

TRANSPORTATION ★ BIG THICKET ★ LAND ★ TEXAS WATER PLAN
POPULATION ★ COMPREHENSIVE PLANNING ★ NORTH EXPRESSWAY
AIR POLLUTION ★ SAN ANTONIO RANCH ★ GUADALUPE MOUNTAINS
FLOOD PLAIN MANAGEMENT ★ PESTICIDES ★ BANDERA EXPRESSWAY



South Texas Group

ENVIRONMENTAL GUIDE to the San Antonio Area

ENVIRONMENTAL GUIDE

"AN INTRODUCTION TO PROBLEMS AND SOLUTIONS"



PREPARED BY

SOUTH TEXAS GROUP

LONE STAR CHAPTER

SIERRA CLUB

".... in wildness is the preservation of the World."

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ACKNOWLEDGEMENTS

This booklet has been prepared in a format to permit addition or deletion of material in the future as the environmental situation evolves. Topic discussions will be added or revised as new knowledge is gained so that the Guide can remain a valid reflection of current environmental concerns in this region and in the state. Information on additions or revisions, and copies of any material issued, may be obtained by writing:

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I. Introduction

"We travel together, passengers on a little spaceship dependent on its vulnerable resources of air, water, and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work, and, I will say, the love we give our fragile craft. "

-Adlai Stevenson

Our spaceship is in trouble. This tiny sphere of land and water with its tissue thin life support system is in mortal danger. It stands precariously on the threshold of dark and frightening devastation. The only known home of life in the universe may well be on a course to self destruction.

The limited and vital supplies of air, land, and water which form our life support system are being degraded to a critical level. Each day we are confronted with new dangers to the survival of this delicate system, dangers spawned by our technological culture. If these hazards are not countered, and the integrity of our life support system insured against further violation, the question "Can the World Be Saved?" assumes grave importance.

Of equal concern is the quality of life. At the same time that our air, water, and land are being defiled, we are increasingly subjected to the stresses of crowding, debilitating noise, loss of open space, litter, and ugliness--ugliness that stifles the human spirit. Our places of beauty are constantly violated or obliterated, and our fellow earthlings, the animals, continue to be destroyed in appalling numbers. The mounting crush of our population degrades the value of the individual and indeed may well bring starvation to vast numbers.

How do we halt this mindless destruction of our environment? In what ways can we work to restore a proper balance to our fragile biosphere? What are the solutions to these grave problems which face us?

Essential to any efforts toward solving these problems is an understanding of the basic relationships of all life. Equally vital is the knowledge of how we are affecting these relationships and what the consequences of our actions may be.

The Sierra Club hopes to help you understand our environmental crisis and some of the things we must do to meet it. For only when people understand the delicate web of life now present on the earth will they appreciate how endangered is our very existence at this moment in mankind's history.

When this knowledge becomes common property, the Sierra Club feels that people will act to re-establish a harmonious relationship between man and nature. For man in his heart loves earth deeply--of earth was he born, on earth has he spent all his days, dreamed all his dreams, loved, and learned all that he knows. Even now, at the dawn of the space age, man has begun to surmise that of all the universe, earth may be the real jewel, the one planet with magnificent color, lush flora, and birds and beasts of rare design and beauty. Man has begun to suspect that earth is, veritably, a paradise. Or was--once upon a time. He must now work to rebuild what he has come close to destroying.

The way will not be easy, but we must attempt it. For if we do not, man himself may have to be written off as an unsuccessful biological experiment.

"THE EARTH--LOVE IT OR LOSE IT!"

II. What Is the Sierra Club?

The Sierra Club is the oldest and one of the most active conservation groups in the United States. Founded by John Muir in 1892, the Sierra Club has grown to a national organization of over 140,000 members.

Hailed by many as the most powerful citizens' conservation organization in the country, it has adhered to its original purposes...

"to help people explore, enjoy, and protect parks, wilderness, waters, forests, and wildlife";

"to rescue places that made America beautiful and can keep it beautiful; places only as safe as people, knowing about them, want them to be."

As our environment has deteriorated, the Sierra Club has become increasingly concerned and involved with the complete ecological spectrum. With efforts such as protection of the Grand Canyon, preservation of the Redwoods, questioning the Trans-Alaska Pipeline System, and the Supersonic Transport, the Sierra Club has established itself as a strong voice for environmental sanity.

Continuing this tradition, in Texas, the Lone Star Chapter through its regional groups has undertaken action on a number of critical conservation problems both local and statewide. Issues such as the Texas Water Plan, Big Thicket National Park, Guadalupe Mountains National Park, preservation of scenic rivers, and disruption of parklands by expressways have been the focus of effective volunteer conservation effort.

Representing no special interest groups, pledged to no cause save preserving our environment, the Sierra Club raises a standard on which is emblazoned -

"Not blind opposition to progress but opposition to blind progress."

Around this standard are gathered a cross section of citizens vitally interested in the environment and its protection. While the academic, business and professional communities are all represented within the Club, the only real qualification for membership is an abiding interest in the natural world and its sheer beauty.

The Sierra Club by its nature is an activist organization and in many instances has served as the watchman of environmental alarm. This has naturally brought confrontation with many interests and groups. Whatever the situation the Sierra Club is pledged to a position of reasoned debate on the environmental issues. Rather than emotional "finger-pointing" we would prefer to frankly discuss with all how our environment can best be protected.

The Sierra Club does not believe that there is a single environmental villain; not industry, not the government, not regulatory agencies. All have played a part in our current environmental crisis, as has the individual citizen. And while we understand that technology cannot (indeed should not) be reversed, we are dedicated to the belief that effects of the application of that technology must be brought into consonance with the natural world for both our sanity and our survival.

III. Purpose and Scope

This booklet is intended to serve a number of needs. Its primary purpose is to help people understand how their environment is being affected by the products of our technology and by the pursuits of our economic and political systems.

A fundamental thesis of this publication is that when people understand the dangers to our environment they will act to combat and eliminate these dangers. The Sierra Club hopes that the information presented here will help people to acquire that understanding. Knowledge without action is useless, and thus an attempt is made to outline what should be done in each area discussed.

Since the number of areas presenting ecological and environmental hazards is so great, only those affecting Texas in general and the San Antonio area in particular are discussed. It should be understood that the treatment of each topic is not exhaustive. Only major issues of environmental concern are included. References to more detailed material are given wherever possible so that the reader may acquire a deeper insight if desired.

The Guide is not intended to be a text on general ecology nor is it meant as a total index of environmental problems. It is designed, rather, to act as a barometer of concern, an early warning indicator of the effects of technology in this region and this state. By bringing together the reflections and insights of many concerned individuals it is hoped the Guide will increase awareness and inspire discussion of environmental issues among many levels of the community, in both private and public groups.

Beyond all plans and programs, true conservation is ultimately something of the mind--an ideal of men who cherish their past and believe in their future. Our civilization will be measured by its fidelity to this ideal as surely as by its art and poetry and system of justice. In our perpetual search for abundance, beauty and order we manifest our love for the land and our sense of responsibility toward future generations.

Stewart Udall

IV. The Environmental Crisis

"What region of the earth is not full of our calamities?"

-Virgil

When the environmental situation is examined today at any level, city, state, national or global, the term "crisis" immediately suggests itself. For wherever the impact on nature of man and his technology is viewed, the spectre of disaster is readily apparent. Ecological systems are perilously out of balance; wildlife is in danger of extinction, the air is murky, the water is unclean, the land is blighted, resources are being ruthlessly exhausted. On every hand natural systems are irreparably crippled by our technological incursions, in many cases to the point of complete collapse.

If these systems finally do collapse under the pressure of our mechanized society then we are all in mortal danger. For we cannot survive on this planet as a life form unless we do so in conjunction with other life forms--this is the ultimate ecological implication. Whenever another of these life forms is threatened the margin of our survival becomes that much thinner. If man should succeed through his depredations in destroying a significant portion of life in the biosphere then he will have wrought his own extinction.

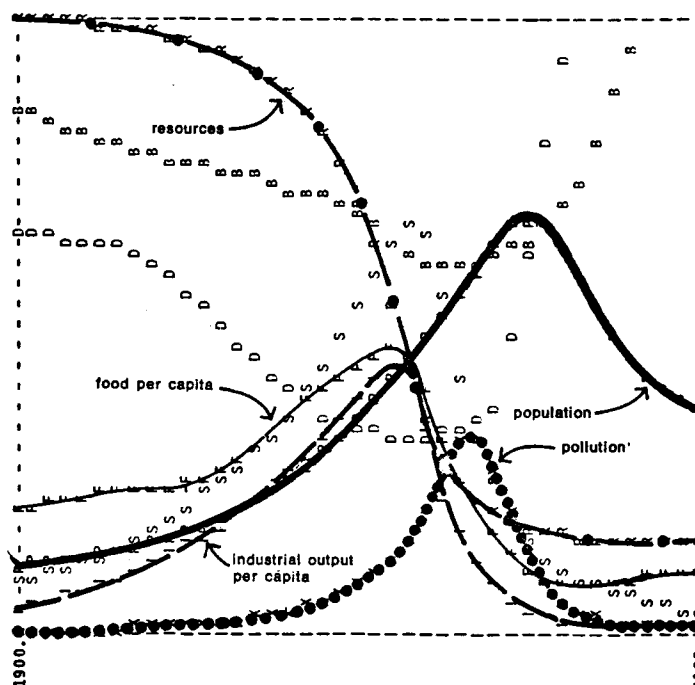
The element of crisis is present because our use of technology is increasing at a faster and faster rate (exponentially) with injury to the environment apace. Coupled with this is an uncontrolled growth of world population and a corresponding depletion of natural resources. If these trends continue, the failure of many ecological systems within the near future becomes a very distinct and positive certainty. Spectres of environmental calamity, mass starvation, severe reduction of living standards and vast social disruption are all visible so long as we ignore the vital interrelationships which sustain not only our cultural systems but life itself.

No one can predict with certainty when disaster will strike. We cannot say at precisely what hour the air will at last become unbreathable in Los Angeles, or at what instant Lake Erie will finally expire. Our knowledge of the very processes on which life depends is too imperfect, and the many interlocking effects too complex for easy analysis. But it is generally acknowledged by experts that within 30 to 50 years, if present trends continue, the world will be faced with environmental catastrophes of vast proportion. In the interim we will continue to suffer the effects of increasing pollution of air, water, and land while more and more people are forced to subsist on fewer and fewer resources.

The next 10 to 15 years thus become critical. We must understand what the impact of technology and our numbers is doing to the biosphere and learn how to reduce or temper these effects in the next decade. If we delay much longer we may have irreparably damaged our vital natural systems and thereby sealed our own doom. We are in a time of environmental crisis which can well determine man's entire future. The challenge which this presents to the structure of entrenched attitudes so cherished in our Western industrialized society further intensifies the crisis. For only when value systems and attitudes are re-ordered around an understanding of man's interdependency with nature will solutions to the environmental crisis be possible.

The situation just described has been reduced to mathematical form with a "world model," and that model has been manipulated by computer to test the trends of our actions.* Although the model has been subject to much criticism for its apparent simplicity, the principal results say, mathematically, what any thinking man can see in the making: the eventual collapse of our civilization as we know it if the current impact of man on his environment is not changed. The only thing left to question by the analysis is the time available to make the necessary changes. Best estimates are 15 to 50 years.

WORLD MODEL STANDARD RUN *



The "standard" world model run assumes no major change in the physical, economic, or social relationships that have historically governed the development of the world system. All variables plotted here follow historical values from 1900 to 1970. Food, industrial output, and population grow exponentially until the rapidly diminishing resource base forces a slowdown in industrial growth. Because of natural delays in the system, both population and pollution continue to increase for some time after the peak of industrialization. Population growth is finally halted by a rise in the death rate due to decreased food and medical services.

*Technology and the Limits to Growth by D. H. Meadows, D. L. Meadows, J. Randers and W. W. Behrens, Universe Books, New York, 1972.

V. Population

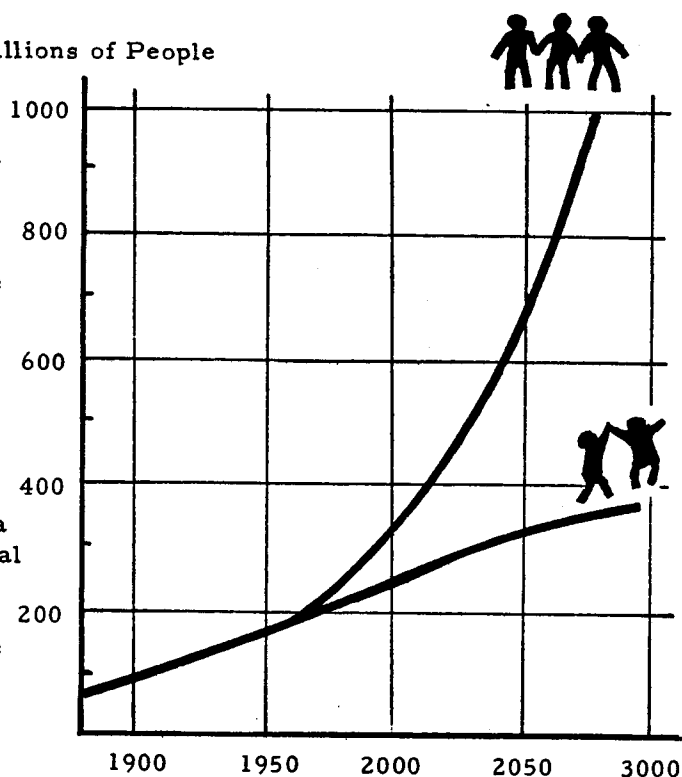
People, human beings, homo sapiens, are today the earth's dominant species. Man has control over, and consequently the responsibility for, the earth's ecosystem. Thus, the examination of population is an extremely important part of any environmental study. This section begins the special topic coverage of the Environmental Guide because it is a logical starting point for any look at environmental problems.

Clearly, man's impact on the ecosystem is directly dependent on how many people there are and the life style adopted by those people. Thus, the impact of the people of India with their huge numbers but small use of natural resources per capita is different than the impact of a fewer number of Americans who use proportionally much, much more of the earth's energy and mineral resources.

In many cases where the immediate resource base is finite and known, like the water resources of Texas, doubling the number of people simply halves the availability per capita. The quality of life is therefore affected by the numbers of people there are, both directly through the use of resources and indirectly through the kind of government and economic system which is necessary to regulate resource use.

But population can also be a resource, depending on the educational and nutritional level of the people, and on their numbers, distribution and resource use. Thus, it is clear that an "optimum" population exists which depends on many factors, including the minimum acceptable quality of life.

Millions of People



Effect of Family Size on Future Population
Fig. 2-3, President's Commission on
Population and the American Future

TOPIC: Population

Background:

The first "man" appeared in Africa about one million years ago, and later grew to perhaps 125,000 individuals who survived by gathering and hunting. By 8000 B.C., when agriculture first became known, total human population was probably about 5 million. At the time of Christ, there were probably 200 to 300 million people, increasing to about 500 million (1/2 billion) by 1650. Population size then doubled to 1,000 million (1 billion) around 1850, doubled again to 2 billion by 1930, and will probably double again to 4 billion by 1975. Not only has population size continually increased, but the rate of population growth has also increased.

"Doubling time"--which is the time required for a population to double in size--is the most meaningful way to describe population growth rates. Between 6 and 7 doublings were required for the 100-fold increase in population between 8000 B.C. and 1650 A.D., or an average doubling time of 1500 years. The next doubling took 200 years to reach 1 billion people in 1850, and the next only 80 years to reach 2 billion people in 1930. The present rate of population growth will double the earth's population in about 35 years.

Three surges of population growth have occurred; one about 600,000 years ago with the advent of primitive man; the onset of the agricultural revolution about 8000 years ago; and one about 200 years ago with the beginning of the industrial revolution and the increased control over death brought about by modern medicine.

Populations change size as the net result of additions due to births and immigrations, and from subtractions due to deaths and emigrations. Birth and death rates are usually expressed as the number per thousand people per year. Growth rate is then calculated by subtracting the death rate from the birth rate (assuming no migration). In the United States and other industrialized nations, the population growth rate is about 0.8% per year. In contrast, the population growth rate for the world is approximately 2% per year.

Population Age distribution differs greatly between underdeveloped and developed countries. In underdeveloped countries, high birth rates and recent decreases in infant and child mortality have greatly increased the proportion of younger, dependent individuals in relation to the number of productive adults. This ratio of dependent to productive individuals is much more nearly equal in developed countries.

Population Density--the number of people per unit area--has increased in the United States from an average of about 0.3 people per square mile before the Europeans arrived, to 58 people per square mile today. The greatest average national population density is found in Japan, with a density of 700 people per square mile.

Population Distribution is also changing due to urbanization; with the migration of an ever-increasing proportion of population into cities. In the United States, only about 6% of the population lived in urban areas in 1800, increasing to 40% by 1900, and to more than 70% today. Similar migrations in underdeveloped countries have led to huge slum settlements in all major cities.

Population Projections have been prepared for the period 1965-2000 from the best demographic data and from past trends by the United Nations. Specific forecasts are based on age, fertility, death-rates, migration, etc. The calculated high, low and medium

projections, and one assuming continuance of current trends in fertility and mortality without migration, for the year 2000, are as follows:

<u>Population Estimate</u> <u>(in billions)</u>	<u>Low</u>	<u>Medium</u>	<u>High</u>	<u>Constant Fertility</u>
Developed regions	1.29	1.44	1.57	1.58
Underdeveloped regions	4.16	4.69	5.42	5.94
World Total	5.45	6.13	6.99	7.52

Problem:

General. Earth's finite resources and the fixed rate of energy input to it from the sun cannot support an infinite population. As population increases and man becomes more aware of his impact on the world environment, his attitudes must change about the impact of further population increases. Photographs of the earth taken from space emphasize the finite nature of our spaceship-planet, and remind man that he can exist only in the thin environment covering Earth's surface.

A common misunderstanding is to think that overpopulation simply means too many people for the amount of space available. A standard for overpopulation based solely on people per unit area is subjective and relatively meaningless. Instead, the most common forms of overpopulation involve too many people for the available resources or for the maintenance of a reasonable living standard.

People, their activities, and the processes which support society, all convert other forms of energy into heat according to the basic laws of thermodynamics. These laws impose critical restrictions on all aspects of population, resources, and environment--including future proposals for expanding energy supplies, utilizing new resources, and increasing food production. The availability of energy imposes an ultimate limit, although not an immediate one, on all human population growth. We are currently using resources that produce energy much faster than these resources are renewed. Finite supplies of non-renewable fossil fuel resources--petroleum, natural gas, and coal--are rapidly being depleted. (See separate topic.)

San Antonio Area. The population problems of the San Antonio area are fundamentally the same as the population problems of Texas, the United States, or the world. San Antonio increased in population from 587,718 in 1960 to 650,188 in 1970--an increase of 62,470 persons, or 10.6%. San Antonio is the fifteenth most populous city in the United States. Bexar County population had increased to 830,656 by April 1970, giving an average population density of 3555 persons per square mile compared with the Houston average of 3000 and the Dallas average of 3180.

During 1970, the birth rate in Bexar County was 22.8 per 1000 people and the death rate 6.8 per thousand people, giving an average population growth of 13,246 people per year or 1.6%. An additional net population increase of about 3500 persons per year is caused by more persons moving into the Bexar County than move away. Doubling time for Bexar County's population at present growth rates is about 40 years--that is, there will be twice as many people in Bexar County in the year 2010 as there were in 1970. How many people this area can ultimately support is not fixed because it depends upon the minimum quality of life we are willing to accept; the more people using a limited resource, the lower the quality of life. Another population and environmentally related problem has to do with energy consumption. As gas reserves in the Southwest are depleted around the year 2000,

more energy consumption with less clean fuel (oil, coal, nuclear) will most likely result in environmental degradation and consequently in the quality of life.

Increasing the population of this area means:

- (1) Increasing the amount and complexity of governmental control necessary to manage larger numbers of people living in closer proximity. (Example: In 1910 each congressman represented 211,000 citizens; in 1970 each congressional constituency was 470,000 citizens. By 2000, each will represent 623,000 (2 children per family prediction) or 741,000 (3 children per family prediction).
- (2) Increasing the tax burden as the number of public services is increased to accommodate more people; the result being fewer services received in proportion to taxes paid.
- (3) Increasing the health-related problems of crowding and human interaction, such as mental and related diseases. The seriousness of this problem depends very much on the urban environment created as the population grows. Good environmental development requires careful organization, planning, control and the expenditure of large sums of money.

Further development of water resources cannot help but degrade our environment (see Water Resources section). Air pollution, already a problem of concern in the area, will increase as more transportation is necessary for an increasing population. Higher urban density is likely to result, which would decrease transportation and energy distribution problems, but would certainly change the area life style. Increasing density also increases the necessity for careful land use control; such controls have not been a part of the accepted role of government in Texas.

Alternatives:

In March 1972, the President's Commission on Population and the American Future published its Final Report. The Commission's conclusion was that the United States should immediately implement the many efforts necessary to stabilize the population of the United States, and encourage whenever possible the rest of the world to do the same. The reasons for these conclusion are well explained by the Commission, and should be read by every American.

There are positive actions available to the people of this area who want to preserve the life style we know today, or who believe that all citizens should participate in a better life style than is now available.

- (1) Support the ideas developed by the President's Commission on Population and the American Future.
- (2) Support legislation which will allow each American family to choose the number of children desired, by making birth control technology available to everyone without economic discrimination.
- (3) Encourage and support education to help all people understand that fewer children mean more opportunities for living children.
- (4) Help reduce infant and child mortality rates by better health care and correction of dietary problems.

- (5) Support more population education, including sex education, for our children so that they may make choices in an intelligent manner.
- (6) Help to bring about a transformation in our society from "more and bigger are better" to an understanding of what more and bigger actually mean to our daily lives, and those of future generations.

Sierra Club Position:

Population stabilization is an essential part of any program of preservation and conservation. Use of our finite resources of land, air, water, and minerals by increasing numbers of people will inevitably result in the degradation of those resources. While the degree of that degradation is in part a matter of subjective judgment, an unchecked demand on resources will ultimately result in disaster, or at least a serious degradation in the quality of our lives.

Enlightened and comprehensive government action is necessary to recognize and realistically cope with the problem of continuing population growth. This action must include education, resource management, economic measures, and pollution control. All of these measures must proceed from an understanding of the consequences of more and more population.

The Sierra Club believes that the United States (including Texas) should seriously begin to question how large a population can be sustained while maintaining a good quality of life for all. (This will mean improving the present quality of life for many of our citizens.) These questions must be raised in terms of electric power production, the acquisition and use of water, land development, highway construction, resource allocation, and any other area which proceeds on an assumption of continued growth for growth's sake. Since population stabilization is inevitable, we should begin now to determine how it can best be achieved within the diverse beliefs inherent in our democratic, capitalistic, private enterprise system.

Paramount to the Sierra Club's involvement is encouraging public understanding of population size and education on the need for population control. The Club has endorsed government plans to make population and family planning information available to all individuals who request it, and the Sierra Club believes that abortion, as a means to population control, should be an individual decision.

It is the policy of the Sierra Club that the population of the United States should achieve a balance with this country's resources (75% of our requirements for 20 key minerals are imported), and the Club has urged that Americans abandon population growth as a pattern and goal in this country.

References:

1. Population, Resources, Environment; Issues in Human Ecology; Paul R. Ehrlich and Anne Ehrlich; W. H. Freeman; San Francisco; 1970.
2. Vital Statistics 1966-1970, Bexar County and City of San Antonio; San Antonio Metropolitan Health District; San Antonio; 1971.
3. Texas Almanac; A. H. Belo Corporation, Dallas, 1971.
4. The 1972 World Almanac; Newspaper Enterprise Association, Inc.; New York; 1972.
5. Report of the President's Commission on Population and the American Future; U.S. Government Printing Office, 1972.

VI. Water

Water in a very real sense is the life blood of the earth, the vital fluid of the biosphere. Over seven-tenths of the earth's surface is covered by water and it was from the primordial seas that life first emerged. In fact, the composition of our blood is strikingly similar to sea water.

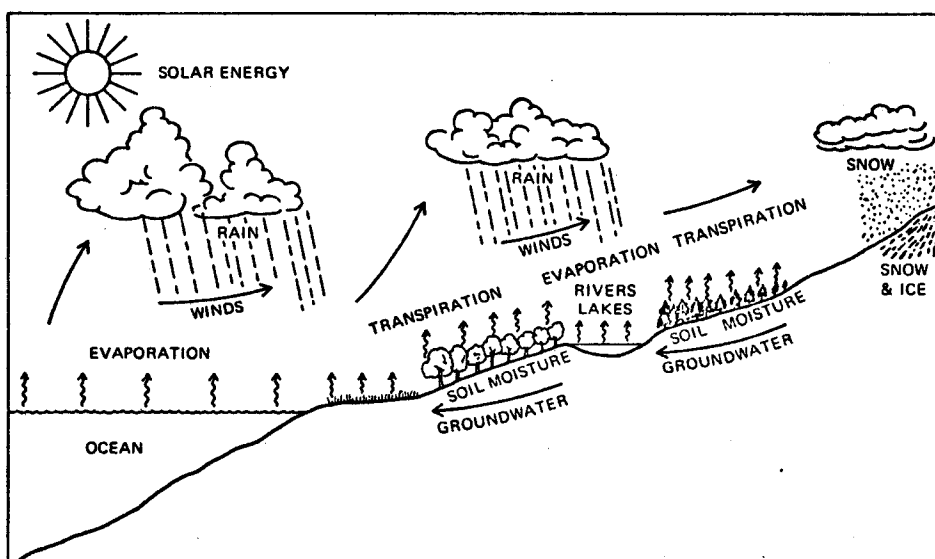
These origins are still strongly felt in the emotions of contemporary man. We return again and again to the ocean, to streams, rivers, and lakes in search of tranquillity and release from stress. This instinctive and inexpressible rapport with water is the common heritage of all men.

Beyond this somewhat spiritual relationship, we depend on water for the continuance of life itself. Without pure water no life, human, animal, or plant, can be long sustained. Our fundamental dependence on the oceans, and the importance of their environmentally sound health, is finally being recognized.

Equally essential, water must also serve industry, transportation, and the disposal of waste materials. It is in meeting these various water requirements that conflicts arise, conflicts in determining what course or courses to follow. The fundamental problem is to ensure that man's technological demands and processes do not finally result in a supply of potable water insufficient to sustain life in the biosphere.

An equally critical factor in the water situation today is the balance of supply and demand. Water, unlike air, is not evenly distributed. There are areas of relative abundance and areas where the supply is always scant. There are sources which do not readily provide water of usable quality, while other sources yield pure water with minimum effort. In both situations conflicts arise as to how water shall be used and by whom. Unwise determination of such conflicts can be as perilous to the water situation as those policies which have led to pollution of rivers, lakes, and the oceans.

The environmental role of water, by its very nature, produces complex ecological conditions. Such conditions are further complicated by the intrusion of economic, political, and governmental influences. This section will attempt to provide an overview of the vast and many-faceted water problem.



TOPIC: Texas Water Plan

Background:

It is immediately apparent that the eastern portion of Texas has more water than the western portion of the state. This holds for both ground or surface water and for rainfall. This natural imbalance has been the object of study by various governmental agencies for a number of years. As industrial, agricultural, and urban growth occurs, demands on water resources inevitably increase. These factors led in 1968 to formulation of the Texas Water Plan by the Texas Water Development Board (TWDB).

Stated in the simplest terms, the Texas Water Plan envisions impoundment of all "surplus" water in the state, importation of "surplus" water from the lower Mississippi River, and the movement of this water to major population centers and agricultural areas across the state by means of large canals. The plan, as presented to Texas voters for approval, was to have cost Texas \$3.5 billion and the federal government \$13.5 billion (1970 dollars). Texas voters decided against adoption of the proposed Texas Water Plan, but the TWDB has stated its intention to proceed with the project in a piece-wise fashion. The San Antonio area is to be included in the Plan through construction of two large reservoirs on the Guadalupe River (Cuero I and II), a reservoir on the Medina River (Applewhite), a reservoir on Cibolo Creek, and by conveyance of water from Canyon Reservoir (see separate discussion). These actions are to be achieved over a period of approximately 30 years.

The plan is based on several major assumptions:

- (a) The population of Texas will increase to 30 million by the year 2020 (an exponential growth rate).
- (b) There is "surplus" water available in the rivers of Texas and from the lower Mississippi River.
- (c) Sale of water provided through the Plan will support the cost of implementing it.

