 FT. MATERIAL FLOWED INTO CASING TO 79.5 FT. INSTALLED 3 INCH I.D., 3-1/2 IN. O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. PVC WAS ORIGINALLY INSTALLED TO 82.7 FT., HOWEVER AFTER ADDING TWO BAGS OF SAND THE PVC RISER SANK TO 93.1 FT. ZONE OF INFLUENCE IS FROM 93.1 TO 83.1 FT. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN

DEPTH / FLD CLASS/LITH / ELEVATION | GEOL UNIT SYMBL

SC

7759.7

10 20 30 40 50 60 70 80 90

QTsa

BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 94.0: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 8.0: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

8.0 - 10.0: GRAVEL, COBBLES AND BOULDERS WITH SAND:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, WITH TRACE OF MEDIUM TO COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

10.0 - 14.5: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY FINE IGNEOUS GRAVEL, AND COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

14.5 - 17.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, WITH LESSER FINE TO COARSE SAND, TRACE AMOUNT OF CLAY; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

17.0 - 22.0: POORLY GRADED SAND AND CLAY WITH GRAVEL, COBBLES, BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND AND CLAY, WITH TRACE OF GRAVEL; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

22.0 - 42.0: GRAVEL, COBBLES, BOULDERS, SAND AND LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, WATER ENCOUNTERED AT 34.5 FT.

42.0 - 46.0: POORLY GRADED SAND AND CLAY WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND WITH CLAY, TRACE OF IGNEOUS GRAVEL; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, LARGE AMOUNTS OF WATER AT 40.0 FT.

46.0 - 50.0: GRAVEL, COBBLES, BOULDERS WITH CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

50.0 - 56.0: SAND AND CLAY WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND AND CLAY, WITH TRACE OF IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-0-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-1B

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-20-93 FINISHED: 05-26-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 48.3 (7719.40) 05-28-93

PROJECT: SAN LUIS VALLEY GROWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 94.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7767.7
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: D. STOCKL

NOTES

FROM 93.1 TO 79.0 FT. BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 83.1 TO +3.0 FT. HOLE DEPTH SOUNDED 3 FT. SHORT. BENTONITE SLURRY TREMMIED FROM 79.0 FT. TO 37.0 FT. AS A MIX OF 75 LBS. OF HYG 200 BENTONITE PER 120 GALLONS OF WATER, WITH 8 LBS. OF CELLOFLAKE LCM AND 2 LBS. OF BENTONITE PELLETS. CEMENT FROM 37.0 FT. TO 0.0 FT. WITH A DENSITY OF 18.8 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7770.7 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7770.7. LOCATED IN SECTION 1; T.40 N., R.6 E., N.M.P.M. RIO GRANDE COUNTY, COLORADO. 726 FEET FROM EAST SECTION LINE, 1178 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:
BEGINNING OF SHIFT

DATE 1993	HOLE DEPTH	WATER DEPTH
05-25	94.0	50.4

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-26	7721.9
05-27	7722.2
05-28	7722.4

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

DIAMTER OF THE SAMPLER): WET.

56.0 - 60.0: NO RETURN:
HAMMER PLUGGED OFF. (SEE DRILLERS NOTES)

60.0 - 70.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

70.0 - 74.0: GRAVEL, COBBLES, BOULDERS, SAND AND CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND AND CLAY; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

74.0 - 78.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
PREDOMINANTLY MEDIUM GRAINED SAND WITH TRACE OF IGNEOUS GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

78.0 - 82.0: GRAVEL, COBBLES, BOULDERS, AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

82.0 - 92.0: SAND AND CLAY WITH GRAVEL:
APPROXIMATELY EQUAL AMOUNTS OF MEDIUM GRAINED SAND AND CLAY, WITH TRACE OF IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

92.0 - 93.5: SAND AND CLAY WITH GRAVEL, COBBLES, BOULDERS:
PREDOMINANTLY COARSE GRAINED SAND AND CLAY, WITH TRACE OF PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIANTER OF THE SAMPLER): WET.

93.5 - 94.0: CLAY WITH SAND, GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY LEAN CLAY, WITH TRACE OF MEDIUM TO COARSE SAND AND PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER): WET.

STRATIGRAPHY:

0.0 - 94.0 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

COMMENTS:

DRAWING NO. 40-D-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
LCM = LOST CIRCULATION MATERIAL
PIEZO. = PIEZOMETER
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

GWRJ-5-Rev 76

COLORADO DIVISION OF WATER RESOURCE
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

PERMIT APPLICATION FORM

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

FOR: ( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
( ) A PERMIT TO INSTALL A PUMP

( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.
STREET P.O. Box 43
CITY Monte Vista, Colorado (State) 81144 (Zip)
TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County
NE ¼ of the SE ¼, Section 1
Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0
Average annual amount of ground water to be appropriated (acre-feet): 0
Number of acres to be irrigated: 0
Proposed total depth (feet): 25.7
Aquifer ground water is to be obtained from:
Unconfined
Owner's well designation DH-WD-2A

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1) ( ) INDUSTRIAL (5)
( ) LIVESTOCK (2) ( ) IRRIGATION (6)
( ) COMMERCIAL (4) ( ) MUNICIPAL (8)
( ) OTHER (9) _____
DETAIL THE USE ON BACK IN (11)

(4) DRILLER

Name UC Regional Drill
Bureau of Reclamation
Street 505 Marquette NW, Suite 1313
City Albuquerque, New Mexico (State) 87102-2162 (Zip)
Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____
Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

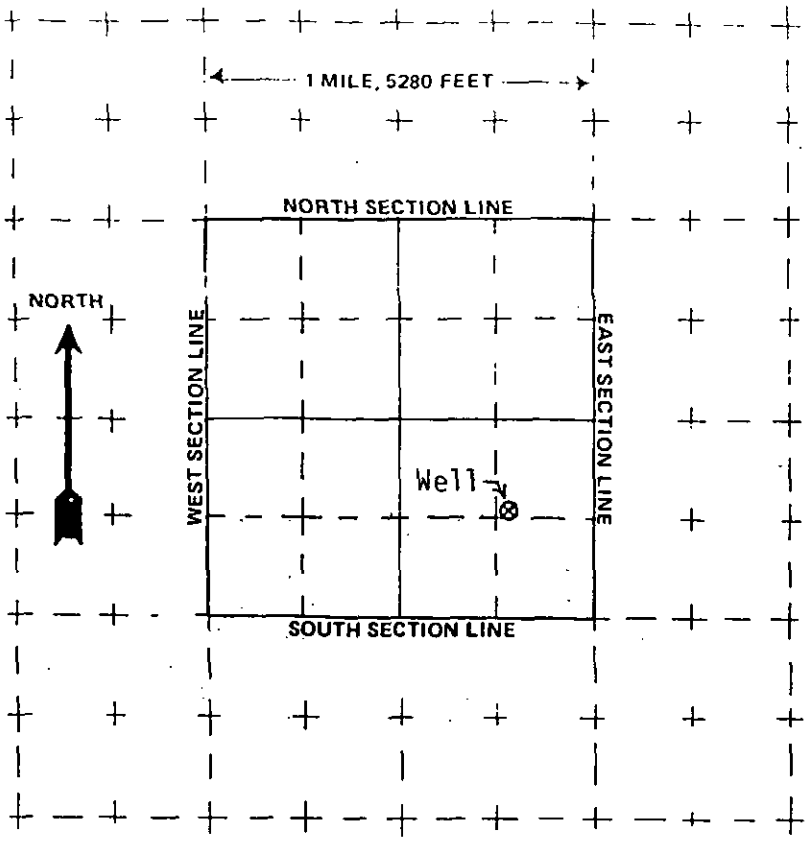
APPLICATION APPROVED

PERMIT NUMBER _____
DATE ISSUED _____
EXPIRATION DATE _____

_____ (STATE ENGINEER)

BY _____
B-10
I.D. _____ COUNTY _____

which the water will be used mu[illegible]e indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)

An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) THE WELL MUST BE LOCATED BELOW by distances from section lines.

