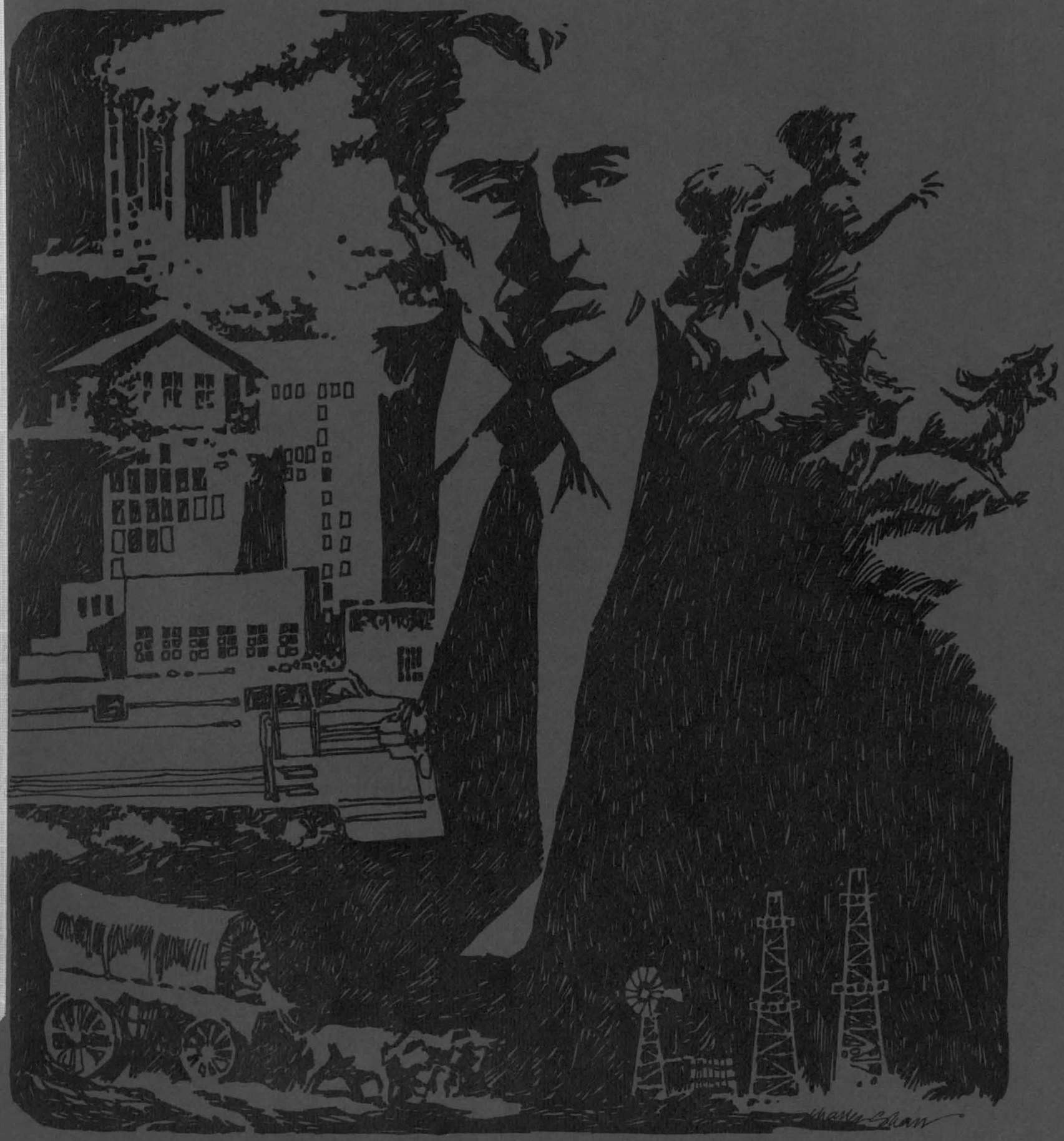
TEXAS LAND USE

3-Problems and Issues



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TEXAS LAND USE

A

Comprehensive Land Resource

Management Study

Report No. Three: Problems and Issues

Conducted by:

Research and Planning Consultants

Austin, Texas

for

The Division of Planning Coordination

Office of The Governor

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I. INTRODUCTION

Historical events and current legislation affecting the use of land have been examined in foregoing sections of this report. The ensuing discussion will be concerned with the identification of existing and potential issues and problems related to land use in Texas.

