SUMMARY OF HYDROLOGIC CONDITIONS IN THE MOUNTAIN HOME AND CINDER CONE BUTTE AREAS

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INTRODUCTION

History

Irrigation development in the Mountain Home area began at the turn of the century with the construction of Long Tom and Mountain Home Reservoirs which were completed in 1906 (see Figure 1, "Site Location Map". From the early 1960's and into the 1970's, bench lands adjacent to the Snake River were developed by high lift pumping from the Snake River. Ground water development also began in the 1960's and continued into the 1980's. Due to declining ground water levels, the Cinder Cone Butte area was declared a Critical Ground Water Area (CGWA) on May 7, 1981. The Mountain Home Ground Water Management Area (GWMA) was designated on November 9, 1982. Since the 1960's and more extensively since the 1980's, numerous wells have been monitored by the United States Geological Survey (USGS) and the Idaho Department of Water Resources (IDWR).

Purpose and Scope

The purpose of this report was to compile information and data generated since the CGWA and GWMA were designated and to determine current hydrological conditions.

The scope of the study included a review of previous investigations, water level data, well drillers reports, land use maps, and other pertinent information. Four days were also spent in the field measuring ground water levels, meeting with some of the areas farmers, and reviewing data at the Agricultural Stabilization and Conservation Service (ASCS) office in Mountain Home.

Previous Investigations

Other investigations completed in the area include Ralston and Chapman (1968 and 1970), Young (1976), and Norton and Others (1982). All were water resource investigations and noted declining ground water levels. It was the 1982 report though, that focused directly on the management area and recommended management status.

The USGS in 1990 began an investigation concerning a ground water contaminant plume located at the Mountain Home Air Force Base. The study was discontinued when the Air Base chose to employ a private consulting firm. A data report was completed and published, but no interpretive report has been published. Trace amounts of chlorinated solvents were detected. These investigations provide an excellent data basis for examining ground water changes or

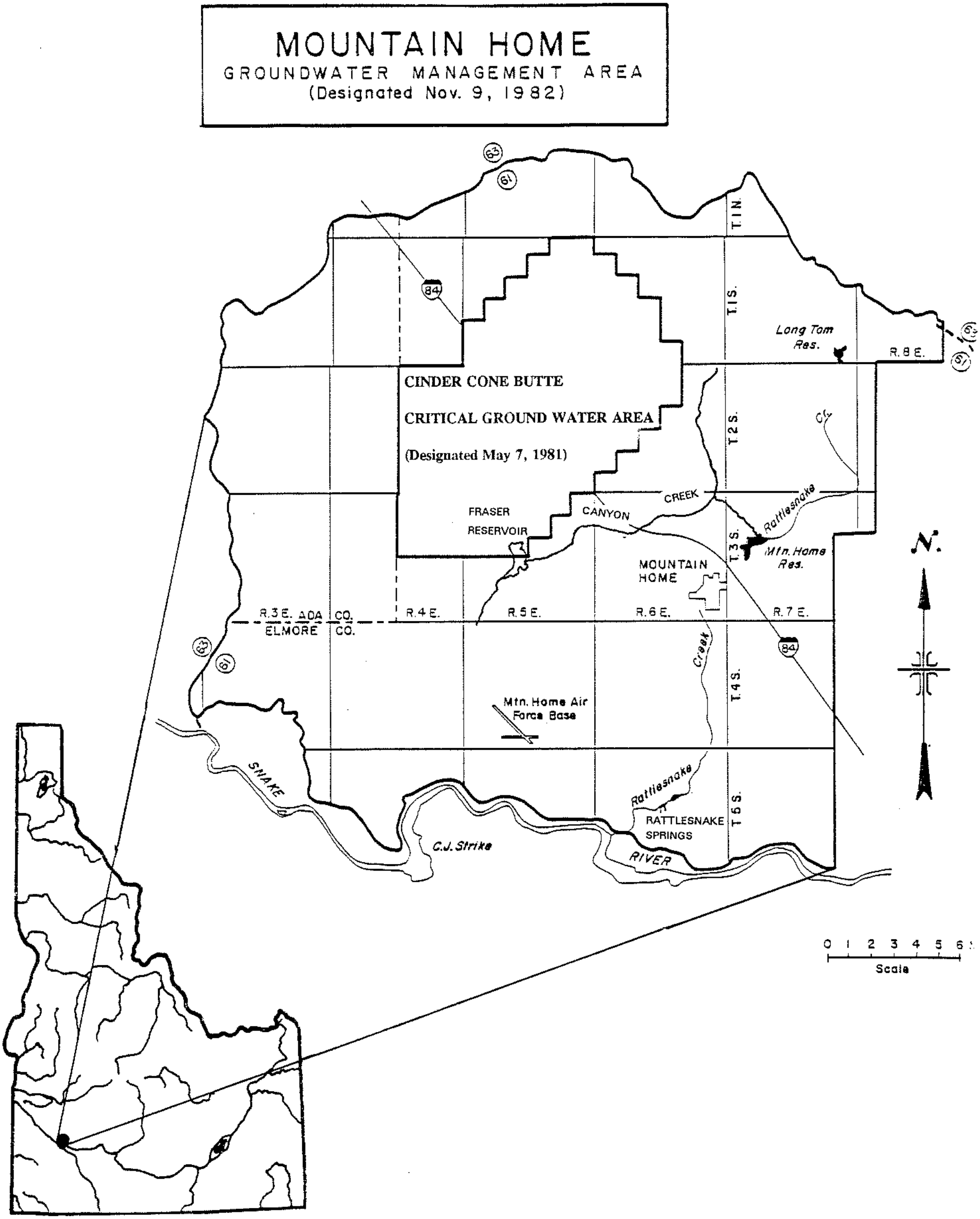


Figure 1. Site Location Map

trends and are frequently referred to in this report.

Site Description and Location

The Mountain Home GWMA is located in southwestern Idaho in Ada and Elmore counties (see Figure 1, previously mentioned). As shown, the Cinder Cone Butte CGWA lies within the Mountain Home GWMA.

Most of the area is a broad plateau sloping gently to the southwest. The northern boundary is the topographic divide in the Danskin Mountains while the southern boundary lies along the northern rim of the Snake River Canyon. The western boundary is a topographic divide which meets the canyon between Corder and Rabbit Creeks. The eastern boundary follows section lines north from the canyon to the Danskin Mountains.

