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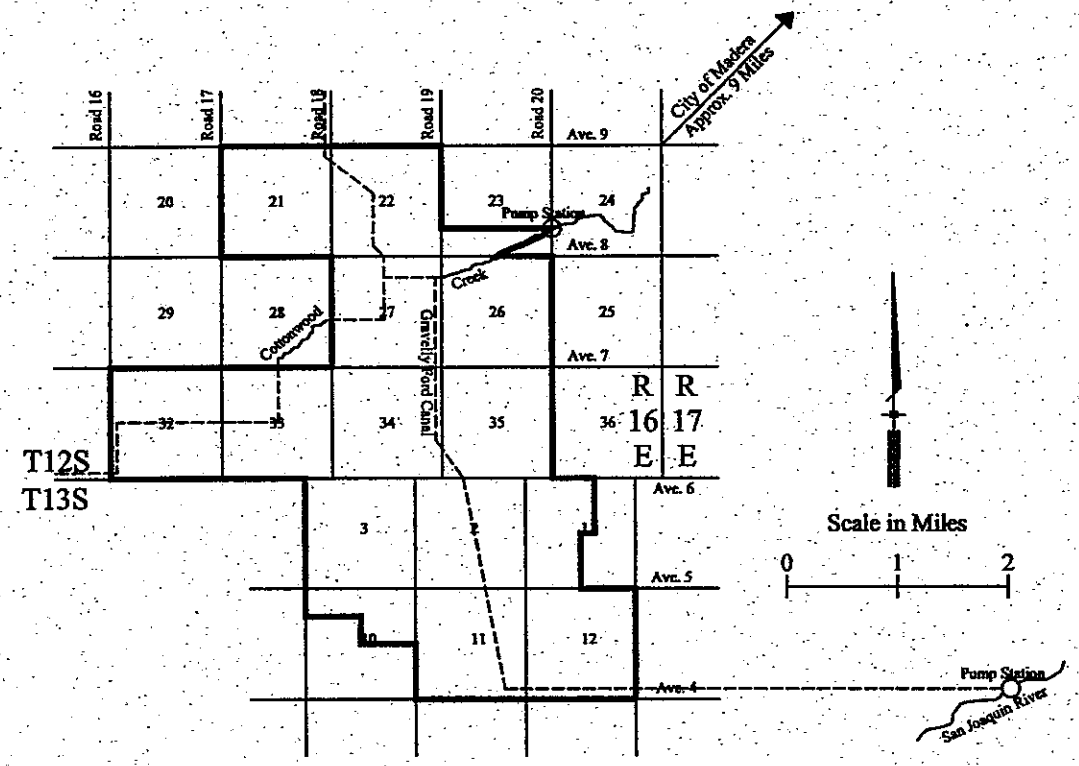
Gravelly Ford Water District

Groundwater Management Plan



by

Lewis E. Bair

Jacob J. Westra

Adopted 4/13/98 Amended 10/03/00

BEFORE THE BOARD OF DIRECTORS OF THE GRAVELY FORD WATER DISTRICT, MADERA COUNTY, CALIFORNIA

RESOLUTION OF THE GRAVELY FORD WATER DISTRICT AMENDING CURRENT GROUNDWATER MANAGEMENT PLAN

WHEREAS, the California State Legislature has authorized the District, and other local public entities, to develop, adopt and implement groundwater management plans pursuant to Water Code Sections 10750 et seq.; and

WHEREAS, regarding all the lands which are contained within the boundaries of the legal description of the Gravely Ford Water District as of October 3, 2000, including Sections 21, 22, 26, 27, 32, 33, 34, 35 and a portion of Section 23 in Township 12 S, Ranch 16 E, MDB&M, and Sections 2, 3, 11, 12, and portions of Sections 1 and 10 in Township 13 S, Range 16 E, MDB&M; and

WHEREAS, the Gravely Ford Water District adopted its AB 3030 Groundwater Management Plan on April 13, 1998; and

WHEREAS, on July 11, 2000 the Madera County Board of Supervisors enacted Ordinance 573A entitled "Rules and Regulations Pertaining to Groundwater Banking; Importation of Foreign Water, for the Purpose of Groundwater Banking to Areas of Madera County Which Are Outside of Local Water Agencies That Deliver Water to Lands Within Their Boundaries; and Exportation of Groundwater Outside the County"; and

WHEREAS, on October 3, 2000, the Gravely Ford Water District adopted Ordinance 2-2000 entitled "Rules And Regulations Pertaining To Groundwater Banking; Importation Of Foreign Water For The Purpose Of Groundwater Banking; Exportation Of Groundwater Outside The District; And Use Of District Facilities For Such Purposes"; and

WHEREAS, it is in the best interest of the District and the landowners within the District to have the District's Groundwater Management Plan to be in conformity with the Madera County Ordinance and Gravely Ford Water District Ordinance 2-2000 for the coordination of long-term management of the groundwater resources and to protect the availability of groundwater for continued use in future years; and

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors amends the Gravely Ford Water District Groundwater Management Plan adopted April 13, 1998 by deleting the current Section 6 (Regulations Pertaining to Exportation of Groundwater) of Part IV (Plan Items) and replacing it with the District "Groundwater Exportation, Groundwater Banking, Importation of Foreign Water, and Use of District Facilities for Such Purposes" Ordinance as the new Section 6.

THE ABOVE RESOLUTION was passed and adopted by the following vote of the Board of Directors of the Gravely Ford Water District this October 3, 2000.

AYES: Basila, DaSilva, Andrews, Keating, Emmert
NOES:
ABSENT:

/s/ James Keating
President

ATTEST:

KENNETH A. BASILA
~~/s/ Timothy DaSilva,~~
Secretary

BEFORE THE BOARD OF DIRECTORS OF
THE GRAVELLY FORD WATER DISTRICT
MADERA, CALIFORNIA

ORDINANCE NO. 98-1

ORDINANCE ADOPTING GROUNDWATER MANAGEMENT PLAN
FOR THE GRAVELLY FORD WATER DISTRICT

WHEREAS, Part 2.75 (commencing with Section 10750) of Division 6 of the California Water Code authorizes local agencies such as the Gravelly Ford Water District to adopt and implement groundwater management plans within all or a portion of their service areas; and

WHEREAS, this District has prepared, in accordance with the procedures presecribed by law, a groundwater management plan for the Gravelly Ford Water District; and

WHEREAS, this Board has given notice and held a public hearing to determine whether to adopt such a plan, all in accordance with the provisions of law;

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF THE GRAVELLY FORD WATER DISTRICT AS FOLLOWS:

Section 1. The groundwater management plan prepared for Gravelly Ford Water District described in Section 2 hereof which is set forth in the document entitled Gravelly Ford Water District Groundwater Management Plan dated January 1998, on file with the Secretary of this District is hereby adopted, and the District is hereby ordered to implement such a plan in accordance with the provisions thereof.

Section 2. Gravelly Ford Water District includes all of the lands which are contained within the boundaries of the legal description of the Gravelly Ford Water District as of August 11th, 1997, including Sections 21, 22, 26, 27, 32, 33, 34, 35 and a portion of Section 23 in Township 12 S, Range 16 E, MDB&M, and Sections 2, 3, 11, 12, and portions of Sections 1 and 10 in Township 13 S, Range 16 E, MDB&M.

THE FOREGOING ORDINANCE was passed and adopted by the following vote of the Board of Directors of the Gravelly Ford Water District this 13th day of April, 1998.

AYES: Directors Keating, Andrew, DaSilva,

NOES: None

ABSENT: Schafer, Basila

James Keating
President

ATTEST:
Timothy DaSilva

GROUNDWATER MANAGEMENT PLAN

for

GRAVELLY FORD WATER DISTRICT

Prepared by

Lewis E. Bair

&

Jacob J. Westra

January 1998

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LIST OF ACRONYMS

AB 3030	California Assembly Bill 3030
AF	Acre-Feet
CEQA	California Environmental Quality Act
CVP	United States Bureau of Reclamation, Central Valley Project
DWR	California Department of Water Resources
ET	Evapotranspiration
GFWD	Gravelly Ford Water District
MID	Madera Irrigation District
MSL	Mean Sea Level
PG&E	Pacific Gas and Electric Company
ppm	Parts Per Million
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
USBR	United States Bureau of Reclamation

I. INTRODUCTION

1. General

The Gravelly Ford Water District (GFWD) is a public water district covering an area of approximately 8,300 acres in Madera County. In 1942 a group of farmers formed the Gravelly Ford Water Users Association with the intention of obtaining a permanent surface water supply. They were denied, and told that only water districts formed under California Law would be eligible for federal water contracts. This eventually led to the formation of GFWD in 1962. In 1981 the district signed its first permanent water contract with the United States Bureau of Reclamation (USBR) for 14,000 acre-feet (AF) of Class II water. That same year the district floated a bond to pay for upgrades to GFWD's distribution system. Since this time GFWD has actively pursued additional surface water supplies. They currently have a contract with Madera Irrigation District (MID) for spill water in Cottonwood Creek and have submitted an application to appropriate 5,000 AF of water from Cottonwood Creek.

Subsequent to the implementation of California Assembly Bill No. 3030 (AB 3030) on January 1, 1993, GFWD's board of directors adopted a resolution of intention on August 11, 1997 to draft a groundwater management plan. The resolution is attached in Appendix A.