These issues manifest themselves in a variety of ways. Sometimes they are related to man's actual or planned use of a natural resource, or to the whim and caprice of nature. In other instances, issues may be raised as a result of conflicting opinions over the manner in which land should be used.

During 1972, many events occurred in Texas which are indicative of these problems:

*A farmer in the High Plains of West Texas gazed at his land and speculated about the number of years he could continue to irrigate his crops from underground water supplies which are rapidly being depleted.

*Inspection and control measures were invoked to stem pollution of the Highland Lakes caused by a proliferation of septic tanks which have been constructed on adjoining land areas not served by municipal sewage collection and treatment systems.

*Tragic loss of life and extensive property damage occurred when torrential rains caused flooding below Canyon Dam along the low lying areas adjacent to the Guadalupe river.

*The San Jacinto Monument near Houston sank approximately six more inches due to land subsidence which is occurring there and in nearby areas of Harris and Galveston Counties.

*Two sites were selected on which nuclear energy plants are to be constructed, and others were being considered. These plant sites require the use of several thousand acres of land.

*A commuter living in an outlying suburb of Houston drove to work along freeways and streets for forty-five minutes in heavy smog caused by a combination of air pollutants and air inversion. It was the third smog alert of the year.

*A teacher moved his family from a small town in Central Texas to a large city where salaries are higher. The house where he formerly lived is still vacant.

*A hearing was conducted by the U.S. Corps of Engineers in Fairfield where varying opinions were presented concerning the proposed construction of a barge canal along the Trinity River from the Gulf to the Dallas-Ft. Worth area.

*During a special session of the Legislature funds were appropriated to study the feasibility of locating a Superport off the Texas Gulf Coast.

*In Austin, the location of a rock-crushing plant was delayed, and perhaps prevented, because of strong protests from residents in the surrounding area who are concerned about air pollution.

These and many other events, though seemingly unrelated, are representative of existing or potential land use problems which are the cause of growing concern among governmental entities and private citizens alike. Taken singly, these problems would not have an obvious statewide impact. In combination, they are significant. When multiplied, they become crucial.

Estimates based on analysis of 1970 census information indicate that the population of Texas will approximate twenty million persons by the year 2000. It is also estimated that about 90 percent of these people will reside within a triangular shaped area with boundaries extending from the Dallas-Fort Worth area southwest through Austin, San Antonio and down to Corpus Christi; then northeast along the coast through Houston-Galveston to Beaumont-Port Arthur-Orange; then returning northwest through East Texas to the Dallas-Fort Worth area.

Such growth is desirable in many respects, and Texas is fortunate that many of the land-use problems associated with older, highly industrialized, and densely populated sections of the country can perhaps still be avoided. However, this will require prompt consideration of the need for land use planning. Cooperative efforts on the part of governmental bodies and private interests are

essential to develop land resource use policies and management techniques which will achieve real and just results of benefits to individuals, local communities and to the entire State.

Before realistic planning mechanisms can be developed, problems significant to the use of land resources must be determined. This report will be concerned with the identification and definition of such problems and an examination of their causes and effects.

A number of the problems identified here are further complicated by the inability of many existing governmental units to adequately cope with problems when they arise. The allocation and use of land resources and present constraints on private development are already entwined with many governmental programs and actions. If both state and local governments were reinforced to deal specifically with land use problems and land resource management issues, the magnitude of existing problems and issues could be substantially reduced.

Problems arising primarily as a result of organizational relationships and methods of operation within the various levels of government are examined in the report entitled "Needs for the Future." Consequently, this discussion will be concerned mainly with land use problems without reference to the governmental matrix in which they occur.

This report deals with an identification and definition of environmental, economic, and social problems which have a major impact on the use of land in Texas. To date, the State has not experienced any one land use problem which has caused a public outcry among all segments of the population. One reason, of course, is the sheer size and diversity of the State. In contrast, Hawaii reacted to tourism and the depletion of its agricultural lands by passing comprehensive legislation which, in effect, resulted in zoning of the entire State. The conversion of the same amount of agricultural land in Texas would go almost unnoticed.