Elevation varies from 2800 feet above mean sea level (MSL) near the southwest corner of the GWMA to 6694 feet above MSL in the Danskin Mountains. Precipitation varies from 9 inches on the plateau to 23 inches in the mountains. The climate is semi-arid with hot dry summers and cold winters.

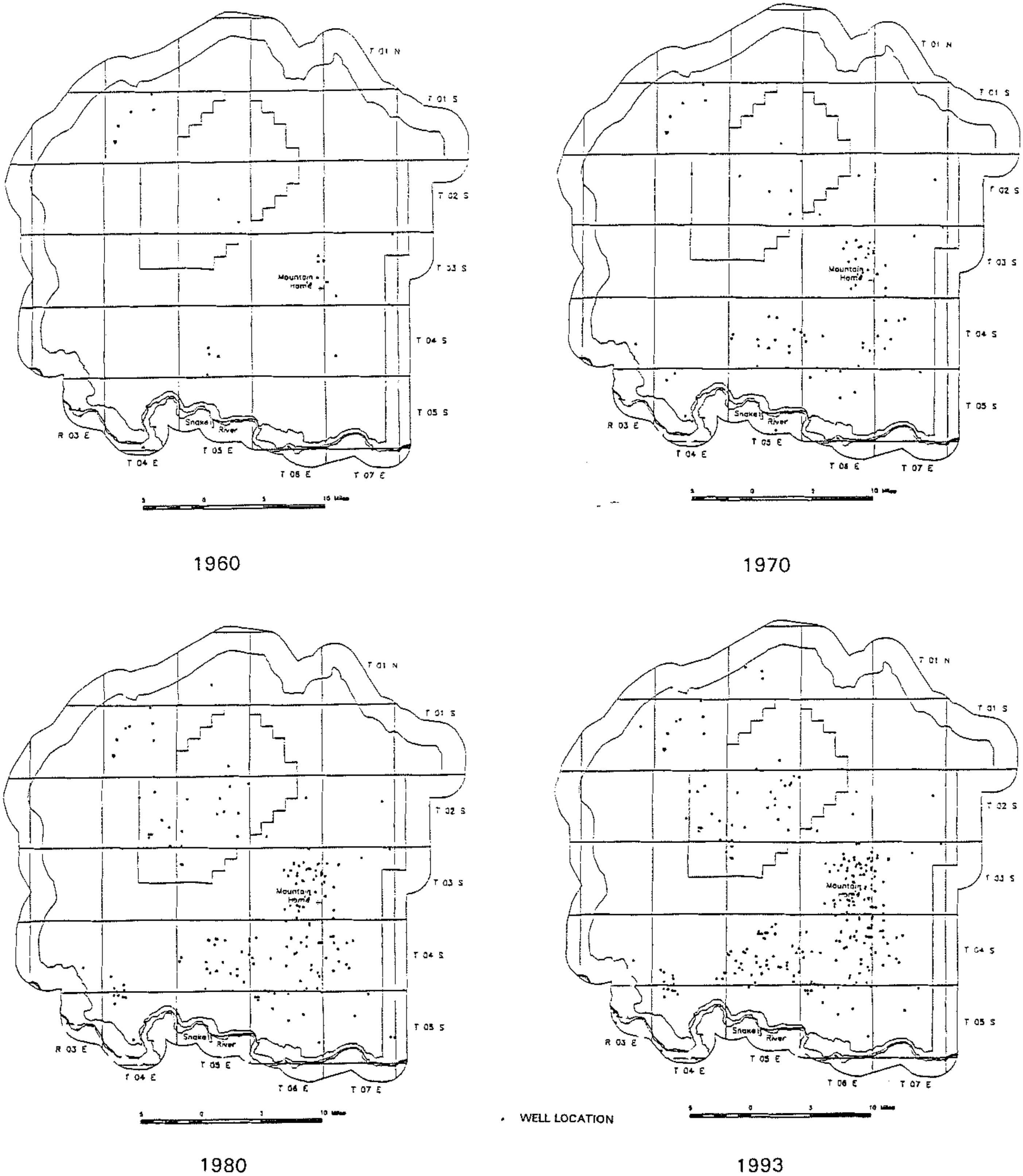
Agriculture and the Air Force Base are the primary industries. Ground water development for agriculture has primarily taken place in the southern and northwestern regions. Development for domestic use is primarily in the area in and surrounding Mountain Home. Figure 2, "Ground Water Development" indicates rates and locations of ground water development by the amount of wells as identified in the USGS and IDWR data bases.

Crops grown are potatoes, sugar beets, alfalfa, and minor amounts of wheat and barley. Potatoes and sugar beets are the primary cash crops. Potatoes can yield as much as 500 cwt. per acre with an average of 394 cwt. per acre for Elmore County. Sugar beets are grown on a contract basis only.

Precipitation Data

Figure 3, "Precipitation and Snow Course Data", presents data for precipitation in Mountain Home and snow at the Camas Creek Divide. As presented, the data for Mountain Home readily shows the recent drought, but no overall trend is seen. When the cumulative departure is taken for the same data though, a steady increase or rise is seen from the mid to late 1960's until approximately 1986 or when the recent drought began. Snow course data at the Camas Creek Divide shows the same trend.

Figure 4, "Stream Flow Data", presents stream flow data for Canyon Creek. Data was only available for the years 1985 to present. The recent drought is readily apparent.