A. Purpose

The purpose of this groundwater management plan is to develop an organized approach to the evaluation and management of groundwater in GFWD. Effective groundwater management is vital to GFWD due to their heavy reliance on a conjunctive use system. With the use of groundwater as a supplemental resource, and the difficulty in obtaining new surface

water supplies, it is important for GFWD to manage this resource effectively.

B. Goals

The goals of this groundwater management plan are to actively manage the groundwater within GFWD in order to mitigate conditions of overdraft and to maintain high-quality, contaminant free groundwater. It is desirable to formulate and implement the plan at the local level rather than having management imposed by the state or federal government.

Upon its adoption, the goals of this plan will be carried out through the implementation of specific programs listed within the plan. The initial program will consist of monitoring groundwater elevations and quality. If evaluation of data collected indicates a need, implementation of additional programs will be considered. If the long term trend in groundwater overdraft continues, it may be necessary to implement more rigorous programs.

C. Authority

AB 3030, which became a law on January 1, 1993 (California Water Code, Sections 10750 et seq.), authorized local agencies that are within groundwater basins, as defined in California Department of Water Resources (DWR) Bulletin 118-80 (Appendix B), and that meet certain other criteria, to prepare and adopt groundwater management plans. GFWD qualifies under the law.

II. EXISTING CONDITIONS

1. Description of Study Area

A. Location

GFWD is located southwest of the City of Madera and encompasses a land area of approximately 8,300 acres. It is adjacent to Cottonwood Creek and extends south towards the San Joaquin River. The district is contained in the southeastern portion of Township 12 South, Range 16 East, and in the northeastern portion of Township 13 South, Range 16 East, Mount Diablo Base & Meridian.

B. Topography

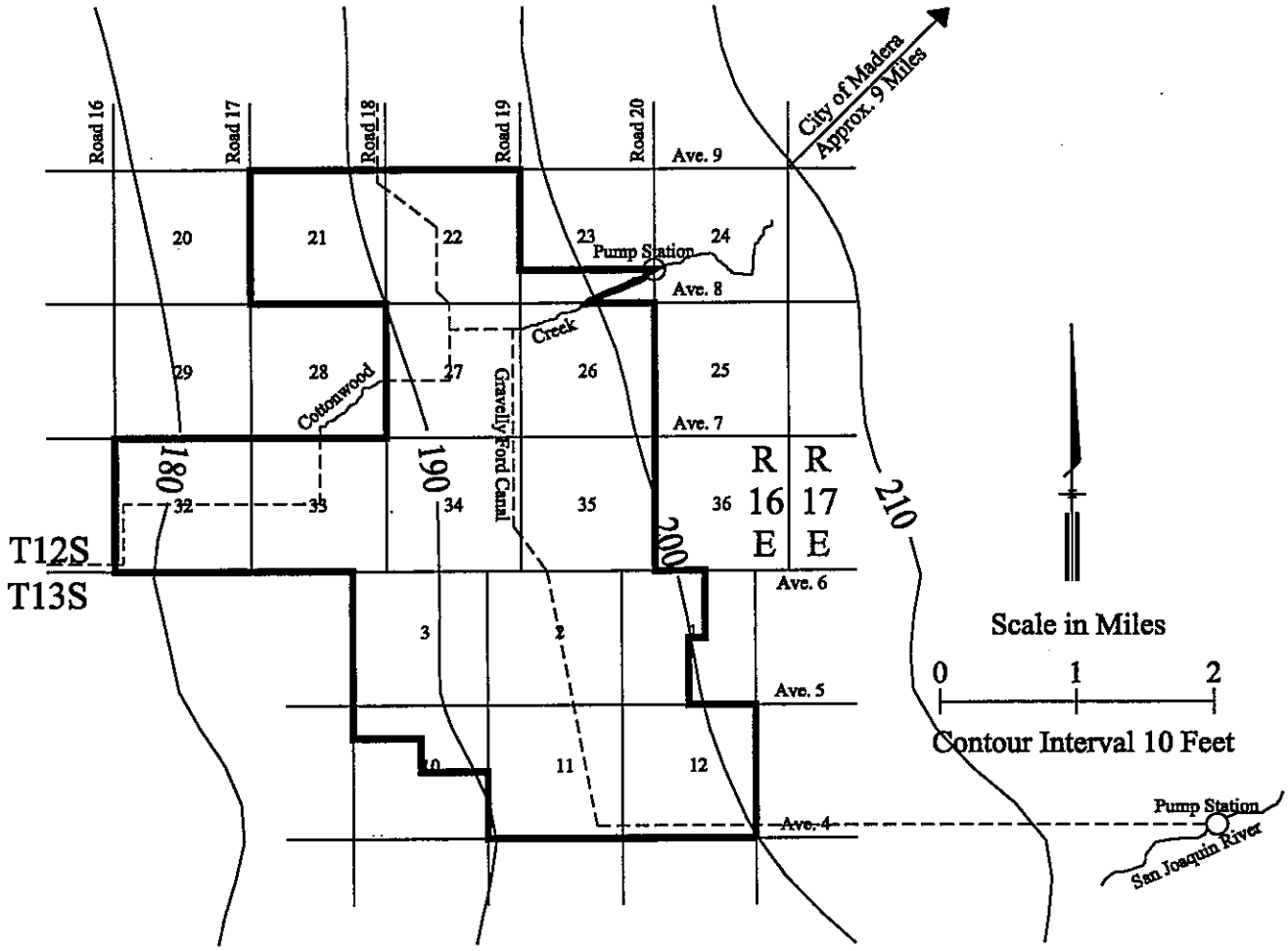
The surface topography is relatively flat with a slight gradient downward from east to west, Figure 1. Ground surface elevations range from 180 to 200 feet above mean sea level (MSL).

C. Climate

The climate in this area is seasonal with fairly mild winters and long, hot summers. Summer has a daily maximum temperature in the upper 90's to low 100's with extremes around 110°F (SCS 1951). January minimum temperatures have been a couple of degrees above freezing. The skies are clear 95 percent of the time in the summer and 50 percent of the time during the winter months. These temperatures and long sunny days allow for a growing season of approximately 265 days. These are average numbers reflecting the trend in the San Joaquin Valley. Historical annual

Figure 1

Ground Surface Elevation



rainfall for this area has averaged only 8.5 inches for the time period from 1957 through 1996, with a low of 4.6 inches in 1989 to a high of 16.4 inches in 1978.

2. Water Supply

A. Historical and Projected Water Supply

Until the construction of the water delivery system in 1984, water demand in GFWD was met through groundwater pumping and Cottonwood Creek surface waters. In 1981 GFWD obtained a Class II water contract of 14,000 AF from the San Joaquin River. These Class II waters are only available in plentiful water years. GFWD also has a contract with MID to purchase all spill waters in Cottonwood Creek. Rainfall in GFWD amounts to approximately 22 percent of the annual water demand from 1971 to 1996.

GFWD has applied to appropriate 5,000 AF of water from Cottonwood Creek, and is currently waiting for approval. The district continually pursues all available surface waters.

B. Additional Water Supplies

During heavy rain flood waters are released into the San Joaquin River. GFWD already diverts these waters for recharge in the Gravelly Ford Canal. If GFWD's recharge facilities were expanded more of these waters could be diverted to supplement the existing conjunctive use system. It is not anticipated that other significant sources of surface water will be available without increased storage facilities on the San Joaquin River.

3. Water Demand

A. Land Use and History

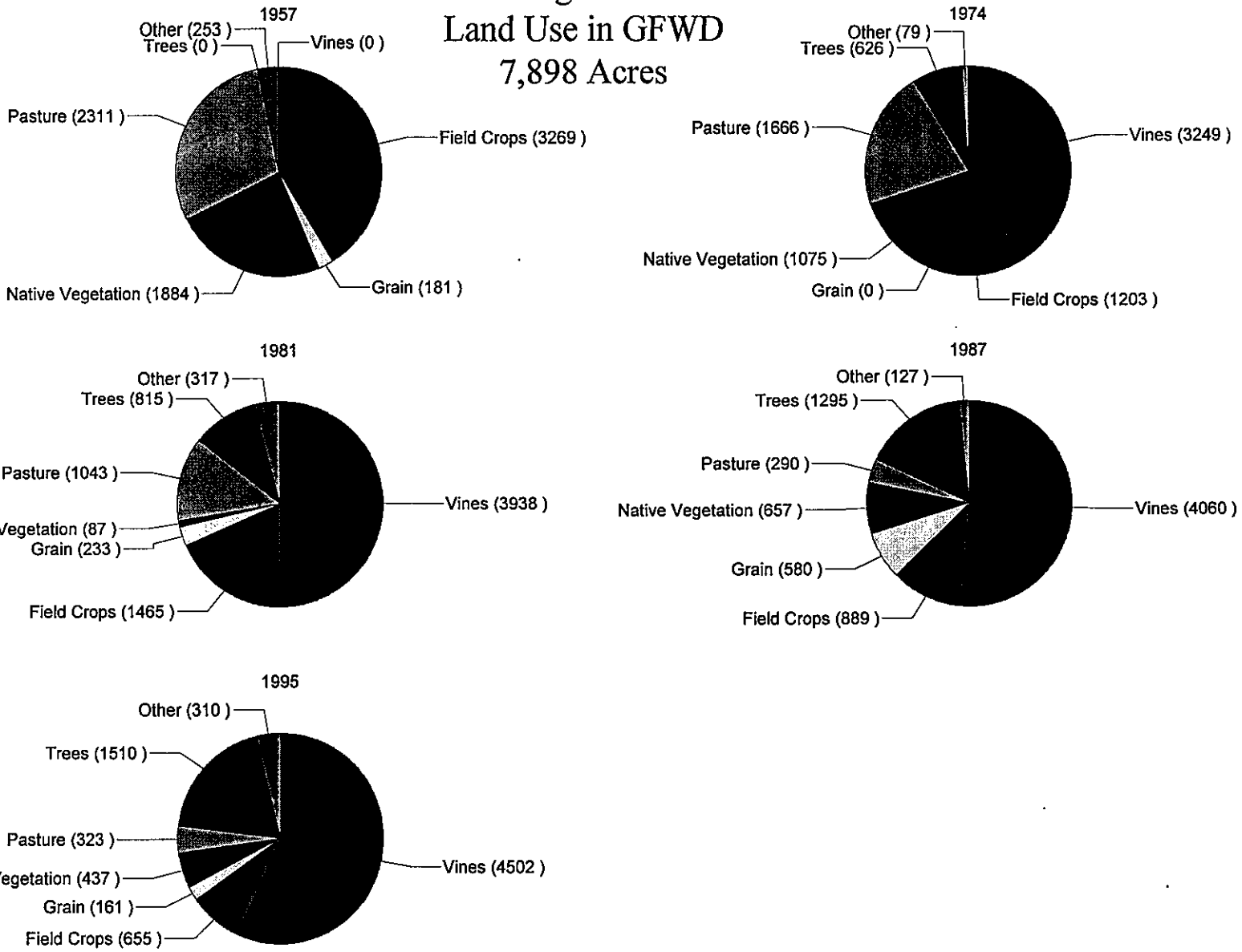
Land use surveys conducted by DWR (1957, 1974, 1981, 1987, 1995) indicate that in 1957, the lands within GFWD were dominated by field crops (3,269 acres), pasture (2,311 acres), and native vegetation (1,884 acres) as shown in Figure 2. By 1981, nearly all of the land was developed and the introduction of permanent crops was evident with fifty percent in trees and vines. By 1995 three quarters of the land was in permanent crops. This reduced field crops, pasture, and native vegetation to 19 percent of the acreage grown in 1957. Roads, head ditches, etc. account for five percent of the total acreage in GFWD. This reduces the cropped land to approximately 7,898 acres.

