GROUND WATER PROTECTION AND MANAGEMENT STRATEGIES FOR THE HILL COUNTRY AREA
(A Critical Area Ground Water Study)

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(Edited by Critical Area Advisory Committee in December 1989 and January 1990)

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FIGURES

INTRODUCTION

A detailed study of this proposed critical area began in April 1987. The study area includes all of Bandera, Blanco, Gillespie, Kendall, and Kerr Counties as well as portions of Comal, Hays, and Travis Counties and covers approximately 5,500 square miles. The study focuses on the total water resources of this Hill Country area with special emphasis on the availability, quality and related historical conditions concerned with the ground-water resources of the Paleozoic and Cretaceous aquifers. The Paleozoic water-bearing units include (from oldest to youngest) the Hickory, Mid-Cambrian, Ellenburger-San Saba and Marble Falls aquifers. The Cretaceous water-bearing units include (from oldest to youngest) the Lower Trinity, Middle Trinity, Upper Trinity and Edwards Plateau aquifers.

PUBLIC PARTICIPATION

Beginning in April 1987, interviews were conducted with individuals in the study area who were familiar with the ground-water problems of the area. Nominations for an advisory committee were solicited and the following is the resulting list of members for the Hill Country Critical Area advisory committee that were appointed by the Commission and the Texas Water Development Board along with the group or office they represent:

Ivan Gerald Bain, Gillespie County
Taylor Virdell, Jr., City of Fredericksburg
Betty Baker, Comal County
Arthur W. Nagel, Kendall County
John Moring, City of Boerne
Bill Bassett, Hays County
Roy "Doc" McNett, Blanco County
Kermit Roeder, City of Johnson City
Raymond "Spot" Wright, Bandera County
Melvin A. King. City of Bandera
Darrell Lochtee, Kerr County
Donald C. Oehler, City of Ingram

Bart Hines, City of Kerrville
..... Metchis, Travis County
Warren Petsch, Farming & Ranching Industry

The advisory committee has met and has been briefed on the area and the study process. A 23 page questionnaire was submitted to each advisory committee member with a majority responding with useful information so that the Commission and Board would have a better understanding of the local problems as seen by the citizens of those communities.

GROUND-WATER RESOURCES

Throughout most of the Hill Country area, the Lower and/or Middle Trinity aquifers are the most utilized Cretaceous water-bearing units; particularly for municipal water-supply needs. The Upper Trinity and Edwards Plateau aquifers are utilized mostly as sources for rural domestic and/or livestock watering supplies. In most of Blanco and Gillespie Counties and apparently in northeastern Kerr and northern Kendall Counties, the Middle Trinity or Lower Trinity aquifers overlie water-bearing Paleozoic rocks. In these areas, the Cretaceous aquifers (Middle or Lower Trinity) are in hydrological continuity with the various Paleozoic aquifers. This condition is particularly evident in and adjacent to the Pedernales River Valley where the Middle Trinity aquifer is hydrologically connected to the Hickory, Mid-Cambrian, Ellenburger-San Saba and Marble Falls aquifers. In northern Gillespie and northern Blanco Counties the Hickory and Ellenburger-San Saba aquifers supply very significant and important amounts of ground water for municipal and irrigation needs as well as rural domestic and livestock watering purposes. In local areas of Gillespie and Blanco Counties, the Mid-Cambrian and Marble Falls aquifers have provided reliable water supplies for rural domestic and/or livestock watering purposes.

The primary source of recharge to these Paleozoic and Cretaceous aquifers is the infiltration of rainfall to their zones of saturation beneath and immediately adjacent to their outcrops. Ground water is naturally discharged readily from these aquifers as spring flow and as baseflow to the areas

effluent streams which include the Pedernales, Blanco, Guadalupe and Medina Rivers. Based on available data, the estimated average annual natural recharge to the aquifers within the Hill Country area is approximately 450,000 acre-feet per year with about 12,300 acre-feet for the Paleozoic aquifers and 437,700 acre-feet for the Cretaceous aquifers. The 450,000 acre-feet per year amount equates to about five (5) percent of the study area's historical average annual rainfall.