SOURCE: IDWR DATA BASE FILE

USGS GROUND WATER SITE INVENTORY FILE

Figure 2. Ground Water Development

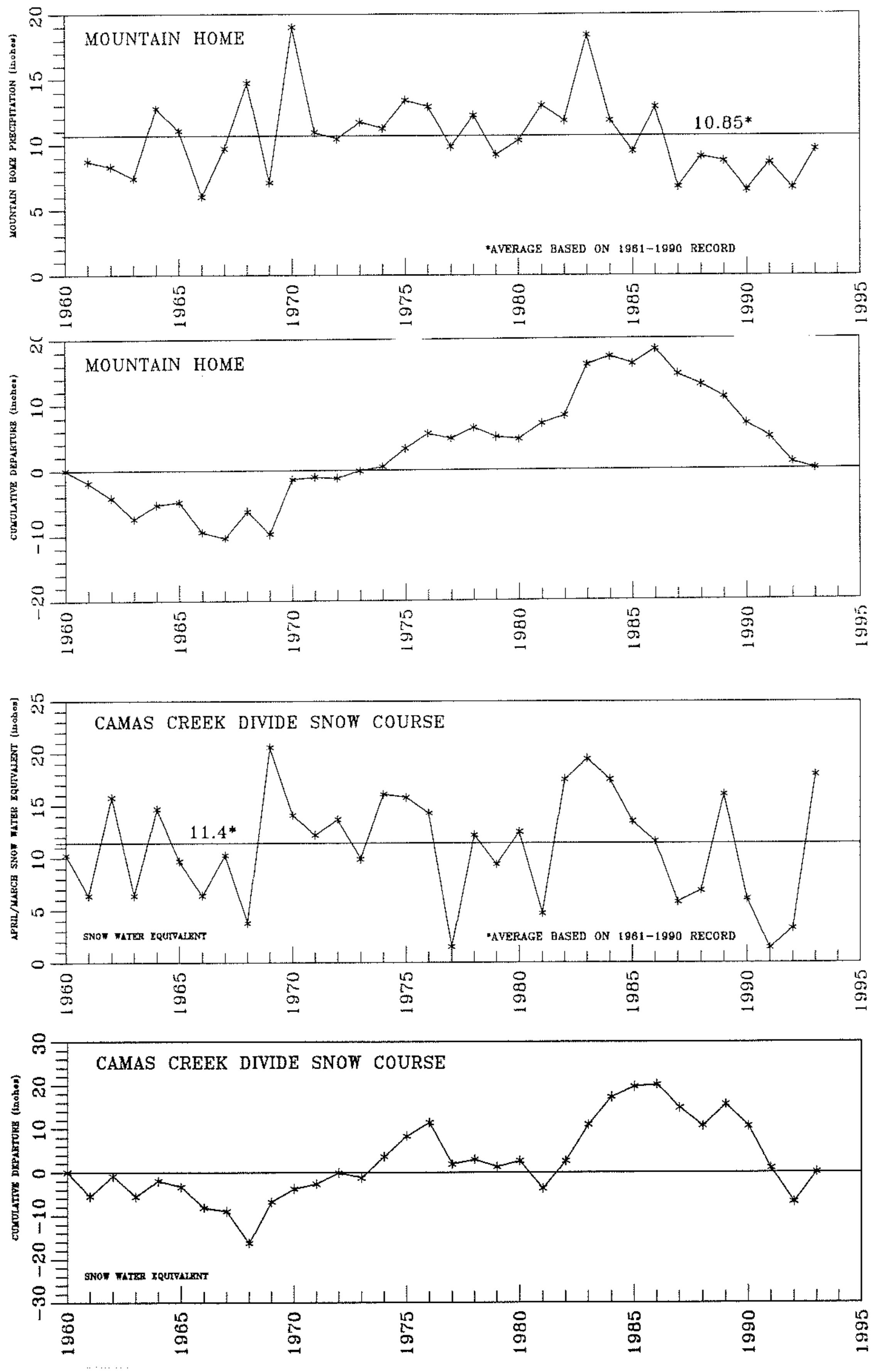


Figure 3. Precipitation and Snow Course Data

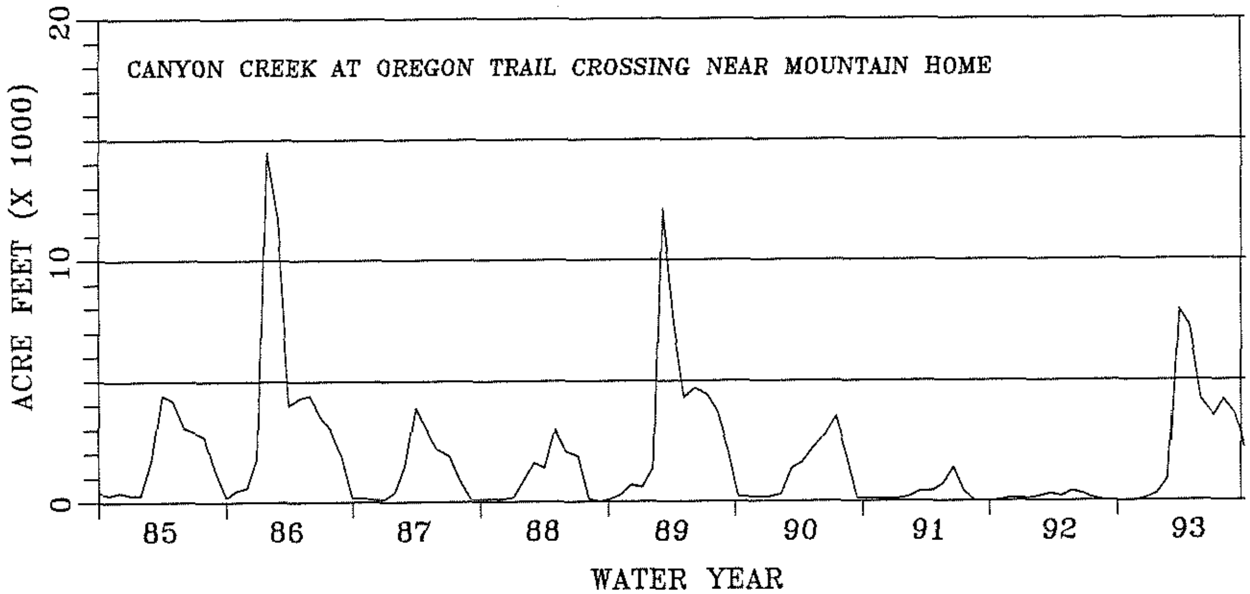


Figure 4. Stream Flow Data

HYDROGEOLOGIC REGIME

Geologic Framework

The following is a brief geologic description as summarized from Norton and Others, (1977) and Ralston and Chapman, (1968).

Figure 5, "Geologic Map", presents the surficial geology for the area. The major geologic units in the area are: 1) alluvium and younger terrace gravels, 2) the Snake River Group, 3) the Idaho Group, 4) the Idavada Volcanics, and 5) the Idaho Batholith. The alluvium and younger terrace gravels consist of unconsolidated clay, silt, sand, and gravels occurring beneath flood plains. Well yields of 2500 gallons per minute (gpm) have been reported, but due to thinness and irregularities of the beds, yields are usually considerably less.

The Snake River group consists of an olivine basalt with a thickness of less than 500 feet. Well yields range from 20 to 3100 gpm, but the basalt is above the water table in most of the area.