B. Historical Water Demand

i. Municipal, Industrial and Domestic Water Demand

The combined municipal, industrial, and domestic water requirement for GFWD has been insignificant, and has remained less than 1 percent since the 1950's. Domestic water use in GFWD consists primarily of scattered single family units using wells for potable water. There are no public water treatment facilities within GFWD.

Figure 2
Land Use in GFWD
7,898 Acres



ii. Agricultural Water Demand

As Figure 3 shows, agricultural water requirements have not increased dramatically since 1957. The development of native lands has increased the total number of acres farmed, but the total water demand has remained fairly constant. This is because the majority of the undeveloped lands along with other high water demand crops have been replaced with vines, a relatively low water demand crop. Water use in GFWD ranged from a low of 16,755 AF in 1988 to a high of 19,378 AF in 1981. These totals were calculated from DWR Land Use Surveys and evapotranspiration (ET) rates from Kings River Conservation District (1994).

iii. Other Water Demand

There is no other known water demand within GFWD.

C. Projected Water Demand

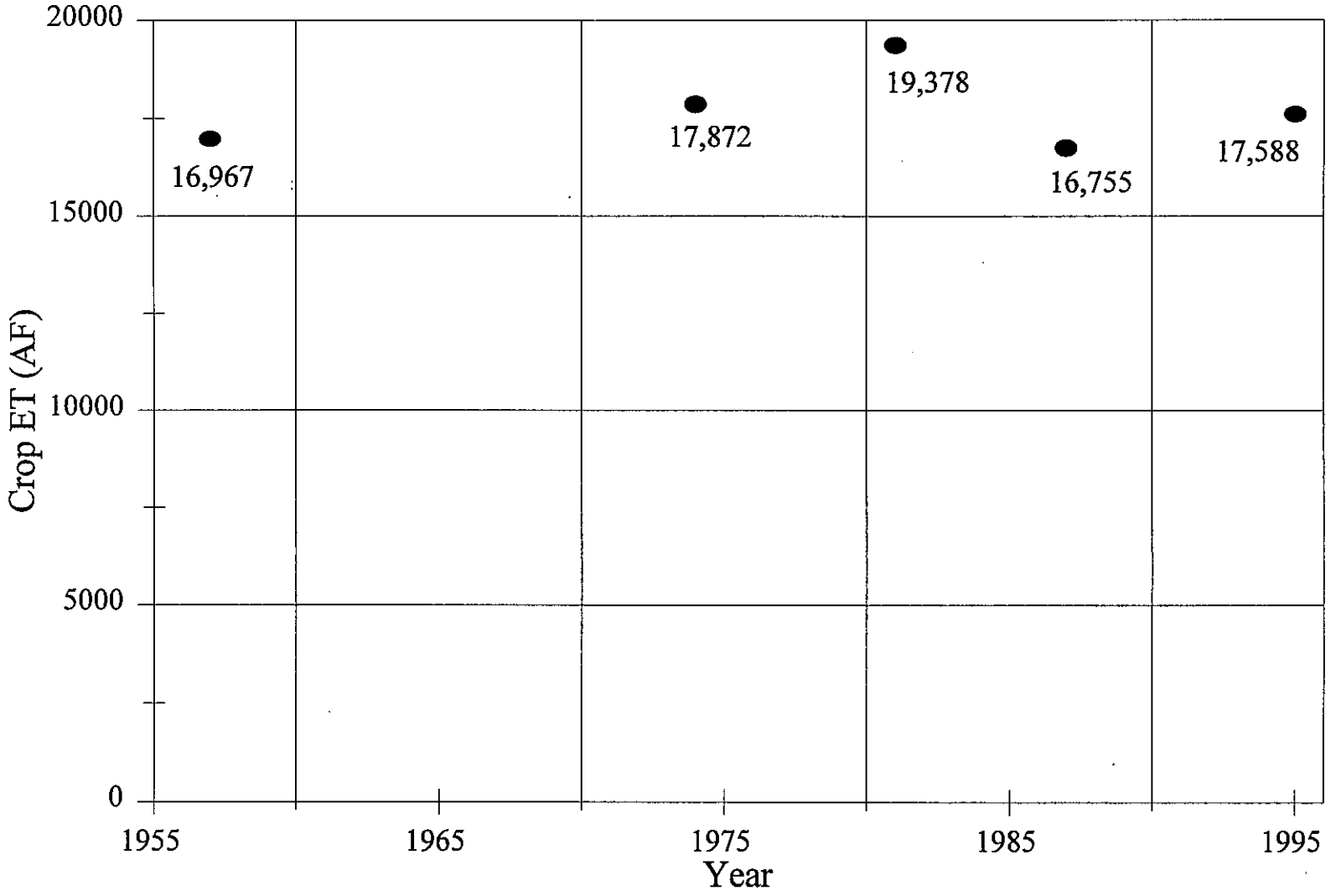
i. Municipal and Industrial Water Demand

The municipal and industrial water demand for GFWD is expected to remain less than 1 percent. If a dramatic change in municipal or industrial demand is proposed the impact on the groundwater basin should be investigated.

ii. Agricultural Water Demand

It is assumed that the agricultural water demand of GFWD will follow the stable course set since 1957. Water demand has

Figure 3
Water Demand in GFWD



averaged 17,875 AF and is expected to remain constant for the foreseeable future unless there is a major change in cropping pattern to crops of different water use.

iii. Other Water Demand

No other demand currently exists in GFWD and there is no expected change to this situation.

4. Water Quality

A. Historical Quality

Groundwater in GFWD is a high quality bicarbonate type water. Total Dissolved Solids (TDS) are well below what would be considered to be high levels. The TDS in the unconfined aquifer in 1965 ranged from approximately 300 to 400 parts per million (ppm) while the TDS in the confined aquifer ranges from 150 to 300 ppm (USGS, 1970). The base of the fresh water where the TDS measure 2,000 ppm is approximately 1,200 feet below ground surface.

B. Agricultural Water Quality Requirements

One of the issues that should be addressed in a groundwater management plan is the quality of water within the management area. A reduction in the quality of water beyond certain limits is equivalent to a loss in the useable water supply. Poor quality water can be treated but the costs are generally much higher than the cost of maintaining a high quality groundwater supply.

The salinity level in water is most often expressed by the term TDS. The presence of salts in groundwater primarily results from the chemical weathering of earth minerals from rocks and soils. The threshold values of TDS where crop yields will be reduced in GFWD are given in Table 1. To maintain optimum crop yield with the crops currently farmed in GFWD it is essential that groundwater TDS levels be maintained well below the thresholds given in Table 1.

Table 1
Salinity Thresholds for Yield Reduction

Crop	TDS ppm
Alfalfa	1,280
Almonds	960
Beans	640
Corn	1,090
Cotton	4,930
Peaches	1,090
Vines	960

5. Water Facilities in the Study Area

A. Water Supply, Storage, Distribution and Recharge Facilities

The current surface water supply for GFWD comes from the 14,000 AF Class II water contract with the USBR, Cottonwood Creek spill water, groundwater pumping, and effective precipitation. GFWD has submitted a proposal to appropriate 5,000 AF of the waters in Cottonwood Creek. The district also diverts flood waters from the San Joaquin River when they are available.

The surface water distribution system consists primarily of the Gravelly Ford Canal. This canal stretches from the San Joaquin River to north of Cottonwood Creek. It is nearly level working much like a reservoir. The canal is unlined and built through highly permeable sandy loam soils. These properties allow the canal to operate as a recharge basin. Where needed small individual pipelines are used to deliver water to the turnouts. All turnouts in the district are metered.