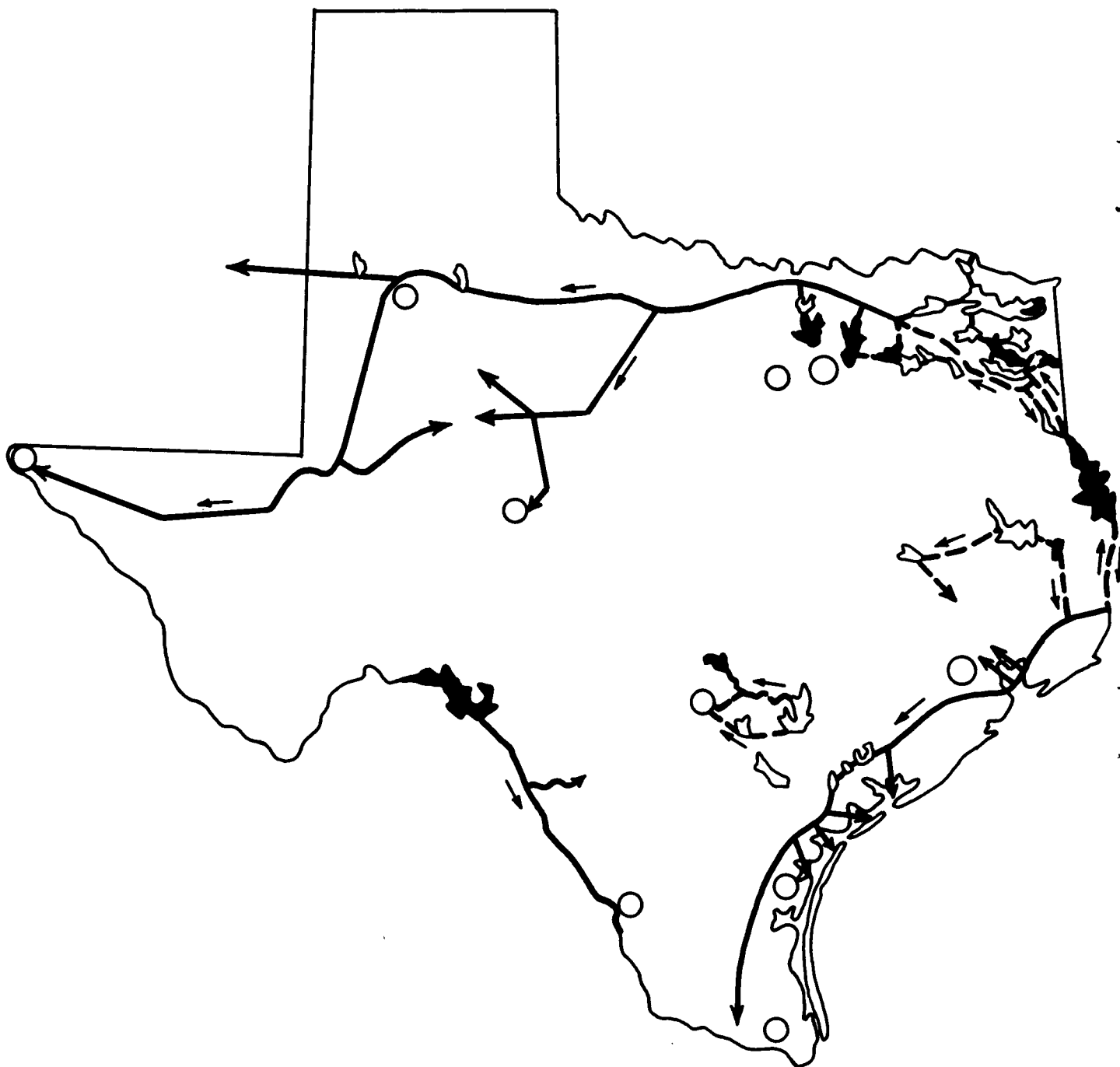
Even without considering the environmental problems related to the Plan, each of these assumptions is subject to considerable doubt. When these doubts are coupled with an evaluation of impact on the environment, the Plan is clearly demonstrated to be economically and environmentally infeasible.

Problem:

The environmental problems connected with the Plan are enormous both in scope and severity. This is to be expected when considering the massive degree of interbasin water transfer which the Plan projects. Such transfers are almost always ecologically unsound unless significant environmental safeguards are provided. Such safeguards are almost totally absent from the Texas Water Plan as now proposed.

Direct and indirect environmental problems associated with the Plan are discussed below.

1. Impact on bays and estuaries. At present there are no comprehensive data on the quantity of water and nutrients required to keep the Gulf Coast bays, estuaries and



-  Existing Reservoirs Included in Texas Water System
-  Proposed Reservoirs for Texas Water System
-  Proposed Major Conveyance Facilities
-  Alternate Major Conveyance Facilities
-  Major Cities

marshes viable. There is, however, clear evidence that decreasing the amount of water and nutrients reaching these areas severely affects the life present in them (see section on Estuaries). The Plan would dam many rivers and streams which flow to the Gulf and instead would provide water and nutrients to the coast only through controlled release. The quantity and timing of such releases are presently open to complete speculation. If these releases are not adequate for the biological needs of the bays and estuaries (and these are not clearly known), then these areas will be severely damaged. The TWDB has also stated that "someone" will have to pay for any water released to the estuaries.

2. Increased energy use. Moving water from east to west in Texas as proposed by the Plan requires a lift of about 3,000 ft. This lift must be provided by a series of pumps as water is moved across the state. Electrical energy for this pumping must be provided by new power plants fueled by natural gas, coal or nuclear energy. The total amount of electrical energy required annually is approximately equal to 20% of all other present power needs in the state. Generation of this energy will consume large quantities of non-renewable fuel resources, require construction of many large transmission lines, and may add to air pollution levels if coal fueled plants are used. Strip mining of coal is also projected to service these plants. Use of nuclear fueled plants will create the additional problems of radioactive waste products and thermal pollution of water.

3. Encouragement of population growth. Whenever and wherever resources are available, growth tends to take place to the level of that resource. Restriction of the resource conversely tends to reduce growth. It is thus difficult when projecting resource needs, and planning for them, to differentiate between growth which would have occurred normally, and that fostered by a surplus resource being provided. In practice, if an oversupply of some resource is provided because of projected future growth, then that growth becomes a self-fulfilling prophecy and occurs. The problems of an ever increasing population are well known, and providing additional impetus to growth of urban centers in dry areas of Texas through an oversupply of water is environmentally unwise.

4. Flooding loss. Providing "surplus" East Texas water requires that this water be impounded by means of dams and reservoirs so that it is not "lost" to the Gulf of Mexico through natural river and stream flow. Such reservoirs (similar to the already built Toledo Bend and Sam Rayburn reservoirs) inundate vast amounts of highly fertile farmlands, scarce forest, and ecologically rich river valley. Besides a major loss of agricultural production, much river valley wildlife habitat will be lost and areas of great archeological potential will be flooded.

In addition to the major environmental problems discussed above, a host of other ecological effects may result from implementation of the Plan.

1. Disruption of Mississippi River Delta. Diversion of 9 to 13 million acre feet of water and silt annually from the lower Mississippi River may seriously alter the shape and character of the delta with concurrent damage to estuaries and wildlife.

2. Wildlife isolation. Presence of major east-west canals will act as barriers to wildlife movement. The effect of creating such ecological corridors is completely unknown.

3. Contamination of water supplies. Water taken from the lower Mississippi carries a large quantity of phosphates, pesticides, silt, sewage, nitrates, and other polluting agents. These materials will pass into municipal water supplies and can also contaminate agricultural products unless removed from the imported water. No such purification is included in the Plan and costs will most probably have to be borne by the cities receiving water.

4. Loss of free flowing streams. Much of the scenic beauty to be found along rivers and streams in Texas will be lost, since many such watercourses will be dammed. Resulting flooding of river valleys will destroy this valuable resource for enjoyment by the citizens of Texas.

Alternatives:

The simplest and most ecologically sound alternative to the Plan is to allow population and agriculture to be controlled by the water available in each area, i. e., let the resource and the demand become self-regulating. This can be simplistically viewed as no plan at all, but such an approach will ultimately result in over-exploitation of the available resources.

The best alternative rather is formulation of a water plan for Texas which is based on the premise that water is not an infinite resource; a plan which fully recognizes and accommodates the complete spectrum of environmental effects. Such a plan would reflect a number of salient factors.

1. Controlled extraction of ground water. An economic and legal structure which recognizes the intrinsic value of water. Rather than permitting the uncontrolled pumping of water, as is presently done, a structure of fees, removal allowances, permits, or taxes would control the usage of ground water as a demand on a finite resource.

2. Usage patterns. Much water is lost through usage patterns such as domestic sewage treatment systems and one pass cooling. Altering these patterns would result in decreased demand.

3. Maximum re-use. Treatment of water after usage and recycling for secondary or tertiary uses would also decrease demand and help to extend the useful life of the finite water supply.

4. Exploration of new sources. Research on new sources such as brackish water, desalinization, and high pressure geo-thermal wells should be conducted to provide supplemental sources.

5. Bay and estuary demand. Extensive research should be conducted to obtain information on which understanding of the critical bay and estuary eco-systems can be based. No impoundment or diversion of water and nutrients to the Gulf should be permitted until the biological demands of these areas are fully understood and accommodated.

Sierra Club Position:

The Texas Water Plan as presently defined is ecologically and economically unsound. If the Plan is implemented, severe and widespread environmental damage will result. In addition to the ecological drawbacks, the Plan is based on a number of specious assumptions and reflects a seriously deficient financing requirement. An ecologically sound plan to meet the reasonable water needs of Texas should be developed within the next five years to reduce exploitation of our finite water resources.

References:

1. The Texas Water Plan; Texas Water Development Board; Austin, Texas; Nov. 1968.
2. The Texas Water Plan - Summary; Texas Water Development Board; Austin, Texas; Nov. 1968.
3. The Water Hustlers; R. N. Boyle, J. Graves and T. N. Watkins; Sierra Club; San Francisco, 1971.

TOPIC: Gulf Coast Estuaries of Texas

Background:

The most valuable coastal waters of the earth are the marsh flats, estuaries and bays. An estuary is a semi-enclosed coastal body of water having a free connection with the open sea and within which the sea water is measurably diluted with fresh water derived from land drainage. The reasons marshes and bays, and especially estuaries, are important is their extreme fertility. They produce 10-25 grams of new life per square meter per day (measured by dry weight) compared to 3-10 for the best agricultural areas and less than 0.5 for the open ocean. Estuaries are the breeding and/or nursing grounds for photosynthetic organisms, a huge diversity of other plant and animal organisms important in the ecology and food web of the sea, as well as some species which are of more obvious importance to the commercial and sports fisherman.

Estuaries of Texas are unique in that they are shallow and, like other Gulf state estuaries, periodic tides are relatively small; thus, water levels and mixing between fresh and salt water depend principally on the wind. Therefore, outward movement and flushing are highly dependent on adequate fresh water inflow. Some estuaries of Texas are unusual, e.g., Sabine Lake is almost fresh water while the Laguna Madre system receives little to no fresh water and is extremely hypersaline.

There are at least 1,344,000 surface acres in the Texas estuary and bay system. The Galveston-Trinity bay system comprises about one-fourth of this, is the largest, and contributes more in annual recreation and commercial dollars than any other bay system. In addition, there are 486,400 acres of marshlands, 128,000 acres of wildlife refuges and 22,400 acres of man-made lands and spoil banks. There are 1,890 miles of waterfront, of which 1,419 are on the bays and 371 on the Gulf.

The dollar value of coastal wetlands is difficult to evaluate. In 1958 the approximately 1.3 million surface acres of Texas bays and estuaries were estimated to be worth \$483 million. This was taking all uses into consideration. Computed as a 50-year annuity at 5%, the worth then would have been \$8.8 billion or \$6,780 per acre. In 1969 commercial landings of seafood in the U. S. were valued at \$519 million, the total Gulf catch at \$156.2 million, and the Texas catch at \$47 million. More than 50% of the total U. S. shrimp landings were made in the Gulf and were worth \$83 million in 1970. Of these landings 40% were made off Texas. In 1967 the annual catch from Texas was valued at \$200 million, considering all sports and commercial species, and 99% of the species caught spend some part of their life cycle in estuaries. Related economic return to the state from tourism attracted to bay areas was estimated at \$300 million.

Problems:

The problems contributing to deterioration of Texas bays and estuaries may be described as follows:

Hypersalinity. The degree of salinity of estuaries and marshes is critical for the productive life of many species. Hypersalinity results naturally during droughts, and it is clear from past records of Texas Parks and Wildlife Department and U. S. Bureau of Commercial Fisheries that when near drought conditions prevail for sustained periods, commercial landings decreased drastically.

Hypersalinity may also result when man builds dams on the rivers which drain into the bays and estuaries, thus preventing essential fresh water inflow. Local conditions of hypersalinity may result from channelization and creation or destruction of barriers. Another source of excess brine is the brine waste discarded by near-shore oil drilling operations.

The successful breeding, growth and development, and survival of many marine species is highly dependent on an appropriate salt concentration of the bays and estuaries in which they live. Changes in species composition of bays and estuaries are observed with increasing salinity. The commercial oyster, as one example, is replaced by a noncommercial oyster in years of increases salinity.

Inflow reduction. Problems which arise from reduction of fresh water inflow may be summarized as follows:

- (1) Increased hypersalinity as already described;
- (2) Disruption of natural, intricate current systems, which are essential to marine ecology;
- (3) The maintenance of natural inlets between barrier islands connecting estuaries to the sea is disrupted;
- (4) Disease-causing microorganisms and predators are encouraged to proliferate in hypersaline waters; they do not tolerate low salinity;
- (5) Normal inflow of essential nutrients is prevented.

The Texas Water Plan allowed 3.5 million acre-ft of fresh water inflow to maintain an ecologically sound balance of life, which is not at all adequate for bays and estuaries. The average inflow from rivers and streams has been about 10 million acre-ft per year since 1960. The annual average for Galveston Bay alone is almost 7 million acre-ft per year. This inflow must be maintained, and pollution must be eliminated if the bays and estuaries of the gulf coast are to remain at their current level of productivity.

Pollution. Pollution of bay and estuaries results from many sources. They include: pulp mill effluents, sewage, industrial pollution of many sorts, including chemicals, metals, temperature changes, and radioactive materials, siltation resulting from natural or man-made erosion, pesticides, and oil. Adequate freshwater inflow tends to decrease the harm caused by all of these pollutants.

Landfill and bulkheading. Landfill and bulkheading eliminates the shallow, fertile estuaries which are prime nursery grounds for marine animals. It has been shown that natural shoreline produced 2.5 times more brown shrimp and 14 times more white shrimp than bulkheaded shoreline in Galveston Bay.

Proposed hurricane levee. The Army Corps of Engineers is studying the feasibility of a hurricane protection levee along the Gulf Intracoastal Waterway. The building of this levee would drastically change the ecology of the bay system and those areas of the bays would be cut off and the water exchange impaired. In addition, other bay bottom areas would be covered by fill for the levee, and still others would be deepened as dredged borrow areas. Estuarine habitat thus lost could never be recovered.

Dredging. Ecosystems of bays and estuaries are damaged by dredging for channels and harbors in several ways. Nursery grounds and habitat site are directly damaged or destroyed by the dredging action itself. Turbidity resulting from dredging operations is also harmful to nearly all organisms, particularly juveniles. Finally, dredging spoil is either dumped over other nursery grounds and habitat sites with consequent damage or placed in spoil banks, which can alter current patterns and also eventually erode with secondary damage to bottom areas.

Alternatives:

Because of their high environmental, economic, scenic, and recreational value, Texas bays and estuaries should be afforded the highest possible degree of protection. Adequate inflows of fresh water should be recognized legally as a priority requirement, and these inflows guaranteed in perpetuity. Industrialization of the coastal area should be rigidly controlled. All development should be banned from a buffer zone of high environmental susceptibility. All waste discharges into the bay and estuary system should meet stringent standards. Certain types of discharge should be totally prohibited. In addition, upstream discharges into rivers should be re-examined and prohibited as necessary based on total effluent loads to the bays and estuaries. All major land movement operations should be under a permit system administered by the Parks and Wildlife Department. Landfilling and shell dredging should be totally prohibited. The most environmentally sensitive areas should be purchased by the State and held in perpetuity as public open space.

Sierra Club Position:

The bays and estuaries of Texas are a common heritage of all citizens and should be preserved. Maintaining these critical areas in a state as close to natural is the best and highest use of the land in this instance. Major impacts of man must be lessened through prohibitions, close control, and outright purchase. All water planning in the state must take cognizance of the bay/estuarine ecosystems as one of its highest priorities.

References:

1. Texas Coastal Resources Management Program; The Governor's Office, Division of Planning Coordination; Austin, Texas; December 1972.
2. The Management of Bay and Estuarine Systems in the Texas Coastal Zone - Phase II; The Governor's Office, Division of Planning Coordination; Austin, Texas; March 1973.
3. Marine Pollution: Tributaries and Coastal Waters of Texas and the Gulf of Mexico; Unpublished Paper; Dr. Fred Rommel; April 1971.
4. The Frail Ocean; Wesley Marx; Ballantine Books, New York; 1967.

TOPIC: Water Resources in the San Antonio Area

Background:

The sole water supply for the San Antonio-Bexar County area is the Edwards Aquifer (an aquifer is an underground water-bearing geological formation). The Edwards Aquifer extends from near Bracketville on the west to near Austin in the northeast, and is the primary water source for nearly a million people. The aquifer is a porous limestone stratum averaging approximately 500 ft thick, beginning at ground level on the north and sloping south and east to many hundreds of feet beneath the surface on its southern boundary, see Figure 1. On the northern edge of the aquifer along the Balcones fault zone, the Edwards limestone outcrops to the surface with many cracks and crevices. This area is known as the recharge zone. Recharge is a process by which rainfall finds its way into the deep limestone portion of the aquifer. This is shown schematically by Figure 1. On the southern boundary of the aquifer is found brackish water of high mineral content. This brackish water has not mixed with the Edwards aquifer water except possibly towards the end of the great drought in 1954. It is believed that mixing will not occur as long as the Edwards aquifer is not too empty, that is, it has a high hydrostatic head of pure water to keep out the brackish water.

To the south and east of this area, there exists another aquifer of a completely different nature, the Carrizo-Wilcox aquifer. It is made up largely of sand and sandstone, which permits a much lower withdrawal rate and has a considerably slower recharge rate than is found in the Edwards. In contrast to the Edwards, the Carrizo-Wilcox aquifer also has a very large capability for filtering water which passes through it.

Problems:

Historically, the Edwards aquifer has been practically an inexhaustible source of water for this area. Within the last 20 years, man's use of water from the aquifer has increased tremendously, so that a drought today means that the level of water in the aquifer will be greatly decreased. By the best estimates, the capacity of the aquifer is approximately 14,000,000 acre-ft (an acre-ft = 326,000 gallons). Unfortunately, all of this capacity is not usable. It has been estimated that approximately 2,000,000 acre-ft of water can be removed from the aquifer before brackish water begins to mix with the Edwards water along the southern boundary. Thus, the useful capacity of the aquifer is only a fraction of its total capacity. Over an extended period of time no more water may be used from the aquifer than is replaced by recharge. Between the years 1934 to 1968, an average of 529,350 acre-ft per year has been removed from the aquifer, while the estimated average recharge has been only 514,100 acre-ft per year. Today, more water is being taken from the aquifer on a long range basis than is being replaced by recharge.

The annual outflow of water from the aquifer includes an average of 200,000 acre-ft per year which flows from several springs, principally Comal and San Marcos springs. The remainder of the water removed from the aquifer each year is pumped for industrial, agricultural and domestic uses. If the average annual spring flow is to be used by man for his purposes, it will be necessary to sacrifice the ecological system of the San Marcos River as well as the aesthetic and economic assets of that spring. The same will be true for Comal Springs.

In Texas there is no existing governmental regulation of ground water resources. Property owners and municipalities may drill wells and remove water for their own use in any quantity they so desire. The largest increase in consumption of Edwards water has

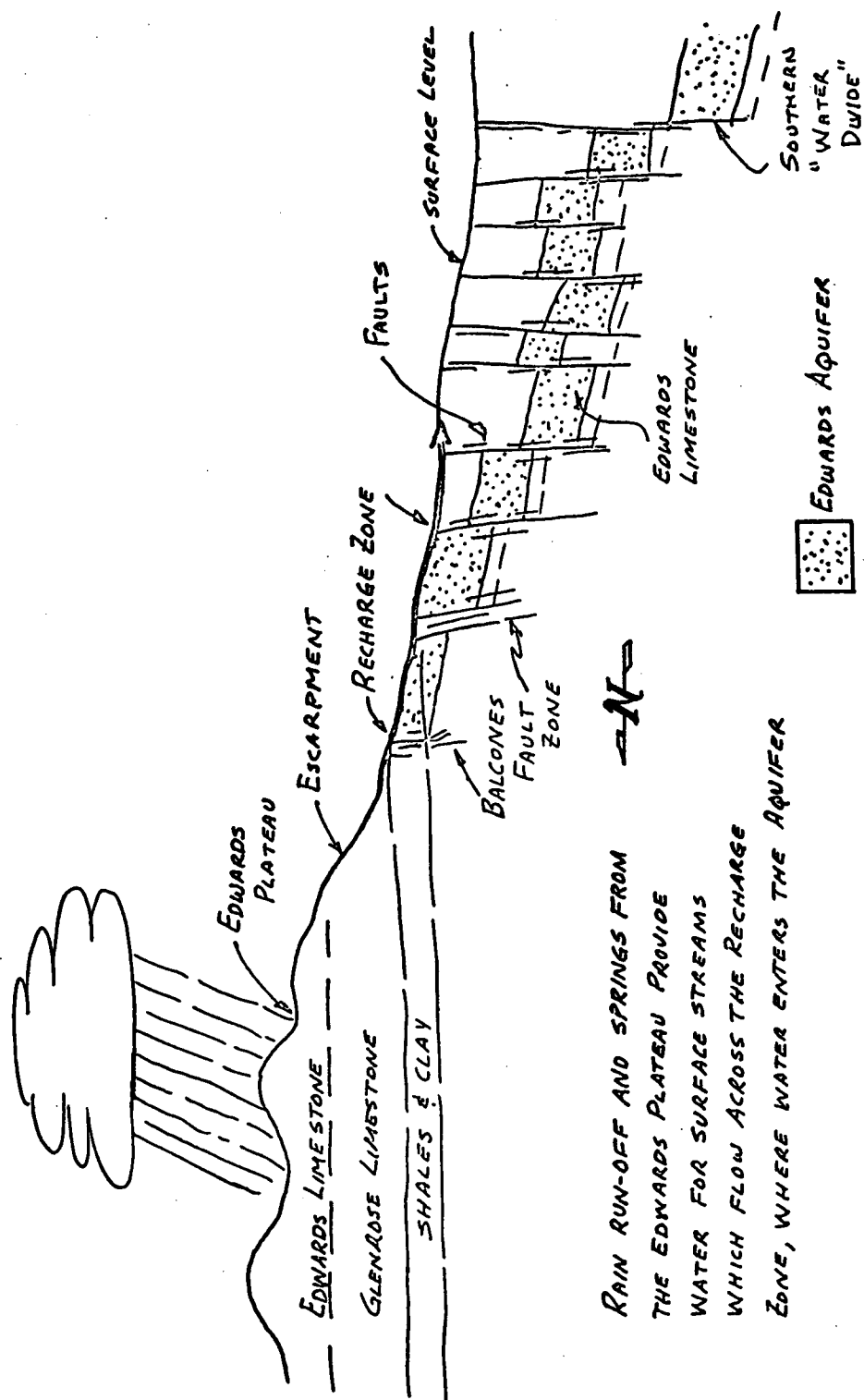


FIGURE 1

been for irrigation purposes, and that trend is likely to continue. Most of the increased agricultural usage of water is occurring west of San Antonio. Since water flows through the aquifer from west to east, increased agricultural use will likely deny the use of this water to the eastern portion of the aquifer. There is no legal tool available with which to guarantee the future ground water supply for the San Antonio-Bexar County metropolitan area, even at its present level. The Texas Water Development Board estimates approximately 260,000 acre-ft of water will be available from the aquifer annually by the year 2020. This estimate is made by extrapolating present conditions of development to that year. Present use exceeds that amount.

Urbanization of the aquifer recharge zone will make it very difficult, if not impossible, to prevent at least some pollution of the Edwards aquifer, and will decrease the amount of annual recharge. Fortunately, urbanization pressures along the recharge zone are not severe except in Bexar County, where San Antonio is moving northwestward over the recharge zone. The Edwards limestone, because of its porous nature, allows practically no filtration of polluting materials as the water moves from the surface down into the storage area of the aquifer (see separate discussion). Although the aquifer has been under study for many years, the exact points of recharge in the direction of water flow within the aquifer are unknown.

Alternatives:

Present trends in water use and urbanization cannot continue much further into the future without serious consequences. There are numerous alternatives available. Agencies concerned with supplying pure water to the San Antonio area, such as the City Water Board and Texas Water Development Board, believe that the only solution is the importation of surface water from another river basin. Two additional reservoirs are planned for the San Antonio area: Cibolo Reservoir on Cibolo Creek in Wilson County, and Applewhite Reservoir on the Medina River in southwestern Bexar County. These two reservoirs will be capable of supplying only approximately 36,000 acre-ft per year and will cost approximately \$90,000,000 to build, with an additional \$10,000,000 necessary to construct water transfer facilities to San Antonio. This small additional supply, contrasted with the overall demands of the area (expected to exceed 350,000 acre-ft/yr by 2000) makes the economic cost questionable. Environmental costs have not yet been estimated.

The most immediate source of water from another river basin is Canyon Reservoir on the Guadalupe River. Controls to prevent pollution of Canyon Lake and the upper Guadalupe will also have to be implemented if costly treatment plants are not to be built, and legal problems exist between the Guadalupe-Blanco River Authority and the City Water Board over how the water is to be purchased.

Another alternative is to begin the implementation of techniques to conserve and protect the existing sources of water. The following steps should be taken in this respect:

- (1) Recognition that unlimited population growth and development in this area is not feasible because of limitations in the water supply.
- (2) Legislation to provide state controls for ground water resources.
- (3) Implementation of water rates commensurate with the available supply, and to encourage the conservation of water in industrial, agricultural and home use.

- (4) Prevent urbanization of the recharge zone for the Edwards aquifer.
- (5) Implement a study of the total water resources of the area, taking a systems approach, which will include waste water recycling and conservation as well as future water resources development.

Sierra Club Position:

Water resources should be developed within this area so that they have a maximum value to man with minimum damage to the natural environment. Vigorous efforts aimed at conserving the water we currently draw from the Edwards aquifer should be made a part of any further water resource development in this area. The implementation of some of the alternatives listed above before surface water sources are developed would provide best long term strategy for supplying water to this area. Finally, we must examine the interactions between water availability, population, and quality of life so that intelligent decisions may be made on further development in this area.

References:

1. The Edwards Underground Water District - a booklet describing the organization and the reservoir.
2. Interaction Between Water Supply and Future Urban Development, Area Policy Council of San Antonio, Report No. 1, April 1970.
3. Water Resources Development and Management in the Edwards Aquifer Region, L. B. Johnson School of Public Affairs, University of Texas at Austin, Seminar Research Report No. 1, 1971.
4. The Texas Water Plan, Summary, Texas Water Development Board, Austin, Texas, 1968.
5. San Antonio and Bexar County, Texas, Report on Reclamation and Re-Use of Municipal Wastewater, by Freese, Nichols and Endress, Consulting Engineers, Ft. Worth, Texas, 1971.

TOPIC: Edwards Underground Aquifer

Background:

An aquifer is a geologic formation in which water movement is relatively easy; thus, it can serve as a water supply. Most of the world land mass is underlain with aquifers. Limestone is a common geologic aquifer formation. Texas from the Hill Country south is underlain by the Edwards limestone formation, which is on the surface along the southern and eastern edge of the Hill Country (Balcones Fault Zone) and is buried progressively deeper as it moves southward to the Gulf. A portion of this massive limestone formation forms the Edwards Underground Reservoir (Aquifer), which is the sole source of drinking water for over a million people from Uvalde to San Antonio to Austin (see map).

Movement of water in the aquifer is poorly understood at present, but in general, it moves from west to east, then northeast at 1 to 5 ft per day, or perhaps more rapidly. This rapid movement is due to the porosity of the limestone and because it is heavily faulted (cracked) and contains many caverns and channels. These physical characteristics also allow pollutants to penetrate the aquifer in the recharge zone.

Problem:

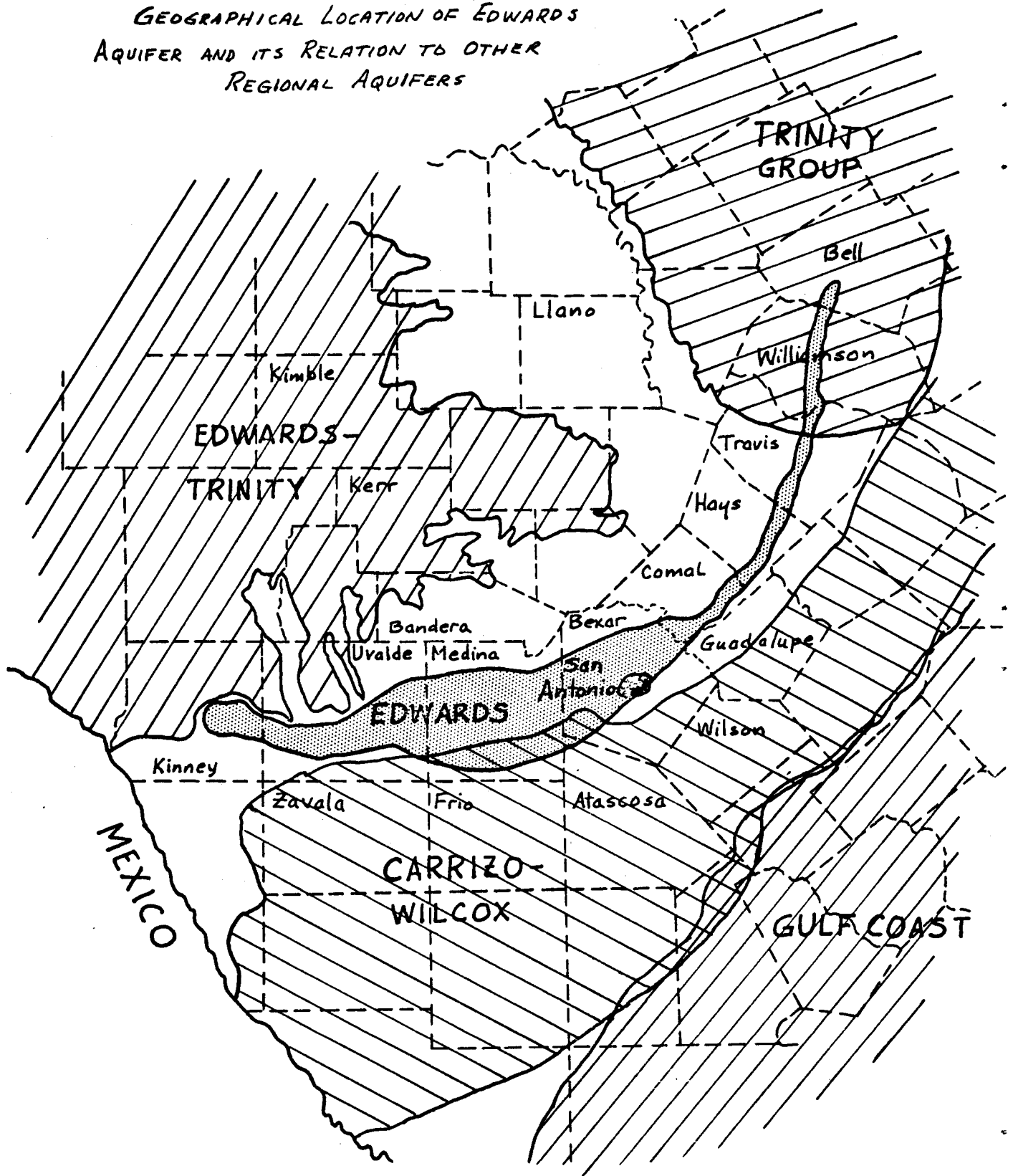
As development of the areas forming the recharge zone progresses, the potential for pollution of the aquifer increases. This pollution can come from a number of sources: septic tanks; sewer lines; feedlots; rainwater runoff leaving oil, chemicals, fertilizers and pesticides; and industrial effluents in streams or rivers. If pollution from such sources is not strictly controlled, eventual loss of the aquifer as a source of pure drinking water for a million people may result.