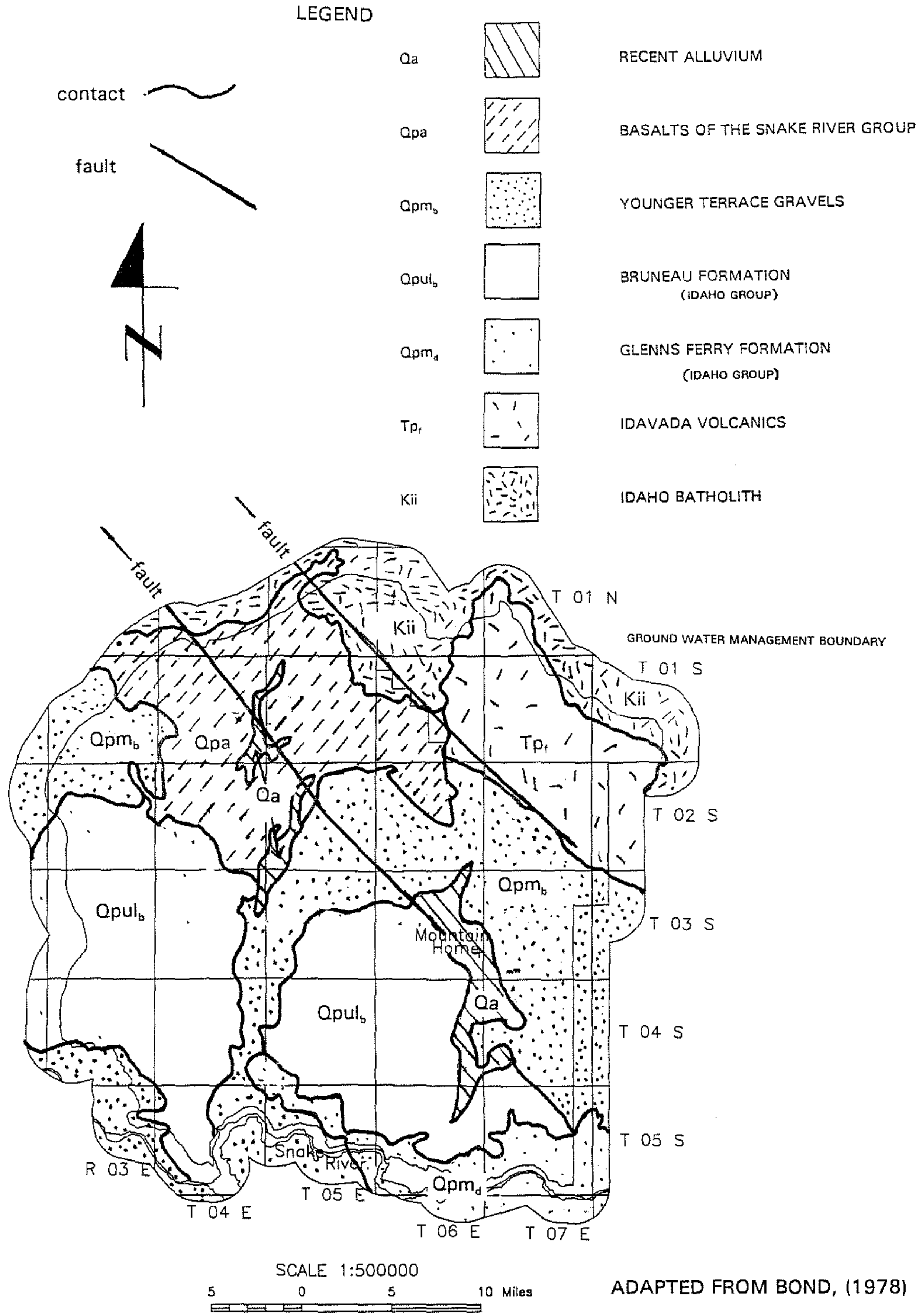
The Idaho Group consists of fluvial lake deposits, layers of ash, and basaltic lava flows. The Bruneau Formation and the Glenns Ferry Formation are also part of the Idaho Group and consists of fan deposits, consolidated detrital material, and an olivine basalt with a thickness of approximately 800 feet. Well Yields range from 10 to 3500 gpm with the basalt from the Bruneau Formation composing the principle aquifer in the area.

The Idavada Volcanics are a 2000 foot thick, layered, welded tuff, with variable well yields, while the Idaho Batholith is a quartz monzonite and/or granodiorite with generally low well yields.

Two Northwest trending faults pass through the northeast part of the area (Bond, 1978). One lies under or parallels Interstate 84 while the other lies approximately nine miles to the northwest. Both are considered normal with the downthrown block to the south and a dip of 70 to 80 degrees to the southwest (Ralston and Chapman, 1968).

Occurrence and Movement of Ground Water

A perched or shallow ground water system exists in the area surrounding the town of Mountain Home. It underlies approximately 38,000 acres as mapped by Young (1977). Depth to ground water in this system can vary from less than 10 feet to approximately 200



ADAPTED FROM BOND, (1978)

Figure 5. Geologic Map

feet. The aquifer consists mainly of Quaternary Alluvium, but basalts of the Snake River Group and Bruneau Formation can also contain water of the perched system.

Figure 6, "Perched System" presents elevation contours for the perched system from data generated in 1968, 1981, and 1990. As presented the contours have not changed to any large degree from 1968 to 1990. The slight deviations seen are most likely related to the different data sets used (ie, not all measurements came from the same wells and some data may reflect pumping levels). Therefore, some deviation between the three data sets would be expected. In any event, no significant change in flow direction or gradient has occurred from 1968 to 1990.

A deeper regional system underlies the perched system and is largely contained within basalts of the Bruneau Formation. Figure 7, "Regional System" presents elevation contours from data generated in 1990. The gradient appears to be much steeper to the northeast of the two northwest trending faults.

This could be explained several ways. The faults could be restricting flow or in essence creating a damming effect. It is also possible that the due to the offset created, more permeable formations were placed down gradient. In either case, faulting appears to be a factor.

Ralston and Chapman (1968) proposed that the flat gradient to the south and southwest was also do to a higher hydraulic conductivity and/or a damming of the aquifer near the Snake River canyon. They inferred from Malde (1963) that the top of the Glenns Ferry Formation adjacent to the Snake River was at 2625 feet with the overlying basalts of the Bruneau Formation from 2625 to 2925. Several of the Air Base wells, approximately five miles from the river, go as deep as 2400 feet without encountering what is believed to be the Glenns Ferry Formation. Therefore the formation could have a northward trend or slope creating a damming effect.

In any event, data are not sufficient to verify any of the proposed hypotheses. All that can be concluded is that ground water to the northeast, which is on the opposite side of a fault zone, appears to have a much steeper gradient.