B. Wastewater Treatment and Disposal/Reclamation Facilities

There are no communities within GFWD that have public wastewater treatment facilities. Residential areas and farmsteads are using septic systems.

C. Groundwater Wells

i. Municipal

No known municipal wells exist in the area. Residential areas have individual wells for domestic water use.

ii. Industrial

There is no significant industrial development in GFWD.

iii. Agricultural

Well driller's logs were obtained from DWR which show depths the wells are completed. Not all the well driller's logs are submitted to DWR. The majority of well logs in GFWD are

composite wells for agricultural water use, pumping from depths of 250 to 550 feet. In the southern tip of the district the well logs tend to be completed in the unconfined aquifer, above the E clay.

6. Groundwater Monitoring Programs

A. Groundwater Levels

The USBR and DWR both act as clearing houses to gather well level data from local agencies, private water users, etc. MID has a monitoring program that includes several wells in GFWD. Pacific Gas and Electric Company (PG&E) has historically performed pump tests in parts of GFWD but the results of these tests are confidential.

B. Water Quality

Although study specific groundwater quality has taken place in the past, no consistent groundwater quality monitoring program is in effect within GFWD.

III. EVALUATION OF GROUNDWATER CONDITIONS

1. Characteristics of the Aquifer

A. Geology of the Groundwater Basin

The surface soils in this area consist mainly of fine sandy loams from alluvial fans and flood plains (SCS,1951). The subsurface soils throughout GFWD are composed of 30 to 50 percent fine and coarse sand from interwoven alluvial fans (USGS, 1970). These alluvial fans have created an effective aquifer system that has yielded large quantities of groundwater to pumping and which possesses the ability to be recharged through active and passive means.

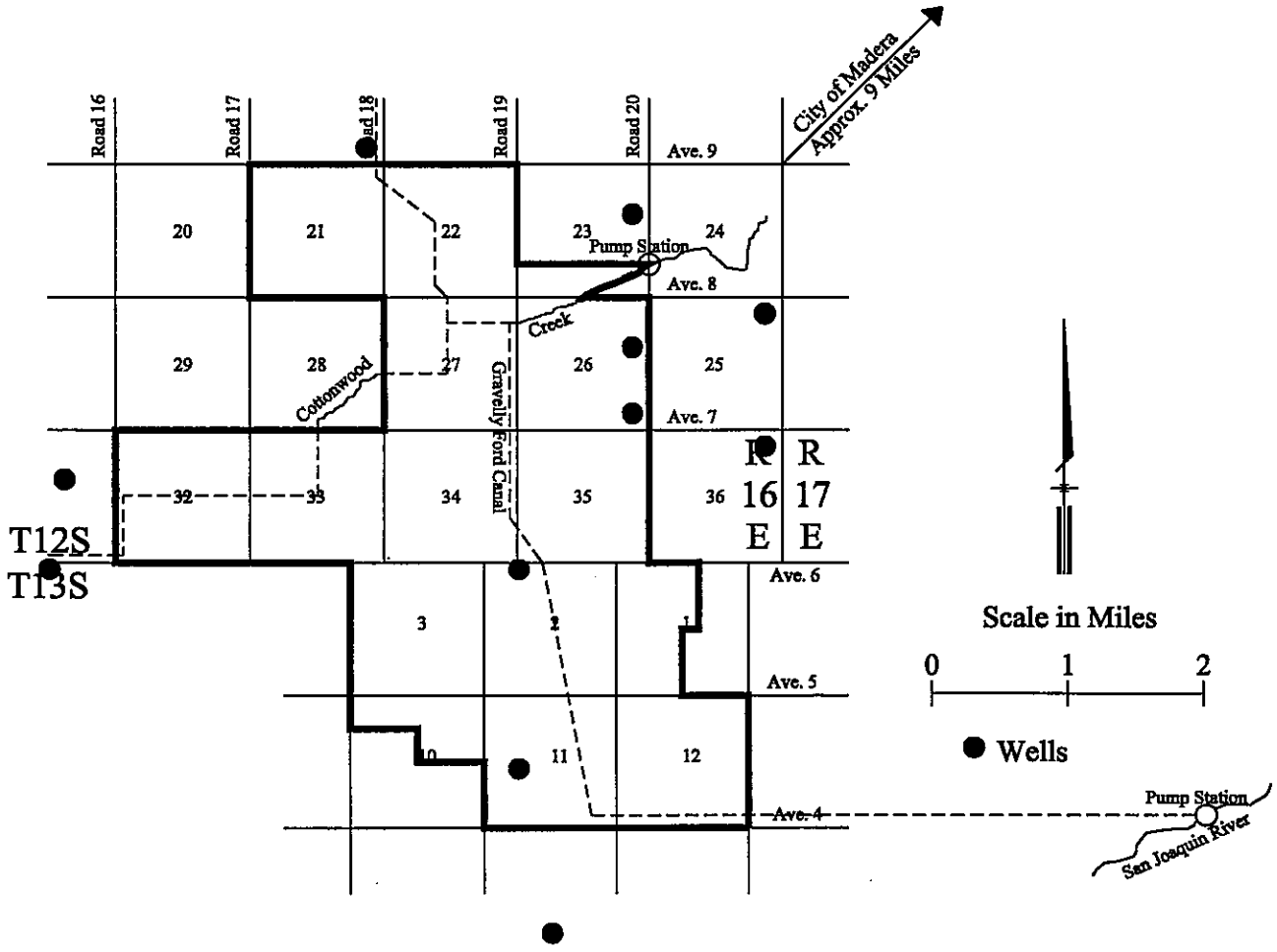
Below the alluvial formation lies a non-permeable clay layer known as the E or Corcoran Clay. Elevation data was obtained for the E clay (USGS 1984) and then subtracted from the ground surface elevations to obtain the depth of the E clay. The bottom of the E clay ranges from 340 to 440 feet below the ground surface and is approximately 25 feet thick, Figure 4. This layer creates a confined aquifer within GFWD.

B. Capacity of the Groundwater Basin

The capacity of an unconfined aquifer is directly related to its specific yield, i.e. the higher the specific yield, the more water the aquifer holds. Specific yield is given as a ratio of the volume of water that a given aquifer will yield by gravity to the aquifer volume, usually expressed as a percent. The specific yield of an aquifer is determined by the type of material that makes up the aquifer. A gravel will have a specific yield between 15 to 25 percent while a clay will only yield 0 to 5 percent. The specific yield for GFWD is

Figure 5

Location of Monitored Wells



B. Depth to Groundwater

The average depth to groundwater in GFWD has ranged from 67 feet in 1971 to 105 feet in 1993. The average depth to groundwater is shown in Figure 6 for the time period from the spring of 1971 to the spring of 1997.

C. Groundwater Elevations

The groundwater elevations can be used to determine the direction of groundwater flow. Groundwater will flow perpendicular to the groundwater elevation contours in the direction of decreasing elevation. Figure 7 and Figure 8 show a continuing trend of groundwater flow from the east to the west. The groundwater elevations are given in feet above MSL.

D. Changes in Storage

The total change in groundwater storage for GFWD is a loss of 29,052 AF for the time period from 1971 through 1996. This amounts to a loss in storage of 1,117 AF per year. This information is calculated using a specific yield of 13 percent and a change in groundwater depth of 27 feet for the 1971 through 1996 time period. Figure 9 shows the annual change in storage from 1971 through 1996.

E. Movement of Groundwater

Groundwater flow has been from east to west since 1964 (USGS 1970) and is still the same in 1983 and 1996. These flows can be influenced on the local level depending on how much water is being extracted from the aquifer. Heavy localized pumping can cause depressions in the