There is already evidence of localized pollution of the aquifer in the Leon Valley area where wells have been contaminated with gasoline for several years. Despite the efforts of various government agencies and consultants, the source of this gasoline has never been located or controlled. A limestone aquifer near St. Louis, Missouri, practically identical in geologic structure to the Edwards Underground Reservoir, has become contaminated by pollution to a sufficient degree that drinking water can no longer be drawn from it.

In 1970 and again in 1974, after extended periods of public hearings, the Board issued orders which intend to regulate potentially polluting activities in the recharge zone. But the order addresses only pollution hazards derived from sewage (septic tanks and sewer lines), which is only part of the problem. Even Texas' Attorney General castigated the Board on the weakness of the order during the meeting in which they adopted it. All the responsible government agencies of the San Antonio area had requested the Board to adopt a stronger order and had, through a Task Force of the Alamo Area Council of Governments, even suggested a more protective order. The reason state government is being so unresponsive on this issue is not known and must be further explored.

By far the largest part of the recharge zone lies outside of any incorporated area. There is, therefore, no form of land use control, and the land is subject to uncontrolled development. This is particularly true in and near the San Antonio metropolitan area where extensive development is taking place. The most attractive and marketable land for residual usage lies to the north and west of San Antonio and has been heavily developed in post-war

GEOGRAPHICAL LOCATION OF EDWARDS
AQUIFER AND ITS RELATION TO OTHER
REGIONAL AQUIFERS



years. This has been further accelerated by the construction of major traffic arteries (IH 10; Loop 410, FM 1604, and US 281), shopping centers (Wonderland, Central Park, North Star Mall) and public facilities (UT Medical School complex). Even greater development impetus will undoubtedly result from proposed additional construction such as the UTSA campus, North Expressway, Bandera Expressway, and San Antonio Ranch New Town. The total thrust of this northward land development over the recharge zone will seriously endanger the integrity of the Edwards Underground Reservoir unless positive and comprehensive control measures are instituted.

Alternatives:

The most direct alternative available is a system of land use control encompassing all areas, not just those within incorporated cities. Such state wide land use control would recognize critical environmental areas such as the aquifer recharge zone and limit development to non-polluting uses.

An indirect method of restricting development would be to refrain from providing growth accelerating factors such as transportation arteries or growth loci, e. g., UTSA Campus. While this is not a positive control method, it at least does not stimulate urban growth in the recharge zone area. In fact, deliberate siting of major growth loci toward the south would have the effect of diverting some development pressure away from the recharge zone.

Consideration should be given to purchase of the areas of the recharge zone subject to the most intensive development pressure. In essence, this means that portion falling within Bexar County. Recent aerial surveys show that only about 4% of this area is presently (1973) developed. Thus, purchase of the remainder, while involving significant expense, would offer an effective means of controlling pollution of the aquifer. Cities in many parts of the world provide for watershed protection through careful land use control.

In addition to these measures, centralized sewage treatment systems should be provided to serve any development occurring near the recharge zone, particularly above it. Where this is not feasible, a comprehensive, adequate, and strictly enforced method of controlling septic tank usage and other pollution sources should be instituted.

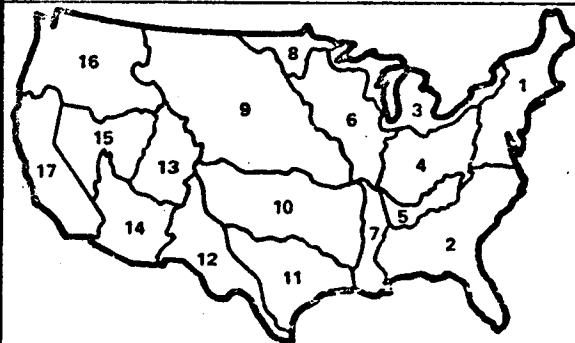
Sierra Club Position:

Protection of the Edwards Underground Reservoir must be a matter of high priority at all governmental levels. This protection should be provided by a combination of methods including land use control, provision of central sewage treatment systems, measures to slow development, and rigid control of all potential pollution sources. Acquisition of portions of the recharge zone under developmental pressure should also be explored. Water resources should be treated from a total system viewpoint, wherein sewage disposal must be properly accommodated as a prerequisite to permitting use. Establishment of a single regional water resource entity (supply and disposal) would provide much more effective controls than are now possible with overlapping public and private interests. Such an authority should be authorized by the State.

References:

1. The Edwards Underground Water District--a booklet describing the organization and the reservoir.
2. Hydrologic Investigations of the Edwards and Associated Limestones in the San Antonio Area, Texas, Progress Report 1970-71. R. W. Maclay and P. L. Rettman, USGS.
3. Interaction Between Water Supply and Future Urban Development, Area Policy Council of San Antonio, Report No. 1, April 1970.
4. Numerous publications of the Edwards Underground Water District in cooperation with the U. S. Geological Survey concerning Discharge, Recharge and Water Quality in the Edwards Aquifer. Available at San Antonio Public Library (Main), Edwards Underground Water District, and the U. S. Geological Survey, San Antonio Field Office.

Water availability: supply vs demand (billion gal./day)							
	Mean annual run-off	Annual flow 90% of the years	available 95% of the years	Fresh water consumptive use		Withdrawals	Projected withdrawals
				1970	2000	1970	2000
1 North Atlantic	163	123	112	1.8	5.0	55	113.9
2 South Atlantic-Gulf	197	131	116	3.3	5.7	35	87.4
3 Great Lakes	63.2	46.3	42.4	1.2	3.2	39	98.6
4 Ohio	125	80	67.5	.9	2.5	36	65.1
5 Tennessee	41.5	28.2	24.4	.24	0.8	7.9	13.9
6 Upper Mississippi	64.6	36.4	28.5	.8	1.8	16	30.6
7 Lower Mississippi	48.4	29.7	24.6	3.6	4.5	13	28.0
8 Souris-Red-Rainy	6.17	2.6	1.91	.07	0.5	.3	2.0
9 Missouri	54.1	29.9	23.9	12.0	15.0	24	27.9
10 Arkansas-White-Red	95.8	44.3	33.4	6.8	10.6	12	25.3
11 Texas-Gulf	39.1	15.8	11.4	6.2	10.9	21	57.3
12 Rio Grande	4.9	2.6	2.1	3.3	5.0	6.3	9.5
13 Upper Colorado	13.45	8.82	7.50	4.1	3.1	8.1	6.6
14 Lower Colorado	3.19	1.07	0.85	5.0	4.6	7.2	8.4
15 Great Basin	5.89	3.12	2.46	3.2	3.6	6.7	7.6
16 Columbia-North Pacific	210	154	138	11.0	17.3	30	90.1
17 California	65.1	33.8	25.6	22.0	32.7	48	120.5



Notes: Consumptive use of water is water that is incorporated into a product or lost to the atmosphere and hence, cannot be reused. Withdrawal use of water is water diverted from its natural course which may be returned later for further use. Some part, however, of withdrawn water may be lost; moreover, withdrawn water may not be returned near the point of withdrawal. Substantial water withdrawals over a short period of time, under certain conditions, may adversely affect "onsite" uses (swamps, natural vegetation, evaporation, wildlife, etc. "Instream" applications - agriculture, irrigation, industry - may also be affected

October 17, 1973 CHEMICAL WEEK

TOPIC: Wastewater Treatment in Bexar County

Background:

Approximately 34.6 billion gallons of water were pumped from the Edwards Underground Reservoir (see separate topic) for Bexar County residents in 1970, and much of this water (about 120 gallons per person per day) carried the wastes of the City of San Antonio down the San Antonio River.

Over 90% of the wastewater of San Antonio and the immediate surrounding area is treated at three major sewage treatment plants in southern San Antonio; the Rilling Road Plant with a capacity of 90 million gallons per day (90 MGD), the Salado Creek Plant (24 MGD), and the Leon Creek Plant (12 MGD). These are secondary, activated sludge type plants in which solid wastes are first settled out of the sewage and then the water is mixed with bacteria and aerated for a period of time to allow the bacteria to degrade a large portion of the dissolved organic matter in the water. The mixture of bacteria and solids which settle after aeration is called waste-activated sludge. The wastewater has been considerably purified at this stage and is chlorinated before it is pumped into the receiving creek or river. This water is not sufficiently purified for human consumption, however. It still contains pathogenic viruses and higher concentrations of organic and inorganic materials than are recommended for potable water.

A portion of the waste-activated sludge is processed for reuse as the bacterial source for further purification of wastewater, and the excess is either digested anaerobically, dried on sand beds, and stock piled for use as land fill or soil conditioner (as it is at the Salado Creek and Leon Creek Plants), or it is pumped to a receiving basin where aerobic and anaerobic decomposition continues at a natural rate. Waste-activated sludge from the Rilling Road Plant is pumped in this way to Mitchell Lake in south San Antonio.

In addition to the three main plants of the City of San Antonio, there are plants at Schertz, Universal City and Kirby, and there are about 35 private, primary (settling only) wastewater treatment facilities around the periphery of San Antonio built to handle the wastes of small subdivisions. The San Antonio River Authority also operates several smaller plants as does the Cibolo Creek Municipal Authority. The City of San Antonio is constructing outfall lines which will eliminate some of these plants, and will provide sewer service for the first time to some septic tank users. The line which extends to Leon Valley will also serve the new University of Texas at San Antonio (UTSA) and the surrounding area. Until outfall lines can be completed to connect outlying areas to the central waste treatment system, the City is constructing a large number of temporary "package plants" to serve new subdivisions. These plants discharge their effluents into streams and creeks in the area.

An average of 650 gallons of water carry one pound of domestic organic waste to the sewage plant, whereas only five gallons are used per pound of industrial organic matter. Since sewer service rates have previously been based upon volume of water used rather than content weight, industries have not carried their full share of the cost of sewage treatment in the past. In 1971, under pressure from the Environmental Protection Agency, the City of San Antonio adopted an Industrial Waste Ordinance which establishes industrial sewer service rates based upon organic content of the waste as well as volume. In addition, the Ordinance prohibits the disposal of certain types of wastes into the sewers, such as heavy metals, acids, certain chemicals, and oils.

To facilitate the efficient and economical treatment of wastewater in the Alamo area planning region the Texas Water Quality Board has adopted the concept of regional wastewater treatment authorities. The TWQB has designated the City of San Antonio as the regional authority for wastewater treatment planning and implementation over an area which basically includes the City of San Antonio with the exception of the Cibolo Creek basin, and extends north from the City boundary to FM 1604. These boundaries will be expanded from time to time as peripheral growth occurs. The San Antonio River Authority has been designated regional wastewater treatment authority in portions of Bexar County outside the area of the City's authority.

Problems:

The equipment at the Rilling Road Plant is old (the plant was completed in 1930), requiring frequent repair and replacement. The plant is operating at or above capacity at all times, which means that water passing through the plant is frequently not treated adequately. The sludge digesters do not function properly, so that all sludge from the plant is currently pumped to Mitchell Lake. Mitchell Lake is a problem to residents of the area around it because of its objectionable odor. There has been an effort made in the State Legislature to prohibit the use of Mitchell Lake as a sludge disposal basin, but the cost to the City to upgrade Rilling Road Plant to the point that use of Mitchell Lake would be unnecessary is so great that the effort has not been successful to date. Instead, the City has plans for improving the quality of the lake while still using it for the disposal of excess sludge. These plans include carrying the sludge to the center of the lake rather than discharging it on the edge, mechanically swirling the water, and aerating it to accelerate the decomposition process.

The Leon Creek plant was completed in 1965 and was expected to reach maximum capacity by 1975. The load from UTSA will probably cause this plant to be operating at maximum capacity as soon as the university opens. There are no immediate plans for expanding this plant, and it would not be able to handle the wastewater of developments such as the San Antonio Ranch New Town without major expansion.

Revenue for operation and maintenance of the wastewater treatment facilities in San Antonio comes from the domestic sewer service charge which until recently has averaged \$1.25 per household per month, plus the industrial sewer service fee. This revenue does not cover the actual cost of operation, let alone the cost of necessary renovation and expansion. The new collection schedule established under the Industrial Waste Ordinance did not go into effect until January 1973, and the City Council has only recently been willing to increase the sewer service charge for residential customers to reflect the true cost of treating wastewater.

Revenue for construction of new plants and updating existing plants must come largely from revenue bonds and grants from the State and Federal Governments (which are always on a matching basis). Millions of dollars per year are needed to keep up with the demands of a rapidly growing population and the City of San Antonio is still lagging behind. Besides money, considerable advance planning is necessary to ensure adequate wastewater treatment. It takes several years to recognize a need, draw up the engineering plans, obtain necessary approval, finance the program, and complete construction. A city must be farsighted, but also have strict zoning and development regulations to ensure that development is not hazardous and does not exceed the capacity of the city to provide adequate wastewater treatment. The City of San Antonio has moderately good secondary sewage treatment, but facilities are only marginally adequate at the present time. There is very little buffering capacity for sudden and unexpected increases in sewer service demands, and there has been no control of the rate or direction of developmental expansion around the city.

The primary reason for the stress placed on the wastewater treatment plants in San Antonio is the excessive amounts of water used in every household for bathing, washing dishes and clothes, and flushing toilets. During heavy rains there is the additional problem of rainwater seeping into the sewer lines through cracked pipe joints and open manholes. During such periods, flow through the treatment plants becomes so large that treatment effectiveness declines and poor quality effluent is discharged to the receiving stream. In extreme cases in the past raw sewage has been bypassed from the system directly to the San Antonio River. Rainwater infiltration also causes sewerage backup in residences and blow-off of manhole covers with sewerage outflow.

The quality of wastewater treatment by the many small primary treatment facilities which surround San Antonio is generally quite poor as shown by data of the San Antonio River Authority and the Texas Water Quality Board. Primary treatment facilities leave a large load of organic matter in the water, and, in addition, these plants are poorly operated and are frequently broken down.

Many heavily populated areas in north Bexar County, over the recharge zone of the Edwards Underground Reservoir are serviced only by septic tanks. The soil conditions in this region are generally unsuited for proper operation of septic tanks, and as a result, these areas are probably contributing significantly to the pollution of the Edwards Underground Reservoir.

Alternatives:

Wastewater treatment in Bexar County has evolved along three different routes: communities on septic tanks, communities or developments served by a small primary treatment facility, and areas served by treatment facilities which are operated by cities, or the San Antonio River Authority. Totally adequate wastewater treatment in Bexar County will be achieved when all areas which are populated with a greater density than one household per five acres are serviced by a few large, efficient tertiary wastewater treatment facilities operated by one regional authority. All existing authorities having responsibilities in the area of water resources, i. e., the City of San Antonio, Bexar County, the Alamo Area Council of Governments, the San Antonio River Authority, the Edwards Underground Water District, the Texas Water Rights Commission, and the numerous Water Districts, could cooperate to develop and implement a water resource management program coordinated with plans for regional land use, solid waste disposal, and transportation.

The Regional Wastewater Development Plan developed by the Alamo Area Council of Governments for Bexar and surrounding counties, the position taken by the Bexar County Commissioners relative to the control of development over the Edwards Underground Reservoir recharge zone, and the Industrial Waste Ordinance provide a good start towards comprehensive water resource management in the region. The AACOG Development Plan establishes a mechanism for designing and estimating the cost of all alternatives for wastewater treatment in the county. AACOG has recommended that the average household sewage rate be raised to \$2.00 per month, and that the regional sewage plants now in existence be upgraded to include advance treatment.

Revenue to finance the necessary expansion of wastewater treatment systems to include all of urbanized Bexar County would come from user fees, connection fees, grants, and the sale of bonds. The financial burden would be borne by all residents of the county, and everyone would benefit from increased water quality in the region.

It has already been pointed out that the present situation of large communities on septic tanks, small, inefficient neighborhood sewage treatment plants, and marginally adequate secondary sewage treatment plants does not protect the water quality of the region, is esthetically unsatisfactory, and imposes a health hazard in some areas where streams are polluted and stagnant pools lie over septic tank drainage fields.

An alternative to a unified regional system would be to allow each city, town, and community in the county to have its own secondary or tertiary treatment plant, regulated by standards of the Texas Water Quality Board. Such an arrangement costs the citizens of the community more because of multiplication of efforts of planning, design, purchasing, personnel, etc. Furthermore, it increases the difficulty of sampling, testing, inspecting of the TWQB because it increases the sites at which they must perform these functions. As an interim measure, however, until a unified sewage treatment system can be planned and constructed, small, secondary treatment plants might be built to service communities such as Hills and Dales, Helotes, Grey Forest, Shavano Park, Hill Country Village, Thunderbird Hills, etc.

One significant alternative which would raise the quality of water in the San Antonio River is to channel all waste treatment plant effluent through the two City Public Service power plant cooling lakes (Braunig and Calaveras). The added flow time in these lakes would permit further natural purification to occur before final discharge to the river. Adequate treatment prior to this channeling of the waste water is still necessary because of corrosion problems which would be experienced by CPS if the water is inadequately treated. Further, CPS lakes are currently used for recreation (fishing), and for this to continue, a high level of waste water treatment must be maintained.

Sierra Club Position:

Planning for total water resource management in Bexar County must be undertaken. Urban development should be controlled in both scope and direction so that all wastewater can be adequately treated. Revenue must be obtained, through increased sewer service charges, increased connection fees, Federal and State grants, and the sale of bonds, to modernize the Rilling Road Plant, eliminate the use of Mitchell Lake as a sludge collection pond, expand the Salado Creek and Leon Creek plants, and extend outfall lines to encompass all residential areas in north and central Bexar County, as soon as possible. As an interim measure, incorporated and unincorporated areas in Bexar County which are currently on septic tanks should take the appropriate actions to construct sewage treatment plants for their areas as soon as possible.

The Sierra Club supports the concept of a regional wastewater treatment system, administered by one authority. All authorities in the region with responsibilities related to water must cooperate in expediting the development of a comprehensive water resource management plan for the region. This plan should include methods of conserving water through restricted use, water reuse for irrigation and industry, realistic rate structures, methods of handling dried sludge for soil reconditioning, a time table for inclusion of all residential areas of the county to be incorporated into the regional system, interim sewage treatment for outlying areas, and a time table for upgrading existing treatment facilities to provide tertiary treatment.

Charges for wastewater treatment should be borne proportionally by all users of the system based on their treatment load. Rates should be set which will fully cover operating costs and provide sufficient funds to achieve a high level of discharge and support necessary extension of the system as needed.

GLOSSARY OF TERMS RELATED TO WASTEWATER TREATMENT:

PRIMARY TREATMENT: Removal of material in wastewater which will float or settle. 35-40% of the original organic matter is removed.

SECONDARY TREATMENT: Treatment process which involves the settling of solids (primary step) and the action of bacteria in the presence of air to decompose about 90% of the dissolved organic matter in the water (secondary step). The water is usually chlorinated before being discharged into the receiving stream.

TERTIARY OR ADVANCED TREATMENT: Processes which result in higher purity discharge, e. g., removal of phosphates and nitrates, treatment to remove viruses. In certain cases discharge may be of sufficiently high quality for domestic or agricultural reuse.

WASTE-ACTIVATED SLUDGE: Solids, including bacteria, which were coagulated and precipitated during the aeration process (bacterial decomposition) of secondary treatment. Some of this material is returned to the aeration tank for further purification of water. The rest is either pumped to a collection pond, or it is anaerobically digested at 70-100° F for about fifteen days, poured onto a sand bed, and dried. This material can be used as a soil conditioner.

TRICKLING FILTER: A bed of rock or charcoal on the surface of which bacteria grow. Wastewater, after primary settling, is trickled over this bed and the organic matter is decomposed by the bacteria. An alternate to waste-activated sludge process of wastewater treatment.

SUSPENDED SOLIDS: Primarily organic matter in water. Raw sewage contains about 220 milligrams per liter (mg/l). Well-treated wastewater treatment plant effluent contains less than 10 mg/l.

BIOCHEMICAL OXYGEN DEMAND: The amount of oxygen used per unit time by the biochemical (organic) matter present in water. Raw domestic sewage generally has a BOD of about 250-300 mg/liter. Well-treated water from a waste water treatment plant has a BOD of 10-20 mg/liter. If water has a high BOD, almost all of the dissolved oxygen in the water is rapidly used up and the water will not support fish and aquatic life.

DISSOLVED OXYGEN: The amount of oxygen dissolved in water. Raw sewage has almost no dissolved oxygen. Water must contain at least 4 mg/l of dissolved oxygen to support fish.

COLIFORM COUNT: A measure of the amount of fecal coliform bacteria in water.

LATERALS: Pipes (6-8 inches in diameter) which transport sewage from residences, businesses, schools, etc., to outfall lines by gravity flow.

OUTFALL LINES: Pipes (54-72 inches in diameter) which transport sewage from residential and business laterals to the sewage treatment plant, by gravity flow.

LIFT STATIONS: Pumping stations which lift sewage whenever the topography prevents total gravity flow from source to treatment plant.

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VII. Land

"The land is a mother that never dies."

-Maori

The use, or misuse, of land is a fundamental cause of many environmental problems. This has been true for hundreds or even thousands of years and is most certainly true today. Primitive peoples were much more aware of a direct interdependence with the land for survival because of their closeness to the natural world. But even among these groups, environmental errors were committed through lack of understanding of how man can affect nature.

Historic views of land use in Western culture have been strongly influenced by the concept of private property ownership. This concept, strongly imbedded in Anglo-Saxon law, does not include any provisions for stewardship, but treats the land, rather, as a commodity. Land can thus be used almost totally at the owner's discretion without regard to any environmental relationships present.

Some attempts have been made to control land use, but for the most part these have proceeded from bases such as health, economics, or minimum standards. The most familiar of these is probably the zoning control exercised in many major cities. With few exceptions these zoning controls fail to recognize the importance of environmental factors and, in fact, compound urban problems in many cases.

By far the largest proportion of the land lies outside of urban centers and is thus not subject to any form of land use control. Environmentally sound use of land, recognizing natural interplay or uniqueness, is therefore very difficult to achieve even where improper use may be ecologically damaging.

The environmental consequences of improper land use can range from the merely unpleasant to the complete destruction of large areas. Such consequences include floods, dust storms, pollution of aquifers, catastrophic erosion, loss of irreplaceable natural beauty, extinction of wildlife, and reduction of fertility. Conversely, the recognition of natural systems as a factor in land use can yield rich dividends in a long, fruitful, and harmonious relationship of man and his works with the land.

Fortunately, there is a growing awareness of the necessity for proper land use. This has led to the development of strategies for preserving the environmental integrity of the land while fulfilling man's need to use it. Among these are greenbelts, flood plain zoning, watershed or aquifer preserves, scenic easements, and environmental corridors. In many instances the best use of land is not to use it at all. This is exemplified by national and state parks and by wilderness areas. These recognize the uniqueness or fragility of certain areas which would be destroyed by extensive use.

If we are to use the land with environmental wisdom, some form of land use control on a regional or state-wide basis is mandatory. Only in this way can the particular pattern in which areas relate ecologically be recognized and preserved. Without this approach, "willy-nilly" development will assuredly bring increasing environmental damage and in some instances disaster. While this concept is an affront to "free enterprise" and private property ownership, as these are commonly conceived, its environmental sanity cannot be questioned. Long established attitudes must change so that a harmonious relationship of man with nature can be restored.

TOPIC: Land Use Control

Background:

Competition for the use of land in urban areas has been at a high level for several decades in the more densely settled parts of the United States. The beginnings of a similar conflict became evident in Texas only in the decade of the 1960's when 90% of the State's 1.6 million gain in population occurred in the six largest Standard Metropolitan Statistical Areas. Most of this growth took place outside the central city, in the suburbs, small towns, and unincorporated areas. This growth was far greater than in previous census periods.

To accommodate this growth, approximately 400,000 acres of land were changed to urban use between 1958 and 1967 according to studies by the U. S. Soil Conservation Service. Bexar County has experienced a 25% reduction in total cropland acreage from 1958 to 1970. In Texas, average urban population densities (number of people per square mile) are well below national averages and have decreased significantly since 1950 due to extensive annexation of adjacent land.

Low density development (under 2500 people per square mile) is referred to as "urban sprawl." The extended distances between dwellings and groups of dwellings result in higher costs for utilities, streets, garbage collection, police and fire protection and other urban services, and makes transportation by private auto imperative. Mass transit cannot be profitably operated at the low densities which characterize a major part of most Texas cities.

Different types of sprawl occur in most cities: low density residential development; "strip" commercial development along major highways which wastes space between points of concentration; and leapfrog development which leaves large areas of land undeveloped but serviced. Low density may not always be undesirable. Soil conditions may dictate low densities; for example, when the use of individual septic tanks is required because of lack of municipal sewage facilities. An accumulation of the different types of sprawl, however, may create disbenefits of economy, quality of development, and land resource use.

Problems:

When the use of land is left largely to private discretion, a number of problems can result. Among these are the following:

- Loss of prime agricultural land,
- Construction in floodplains,
- Loss of open space,
- Disruption of neighborhoods,
- Pollution of watersheds and aquifers,
- Distortion of desirable growth patterns.

The environmental consequences of these inappropriate land uses are varied. Some specific examples of such problems which exist in the San Antonio area are discussed elsewhere in this handbook. Problems arise when land is viewed primarily as a commodity, to be used for private gain, and without consideration of its total ecological or public use significance.

The problem of urban sprawl is an example of the consequences which follow a lack of comprehensive policy of land use. Major reliance on the private automobile has increased the magnitude of air pollution and created pressures for more urban roadways with the resulting impact on open space, and favors use of land in the Central Business District for parking space. Moreover, the dispersion of population brought on by the automobile has strained the city's financial resources; thus, the city's ability to meet critical requirements in areas such as high quality waste treatment are reduced. These problems can be met most effectively through some form of land use regulation.

Land use regulation in Texas has been largely an activity of local municipal governments, although authority for planning or regulation of land use is held, to some degree, by almost all government levels from cities and counties to state agencies or state-controlled authorities. After reviewing existing governmental policies and procedures for land-use protection and guidance, the Texas Urban Development Commission concluded in its report published in November, 1971, "that governmental institutions in Texas are not adequately equipped to meet their present and future responsibilities for land management in urban areas of the state."

Outside the jurisdiction of the commission, but posing equally serious weaknesses are land use guidance needs in semi-urban and non-urban areas.

Some of the weaknesses in land use control are traceable to state enabling legislation which authorizes powers inadequate to regulate large-scale and complex developments. Present land use regulations were designed primarily for smaller individual land parcels already developed, in the case of zoning, and new land in the case of subdivisions. They are relatively rigid and cannot be imaginatively applied in larger-scale developments. There is also a historical lack of coordination between planning and regulation. To be effective, land use regulations should be related to land use policies developed by local governments.

Another major weakness of present land use controls is the lack of coordination regarding land use decisions among adjacent or overlapping governments. This is compounded by the lack of a higher level regional or state review framework to arbitrate disputes which are now settled only through the courts. There is also a lack of guidelines for inter-agency cooperation at all government levels.

Other weaknesses are lack of regulations, standards or guidelines for specific purposes such as flood plain protection, control of developments around reservoirs or other urban resources such as aquifers or watersheds, the preservation of open space, wildlife and marine refuges, or ecologically "frail" lands or waters such as wetlands and river estuaries.

Alternatives:

Two extremes are apparent: (1) Greatly increase local regulatory powers through revised state enabling legislation granting both extension of existing powers and new authority to political subdivisions such as counties which do not now have such powers; or (2) create broad state powers to be exercised by existing or created regional agencies which will assume responsibilities for large-scale land use policy decisions at metropolitan or regional levels, together with a state-operated planning office. Local governments would retain powers of zoning and subdivision regulation.

The Texas Urban Development Commission proposes an approach which calls for a better definition of responsibilities at each governmental level; and the establishment of a

single statewide framework for land use policy development, and implementation devices. Essentially, this approach views land as a resource to be managed for the general good of all citizens rather than exploited, often inefficiently, by special interest groups.