Two basic approaches were employed to determine the nature and extent of land use problems in Texas. Initially, an intensive literature search was conducted by study team members in order to identify important land related issues which have been expressed as concerns not only in Texas but also in other states and at the federal level as well. From this research, certain problems and

issues emerged which could logically be grouped into several broad categories for more intensive study.

The second research effort took the form of personal interviews with governmental agencies, corporate organizations and private individuals whose activities would involve, or have some influence on, the use of land. The main objective of this investigation was to develop information about specific problem areas of major concern to those persons or organizations interviewed. It soon became apparent that there were conflicting opinions over both the definition and seriousness of some land use problems. A situation classified as problematic by one group might well be considered as beneficial or necessary by another.

Based on the information developed through these investigations, the more significant problems were selected for study in this report. These problems reflect the thoughts and opinions expressed in the literature which was examined and by the persons interviewed as well as the interpretations of information made by the study team. Specific examples have been cited to illustrate the nature of these problems and their cause-and-effect relationship to population growth and distribution, economic development, and allocation of resources.

Because many land use attitudes are influenced by the location of people, their lifestyles, and resulting local conditions, different groups within the State have varied goals and priorities. However, there are some problems which are of such significance that they are considered to be matters of statewide concern. These were the first to be examined here.

The next discussion deals with problems of regional nature, since land use problems tend to become regionalized because of the diverse and unique characteristics--physical, cultural and otherwise--of the respective regions. For instance, in the High Plains region, the most severe land resource problems stem from a rapidly dwindling supply of water for irrigation. As water tables continue to drop, the region will experience dramatic changes in land use patterns.

Other regions of the State such as the areas around Houston, Dallas, and Ft. Worth, are facing land use problems in the form of urbanization and attendant rapid growth. Urban areas develop at the expense of other existing land uses. For example, as city limits are pushed

outward, they often enclose and permanently displace prime agricultural land.

Since many problems are significant to an entire region, the State has been divided into five regions for purposes of this study, and problems common to a given region are discussed in that context. The study regions were delineated by combining appropriate State planning regions. Each of these areas is fully described in the discussion of problems of regional significance.

In addition to problems of statewide concern and those of regional significance, several classifications of a functional nature have been chosen for examination in this report. The following categories are discussed in the context of their relationship to land use:

Urbanization	Transportation
Water Resources	Agriculture and Forestry
Energy Resources	Recreation

This method of classification does not imply that these land use problems do not overlap. Most certainly, problems related to the functional activities listed above will have interrelationships of their own, and may also have regional or statewide implications. Consequently, some subjects will be discussed in more than one section of this report.

It is within this organizational framework that selected land use problems and issues of statewide concern, regional significance and functional activity will be discussed. The problems identified here will then be related to other parts of this study where appropriate.

II. LAND USE PROBLEMS OF STATEWIDE SIGNIFICANCE

Some land resources and uses of land, selective in number but of great significance, have a wide-ranging importance which extends far beyond the immediate area in which the resource or land use is located. These may be classified as land resource problems of statewide significance. Such a concept is a dynamic one and expands or contracts as conditions change and as the public's priorities and aspirations shift. Thus, a definition of which land use decisions are important from a statewide viewpoint should be based upon fundamental criteria that are flexible enough to allow an evolving delineation of significant concerns.

Land resources and development decisions of important statewide significance are those which:

*are important to the intrinsic values of the State's environment and natural resource base;

*have, or could have, a large and wide-ranging impact which extends beyond the boundaries of the political jurisdiction making the decision, and affect a public purpose to which the State bears an inherent and ultimate responsibility;

*significantly affect the implementation of important statewide policies.

There are several broad areas of concern to the entire State which meet one or more of these criteria. While their statewide importance is stressed here, these issues are also examined in detail in other sections of this report.

Texas Gulf Coast

Land use practices in this part of Texas will continue to have a significant impact throughout the State. The importance of this concept is emphasized by the concern of the 61st Legislature which passed Senate Concurrent Resolution No. 38. This resolution authorized and

directed the State Interagency Natural Resources Council to conduct a comprehensive study of the Coastal Zone and the Gulf of Mexico seaward to the State's territorial boundaries. The result has been the development of plans for a Coastal Resources Management Program for Texas. The following excerpt is found in the introduction to the interim report on this study.