Figure 6
Average Depth to Groundwater
1971 - 1997

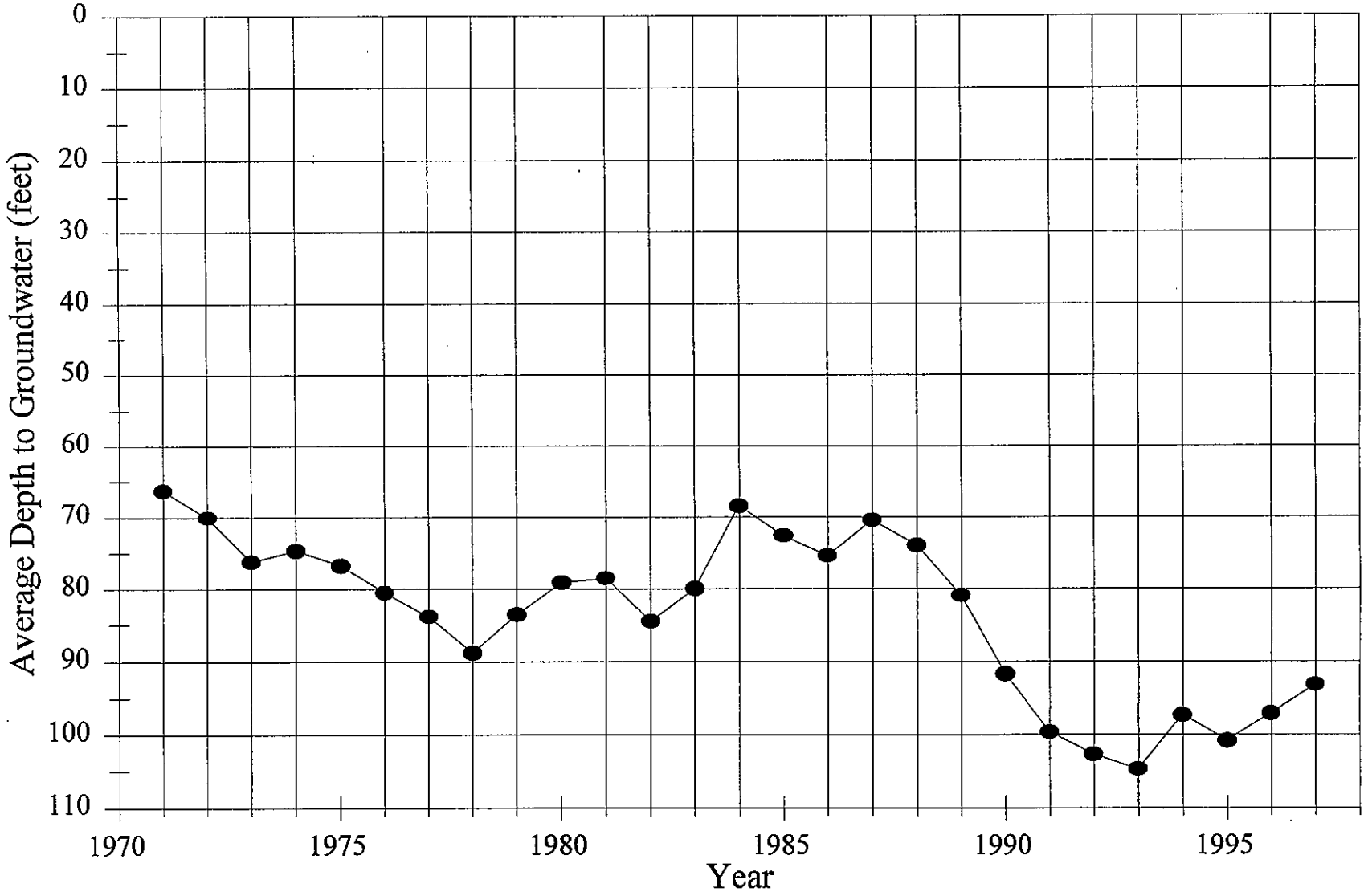


Figure 7
Groundwater Elevations in Feet Above MSL, Spring 1983

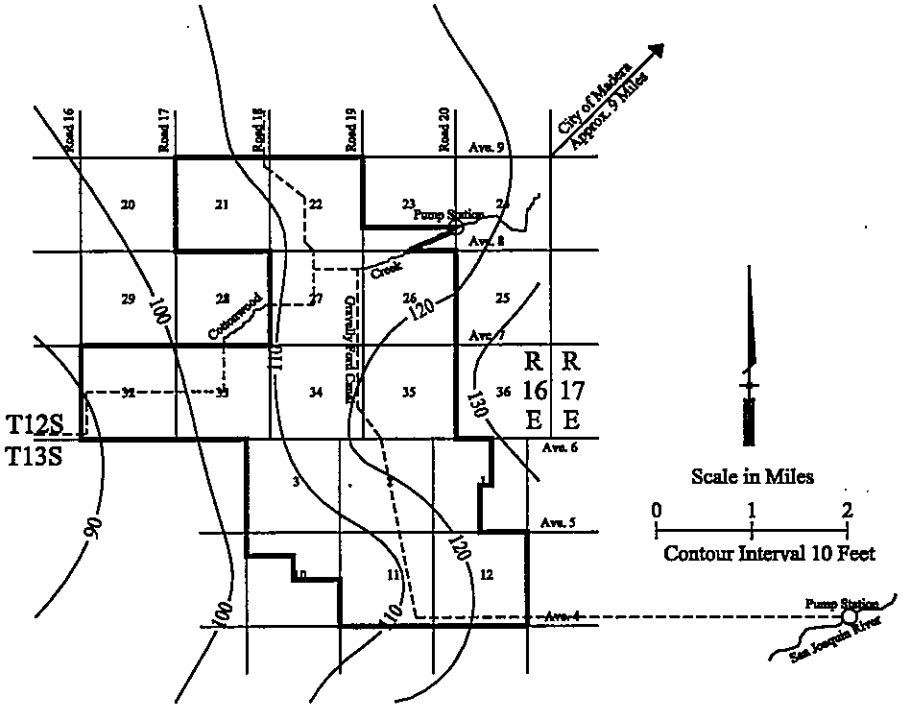


Figure 8
Groundwater Elevation in Feet Above MSL, Spring 1996

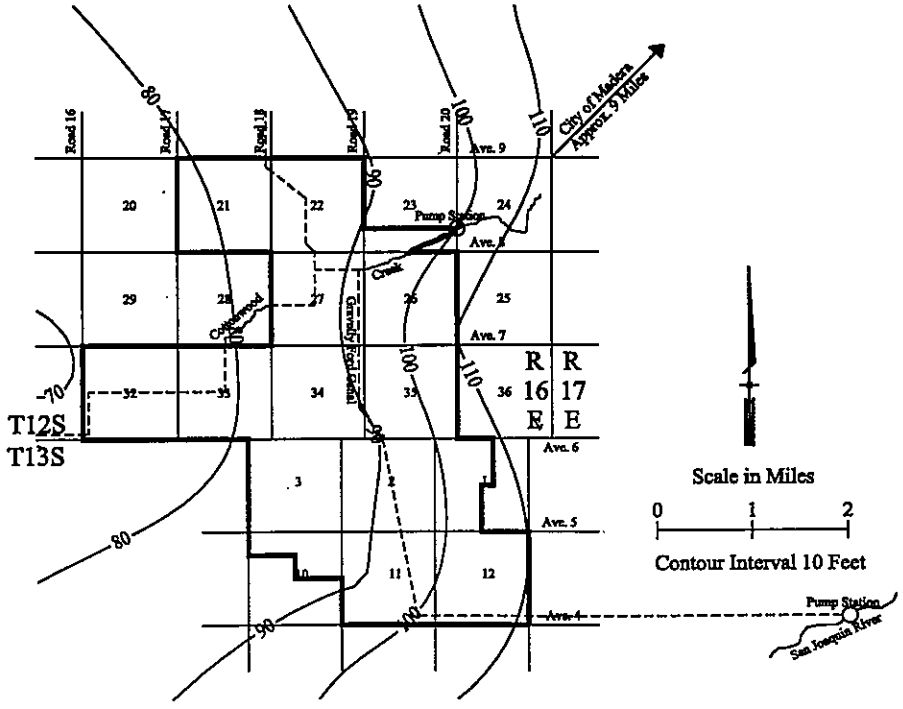
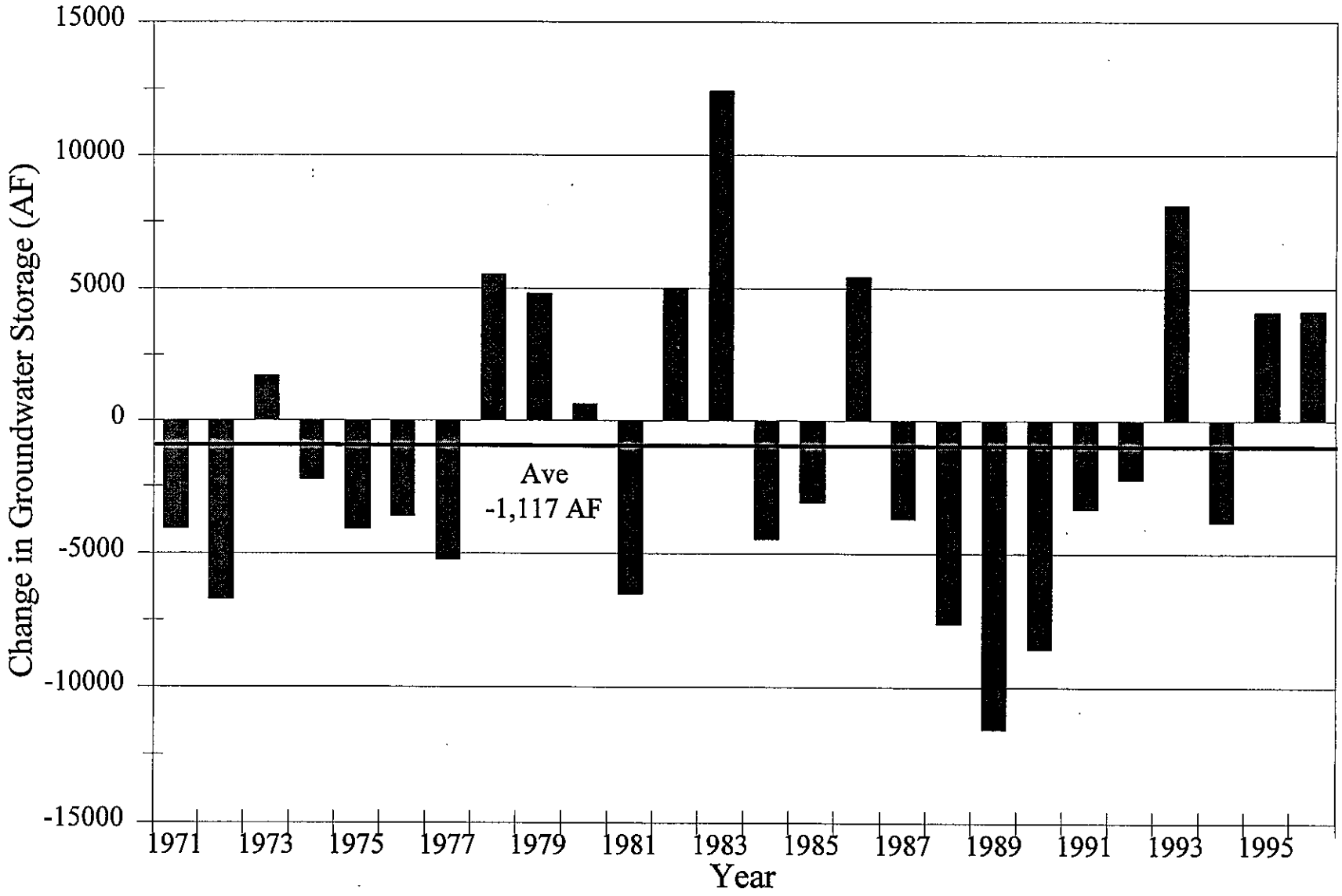


Figure 9
Change in Groundwater Storage
1971 - 1996



groundwater table. These depressions cause groundwater to flow from adjacent areas, influencing local groundwater movement.