Coupled with the very large but unknown amount of ground water in transit storage, it would seem apparent that this very large amount of ground water which is physically available on a perennial basis would be more than adequate to fulfill the expected water-supply needs of the study area without any problems. However, only a very small portion of this relatively large amount of ground water can be realistically recovered by wells on a sustained basis. This condition is due to the extremely low transmissibilities of the aquifers; but also, in some cases, may be due to the unwillingness of ground-water users to practice and use more prudent ground-water exploration and drilling techniques, and proper well spacing, well development and/or well construction. As an example, the average annual withdrawal by wells during the 1977-1987 period was estimated to be about 17,800 acre-feet per year, and yet water-level declines were detected for the same period throughout much of the study area with maximum declines of about 19 feet in the Hickory aquifer, about 32 feet in the Ellenburger-San Saba aquifer, about 6 feet in the Marble Falls aquifer, about 155 feet in the Lower Trinity aquifer, about 59 feet in the Middle Trinity aquifer and about 16 feet in the Upper Trinity aquifer. Although water-level rises occurred in some areas during the same period, water-level declines significantly out-weighed water-level rises in all aquifers, except the Edwards Plateau aquifer. Throughout the Hill Country area, very significant, long-term net water-level declines have occurred at and near centers of ground-water withdrawals used for municipal (public) water supplies. The largest detected or estimated declines include 108 feet from 1953 to 1987 in the Hickory aquifer near Fredericksburg, 26 feet from 1939 to 1986 in the Ellenburger-San Saba aquifer near Fredericksburg, 271 feet from 1953 to 1987 in the Lower Trinity aquifer at Bandera, 105 feet from 1962 to 1983 in the Middle Trinity and Hickory aquifers at Fredericksburg, 108 feet from 1975 to 1986 in the Middle Trinity aquifer near Dripping Springs, 98 feet

from 1947 to 1987 in the Middle Trinity aquifer at Comfort, 101 feet from 1940 to 1987 in the Middle Trinity aquifer at Boerne, 208 feet from 1923 to 1987 in ower Trinity aquifer at Kerrville and 154 feet from 1949 to 1986 at St. Stephens School near Austin.

The Paleozoic and Cretaceous aquifers within the study area yield fresh to slightly saline waters which are hard to very hard. Some of the wells completed in the Upper Trinity aquifer produce water of poor quality due to the presence of more mineralized ground waters which are found in evaporite zones within the upper unit of the Glen Rose Formation. One serious problem with ground-water quality is an apparent local and gradual increase in nitrate concentrations. Historical data indicates that only a very few nitrate concentrations exceed the Texas Department of Health maximum constituent level of 44.3 milligrams per liter (mg/l), but that locally many nitrate concentrations formerly at much lower ambient levels gradually and significantly increased in some of the area's shallower ground waters. Also, nitrate concentrations significantly above estimated ambient levels have been detected in a significant number of recent initial analyses. In most cases, the most probable source of these unusually high nitrate concentrations seems to be related to animal and/or human waste discharges. Another serious water-quality problem is the excessively high radium concentrations found in the water produced from the Hickory aquifer. Practically all of the Hickory wells sampled for radioactive water analyses had total radium concentrations well above the 5.0 picocurries per liter maximum constituent level for total radium. Other less serious ground-water quality problems evident in the Hill Country area include the inherently high and in some cases excessive sulfate contents found in waters produced from the Trinity Group aquifers, and excessive iron contents found locally in waters produced by some Paleozoic aquifer and Cretaceous aquifer wells.

EFFICIENCY OF EXISTING GROUND-WATER REGULATORY INSTITUTIONS

In 1987, the Hill Country Underground Water Conservation District was created through the 70th regular session of the Texas Legislature. The district encompasses all of the aquifers within Gillespie County. Additionally, in 1989 the Springhills Water Management District was created through the 71st

regular session of the Texas Legislature. The district encompasses all of the aquifers within Bandera County. These districts have broad powers to regulate activities that could endanger the Paleozoic and Cretaceous aquifers from either overpumping or from pollution. These districts have the most appropriate powers for ground-water management and protection in the study area. No other local entities within the Hill Country area have such ground-water management responsibilities.

Septic tank orders are enforced by the counties within the study area to help assure protection of ground-water quality. These orders contain standards that are at least as stringent as those recommended by the Texas Department of Health. However, these entities are under-staffed which greatly limits the effectiveness of their required site inspection programs.

Kendall, Gillespie, and Hays Counties in addition to some cities are presently the only entities within the study area which require that water wells be registered and permitted, although the recently created Springhills Water Management District, in Bandera County, will address well registration and permitting in the near future. Additionally, in the City of Kerrville, a municipal ordinance requiring registration and permitting of water wells has been recently enacted.

ADMINISTRATIVE FEASIBILITY AND ECONOMIC IMPACT OF RESTRICTING GROUND-WATER WITHDRAWALS

The economic impacts of restricting ground-water withdrawals in the Hill Country area vary. Positive impacts would include extending the economic life of the region by prolonging the life of the aquifers. Conservation of energy is promoted by water use restrictions, which results in cost savings to those who pump water. Land values increase as ground water remains for future use and increases in value. One of the greatest beneficial impacts is the assurance of adequate water supplies for the future. Broader economic benefits from underground water conservation districts could be realized through their powers to assure proper well spacing, well drilling, well development, well construction and prevention of pollution through plugging of abandoned wells.