1490 ft. from south (north or south) sec. line

1171 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640. Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 20.7 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 20.7 ft. to 25.7 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: **Household use and domestic wells must indicate type of disposal system to be used.**

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE NO. I-WD-2A

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-27-93 FINISHED: 04-28-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: NE

PROJECT: SAN LUIS VALLEY GWCNTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 25.7
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7769.2
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW; D. KRAKE, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-25.7 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-25.7 AIR

DRILLERS NOTES:
NONE.

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY. MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
INSTALLED 3 INCH I.D., 3-1/2 INCH O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. ZONE OF INFLUENCE IS FROM 25.7 TO 20.7 FEET. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN FROM 25.7 TO 18.0 FEET BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 20.7 TO +3.0 FT. HOLE CAVED FROM 18.0 TO 5.0 FEET WHILE PULLING CASING. CEMENT FROM 5.0 TO 0.0 FEET. WITH A DENSITY OF 15.8 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7772.2 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7772.2. LOCATED IN SECTION 1; T.40 N., R.6 E., N.M.P.M.

DEPTH | FLD CLASS/LITH | ELEVATION | GEOL UNIT SYMBL

SC
7764.7
10
QTsa
20
BOTTOM OF HOLE
30

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 25.7: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 4.5: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

4.5 - 7.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

7.0 - 7.5: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

7.5 - 12.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

12.0 - 15.0: POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

15.0 - 19.5: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

19.5 - 21.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

21.0 - 21.5: POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

21.5 - 22.5: GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

22.5 - 24.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-D-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-2A

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-27-93 FINISHED: 04-28-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: NE

PROJECT: SAN LUIS VALLEY GROWTH. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 25.7
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7769.2
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZIAN
REVIEWED BY:

NOTES

RIO GRANDE COUNTY, COLORADO. 1171 FEET FROM EAST SECTION LINE, 1490 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:
BEGINNING OF SHIFT

DATE 1993	HOLE DEPTH	WATER DEPTH
04-28	25.7	DRY

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-14	DRY
05-18	DRY
05-21	DRY
05-24	DRY
05-26	DRY
05-27	DRY
05-28	DRY

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

24.0 - 25.7: **GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:** PREDOMINANTLY IGNEOUS GRAVEL. TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

STRATIGRAPHY:

0.0 - 25.7 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

COMMENTS:

DRAWING NO. 40-0-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
PIEZO. = PIEZOMETER
I.D. = INSIDE DIAMETER
O.D. = OUTSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

WRJ-5-Rev 76

COLOR. DO DIVISION OF WATER RESOURCE
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

PERMIT APPLICATION FORM

FOR: ( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
( ) A PERMIT TO INSTALL A PUMP

( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.
STREET P.O. Box 43
CITY Monte Vista, Colorado (State) 81144 (Zip)
TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County
NE ¼ of the SE ¼, Section 1
Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0
Average annual amount of ground water to be appropriated (acre-feet): 0
Number of acres to be irrigated: 0
Proposed total depth (feet): 45.5
Aquifer ground water is to be obtained from:
Unconfined
Owner's well designation DH-WD-2B

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1)
( ) LIVESTOCK (2)
( ) COMMERCIAL (4)
( ) INDUSTRIAL (5)
( ) IRRIGATION (6)
( ) MUNICIPAL (8)
( ) OTHER (9) _____
DETAIL THE USE ON BACK IN (11)

(4) DRILLER

Name UC Regional Drill
Bureau of Reclamation
Street 505 Marquette NW, Suite 1313
City Albuquerque, New Mexico (State) 87102-2162 (Zip)
Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____
Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

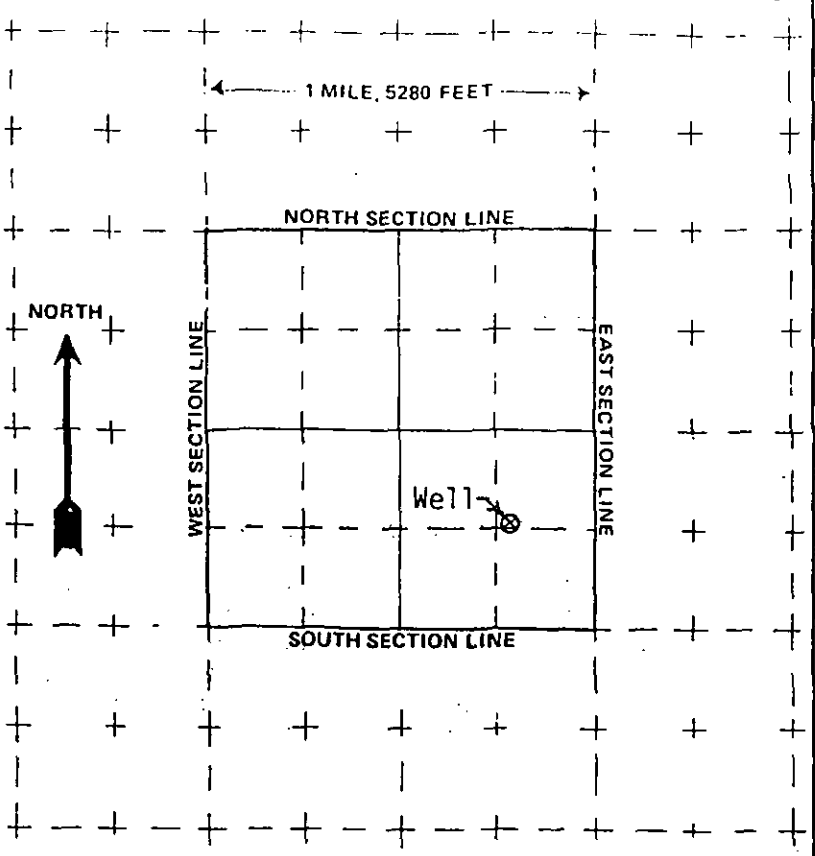
APPLICATION APPROVED

PERMIT NUMBER _____
DATE ISSUED _____
EXPIRATION DATE _____

_____
(STATE ENGINEER)

BY _____
B-14
I.D. _____ COUNTY _____

which the water will be used mu[illegible]e indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)

An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) IF [illegible] WELL MUST BE LOCATED BELOW by distances from section lines.

1491 ft. from south (north or south) sec. line

1132 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640 . Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 40.5 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 40.5 ft. to 45.5 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: Household use and domestic wells must indicate type of disposal system to be used.

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-2B

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-19-93 FINISHED: 05-20-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 33.3 (7736.40) 05-28-93

PROJECT: SAN LUIS VALLEY GWDWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 45.5
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.7
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW; D. KRAKE, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-45.5 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-45.5 AIR

DRILLERS NOTES:
BATTERY POST ON COMPRESSOR SELF DESTRUCTED.

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY. MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
HOLE WAS DRILLED TO 45.0 FT. HAMMER WAS TRIPPED AND HOLE SOUNDED AT 45.5 FT. INSTALLED 3 INCH I.D., 3-1/2 IN. O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. ZONE OF INFLUENCE IS FROM 45.5 TO 40.5 FT. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN FROM 45.5 TO 36.0 FT. BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 40.5 TO +3.0 FT. HOLE CAVED FROM 36.0 TO 26.5 FT. CEMENT FROM 26.5 FT. TO 0.0 FT. WITH A DENSITY OF 18.8 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7771.7 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7771.7.

DEPTH | FLD CLASS/LITH | ELEVATION | GEOL UNIT SYMBL

SC
7765.2

10
20
30
40
QTsa

BOTTOM OF HOLE
50

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 45.5: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 3.5: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

3.5 - 7.0: GRAVEL, COBBLES, BOULDERS AND SAND:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, WITH TRACE AMOUNTS OF MEDIUM TO COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

7.0 - 8.0: SAND WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND, WITH TRACE OF PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

8.0 - 10.0: SAND WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

10.0 - 14.0: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF CLEAN PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

14.0 - 17.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

17.0 - 17.5: GRAVEL, COBBLES, BOULDERS AND SAND WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND WITH LESSER AMOUNTS OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

17.5 - 19.0: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY WITH SAND:
PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY, WITH TRACE OF COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

19.0 - 28.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND WITH LESSER AMOUNTS OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-D-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-2B

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-19-93 FINISHED: 05-20-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 33.3 (7735.40) 05-28-93

PROJECT: SAN LUIS VALLEY GWQNTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 45.5
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.7
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: G. Sugs

NOTES

LOCATED IN SECTION 1; T.40 N., R.6 E., N.M.P.M. RIO GRANDE COUNTY, COLORADO. 1132 FEET FROM EAST SECTION LINE. 1491 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:
BEGINNING OF SHIFT

DATE 1993	HOLE DEPTH	WATER DEPTH
05-20	45.5	37.0

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-21	7737.1
05-24	7737.2
05-25	7737.3
05-26	7737.5
05-27	7738.0
05-28	7738.4

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

SAMPLER); DRY.