3. Water Balance

The water balance for GFWD is intended to show how water is used in the district. It is not a indication of the overdraft in the district. The overdraft in the district is 1,117 AF per year as indicated by the change in storage. The values in Table 2 are the best estimates possible with the data available.

A. Inflow

i. Surface Water

The surface water available to GFWD is a feast or famine situation. This makes conjunctive use a critical element of GFWD's groundwater management. They currently have two contracts for surface water. The first is through the USBR for 14,000 AF of Class II water from the San Joaquin River. The second is a contract with MID for spill water in Cottonwood Creek. These inflows have averaged 14,801 AF. Figure 10 shows the annual surface water deliveries from 1957 through 1996.

ii. Effective Precipitation

Effective precipitation provides an annual average of 3,929 AF within GFWD. This provides about 22 percent of the average water demand. Figure 11 shows the annual effective precipitation from 1957 through 1996.

Table 2

Water Balance

Year	Crop ET AF	Surface Water AF	Effective Precipitation AF	Change in Groundwater Storage AF	*Subsurface Inflow AF
1971	17,712	4,090	2,373	(4,064)	(15,313)
1972	17,765	1,118	2,654	(6,701)	(20,694)
1973	17,818	9,592	4,930	1,708	(1,588)
1974	17,872	6,597	3,055	(2,270)	(10,490)
1975	18,087	10,441	2,446	(4,085)	(9,285)
1976	18,302	540	3,253	(3,588)	(18,097)
1977	18,517	209	2,487	(5,253)	(21,074)
1978	18,732	19,399	7,209	5,534	13,410
1979	18,947	17,243	4,067	4,820	7,183
1980	19,163	23,082	3,184	627	7,730
1981	19,378	2,638	3,935	(6,485)	(19,290)
1982	18,941	31,788	5,692	5,017	23,556
1983	18,504	4,102	7,490	12,438	5,526
1984	18,067	31,415	2,706	(4,494)	11,560
1985	17,629	5,511	2,716	(3,134)	(12,536)
1986	17,192	79,466	2,990	5,433	70,697
1987	16,755	1,216	3,804	(3,712)	(15,447)
1988	16,859	663	2,660	(7,647)	(21,183)
1989	16,963	646	2,023	(11,592)	(25,886)
1990	17,067	426	3,062	(8,602)	(22,181)
1991	17,172	2,472	3,606	(3,333)	(14,427)
1992	17,276	660	4,098	(2,243)	(14,761)
1993	17,380	46,332	5,065	8,133	42,150
1994	17,484	189	4,223	(3,846)	(16,918)
1995	17,588	46,530	5,910	4,116	38,968
1996	17,588	38,470	6,506	4,170	31,558
Sum	464,758	384,835	102,144	(29,053)	(6,832)
Min	16,755	189	2,023	(11,592)	(25,886)
Max	19,378	79,466	7,490	12,438	70,697
Avg	17,875	14,801	3,929	(1,117)	(263)

* Subsurface Inflow is a calculated value. () indicate a loss to GFWD

Figure 10
Surface Water Supply
1957 - 1996

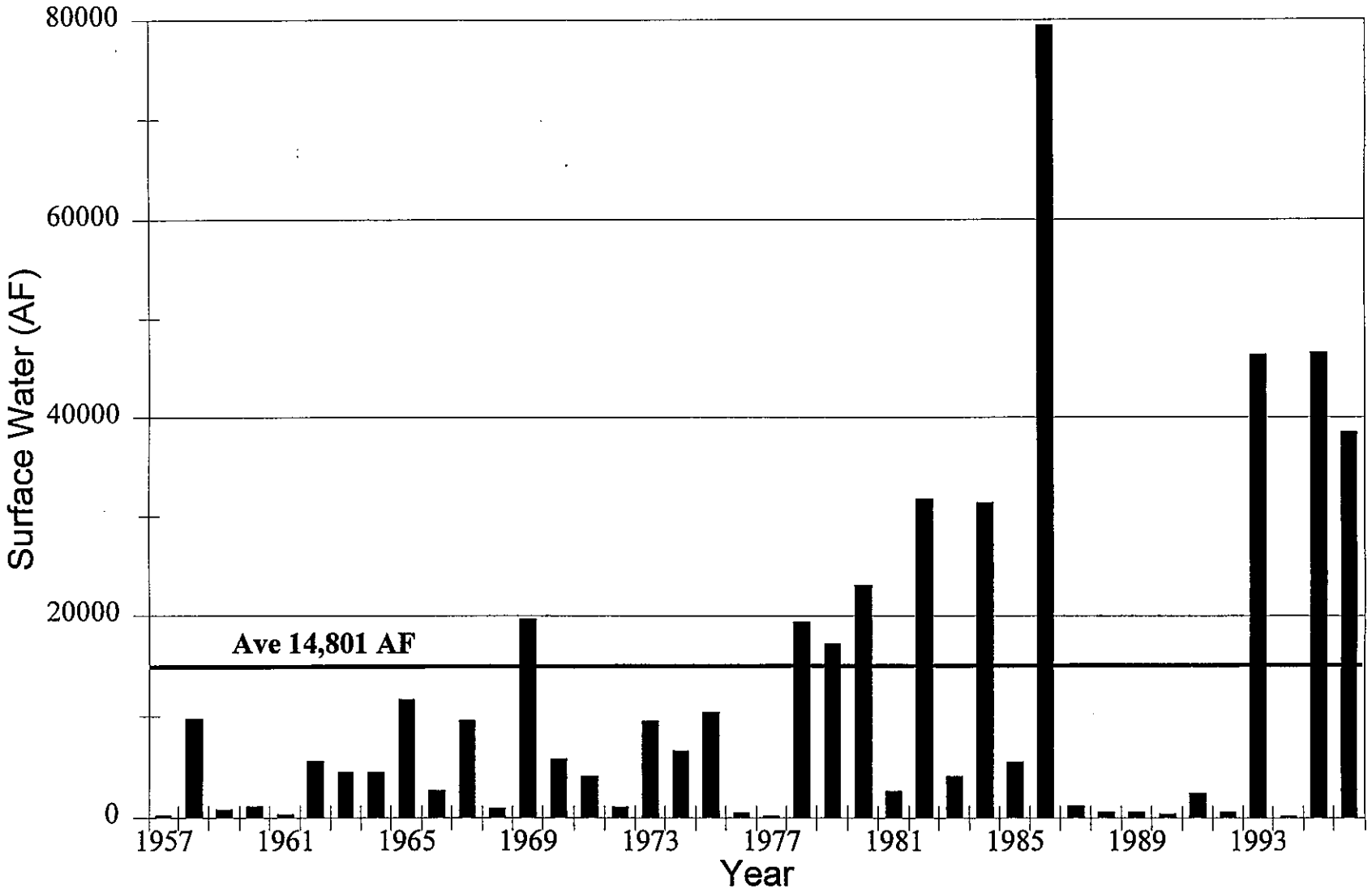
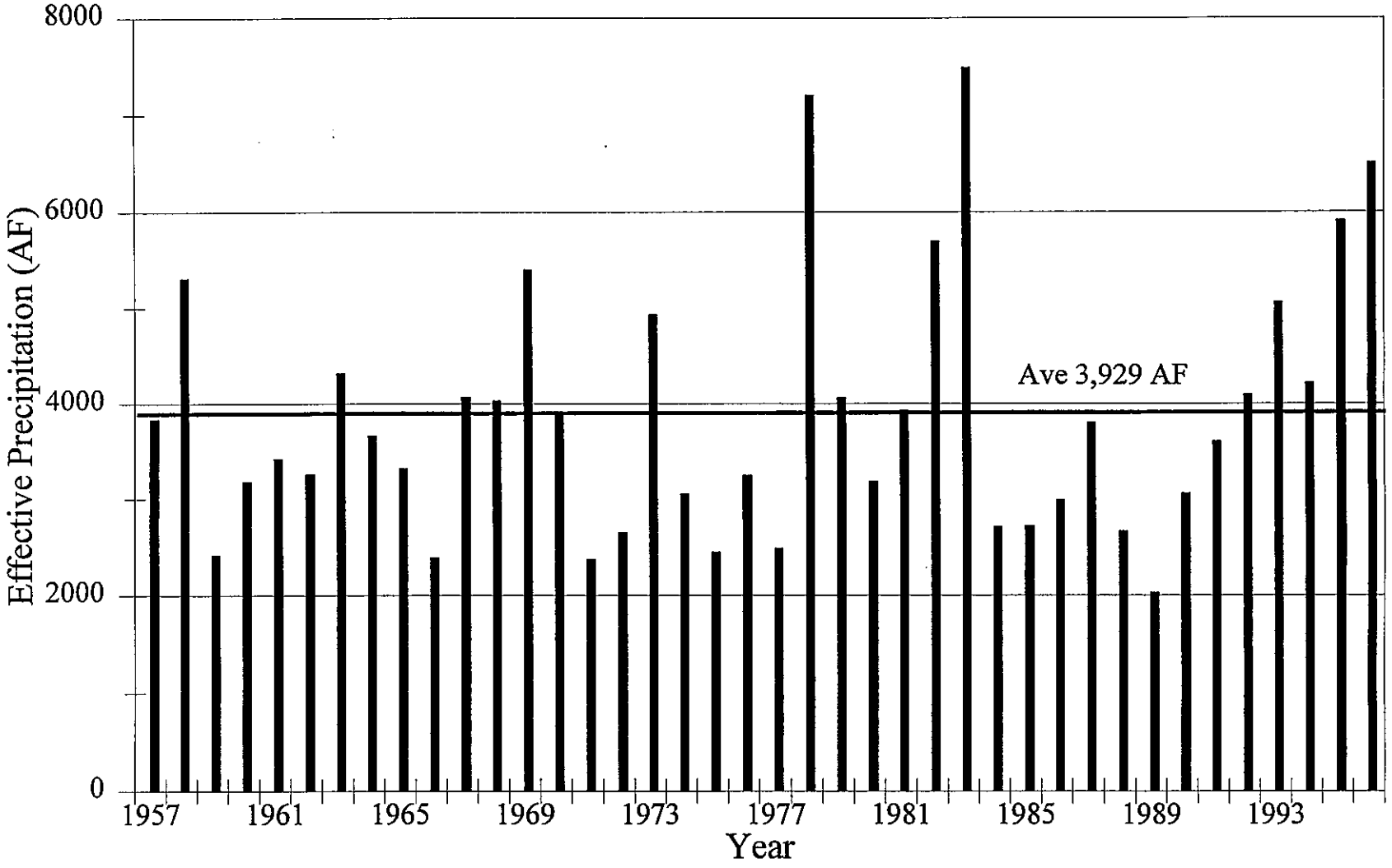