The Hill Country UWCD presently has a tax rate of $0.0125 per $100 assessed valuation. The district feels that adequate regulation and protection can be ied at this tax rate. Although this may have been viewed as a negative impact upon the community, the voters overwhelmingly approved this tax rate in the District's confirmation election. A tax rate has not been established for the Springhills Water Management District of Bandera County. However, the District was approved by Bandera County voters by a 6 to 1 margin.

Most individuals on the advisory committee indicated that pumps have been and continue to be lowered in certain areas to obtain adequate ground-water supplies. This obviously causes an increase in the cost of pumping ground water, and an eventual requirement for more wells to meet increasing and expected water needs. It is felt that district creation within the Hill Country area would be administratively feasible and would have relatively small impacts on the residents of the Hill Country area.

CONJUNCTIVE USE OF GROUND AND SURFACE WATER

The conjunctive use of ground and surface water is practiced on a relatively small scale in the study area. One of the largest conjunctive users is the City of Kerrville which obtains a large portion of its water supply from the Guadalupe River. The remainder of the City's water supply is obtained from wells producing from the Lower Trinity aquifer. Presently the City and the Upper Guadalupe River Authority (UGRA) are exploring the potential of an off-channel storage reservoir utilizing the Guadalupe River as a source. Potential users are the Cities of Kerrville and Ingram. Additionally, the UGRA and the City of Kerrville are considering an aquifer storage and recovery (ASR) well to be located in the City of Kerrville. This well would recharge (inject) excess, treated Guadalupe River water into the Lower Trinity aquifer where it would be stored for later recovery during certain periods of peak demand.

The Cities of Blanco, Johnson City and Boerne use surface waters to supply some or at times all of their water-supply needs. Throughout the remainder of the study area, few entities on a needed large-scale basis use surface water exclusively or in combination with ground water. Several advisory committee

members indicated that at present there is not a sufficient supply of surface water, and that there is a large need for the conjunctive use of ground water surface water in the Hill Country area.

Currently, there are four major existing surface-water reservoirs within or bordering the Hill Country area. These reservoirs include Medina Lake on the Medina River in Medina and Bandera Counties, Canyon Lake on the Guadalupe River in northern Comal County, Lake Travis on the Colorado River in Travis and Burnet Counties and Lake Austin on the Colorado River in Travis County. These reservoirs combined have a conservation storage capacity of about 1.78 million acre-feet. Although these reservoirs are geographically convenient to part of the Hill Country area, only relatively small amounts of their waters are available currently for use within the area.

Medina Lake through the Bexar-Medina-Atascosa Counties Water Improvement District No. 1 (BMA-WID No. 1) (permit owner) supplies water to a specific irrigated area in parts of Bexar, Medina and Atascosa Counties just outside of the Hill Country area. A very small amount of water (18 acre-feet in 1985) is supplied to a small subdivision immediately adjacent to Medina Lake in Bandera County. Canyon Lake through the Guadalupe-Blanco River Authority (GBRA) (permit owner) supplies water for relatively large municipal, industrial and irrigation needs primarily in and adjacent to the down river and coastal portions of the Guadalupe River basin far outside of the Hill Country area. A very small unknown amount of water from Canyon Lake is currently supplied to rural domestic water users immediately adjacent to the reservoir. Lake Travis through the Lower Colorado River Authority (LCRA) (permit owner) supplies the relatively large industrial and irrigation water needs within the LCRA's large service area; particularly in and adjacent to the down river and coastal portions of the Colorado River basin far outside of the Hill Country area. Lake Austin through the City of Austin supplies a portion of the municipal, industrial and steam power water needs of the City of Austin. The LCRA and the City of Austin supply a relatively small amount of water (5,405 acre-feet in 1985) to water districts and subdivisions outside of the City of Austin but within the Travis County portion of the Hill Country study area. If physically and economically feasible, perhaps more of the existing developed surface-water resources controlled by the BMA-WID No. 1, GBRA, LCRA and the

City of Austin could be used to provide adequate amounts of surface water for future meaningful conjunctive use with appropriately managed and protected ground water in the Hill Country area.

Also, if physically and economically feasible, the existing surface-water supplies developed and controlled by the Upper Guadalupe River Authority and the Cities of Kerrville, Johnson City, Blanco and Boerne may be used effectively in an expanded manner for conjunctive use in strategic unincorporated areas within or immediately adjacent to their service areas in Kerr, Blanco and Kendall Counties.