> The Coastal Zone of Texas is an extremely valuable resource for the people of the State. It should be conserved, developed and preserved to serve the goals of the people while respecting individual rights. The area's value to Texas cannot be measured by economic benefits alone. The social value of our coastal environment is high for those who live and work there, as well as for all other Texans.

There are several key issues which should be considered in this context.

▲ Beaches and coastal waters provide opportunities for a wide variety of recreational and aesthetically appealing activities and attract visitors from the entire State, as well as tourists from other parts of the country.

Unfortunately, some of the areas where the demand for recreation-tourism activities is greatest are also the areas where coastal resources have deteriorated the most. The industrial complex situated in the Houston-Galveston-Texas City area has caused pollution of both water and air due to waste discharge from manufacturing, shipping, oil drilling, and dredging operations. In portions of Galveston Bay, for example, the water quality is so poor that recreational activities such as swimming, skin diving, underwater exploration and spearfishing have been abandoned.

There are other areas of the coast, however, which can be developed or restored to provide both quality and quantity locations for recreational use by future generations. This will require careful study, planning, and cooperation on the part of public and private sectors of the State.

▲ The dynamic economy created by industry and commerce in this region has benefitted the entire State. Yet, the land uses which have been necessary to establish and expand these economic activities sometimes conflict with alternative uses that are also desirable. There has been particular concern expressed over the alteration of the environment of bays and estuaries along the Coast.

From an ecological standpoint, it is desirable that bays and estuaries remain unchanged to the greatest extent possible. These water bodies, particularly the shallow waters less than 4 feet deep, are the nursery grounds of the fish supplying our seafood industry. The 75 million dollar annual income from the shrimp industry alone would cease to exist if these areas are lost. Sea trout spawn in the shallow bays, and juvenile redfish migrate to these waters where they attain maturity.

Bays and estuaries can be adversely affected by a number of factors. Decreased fresh water flows into the bays caused by damming of rivers and streams, and dredging operations which cause increased salinity levels in nursery and spawning areas, result in their degradation. Pollution from municipal and industrial waste discharges has also proved detrimental to fish and marine life.

▲ The decline of domestic petroleum reserves has resulted in increased imports of foreign crude oil. This increase is expected to accelerate as depletion of these reserves becomes more critical. Ship building techniques have advanced to the point where tankers of mammoth proportions are now being constructed to provide more economical shipping costs.

When filled to capacity, these ships require a water depth of 80 to 100 feet in order to maneuver. There are no ports on the Texas Coast whose waters are that deep. Consequently, urgent consideration is being given to the construction of superports in deep waters off the Gulf Coast. Crude oil could be transported from these tankers via pipelines to land-based storage facilities or refineries in the coastal areas.

The importance of the superport concept to Texas cannot be emphasized too strongly. The location near the Texas Gulf Coast of such ports to accommodate deep draft vessels will be vital to the maintenance and expansion of the petroleum and petrochemical industries upon which Texas relies so heavily. Without these facilities, the existing refining and production facilities will suffer as supplies of crude stocks decline. If deep water ports are established, this dynamic industry can be further expanded with accompanying economic growth.

The major land use issues which might arise will be those associated with increased urbanization and expanded industrial and commercial activities in this already heavily populated and industrialized area. There is also the possibility of accidental oil spillage from tankers or

pipelines which would be detrimental to coastal waters and beaches. The issue is so important, however, that every effort must be made to solve these problems through technological innovation and effective advance planning.

Metropolitan Areas

About 80 percent of the State's population is now located in six metropolitan areas. As this trend toward urbanization continues, all of the land use problems associated with rapid urban growth will increasingly become matters of greater statewide concern. Future legislative bodies will be composed mainly of representatives elected by people living in these highly urbanized areas, and consequently will be more aware of the attitudes of their constituency concerning urban land use problems.