28.0 - 28.5: GRAVEL, COBBLES AND BOULDERS WITH SAND AND LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, WITH TRACE OF MEDIUM TO COARSE GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); MOIST AT 28.0 FT.

28.5 - 30.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); MOIST.

30.0 - 38.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, WATER ENCOUNTERED AT 33.0 FT.

38.0 - 44.0: CLAY AND SAND WITH GRAVEL, COBBLES, AND BOULDERS:
PREDOMINANTLY CLAY AND MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

44.0 - 45.5: GRAVEL, COBBLES, BOULDERS, SAND AND CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

STRATIGRAPHY:

0.0 - 45.5 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

COMMENTS:

DRAWING NO. 40-D-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
PIEZO. = PIEZOMETER
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

WRJ-5-Rev 76

COLOR DO DIVISION OF WATER RESOURCE
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

PERMIT APPLICATION FORM

( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
FOR: ( ) A PERMIT TO INSTALL A PUMP

( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.
STREET P.O. Box 43
CITY Monte Vista, Colorado (State) 81144 (Zip)
TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County
NE ¼ of the SE ¼, Section 1
Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0
Average annual amount of ground water to be appropriated (acre-feet): 0
Number of acres to be irrigated: 0
Proposed total depth (feet): 192.9
Aquifer ground water is to be obtained from:
Unconfined
Owner's well designation DH-WD-2C

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1)
( ) LIVESTOCK (2)
( ) COMMERCIAL (4)
( ) INDUSTRIAL (5)
( ) IRRIGATION (6)
( ) MUNICIPAL (8)
( ) OTHER (9) _____
DETAIL THE USE ON BACK IN (11)

(4) DRILLER

Name UC Regional Drill
Bureau of Reclamation
Street 505 Marquette NW, Suite 1313
City Albuquerque, New Mexico (State) 87102-2162 (Zip)
Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____
Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

APPLICATION APPROVED

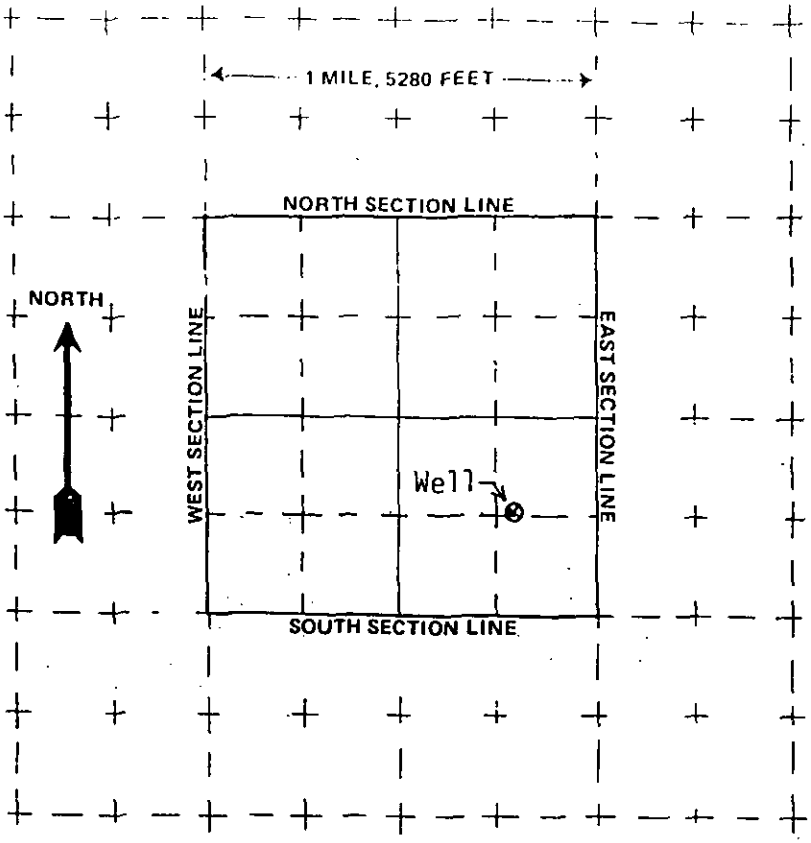
PERMIT NUMBER _____
DATE ISSUED _____
EXPIRATION DATE _____

_____
(STATE ENGINEER)

BY R-18

I.D. _____ COUNTY _____

which the water will be used mo[illegible] PROPOSED WELL and the area on [illegible]e indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)

An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) TH[illegible] WELL MUST BE LOCATED BELOW by [illegible]ances from section lines.

1491 ft. from south (north or south) sec. line

1151 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640 . Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 182.9 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 182.9 ft. to 192.9 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: **Household use and domestic wells must indicate type of disposal system to be used.**

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE NO. D. .D-2C

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-28-93 FINISHED: 05-18-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 54.8 (7713.80) 05-28-93

PROJECT: SAN LUIS VALLEY GROWTH. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 196.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW; *D. KRAKE*, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO.

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-196.0 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-196.0 AIR

DRILLERS NOTES:
HAMMER NOT WORKING AT 88.0. TRIPPED RODS TO FIND A LIGHT WEIGHT ROD BROKEN AT WELD. MAJOR DIFFICULTY FISHING OUT REST OF RODS AND HAMMER. BIT HAD BACKED OFF AND WAS STILL DOWN THE HOLE. BACK IN HOLE WITH AIR ON TO CLEAN OUT 7 FEET OF SAND AT BOTTOM AND RETRIEVED BIT. HAMMER PLUGGED WITH SAND A COUPLE OF TIMES CAUSING TIME DELAYS. MANAGED TO TO BLOW IT FREE ONCE. ENCOUNTERED MORE SAND FROM 189 TO 198 FT., ODEX SYSTEM WOULD NOT RETRIEVE. COULD NOT SHUT OFF AIR FOR FEAR THAT HAMMER WOULD SAND IN. WORKED ON RETRIEVING HAMMER UNTIL IT FINALLY CAME FREE. HAMMER WAS PLUGGED OFF WITH SAND AGAIN. JACK CUNNINGHAM IN DENVER OFFICE DECIDED TO CALL THIS HOLE AT THIS DEPTH BECAUSE OF PROBLEMS AND TIME SPENT. USED ALL THE GRADED SAND FOR ENTIRE PROJECT INSTALLING THE FIRST 4 FT. OF THE SCREEN. LOOKED FOR A LOCAL SOURCE

DEPTH | FLD CLASS/LITH | ELEVATION | GEOL UNIT SYMBL

SC 7765.6

10 20 30 40 50 60 70 80 90

QTsa

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 192.5: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 3.0: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE, 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

3.0 - 10.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

10.0 - 12.0: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

12.0 - 12.5: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
PREDOMINANTLY IGNEOUS GRAVEL AND SAND, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED *DIAMETER OF THE SAMPLER); DRY.*

12.5 - 15.0: GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL; TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

15.0 - 16.0: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

16.0 - 16.5: POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

16.5 - 22.0: GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

22.0 - 23.0: POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

23.0 - 25.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, MAXIMUM SIZE, 25 MM

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-D-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-2C

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-28-93 FINISHED: 05-10-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 54.8 (7713.80) 05-28-93

PROJECT: SAN LUIS VALLEY GROWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 196.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAIZAN
REVIEWED BY: B. Brodi

NOTES

WITH NO SUCCESS. STARTED ANOTHER HOLE WHILE WAITING FOR MORE SAND. ADDED A TOTAL OF 6400 LBS. OF SAND TO COVER SCREEN. THE LARGE AMOUNT OF SAND WAS USED TO FILL VOID CREATED AS A RESULT OF LEAVING AIR ON WHILE TRYING TO RETRIEVE HAMMER. HOLE TOOK A TOTAL OF 720 GALLONS OF BENTONITE SLURRY FOR A ORIGINAL VOLUME OF 260 GALLONS, WHICH IS THE REASON WE BEGAN ADDING LCM AT 106.0 FT. ACCESS FLOODED OUT BY WATER DISTRICT FOR ONE DAY.