The Cloptin Crossing reservoir, proposed in the 1984 Texas Water Plan, an authorized Corps of Engineers project for construction in Hays and Comal Counties on the Blanco River, would have been a useful water supply for the southeast portion of the study area. However, plans for this reservoir have been dropped (J. Kowis, Personal Communication). Other potential reservoirs which are included in the 1984 Texas Water Plan and which have been considered as future water supplies for the study area include Pedernales reservoir, a proposed Corps of Engineers project, on the Pedernales River northwest of Johnson City in Blanco County and Ingram reservoir, a proposed Upper Guadalupe River Authority project, on Johnson Creek northwest of Kerrville in Kerr County. The Dripping Springs reservoir which is a proposed water supply from Onion Creek has been considered in a Hays County water and wastewater study for the Hays County Water Development Board (HDR Engineering, Inc., 1989) as a potential surface-water supply for the Dripping Springs area. If physically and economically feasible, perhaps these and perhaps other proposed reservoirs and surface-water diversions could be used to provide adequate surface-water supplies for future meaningful conjunctive use with appropriately managed and protected ground water in the Hill Country area.

The 1980 and 1985 water use in the Hill County area was as follows:

Sources of	1980 Use Amount (Acre-Feet)	Percent	1985 Use Amount (Acre-Feet)	Percent
Ground Water	17,427	71	18,207	61
Surface Water	7,207	29	11,691	39
Total Water Use	24,634	100	29,898	100

In 1980, water used for drinking purposes (public supply and rural domestic) amounted to approximately 12,274 acre-feet of ground water and 3,289 acre-feet of surface water. The remaining water used in 1980 (9,071 acre-feet) was utilized for manufacturing (620 acre-feet), irrigation (4,391 acre-feet) and livestock watering (4,060 acre-feet) from the various available ground-water and surface-water sources in the Hill Country area.

In 1985, water used for drinking purposes (public supply and rural domestic) amounted to approximately 13,287 acre-feet of ground water and 9,048 acre-feet of surface water. The remaining water used in 1985 (7,563 acre-feet) was utilized for manufacturing and mining (412 acre-feet), irrigation (3,811 acre-feet) and livestock watering (3,340 acre-feet) from the various available ground-water and surface-water sources in the Hill Country area.

Comparison of the 1980 and 1985 annual water uses indicates a general trend in the increase of the use of available surface-water supplies for drinking water purposes, and at the same time, an increase in the use of ground water. Such trends generally exemplify the need for more conjunctive use of ground water and surface water in the future in the Hill Country area.

The projected water requirements for the years 1990, 2000 and 2010 for the Hill Country area are offered as follows:

Water Requirements (TWDB, 1988)

Use Categories	1990 (Acre-Feet)	2000 (Acre-Feet)	2010 (Acre-Feet)
Municipal (Public Supply and Rural Domestic)	30,369	33,984	47,380
Manufacturing	828	1,112	1,416
Mining	24	48	36
Irrigation	3,413	3,466	3,509
Livestock	4,700	5,349	5,349
Total Water Requirements	39,334	49,959	57,690

The general increasing trend of the projected water requirements offered above correlate well with the general increasing trend of water use experienced from 1980 to 1985. Without conjunctive use, this expected condition will impose more and more demand on the Hill Country area's ground-water resources which will cause increasing, undesirable, water-level declines; particularly in areas where heavy pumpage is expected to provide water needed for municipal (public supply) uses. Well planned and implemented conjunctive use programs in and adjacent to the large population centers of the Hill Country area are recommended as a means to appropriately meet the area's projected water requirements to the year 2010.

FINANCING MANAGEMENT AND PROTECTION ACTIVITIES

Underground Water Conservation Districts will require financial support through taxation or fees. As an example, the Hill Country Underground Water Conservation District in Gillespie County has a present tax rate of $0.0125 per $100 assessed valuation. With a property valuation for the County tax base of $6,937,224.82, the district has a proposed 1989-90 budget of approximately $82,000.00 The district currently plans to require well permits. Additional money is available to the district through a $20.00 well permit fee.

Other districts located adjacent to the study area include the Edwards Underground Water District and the Barton Springs-Edwards Aquifer Conservation District. The Edwards Underground Water District is financed through the collection of taxes based upon $0.0097 per $100 property valuation. The Barton Springs-Edwards Aquifer Conservation District is financed through a usage fee of $0.25 per 1,000 gallons. Additionally, there is a one-time well registration fee of $25.00 per well. Wells capable of producing not more than 10,000 gallons per day, wells used to satisfy domestic needs of five or fewer households, wells used only for watering livestock and poultry in connection with farming, ranching, or dairy enterprise, jet wells used for domestic needs, and wells used to supply water for hydrocarbon production activities are exempt.

Amendments to Chapter 52 of the Texas Water Code contained in House Bill 2 (69th regular session) allow districts to sell surface water and ground water. To date, none of the existing districts have begun these operations. This could be a very significant source of revenue for districts. However, some districts which were created through the Texas Legislature, such as the Hill Country Underground Water Conservation District, are specifically prohibited from supplying ground water inside or outside the district. If a district was created in the study area through the critical area process, and it remained a separate entity from the Hill Country Underground Water Conservation District, it would be allowed to sell water as a source of revenue.