Many changes would be required to achieve such a land resource management system:

- (a) New state and regional responsibilities to aid local governments in land resource planning and management;
- (b) Recognition that some public goals and interests extend beyond local jurisdictions;
- (c) More effective coordination to relate policy or goal formation, specific plans, regulation and controls, and arbitration at each government level;
- (d) Review and revision of state enabling legislation to eliminate conflicts, unnecessary restraints, and outdated proscriptions relating to local planning and regulatory activities;
- (e) Creation of more flexible and contemporary standards for development and redevelopment which may supplement or replace existing inadequate standards. These might include cluster and planned unit development ordinances, green belts, scenic easements, acquisition in advance of needs, open space and flood plain regulations, density zoning, resource protection, wilderness-wildlife-and-marine protection, environmental quality protection;
- (f) Some system for planning and land use decisions in unincorporated areas;
- (g) A system for arbitration of disputes locally and among different government levels;
- (h) A structure to permit and encourage citizen participation in policy or goal formation, planning and arbitration.

Sierra Club Position:

Thorough revision of existing laws, policies and procedures must be accomplished to achieve a sound land resource management system. A program-oriented system such as this will involve value conflicts and will introduce previously unconsidered land use issues. A major consideration in the land ethic should be the inclusion of intangible factors such as environmental quality, historic or cultural significance, aesthetic value, and quality of life when public policy is being formulated, along with the traditional tangible economic benefits. This will require the introduction of a long range view in the planning stages; the recognition of impact which public and private decisions have on land use such as location of highways or "new town" developments; and a land use classification system much more sensitive to these new concerns. A statewide inventory of "endangered lands" with historic, cultural, aesthetic and ecological significance should be prepared. Local governments should retain jurisdiction where possible, guided by responsive and sound regional information and analysis, and supported by effective state legislation. The obvious benefits to be gained from a comprehensive land resource management system do not preclude incremental actions which should be taken in the interim. Much time and work will be required to implement the total system. Meanwhile, needed legislation regarding protection of aquifers, watersheds, and flood plains, for example, should be pursued as independent but coordinated efforts.

Finally, Congress is considering comprehensive Land Use Legislation. In the 92nd Congress it was H.R. 7211, The National Land Policy, Planning and Management Act of

1972. The 93rd Congress is considering S. 268, The National Land Use Policy Act, which will require states to do planning in a comprehensive manner, inventory land areas, and develop plans based on social, environmental, and economic factors. Failure to respond would subject the state to reductions in federal highway, airport, and open space funds. Legislation of this nature is supported by the Sierra Club.

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TOPIC: Flood Plain Management

Background:

Streams and rivers form a major feature of the natural landscape. They carry water from springs and precipitation in a well defined area--the watershed. Each stream or river usually carries its flow within its streambed, but expands into its flood plain during periods of extraordinary water volumes--the flood.

Floods are nature's way of housecleaning the streambed and flood plain. The cleansing action of a flood is a well understood necessity in the ecology of streams. Flood plains are areas rich in nutritious soils supporting a large variety of life. Animals and man have benefited from the renewing, fertilizing qualities of floods in their food gathering process since the beginning of the species, and man's agricultural use of the flood plain may be traced back at least 5,000 years.

With the advent of large urban settlements, those portions of the flood plain within the city lost their historical agricultural usage. Man drastically alters urbanized watersheds through removal of vegetation, alteration of topography, and construction of impervious surfaces, such as streets. These alterations increase precipitation run-off rates, which intensifies flooding and causes it to be more frequent. Transportation wastes (oil, grease, rubber, etc.), chemical fertilizers, pesticides, and man's refuse are often carried away by heavy rainfall, and constitute a significant pollution load on a flooding stream.

The primary usage of flood plains in the urban setting has historically been storm water drainage. They have often become weed choked or concrete lined eyesores, i.e., problem areas for the city administration, a burden for taxpayers to construct and maintain, and another ugly part of the urban scene. Moreover, they often do not adequately carry water during floods.

The Problem:

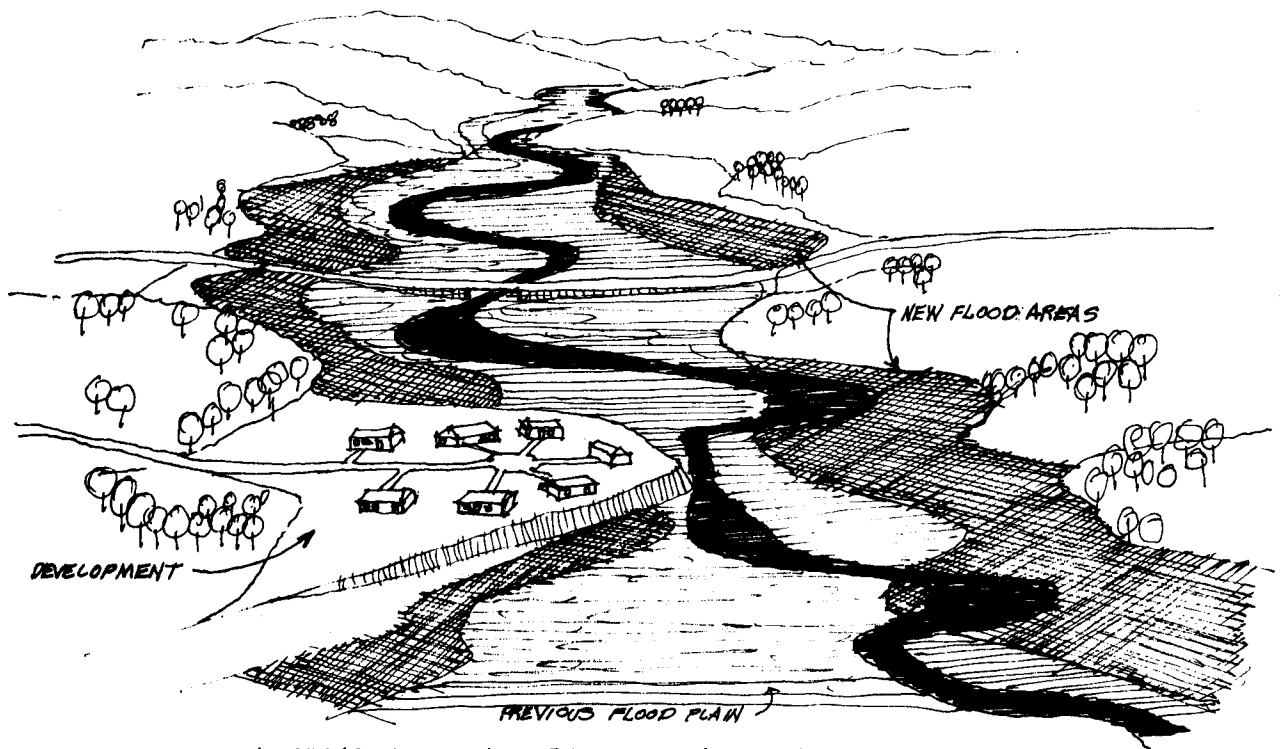
Is man's treatment of flood plains in the urban environment the best he can do with some of nature's most important real estate? Flood control problems have generally been handled by locally established flood control districts and river authorities, who have worked with various federal agencies including the Corps of Engineers, Soil Conservation Service, and the Bureau of Reclamation. Through the years, flood control projects have come to mean the spending of federal funds on a local level, a process which has been politically beneficial to the elected officials representing the area getting the funds. Most of the money has gone for construction of dams and channelizing stream beds. But after years of work and the expenditure of billions of dollars, flood losses are still high, both in property and in lives, and we have learned that construction projects are not the answer to flood control. Indeed, in today's urban environment, this real estate can be used to carry flood water as well as perform other beneficial functions, and at a lower cost to the taxpayer.

Alternatives:

It has been shown by the Federal Government, after extensive study, that the society as a whole benefits more when flood plains are not developed, and are allowed to carry flood waters just as they historically have done. Non-development, or limited, restricted development may be accomplished by government exercise of modern land control techniques such as zoning. By this technique, the amount of construction funds necessary for flood control



VIEW OF NATURAL FLOOD PLAIN



FLOODING AFTER ALTERATION THROUGH DEVELOPMENT

is drastically reduced. There are other significant benefits; today we recognize that open space within the urban environment is invaluable. Open spaces are pleasant places to walk, to have playgrounds, bicycle trails, baseball fields, and other recreation facilities. If urban flood plains are left undeveloped, a natural interconnecting open space network results which can be used for these important urban activities. Vegetation left in these open spaces also helps to decrease the air pollution normally a part of today's urban environment.

Excellent examples of proper use and misuse of flood plains may be found in the San Antonio area. Olmos Basin is a flood plain which provides this area not only with flood protection, but also with a beautiful open space-park together with baseball, football, soccer, golf, archery, and skeet facilities, nature trails, and picnic grounds. Brackenridge Park is another multiple use flood plain-recreational-open space area. This area, together with Olmos Basin, forms one of the unique features of the San Antonio area--an area remembered by most visitors to the city. Salado Creek is a good example of flood plain preservation and land use compatible with its primary role as a flood plain. Probably the worst examples of flood plain management in this area are the various channelized creeks found on the near west side and near north side, such as Apache, Alazan, Zarzamora and Martinez. The San Antonio River channelization project south of the city core, although beautified extensively, is still a channelization project. The principal result of these various channelization projects has been to shorten the time between rainfall and peak flooding, to intensify flooding, and to move the flooding to another area. Proper flood plain management-flood plain preservation minimizes these effects.

A knowledge of the history of the San Antonio area shows that flood plain management has come full circle from a philosophy of preservation in the early days, to a later philosophy of man being able to dominate and thus eliminate flooding (1920 - 1970), and back to the now considered "modern" policy of preservation, although this philosophy has not yet been rediscovered by all levels of government.

Status of Flood Plain Zoning:

Governments in all areas which desired to be included in the National Flood Plain Insurance Act of 1968 (as amended) must agree to the passage of flood plain zoning ordinances compatible with the concept of excluding all incompatible development from flood plains. During the past few weeks of 1971, Bexar County, the City of San Antonio, and several other municipalities within the county agreed to pass flood plain zoning ordinances, and these ordinances are currently under preparation by the various governments.

Area Flood Plains in Need of Protection:

Salado Creek (particularly the portion north of Loop 410) and its tributaries, Mud and Elm Creeks, represent a largely undeveloped flood plain that must be protected from future development. Leon Creek is largely undeveloped, as is Huebner Creek, and should be protected, as should the upper portion of Zarzamora Creek. The Medina River runs through southern Bexar County, and Cibolo Creek along the northeast edge. Future urbanization should be excluded from these waterways also. The benefits of open space in the urban area, which would be gained in this way, are highly attractive.

Sierra Club Position:

Better use of flood plains for man should be the goal of all governmental policy. This means preservation of flood plains for their use as flood ways, open space, recreation, and scenic corridors within the city. We generally oppose the concept of channelization, urban

or rural, because it is both costly, and because it does not achieve the long range goals of making the land useful to man. Preservation of land in a natural state has come to be one of man's most enlightened uses of real estate. Some of the benefits to him are already well known, and others are still being discovered. Good flood plain management achieves a benefit to society in general, not just to land developers, construction companies or politicians.

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TOPIC: San Antonio Ranch

Background:

Since approximately 1970 it has been evident that a large land development was being privately planned for a site in northwest Bexar County. This development, known as San Antonio Ranch (SAR), would be located between Bandera Road and Culebra Road approximately 20 miles from downtown San Antonio (see map inside back cover). The developer, San Antonio Ranch, Incorporated, proposed a "new town" of 80,000 to 90,000 population to be constructed over 25 to 30 years on a site of about 9300 acres. Financing for the project is to be supported by federal loan guarantees up to \$18 million provided by the Department of Housing and Urban Development (DHUD). Eventual annexation by the City of San Antonio is envisioned by the developers.

On February 3, 1972, the San Antonio City Council voted (6 to 3) to enter into a contract with SAR Inc. which, in effect, gives city "approval" to the project. Without such approval it is very unlikely that DHUD would agree to extend the loan guarantees needed for the project.

Opposition to SAR has been voiced by Bexar County Commissioners Court, San Antonio River Authority, Edwards Underground Water District, San Antonio Independent School District, Citizens Participation Policy Committee of Model Cities, City of San Antonio Planning Department, San Antonio Conservation Society, Citizens for a Better Environment, American Association of University Women, League of Women Voters, and The Sierra Club.

Following submission by DHUD of a totally inadequate environmental impact statement, suit was brought by the last four citizen organizations listed above to block DHUD action in extending federal loan guarantees. The basis for this suit was failure to comply with the provisions of the National Environmental Policy Act (NEPA) and the New Communities Act. Bexar County Commissioners Court and the Edwards Underground Water District subsequently joined the suit as co-plaintiffs with the citizen groups. The case was tried in District Court in San Antonio in May, 1973. Judge Adrian Spears ruled that he could not find the defendants guilty of violating the law but that the situation clearly showed the complete laxity or inability of government to cope with the problem. He further commended environmentalists for bringing the matter to public view through the courts and has ordered San Antonio Ranch, Inc., to pay attorneys' fees for the plaintiffs. Texas Water Quality Board and Edwards Underground Water District have been ordered to submit reports to the Court on their actions to protect the aquifer.

Problems:

SAR poses a number of both direct and indirect environmental threats to San Antonio. The major ones are discussed below.

1. Possible Effects of SAR on the Edwards Underground Aquifer. Eighty-three percent of the proposed SAR site lies on exposures of the Edwards Limestone--the recharge zone--where surface water enters the aquifer. From this area the Edwards formation slopes south toward San Antonio (see sketch) until it is 600 ft below the surface with its charge of water. This underground reservoir is San Antonio's only source of water (see separate topic).

The general direction of water movement in the Edwards is from west (Uvalde area) to east (Aquarena Springs area), but details of the flow are greatly modified by the structural intricacies of the cracked, fissured, honeycombed limestone, and certainly by municipal pumpage.

The SAR developers have conducted a brief initial environmental study and claim to have come up with all the answers to the problems of placing a population of nearly 90,000 residents directly over the geologically complex recharge zone of a water supply belonging to nearly a million people. In spite of extensive study by the USGS, the Army Corps of Engineers, and the San Antonio River Authority, over an extended time period, the hydrology and geology of this incredibly complex and priceless water resource are not yet fully understood (see separate topic). It seems unlikely that a short-term "justification" study by the developers' subcontractors can have added much to that understanding. All that is positively known is the general direction of movement in the aquifer, discharge and recharge rates, and approximate areas of recharge. This knowledge is grossly inadequate for planning development over the recharge zone at this time. At best, it tells us that years of intensive study may be required before any form of concentrated residential use, if any, should even be considered. In the interim, all urbanization should be severely limited.

The proposals for handling sewage from SAR are of prime importance in determining the possible hazard to the purity of the Edwards. A sewerage tie-in with San Antonio's Leon Creek Treatment Plant lines is proposed, but this system is already projected to be overburdened by the time SAR would be completed. That notwithstanding, however, it is a well-known fact that even the best sewerage systems leak and this leakage increases with time. Whether or not the leakage is detected, the danger of contamination of the Edwards seems eminently possible. Presumably, the City of San Antonio, not SAR, would eventually bear the cost of treatment of water from a contaminated aquifer.

If SAR density and sewage system design are extrapolated to cover the remaining part of the recharge zone, then the Edwards will receive an estimated daily recharge of 2 to 3 million gallons of untreated sewage from Bexar County alone. Current average daily recharge for the whole aquifer is about 70 million gallons per day.

2. Distortion of "New Town" Concept. Several aspects of the SAR proposal raise questions as to its "new town" classification in the true sense. Most important is the fact that this development is not part of an overall planned regional development process. No controls are provided to prevent conventional strip development between San Antonio and SAR. Nor is any provision made to prevent unplanned industrial or real estate expansion in surrounding areas. The project amounts to federally-financed block-busting unless a legally sanctioned and enforced regional land zoning system is established to protect ranchers and farmers, as well as aquifer recharge and special natural areas, from skyrocketing property taxes and eagerly waiting real estate promoters. A regional land zoning system under law is an absolute necessity before any government-sanctioned projects such as SAR are established. SAR cannot be justified on the grounds that it will protect the area from uncontrolled development north of San Antonio when no specific provisions are made for doing so. As things stand, SAR will encourage additional development over the Bexar County Recharge Zone area in a totally uncontrolled manner.

3. Social and Economic Effects. With increased expenditures necessary to revitalize the central, east and southern parts of San Antonio, the public expenditures necessary by San Antonio for the SAR project are unfounded. The City Council, in its support of this project, has distorted its priorities to use public money to support an environmentally and economically unsound and unbalanced growth for the city. Furthermore, analysis of

past city growth has indicated that the developers' plans are totally inadequate to ensure a lack of economic discrimination in the housing, jobs, and transportation facilities.

Whether or not SAR will become a financial burden on the City of San Antonio is made clear neither by HUD nor the developers. The problems of utilities (sewerage, water supply, garbage disposal, etc.) and transportation development have not been clarified. Vague allusions are made to eventual annexation by San Antonio. This is scarcely the intention of modern new town planning.

Alternatives:

SAR is planned to accommodate or absorb a major portion of the population growth in Bexar County over the 30-year project period. Alternatives should thus address either retarding population increase or accommodating it in an environmentally sound way. Several possible approaches exist:

1. Increase the density of population within the present city. San Antonio has a very low population density (see Population topic). Low density causes more land to be occupied, increases the cost of delivering city services, acts as an impetus to urbanization of the recharge zone, and complicates the provision of effective public transit. While it is not desirable to have very high densities, e.g., New York, Chicago, Philadelphia, a moderate increase in density could accommodate reasonable population increase while still maintaining our regional life style.
2. Channel population growth to existing outlying urban areas. This is the approach used with success in the British new towns. Viable urban centers such as New Braunfels, Seguin, Boerne, Castroville, and Pleasanton would be used to accommodate regional growth. This would be accomplished through various economic incentives, the expansion of urban amenities, and provision of rapid transit between these satellite towns and the central San Antonio area. These steps would be accompanied by measures to prevent or limit urbanization on the critical recharge area and other intervening open spaces. Measures could range from stringent waste control requirements to outright purchase of the most seriously threatened recharge areas.
3. Slowing of population growth. This region has a finite carrying capacity for population based on several critical factors; the most significant of these is water. Increasing population raises demands for water and other resources such as natural gas, gasoline, and electrical energy. Thus, measures to discourage or retard significant population growth would have a number of positive environmental effects.
4. Location of a "new town" elsewhere. If public opinion favors a "new town" project in spite of the economic consequences to the city, it should be located to the south or east where no threat to the Edwards Aquifer would be posed.

Sierra Club Position:

San Antonio Ranch is part of a much larger issue: Should public funds be used to promote construction of housing which is (a) economically discriminatory, (b) in an environmentally sensitive area, and (c) detrimental to balanced, planned city growth? Also at issue is the national and state issue of adequate land use planning to provide for growth in an orderly and environmentally sound way.

The Sierra Club position is that SAR, because of its location and degree of planning, should not be constructed as proposed on the critical recharge zone of the Edwards Underground Reservoir. Development and/or urbanization of the recharge zone must be halted through a combination of measures which would include purchase of directly threatened areas for use as a greenbelt, discontinuation of federal building subsidies, stringent waste control requirements, and some form of land use control. Alternatives should receive expeditious investigation and extensive public exposure. Appropriate alternatives should be formally adopted by the City of San Antonio and Bexar County and put into practice through planning and operating policy.

References:

1. Texas Observer (newspaper), May 25 and June 8, 1973
2. Positive Options for San Antonio's Future Water Quality; Citizens for a Better Environment, American Association of University Women, Sierra Club, League of Women Voters; May 1972.
3. "The Big Troubles at San Antonio Ranch"; Business Week; November 3, 1973.
4. Final Environmental Impact Study: Proposed New Community of San Antonio Ranch - Bexar County, Texas; U. S. Department of Housing and Urban Development; January 1972.
5. Addendum to Final Environmental Impact Study (San Antonio Ranch); U. S. Department of Housing and Urban Development; August 1972.

TOPIC: UTSA Site

Background:

In 1970 after an extended period of consideration, the Board of Regents of the University of Texas selected a site northwest of San Antonio for a major new campus (see map inside back cover). This site, located in proximity to the intersection of IH 10 and FM 1604 (outer loop), was selected from among ten proposed in various locations. The new campus is expected to be capable of accepting 6,000 students by 1974; an eventual enrollment of 40,000 is planned.

The site chosen is immediately adjacent to two major traffic carrying arteries and is within the corporate limits of the City of San Antonio by virtue of a "spoke" annexation. It is anticipated that construction of the University will foster development around the area and further increase the impetus for general development to the north and northwest.

Problems:

The most critical problem associated with the UTSA site is potential pollution of the Edwards Underground Reservoir. The general problem of pollution of this aquifer is discussed elsewhere in the Guide. The UTSA campus is located directly on the recharge zone and will undoubtedly foster other pollution generating development, also on the recharge zone. The city has indicated that complete services, including sewage treatment, will be provided to the site. The Leon Creek outfall line will probably be extended to the site. However, with the exception of the "spoke" containing the site proper, all surrounding land is unincorporated and thus not subject to adequate control with regard to sewage disposal or treatment and other land-use controls. This invites the large scale use of septic tanks for residential and commercial development in the vicinity of UTSA with concurrent high risk of pollution to the aquifer.

A secondary source of possible aquifer pollution is rainfall runoff from streets and parking areas. This runoff normally carries large quantities of oil and other pollutants which can penetrate the aquifer through the recharge zone if not controlled. There is already evidence that such runoff has contributed to fish kills in the San Antonio River, particularly following intense but short rainfall periods. The large UTSA parking lots, and the streets and parking areas created by surrounding development will be the source of a large amount of such runoff.

Alternatives:

The most obvious alternative is no longer available, location of UTSA on a site where it will not foster polluting growth and development. The site now being fixed in an ecologically unfavorable location requires that other measures be used to prevent pollution of the Edwards Aquifer.

Paramount among these measures is extension of centralized sewage treatment to the largest possible area surrounding the site, with concurrent legal requirements that hook-up to the sewage system be mandatory. This presents both physical and legal problems. The physical capacity of the sewage collection and treatment system must be adequate to accommodate the UTSA site and the projected surrounding development. Additional plant and outfall line capacity may be required to assure this (see Sewage topic).

The legal aspects can be handled in a number of ways: use of the city's extra-territorial jurisdiction, designation of the city as the regional sewerage authority in the area involved, and additional annexation are some of the means available. Additional state legislation may also be required to handle specific problems, but reasonably direct and readily available measures should suffice for the near future.

In addition to providing centralized sewage treatment to the largest possible area, any development beyond this area must be controlled with regard to septic tank density. This can be accomplished by making an existing Texas Water Quality Board order more stringent and by assuring that the order is strictly enforced.

Rainfall runoff with its pollutants must also be contained and channeled by a suitable storm sewer system and carried south out of the recharge zone. In some cases, local measures such as settling ponds or retention lagoons may be necessary to hold runoff water for subsequent disposal outside the recharge zone.

Sierra Club Position:

The UTSA campus should not have been located on or near the recharge zone of the Edwards Underground Reservoir. Positive and comprehensive action must now be taken to prevent pollution of the Edwards Aquifer by development which will occur around the present site. This action should include centralized sewage treatment for the entire area, and strict control of septic tanks in the remainder of the region. Rainfall runoff from streets and parking areas must also be controlled to prevent polluting the aquifer.

References:

"The Counting House of Academe" by Ronnie Dugger, Harper's Magazine, Vol. 248, March 1974, p. 70.

TOPIC: The Big Thicket

Background:

The Big Thicket today is a remnant of a once vast, ecologically unique wilderness in East Texas which contains piney woods, hardwood forests, bogs and marshes, grasslands, jungles, bayous and baygalls, and swift creeks, all intermingled. The Thicket is a "biological crossroads," a transition area where the floral and faunal types of the North, the Southeast, and the West merge. Nowhere else in the United States can so many different species of plants and animals be found together in such a small geographical area. At one time black bear, panthers, and jaguars could be found. The Big Thicket today harbors some 300 species of permanent-dwelling birds (including the nearly extinct ivory-billed woodpecker), countless migratory bird species, alligators, snakes, and other reptiles, bobcat, deer, mink, fox, red wolf, otter and racoon, to name a few. The 60-in. annual rainfall and mild Gulf climate have produced "champion-sized" magnolia trees, cypresses, and American hollies, some 100 species of trees, 40 varieties of orchids, four of America's five insect-eating plants, 25 varieties of ferns, giant palmettos, mosses, fungi, algae, and nearly every known flower of the southeastern United States.

Originally covering more than three million acres, the Big Thicket has been reduced to less than 300,000 acres in broken patches of less than 5,000 acres each. All of the land is privately owned. What remains of the once vast wilderness in East Texas is approximately bounded by Highways US 90 and 190 and the Trinity and Neches Rivers (north of Beaumont, Texas). The "heart" of the Big Thicket is the "Saratoga Triangle," an area located between the towns of Saratoga, Kountze, and Sour Lake.

Efforts to preserve the Big Thicket have been underway for decades (primarily under the leadership of East Texan Lance Rosier), with the most concerted push in the last ten years. The Big Thicket Association, formed in 1965, is heading the fight to preserve the Thicket. Former Texas Senator Ralph Yarborough, the Thicket's biggest proponent at the national level, submitted his first bill in 1966 to preserve 100,000 acres. Since that time certain lumber companies have intensified their efforts to log the land, and the Big Thicket is presently disappearing at a rate of 50 acres per day. Other threats to the continuing existence of the Thicket include land development that is carving out weekend home tracts, and federal-state plans to dam and channelize rivers and drain swamps in the area. Numerous proposals for preserving the Big Thicket have been forwarded, ranging from 35,500 acres in scattered patches to 191,000 acres; 100,000 acres is the size agreed upon by most legislators at the present time. Legislative efforts to establish a Big Thicket National Park are now spearheaded by U. S. Senators Bentsen and Tower of Texas.

Problem:

The urgent need to preserve the Big Thicket now is based on several complex and interrelated factors. First, lumbering is destroying 50 acres of the Big Thicket per day. At this rate, most of the remaining 300,000 acres could be gone in little over a decade. Lumbering actually destroys the Big Thicket because present practices emphasize complete cutting (and frequently bulldozing and burning) of both the undergrowth and young trees as well as the mature ones. Large sections of the clearcut land are then replanted in slash-pine tree farms; other denuded areas are left to re-forest as best they can. If good forestry practices were employed (which means selective cutting of only mature trees), the Big Thicket could eventually replace itself. In fact, most of the present Big Thicket is second and third growth. (However, it will be a long time before a 500-year-old magnolia can be

regrown.) The action plan to replace the Big Thicket with pulpwood-producing single-species tree farms (a practice that is an ecological disaster in its own right) is being carried out by Eastex, Inc. (a subsidiary of Time-Life, Inc.), Southland Paper Mills, Inc. (of Lufkin), and the Kirby Lumber Co. (owned by Santa Fe Industries of Chicago).

Water is another critical facet of the problem. The very existence of the Big Thicket is dependent upon unrestrained water flow, including occasional flooding. Proposals for, and actual work on, the construction of dams, the channelization of rivers, and the drainage of swamps will, and have already, seriously damaged parts of the Big Thicket. Any realistic proposal to preserve the Thicket must set aside sufficient acreage to allow for the protection of the entire watershed (including the Neches River). The catastrophic experience with the Everglades National Park makes the importance of maintaining the natural water flow painfully clear.

Land ownership is an additional aspect of the problem. The entire area is privately owned, most of it by the lumber companies. Even if a designated tract is set aside as a National Park or Monument, lumber companies will probably continue to log the land during the several years required for the Federal government to complete acquisition. (The tactics of the Kirby Lumber Co. to date in the battle to save the Big Thicket indicate that this is a very real possibility.) On the bright side is the fact that the major lumber companies have declared a cutting moratorium on 35,500 acres of the Big Thicket known as the "String of Pearls." However, only 18,000 of these acres are owned by the lumber companies; the remaining 17,000 are in other private hands, and cutting is taking place.