Also as shown, in the area of T2 & 3S, R4 & 5E, a mounding or recharge zone is seen by the 2800 foot contour line. Norton and Others (1982) postulated that an east-west trending fault was restricting flow northward. Through communication with Clayton Colthorp, Water Master for the Mountain Home Irrigation District, it was learned that flood stage or excess flow from Canyon Creek is not diverted into Mountain Home Reservoir, but left to flow down its historic channel and through Frazer Reservoir. Therefore, the east-west fault may be restricting flow, but the cause of the

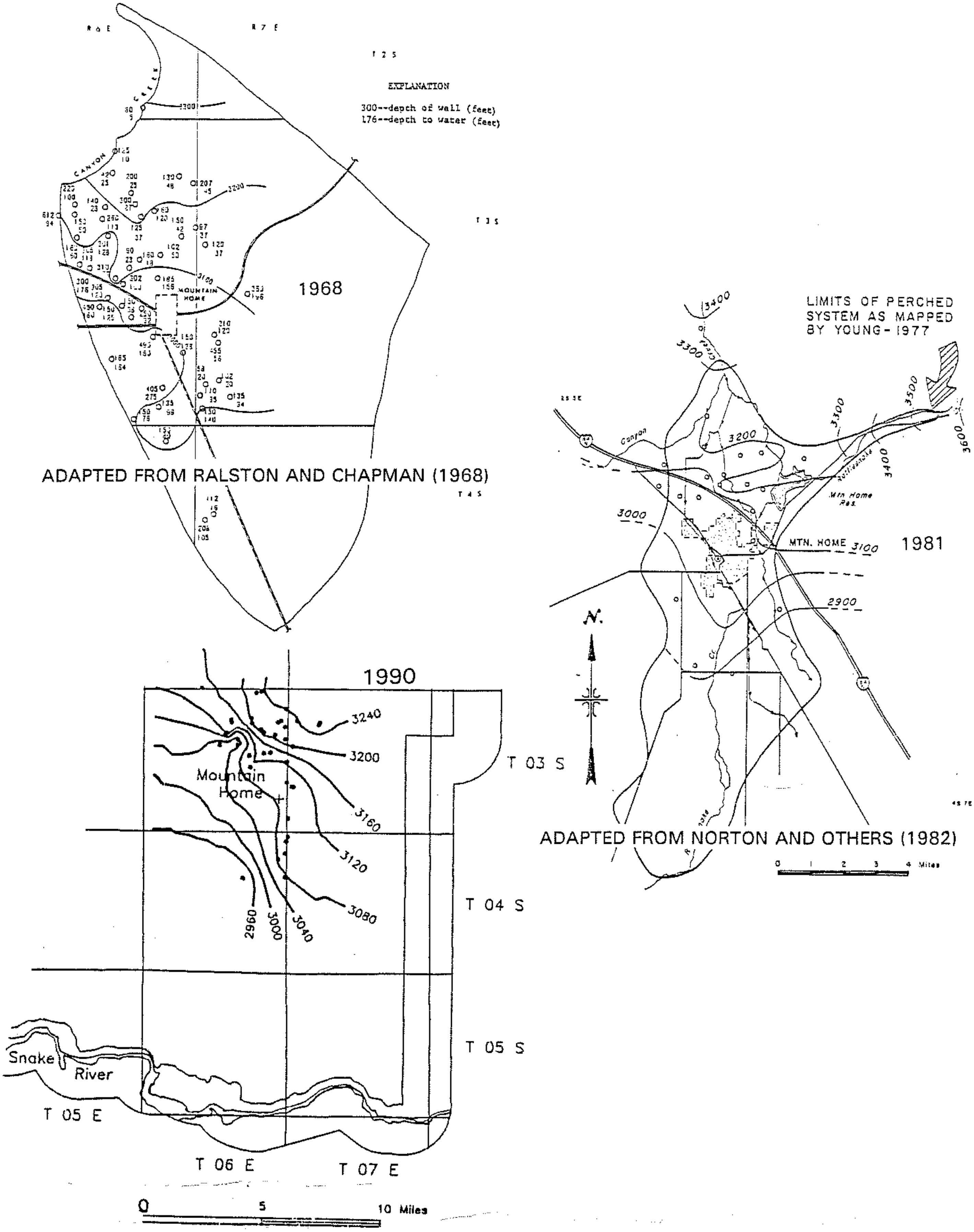


Figure 6. Perched System

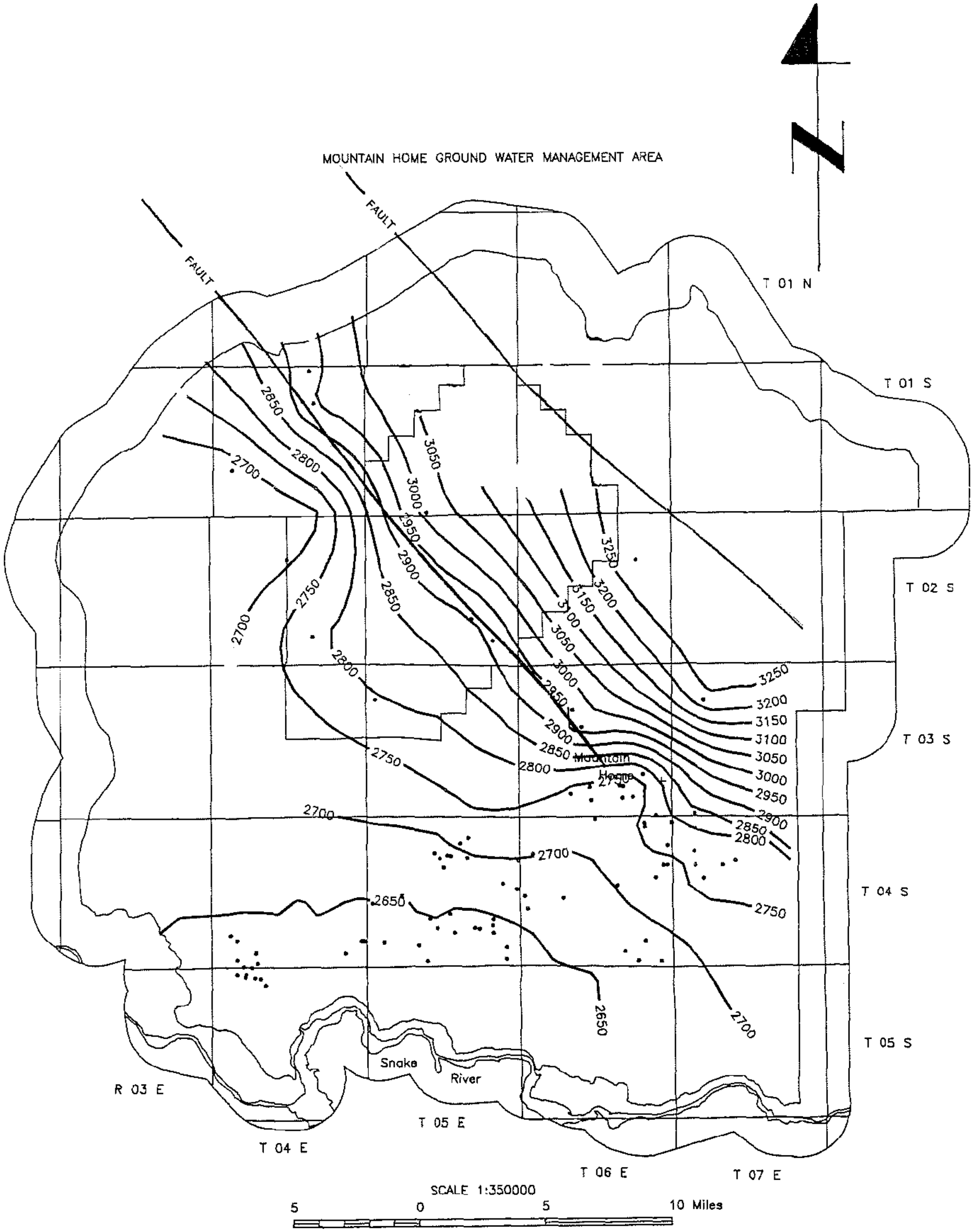


Figure 7. Regional System

mounding could be related to excess water from Canyon Creek not being diverted.

Gravity data suggests that there may be 10,000 feet of material above the basement complex (Hill, 1963). Therefore saturated conditions or other aquifers may exist at depth.

Recharge vs. Discharge

Perched System

Recharge to the perched system is from both Rattlesnake and Canyon Creeks (irrigation) and leakage from Mountain Home Reservoir. Natural discharge occurs mainly as unsaturated downward flow into the regional system and as spring flow at Rattlesnake Springs near the Snake River Canyon rim (Norton and Others, 1982). Since the downward flow is unsaturated, it is not affected by trends or pumpage in the regional system.

Figure 8, "Water Level Change: Perched System", presents water level changes in the perched system for the years 1976 to 1990 and the hydrographs from wells monitoring the system. As seen, declines have occurred, but can be held suspect. Three of the hydrographs presented, show how the water table can fluctuate from 10 to 30 feet, if not more, between dry and wet years. Therefore any water level change map can vary greatly from year to year. The one constructed by Norton and Others, (1982) was based on very short term data.

Therefore, declines in the perched system have occurred, but as to what degree is debatable. Three of the four hydrographs presented in Figure 4, suggest a relatively stable system that readily responds to wet and dry periods.

Regional System

Recharge to the regional system will occur mainly from downward flow from the perched system, precipitation on the uplands, and underflow from the north. Since no importation of water is taking place, a correlation should be seen between snow course or precipitation data and well hydrographs.

Figure 9, "Regional Hydrographs" presents hydrographs for 13 wells monitoring the regional system. These wells were chosen as being the most representative. All hydrographs cover the same time period and with the same vertical scale. Hydrographs #4 and #5 are also presented with an additional expanded vertical scale.

In the most northern part of the GWMA hydrographs (labeled #1, #2, and #3) show rising ground water levels of approximately 2 to 8