Permit application fees could be used to fund the expenses related to issuance, monitoring, and enforcement of permits. As currently written, Section 52.166, Texas Water Code, directs districts to issue permits for drilling, equipping, or completing wells or for substantially altering the size of wells, well pumps, or for all of these operations. These permits do not expire, so routine renewal is not required. It is likely that any reasonable, one-time fee per permit would not generate sufficient revenue to fund the operations of an underground water conservation district in the Hill Country area.

CONCLUSIONS

Although the Paleozoic and Cretaceous aquifers in the Hill Country area have significantly large amounts of ground-water available on a perennial basis, only a very small amount of this water can be recovered by wells on a realistic and practical basis. Historically, areas of concentrated ground-water withdrawals have experienced severe water-level declines which cause pumping lifts to increase and a corresponding reduction in well yields. Under this condition, more and more wells have been needed to meet the increasing water demands. This condition primarily is caused by the very low coefficients of transmissibility and storage of the aquifers which severely restrict ground-water flow to and the availability of ground water for the areas of concentrated withdrawals. In some cases, this condition has been made worse by the unwillingness of ground-water users to practice and use more appropriate ground-water exploration and drilling techniques and proper well spacing, well development and well construction. In the future this condition will continue to be very evident in areas where concentrated ground-water withdrawals are expected to be the only water supply used to meet the expected, increasing water needs of the Hill Country area.

The Paleozoic and Cretaceous aquifers within the study area are capable of supplying ground water of generally suitable quality. However, some of the area's shallow ground waters have unusually high nitrate concentrations which are significantly higher than ambient levels. There are some indications that nitrate levels are gradually increasing in some portions of the Hill Country area. Also, ground water produced from the Hickory aquifer is inherently high in excessive concentrations of total radium.

Both single-county and multi-county or regional districts have distinct advantages. A single-county district would offer immediate information and response to local problems, put resources to work locally instead of subsidizing localized problems elsewhere in the critical area, and allow more equitable local control because the district representation is not based on demographics. On the other hand, a multi-county or regional district would offer a larger tax base and execise greater single-district control over a greater portion of the aquifers in the Hill Country area. All advisory

committee members indicated that the voters in their counties favor single-county districts.

Presently, there are no existing entities, other than in Gillespie and Bandera Counties, to properly manage and protect the ground-water resources in the Hill Country area. Those areas where significant water-level declines have occurred and conjunctive use is not probable or adequate to meet expected water needs within the next 20 years should manage and protect the ground-water resources through an underground water conservation district. All advisory committee members felt that UWCD's are an appropriate local entity for addressing water problems and controlling, managing and protecting ground-water resources. Acquisition of sufficient water rights for the establishment of additional surface-water supply facilities will be required, if meaningful conjunctive use is to be successfully practiced in the Hill Country area.

Managing and protecting ground water in the Hill Country area through underground water conservation districts include the following control strategies: (a) consideration and development of realistic spacing regulations for septic systems in heavily populated areas to prevent large scale loading of the aquifers; (b) implement strong enforcement programs to assure that ground-water management and protection objectives are being met; (c) development of public education programs; (d) development of stringent requirements for the drilling, development and construction of water wells; (e) consideration and development of realistic well spacing regulations; (f) an enforcement program to ensure that abandoned wells are properly closed in a timely manner; (g) promotion of water conservation, (h) establish and maintain meaningful hydrogeological monitoring networks and periodically report the results of such monitoring, (i) cooperate with appropriate local and State entities to help assure responsible ground-water management and protection, and (j) communication and cooperation between the districts should be mandatory.

RECOMMENDATIONS

The Hill Country area (Figure 1) should be designated as a critical area to have ground water appropriately managed and protected. Two single county

districts presently exist within the study area and interest in district creation has been shown in Kendall and Blanco Counties. Action by the ;sion on district creation should be held in abeyance until conclusion of the next regular session of the Texas Legislature to see if other districts are created within the Hill Country area.