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY. MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
HOLE WAS DRILLED TO 196.0 FT. CASING SANK TO 200.0 FT. IN SATURATED SAND. CASING WAS PULLED BACK TO 193.8 FT. FOR GOOD WORKING LEVEL. SAND SLUICED INTO CASING TO 192.9 FT. INSTALLED 3 INCH I.D., 3-1/2 IN. O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. ZONE OF INFLUENCE IS FROM 192.9 TO 182.9 FT. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN FROM 192.9 TO 173.9 FT. BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 182.9 TO +3.0 FT. BENTONITE SLURRY TREMMIED FROM 173.9 FT. TO 106.0 FT. AS A MIX OF 75 LBS. OF HYG 200 BENTONITE PER 80 GALLONS OF WATER. BENTONITE SLURRY SAME MIX RATIO WITH CELLOFLAKE LCM FROM 106.0 FT. TO 33.0 FT. CEMENT FROM 33.0 FT. TO 0.0 FT. WITH A DENSITY OF 15.8 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7771.6 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7771.6. LOCATED IN SECTION 1; T.40 N., R.6 E., N.M.P.M. RIO GRANDE COUNTY, COLORADO. 1151 FEET FROM EAST SECTION LINE, 1491 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:

BEGINNING OF SHIFT DATE 1993	HOLE DEPTH	WATER DEPTH
04-29	85.5	50.6
04-30	86.5	50.0
05-06	196.0	54.7
05-07	192.9	49.2
05-10	192.9	55.3
05-11	192.9	55.3
05-13	192.9	45.6
05-14	192.9	55.9

DEPTH / FLD CLASS/LITH / ELEVATION | GEOL UNIT SYMBL

110
120
130
140
150 — QTsa
160
170
180
190
BOTTOM OF HOLE

CLASSIFICATION AND PHYSICAL CONDITION

(MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

25.0 - 27.0: GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

27.0 - 31.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

31.0 - 39.0: GRAVEL, COBBLES, BOULDERS WITH CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, WATER ENCOUNTERED AT 31.0 FT.

39.0 - 68.0: CLAY WITH GRAVEL, COBBLES, BOULDERS AND SAND:
PREDOMINANTLY CLAY WITH LESSER AMOUNTS OF COARSE GRAINED SAND AND PREDOMINANTLY IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMTER OF THE SAMPLER); WET.

68.0 - 80.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

80.0 - 81.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

81.0 - 84.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

84.0 - 91.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

91.0 - 92.0: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

92.0 - 96.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM

COMMENTS:

DRAWING NO. 40-0-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
LCM = LOST CIRCULATION MATERIAL
PIEZO. = PIEZOMETER
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-28-93 FINISHED: 05-18-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 54.8 (7713.60) 05-28-93

PROJECT: SAN LUIS VALLEY GROUNTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 198.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: C. Todd

NOTES	CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

05-17 192.9 56.3
05-18 192.9 55.6

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-19	7716.5
05-20	7716.1
05-21	7716.6
05-24	7716.8
05-25	7716.6
05-26	7716.6
05-27	7716.6
05-28	7716.8

SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

96.0 - 102.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY FINE IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

102.0 - 104.0: CLAY WITH GRAVEL, COBBLES, BOULDERS AND SAND:
PREDOMINANTLY CLAY WITH LESSER AMOUNTS OF COARSE GRAINED SAND AND PREDOMINANTLY FINE IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMTER OF THE SAMPLER); LARGE AMOUNTS OF WATER.

104.0 - 105.5: CLAY WITH SAND:
PREDOMINANTLY LEAN CLAY, NO DILATANCY, MEDIUM PLASTICITY, MEDIUM TOUGHNESS; TRACE OF COARSE SAND; WET.

105.5 - 108.5: SAND AND CLAY WITH GRAVEL:
APPROXIMATELY EQUAL AMOUNTS OF MEDIUM GRAINED SAND AND CLAY, TRACE OF FINE GRAVEL; WET.

108.5 - 110.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY FINE IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

110.0 - 112.0: POORLY GRADED SAND:
MEDIUM GRAINED SAND; WET; (POSSIBLE RUNNING SAND).

112.0 - 129.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY FINE IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

129.0 - 134.0: POOR RECOVERY
POORLY RECOVERED BECAUSE OF LARGE AMOUNTS OF WATER AS APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY FINE IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER).

134.0 - 135.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

135.0 - 140.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

140.0 - 140.5: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

140.5 - 145.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

145.0 - 148.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE

GEOLOGIC LOG OF DRILL HOLE NO. 1-WD-2C

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 04-28-93 FINISHED: 05-18-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 54.8 (7713.80) 05-28-93

PROJECT: SAN LUIS VALLEY GROWTH, DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 196.0
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: D. [illegible]

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

146.0 - 148.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

148.0 - 149.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM TO COARSE GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

149.0 - 160.5: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

160.5 - 163.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM TO COARSE GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

163.0 - 173.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

173.0 - 174.0: GRAVEL, COBBLES, BOULDERS WITH SAND AND CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNTS OF COARSE SAND AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

174.0 - 175.0: GRAVEL, COBBLES, BOULDERS AND CLAY WITH SAND:
PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY, TRACE OF MEDIUM SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

175.0 - 180.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

180.0 - 180.5: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
MEDIUM GRAINED SAND WITH TRACE OF GRAVEL AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

180.5 - 184.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

184.0 - 185.0: GRAVEL, COBBLES, BOULDERS WITH SAND AND CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNTS OF MEDIUM SAND AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

185.0 - 189.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

189.0 - 195.0: SAND AND CLAY WITH GRAVEL:
PREDOMINANTLY MEDIUM TO FINE GRAINED SAND AND CLAY, TRACE OF GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

195.0 - 196.0: POORLY GRADED SAND:
MEDIUM GRAINED SAND; WET; (POSSIBLE RUNNING SAND).

STRATIGRAPHY:

0.0 - 196.0 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

RJ-5-Rev. 76

COLORADO DIVISION OF WATER RESOURCES
818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203

PERMIT APPLICATION FORM

Application must be complete where applicable. Type or print in BLACK INK. No overstrikes or erasures unless initialed.

FOR: ( ) A PERMIT TO USE GROUND WATER
( ) A PERMIT TO CONSTRUCT A WELL
( ) A PERMIT TO INSTALL A PUMP

( ) REPLACEMENT FOR NO. _____
(X) OTHER Monitoring well
WATER COURT CASE NO. _____

(1) APPLICANT - mailing address

NAME San Luis Valley Water Conservancy Dist.
STREET P.O. Box 43
CITY Monte Vista, Colorado (State) 81144 (Zip)
TELEPHONE NO. (719) 852-2315

(2) LOCATION OF PROPOSED WELL

County Rio Grande County
NE ¼ of the SE ¼, Section 1
Twp. 40 N (N,S), Rng. 6 E (E,W), N.M. P.M.