Figure 11
Effective Precipitation
1957 - 1996



B. Outflow

i. Evapotranspiration

Evapotranspiration is the method by which water is lost to the atmosphere by transpiration of a plant and evaporation from the soil surface in the vicinity of the plant. ET is the only significant component of water consumption in GFWD, peaking at 19,378 AF in 1981. The average ET demand for GFWD is 17,875 AF for the period between 1957 and 1996.

C. Changes in Storage

The average annual storage change for GFWD during the period from 1971 through 1996 is an overdraft of 1,117 AF, about eight percent of the average annual water demand. The change in storage varied from a decrease (overdraft) of 11,592 AF (1989) to a recharge of 12,438 AF (1983).

D. Estimated Subsurface Inflow

Data is not available to calculate the subsurface inflow into or out of GFWD. The subsurface inflow is calculated as the last unknown in our water balance. The sum of the five components: crop ET, effective precipitation, change in groundwater storage, surface water, and subsurface inflow must balance. We have calculated the inflows (effective precipitation, surface water deliveries, change in storage), and outflows (crop ET). The balance is the subsurface inflow. For the 26 year period from 1971 through 1996, the calculated annual subsurface flow averaged 263 AF out of the district.

IV. PLAN ITEMS

A successful groundwater management program does not have to include all plan items, but it is important that all items be specified and discussed in the event that they must be used. If funding is required for implementation of a plan item, an election shall be held with the majority of the votes determining if the proposition passes or fails. This list is not intended to be an exhaustive list and can be amended in the future as necessary.

In addition GFWD is a small district. The groundwater management of adjacent districts has a dramatic impact on the groundwater conditions within GFWD. It will be of the upmost importance to maintain a coordinated effort with neighboring districts. AB 3030 requires annual coordination meetings with other AB 3030 plan managers within the same groundwater basin.

1. Control of Saline Water Intrusion

There are no known occurrences of saline water intrusion within GFWD. With the establishment of a monitoring program, any intrusion can be identified. If an intrusion is identified, then at that time a plan will be developed to deal with the problem.

2. Identification and Management of Wellhead Protection and Recharge Areas

There are currently no municipal drinking water systems in GFWD, however, residents pump their drinking water from individually owned wells. Issues of wellhead protection for GFWD should be adequately covered by current county, state, and federal laws and regulations. If inadequacies are found, GFWD will work to cooperate with the appropriate agency in correcting the deficiency.

3. Regulation of the Migration of Contaminated Groundwater

GFWD's intent is not to take the responsibilities of any regulatory agency such as the State Water Resources Control Board (SWRCB) or U.S. Environmental Protection Agency. GFWD will however cooperate with the regulatory agencies to aid in maintaining the best practical quality water supply.

4. Administration of a Well Abandonment and Destruction Program

Wells that are improperly abandoned could lead to inappropriate materials contaminating the groundwater. Also, improperly abandoned wells can lead to interaquifer mixing.

The responsibility for administration and enforcement of a well abandonment and destruction program will be left with Madera County. The county has a program in place similar to the program explained in DWR bulletins 74-81 and 74-90.

5. Mitigation of Conditions of Overdraft

Reducing the ET requirements of the area by fallowing land or taking land out of production would definitely reduce groundwater pumping. Doing so is controversial and this type of program would be voluntary. Also, some analysis would need to be conducted to determine the impact that land fallowing, retirement, crop pattern changes or limiting pump extractions would have on the economy, both directly and with multiplier effects taken into consideration. The goal of this plan is to effectively manage groundwater with the smallest impact to current farming practices.

A. Land Fallowing

A certain number of acres could be fallowed (i.e. not planted or irrigated) each year. For example, assuming an average water use per acre of 3.0 AF, overdraft could be reduced by 300 AF by fallowing 100 acres. Participation in this type of program would be voluntary. A method of compensation would be developed for this type of action.

B. Change to Lower Water-use Crop

Water intensive crops such as alfalfa (48 inches/year), almonds (38 inches/year) or stone fruit (38 inches/year) could gradually be replaced by crops using less water, such as vineyards (for raisins), grains, and vegetables.

C. Land Retirement

Another option for reducing the overall ET of the area is to permanently take some land out of production. Growers volunteering to retire some or all of their acreage would be compensated through a plan that remains to be developed.

D. Limiting Pump Extractions

It is highly unlikely that groundwater "management" would come down to this. It is to prevent state or federal actions such as this that GFWD is preparing a local plan. Any pumping restrictions would be the last resort in preventing further overdraft and would have to be approved by a majority vote. Pumping restrictions would, however, definitely restrict groundwater use and could prevent overdraft.

6. Replenishment of Extracted Groundwater

Currently GFWD uses its distribution system as a recharge facility. The development of additional replenishment facilities would require significant capital and resources. Any replenishment project for GFWD would require three decisions, where to get supplemental water, how to use the supplemental water, and how to distribute the water. Due to the aforementioned questions, any replenishment program would require feasibility studies, design and construction prior to implementation. Following are some possibilities to be investigated.

A. Potential Water Sources

i. Cottonwood Creek

If the additional Cottonwood Creek water contract is obtained it will have a big impact on the future decision making for GFWD. This contract could bring the district into a balanced groundwater situation.

ii. San Joaquin River Flood Waters

It is possible that San Joaquin River flood waters could be obtained and recharged.

iii. Other Flood Waters

Another possibility is to obtain flood waters from other sources throughout California, municipal runoff or local small watersheds and use them for groundwater recharge.

iv. Imported Water

Surface water could be imported from outside GFWD and used for irrigation instead of pumping.

v. Reclaimed Water

Treated wastewater could be obtained from municipalities and used for recharge.

vi. Water Banking

Agreements could be made with other entities for the storage of groundwater in the available groundwater storage space of GFWD. The benefit to GFWD is that a minimum balance could be required before the recharging agency can remove anything, and they can only withdraw a predefined fraction of what they deposit, two-thirds for example.

B. Use of Additional Water

Basically, two options exist for the use of additional water: recharging it directly using percolation basins, or irrigating with it.

i. Recharge Basins

As previously mentioned, any other water source could be used to fill recharge basins and directly recharge the groundwater.

ii. Irrigation Deliveries (In-Lieu Recharge)

Any additional water obtained by GFWD could be used directly for irrigation water, reducing the amount of pumping. This is known as "in-lieu" or indirect recharge, since the water that would have been pumped to meet irrigation needs is effectively recharged as it stays in the ground.

7. Monitoring Groundwater Levels and Quality

GFWD plans to begin a program of groundwater monitoring for quantity and quality as soon as possible. This program will supplement the depth to groundwater monitoring that is done by the USBR and MID ensuring accurate assessments of the changes in groundwater storage. It is desirable to have a monitoring well about every two square miles. This would require the addition of about four monitored wells within GFWD. Sporadic water quality monitoring has taken place in the past but no routine monitoring program has been established. It is important to begin such a program to establish whether or not the water supply for this area is in a process of slow degradation. The test should be a general agricultural water quality test. The data obtained from the water quality tests should be compared to the 1970 USGS report to determine if any changes groundwater quality have occurred.