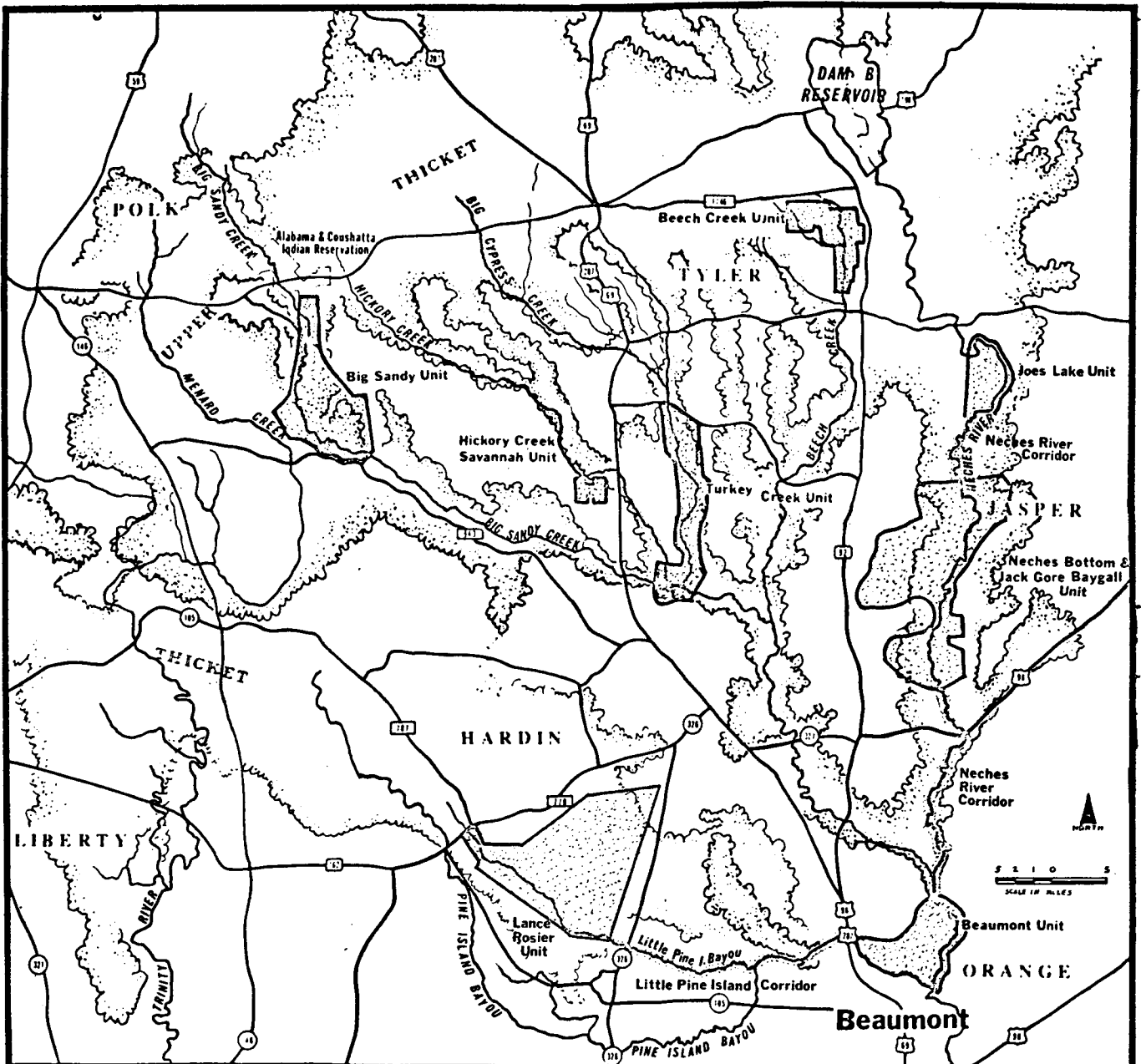
One last factor to be considered is land development. Located only 60 miles from Houston, the Big Thicket wilderness is ideal for weekend homes and is being rapidly cut up for this purpose. A new development has recently been started in the so-called Saratoga Triangle, the heart of one of the proposed bills to preserve the Thicket. It may be possible to restore much of the Big Thicket after logging, but housing developments and their associated pollution can never be obliterated.

Alternatives:

The National Park Service has been conducting a study of the Big Thicket for several years but as yet has not released its report; consequently, public hearings on their proposals cannot be held. In the Legislative branch, numerous bills have been submitted in the past five years ranging in size request from 35,000 to 190,000 acres. In late 1971 a concerted effort was made by the Big Thicket Association, Sierra Club, and others to unite the entire Texas delegation behind a single park request that would be, hopefully, more acceptable to the Administration and to the lumber interests. Representatives Bob Eckhardt of Houston and Alan Steelman of Dallas have introduced bills for 100,000 acres and specified the particular areas and boundaries; their bill includes a few large tracts (25,000 to 30,000 acres each) with inter-connecting streamway corridors along the major creeks and bayous and the Neches River. Representative Charles Wilson of Lufkin has introduced a 75,000-acre bill.

Most of the Texas delegation are co-authors of a bill requesting a 100,000-acre park, with no particular areas specified. A representative from New Jersey has also submitted a 100,000-acre bill. And in the Senate, Texas Senator Lloyd Bentsen's bill requests 100,000 acres or less with no boundaries specified.

Regardless of which bill (or a compromise yet to be proposed) is considered, two factors are vital if the Big Thicket is to survive: (1) the watershed must be protected, preferably by inclusion into the Park itself, and (2) action must come very soon.



Big Thicket National Biological Reserve **TEXAS**

Feb. 1973
 NBR-BT-91.019

Sierra Club Position:

The Big Thicket is an ecologically unique area, a "biological crossroads," that is a national resource and deserving of preservation. Establishment of a Big Thicket National Park will help to satisfy the open-space and wilderness needs of both Texans and all Americans. The Big Thicket National Park should contain not less than 100,000 acres in order to be an ecologically self-sustaining unit, and the natural watershed must be maintained with its present flow and drainage systems. In addition, the Sierra Club supports:

- (1) the environmental corridors plan (to connect major tracts and protect streamways),
- (2) inclusion of all eight major plant communities,
- (3) inclusion of Jack Gore Baygall and Deserter's Island,
- (4) inclusion of corridors along the Neches River, Village, Turkey, and Menard Creeks, Pine Island Bayou and Little Pine Island Bayou,
- (5) interconnection of the entire park by streamways.

Finally, the Sierra Club urges that prompt action on the Park proposals be taken with a goal of finalizing plans to preserve the Big Thicket soon.

References:

1. The Big Thicket: A Challenge for Conservation, by Pete Gunter, Jenkins Pub. Co., Austin, Texas, 1972.
2. "Little Big Thicket: Pulpwood vs the People," by Chet Flippo, Clear Creek, April 1971, p. 23.
3. "Big Thicket Blues," by Pete Gunter, The Texas Observer 58 (Oct. 22, 1971): 3.
4. The Big Thicket Forest of East Texas, by C. A. McCleod, Texas Journal of Science 23: 221 (1971).

TOPIC: Guadalupe Mountains National Park

Background:

The Guadalupe Mountains National Park, located along the Texas-New Mexico border due south of Carlsbad, New Mexico, is the only unspoiled, virgin-timbered, mountainous wilderness region left in Texas. The area was formerly owned by J. C. Hunter, Jr., of Abilene, Texas, who maintained it as a hunting preserve, importing and building up a herd of several hundred elk. Domestic livestock have essentially never grazed the mountain top vegetation and only native wild animals and elk occupy the area. This region is, in addition, of importance geologically and archeologically.

Problem:

Despite the rugged nature of the region, many of the floral and faunal populations are very easily destroyed. The critical factor in maintaining the delicate ecological balance is water, which is severely limited in this arid area of West Texas. In anticipation of making decisions for a finalized Master Plan for park development and utilization, the following points are suggested for serious consideration:

(1) Boundaries. So as to encompass all of the mountains and virgin forests within the park, the boundaries should include the present Guadalupe Mountains National Park and extend sufficiently far south to include Guadalupe Peak and El Capitan; on the east side of present park land, an area southeast of the highway should be acquired for the Visitor Center and camping facilities; and the western boundary should follow the base of the escarpment near Bone Canyon northwest to the Hudspeth County line and then north to the New Mexico border.

(2) Visitor Utilization. Because of the delicate ecological balance, all hiking and trail riding or horse packing should be on a permit basis to allow maximum enjoyment of the park without destruction. Some exceptionally delicate areas and archeological sites should be visited by guided tour only. Horse travel should be restricted to the most hardy areas with a maximum of 25 to 50 horses per day in the high country. Day hikers should be limited to 100 per day in the high country. For back-packing, primitive campsites (no open fires and all water packed in) should be designated. Thirty such overnight sites with a maximum of five persons each would limit backpackers to 150 daily.

(3) McKittrick Canyon and the Bowl. The Canyon is both the most beautiful and most delicate area of the park, and also contains several of the best day-hiking trails. The area should be maintained under strict supervision. The Bowl is the heart of the virgin stands of Ponderosa Pine and Douglas Fir. A dirt tank located here is heavily used by wildlife. Because of the use of the Bowl area and the neighboring Rough Ridged Island area by wildlife, no campsites or heavy hiking should be permitted in these areas.

(4) Visitor Center and Major Camping Facilities would best be located outside of the mountainous forested regions of the Park. To the southeast of the highway is a relatively flat area with a panoramic view of the escarpment that could serve this purpose.

(5) Tramway or Road. Certain groups have proposed either a tramway or graded road into the heart of the Park, and these proposals are at present included in the Master Plan. All possible sites for these "improvements" would put visitors within an easy 40-minute walk of the most ecologically delicate areas of the Park. Within a few

years the Bowl and eastern ridge vegetation would be literally trampled to death and the wildlife driven out.

Alternatives:

It has been argued that designation of a Park as a Wilderness Area unfairly excludes the public for whom parks are bought. However, if the number of visitors to the particularly delicate Guadalupe Mountains were not severely limited, there would be in a few years an obvious and irreversible pattern of West Texas cacti and grasses encroaching upon the stands of Ponderosa Pine and Douglas Fir. With the decline of the present vegetational groups (and the accompanying loss in water retention by the exposed soil), the elk would disappear and other wildlife would be far less abundant. It is senseless to designate an area as a National Park for use by the general public when such utilization would so completely destroy the rugged beauty for which the land was initially set aside. For these reasons the development of the Park as a heavily used National Park is hardly a feasible alternative.

A second alternative is to combine the Guadalupe Mountains National Park with the adjoining Lincoln National Forest and Carlsbad Caverns National Park into the Guadalupe Escarpment Wilderness Area as proposed by the National Speleological Society. This alternative would permit greater public use of the Guadalupe Mountains and still allow for protection of the most delicate regions.

Sierra Club Position:

The Guadalupe Mountains National Park should be maintained as a Wilderness Area and the boundaries extended to include the base of the Guadalupe Escarpment. The Sierra Club firmly opposes any plans to construct a tramway or graded road into the heart of the Park. Utilization of the Park should be designed to preserve and maintain this last wild region in Texas in its virgin, unspoiled, rugged and forested condition.

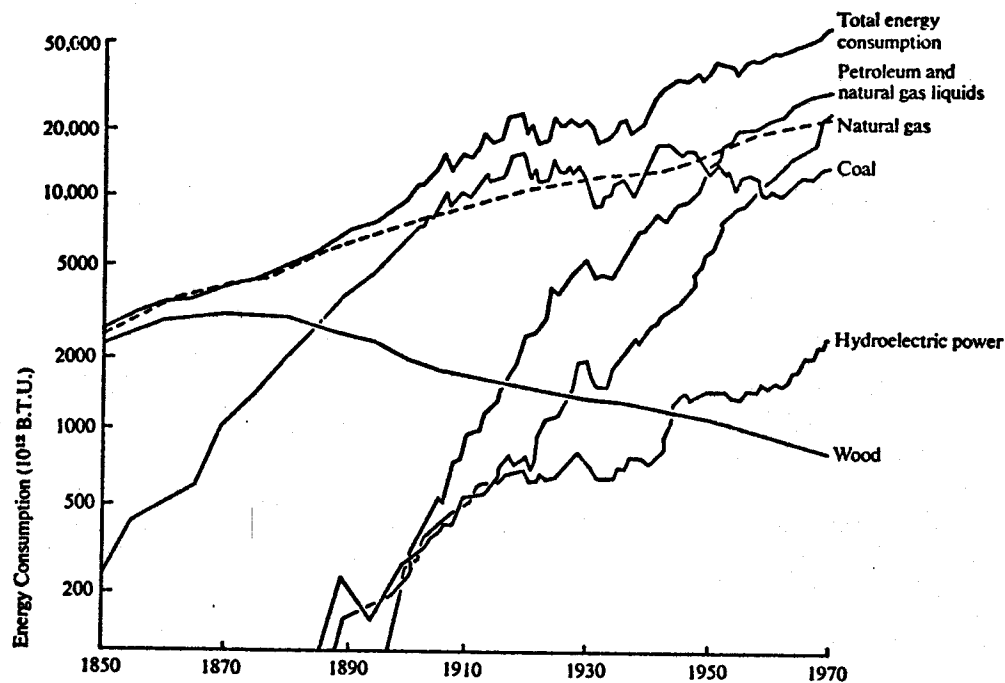
References:

John T. Baker. Guadalupe Mountains National Park Wilderness Area Proposal (first draft). Prepared by Texas Explorers Club, Sierra Club, and the Wilderness Society.

VIII. Energy and Transportation

Energy is an essential ingredient of the earth's ecosystem, and nearly all of this energy is derived from the sun. Energy, unlike other essential elements of the ecosystem, flows through it and cannot be recycled. For most of history, man has used only the energy from the sun stored in plant life, and this still accounts for much of his energy, but in recent history (beginning in the 1800's) man began to use energy of the sun stored over long periods of time in the form of fossil fuels, petroleum and coal. The industrial revolution was built on the availability of low-cost energy, mostly from the fossil fuels. Although the fossil fuels are useful in many ways, their use in transportation has been one of the most important. Thus, it is useful to look at energy and transportation together. Personal transportation in the United States is largely (88%) by private automobile, and freight is moved mostly by truck, and these have set our life style. But transportation is a grossly inefficient use of energy (15% efficiency), and it has caused (both directly and indirectly) many of the environmental problems we face today. Thus, transportation (and the whole life style) will be greatly affected as we deplete the world's petroleum resources.

This section looks at the flow of energy through our system in the United States and examines the sources of this energy as they are today and might be in the future. And because transportation and environmental quality are so intertwined with energy, transportation issues are examined in this section also. The topics examined are but an introduction to the whole complex subject of energy, and the reader is encouraged to pursue the references listed.



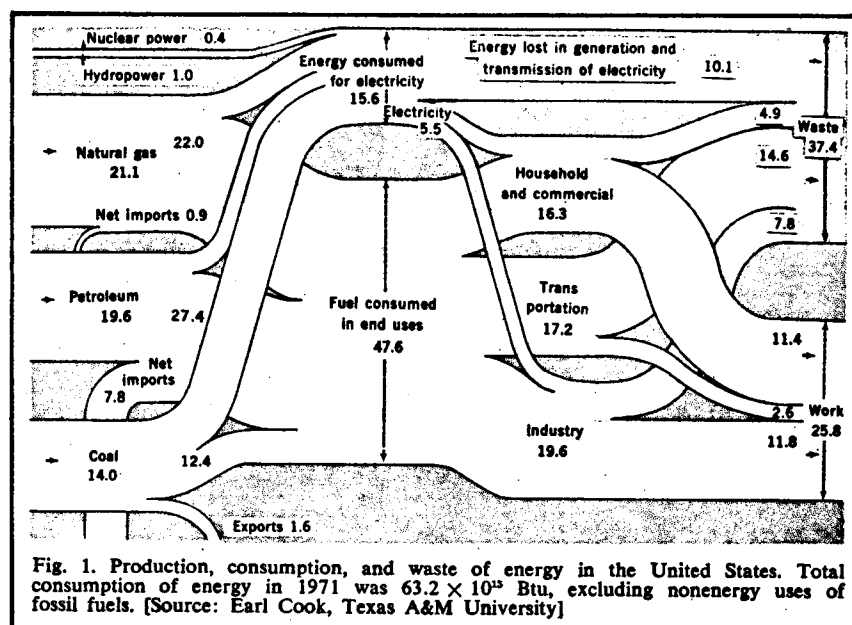
U.S. energy consumption (in trillions of British thermal units) since 1850.
[Source: From "An Agenda for Energy," by Hoyt J. Hottel and J. B. Howard. Copyright © Technology Review.]

TOPIC: Energy

Background:

The use of energy presents a complex, ever changing picture depending on supply, demand, and technology. Since the industrial revolution, the well-being of mankind has been directly linked to the availability of fuels and knowledge of how to convert fuels into energy. To get some idea of how energy flows in our society, refer to Figure 1, which shows fuel sources on the left, how the fuel is converted to energy in the center, and on the right, how that energy is used. Note that approximately half of the energy is wasted and only half goes into useful work. No similar worldwide energy balance is available, but since much of the world uses older technology than does the U.S., the waste of fuel is even greater worldwide. The U.S. uses 33% of the fuel consumed globally each year--and with only 6% of the world's population, this means our energy consumption is about 9 times the world's average energy consumption. In a sense, cheap, plentiful energy has been responsible for the enormous economic growth of our industrial society (together with a stable, productive agricultural economy). But inevitably, as with any undervalued commodity, cheap energy has encouraged wasteful practices, inefficient industrial processes, and a belief that our generally high quality of life necessarily requires the amount of energy we use.

The energy situation in the United States may be simply put: We want to use more than can be produced from fuels within the continental limits at a price (both economically and environmentally) we want to pay. Whereas the U.S. has enormous deposits of coal, that fuel in its natural form pollutes badly unless considerable effort is expended to prevent the pollution. Natural gas, a clean fuel, still exists in large quantities in this country, but the consumption is so great that supplies are expected to be nearly exhausted within 30 years. Oil, likewise, exists in enormous quantities, but consumption is so great that a find like Alaska's huge field will last only a few years. Most of the potential hydroelectric sites are already being utilized, and today nuclear fission is generating only about 4% of our electricity. All forecasts indicate that there will be an enormous increase in nuclear generating capacity, so that by 2000 nuclear



will account for 60% of electrical generating capacity. Geothermal sources of energy will be usable in limited areas (western U.S.), and solar energy as a generator of electricity on a large scale is still unproven.

The United States is, today, facing the first real energy problem it has ever had, and it is likely to be a problem of long duration. If large quantities of electricity can and will be generated by nuclear plants, then at least part of the supply problem will be temporarily solved. Petroleum for use in transportation is an enormous problem. Even with vigorous exploration efforts within the United States, considerable petroleum must be imported from abroad to meet demand. Importation of these vast quantities of petroleum will cause environmental, economic, and political problems. Most of the available oil reserves are in the Middle East and Soviet Union.

Nuclear energy is today fraught with problems. The Atomic Energy Commission is currently in a state of flux, with the regulatory and promotional functions of nuclear energy just having been separated within the AEC. This conflict of interests had existed since the Commission was formed in 1947. Problems with power reactor technology in use today are: (1) The emergency core cooling system has not been proven to function in an emergency; in fact, simulated model tests have failed to function properly. (2) Nuclear ashes (the fission process creates radioactive elements, some of which tend to stop further fission) from reactors are highly radioactive, long-lived elements which will give off large amounts of heat and high level radioactivity for the next half million years. The AEC currently has no permanent disposal or storage technique to handle these wastes. (3) Quality control of reactor fabrication continues to be a difficult task requiring a level of technical and management competence not often found in industry. Today, many in-service reactors are operating at limited capacity because of unknown factors in their design and fabrication. (4) The long term environmental effects (both human and natural) of radiation released by nuclear plants are today a subject of heated debate by health physicists. Resolution of this very complex problem is not likely to come soon, since the effects are long term and statistical in nature. So far, no member of the public has ever been killed by a nuclear accident associated with a commercial power plant. But there is serious question as to the long term effects of low-level radiation on plant personnel and on the public at large.

Coal, although available in enormous quantities, is a dirty fuel when burned directly as mined. Consequently, considerable effort on coal gasification is currently underway, with full-scale plants now under construction. But strip mined coal is enormously damaging to the environment. This country has no strict laws regulating strip mining, and land reclamation procedures in use today are totally inadequate. For example, an average of \$75 per acre is spent in the U.S. for reclamation, while \$1600 per acre is spent in Germany. Deep mining of coal is still a very hazardous occupation, and also has many environmentally bad side effects.

Future energy sources include solar power, fuel cells, nuclear fusion, wind power, and many others. Considerable research effort will be necessary to make these commercially feasible on a large scale. Solar power is now technically feasible on an individual water and space heating basis, and with rapidly changing energy economics, will probably become economically feasible in the near future.

Problem:

The maintenance of a sufficient energy supply to support a high quality of life without creating land use problems, air pollution, and other forms of environmental degradation constitutes the major problem today in the United States. The biggest point of concern has

to do with what amount of energy is necessary to support a high quality of life. Some maintain that it is necessary to continue present levels of personal consumption (nearly 9000 kilowatt-hours annually). As shown in Figure 1, half of the energy consumed today is wasted.

Economics plays an enormous role in energy consumption. For example, our entire transportation system is built upon the assumption that large quantities of cheap fuel will always be available. Energy economics chiefly determines which industrial processes are used, how much insulation goes into our houses, the mileage of our automobiles, the fuel used to heat our homes, etc.

Thus, the energy problem today is at least four fold: (1) There are too many people (2) consuming too much energy for historical trends to continue, and it will be increasingly (3) environmentally degrading, regardless of the types of future energy systems used, to maintain our quality of life at its present level, and (4) there appears to be no way to find enough energy or raise enough capital to extract that energy and to generate electricity without increasing the costs significantly.

The problem in Texas is the same as that in the rest of the U.S., except that in some ways it is not quite as critical. But Texas' utilities have just begun to experience shortages in the oil and gas supplies which have traditionally powered industry, utilities, and transportation. Utilities in Texas have thus begun to turn to other energy forms--specifically coal (including lignite) and nuclear. No commitment to energy conservation is apparent anywhere in Texas.

The problem in San Antonio and Austin is unique, in that the gas supplier for the utilities servicing these areas apparently oversold his supply, creating severe shortages for these utilities. These cities have, through necessity, started learning to conserve energy. San Antonio has joined the "South Texas Nuclear Project," which will construct a light-water reactor near Bay Port and transmit electricity to Corpus Christi, San Antonio and Houston. Construction of more generating units will be necessary near San Antonio if the current 11% annual increase is to be sustained. Construction of generating capacity to meet this demand will severely burden the ability of San Antonio to raise capital for municipal improvements and will create problems in finding sufficient cooling water.

Alternatives:

Changing our energy consumption patterns, defining what our need is as opposed to our want, and increasing the efficiency of energy use is the obvious direction for our nation. Thus, if the country were to commit itself to energy conservation as an alternative to the present consumption patterns, many benefits could accrue: (1) The enormous pressure to find new energy resources, with the attendant capital outlays necessary to do so, would be eased, giving the country (2) time to catch up on research into more efficient and less environmentally degrading forms of energy. (3) The balance of payments and international political problems incurred due to importing Middle Eastern oil would be eased. (4) A reduced rate of per capita consumption would allow more time to stabilize population growth, and possibly even industrial growth.

Sierra Club Position:

Energy conservation is the first priority of the Sierra Club's energy policy. Recognition of the energy problem as coupled closely to environmental quality is another goal. If it is recognized that the energy problem is not temporary, then changing consumption patterns to increase energy efficiency and decrease pollution becomes a natural part of any

energy policy. More research into advance forms of energy sources, including solar energy, is another part of the policy, as is better and less polluting use of coal, together with strict laws to control strip mining. It is Sierra Club policy to encourage a decrease in per capita consumption, partly through the use of economic incentives, and regulation of all phases of energy extraction and use. This includes coordination of energy policy with other related policies (such as transportation and land use). A National Energy Policy is necessarily a part of this plan. Specific recommendations on energy include:

- (1) Revision of rate structures to assure that energy is priced at its full cost. This includes setting prices at a level which includes the cost of new supplies of energy and prices which are higher during peak demand periods.
- (2) Rapid phasing out of all economic subsidies to energy industries, including depletion allowances.
- (3) Removal of environmental and social "subsidies" which prevent the inclusion of all costs in the pricing of energy. Allowing pollution, which means individuals bear the burden of the pollution costs, rather than having laws which cause industries to spend the necessary funds to clean up their pollution (and distributing this cost to users of their product), is an example of this.
- (4) Termination of fuel import quotas, thereby letting the free market system determine supply and demand.

An example of applying the Sierra Club energy policy has been the Alaska Pipeline issue. The Sierra Club, along with a number of other environmental groups, blocked construction of the pipeline for several reasons: Impact on the environment by this extraction and transportation system was not adequately studied, nor were the alternate methods of moving oil and gas through Canada studied. Finally, the delay has bought time to educate the public with respect to our use of energy and to begin the process of converting to more efficient uses of energy before the precious source of Alaskan oil is tapped.

Sierra Club policy on a local level consists of finding ways for local utilities to lessen the environmental impact of their operations. These measures consist principally of finding ways to encourage energy conservation and watchdogging electrical generation plant siting.

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TOPIC: Transportation

Background:

Up to the present, San Antonio has relied almost exclusively on surface streets and highways to meet its transportation needs. The planning for new facilities and improvement of existing ones has been done through an ongoing project begun in 1963, the San Antonio-Bexar County Urban Transportation Study (SABCUTS). SABCUTS was initiated, in part, to satisfy a provision of the Federal Highway Act of 1962 which required that metropolitan areas of over 50,000 population institute a continuing transportation planning process before Federal Road monies could be obtained. The plan advanced by SABCUTS is concerned almost exclusively with motor vehicle transportation (primarily private autos), the projection of demand, and the development of proposals for expressways and arterial streets to meet that demand.

The SABCUTS plan has recommended the Bandera Expressway to relieve congestion on IH 10 and has developed proposals to increase the capacity of existing expressway facilities by the addition of more lanes.

SABCUTS is also engaged in a continuing program of arterial street improvement through the TOPICS program--Traffic Operations Program to Increase Capacity and Safety. The Federal funds obtained under this program have been devoted to street widening and channelization and railroad grade crossing protection.

The San Antonio Transit System (SATS), under a grant from the Urban Mass Transportation Administration, is engaged in a short-range urban transit study. After analysis of the data gathered, some of which was obtained from on-bus questionnaires and home interviews, an improvement program for the system will be developed.

The Alamo Area Council of Governments (AACOG) is in the process of applying for Federal funding for a long-range urban transit study. The study will last 20 months and will consider all mass transit modes for Bexar County and the corridors leading into and out of the county. A consultant will be undertaking the project. He will be working out of the AACOG offices and coordinating with other area agencies concerned with transportation, SABCUTS, SATS, the San Antonio Planning Department, and the San Antonio Transportation Department. As part of the study the consultant will develop an outline for a comprehensive area transportation study encompassing the entire 10-county AACOG planning region.

Problem:

The transportation problem may be characterized as being basically a conflict. The conflict takes many forms. The friction involved in the movement of people along the traveled way--accidents, congestion, inaccessibility. The impact of various transportation modes upon the environment in which they operate--air pollution, ugliness, noise. The problem of deciding how to use limited material and human resources to satisfy the requirements for housing, education, and transportation. The difficulty lies in providing a balanced transportation system which satisfies human desires and environmental considerations.

Some of the problem areas facing San Antonio are:

(1) The Highway Trust Fund, from which the Interstate Highway System is financed, produces about \$5 billion per year in revenue from the sale of gasoline, oil, and auto accessories. Between 1955 and 1985, an estimated \$297 billion will have been spent on the

Interstate System. A third of this sum has been allocated for urban areas, yet up until now none of this money has been spent on mass transit. The vast sums spent on highways has produced a severe imbalance between highways and other transport modes, and nowhere is this more evident than in San Antonio. At present there is no real choice available to the transportation consumer but to confine his transport usage exclusively to highways.

(2) The growth of suburbs has been characterized by haphazard development which follows highways intended to serve through traffic and which had been "planned" with no thought to their effect on urban growth. The proposed Bandera Expressway, extending beyond IH 410 to the northwest, is an example of this phenomenon. Aside from the aesthetically undesirable strip development that the highway will generate, population growth will be stimulated in the Edwards Underground Reservoir recharge zone, bringing with it the threat of pollution. The failure to consider the environmental consequences of growth stimulated by the Bandera Expressway coupled with the lack of land use regulations to control development could result in severe environmental damage.

(3) A decision on the feasibility of a highway proposal is based on cost benefit analysis, i.e., whether the benefits to be accrued exceed the investment in the transport system. However, consideration of transport costs alone is not enough. The total outlay, including the social costs resulting from the transport system, must figure in the yields to be expected from a transportation investment. This approach may lead to the selection of an alternative with higher transportation costs but which lowers other costs more than it increases transportation costs. Therefore, before San Antonio rejects mass transit as being uneconomical, it must adequately assess the true cost of the alternative, more highways, and with them more air pollution, noise, congestion, less open space as a result of suburban sprawl, and perhaps less parkland.

(4) The government and citizenry of San Antonio share a common interest in the revitalization of the central business district. However, this desirable goal must not be used to justify the building of expressways from the suburbs to the CBD by insisting that they are needed to stimulate a lagging downtown economy. Evidence from other parts of the country suggests the opposite may result. Between 1958 and 1963, despite considerable freeway construction, Boston lost 9% of its total retail sales. Yet San Francisco, despite halting all freeway construction in 1966, had by 1967 increased sales 16% over 1963.

(5) San Antonio faces the problem of how to increase bus transit usage. A reduction in fare may be suggested as a technique to stimulate patronage. Yet a study drawing upon data gathered in Boston suggests that fare reductions have little effect on transit usage. On the contrary, when fares were raised total revenue showed a net increase, although ridership did decrease somewhat. The most significant finding was that increasing the geographical coverage of the system and increasing the schedule frequency would have the greatest effect on the transit demand. The results of the SATS short-range study must be awaited before any firm judgements can be made on how bus usage in San Antonio could be affected by fare changes. But it seems clear that the coverage and schedule frequency of the system must be increased if bus ridership is ever to be made feasible for most transportation consumers.

(6) A comprehensive, area transportation study may be conducted in the future for San Antonio and the surrounding region. This is an urgently needed approach to the transportation problems of the area and is the best medium through which all modes can be considered and all disciplines can contribute to the design of a balanced system. Yet a caution must be sounded. In many instances area transportation studies have acted primarily as a vehicle for the sanction and validation of existing highway plans. San Antonio must ensure

that such an undertaking be approached with no bias toward any mode and with good faith by all participants.

Alternatives:

San Antonio's transportation problems should be viewed as a challenge and an opportunity to improve the quality of the environment while at the same time facilitating the movement of people and goods. An appraisal of what is being done in other areas indicates the range of possibilities and, more importantly, gives hope for the solution of local problems. In San Francisco, the Bay Area Rapid Transit System, a fast, comfortable, modern rail rapid transit system, is now in operation. The city of Atlanta has recently decided to build a rapid transit system. The establishment of computerized car pools in some areas is one approach being tried to relieve traffic congestion. Several states in the far west have begun diverting a small percentage of highway funds to the maintenance and construction of bike-ways.