(3) WATER USE AND WELL DATA

Proposed maximum pumping rate (gpm) 0
Average annual amount of ground water to be appropriated (acre-feet): 0
Number of acres to be irrigated: 0
Proposed total depth (feet): 84.4
Aquifer ground water is to be obtained from:
Unconfined
Owner's well designation DH-WD-2D

GROUND WATER TO BE USED FOR:

( ) HOUSEHOLD USE ONLY - no irrigation (0)
( ) DOMESTIC (1)
( ) LIVESTOCK (2)
( ) COMMERCIAL (4)
( ) INDUSTRIAL (5)
( ) IRRIGATION (6)
( ) MUNICIPAL (8)
( ) OTHER (9) _____
DETAIL THE USE ON BACK IN (11)

(4) DRILLER

UC Regional Drill
Name Bureau of Reclamation
Street 505 Marquette NW, Suite 1313
City Albuquerque, New Mexico (State) 87102-2162 (Zip)
Telephone No. _____ Lic. No. _____

FOR OFFICE USE ONLY: DO NOT WRITE IN THIS COLUMN

Receipt No. _____ / _____
Basin _____ Dist. _____

CONDITIONS OF APPROVAL

This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

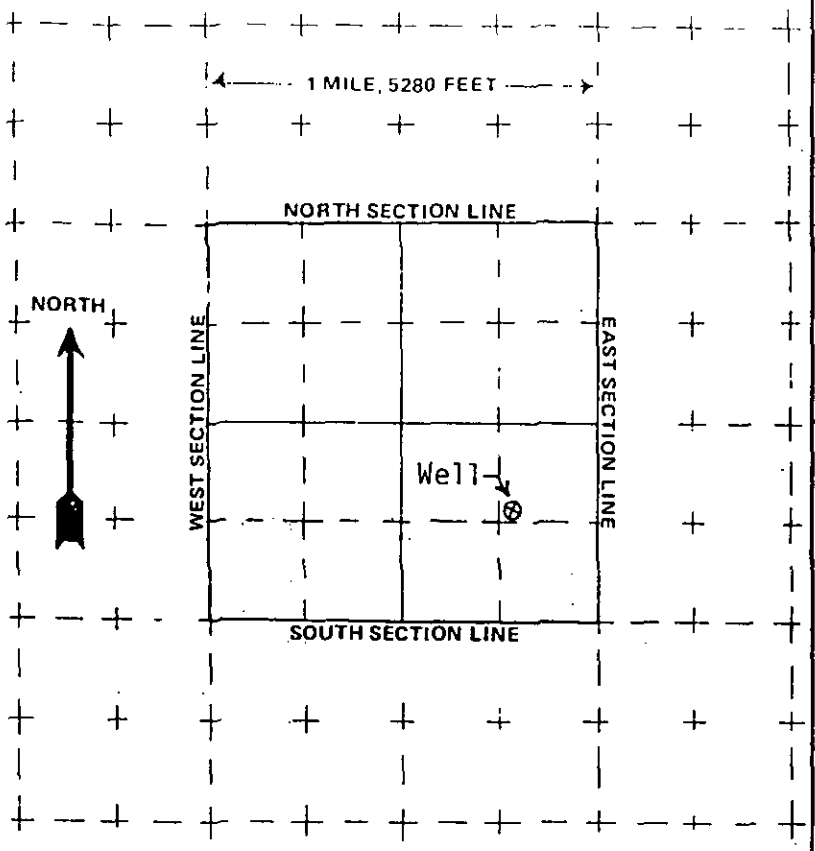
APPLICATION APPROVED

PERMIT NUMBER _____
DATE ISSUED _____
EXPIRATION DATE _____

_____
(STATE ENGINEER)

BY _____
B-24
I.D. _____ COUNTY _____

(5) THE LOCATION OF THE PROPOSED WELL and the area on which the water will be used must be indicated on the diagram below. Use the CENTER SECTION (1 section, 640 acres) for the well location.



The scale of the diagram is 2 inches = 1 mile
Each small square represents 40 acres.

WATER EQUIVALENTS TABLE (Rounded Figures)

An acre-foot covers 1 acre of land 1 foot deep
1 cubic foot per second (cfs) . . . 449 gallons per minute (gpm)
A family of 5 will require approximately 1 acre-foot of water per year.
1 acre-foot . . . 43,560 cubic feet . . . 325,900 gallons.
1,000 gpm pumped continuously for one day produces 4.42 acre-feet.

(6) THE WELL MUST BE LOCATED BELOW by distances from section lines.

1505 ft. from south (north or south) sec. line

1149 ft. from east (east or west) sec. line

LOT _____ BLOCK _____ FILING # _____

SUBDIVISION _____

(7) TRACT ON WHICH WELL WILL BE LOCATED Owner: State of Colorado

No. of acres ±640 . Will this be the only well on this tract? No

(8) PROPOSED CASING PROGRAM

Plain Casing

3 in. from +3.0 ft. to 74.4 ft.

_____ in. from _____ ft. to _____ ft.

Perforated casing

3 in. from 74.4 ft. to 84.4 ft.

_____ in. from _____ ft. to _____ ft.

(9) FOR REPLACEMENT WELLS give distance and direction from old well and plans for plugging it:

(10) LAND ON WHICH GROUND WATER WILL BE USED:

Owner(s): _____ No. of acres: _____

Legal description: _____

(11) DETAILED DESCRIPTION of the use of ground water: **Household use and domestic wells must indicate type of disposal system to be used.**

(12) OTHER WATER RIGHTS used on this land, including wells. Give Registration and Water Court Case Numbers.

Type or right	Used for (purpose)	Description of land on which used

(13) THE APPLICANT(S) STATE(S) THAT THE INFORMATION SET FORTH HEREON IS TRUE TO THE BEST OF HIS KNOWLEDGE.

SIGNATURE OF APPLICANT(S)

Use additional sheets of paper if more space is required.

GEOLOGIC LOG OF DRILL HOLE A DH-WD-2D

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-11-93 FINISHED: 05-13-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 48.1 (7720.50) 05-28-93

PROJECT: SAN LUIS VALLEY GNDWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 84.4
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: J. D. FAZZAN
REVIEWED BY:

NOTES

ALL MEASUREMENTS ARE FROM GROUND LEVEL AND ARE THE SAME AS THOSE USED BY THE DRILLER.

ALL MEASUREMENTS ARE REPORTED IN FEET EXCEPT WHERE NOTED.

DRILLED BY:
UC REGIONAL DRILL CREW: D. KRAKE, DRILLER.

PURPOSE:
OBSERVATION WELL DRILLED AS TECHNICAL ASSISTANCE TO THE STATE OF COLORADO.

DRILL EQUIPMENT:
MOBILE B-80 TRUCK MOUNTED ROTARY DRILL RIG, WITH INGERSOLL RAND 900 COMPRESSOR.

DRILL METHOD:
0.0-84.4 6 INCH ODEX SYSTEM CONSISTING OF DOWN THE HOLE AIR HAMMER AND BUTTON BIT WITH 2-3/8 INCH I.D. INTERNAL FLUSH RODS.

CASING RECORD:
TEMPORARY 6-3/4 INCH O.D. STEEL CASING REMOVED UPON COMPLETION.

DRILLING MEDIUM:
0.0-84.4 AIR

DRILLERS NOTES:
BENTONITE TOO THICK TO MEASURE WITH VISCOSIMETER.

TESTING AND SAMPLING:
NO TESTING OR SAMPLING OF DRILL HOLE. HOLE LOGGED BY CUTTING CHIPS ONLY, MAXIMUM SIZE 1 INCH.