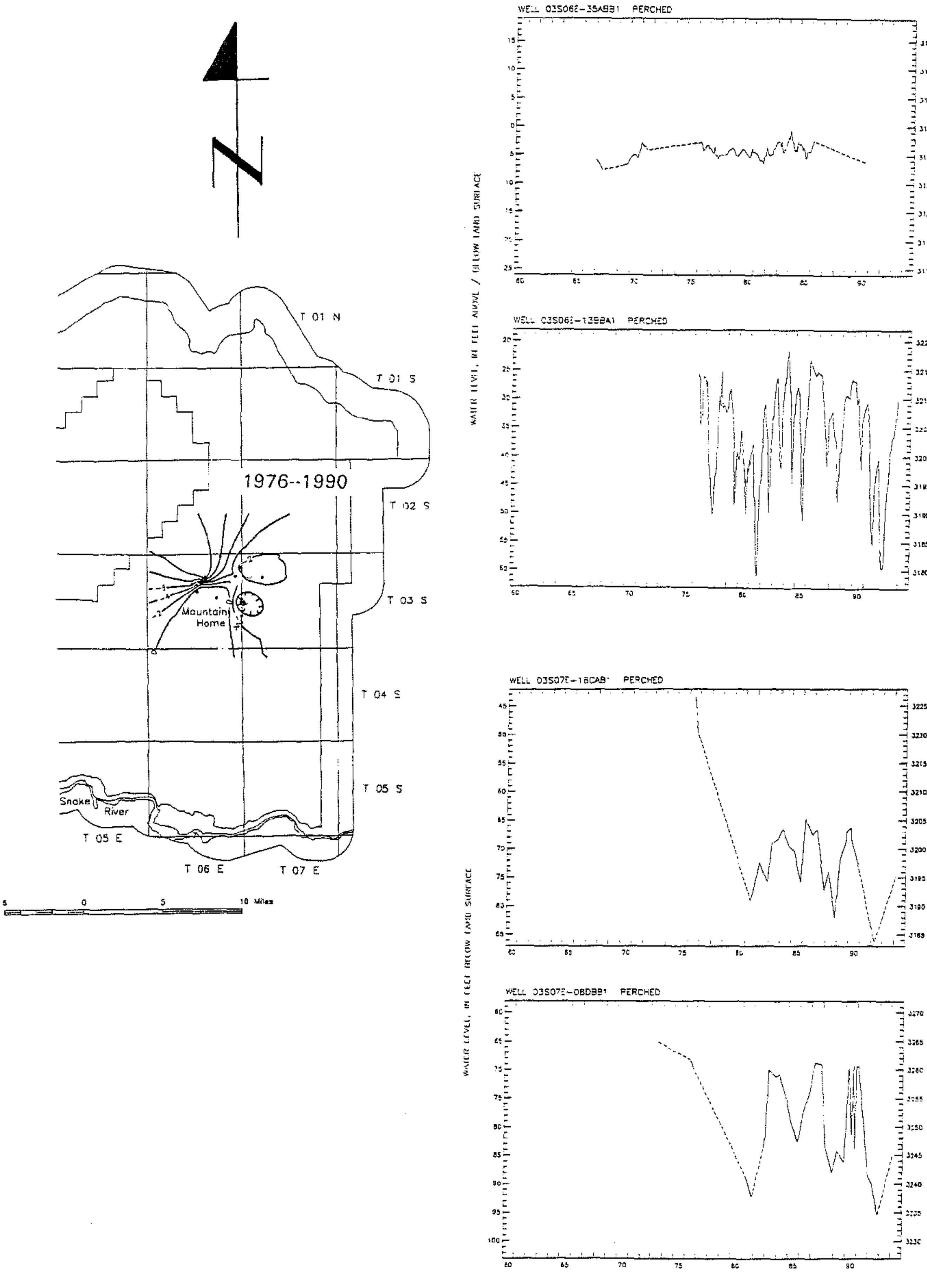


Figure 8. Water Level Change: Perched System

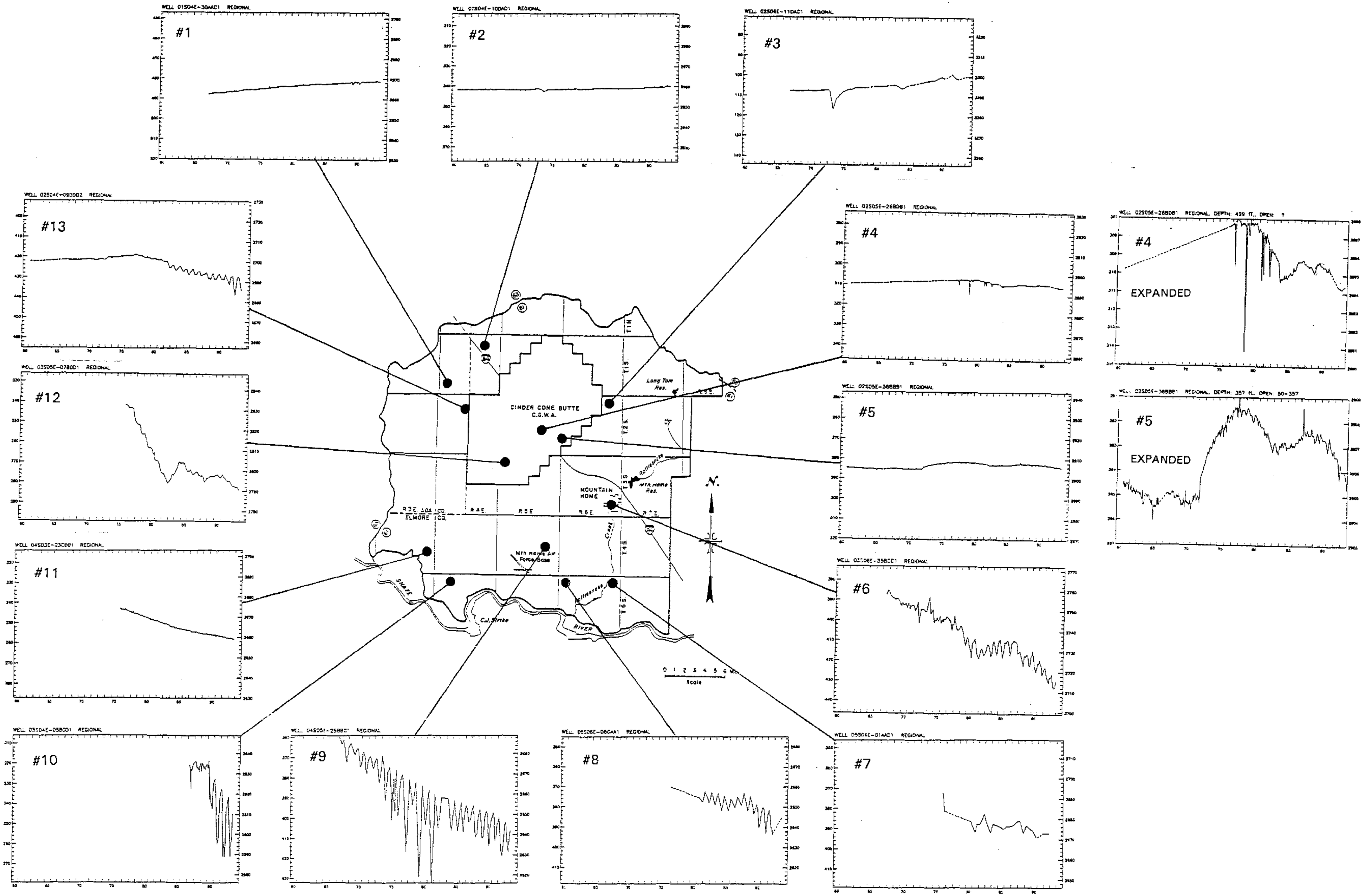


Figure 9. Regional Hydrographs

feet over the past 25 to 30 years. The 1987-92 drought did not interrupt the rise. The same general trend is seen in Figure 3, (previously mentioned) for cumulative departure with snow and precipitation data.

Hydrographs #4 and #5, located in the Cinder Cone Butte CGWA, but up gradient from development and adjacent to one of the faults, show rising and falling levels that correspond with climatic sequences. This could be associated with excess water from Canyon Creek being diverted.

Hydrographs for wells to the east, south, and southwest, which are down gradient from irrigation, all show falling levels. Rates of decline have moderated for some, (#7, 11, & 12), but there is no evidence that the overall system is nearing equilibrium.

Norton and Others, (1982) also stated that the decrease for 1973 in hydrograph #3 was due to pump testing for that particular year. The two or three year period for recovery is indicative of limited recharge.

A review of records at the Mountain Home ASCS office showed that approximately 11,000 acres of land once irrigated with ground water is now in the Conservation and Recovery Program (CRP) and is now out of production. This would amount to approximately 20,000 less acre feet per year in discharge. None of the hydrographs (ie water levels) have responded to this.

Figure 10, "Water Level Change Map: Regional System", presents level changes between from 1976 to 1990. Not enough data points (ie water level measurements) were available for a present change map.