For San Antonio several measures deserve consideration:

The closing of rail lines inside IH 410 and using the right of ways for bus and/or bicycle ways could reduce the traffic load on the radial arteries and provide a reasonable alternative to autos for many people.

Better geographical coverage and increased schedule frequency could improve bus ridership on the SATS and relieve some vehicle congestion.

A consideration of the true costs (including environmental impact) of any transportation proposal (such as the Bandera Expressway) would result in a more balanced transportation system and a reduction in the high social costs (air pollution, loss of open space, etc.) resulting from an exclusive dependence on highways.

An area transportation study would offer the best hope for developing comprehensive, coordinated approaches to transportation problems. Coupled with an area-wide land usage plan, development of the urban area could be channeled in the most desirable direction.

Finally, each individual can examine how his actions and attitudes determine the kind of transportation system we have. He can choose to spend his transportation dollar in a manner which minimizes the cost to the environment, and he can demand from his elected officials decisions which balance all costs and maximize the quality of the environment.

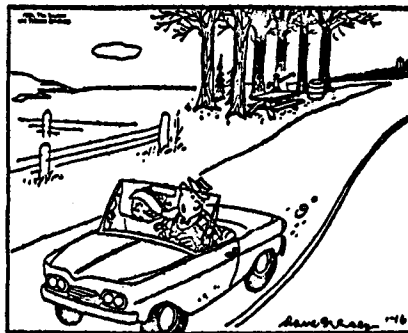
Sierra Club Position:

Comprehensive transportation planning should be conducted, including projected land uses and alternative transport methods. Planning should not be done on the assumption that private autos will continue indefinitely to carry the majority of travelers as at present. Innovative and experimental use of bus mass transit should be instituted as soon as possible. Such mass transit should be supported in part as a necessary public utility. While higher fares are in order for economically advantaged groups, fare box receipts should not be expected to completely cover expenses.

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CITIZEN SMITH By Dave Gerard



"State Park! I think we just passed through it!"

TOPIC: North Expressway

Background:

Since about 1956 the City of San Antonio and the Texas Highway Department have planned a major expressway to run northward from the central city. This expressway, now known as the North Expressway, would satisfy an assumed increase in automobile traffic to the north central portion of the city, and connect other expressways with US 281. Funds for right of way acquisition by the city were secured through a bond election in 1961 following an earlier unsuccessful bond election. A firm route for the expressway was subsequently released, and ran from the intersection of IH 35 and Broadway to connect with US 281 north of Loop 410 in the vicinity of International Airport. This route and its concurrent environmental damage have been the source of concern and opposition by conservation groups ever since its announcement.

Problem:

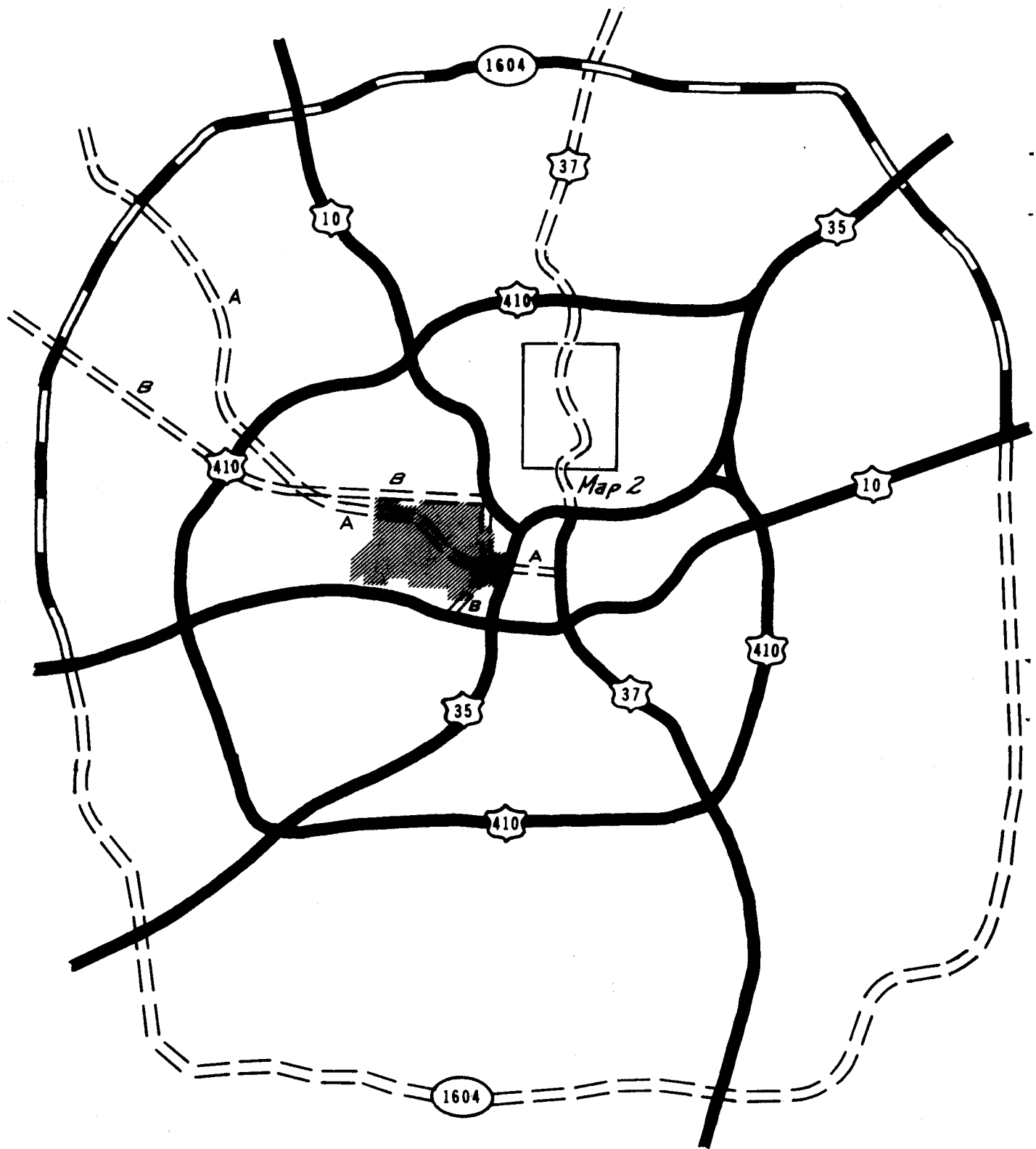
Based on the available information, it appears that there has never been a comprehensive study to: firmly establish the necessity for the North Expressway as part of an overall transportation plan for San Antonio; evaluate all feasible alternate routes for the expressway; comprehensively analyze environmental impact. In fact, it appears that the current route was selected solely to minimize acquisition costs by large use of publicly owned lands now dedicated to parks. At the same time that parkland is destroyed or encroached upon, the expressway also infringes on the zoo, a botanical garden, an outdoor theatre, an athletic stadium, a college campus, and nature trails.

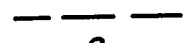
The major environmental problems which will stem from the North Expressway are briefly outlined below.

1. Loss of parklands and open space - San Antonio, in 1960, ranked very unfavorably among 50 major U.S. cities in the ratio of parklands to population, having 4.8 acres per 1000 population, or about 3% of the urban area. Planning and recreational experts generally recommend a ratio of 10 acres in parkland per 1000 population, or 10% of the urban area. At present, it is estimated that San Antonio has approximately 6 acres of parks per 1000 population, or about 4% of the urban area; still well below the recommended levels. We can ill afford to lose any parklands and particularly not in the Brackenridge-Olmos complex. This is the largest contiguous open space near the center of the urban area. Its wide variety of assets makes it the center of recreational use by a large and widely distributed segment of the population.

2. Ecological damage - Loss of habitat, construction disturbance, and vehicle noise are expected to greatly reduce the population of wildlife and birds in the entire Brackenridge-Olmos open space system. Large numbers of trees, many of great age, will be lost. These will be destroyed either by the route itself or because of incidental fill removal in Olmos Basin.

3. Noise and air pollution - Use of the projected six lane, high speed expressway is expected to generate a 1/2 mile to 3/4 mile wide noise corridor with attendant amounts of air pollutants. These will further damage the parklands and recreational facilities which are in close proximity to the route, since people come to these areas for relaxation and release from urban stress. These environmental pollutants are also expected to further damage wildlife and plant life over the long term. Impact on zoo animals may be catastrophic based on recent information.



-  Existing Expressways
-  Proposed Expressways
-  Bandera Expressway, Proposed Route
-  Bandera Expressway, Alternate Route



Model Cities Area

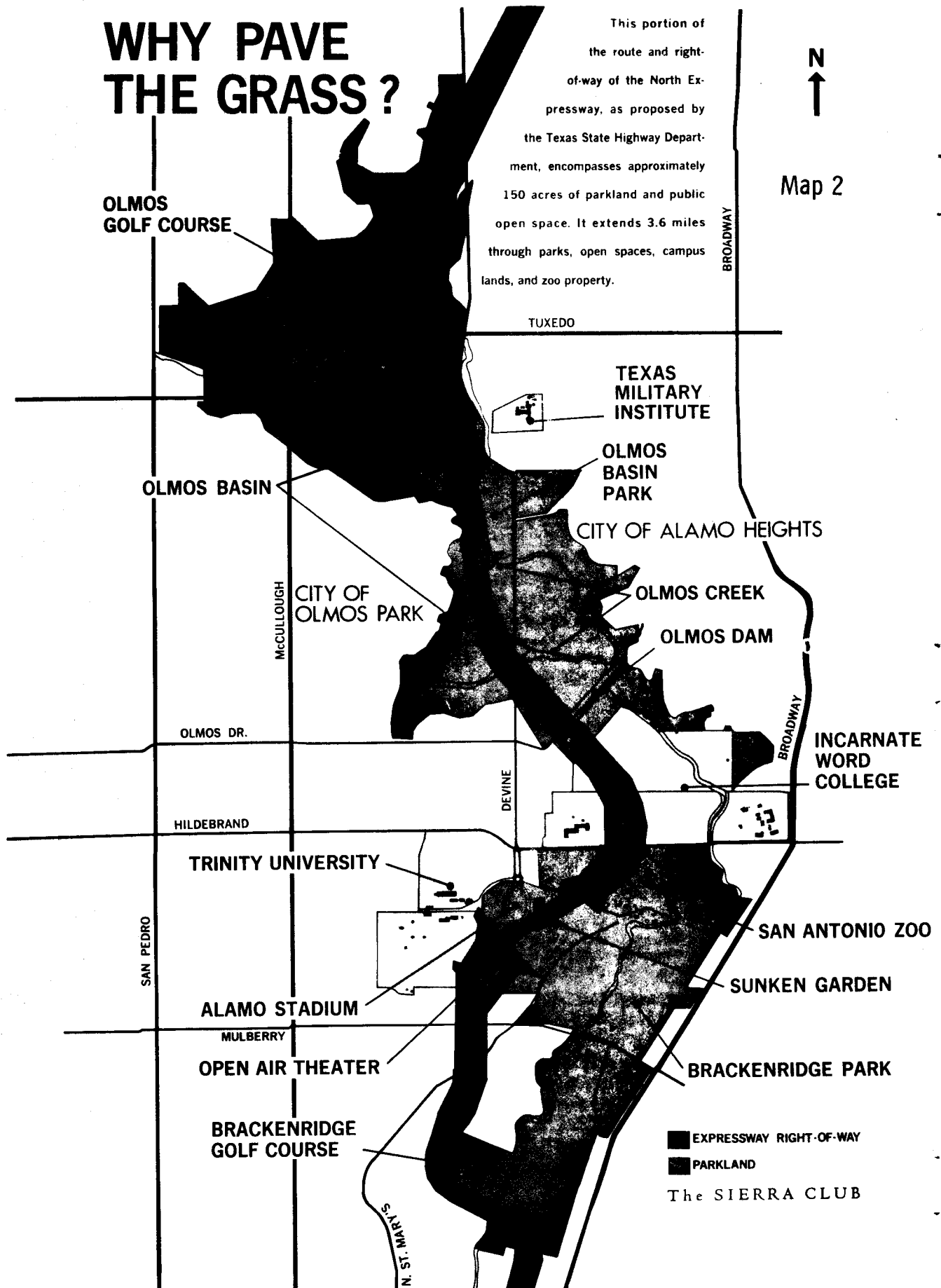
MAP 1

WHY PAVE THE GRASS?

This portion of the route and right-of-way of the North Expressway, as proposed by the Texas State Highway Department, encompasses approximately 150 acres of parkland and public open space. It extends 3.6 miles through parks, open spaces, campus lands, and zoo property.



Map 2



4. Visual blight - The visual ugliness of an elevated, six lane, high speed expressway with its concurrent access roads and traffic interchanges is expected to further decrease the usefulness of the parklands and recreational facilities. Such structures in close proximity to recreational areas are particularly inappropriate and damaging.

5. Impact on Edwards Aquifer - San Antonio suffers from seriously unbalanced urban growth with most development taking place to the northwest. This growth is endangering the recharge zone of the Edwards Underground Reservoir (see separate topic). Construction of additional major roads to the north will increase the hazard to the aquifer by acting as a further impetus to growth and urbanization on the critical recharge zone.

Alternatives:

Any consideration of alternatives must address the two major elements of a comprehensive study, i. e. , need and feasible alternate routes.

Need should be firmly established using the most current data and considering all projection factors. Recent traffic flow information indicates a decreasing use of north-south arterial streets over the general route of the expressway. Major urban growth has been to the northwest rather than north central. There are indications that a new regional airport may be constructed within 10-15 years. San Antonio must soon have some form of better public transportation. All of these factors impact on an evaluation of need in the overall urban transportation system. Improvement of existing arterial streets and provision of effective public transportation may be sufficient to meet genuine need. Alteration of an out of balance urban growth pattern will further decrease northward transportation requirements.

In the event that comprehensive study of transportation requirements indicates an additional roadway is necessary, then all feasible alternatives which minimize environmental damage should be evaluated. Among possible alternatives are an expressway following the Missouri-Pacific railroad right-of-way or a limited access surface parkway.

The Gruen Report, which is the only comprehensive study made of environmental impact on any portion of the proposed route, was exclusively devoted to the so called "center section" from Mulberry to Tuxedo. This study clearly showed a number of alternative routings which would significantly decrease environmental damage. It is obvious that a similar study, in greater depth, should be done for the proposed route as well as all other feasible alternative routes.

Sierra Club Position:

A high speed, six lane expressway should not be built along the presently planned route due to the environmental damage to San Antonio's already inadequate parks and open spaces. A comprehensive study of transportation requirements for the entire urban area should be accomplished using the latest available data and projection trends. Whatever solution is finally selected should reflect the skills of several urban disciplines and cause a minimum amount of damage to the environment.

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TOPIC: Bandera Expressway

Background:

The Bandera Expressway, a 10.2-mile-long roadway costing an estimated \$90,000,000 is to run on an approximately northwest axis from the Central Business District (CBD) of San Antonio to the town of Bandera, intersecting Loop 410 somewhere between IH-10 and US-90. It is to be a six-lane facility from Loop 410 to General McMullen Drive and eight lanes from General McMullen to downtown. Completion of the road is to take 10 years and is estimated to serve projected needs to 1985. (See Maps 1 and 2 in previous section.)

The three primary users of the freeway would be the central Business District, the inner-city neighborhoods, and the suburban neighborhoods. It would receive moderate use from the CBD by a commercial and small residential population which will use it to travel to work or to suburban shopping development on Loop 410. It will receive light use from the inner city populace. A small number of people will use it to reach either suburban or downtown jobs. The heaviest users will be the suburban dwellers in developments generated by the existence of the freeway. It appears that this road will act as a trip generator rather than a means to serve existing demand.

The Bandera Expressway would be a state highway, not part of the interstate system, and would therefore receive 50% city and 50% state funds for right-of-way acquisition, and 50% state and 50% federal funds for construction. In addition, a section of interstate highway, called the "IH-10 By-Pass," is being considered along with the Bandera Freeway. The by-pass would run approximately north-south, meeting the Bandera Freeway at either Durango Boulevard or Culebra Road, to relieve present congestion on the inner portion of IH-35.

The Bandera Expressway was first proposed in the San Antonio Bexar County Urban Transportation Study (SABCUTS) of 1965. In July 1968, the Texas Highway Department, in conjunction with Model Cities Development of San Antonio, released a set of proposed routes for the Bandera Expressway and the IH-10 By-Pass. All of the suggested routes were to go through some part of the Model Cities Area. However, up until the present, no exact route has been set.

In November 1969, a citizens' committee was appointed by the City Council to study \$208,000,000 of capital improvements recommended by the City Staff which included \$10,000,000 of right-of-way funds for the Bandera Expressway. In July 1970, when the total bond issue was reduced to \$65,000,000, the \$10,000,000 for the Bandera was cut to \$500,000. This represented the money needed for right-of-way acquisition of the Bandera Expressway IH-10 By-Pass intersection only, and served as a guarantee to the Texas State Highway Department that the expressway would be built. The exact nature of this reservation of funds was not clearly explained to the voters, and on September 26, 1970, the bond issue was approved, including the \$500,000 for the Bandera Freeway.

In July 1971, a "Design Concept Team" was appointed for the Bandera Expressway and tasked with examining the best route and design for the road. However, several team members expressed dissatisfaction with the narrowly conceived charge given the team, feeling that a fundamental appraisal of the entire transportation problem and all feasible alternatives was necessary. After taking this position, the team was allowed to examine the need for the proposed road in addition to its route and design. The design team's first meeting was held in July, and a final report of their findings was submitted to the City Council in October 1971.

Problem:

One of the purported benefits of the proposed Bandera Expressway is that the downtown area will be made more accessible to the suburbs and that an economic resurgence will ensue downtown. This contradicts one of the most widespread phenomenon observed in metropolitan growth. This is that freeways hasten the flight to the suburbs, hasten the decline of the CBD, and result in further suburban sprawl. The only benefit will accrue to downtown businesses which locate branches in suburban shopping centers as the freeway makes more accessible the shopping, employment, and recreational facilities that will spring up along the outer reaches of the route.

The Bandera Freeway would cause several environmental problems:

(1) The expressway would produce the usual fallout associated with high-speed, multi-lane roads. It will create a noise corridor at least one-half mile wide, increase air pollutants at a time when federal regulations are attempting to reduce the high concentrations in city centers, and would bring the usual visual blight of a huge concrete structure thrust into a residential area.

(2) An essentially undeveloped area of open rural land would be opened to residential and commercial real estate speculators. As such development occurs, it will tend to perpetuate the automobile based economy of shopping centers and sprawling communities. More low density suburbs and exurbs will reinforce arguments against mass transit for San Antonio, and take the city one step closer toward emulating the smog-choked "slurb" nature of Los Angeles.

(3) Most importantly, the expressway would thrust further commercial and residential development toward the northwest, onto the Edwards Aquifer recharge zone, which will worsen the already serious threat of pollution of San Antonio's water supply. The further encroachment of Suburbia into the recharge area will bring more septic tanks and sewer lines, runoff from oily streets and parking lots, and the concentration of surface water runoff on a smaller area, thereby increasing the possibility that pollutants can percolate into the aquifer.

The Bandera Freeway once again raises the issue of comprehensive planning, or lack of it, for the San Antonio area. As the freeway affects the immediate area through which it passes, the Model Neighborhoods Area, does it coincide with the goals of the area, namely the revitalization of the inner city and the creation of a liveable environment there?

On a broader scope, no consideration seems to have been given to the interrelationship between such things as the Bandera Expressway, North Expressway, Inner Loop, and University of Texas at San Antonio, nor to the effect of these parts on the whole of development of the area. There is lacking a sense of where all these projects are taking us. The idea that a comprehensive regional plan should be developed and adhered to, based on the environmental, economic, and social constraints involved, is not in evidence. The issues of open space development and sprawl and the encroachment onto the recharge zone have not been adequately assessed, if they have been considered at all.

The appointment of a design concept team for the Bandera Expressway (or any other road) is a hopeful development, yet it also has several shortcomings which may prevent it from living up to its promise. By the very nature of its makeup, the team's part-time investigators cannot do justice to this complex problem. In particular, the SABCUTS study justifying the freeway's need, representing a huge volume of data, cannot be thoroughly researched given the team's resources.

Related to the problem of lack of time and resources is the design team's composition, which does not seem to represent the broad cross-section of urban disciplines so necessary for proper planning. Finally, there is a real danger that because team member selections seem to have been weighted in favor of the original expressway proposal, many alternatives may have been foreclosed from the start.

Alternatives:

A consideration of alternatives may address itself to needs and to feasible alternate routes, yet these factors are secondary to considering the stimulation of development into the Edwards Aquifer recharge zone caused by the Bandera Expressway. Arguing that a freeway is needed to serve the suburban development that will exist northwest of San Antonio forecloses any discussion of whether such development should be encouraged at all. The important item for debate is whether development to the northwest is wise in light of the pollution threat to the aquifer, and not how best to serve this development.

This appraisal of growth patterns as they are affected by the expressway should be made within the framework of a comprehensive regional transportation and land use plan. In the course of developing a regional plan it is important that all transportation modes be given equal consideration, especially public mass transit, which in the past has not been considered at all. Additionally, planning decisions (e.g., the location of a major public works project such as an expressway or school) should be made so that development occurs in the most environmentally sound direction.

Sierra Club Position:

The proposed Bandera Expressway as presently advanced cannot be justified on reasonable grounds. It poses a clear and implicit threat to the Edwards Aquifer by stimulating suburban growth and development on the aquifer recharge zone. In addition, it will further damage the health of downtown, while giving further impetus to a "private auto only" transportation system.

The roadway should not be built until a comprehensive study has been accomplished by a full-time professional interdisciplinary planning team. This study should evaluate, among other significant factors, the following:

- Alternate development/land use strategies for the entire Northwest Quadrant
- Impact of the road on the Model Neighborhood Area (social, cultural, economic)
- Overall transportation needs
- Plans/Timetables for waste treatment facilities for the Northwest Quadrant
- Impact on the Edwards Aquifer
- Interrelationship with planned growth centers (UTSA, San Antonio Ranch New Town)

This study should be integrated with regional planning for water resources, open space, transportation, waste treatment, and flood plain control so that overall community goals are recognized.

References:

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IX. Air

Air is our most vital resource. Pollution of this resource is usually readily apparent and has resulted in the most dramatic incidents of public discomfort and complaint. Air, unlike other resources such as water or land, is commonly shared. Because of this, its degradation affects large numbers of people in a direct and personal way. And because air is commonly shared and utilized, the difficulty of controlling air pollution is proportionally greater. A vast number of polluters contribute to overall degradation while conversely the effects of a single pollution source can distress an unbelievably wide area.

These factors make clean air a matter of general and pronounced concern, more pressing perhaps than any other environmental topic. Furthermore, the quality of air is not only a matter of health; it is also a matter of esthetics, for it can enhance or mar the landscape around us and either clarify or obliterate the sky above us.

The effects of air pollution are varied and complex, ranging from a simple loss of visibility and actual damage of certain materials to positive physiological injury to man. In most instances, data to definitively establish human response are incomplete or lacking. This argues strongly for a conservative approach when discussing permissible levels of various polluting agents.

Air pollution arises from a number of sources, some natural and some man made. Pollutants are of two major types, solid matter (particulates) and gaseous, although in certain instances liquid, in the form of mist or aerosol, can be a polluting material.

For the most part air pollution is worse in those centers where population is denser--cities, in other words. Cities contain more manufacturing plants, larger numbers of motor vehicles, and various other fuel consuming devices. Thus in Texas the lowest quality air is found in Houston and El Paso, whereas San Antonio has relatively clean air at present. But whatever the situation, strong and comprehensive measures are required to keep air from becoming more polluted and to restore to all citizens air of the highest quality.



TOPIC: Air

Background:

Air is our most vital resource and as such its purity must be carefully guarded. Air pollution has a pronounced effect on the health of humans, animals, and plants, besides causing the deterioration of materials and making living generally unpleasant. Studies have linked air pollution to lung disease, including cancer and emphysema, and there are suggestions that it may also be linked with cardiovascular disease. It has been estimated that morbidity and mortality due to air pollution cost the American public at least \$2000 million each year. In addition, \$200 million is lost annually because of material deterioration and the Environmental Protection Agency (EPA) estimates the nation's annual agricultural loss due to air pollution to be \$500 million in crop damage and in livestock sickness and death.

The major sources of air pollution are generally grouped in four categories: transportation, fuel combustion by stationary sources (power plants, space heating), refuse disposal, and industry (primarily iron and steel mills, petroleum refineries, smelters, and chemical manufacturers). Table I shows the estimated millions of tons of pollutants emitted in 1968 by major sources throughout the country.

TABLE I. ESTIMATED NATIONWIDE EMISSIONS, 1968
(Millions of Tons Per Year)

<u>Sources</u>	<u>Particulate Matter</u>	<u>Carbon Monoxide</u>	<u>Nitrogen Oxides</u>	<u>Sulphur Oxides</u>	<u>Hydrocarbons</u>
Transportation	1	64	8	1	17
Power Plants	9	2	10	24	*
Refuse Disposal	1	8	*	*	2
Industry	8	10	*	7	5

* Less than 1 million ton

Source: National Air Pollution Control Administration

The process of combustion contributes most to air pollution. Products of combustion include all of those listed in the table above and originate from all of the sources listed. Processes such as sanding, demolishing, drilling, spraying, grinding, and crushing result in millions of tons of airborne particulate matter annually and rank as the second major contributor to air pollution.

Photochemical reactions which occur when the radiant energy of the sun reacts with chemical components of exhaust fumes produce ozone, nitrogen oxides, and other compounds which build up and contribute to the phenomenon we know as smog. All of these products of photochemical reactions are damaging to tissues, especially eyes, nasal membranes, lungs, and plant tissue.

Air movements, oxidation, washing by rain, adsorption, settling, and precipitation enable the atmosphere to be cleansed of most of the materials which naturally get into the air from forest fires, dust storms, volcanic eruptions, etc. In recent years man has accepted the air as an appropriate route for his waste disposal and the self-cleansing ability of the air is now often exceeded. Inversions, an atmospheric phenomenon which occurs when a cool surface layer of air is trapped by a warmer overlying layer of air, occur over all cities and tend to trap pollutants, thereby making the air pollution situation worse. Inversions occur in San Antonio on about 25% of the days of the year, occurring three times more frequently in the winter. Fortunately for local residents, pollutants are fairly easily dispersed vertically and horizontally the rest of the year.

National emission figures such as those in Table I are impressive, but they are misleading and of little value because they do not reflect the concentrations of pollutants at a specific time and place. Somewhat more useful is information such as the 1968 emission inventory of the San Antonio Metropolitan Area. Estimates were obtained regarding the tons of various pollutants emitted per year. These data are tabulated in Table II to show the relative percentage of the total amount of a pollutant contributed by each major source in the San Antonio area.

TABLE II. 1968 EMISSION INVENTORY - SAN ANTONIO
METROPOLITAN AREA
(% of Total From All Sources)

Source	Particulate Matter	Carbon Monoxide	Nitrogen Oxides	Sulphur Oxides	Hydrocarbons
Transportation	4	90	70	90	83
Power Plants	*	*	21	*	*
Industry	95	*	4	10	1
Total Emissions in Tons	150,000	436,200	34,000	2,000	69,000

* Negligible

Transportation sources contribute most of the carbon monoxide and nitrogen oxides in the San Antonio region. Power plants also contribute a significant portion of the nitrogen oxides, although the combustion in power plants in this area is relatively "clean" because natural gas is used as a fuel instead of coal. Industry (primarily cement plants) contribute 95% of the particulate matter. Preliminary reports for 1969 and 1970 indicate that emissions have remained much the same, except that the amount of particulate matter resulting from industrial operations has declined because of air pollution control devices installed during 1968-1970.

Emission inventories can also be misleading, however. For instance, most of the sulphur dioxide emitted by industry in San Antonio comes from a few plants, and, therefore, this sulphur dioxide is of considerably more nuisance and a health hazard to people in the immediate area of those plants than it would be if the same amount of sulphur dioxide were emitted by many sources spread throughout the city. Likewise, the greatest concentration of carbon monoxide in the region is probably in the downtown San Antonio area where there

is a high density of vehicles and where tall buildings prevent rapid dissipation of pollutants. Most of the industrial particulate matter comes from plants concentrated in specific locations, thus presenting a marked health hazard to workers in those plants and residents in the immediate vicinity.

The most significant kind of air pollution data is the concentration of specific pollutants in the ambient or circulating air of relatively small areas of a region measured over short and long periods of time. Such data are almost non-existent for the San Antonio region. The most complete ambient air monitoring has been done for particulate matter. Data from 1969 indicate that total suspended particulate matter in San Antonio averages 66 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$). However, the concentration of particulate matter on the east and west sides of the city was 80-100 $\mu\text{g}/\text{m}^3$. The National Air Surveillance Network (NASN) has a monitoring station at 302 South Laredo Street. The data obtained from this station in 1969 are listed in the third column of Table III. The high concentration of nitrogen dioxide at this location is seen to be above the national standard.