HOLE COMPLETION:
HOLE WAS DRILLED TO 84.4 FT. TRIPPED RODS AND HAMMER, SOUNDED HOLE AT 74.3 FT. INSTALLED 3 INCH I.D., 3-1/2 IN. O.D. PVC SLOTTED PIPE WITH 1/32 IN. SLOTS AND 39 SLOTS PER FOOT. ZONE OF INFLUENCE IS FROM 84.4 TO 74.4 FT. NO TROUBLE GETTING PVC TO 84.4 FT., MUST HAVE HUNG UP TAPE ON A CASING JOINT DURING ORIGINAL SOUNDING. 8/12 GRADED SAND INSTALLED SURROUNDING SCREEN FROM 84.4 TO 72.3 FT. BY POSITIVE DISPLACEMENT. SOLID FLUSH JOINT PVC PIPE OF THE SAME DIAMETER FROM 74.4 TO +3.0 FT. BENTONITE SLURRY TREMMIED FROM 72.3 FT. TO 36.6 FT. AS A MIX OF 17 LBS. OF HYG 200 BENTONITE PER 50 GALLONS OF WATER. SOUNDING FELT SOLID NEXT MORNING, SO THERE MUST BE

DEPTH	FLD CLASS/LITH	ELEVATION	GEOL UNIT SYMBL
0	SC	7764.6	
10			
20			
30			
40			QTsa
50			
60			
70			
80			
84.4	BOTTOM OF HOLE		
90			

CLASSIFICATION AND PHYSICAL CONDITION

0.0 - 84.4: UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa):

0.0 - 4.0: CLAYEY SAND WITH GRAVEL:
ABOUT 65 PERCENT FINE TO MEDIUM GRAINED SAND, ANGULAR TO SUBROUNDED; ABOUT 20 PERCENT FINE GRAVEL, ANGULAR TO SUBROUNDED; ABOUT 15 PERCENT FINES, POSSIBLY CLAYEY; MAXIMUM SIZE, 50 MM; DRY TO MOIST, BROWN; SOFT, DRILLED WITH AIR ONLY; ROOTS; NO REACTION WITH HCL. (SC)

4.0 - 10.0: GRAVEL, COBBLES AND BOULDERS:
CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

10.0 - 10.5: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL, TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

10.5 - 11.0: SAND WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM TO COARSE GRAINED SAND, TRACE AMOUNT OF IGNEOUS GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

11.0 - 12.0: GRAVEL, COBBLES, BOULDERS WITH LEAN CLAY:
PREDOMINANTLY IGNEOUS GRAVEL; TRACE AMOUNT OF PLASTIC FINES; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

12.0 - 16.0: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

16.0 - 19.0: GRAVEL, COBBLES, BOULDERS WITH SAND:
PREDOMINANTLY IGNEOUS GRAVEL, WITH TRACE OF MEDIUM GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

19.0 - 21.0: GRAVEL, COBBLES, BOULDERS AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM TO COARSE GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

21.0 - 23.0: POORLY GRADED SAND AND CLAY WITH GRAVEL, COBBLES AND BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND AND LEAN CLAY, WITH TRACE OF GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

23.0 - 25.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY:

COMMENTS:

CENTER COLUMN DATA IS NOT SHOWN IN INTERVALS OF LESS THAN 1.0 FOOT THICKNESS. THE DATA FOR THESE INTERVALS CAN BE FOUND IN EITHER THE "NOTES" OR "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN. CENTER COLUMNS AND "CLASSIFICATION AND PHYSICAL CONDITIONS" COLUMN ARE BASED ON BUREAU OF RECLAMATION GEOLOGY FIELD MANUAL AND DRAWINGS TITLED FOR DESIGNS AND SPECIFICATIONS AS FOLLOWS -

DRAWING NO. 40-D-6493 STANDARD DESCRIPTIONS AND DESCRIPTIVE CRITERIA FOR ROCK.

GEOLOGIC LOG OF DRILL HOLE NO DH-WD-2D

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-11-93 FINISHED: 05-13-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 48.1 (7720.50) 05-28-93

PROJECT: SAN LUIS VALLEY GWQNTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 84.4
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.6
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY:

NOTES

SOME HOLE CAVE ON TOP OF BENTONITE. CEMENT FROM 36.6 FT. TO 0.0 FT. WITH A DENSITY OF 20.0 LBS./GAL. INSTALLED A 5 FOOT STEEL STANDPIPE WITH APPROXIMATELY 3 FOOT STICKUP. STANDPIPE IS 3-7/8 INCH I.D. AND 4-3/8 INCH O.D. ELEVATION OF TOP OF PVC RISER IS 7771.6 FEET. ELEVATION OF TOP OF STEEL STANDPIPE IS 7771.6. LOCATED IN SECTION 1; T.40 N., R.6 E., N.M.P.M. RIO GRANDE COUNTY, COLORADO. 1149 FEET FROM EAST SECTION LINE, 1505 FEET FROM SOUTH SECTION LINE.

WATER LEVEL DATA:

BEGINNING OF SHIFT

DATE 1993	HOLE DEPTH	WATER DEPTH
05-12	71.0	48.2
05-13	84.4	49.5

PIEZO. WATER LEVELS:

DATE 1993	WATER SURFACE ELEVATIONS
05-14	7722.1
05-17	7721.7
05-18	7722.1
05-19	7722.1
05-20	7722.3
05-21	7722.4
05-24	7722.9
05-25	7722.8
05-26	7723.0
05-27	7723.3
05-28	7723.5

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND COARSE SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

25.0 - 30.0: GRAVEL, COBBLES AND BOULDERS WITH SAND: CLEAN GRAVEL, PREDOMINANTLY IGNEOUS, WITH TRACE OF MEDIUM GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

30.0 - 33.0: GRAVEL, COBBLES, BOULDERS AND SAND: APPROXIMATELY EQUAL AMOUNTS OF CLEAN PREDOMINANTLY IGNEOUS GRAVEL, AND MEDIUM GRAINED SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

33.0 - 34.0: GRAVEL, COBBLES, BOULDERS AND SAND WITH CLAY: APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL AND MEDIUM GRAINED SAND, TRACE AMOUNTS OF CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); DRY.

34.0 - 44.0: GRAVEL, COBBLES, BOULDERS, SAND AND CLAY: APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND, AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, WATER ENCOUNTERED AT 35.0 FT.

44.0 - 46.0: GRAVEL, COBBLES, BOULDERS AND LEAN CLAY WITH SAND: PREDOMINANTLY IGNEOUS GRAVEL AND LEAN CLAY, WITH TRACE OF COARSE SAND; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

46.0 - 50.0: GRAVEL, COBBLES, BOULDERS, WITH CLAY AND SAND: PREDOMINANTLY IGNEOUS GRAVEL, WITH TRACE AMOUNTS OF MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

50.0 - 62.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND: APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

62.0 - 71.0: GRAVEL, COBBLES, BOULDERS, WITH SAND AND CLAY: PREDOMINANTLY IGNEOUS GRAVEL, WITH TRACE AMOUNTS OF MEDIUM TO COARSE GRAINED SAND AND CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

71.0 - 73.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND: APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM TO COARSE GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

COMMENTS:

DRAWING NO. 40-D-6499 STANDARD DESCRIPTORS AND DESCRIPTIVE CRITERIA FOR DISCONTINUITIES.

ABBREVIATIONS
NE = NOT ENCOUNTERED
UC = UPPER COLORADO
PVC = POLY VINYL CHLORIDE
PIEZO. = PIEZOMETER
O.D. = OUTSIDE DIAMETER
I.D. = INSIDE DIAMETER
(SHC) = SEE HOLE COMPLETION IN NOTES COLUMN

GEOLOGIC LOG OF DRILL HOLE NO. DH-WD-2D

FEATURE: OBSERVATION WELLS
LOCATION: SAN LUIS VALLEY
BEGUN: 05-11-93 FINISHED: 05-13-93
DEPTH AND ELEV. OF WATER LEVEL AND DATE MEASURED: 48.1 (7720.50) 05-26-93

PROJECT: SAN LUIS VALLEY GNDWTR. DEMO.
COORDINATES: N (SHC) E (SHC)
TOTAL DEPTH: 84.4
DEPTH TO BEDROCK: NE

STATE: COLORADO
GROUND ELEVATION: 7768.5
ANGLE FROM HORIZONTAL: 90 AZIMUTH:
HOLE LOGGED BY: D. FAZZAN
REVIEWED BY: B. Cobb

CLASSIFICATION AND PHYSICAL CONDITION (CONTINUED)

73.0 - 79.0: POORLY GRADED SAND AND CLAY, WITH GRAVEL, COBBLES, BOULDERS:
PREDOMINANTLY MEDIUM GRAINED SAND AND CLAY, WITH TRACE OF IGNEOUS GRAVEL; MAXIMUM SIZE 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

79.0 - 81.0: GRAVEL, COBBLES, BOULDERS, CLAY AND SAND:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, MEDIUM GRAINED SAND AND LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

81.0 - 83.0: POORLY GRADED SAND WITH GRAVEL, COBBLES, BOULDERS AND CLAY:
COARSE GRAINED SAND, WITH TRACE OF PREDOMINANTLY IGNEOUS GRAVEL AND COATINGS OF CLAY ON THE SAND AND GRAVEL; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET, LARGE AMOUNTS OF WATER AT 81.0 FT.