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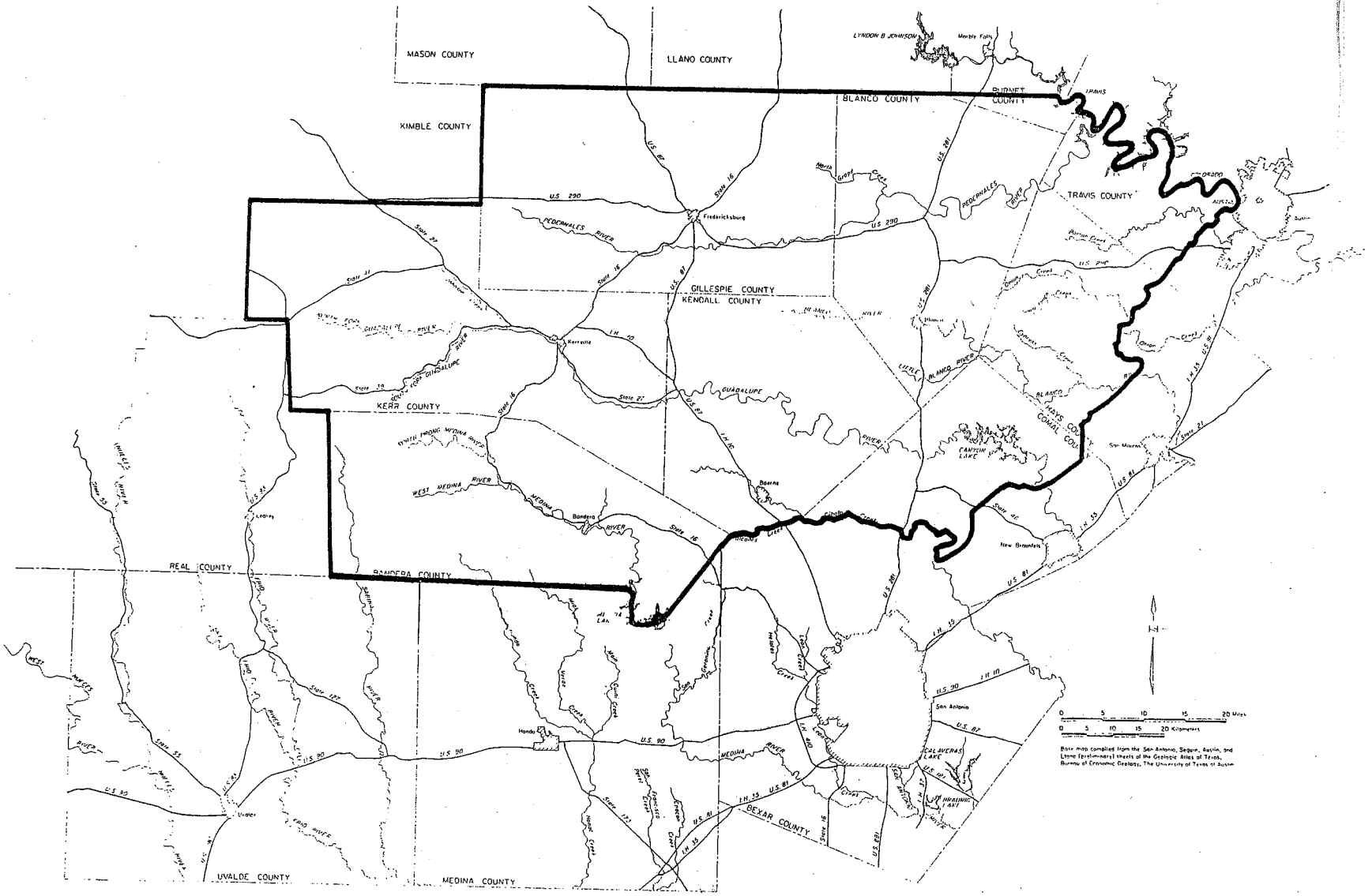


Location Map
Hill Country Critical Area Study

FIGURE 1

TEXAS WATER COMMISSION

April 30, 1990

PUBLIC HEARING NOTICE
DESIGNATION OF A CRITICAL AREA

A representative of the Texas Water Commission will conduct a public hearing on:

May 16 1990, at 7 p.m.
Main Meeting Room
Gillespie County Agricultural Building
1906 North Llano
Fredericksbug, Texas

This hearing will be held pursuant to Sections 52.051 - 52.054 of the Texas Water Code to receive public comment on the proposed designation by the Water Commission of the Hill Country Critical Area in 31 Texas Administrative Code Chapter 294.

The Water Commission will consider adoption of this rule designating the Hill Country Critical Area on June 6, 1990, at 9 a.m. in Room 118 of the Stephen F. Austin Building, 1700 N. Congress Ave., Austin, Texas.

Persons who are interested in obtaining copies of the proposed rule designating this critical area may call the Texas Register at (512) 463-5561. Also, a copy of the critical area report prepared by the Commission staff appraising the hydrogeology of the area may be examined at the Water Commission offices at 1700 North Congress Ave., Austin, Texas, or at the Bandera County Library in Bandera, Texas, the Buda Public Library in Buda, Texas, the Butt-Holdsworth Memorial Library in Kerrville, Texas, the Comfort Public Library in Comfort, Texas, the Kendalia Public Library in Kendalia, Texas, the Pioneer Memorial Library in Fredericksburg, Texas, the Austin Public Library in Austin, Texas, the Blanco Library in Blanco, Texas, the Bulverde Public Library in Bulverde, Texas, the Dittlinger Memorial Library in New Braunfels, Texas, the Johnson City Library in Johnson City, Texas, and the Kendall County Library System in Boerne, Texas.