TABLE III

	National Ambient Air Quality Standards		San Antonio Regional Air Quality Standards		National Air Surveillance Network Survey-S.A. 1969
Sulphur	80 $\mu\text{g}/\text{m}^3$ * (a)		13 $\mu\text{g}/\text{m}^3$ (a)		9 $\mu\text{g}/\text{m}^3$ (c)
Dioxide	365 $\mu\text{g}/\text{m}^3$ (b)		53 $\mu\text{g}/\text{m}^3$ (b)		
			260 $\mu\text{g}/\text{m}^3$ (e)		
Particulate	75 $\mu\text{g}/\text{m}^3$ (c)		55 $\mu\text{g}/\text{m}^3$ (c)		49 $\mu\text{g}/\text{m}^3$ (c)
Matter	260 $\mu\text{g}/\text{m}^3$ (b)		125 $\mu\text{g}/\text{m}^3$ (b)		
Carbon	10 mg/m^3 ** (d)		10 mg/m^3 (d)		no data
Monoxide	40 mg/m^3 (e)		25 mg/m^3 (e)		
Photochemical					
Oxidants	160 $\mu\text{g}/\text{m}^3$ (e)		100 $\mu\text{g}/\text{m}^3$ (e)		14 $\mu\text{g}/\text{m}^3$ (c)
Non-methane					
Hydrocarbons	160 $\mu\text{g}/\text{m}^3$ (f)		130 $\mu\text{g}/\text{m}^3$ (f)		no data
Nitrogen					
Dioxide	100 $\mu\text{g}/\text{m}^3$ (a)		no standard		123 $\mu\text{g}/\text{m}^3$ (c)

* Micrograms per cubic meter of ambient air

** Milligrams per cubic meter of ambient air

(a) annual arithmetic mean

(b) maximum 24-hr average

(c) annual geometric mean

(d) maximum 8-hr average

(e) maximum 1-hr average

(f) maximum 3-hr average (6-9 am)

Occasional monitoring for 24 hours and sometimes two-week periods has been performed by the San Antonio Metropolitan Health District over the past three years for the other major air pollutants. The data provide no truly useful information, but do give an indication of the possible concentrations of these pollutants in the air of the region. Monitoring was carried out for five 24-hour periods at five sites around the city in July and August of 1970. At that time sulphur dioxide ranged from about 10 $\mu\text{g}/\text{m}^3$ at most sites

to over 100 ug/m^3 in the Walzem Road area. Hourly peaks of about 90 mg/m^3 of carbon monoxide have been detected at Alamo Plaza, but monitoring has never been done on a long term basis at this site. Spot checks of oxidants and hydrocarbons have indicated no appreciable concentrations of these substances at any one location.

A Federal Clean Air Act was passed by Congress in 1967 and amended in 1970 to begin the arduous task of bringing the pollution of our air under control. In the same year the Clean Air Act of Texas was adopted. The Texas Air Control Board established by this Act is composed of nine members who are appointed by the Governor and who meet monthly in Austin. The Board is assisted by 96 paid staff members who are employees of the Texas State Department of Health and an Executive Director. In 1971 and 1972, 146 additional staff members were employed with additional funds appropriated by the legislature. The Texas Air Control Board has recently adopted a fairly aggressive attitude toward the control of air pollution in the State. Only time will tell whether their efforts will be sufficient to succeed in cleaning up the air.

The Air Pollution Control Office in San Antonio is within the San Antonio Metropolitan Health District. This office is responsible for monitoring air pollution in the San Antonio region and seeing that polluters come into compliance with State and Federal law.

Under provisions of the Federal Clean Air Act, national ambient air quality standards were adopted by the Environmental Protection Agency in 1971. These are listed in Table III along with standards adopted by the Texas Air Control Board for the San Antonio Metropolitan Air Quality Control Region (which includes Bexar and surrounding counties), and monitoring data from one site in downtown San Antonio. States had until January 31, 1972, to write a plan for bringing all regions of the State into compliance with these national standards.

Problems:

We are fortunate in San Antonio that our city is not heavily industrialized and we do not have high concentrations of industrial chemicals in our air. To prevent degradation of air quality, this region needs stringent ambient air quality standards, stringent emission standards, and strict enforcement of these standards. Before meaningful standards of any sort may be adopted, however, comprehensive monitoring information must be available. As mentioned previously, monitoring in the region has thus far been sporadic and totally insufficient. In addition, data which have been collected have not been available to the public in an understandable form until two years after they have been collected.

Automobiles contribute significantly to the air pollution in the San Antonio region, illustrated by the emission inventory of 1968 (Table II)--the high concentration of carbon monoxide detected at times at Alamo Plaza, and the high annual average of nitrogen dioxide detected at the downtown site by the National Air Surveillance Network. However, no consideration has yet been given to methods of controlling this source by city, county, or state authorities. The Environmental Protection Agency required Texas to establish a transportation control plan for major urban areas, but after holding hearings in March 1973, Texas decided not to submit a plan to EPA because in all urban areas, excepting San Antonio, 1975 auto emission controls were forecast to successfully control hydrocarbons by that year. EPA is, however, pressing its requirement for transportation controls, and it appears as though these controls will be mandatory.

Finally, there is the problem of the philosophy of officials who believe that air pollution problems will only be tackled sometime in the future after the city has been heavily developed and industrialized in order to provide jobs for all the people. In general, the

standards listed in Table III provide no incentive for the protection of the quality of air in San Antonio, but instead they provide considerable margins for degradation in most categories. These are not consistent with the Supreme Court ruling.

Sierra Club Position:

The goal of citizen groups and governmental agencies should be to prevent further degradation of air quality in the San Antonio region. This is necessary for the preservation of human health, the protection of plants and animals, and the preservation of an esthetically pleasing environment in which to live. The Sierra Club maintains that the air is not an appropriate sink into which to dump manmade wastes.

City, county, state and regional governments must take aggressive action to control air pollution from all sources. High quality air will be an ever increasing asset of this region, and, therefore, money invested in the improvement of air quality should be considered as a sound investment in the future of San Antonio.

Industrial and commercial incineration should be done only in incinerators which are properly designed to burn at high heat, high oxygen availability, and with systems for collecting particulate matter. Other material should be transported to regional land fill areas or incinerators which can do a completely clean job of incineration.

Public transportation systems should be developed to substitute for the private automobile, especially in the most highly congested areas of the city. Traffic control systems should be developed which minimize stop-and-go driving and traffic congestion, thus diminishing auto emissions. Consideration should be given to routing through traffic around the city.

A program for inspection and maintenance of vehicles should be established to help reduce exhaust emissions. In addition, procedures should be established for requiring emission control devices on all pre-1968 vehicles which are regularly driven within the city.

A network of permanent monitoring stations should be established throughout the region. Comprehensive data must be obtained concerning the concentrations of all major air pollutants in the ambient air of the region. These data are necessary as basic information upon which to formulate standards and methods of air pollution control. Air quality information should be made public in monthly reports published by the newspaper.

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GLOSSARY OF TERMS RELATING TO AIR POLLUTION:

AIR: a colorless, odorless, tasteless gaseous mixture; mainly nitrogen (78%), and oxygen (21%), with lesser amounts of argon, carbon dioxide, neon, helium, and other gases.

AIR MONITORING: the sampling for and measuring of pollutants present in the ambient air.

AIR POLLUTION: the presence in the outdoor atmosphere of one or more man-made contaminants in quantities, characteristics, and of duration such as to be injurious to human, plant or animal life or to property or which unreasonably interferes with the comfortable enjoyment of life and property.

AIR QUALITY CRITERIA: data showing the range of effects that may be associated with exposure to various concentrations of pollutants in the air for various time periods.

AIR QUALITY STANDARD: air quality goals established for the purpose of protecting public health and welfare.

AMBIENT AIR: the air around you.

ATTRITION: wearing or grinding down by friction; one of the three basic contributing processes of air pollution.

CARBON DIOXIDE: a colorless, odorless, incombustible gas formed during respiration, combustion and organic decomposition.

CYCLONE COLLECTOR: a type of mechanical control device using centrifugal force to remove solid particles from a gas stream.

EMISSION INVENTORY: a compilation of the estimates of emissions from all sources in a community.

EMISSION STANDARD: the maximum amount of a pollutant that is permitted to be discharged from a polluting source.

FLY ASH: finely divided particles of ash entrained in gases arising from the combustion of fuel.

HI-VOLUME SAMPLER: a device used to collect a sample of particulate matter on a filter; often called a Hi-Vol.

HYDROCARBONS: any of numerous organic compounds that contain carbon and hydrogen in various combinations, come mostly from incompletely burned fuel and evaporation of gasoline.

INVERSION: a state in which the air temperature increases with increasing altitude, holding surface air down along with its pollutants.

MICRO: a prefix meaning one-millionth; abbreviated by the Greek letter μ .

MICROGRAMS PER CUBIC METER: unit used to express concentration of many air pollutants; abbreviated $\mu\text{g}/\text{m}^3$.

NITROGEN OXIDES: gases formed from nitrogen and oxygen when combustion takes place under conditions of high temperature and pressure.

OZONE: an unstable, poisonous, oxidizing agent with a pungent, irritating odor.

PARTICULATE: a particle of solid or liquid matter.

PARTS PER MILLION: unit sometimes used to express volumetric concentration of gaseous pollutants; abbreviated ppm.

PHOTOCHEMICAL: chemical reaction initiated by sunlight.

SMOG: irritating haze resulting from the sun's effect on certain pollutants in the air, notably those from automobile exhaust; also a mixture of smoke and fog.

SULFUR OXIDES: compounds formed from sulfur and oxygen primarily by the combustion of fossil fuels.

CARBON MONOXIDE: a colorless, odorless gas which forms during incomplete combustion of carbon-containing material.

X. General Problems

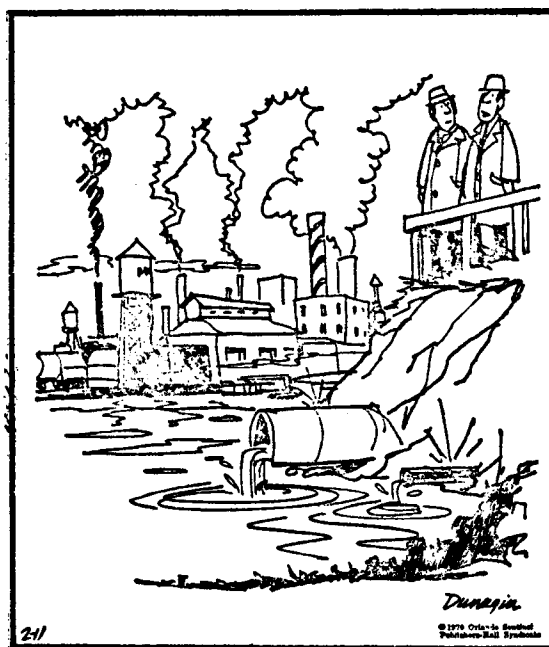
Aside from those environmental problems which can be readily categorized as air, water, or land related, there are others which extend across many areas of concern. In fact, this multi-dimensional nature makes some of them truly crucial to the future of both man and the earth. Among these, population and the consumption of energy are of grave significance. Of only slightly less importance is the role of planning since it is evident that much of the degeneration of our environment is due to a complete lack of foresight and poor planning.

Other topics are included here simply because they cannot be easily assigned to a broad area of definition. This should not be interpreted as a lack of importance; rather, it should illustrate the universality of ecological concerns, both vast and minute. The very basis of ecological philosophy is the dependent interrelationship of all life forms in the natural world, including man and man-made works by which he has altered his world. One of the best and simplest definitions was given by John Muir himself, who said, "When we try to pick out anything by itself we find it hitched to everything else in the universe."

The entire natural world is, therefore, the province of the ecological scholar to study and to evaluate. Such study and research have led many times to recognition of the importance of certain phenomena previously considered of no significance. Because of such discoveries and because of our limited knowledge, environmentalists and conservationists continually advocate an attitude of caution in approaching the natural world.

Until it can be established that there are no undesirable ecological consequences, we should proceed slowly when considering a new influence on the environment. This is true whether the matter is a supersonic transport or a new detergent. Being short-sighted or profit-minded can result in environmental disaster.

DUNAGIN



"It isn't man's inability to adapt to the environment that bothers me. It's the environment's inability to adapt to man."

TOPIC: Comprehensive Planning

Background:

The form, character, and growth of cities are influenced by many diverse forces. Economic, political, social, cultural, and technological pressures all contribute in some way to how a city develops. These forces interact in complex and often nearly inexplicable ways to stimulate growth in a seemingly random fashion.

In limited instances, and over short periods of time, processes much easier to see may be operative, but it is not this level from which results which are significant to the city over the long span rise. Rather it is the less clearly perceived long range factors, and their interplay, which determine the course of a city's evolution.

Many private and public organizations continually make decisions affecting the development of the urban area. The following organizations each have some influence on the course of city development.

City Government

- City Council
- Planning Commission
- City Public Service Board
- City Water Board
- Housing Authority
- Parks and Recreation
- Traffic and Transportation
- Planning Department
- San Antonio Transit Company

County Commissioners Court

- Texas State Agencies
 - Highway Department
 - Legislature
 - Water Quality Board
 - Air Control Board
 - Water Development Board

Federal Agencies

- Congress
- Department of Transportation
- Army Corps of Engineers
- Housing and Urban Development
- Health, Education and Welfare
- Federal Housing Administration
- Environmental Protection Agency

Miscellaneous Multi-Governmental Agencies

- Alamo Area Council of Governments
- Bexar County Metropolitan Health District
- San Antonio River Authority
- Model Cities
- Edwards Underground Water District

The focus of most of these groups is on a specific functional area such as water or highways, despite the critical environmental relationships which may exist among functional areas. There is presently no guarantee that a coordinated effort will be carried on between the appropriate agencies or departments. Financial resources similarly are usually allocated by individual functional area with only minimal consideration of overall requirements, or how the interaction of areas relates to overall need. Also, except in isolated instances, there is no system to develop a rational overview which will guide efforts and capital expenditures. This is frequently true even where functional areas bear the most direct relationship and, of even greater importance, where elements of vital environmental importance exist. Examples of problems resulting from this can be found elsewhere in this booklet.

In general, the federal government is cognizant of the frequent lack of local planning and has instituted certain procedures aimed at encouraging comprehensive planning, particularly where congressional action is required. In essence, projects submitted for federal

grant funding in areas such as transportation, water, and waste treatment must arise from and be a part of overall regional plans for those functional areas.

Problem:

When the diverse factors affecting urban growth are allowed to operate as essentially free dynamics, then urban problems inevitably follow. All cities and regions have finite resources and constraints composed of financial, geographic, environmental, and social elements. These resources should be applied in some rational way to the concurrent needs of the city and region for optimum urban health. When they are allocated without a clear definition of needs or goals, conflicts and problems arise.

Urban problems may take many forms: The city can be ugly, be difficult to move about in, have poor fire, police and health services, have dirty air, or be poorly cared for. The city may have high disease rates, insufficient open spaces, illiteracy; it may inadequately treat its wastes. Solutions to these problems all require the use of a resource. In almost every instance, cities have insufficient resources to solve all of their problems simultaneously. Application of resources in piecemeal fashion without an understanding of problem interrelationships, and without definition of a desired future state can, in many cases, intensify the severity of the problems being dealt with. Ad Hoc solutions which fail to realistically address environmental issues are not only more expensive over the long run, but they usually do not solve the problem. To extend a sewer line simply in response to pressures generated by private land developers, without consideration of overall regional waste treatment needs, is short-sighted at best. Over the long term it means added pollution to neighboring streams and rivers. Similarly, construction of expressways without comprehensive analysis of overall transportation needs (not merely a study of highways) can lead to vast expenditures without materially increasing mobility or reducing traffic congestion. Moreover, the legacy of poor land use and distortion of a desirable growth pattern can have a significantly undesirable long term impact on the city.

Presently there are no clearly stated goals for this urban area except as defined in regional plans prepared by AACOG to fulfill federal guidelines related to eligibility for funding. These regional plans are comprehensive and workable so far as they go. Unfortunately, they do not address problems in many instances at a scale where planning action by various independent agencies is required. The overall interrelated allocation of resources is not usually considered in these plans and time scales are normally rather general. Moreover, agencies are at liberty to follow these plans to the degree which they choose even though financing of specific projects was predicated on the assumption that these projects were in consonance with an approved regional plan.

In addition, the degree of coordination among environmentally related areas, e. g., land use and sewerage, is tenuous at best. This is true since the agencies charged with responsibilities for various areas work only loosely under the AACOG regional planning "umbrella." In reality these agencies operate to preserve their autonomy as far as possible and within their individual political arenas have considerable individual discretion. The threat of loss of federal funds causes some degree of coordinated action, but in many cases this satisfies the letter rather than the spirit of comprehensive planning requirements.

The foregoing is not meant to imply that relationships among agencies are simple. In practice these relationships are many and complex. Planning and action on any given element may require the coordination of efforts at federal, state, county, and several local levels. At each level there are conflicting demands and "constituencies" to be reckoned with. These, however, should be brought into consonance through the comprehensive planning

methodology to achieve recognized goals, on an agreed schedule which recognizes the overall availability of resources. Since the comprehensive planning technique is not truly implemented, we continue to have environmental problems, in efficient or wasteful use of resources, development of individual "crises," and the perpetuation of overall urban problems.

Alternatives:

If urban and regional problems are to approach solution there is no practical alternative to responsible, comprehensive planning. This is not to say that planning will lead to a utopian environment with all problems resolved. Indeed, the dynamics which make planning necessary mandate that it will not be totally successful in every instance. Moreover, the dehumanizing aspect of a totally planned system is not desirable. But planning can increase the efficient use of resources by providing a rational guide for their application to our needs, and to achievement of a desirable future.

Several major elements must be present in the comprehensive planning process if it is to achieve this result. Among these are the following:

- The goals of the community or region must be formulated.
- This process should involve all segments of the community and should reflect in some way each group's position, aspirations, and perceptions.
- An inventory of assets and liabilities must be made to include all major determinants of city evolution.
- A comprehensive plan must be prepared which relates goals to resources in an ordered way and within a time framework. This should not be a rigid plan to be followed inflexibly, but rather a dynamic guide, subject to constant review and revision as circumstances reveal better approaches toward the community's goals, or as resources change.
- Plans must be implemented through the coordinated efforts of all affected and involved agencies. In some instances the development of comprehensive plans may highlight undesirable consequences and conflicts stemming from agency relationships. Development of cooperative procedures then becomes a necessity. Formation of new agencies to consolidate functions is sometimes preferable in order to gain efficiency and provide integrated environmental consideration.

Implementation of comprehensive planning in effect provides a "road map" of where the community is going, how it is going there, what resources are needed, what resources are available, and at what time the community will arrive at the various stages along the way. Moreover, through formulation of goals, with participation from a cross-section of the community, the destination will be where we want to go. It should not be implied that this course is easy or uncomplicated; factors affecting urban areas are enormously complex. Many views and persuasions are at work within the total framework and each operates from a vested viewpoint to some degree. Indeed, this is part of the democratic process, and the responsible planner must recognize this. What is necessary (and possible) is that some method of integrating and unifying these diverse aims be employed so that the community may achieve the common goal of a city and a region that is desirable and sound.

Sierra Club Position:

Comprehensive planning is a mandatory requirement for achieving and maintaining a quality environment, which is essential to a high quality of life, particularly in urban areas,

due to the impact of population concentration on the natural world. The demands of cities upon resources such as land, minerals, fuels, and water, with the concurrent by-products of air pollution, water pollution, noise, and ugliness, pose critical environmental problems. These problems cannot be solved in a haphazard, piecemeal fashion. Only through comprehensive planning which integrate all facets of the situation can a real, environmentally sound solution be approached.

All levels of government should strive to institute comprehensive planning, particularly in the environmentally critical areas of land use, water, waste treatment, energy, and transportation. Cooperation and cooperative efforts among all agencies concerned with major functional areas should be encouraged to the maximum. Serious consideration should be given to the formation of regional agencies for significant functional areas where such agencies are able to provide a higher environmental standard. Budgets should be adequate to support appropriate planning staffs in all major agencies.

Open channels of communication should be established to permit full citizen information and participation in the planning process. This should be accompanied by an educational program to inform the public of the structure and role of comprehensive planning as it is being practiced in the community. Governments and agencies at all levels should accept the concept of comprehensive planning as a matter of policy and organize functional staffs accordingly.

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TOPIC: Pesticides

Background:

Chemicals as pesticides have assumed great importance in contemporary life. These chemicals are used to kill insects (insecticides), fungi (fungicides), "weeds" (herbicides), and predatory animals. Nothing is a pest per se, however, Only in localized excess numbers are insects really pests. Plants where we do not want them are weeds, fungi are pests when they damage plants which have economic or esthetic value to us, predatory animals are pests when they destroy, or appear to destroy, animals or plants of commercial value, insects are pests if they damage plants or animals, or if they carry disease. After World War II insecticides, such as DDT, decreased disease and increased crop production to a point never believed possible. The benefits of DDT were so widely acclaimed that Paul Mueller, the Swiss chemist who discovered its insecticide properties, received a Nobel Prize in 1948.

Synthetic organic insecticides are generally classified into three broad groups; the chlorinated hydrocarbons, organophosphates, and carbamates (Table I). Within each group there is a great variation in toxicity as well as in ability to persist in the environment (not be chemically changed to a non-toxic product). For instance, TEPP is one of the most toxic chemicals known, and yet it is completely degraded within 24 hours after application to a crop. DDT, on the other hand, is far less toxic, but it persists in the environment for years and is concentrated in the fatty tissue of animals. (See references at the end of this section for further information regarding persistence and toxicity of pesticides.)

TABLE I

<u>Chlorinated Hydrocarbons</u>	<u>Relative* Toxicity</u>	<u>Organophosphates</u>	<u>Relative* Toxicity</u>	<u>Carbamates</u>	<u>Relative* Toxicity</u>
Aldrin	38	Malathion	1	Carbaryl	3
Dieldrin	33	Parathion	190	Zectran	75
DDT	6	Methyl parathion	100		
Endrin	125	Azinphosmethyl	100		
Heptachlor	17	TEPP	940		
Lindane	12	Mevinphos	250		
Toxaphene	22	Ethion	7		
Endosulfan	14	Temik	1500		
Telodrin	310	Trichlorphon	3		

*
In white rats

Problems:

Problems will be discussed here with relation to insecticide use only. However, similar problems exist with all pesticide use.

The benefits of insecticides must be balanced by the sobering reality of a number of serious problems. The persistence of some insecticides, particularly the chlorinated hydrocarbons, has been mentioned and this persistence leads to their accumulation in food chains. One of the simplest of food chains is that which begins with grass and terminates with man; grass is eaten by cows, which in turn produce milk and beef for human consumption. Because of the energetically inefficient process of converting grass to animal protein, a cow eats a tremendous amount of grass. Since chlorinated hydrocarbons are not excreted by the cow but are concentrated in his tissues, compounds such as DDT on grass are concentrated many fold in the cow and are subsequently passed on to be concentrated in the tissues of man.

A fish food chain involving the eagle as the ultimate consumer is a good example of the potential harm of persistent pesticides in the environment. The process starts as insecticides such as DDT are washed from trees and crops into rivers (only about 10% of insecticides administered on land reach their target). Eventually these waters run into lakes and bays where the chemicals are consumed by microscopic marine organisms. These organisms are the food sources of small fish, which in turn are the food source of larger fish. In each step up the food chain, the insecticide becomes more concentrated in the fish tissue. Finally, the eagle eats the fish and the insecticide becomes concentrated in the eagle's tissue. Dead eagles have been found with DDT levels in their bodies thousands of times higher than that originally sprayed on crops.

Increasing numbers of fish-eating birds, including the eagle, are producing soft-shelled, non-productive eggs. Although it is not absolutely proven, it is believed by many biologists who have supporting evidence that insecticides concentrated in the reproductive organs of birds are responsible for their inability to reproduce normally.

It is possible that the increasing concentration of pesticides in human tissues is one cause for an increasing incidence of infertility, a variety of diseases, and cancer. An ever increasing use of pesticides will only increase the potential danger of such effects.

All pesticides upset the balance of nature to some extent, and the effect is particularly damaging when the chemical is broadcast over large areas with the intent of irradiating a species. Few pesticides are species specific and, therefore, kill many organisms besides the one for which it was intended. The populations of all organisms in nature are controlled to some extent by other organisms (predators, viruses, bacterial diseases) and pesticides frequently kill the predatory organisms as well as the target organisms. There are many documented examples of the use of a chemical to kill off a particular insect species with the result that another species became even more of a pest shortly thereafter. In such cases predators had been killed by the pesticide also. Birds and reptiles are very effective in the control of insect populations, and they are frequently killed by pesticides broadcast widely but intended for another species.

Government agencies continue to advocate what is called area control. The fire ant irradiation program in the southeast United States is a good example of this. The highly persistent insecticide, Mirex, is being used at the present time. In the past dieldrin or heptachlor have been used with little lasting effect against the fire ant, although vast numbers of mammals and birds were killed in the process. The fire ant appears to be mainly a nuisance. Its mounds inhibit the use of farm implements and its sting is annoying, although

there has been only one documented case of death due to a fire ant sting.⁽¹⁾ However, fire ant irradiation has become a hot political issue in the South, and the government is currently subsidizing the aerial spraying of vast areas of land with Mirex-soaked corn. This has been likened to "dropping nuclear bombs on pick pockets." The result is that much of the Mirex bait is eaten by birds and animals or is eventually washed into the rivers, lakes, and bays, to be incorporated into our food chains, and the fire ant reappears in fields the next year.

Another problem with using insecticides at all is that insects are known to acquire resistance to particular insecticides, making their chemical control all the more difficult. The use of insecticides simply leads to the use of an ever increasing variety and quantity of insecticides.

Our cultural conditioning to abhor cockroaches, ants, spiders, wasps, and the like in and around our homes leads to excess use of insecticides. Our insistence on growing ornamental plants in poor soil, and improper climates also encourages disease, and subsequent overuse of insecticides. Our excessive standards of quality for crop and ornamental plants encourage the heavy use of pesticides. By insisting that our food be blemish-free, we are ensuring that more pesticides are being spread throughout our environment.

Pesticides are misused and over-used, often because of misinformation or carelessness. Chemical company salesmen are under tremendous pressure to sell, even if their product is not the one most suitable for a particular problem. Besides, they usually do not have sufficient information to be in the position of advising customers. They find themselves in much the same position as drug salesmen who are not qualified to tell the patient which drug to take for a particular disease.

Alternatives:

Over 20 years of experience has shown that the heavy use of pesticides simply increases our problems with pests and threatens the very existence of all animals, including man. Insects compete with man for food and act as disease carriers, and thus must be controlled, but there are alternatives to the use of chemical pesticides.

The simplest alternative is to do nothing and "let nature take its course." Most insects have natural predators (other insects, parasites, spiders, wasps, reptiles, amphibians, and birds). In many instances of insect infestation of forests or home gardens, if natural predators are allowed to work, they will. Natural predators can also be introduced into an area. Organic gardeners have shown that crop rotation, good soil conditions and drainage, and planting in the proper season will eliminate many plant disease problems. In the home, drying agents such as silica gel or Borax are an effective way of controlling roaches and ants (mix Borax with honey) without the use of insecticides.

On a larger scale, again, letting nature take its course frequently works. Looking back over all the years that the Federal Government has been pursuing the gypsy moth with DDT in the eastern states, to no avail, suggests that it might have been better to allow the insect to have free rein, sustain the damage, and allow natural predators to bring the moth under control.

Economic costs of alternatives should always be weighed before area control of insects is attempted. (If true economic costs were evaluated, including the long-term costs of damage to the environment, area control would never be attempted.) For instance, the Douglas-fir tussock moth defoliates several species of conifers and it occurs in high density

every 10 to 15 years in the western United States. (The fact that it occurs only periodically suggests that its population is under some kind of natural control.) The moth defoliates trees in patches and doesn't affect all trees in a region. In 1965 the moth was infesting an area of about 12,000 acres of white fir in California, a tree which had very little economic value at the time. Biologists noted that in some areas the larvae of this moth were infected by a virus and suggested that the virus might control the moth population and chemicals would be unnecessary. Nevertheless, 60,000 acres of land were sprayed with DDT, leaving one area untreated for study. All of the larvae were killed by the virus in the study area, illustrating that in this case spraying had been unnecessary. In addition, a tremendous amount of money was spent to temporarily control a moth, save some trees of no economic value, and inflict long-term damage on untold numbers of other species.

Some diseases affect crops only some years and to different extents in different years. Rather than spraying every year to ensure 100% production, it has been suggested⁽²⁾ that it might be better to sustain the periodic loss as the price to be paid to protect our total environment. A system of crop insurance against these sporadic, relatively mild, and frequently predictable losses could protect the producer and the environment.

Newer techniques of insect control include sterilization. Elimination of the screw worm in the southern United States was accomplished by releasing male flies which had been sterilized by irradiation. Such a technique will undoubtedly be used more in the future for the control of other insect pests.

Specific viruses have been used to control harmful insects in Russia for the past three years. A virus is now being used experimentally against the cotton bollworm in this country, and the United States Department of Agriculture has reported that about 18 other viruses are ready to be used. Such predator control which is specific is far superior to chemical pesticides which kill everything, including predatory insects, and which leave a residue which can be harmful to animals and man.

Sierra Club Position:

The National Sierra Club has adopted an official resolution relative to the use of pesticides, which follows:

The Sierra Club opposes the aerial or other general application of chlorinated hydrocarbons as pesticides on all lands and waters, both public and private, because of their considerable damage to the environment.

General or extensive pest control programs should be preceded by public justification of the project. Decisions regarding pest control programs should be made with consideration for the total environment.

No species should be considered inherently and always as a pest or "bad" species; the concept of the pest species has meaning only in relation to circumstances prevailing at a specific place and time. Each control program, therefore, should be independently justified.

Pest eradication (as opposed to control) is rarely feasible, economical, or possible without profound impact on the environment. Eradication should be attempted only in rare and unusual circumstances, if at all.

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TOPIC: Noise

Background:

Noise is any undesired sound which intrudes between man and his fellow man or between man and his environment. Noise could be characterized as destructive sound.