In recognition of these trends toward urbanization, Governor Preston Smith created the Texas Urban Development Commission in May 1970. The Governor's mandate to the Commission required that it take a broad approach to a study of urban development problems in Texas. In doing this, the Commission reviewed the capability of Texas governmental institutions to deal with urban problems and defined long-range development goals to help make the urban areas of this State better places to live. Several problems discussed in the Commission's report have been included in various sections of this report.

One of the major problems which already confronts metropolitan areas is the unregulated growth of poor quality subdivisions, mobile homes, or trailer parks in areas outside the territorial jurisdictions of incorporated cities. This type of development is commonly referred to as urban sprawl. Some of the consequences attributable to urban sprawl are:

▲ Land can be prematurely characterized by the ill-timed establishment of residential developments, factories or commercial buildings which subsequently make an area unfavorable for uses to which it might be better suited. Such characterization is often done quite unintentionally by developers or purchasers of these properties. They are simply trying to avoid high land prices or restrictive regulations in other areas.

▲ Single-purpose special improvement districts--such as water or waste disposal districts--often accompany urban sprawl. Sometimes they operate without coordination, some with their own taxing authority and administrative

mechanisms. They may not be adequately visible to the public and frequently outlive their original purpose due to inadequate public review of their functions. However, if districts are properly organized and managed, they can serve as an effective growth mechanism to promote orderly incremental growth.

▲ Many local agencies are unable to enforce good subdivision, housing, building, or health codes. Community services such as transportation, education, fire and police protection are often inadequate. When public services such as sewers, water, gas, and electricity are extended, the cost is higher because of the excessive distance which must be traversed in providing sewer, water, electric, and gas distribution or collection systems.

As metropolitan suburbs and rural subdivisions continue to attract residents from inner city areas, many established communities find themselves faced with major problems quite different from those in the newer areas.

▲ Many of these older sections are characterized by deterioration of residential neighborhoods with the accompanying loss of tax bases, loss of purchasing power, social and economic segregation, and needs for increased health and public safety services.

▲ The older, sprawling cities with decaying cores frequently lack adequate community facilities, such as park and recreation areas in locations where they are most needed, and suitable public transportation facilities to serve the needs of the young, the aged, and the poor.

▲ Central industrial and commercial districts become deteriorated, resulting in the erosion of tax bases due to the competition from new outlying areas.

These are but a few of the issues which will need to be considered in their relationship to continued urban expansion. Others will be reflected by increased requirements for transportation facilities, adequate water supplies, and power needs, particularly electricity and natural gas.

The importance of ever increasing energy requirements was magnified recently when natural gas and fuel oil supplies were curtailed to industry and to private and municipal generators of electricity during an unusually prolonged period of severe winter weather in the State. The use of nuclear energy for the generation of electricity is gaining recognition as a feasible and necessary means

to help meet the increasing demands for uninterrupted electrical power.

Water Resources

The aquifers, rivers, lakes, large reservoirs, and navigable waterways located in Texas have exerted a profound influence on the development of the State. Whether they are man-made or have occurred naturally, these bodies of water will continue to attract people, and with them a wide variety of industrial, commercial, and recreational activities.

The importance of water and its related effects on the manner in which land is used has been recognized by both the private and public sectors of the State. The Texas Water Plan was developed in an attempt to determine present water resources and to provide for future water requirements. Though the implementation of this plan is still at issue, eventual action on the plan, combined with adequate environmental and land use considerations, is essential to the efficient use of the State's land and water resources.

As water requirements have grown with the passage of time, conflicting opinions have sometimes resulted over related land uses.

▲ The city of San Antonio is concerned that residential development on surface lands above the Edwards Aquifer will be detrimental to recharge areas or pollute the water which is the source of that city's municipal water supply.

▲ Owners of land which would be inundated by proposed reservoirs have waged lengthy court battles in efforts to prevent condemnation of their property.

▲ Sport and commercial fishing interests are concerned that spawning grounds and marine life are being severely damaged by ecological changes in bays and estuaries caused by pollution and increased salt water intrusion.

▲ The construction of canals for barge traffic or the transfer of water is being objected to by persons who feel that such actions will destroy or damage unique natural areas or wildlife habitats.