83.0 - 84.4: GRAVEL, COBBLES, BOULDERS, AND SAND WITH CLAY:
APPROXIMATELY EQUAL AMOUNTS OF PREDOMINANTLY IGNEOUS GRAVEL, AND MEDIUM TO COARSE GRAINED SAND, WITH TRACE OF LEAN CLAY; MAXIMUM SIZE, 25 MM (MAXIMUM SIZE DOES NOT NECESSARILY REFLECT IN-PLACE DIMENSION DUE TO THE LIMITED DIAMETER OF THE SAMPLER); WET.

STRATIGRAPHY:

0.0 - 84.4 UNCLASSIFIED SURFICIAL DEPOSITS AND UNDERLYING TERTIARY ALAMOSA FORMATION (QTsa)

APPENDIX C

PERMITS AND LOGS FOR WELLS

AT BROWNELL RECHARGE SITE

Form No.
GWS-25

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

1137

WELL PERMIT NUMBER 170574 - ____ -__
DIV. 3 CNTY. 2 WD 20 DES. BASIN MD

Lot: Block: Filing: Subdiv:

APPLICANT

SAN LUIS VALLEY WATER CONSERVANCY
P O BOX 43
MONTE VISTA CO 81144

(719)852-2315

APPROVED WELL LOCATION
ALAMOSA COUNTY
SW 1/4 NW 1/4 Section 29
Twp 40 N RANGE 9 E NM P.M.

DISTANCES FROM SECTION LINES
2590 Ft. from North Section Line
640 Ft. from West Section Line

PERMIT TO USE AN EXISTING WELL (MH-19252) FOR MONITORING AND OBSERVATION (WELL C)

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

2) The construction of this well shall be in compliance with the Water Well Construction and Pump Installation Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 17.

3) Approved pursuant to CRS 37-92-602(3)(b)(1) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.

4) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept locked at all times except during sampling or measuring.

5) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.

6) Upon conclusion of the monitoring program the well owner shall plug and abandon this well in accordance with the Water Well Construction and Pump Installation Rules.

7) The owner shall mark the well in a conspicuous place with well permit number and name of aquifer as appropriate. He shall take necessary means and precautions to preserve these markings.

OWNER'S COPY

HF 6-17-93
APPROVED
HCF

Hal D. Simpson C-2
State Engineer

By

Receipt No. 0352347A DATE ISSUED JUN 18 1993 EXPIRATION DATE JUN 18 1995

FORM NO. GWS-31 11/90

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO, OFFICE OF THE STATE ENGINEER

For Office Use only

1. WELL PERMIT NUMBER 170574

2. OWNER NAME(S) San Luis Valley Water Conservancy Dist.
Mailing Address P.O. Box 43
City, St. Zip Monte Vista, Colorado 81144
Phone (719) 852-2315

3. WELL LOCATION AS DRILLED: SW 1/4 NW 1/4, Sec. 29 Twp. 40 N, Range 9 E
DISTANCES FROM SEC. LINES:
2590 ft. from north (north or south) Sec. line. and 640 ft. from west (east or west) Sec. line. OR
SUBDIVISION: LOT BLOCK FILING(UNIT)
STREET ADDRESS AT WELL LOCATION:

4. GROUND SURFACE ELEVATION ±7600 ft. DRILLING METHOD Mud Rotary
DATE COMPLETED 4/16/92 TOTAL DEPTH 20 ft. DEPTH COMPLETED 20 ft.

5. GEOLOGIC LOG:

Depth	Description of Material (Type, Size, Color, Water Location)
0-2	Topsoil
2-20	Medium gravel

REMARKS:

6. HOLE DIAM. (in.)

From (ft)	To (ft)
0	5

7. PLAIN CASING

OD (in)	Kind	Wall Size	From(ft)	To(ft)
6 5/8	Steel	.188	+1	5
4 1/2	PVC	.250	0	10

PERF. CASING: Screen Slot Size:

4 1/2	PVC		10	20

8. FILTER PACK:
Material Washed gravel
Size pea gravel
Interval 8-20

9. PACKER PLACEMENT:
Type
Depth

10. GROUTING RECORD:

Material	Amount	Density	Interval	Placement
Neat Cement	94lbs	7gal.	0-8	Poured
Bentonite grout	2 sacks.			

11. DISINFECTION: Type Amt. Used

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Supplemental Form.
TESTING METHOD None
Static Level ft. Date/Time measured , Production Rate gpm.
Pumping level ft. Date/Time measured , Test length (hrs.)
Remarks

13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. [Pursuant to Section 24-4-104 (13)(a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.]

CONTRACTOR Ken C. Burk Phone (719) 852-4845 Lic. No. 1137
Mailing Address 2939 North Hwy. 285, Monte Vista, CO 81144

Name/Title (Please type or print)	Signature	Date
Burk Drilling Inc.	Ken C. Burk	4/9/93

GWS-25 COLORADO DIVIS J OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

1137

WELL PERMIT NUMBER 170575 - ____ -__

APPLICANT

DIV. 3 CNTY. 2 WD 20 DES. BASIN MD

Lot: Block: Filing: Subdiv:

APPROVED WELL LOCATION
ALAMOSA COUNTY
SW 1/4 NW 1/4 Section 29
Twp 40 N RANGE 9 E NM P.M.

DISTANCES FROM SECTION LINES
2240 Ft. from North Section Line
190 Ft. from West Section Line

SAN LUIS VALLEY WATER CONSERVANCY
P O BOX 43
MONTE VISTA CO 81144

(719)852-2315

PERMIT TO USE AN EXISTING WELL (MH-19252) FOR MONITORING AND OBSERVATION (WELL B)

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.
2) The construction of this well shall be in compliance with the Water Well Construction and Pump Installation Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 17.
3) Approved pursuant to CRS 37-92-602(3)(b)(1) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.
4) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept locked at all times except during sampling or measuring.
5) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.
6) Upon conclusion of the monitoring program the well owner shall plug and abandon this well in accordance with the Water Well Construction and Pump Installation Rules.
7) The owner shall mark the well in a conspicuous place with well permit number and name of aquifer as appropriate. He shall take necessary means and precautions to preserve these markings.

OWNER'S COPY

6-17-93
APPROVED
HCF

Hal D. Simpson
State Engineer

By

Receipt No. 0352347B DATE ISSUED JUN 18 1993 EXPIRATION DATE JUN 18 1995

FORM NO. GWS-31 11/90

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO, OFFICE OF THE STATE ENGINEER

For Office Use only

1. WELL PERMIT NUMBER 170575

2. OWNER NAME(S) San Luis Valley Water Conservancy Dist.
Mailing Address P.O. Box 43
City, St. Zip Monte Vista, Colorado 81144
Phone (719) 852-2315

3. WELL LOCATION AS DRILLED: SW 1/4 NW 1/4, Sec. 29 Twp. 40 N, Range 9 E
DISTANCES FROM SEC. LINES:
2240 ft. from north (north or south) Sec. line. and 190 ft. from west (east or west) Sec. line. OR
SUBDIVISION: LOT BLOCK FILING(UNIT)
STREET ADDRESS AT WELL LOCATION:

4. GROUND SURFACE ELEVATION ±7600 ft. DRILLING METHOD Mud Rotary
DATE COMPLETED 4/16/92. TOTAL DEPTH 20 ft. DEPTH COMPLETED 20 ft.

5. GEOLOGIC LOG:

Depth	Description of Material (Type, Size, Color, Water Location)
0-2	Topsoil
2-20	Medium gravel

REMARKS:

6. HOLE DIAM. (in.)

From (ft)	To (ft)
0	5

7. PLAIN CASING

OD (in)	Kind	Wall Size	From(ft)	To(ft)
6 5/8	Steel	.188	+1	5
4 1/2	PVC	.250	0	10

PERF. CASING: Screen Slot Size:

4 1/2	PVC		10	20

8. FILTER PACK:
Material Washed gravel
Size pea gravel
Interval 8-20

9. PACKER PLACEMENT:
Type
Depth

10. GROUTING RECORD:

Material	Amount	Density	Interval	Placement
Neat Cement	94lbs	7gal.	0-8	Poured
Bentonite grout	2 sacks.			