Noise (or sound intensity) is measured in decibels. The decibel scale is logarithmic and, therefore, an increase in sound from 10 dB to 20 dB represents a tenfold increase in sound pressure.

To get an idea of the relative intensity of recognizable sounds, some typical decibel values encountered in daily life are listed below:

Rustling leaves	20	Beginning of hearing damage	
Soft whisper at 5 ft	34	(prolonged exposure)	85
Window air conditioner	55	Heavy city traffic	92
Conversational speech	60	Home lawn mower	98
Vacuum cleaner at 10 ft	69	Air compressor	100
Loudly reproduced orchestral		Air hammer	107
music in large room	82	Jet airliner (500 ft overhead)	115

The frequency range of human hearing is from 15 to 20,000 cps (or Hz) for the average 25 year old. The upper limit decreases with increasing age. For example, the D of an operatic bass is 74 Hz, middle C on a piano is 261 Hz, and the very high F''' of a soprano is 1,408 Hz. However, the ear is most sensitive to frequencies of 1,000 to 4,000 Hz.

Problem:

Noise experts estimate that the noise level of our world is increasing by an average of one decibel a year. If this is true, in about ten years we will reach an average noise level of 85 dB, at which point permanent hearing loss may occur.

Everyone is aware of the damaged hearing suffered by those who work in the very noisy environments of a factory, construction site, or quarry. The noise levels may vary from the 87 dB experienced by a lathe operator to the 118 dB of a boiler works and may go as far as the 155 dB measured on the landing deck of an aircraft carrier, supposedly the noisiest place in the world.

However, the noise level experienced by those not normally associated with noisy occupations is alarmingly high. A secretary working near a Xerox machine may hear 75 dB all day while an accounting office may produce about 79 dB. A computer operations room generates 85 dB of noise.

The noise level inside two 1955 G.M. sedans driven over a level concrete surface at 20 mph was measured as 73 dB in Car A and 71 dB in Car B. At 40 mph, Car A was 84 dB; Car B, 83 dB. At 70 mph, Car A was 94 dB and Car B, 90 dB. Despite claims to the contrary, today's autos are not appreciably quieter.

Even the home can be a rather noisy place. Noise generated by sound-producing mechanical devices make kitchens the noisiest room in the home. Noise levels can vary from 56 dB to 100 dB (the vent fan over the stove produces 84 dB; adding the dishwasher increases

this to 88 dB, the garbage disposal to 91 dB and with the peak noise levels of the disposal, the noise can go over 100 dB). The toilet and ventilating fan together produce 72 dB in the bathroom. A cocktail party has been measured at over 100 dB and music produced by amplified instruments averages 90 to 105 dB, with peaks of 130 dB.

Despite the relatively high noise levels experienced by most people during their lifetimes, the deterioration in hearing which most people suffer is usually attributed to the aging process. Seldom is prolonged exposure to average noise levels blamed for hearing loss. Yet two significant cases refute the assumption that reduced hearing capacity is due solely to aging.

Several teams of researchers, led by Dr. Samuel Rosen of New York, have studied members of the Mabaan tribe in Sudan, Africa. They found that the hearing of these primitive people is significantly more acute in age levels 10 through 70 years than in people of the same age group living in industrial areas of the U. S. The sound level recorded in Mabaan villages was generally below 40 dB.

Another case was recorded by Dr. A. J. Philipszoon of the University of Amsterdam. An 82-year-old man came to his clinic to be fitted for a hearing aid. An examination showed that his left ear was filled with a dirty piece of cotton that completely blocked the auditory canal. The old man had suffered an inflammation in his left ear 32 years before and the cotton placed in his ear had never been removed. His hearing was tested after removing the cotton. The right was deaf, the left ear showed some hearing loss. Bone conduction tests (to test the inner ear) showed the left far superior to the right. The cotton that had protected his ear for 32 years showed experimentally that everyday noise has a significant bearing on hearing loss.

The effects of noise go far beyond the diminution of hearing. Tests on laboratory animals have shown that noise increases susceptibility to viral infection, interferes with kidney function and stimulates changes in hormone output, causes thymus gland atrophy, overstimulation of the adrenal glands, gastric ulcers; and raises the cholesterol content of the blood (cholesterol is a fatty substance which clogs blood vessels).

Tests on human subjects have shown that noise causes a decrease in the stroke volume (or recoil) of the subject's heart. The most significant finding may be that noise, even relatively low levels, causes the tiny peripheral blood vessels in fingers, toes, abdominal organs, and skin to constrict, cutting down the supply of blood there. Vasoconstriction, the closing of small blood vessels, can be triggered by the production of adrenaline, the hormone secreted by the adrenal gland in stress situations. Vasoconstriction is believed to be the body's reflex reaction to the stress of noise.

One of the most annoying effects of noise is its interference with sleep. Measurements of the brain waves of sleepers showed that even low sounds, a quiet radio or a passing truck, lifted a sleeper from a deeper phase of sleep to a shallower phase. The same results were obtained by measuring the duration of dreams (by observing Rapid Eye Movements): even low sounds raise a person's stage of sleeping from dreaming to drowsiness. These findings certainly sound ominous for anyone living near a busy traffic artery.

Besides the physiological effects of noise, the steady din emanating from countless sources causes considerable psychological stress. The interruption of our concentration during the working day by construction equipment, traffic noise, and clattering typewriters reaches its zenith when we are greeted at the end of the day by a cacophony of power lawn mowers, vacuum cleaners, blenders, and screaming children. It is no wonder that the use of tranquilizers is rampant.

In this context it is particularly disturbing to contemplate sources of noise such as helicopters, hovercraft, aircraft, and in San Antonio, the North Expressway. The thunderous noise from the recently proposed SST was frightful to consider. Moreover, in all the studies made on the acceptability of the sonic boom, no attention was ever given to the citizen caught in despair over the prospect that the sonic booms would continue day and night, weekdays and holidays for the rest of his life.

In similar fashion, the construction of the North Expressway through San Antonio's prime parkland will forever shatter the serenity of that area. The 92 dB produced by that meandering ribbon of concrete will so alter that environment that a picnic in the park, a stroll through the Sunken Gardens, a performance in the outdoor theatre, or a basketball game in the Trinity gym will be endured rather than enjoyed.

Alternatives:

Some alternatives are simple and straightforward, though certainly not easy to accomplish. Do not build the SST or the North Expressway. We have defeated the SST but must remain alert to any conspiracies to revive it. We are still engaged in the fight to defeat the North Expressway.

In addition to these engagements, we must design for quiet. Trucks should be equipped with adequate mufflers. Roads should be constructed of quieter asphalt rather than portland cement concrete where possible. We must use quieter plastic garbage cans. Cities must use quiet garbage trucks (New York City purchased ten such trucks as experimental units). Construction firms should be required to use the quiet equipment now becoming available (silenced equipment such as jackhammers and air compressors have been used in Europe for many years, but American firms began producing quiet equipment only after pressure from anti-noise groups in New York City). Building construction should conform to design standards which eliminate the transmission of sound and which insulate noise facilities such as air conditioning units. For example, the staggered-stud is an interior wall construction technique which eliminates the tendency of walls to transmit noise directly from one room to another. Sound transmission through doors can be impeded by placing soft gaskets or weather strip-pings on all edges. A quieter vacuum cleaner has been designed (but not marketed) by sloping and tilting the impeller blades for the centrifugal fan. Similarly, over ten years ago, a quieter power mower was developed using an S-curved blade, thereby reducing the noise level by 40 dB to about 48 dB. Both of these products and others like them need to be used in place of the noisy monsters of today.

The noise problem is approaching a magnitude that will demand stricter enforcement of anti-noise laws and passage of even more restrictive measures. Switzerland and Germany have ordinances regulating traffic noise that enable a policeman to issue citations which prohibit operation of the vehicle until it has been certified suitably quiet.

The list is endless. What is needed is the creation of a demand for quieter products and services and the realization that noise is not the inevitable by-product of every design. It must be made an important consideration in the design process, having equal status with strength, efficiency, or aesthetic appeal.

Sierra Club Position:

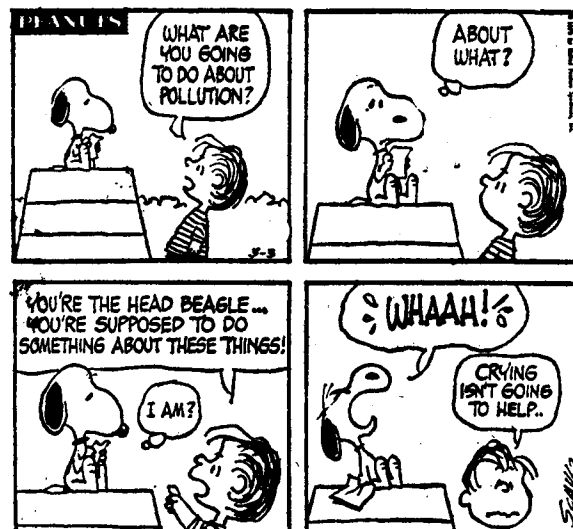
Strong opposition to the North Expressway must continue. A balanced transportation system should be the goal of San Antonio, emphasizing mass transit, which is quieter and more efficient. Strictly enforced quiet zones should be established around hospitals, and

ordinances against the use of auto horns should be passed to decrease the intensity of noise, especially in the downtown area. Building codes should require proper insulation against noise and isolation of all sounds at their sources. All machines, appliances, autos, airplanes, etc., should be designed with noise suppression in mind. Airport traffic patterns, which should be set so as to avoid flight over residential areas and recreation land such as the Northeast Preserve, may necessitate establishment of buffer areas around the International Airport. Finally, citizens should be given recourse in the courts to fight the tyranny of noise.

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TOPIC: Canyons of the Painted Cave

Background:

For at least 10,000 years the limestone canyons of the Pecos-Rio Grande confluence region have held the remains of the ancient river people. The earliest sign is of the Paleo-hunters. At Bonfire Site a canyon bone-heap contains some finely worked flint points; the bones are those of a giant bison species now extinct. After the Ice Age animals withdrew, the canyon overhangs sheltered a hunting and gathering culture, which we call Desert Archaic, for some 8,000 years. The signs of these people are buried in shelter floors; there are fragments of mats, baskets, finely woven nets, broken sandals, pieces of weapons. But the most impressive signs are on the shelter walls; costumed figures up to fifteen feet tall, mysterious symbols, panthers, deer, birds are painted on the rock in earth reds, browns, yellows, or oranges, touched with black or white. These scenic canyons are the galleries for the 3,000 year old Pecos River Style Pictographs, the oldest known rock paintings in the New World. We have set them up for destruction.

Problem:

As Amistad Dam was being built, an Archeological Salvage project was carried out in the area to be inundated. Some forty plus sites with rock paintings were identified. Those in the Rio Grande Canyon were doomed; efforts were made to cut the rock out but they failed. Slowly the reservoir filled. Panther Cave with 125 feet of murals was thirty feet from flood height. Vandal pressure increased from both the highways and the waterway as more and more people visited the reservoir. The Texas State Historical Association raised funds and built a fence at Panther Cave. To date this is the only protection the pictographs have received, and the Seminole Canyon complex and Pecos Canyon caves continue to be hard hit. If some solution is not found in the near future, all we will have left will be photographic records, for every pictograph site in the United States that is easily accessible has been destroyed.

Sierra Club Position:

Although the Texas Parks and Wildlife Department has considered the area for inclusion in the State Park System, the pictograph canyons should be set aside as a National Monument and be fully protected by the National Park Service who would bring to the project years of valuable experience gained at the great Pre-Columbian sites in the West. A Park Service study has suggested the caves and their canyon environment be left as natural as possible, with a minimum of small developed trails for tours and patrols. An Interpretive Center and Museum could be constructed on Highway 90 near Amistad Reservoir.

A 24-minute television video tape called "Canyons of the Painted Caves" has been completed with the help of Trinity University's television production studios. This film was made to show and explain the significance of this Texas treasure and to plead for National Monument status for the caves. Perhaps the video film can be transferred to 16-mm sound motion picture film for easier distribution. With the film, an effort will be made to contact the appropriate government officials and renew the push for pictograph protection. The Sierra Club has had input on this subject at the Amistad National Recreation Area Senate hearing of 1972, and contact was established with the Texas Senators and the National Park Service.

XI. Summary

The foregoing has been a brief introduction to major environmental problems in the State of Texas and in the San Antonio metropolitan area.

It is hoped that this booklet will prompt a sense of awareness in readers and motivate action by citizens throughout the community. Such action must be forthcoming if the environmental crises facing us are to be met. The determined efforts of not only the citizen but of his elected representatives and of governmental agencies are required.

Conservation organizations can serve to catalyze action and focus attention on the most urgent problems. But only when a majority of people understand the threats to our environment and are willing to do what must be done, as citizens and as individuals, will effective solutions be undertaken.

The Sierra Club stands ready to assist all those interested in pursuing a course of environmental sanity. It is our hope that we can stimulate a dialogue among all segments of the community to help bring about the ecological awareness so vital to our future. All levels of society, all ages and all groups, must play a role in meeting the environmental crisis that confronts us. Members of the business world, of government, the judiciary, the press, citizens' groups, all have a part in restoring the environment. For all these groups share a common interest transcending any differences they may have--survival.

"'Would you tell me, please, which way I ought to go from here?' asked Alice.

'That depends a good deal on where you want to go,' said the Cat.

'I don't care where,' said Alice.

'Then it doesn't matter which way you go,' said the Cat. "

Alice's Adventures in Wonderland

-Lewis Carroll

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APPENDIX: Environmentally Related Governmental Agencies

Material in this section is intended to provide a limited overview of some resources available to meet the environmental crisis. It is neither comprehensive nor exhaustive, treating only the more significant or strategic sources. This judgment is, of course, subjective. Moreover, it should not be assumed that the resources noted are considered adequate to a final solution of our environmental problems. The dimensions of these problems demand initiative in adopting new techniques, innovations in government structure and in social patterns. More importantly, solutions call for a reshaping of attitudes and a re-ordering of priorities. As these changes come about there must naturally be a corresponding shift in our cultural, economic, and political systems.

We should not and cannot defer action on environmental problems while arguing endlessly about new laws, new agencies, and new technical information. Practically all of the knowledge needed to cope with environmental problems is already available. Existing legal provisions and governmental structures are adequate to meet many of the environmental problems now facing us. What is lacking is the realization of how critical environmental problems are and a basic understanding of man's place in the ecological pattern of the earth. Once these concepts are understood and accepted, necessary changes can be effected to restore the harmonious relationship of man with nature. For it will be action impelled by the knowledge that it is the survival of mankind at stake. Such a challenge cannot be ignored.

A brief description of the various local, state and federal agencies which have an impact on, or responsibility for, our environment is given in this appendix. This reference material is included in order to give some perspective to the complexity of government associated with resource use, environmental management, and pollution control. It is not comprehensive and cannot hope to show the interrelationships between environmental problems and those governmental agencies responsible for solutions to the problems, or developing technical data, new laws, or plans which will lead to the solutions.

LOCAL AGENCIES

The San Antonio Water Board (SAWB)

The San Antonio Water Board, established in 1925, is governed by a board of trustees that is appointed by the city council. In turn, the board appoints the general manager who acts as chief administrator of the Board. Even though the Board is part of the city government and must act in accordance with the terms of the bond ordinance under which the system's bonds are issued, it is still somewhat autonomous in conducting its business.

System expansion is being carried out according to a comprehensive plan for future development that was adopted by the city council in 1959. The plan is based on estimated water needs of the San Antonio area up to 1980.

Since the City Water Board is the largest supplier and distributor of water in Bexar County, it is concerned with the development of additional water sources. The Board supports this interest by participating in programs aimed at developing means of recharging the Edwards Aquifer and developing supplemental surface-water supplies from surrounding areas.

City Public Service Board (CPSB)

The City Public Service Board was created in 1942 when the City of San Antonio purchased the then privately owned gas and electric utility companies through issuance of municipal bonds. Under terms of the original and subsequent bond indentures, management of the CPSB is vested in a Board of Trustees. The original Trustees were appointed by the bond holders, the Mayor, and the City Commissioners. The Mayor is at all times an ex officio member of the Board of Trustees and the Board itself selects replacement members. The Board has a maximum of five members who may serve not more than two 5-year terms. Board members receive \$2,000 a year, with the Chairman receiving \$2,500 a year while the Mayor serves without compensation.

The CPSB supplies gas and electricity to a service area encompassing almost all of Bexar County. Revenues from sales of gas and electricity are used to retire bonded indebtedness, pay all operating costs, expand the utility system, and make payments to the City in lieu of taxes. Payments and services to the City are currently set at 14% of gross revenues annually.

CPSB operates in a semi-autonomous manner requiring City approval only for sale of additional bonds and setting of utility rates. San Antonio is the only major city in Texas which owns its gas and electric utility systems.

San Antonio River Authority (SARA)

The San Antonio River Authority, a conservation and reclamation district, was created in 1937 by authority of Article XVI, Section 59, of the Texas Constitution. It includes all that part of the state within the boundaries of the counties of Bexar, Wilson, Karnes, and Goliad. The SARA Board of Directors is composed of 12 members elected to 6-year terms by plurality vote in their county; 6 from Bexar County and 2 each from the other counties.

The Authority is empowered to construct, maintain, and operate navigable canals and waterways, to effectuate flood control, conservation, and use, for all beneficial purposes, of ground, storm flood, and unappropriated flow waters in the District, and also to effectuate irrigation, soil conservation, sewage treatment, and pollution prevention. The district is

also charged to encourage and develop parks, recreational facilities, forestation and re-forestation, and to preserve fish.

The District is assigned the responsibility of preparing a master plan for the maximum development of the soil and water resources of the entire District, including plans for the complete utilization, for all economically beneficial purposes, of the water resources of the District. In accordance with the master plan, the Authority may act as a coordinating agency dealing with the problems of water supply and distribution on a basin-wide basis. It may also act as a bargaining agency in negotiating with other river authorities in the state, and agencies of the federal government.

The Authority can also issue negotiable bonds and levy ad valorem taxes (up to a maximum rate of two cents per \$100 valuation). However, a large segment of the Authority's revenue comes from a 15-cent flood-control tax which is levied and collected by the county.

The Edwards Underground Water District (EUWD)

The Edwards Underground Water District was created by the state legislature in 1959 for the purpose of "protecting, conserving, and recharging the Edwards Underground Reservoir." The District consists of all of Uvalde County, most of Medina and Bexar counties, and a small part of Comal and Hays counties.

A 15-member board of directors, three from each county area, an engineer-manager, and an assistant secretary administer the District. A two-cent tax per \$100 property valuation provides the funds for operation.

Operations consist primarily of studying the recharge potential of the Edwards Aquifer. The U. S. Geological Survey aids the District by making studies of the amount, quality, and movement of water through the aquifer.

San Antonio Planning Commission

In accordance with the City Charter, San Antonio has a Planning Commission of nine members appointed by the City Council. The Commission is responsible to and acts as an advisory body to the Council. As required by the Charter, the Commission is responsible for making, amending, and revising a Comprehensive Master Plan for the physical development of the City. It also submits annually to the City Manager a five-year Capital Improvement Program listing recommendations for physical improvements. The Commission has the power to adopt and administer rules and regulations pertaining to subdivisions and to platting within the city limits and in unincorporated areas outside the City within five miles. These rules are subject to review by the City Council.

San Antonio Metropolitan Health District

The San Antonio Metropolitan Health District is a joint venture of Bexar County and the City. It represents a merger of the former County and City Health Departments, but provides health services to other incorporated areas under special contract. Among other duties the District is responsible for air pollution monitoring and control. It also has the responsibility and power to abate any health hazard involving air or water pollution.

Alamo Area Council of Governments (AACOG)

The Alamo Area Council of Governments is a voluntary organization of local governments cooperatively working on solutions to problems of area wide importance. Its plans and programs are implemented by the member governments since AACOG itself has no powers of taxation or enforcement. AACOG includes cities, counties, school districts, and other special districts in a 12 county region surrounding Bexar County.

Any local government within this region may become a member of AACOG. Management and administration of the Council is vested in an Executive Committee whose membership is allocated as follows: Bexar County - 2; City of San Antonio - 2; Every six-member city other than San Antonio - 1; School Districts - 1; Each member county other than Bexar - 1; All utilities and special districts - 1 (represents all).

The primary functions of AACOG are comprehensive planning and governmental cooperation. Functional areas include health, public safety, water supply/quality, waste treatment, open space, housing, transportation, and justice. Other areas may be studied at the discretion of the Executive Committee. AACOG also functions as the regional approval authority for federal grant applications and environmental impact statements.

STATE AGENCIES

The Texas Water Rights Commission (TWRC)

When the Texas Water Rights Commission was reconstituted in 1965, it was vested with all the powers, duties, purposes, and responsibilities of the Texas Water Commission and the Board of Water Engineers that were not expressly transferred to the Water Development Board.

The Commission is governed by three full-time members appointed by the governor, with the advice and consent of the senate, and an executive director who is the chief administrative officer of the Commission.

The primary functions of the Commission are regulating and permitting use of public water of the state. Its general responsibilities include the protection of public safety and private property from damage that might occur from improperly designed dams and reservoirs. It may declare any project a public nuisance and order it to be abated or removed if it finds the project to be dangerous to public safety.

The Commission creates several kinds of water districts and approves the organization and feasibility of most water districts which propose to construct projects that are to be financed by the issuance of bonds. Most of the water districts and river authorities are subject to continuing supervision by the Commission.

The Commission recognizes and provides local interests with continuing opportunities to develop projects for local and regional needs; however, the Commission usually considers the State Water Plan as a guide for authorizing projects. Resolution of any conflict between the State Water Plan and private, local, and/or regional interests is vested in the Commission; ultimate authority is vested in the courts.

The Texas Water Development Board (TWDB)

The Water Development Board was established by an act of the legislature in 1957 primarily to assist and advise local units of government in undertaking water-development projects. It is the responsibility of the TWDB to prepare and maintain a comprehensive state water plan; to act as state cooperator in water development planning with the Bureau of Reclamation and U. S. Army Corp of Engineers; to collect and publish basic data on surface and ground water resources; and to provide financial assistance to local governments for approved water projects.

The constitution of Texas authorizes the Board to issue up to \$350 million of state general-obligation bonds for the creation of a revolving fund from which loans can be made to local governmental units. The Board may lend local units of government up to a maximum of one-third of the total cost of the water project, or \$5 million, whichever is smaller. It may be noted that since the Board's inception the size of the Development Fund has been increased and the Board has been authorized to acquire fee interests in reservoir storage projects constructed on Texas streams.

The Board has formulated and adopted a state water plan that is being used as a flexible guide to state policy for the development of water resources. The Board's responsibility for investigating all matters concerning the quality of groundwater in the state, and reporting its findings to the Texas Water Quality Board, includes the San Antonio underground water supply.

The Texas Water Quality Board (TWQB)

The Texas Water Quality Board replaced the Texas Water Pollution Control Board. It is composed of seven members, of whom three are appointed to 6-year terms by the governor, with the advice and consent of the senate, while the other four are the Executive Director of the Texas Water Development Board, the State Commissioner of Health, the Executive Director of the Parks and Wildlife Department, and the Chairman of the Texas Railroad Commission.

The Board is the principal authority in the state on matters relating to the quality of water within the state. Under the Water Quality Act, the Board is to be informed on all aspects of water quality, and specifically on the control and abatement of water pollution. The Board is further directed to assist in resolving questions as to the respective authorities and duties of state agencies which have vested water-quality-control functions, and in doing so to minimize duplication of activities so that state policy for controlling and maintaining the quality of the state's waters can be effectuated. The TWQB is statutorily authorized to establish water quality criteria, collect and disseminate information concerning prevention, abatement and control of water pollution and water disposal, issue permits for discharge of wastes to the waters of the state, and initiate prosecution of water pollution offenders.

The Board is also responsible, along with the Railroad Commission, for administration of the Injection Well Act and the Solid Waste Disposal Act. Under the former act, the Board's jurisdiction extends to the disposal, by injection well, of industrial and municipal wastes. Under the latter, the Board is designated as the State Solid Waste Agency with respect to the collection, handling, storage, and disposal of industrial wastes.

The General Land Office (GLO)

The General Land Office is administered by the Commissioner of the General Land Office, who is elected by the people of Texas. It is responsible for planning for the reclamation, development and beneficial use of state-owned lands. The office is required to

ensure that all development and operations, especially those dealing with oil and gas, upon such lands will be done in such a manner as to prevent the pollution of water, destruction of marine life, and obstruction of navigation.

Department of Health (TSDH)

The State Department of Health is charged with minimizing health hazards that are associated with water. Of the Department's 18 divisions, the sanitary-engineering and water-pollution-control divisions in the section on Environmental Sanitation Services have the most direct jurisdiction over water. Protection of the purity of the public water supply is one of the major tasks of this section. The Department is responsible for making studies and investigations, and collecting evidence, in connection with the enforcement of laws that pertain to the provision of safe water for the public, the pollution of streams, and various other items of general sanitation. Where any pollution is found, the Department may bring legal action to enjoin this activity.

The Department is empowered to approve or disapprove the establishment of all water supply and sewage disposal systems. It must also make available consulting services and vocational-training programs in the field of sanitation to various local units of government.

The Railroad Commission

The Railroad Commission has jurisdiction over the oil and gas industry. A related responsibility is the prevention of pollution of surface and groundwaters by crude oil, salt-water, or other mineralized water which may escape from oil and gas wells.

Texas Air Control Board (TACB)

The Texas Air Control Board is the state air pollution control agency. The Board is the principal authority in the state on matters relating to the quality of air and for setting standards, criteria, levels, and emission limits for air content and pollution control. The TACB is responsible for developing a general, comprehensive plan for control of the air resources of the state including an inventory of air pollution emissions.

The Board is composed of nine members appointed by the Governor with the consent of the Senate; one must be a professional engineer; one a licensed physician; one engaged in managing a private manufacturing/industrial concern; one experienced in municipal government; one an agricultural engineer; and four from the general public. Each Board member holds office for six years.

Texas Parks and Wildlife Commission (PWC) and Department (PWD)

The Parks and Wildlife Commission governs the Parks and Wildlife Department and appoints its executive director. The Commission is responsible for protecting, perpetuating, and improving the state's public outdoor recreational areas and for preserving its wildlife resources. It is responsible for all state parks, for wildlife management, and for game law enforcement.

FEDERAL AGENCIES

The Environmental Protection Agency (EPA)

The Environmental Protection Agency is a result of the consolidation of several of the major programs that deal with pollution into a single agency independent of existing departments. Functions transferred to it included those of the Federal Water Quality Administration, the National Air Pollution Control Administration, parts of the Environmental Control Administration, the pesticides registration authority of the Department of Agriculture, and certain research authorities of the Council on Environmental Quality.

The Council on Environmental Quality (CEQ)

The Council on Environmental Quality, established by the National Environmental Policy Act of 1969, formulates and recommends national policies to the President and Congress of the United States in order to promote the improvement of the quality of the environment.

The Water Resources Council (WRC)

The Water Resources Council was established by the Water Resources Planning Act of 1965 to maintain a continuing study of the adequacy of supplies of water that are necessary to meet the requirements in each water-resource region in the nation. It is also responsible for studying the relation of regional or river-basin plans and programs to the requirements of larger regions of the nation, and the adequacy of the administrative and statutory means for coordination of the water and related land-resource policies of the several federal agencies. The Council also reviews the plans of the river-basin commissions and transmits these plans, with the Council's recommendations, to the President for his review and transmittal to Congress.

The Council also administers a program for federal financial grants to states to aid them in comprehensive water and related land-resource planning.

The U. S. Army Corps of Engineers ("The Corps")

The Corps of Engineers is primarily responsible for improvement of the navigability of rivers and harbors, and for undertaking flood-control measures. The Corps is also concerned with the following: (1) drainage and soil conservation; (2) conservation of water for domestic, industrial, and agricultural use; (3) hydroelectric power; (4) recreation; (5) public health and sanitation; (6) prevention of saltwater intrusion; and (7) fish and wildlife preservation. It must be noted that the Corps has much influence over congressional committees that are responsible for planning and funding water programs.

Bureau of Reclamation (Department of Interior) (BUREC)

The Bureau of Reclamation is concerned not only with providing water facilities for irrigation, but also with water-resource development in general. The Bureau is specifically concerned with the development of water resources for (1) generation of hydroelectric power, (2) drainage, (3) flood control, (4) improvement of navigation, (5) silt control, (6) creation of recreational facilities, (7) wildlife refuge, and most important, (8) the provision of water supplies for municipal and industrial use. Probably the most important contribution of the Bureau in Texas is the many comprehensive studies of water problems which the Bureau has itself conducted or in which it has participated.

The United States Geological Survey (USGS)

The U. S. Geological Survey is responsible for determining, appraising, and describing surface and underground water resources so as to aid in the solution of the nation's water problems. These investigations are undertaken by the Water Resources Division of the Survey, and are financed on a federal-local matching-fund basis.

Soil Conservation Service (Department of Agriculture) (SCS)

The Soil Conservation Service conducts exhaustive research into various aspects of soil erosion problems. It has the responsibility of administering the upstream watershed programs that provide assistance to local watershed groups for building flood-control and erosion-prevention structures when these programs are approved by Congress. The Service cooperates closely with the State Soil Conservation Board and the local Soil Conservation Districts in their respective activities.

The Public Health Service (Department of HEW) (USPHS)

The Public Health Service collects data to show the degree of pollution of the nation's waterways, and conducts research for finding more effective and efficient means of treating municipal and industrial wastes. The Service is authorized to provide monetary grants to municipalities for the construction of needed sewage-treatment plants. In addition, the Service conducts studies of the various state laws pertaining to pollution control. The Service also provides the states with model statutes that can aid the states in their attempts to abate pollution.