These are but a few of many issues which must be resolved as Texas considers the most practical and efficient methods of managing its land and related water resources. Already, measures have been taken to alleviate pollution and flooding conditions, and plans are being carefully studied concerning the possible transfer of water from areas of abundance to areas of need. Future policy determinations will undoubtedly have a significant bearing on water and land use relationships.

Agriculture

As yet, Texas farm lands have not been converted to public uses in quantities significant enough to create serious shortages of agricultural land. However, this does not preclude such problems for the future.

It is difficult to predict with any degree of certainty just how much land will be needed in coming years to produce a sufficient food supply. Consequently, it is vital that options for the future be maintained. Prime agricultural lands should be prudently and selectively preserved until it can be determined with reasonable certainty, that current rates of agricultural land conversion can occur without threatening the food and fiber supplies of future generations.

Conclusion

In considering these problems which are of concern to the entire State, governing bodies will find it difficult to enact legislation and establish policies that will be equitable to all interests. Certainly, the rights and privileges inherent in private ownership of property must be protected. Continued economic growth and equality of opportunity must be encouraged, simultaneous with the protection of those recreational, ecological, and historical areas which can benefit the general public. This will require adequate planning and management of land use practices in order that optimum benefits may be achieved.

STUDY REGIONS

Figure I

III. SIGNIFICANT PROBLEMS RELATED TO REGIONS OF TEXAS

A variety of problems and issues related to land use have been examined on the basis of their importance to the entire State. The impact of these and other problems will be greater in some parts of the State than in others. Attention is focused here on those problems which are of significance to particular regions of Texas.

The counties in Texas are presently divided into twenty-one official state planning regions. One or more regional planning agencies exist in each of these designated regions. For purposes of this report, these planning regions have been further combined into five groups in which land use problems common to each region are identified. As indicated by the map in Figure I, these five areas are established in the following manner:

Study Regions	State Planning Regions
I	North East Texas
	East Texas
	Deep East Texas
II	South East Texas
	Gulf Coast
	Golden Crescent
	Coastal Bend
	Lower Rio Grande Valley
III	South Texas
	Alamo (a) and (b)
	Concho Valley
	Permian Basin
	Upper Rio Grande
IV	South Plains
	Panhandle
	West Central Texas
	North Texas

V North Central Texas (a) and (b)
Central Texas (a) and (b)
Capital
Brazos Valley

Region I--Northeast, East, and Deep East Texas

The land use considerations significant to this area do not present problems as serious as those in other parts of the State at the present time. However, expected future development in the area may be accompanied by more severe associated land use problems.

This region enjoys abundant water resources in the form of numerous large reservoirs, smaller lakes, rivers, stremas, and an annual rainfall rate sufficient to maintain them. Much of the land area is composed of rolling hills which are heavily wooded and pleasing to the eye. Soil types are capable of supporting a variety of agricultural and nonagricultural activities.

Natural resources are plentiful, some of which are oil, natural gas, lignite coal deposits and timber. Though no major metropolitan areas are to be found in this region, it does contain a number of smaller cities such as Tyler, Longview, Taxarkana, Paris, Marshall, and Lufkin which are important to the area's growth and development.

With the presence of all of these advantages, it is probable that Region I will continue to experience population growth and urban development, perhaps at a more rapid pace in the future than in the past. This growth would logically occur in the cities and towns which are already established. However, it is also evident that bodies of water, particularly major reservoirs, will also attract industry, commerce and people. As nuclear power emerges as an important future source of energy for the generation of electricity, it is highly probable that such installations may be located in this region of abundant water. This in itself will tend to attract industry and result in accelerated population growth.

Another development which may have a major impact is the proposed Trinity River Canal project. The route of this barge canal would traverse the western portion of Region I--an area which at present is generally underdeveloped. Docking and loading facilities would be constructed to accommodate the shipment of bulk cargoes such as building materials to the Dallas-Ft. Worth and Houston markets. Water which is impounded as a result of

this project will provide still further stimulus to recreational activities, commercial and industrial development, and residential construction.

This expected growth is a welcome prospect to most residents of the area. However, it will not occur without the creation of some problems which usually accompany urban development. Demands will be created for additional public services in areas where none presently exist. Natural areas and wildlife habitats may be adversely affected. Air and water pollution may occur in the event of increased industrial development, or septic tank usage in areas around lakes which are not served by sewage disposal systems. Hopefully, these probems can be minimized through careful advance planning, implementation, and effective, equitable enforcement.