11. DISINFECTION: Type Amt. Used

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Supplemental Form.
TESTING METHOD None
Static Level ft. Date/Time measured, Production Rate gpm.
Pumping level ft. Date/Time measured, Test length (hrs.)
Remarks

13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. (Pursuant to Section 24-4-104 (13)(a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.)
CONTRACTOR Ken C. Burk Phone (719) 852-4845 Lic. No. 1137
Mailing Address 2939 North Hwy. 285, Monte Vista, CO 81144

Name/Title (Please type or print)	Signature	Date
Burk Drilling Inc.	Ken C. Burk	4/9/93

Form No. GWS-25

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

818 Centennial Bldg., 1313 Sherman St., Denver, Colorado 80203
(303) 866-3581

1137

WELL PERMIT NUMBER 170576 - ____ - __
DIV. 3 CNTY. 2 WD 20 DES. BASIN MD

Lot: Block: Filing: Subdiv:

APPLICANT

SAN LUIS VALLEY WATER CONSERVANCY
P O BOX 43
MONTE VISTA CO 81144

(719)852-2315

APPROVED WELL LOCATION
ALAMOSA COUNTY
SW 1/4 NW 1/4 Section 29
Twp 40 N RANGE 9 E NM P.M.

DISTANCES FROM SECTION LINES
2460 Ft. from North Section Line
210 Ft. from West Section Line

PERMIT TO USE AN EXISTING WELL (MH-19252) FOR MONITORING AND OBSERVATION (WELL A)

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

1) This well shall be used in such a way as to cause no material injury to existing water rights. The issuance of the permit does not assure the applicant that no injury will occur to another vested water right or preclude another owner of a vested water right from seeking relief in a civil court action.

2) The construction of this well shall be in compliance with the Water Well Construction and Pump Installation Rules 2 CCR 402-2, unless approval of a variance has been granted by the State Board of Examiners of Water Well Construction and Pump Installation Contractors in accordance with Rule 17.

3) Approved pursuant to CRS 37-92-602(3)(b)(1) for uses as described in CRS 37-92-602(1)(f). Use of this well is limited to monitoring water levels and/or water quality sampling.

4) This well must be equipped with a locking cap or seal to prevent well contamination or possible hazards as an open well. The well must be kept locked at all times except during sampling or measuring.

5) Records of water level measurements and water quality analyses shall be maintained by the well owner and submitted to the Division of Water Resources upon request.

6) Upon conclusion of the monitoring program the well owner shall plug and abandon this well in accordance with the Water Well Construction and Pump Installation Rules.

7) The owner shall mark the well in a conspicuous place with well permit number and name of aquifer as appropriate. He shall take necessary means and precautions to preserve these markings.

OWNER'S COPY

HF 6-17-93
APPROVED
HCF

Hal D. Simpson
State Engineer

By

Receipt No. 0352347C DATE ISSUED JUN 18 1993 EXPIRATION DATE JUN 18 1995

FORM NO. GWS-31 11/90

WELL CONSTRUCTION AND TEST REPORT
STATE OF COLORADO OFFICE OF THE STATE ENGINEER

For Office Use only

1. WELL PERMIT NUMBER 170576

2. OWNER NAME(S) San Luis Valley Water Conservancy Dist.
Mailing Address P.O. Box 43
City, St. Zip Monte Vista, Colorado 81144
Phone (719) 852-2315

3. WELL LOCATION AS DRILLED: SW 1/4 NW 1/4, Sec. 29 Twp. 40 N, Range 9 E
DISTANCES FROM SEC. LINES:
2460 ft. from north (north or south) Sec. line. and 210 ft. from west (east or west) Sec. line. OR
SUBDIVISION: LOT BLOCK FILING(UNIT)
STREET ADDRESS AT WELL LOCATION:

4. GROUND SURFACE ELEVATION ±7600 ft. DRILLING METHOD Mud Rotary
DATE COMPLETED 4/16/92 TOTAL DEPTH 20 ft. DEPTH COMPLETED 20 ft.

5. GEOLOGIC LOG:

Depth	Description of Material (Type, Size, Color, Water Location)
0-2	Topsoil
2-20	Medium gravel

REMARKS:

6. HOLE DIAM. (in.)

From (ft)	To (ft)
0	5

7. PLAIN CASING

OD (in)	Kind	Wall Size	From(ft)	To(ft)
6 5/8	Steel	.188	+1	5
4 1/2	PVC	.250	0	10

PERF. CASING: Screen Slot Size:

4 1/2	PVC		10	20

8. FILTER PACK:
Material Washed gravel
Size pea gravel
Interval 8-20

9. PACKER PLACEMENT:
Type
Depth

10. GROUTING RECORD:

Material	Amount	Density	Interval	Placement
Neat Cement	94lbs	7gal.	0-8	Poured
Bentonite grout	2 sacks.			

11. DISINFECTION: Type Amt. Used

12. WELL TEST DATA: ☐ Check box if Test Data is submitted on Supplemental Form.
TESTING METHOD None
Static Level ft. Date/Time measured , Production Rate gpm.
Pumping level ft. Date/Time measured , Test length (hrs.)
Remarks

13. I have read the statements made herein and know the contents thereof, and that they are true to my knowledge. [Pursuant to Section 24-4-104 (13)(a) C.R.S., the making of false statements herein constitutes perjury in the second degree and is punishable as a class 1 misdemeanor.]

CONTRACTOR Ken C. Burk Phone (719) 852-4845 Lic. No. 1137
Mailing Address 2939 North Hwy. 285, Monte Vista, CO 81144

Name/Title (Please type or print)	Signature	Date
Burk Drilling Inc.	Ken C Burk	4/9/93

APPENDIX D

LIST OF COST SHARE RECHARGE SITES

Location of Site	Owner
NW¼ NW¼ Sec. 14, T. 39 N., R.7 E., N.M.P.M.	John Heersink
SW¼ SE¼ Sec. 2, T. 41 N., R. 7 E., N.M.P.M.	Ellithorpe & Son
SW¼ NW¼ Sec. 19, T. 41 N., R. 7 E., N.M.P.M.	Ellithorpe & Son
NW¼ NE¼ Sec. 11, T. 41 N., R. 7 E., N.M.P.M.	Ellithorpe & Son
SE¼ SE¼ Sec. 2, T. 41 N., R. 7 E., N.M.P.M.	Ellithorpe & Son
SW¼ NE¼ Sec. 19, T. 40 N., R. 9 E., N.M.P.M.	James Selters
SW¼ SW¼ Sec. 9, T. 40 N., R. 8 E., N.M.P.M.	Frank Machado
SW¼ NW¼ Sec. 35, T. 40 N., R. 8 E., N.M.P.M.	Robert L. Mattive
NW¼ SW¼ Sec. 27, T. 40 N., R. 8 E., N.M.P.M.	Carl L. Worley
SW¼ NW¼ Sec. 26, T. 40 N., R. 8 E., N.M.P.M.	Carl L. Worley
SE¼ Sec. 28, T. 40 N., R. 8 E., N.M.P.M.	Carl L. Worley
SE¼ Sec. 17, T. 41 N., R. 8 E., N.M.P.M.	Ellithorpe & Son
SE¼ SE¼ Sec. 19, T. 40 N., R. 7 E., N.M.P.M.	Kurt T. Metzger
SW¼ SE¼ Sec. 24, T. 42 N., R. 7 E., N.M.P.M.	Donald J. Evans
SW¼ NE¼ Sec. 32, T. 41 N., R. 8 E., N.M.P.M.	J.O. Lewis
NW¼ SW¼ Sec. 17, T. 41 N., R. 8 E., N.M.P.M.	Wayne C. Davis

APPENDIX E

DIVERSIONS BY RIO GRANDE, SAN LUIS VALLEY IRRIGATION DISTRICT

AND SAN LUIS VALLEY CANALS

DATA USED TO PLOT GRAPH OF DIVERSIONS

VERSUS CHANAGE IN AQUIFER STORAGE