Persons who have questions concerning these hearings or who wish to submit written comment should contact Robin Smith, Staff Attorney, Legal Division, Texas Water Commission, P. O. Box 13087, Capitol Station, Austin, Texas 78711, (512) 463-8069. Written comment will be accepted until June 4, 1990.

TECHNICAL SUMMARY

The Hill Country Area was identified as a potential critical area and nominated for detailed study by the Commission and the Water Development Board in a joint press release dated January 13, 1987. The critical area study and report are a joint effort of the Commission and the Board. The area of investigation includes the southern edge of the Edwards Plateau and extends southeastward into the Balcones Fault Zone. It includes all of Bandera, Blanco, Gillespie, Kendall, and Kerr Counties as well as portions of Comal, Hays, Medina, and Travis Counties. The southeast boundary coincides with that of the Edwards Underground Water District and the Barton Springs-Edwards Aquifer Conservation District. A Critical Area Report has been prepared recommending designation of the Hill Country area as critical, delineating the boundaries of the critical area, proposing a ground water management strategy for the critical area, and providing information about the area in support of the recommendations.

The primary hydrologic problems facing the study area are the continuing decline in water levels of the Cretaceous and Paleozoic aquifers, and the potential over the next 20 years (1990-2010), for ground water shortages. Additionally, ground water quality problems are significantly increasing within the study area. The conjunctive use of ground and surface water is practiced on a relatively small scale in the study area. Regional surface water resources are very limited and water rights are already committed. Artificial recharge is in the experimental stages in Kerr County and is not yet a reliable source of water.

Although water level rises occurred in some areas, water level declines significantly out-weighed water level rises. Throughout the Hill Country area, very significant, long-term net water level declines have occurred at and near centers of ground water withdrawals used for municipal (public) water supplies. The largest declines include 108 feet from 1953 to 1987 in the Hickory aquifer near Fredericksburg, 26 feet from 1939 to 1986 in the Ellenburger-San Saba aquifer near Fredericksburg, 271 feet from 1953 to 1987 in the Lower Trinity aquifer at Bandera, 105 feet from 1962 to 1983 in the Middle Trinity and Hickory aquifers at Fredericksburg, 108 feet from 1975 to 1986 in the Middle Trinity aquifer near Dripping Springs, 98 feet from 1947 to 1987 in the Middle Trinity aquifer at Comfort, 101 feet from 1940 to 1987 in the Middle Trinity aquifer at Boerne, 208 feet from 1923 to 1987 in the Lower Trinity aquifer at Kerrville, and 154 feet from 1949 to 1986 at St. Stephens School near Austin. This trend of water level declines is projected to continue for the next 20 years.

There are no existing entities, other than the Hill Country Underground Water Conservation District in Gillespie County and the Springhills Water Management District in Bandera County, to properly manage and protect the ground water resources in the Hill Country area. It is felt that district creation within the Hill Country area would be administratively feasible and would have relatively small impacts on the residents of the Hill Country area. Voters in Gillespie and Bandera Counties have overwhelmingly approved district creation. Additionally,

there has been interest shown for district creation in Kendall and Blanco Counties.

Beginning in April 1987, interviews were conducted with individuals in the study area who were familiar with the ground-water problems of the area. Nominations for an advisory committee were solicited and a fifteen member committee was jointly approved by both the Texas Water Commission and Texas Water Development Board. The advisory committee consists of representatives from each of the counties within the study area and also includes representatives of those economic sectors that are significant water users in the area. The advisory committee has edited the Critical Area Report and agrees with the conclusions and recommendations contained therein.

It is recommended that the Texas Water Commission designate a Critical Area and delineate the boundaries of the Critical Area as given in the attached map (Figure 1). It is further recommended that action by the Commission on district creation be held in abeyance until the conclusion of the next regular session of the Texas Legislature in 1991 to see if other districts are created within the Hill Country area.