In summary, underflow from the north is probably the major source of recharge. Only a few of the hydrographs show any response to wet and dry periods over the past 20 to 25 years. These few might be explained by diversions out of Canyon Creek or receiving recharge from the perched system. If direct precipitation was a factor, then well hydrographs should be responding to wet and dry years. Through attenuation, the recent drought is either being masked or due to a 'lag period', the effects are not yet seen in the hydrographs. This is supported by the rising trend in three of the northern well hydrographs.

CONCLUSIONS

All available information supports previous investigations. Discharge is exceeding recharge where development has taken place within the regional system. Equilibrium has not yet been achieved. Presently, the perched system appears to be stable. The present monitoring system is sufficient and should not be changed.

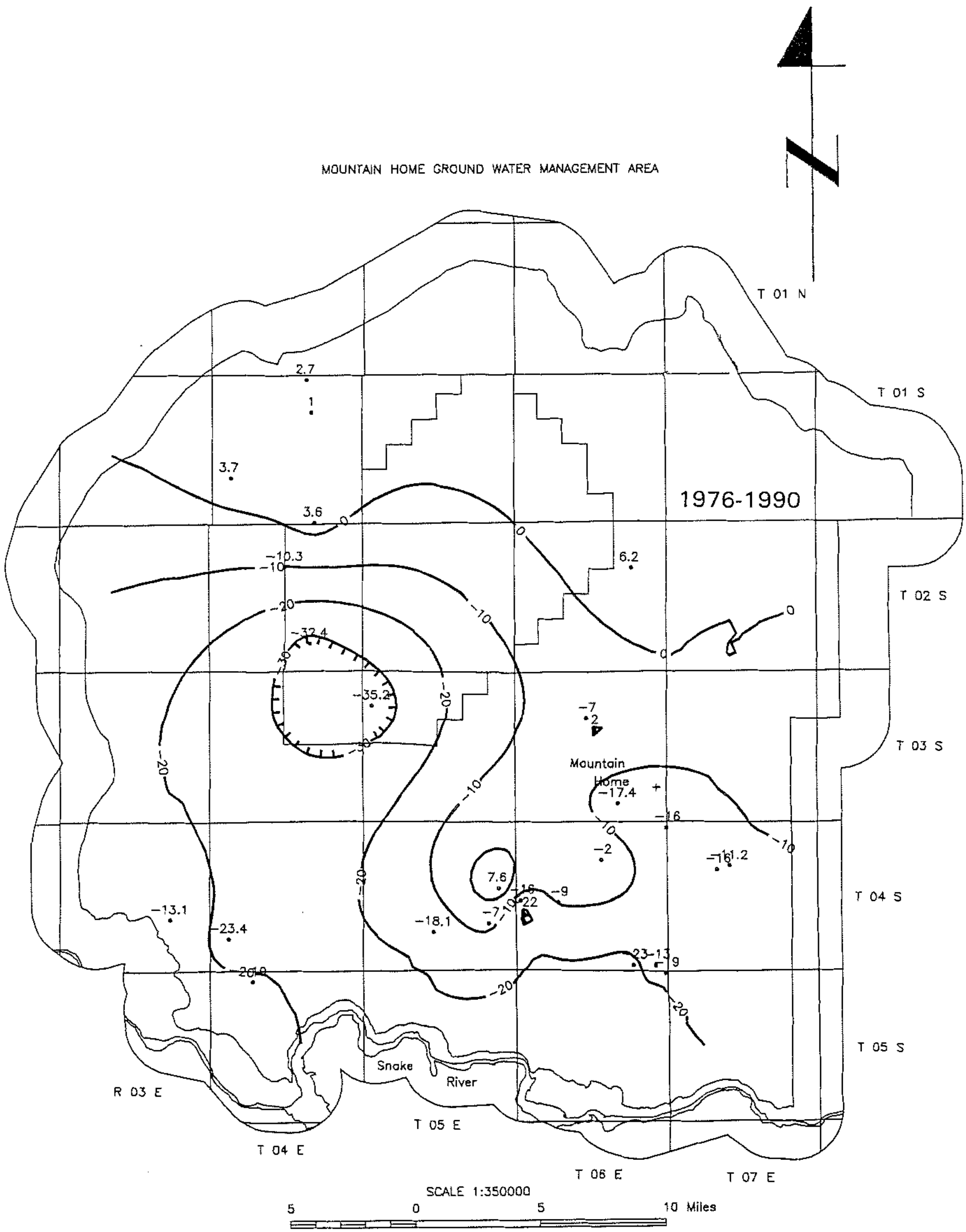


Figure 10. Water Level Change Map: Regional System

REFERENCES

Allen, R.G., and Brockway, C.E., 1983, Estimating Consumptive Irrigation Requirements for Crops in Idaho: Idaho Water and Energy Resources Institute Research Institute Research Technical Completion Report, 183 p.

Bond, John G., Idaho Department of Lands, Bureau of Mines and Geology, with contributions from the United States Geological Survey, Geologic Map of Idaho, 1978.

Groat, Jeff, Personnel Communication, Agriculture Stabilization and Conservation Service, Mountain Home Office, Spring 1994.

Colthorpe, Clayton, Water Master for the Mountain Home Irrigation District: Personnel Communication, March, 1994.

Idaho Department of Water Resources in Cooperation with Pacific Northwest Regional Commission, Water Related Land Use - 1975, Elmore County, Idaho.

Idaho Department of Water Resources, Method of Irrigation Development in Elmore County Idaho, 1993.

Idaho Department of Water Resources, Agricultural Land-Mapping from Land SAT MSS, 1986.

Malde, H.E., Powers, H.A., and Marshall, C.H., 1963, Reconnaissance geologic map of west-central Snake River Plain, Idaho: U. S. Geol. Survey Misc. Geol. Inv. Map I-373.

Norton, Marc A., Ondrechen W.T., and Baggs J.L., 1982, Ground Water Investigations of the Mountain Home Plateau, Idaho; Idaho Department of Water Resources, 62 p.

Ralston, D.R. and Chapman, S.L., Ground Water Resources in the Mountain Home Area, Elmore County, Idaho; Idaho Department of Reclamation Water Information Bull. #4, 63 p., 1968.

Ralston, D.R. and Chapman, S.L., Ground Water Resources of Southern Ada County and Western Elmore County, Idaho; Idaho Department of Reclamation Water Information Bull. No. 15, 52 p., 1970.

Young, H.W., Reconnaissance of Ground Water Resources in the Mountain Home Plateau Area, Southwest Idaho; U.S. Geological Survey Water Resources Investigations 77-108, open File Report, 40 p., 1977.