8. Facilitating Conjunctive Use

GFWD manages its resources with a system of conjunctive use. The district uses their surface water allotment for in-lieu recharge during the growing season. They are also able to use Gravelly Ford Canal to recharge available flood waters when there are no irrigation demands. This is the backbone of GFWD's groundwater management.

9. Well Construction Policies

Madera County currently regulates well construction policies in the county. These duties will be retained and administered by the county under this plan.

10. Construction and Operation of Groundwater Management Facilities

As implementation of the groundwater management plan progresses the design and construction of projects will be necessary. These processes will include conforming to all necessary environmental laws (CEQA) and public finance requirements. Funding for these types of projects would include a public vote and a method of equitable payment. Prior to these phases, feasibility studies would be completed and presented to GFWD.

11. Relationships with State and Federal Regulatory Agencies

The development of relationships with state and federal regulatory agencies will be an important part of an ongoing groundwater management plan. For starters, this plan will be submitted to DWR. The water level and quality monitoring may also be reported to them on a regular basis.

12. Land Use Plans

A program will be implemented for review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination and depletion.

V. RECOMMENDED GROUNDWATER MANAGEMENT PROGRAM

1. Program

GFWD is recommending the immediate implementation of the following items of the groundwater management plan into a groundwater management program:

- Actively pursue Cottonwood Creek Water Contract.

- Develop relationships with regulatory agencies and other groundwater management agencies within the Madera Basin.

- Monitoring and reporting of groundwater levels and quality.

- Establishment of an education/information program on groundwater including annual estimates of overdraft and safe yield.

- Begin investigations and feasibility studies of other options listed in plan beginning with replenishment of extracted groundwater.

2. Fees

As the level of effort in the management programs increase to design and construction the determination of who will pay and how much will be determined at that time. If general assessments are required and are outside the current powers of the districts, but within the powers of AB 3030 it may be necessary to hold public elections for the approval of groundwater management assessments.

3. Time Lines

Upon adoption of the groundwater management plan the following time line will be put into place:

- Develop relationships with other agencies immediately.
- Begin educational efforts within 6 months.
- Begin monitoring programs within one year.
- Begin initial feasibility studies within two years.
- Complete recharge feasibility studies within 5 years.

4. No Action

If no action is taken towards active groundwater management for GFWD it is anticipated that the following results will occur:

A. Water Table Continues to Fall

As the groundwater table continues to fall it may become uneconomical to grow certain crops. As the groundwater levels drop the pumping costs will rise. Additionally a falling water table may lead to the lowering of pumps, developing newer and deeper wells, land relevelling due to land subsidence, etc.

B. Adjudication

It's quite possible that if nothing is done to improve the groundwater situation that another agency will intervene to limit pumping to the basin's safe yield through adjudication.

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GLOSSARY OF TERMS

Note: the definitions presented are not all-inclusive but are presented for the benefit of the reader of this report. The terms included may have other broader definitions that do not apply to this report and are not presented here.

Active Recharge-- see Recharge, Active

Acre-Foot -- A unit of water volume equal to 43,560 cubic feet or approximately 325,800 gallons.

Alluvial Fan-- A gradually sloping mass of sands and clays which are deposited by slow moving water entering a plane.

Aquifer-- A ground-bearing formation that is sufficiently permeable to transmit and yield water in usable quantities; usually composed of gravel, sand, or other course-textured particles.

Confined Aquifer-- A formation in which the groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations. A confined aquifer is usually subject to pressure greater than atmospheric.

Conjunctive Use-- The planned joint use of surface and groundwater to improve the reliability, economic and firm yield of the total water resource.

Crop Water Demand-- Estimated evapotranspiration of a field or region.

Drawdown-- The distance between the static water level and the pumping water level in a well. It is a measure of the force required to drive water into a well.

Effective Rainfall-- The amount of rain that can actually be used by a crop to meet evapotranspiration requirements.

Evapotranspiration (ET)-- The method by which water is lost to the atmosphere by transpiration of a plant and evaporation from the soil surface in the vicinity of the plant.

Groundwater (as defined by AB 3030)-- All water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water.

Groundwater Basin-- Any basin defined in DWR Bulletin 118-80.

Groundwater Management Plan-- A document that describes activities intended to be investigated to stabilize and/or improve groundwater conditions within a defined area.

Groundwater Management Program-- Coordinated and on-going activities undertaken for the purpose of implementing the Groundwater Management Plan.

Hydraulic Conductivity-- The measure of how effectively groundwater moves through a porous media (soil or aquifer), expressed as feet per day.

In-Lieu Recharge-- see Recharge, In-Lieu

Overdraft--The volume of water removed from an aquifer or similar holding basin that is greater than the amount entering that aquifer or holding basin..

Passive Recharge-- see Recharge, Passive

Permanent Crops--Agricultural plants such as grape vineyards and fruit or nut trees that are not replanted on an annual or bi-annual basis.

Plan-- see Groundwater Management Plan

Program--see Groundwater Management Program

Root Zone-- The strata of soil immediately below the ground surface that contains plant roots; the portion of soil that can hold water for use by crops.

Recharge, Active-- Any of various means of intentionally causing surface water to percolate into the groundwater table in order to increase the volume of water stored in the groundwater table, such as percolation ponds or basins, flood storage basins, intentional over-irrigation, routing flood and irrigation water through unlined canals, etc.

Recharge, In-Lieu-- Intentionally using water sources besides groundwater (such as flood water, surface water, or imported water) in order to avoid making extractions from the groundwater table.

Recharge, Passive-- Any of various means in which surface water, through no effort of man, percolates into the groundwater table such as seepage from rivers, lakes, canals, and rainwater; lateral flow

Seepage-- The process of water flowing through soil pore spaces, primarily due to the force of gravity.

Specific Yield--The ratio of the volume of water that a given aquifer will yield by gravity to that aquifer's volume, usually expressed as a percent.

Static Water Level-- The level of water in a well that is not being affected by withdrawal of groundwater.

Subsurface Flow-- The flow of groundwater through a porous media (aquifer) that exits a defined boundary.

Unconfined Aquifer-- An aquifer that is not restricted from above by an impermeable layer or other formation and in which the water contained is under the pressure exerted by the overlying atmosphere and water. The water table in an unconfined aquifer will fluctuate with extraction and recharge.

Vadose Zone– An unsaturated portion of the soil between the ground surface and the water table.

Water Balance-- A method of accounting for the quantity of water that enters, exits and is stored within a defined boundary.

Water Banking-- A technique by which an entity, such as a water district, stores water in the groundwater storage space of another entity, to be extracted in the future.

Water Table--The surface between the vadose zone and the groundwater; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

Well Field-- A group of wells used to pump groundwater for delivery to users.

Well Yield-- The volume of water per unit of time discharged from a well, either by pumping or free flow. It is commonly measured as a pumping rate in gallons per minute per foot of drawdown.

APPENDIX A

Resolution of Intention

GRAVELLY FORD WATER DISTRICT

Notice is hereby given that the Board of Directors of the Gravelly Ford Water District held a public hearing on August 11, 1997 to consider adoption of a Resolution of Intention to draft a groundwater management plan for Gravelly Ford Water District. At the conclusion of the hearing, the following resolution was adopted:

BEFORE THE BOARD OF DIRECTORS
OF THE GRAVELLY FORD WATER DISTRICT
MADERA COUNTY, CALIFORNIA
RESOLUTION OF INTENTION OF THE GRAVELLY FORD WATER DISTRICT TO DRAFT A GROUNDWATER MANAGEMENT PLAN

WHEREAS, all the lands which are contained within the boundaries of the legal description of the Gravelly Ford Water District as of August 11th, 1997, including Sections 21, 22, 26, 27, 32, 33, 34, 35 and a portion of Section 23 in Township 12 S, Range 16 E, MDB&M, and Sections 2, 3, 11, 12, and portions of Sections 1 and 10 in Township 13 S, Range 16 E, MDB&M; and

WHEREAS, it is in the best interest of the District and the landowners within the District to investigate and develop a plan for the long term management of the groundwater resources within the District in order to protect the availability of groundwater for continued use in future years; and

WHEREAS, the California State Legislature has authorized the District, and other local public entities, to develop and adopt groundwater management plans pursuant to Water Code sections 10750 et seq.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors intends to draft a plan for the management of groundwater resources lying beneath Gravelly Ford Water District. The process for the development of the draft groundwater management plan shall consider the relationship of groundwater resource availability and utilization within the Gravelly Ford Water District and adjacent areas. Such draft plan shall be acted upon within two (2) years from the date of this resolution, after further public hearing in accordance with the provisions of Section 10750, et seq., of the California Water Code.

THE ABOVE RESOLUTION was passed and adopted by the following vote of the Board of Directors of the Gravelly Ford Water District this 11th day of August, 1997.

AYES: Directors Keating, Andrew, Schafer, DaSilva
NOES: None
ABSENT: Basila

/s/James Keating
President

ATTEST:
/s/Timothy DaSilva
Secretary

BEFORE THE BOARD OF DIRECTORS
OF THE GRAVELLY FORD WATER DISTRICT
MADERA COUNTY, CALIFORNIA

RESOLUTION OF INTENTION OF THE GRAVELLY FORD WATER DISTRICT TO DRAFT A GROUNDWATER MANAGEMENT PLAN

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THE ABOVE RESOLUTION was passed and adopted by the following vote of the Board of Directors of the Gravelly Ford Water District this 11th day of August, 1997.

AYES: Directors Keating, Andrew, Schafer, DaSilva, Basila

NOES: None

NOES: None

James Keating
President

ATTEST:

Secretary