Prepared by:

Brad A. Cross

Brad Cross, Geologist

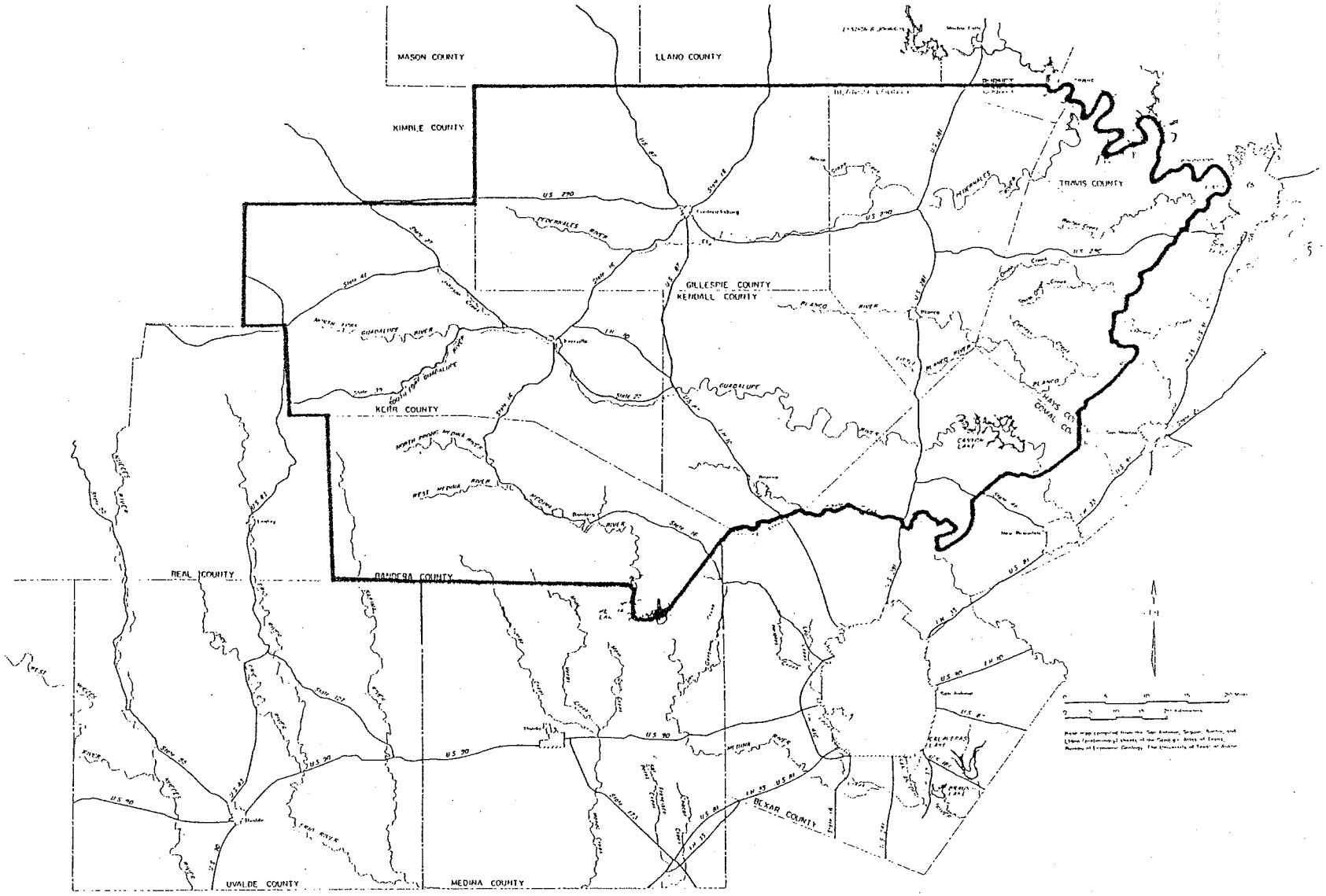
Date: 2-26-90

Approved by:

Bill Klemt

Bill Klemt, Chief
Ground Water Conservation Section

Date: 2-26-90



Location Map
Hill Country Critical Area Study

FIGURE 1

CRITICAL AREA NO. 2 BOUNDARIES

Critical Area No. 2 includes all of Bandera, Blanco, Gillespie, Kendall, and Kerr Counties as well as portions of Comal, Hays, and Travis Counties.

The boundaries of Critical Area No. 2 are as follows. Starting at the northwest corner of Kerr County, the northern boundary is coterminous with the Kerr-Kimble County Line and continues eastward to Gillespie County. The boundary continues northward along the Gillespie-Kimble County Line to Mason County. At that point the northern boundary is coterminous with the Gillespie-Mason, Gillespie-Llano, Blanco-Llano, and Blanco-Burnet Counties Lines and continues eastward to the Travis County Line. The boundary then continues north to the Colorado River. The boundary then continues southeast along the Colorado River to the western boundary of the Barton Springs-Edwards Aquifer Conservation District. The boundary continues southerly along this boundary and also includes the northern-western boundary of the Edwards Underground Water District to the Medina County Line. The boundary is then coterminous with the Bandera-Medina and Bandera-Uvalde County Lines. The boundary continues westward along the Bandera-Uvalde County Line to Real County. The boundary then continues northward and is coterminous with the Bandera-Real, Kerr-Real, and Kerr-Edwards County Lines to the starting point, the northwest corner of Kerr County.