Another cause for concern may be noted in connection with extensive forestry and lumber operations in this region. It is probable that some strip mining for coal will take place in areas where these deposits are located. During the period of time (probably of some years duration) in which these mining operations occur, there will be some destruction of trees and alteration of present land uses. However, reclamation processes now being employed can restore the land after mining operations have been completed.

The Big Thicket area in East Texas has been reduced by past developmental and forest management practices. Efforts are being made at both the federal and state levels to perpetuate the relatively undisturbed areas in the Big Thicket that still remain. Such action would protect unique wildlife habitat areas and preserve for future generations an example of a once vast and magnificent pine and hardwood forest extending over an area exceeding one and one-half million acres of the East Texas landscape.

Region II--South East Texas, Gulf Coast, Golden Crescent, Coastal Bend, Lower Rio Grande Valley

Region II extends from the Beaumont-Port Arthur-Orange Golden Triangle down the Gulf Coast to Brownsville and the Rio Grande Valley. Within its boundaries are found a combination of resources, many of which are unique not only to the State, but to the entire country. The shoreline is dotted with seaports and docking facilities of varying sizes and capabilities. A high average rainfall, the flow of numerous rivers into the Gulf, and extensive underground aquifers provide abundant fresh water supplies,

except in the Lower Valley. Oil and gas fields and other mineral deposits occur throughout the region. Soil composition and climatic conditions are conducive to a wide variety of agricultural and forestry operations, including such specialized crops as rice and citrus fruits. Wildlife, fish, and marine life have proliferated in the wet lands, bays and Gulf waters. Recreation areas unique to the State are provided by the beaches and islands along the Coast. There are also many areas of historical and archeological significance in this region.

The presence of these resources has attracted a wide variety of industry, commerce and people since the early colonial days of Texas. Growth and development have accelerated during the twentieth century causing an economic impact significant to the entire State. This development has been so diverse, however, that certain interests have found themselves to be in conflict with others in matters which now have a direct bearing on existing or potential land use problems.

Much economic and industrial development has occurred on the Gulf Coast which has been beneficial to this region and to the State as a whole. As this development has intensified, however, an ecological problem has been created concerning the deterioration of natural wildlife habitats. In some instances, wetlands or winter feeding grounds for water fowl have been drained or filled to provide land for industrial or residential development. The same situation has occurred to some extent due to the construction of hurricane protection barriers.

Other divergent interests are reflected in attitudes toward waste water discharges from industry and urban communities which eventually empty into the Gulf. Industries and local governments seek an economical, safe standard of waste water treatment, while persons enjoying the recreation of sport fishing and those benefitting from the $200 million a year commercial fishing industry might well desire higher standards which would not be detrimental to fish and other marine life. If the standards are set unreasonably high, industrialization is made less attractive, and negative effects on job opportunities and economic growth are likely to result. If standards are set too low, a valuable and desirable natural resource and fishing industry may be severely damaged. Although it will be difficult, a mutually acceptable balance between the conflicting interests can be achieved through proper planning and management.

The early development of port facilities in Texas has been one of the major factors contributing to the dynamic growth of the coastal area. There is growing concern about their future, however, because of the rapid development of supertankers with 80-100 feet drafts, and the inability of Texas ports to handle the superships because of channel depth limitations.

A possible solution of this problem is the development of new offshore ports or terminals in deeper waters, which would accommodate the new supertankers. Wherever a superport is located, there is the possibility that problems may be generated affecting land use. These include the possible damage to beaches and wetlands caused by accidental leakage from the pipelines serving the supertankers, or spillage from the tankers themselves.

This potential spillage could adversely affect land use in terms of spoiled beaches, reduced tourism, recreational opportunities, and aesthetic pleasures of the area. Wetlands which provide breeding, spawning, nursery, and habitat areas for fish and wildlife could also be threatened.

The fact that there may be problems involved does not alter the need for prompt action directed toward the development of a Texas superport in response to the need for foreign oil imports as domestic reserves are depleted. This type of facility will be needed to continue the expansion of the petrochemical industry in Texas, and possibly for the mere maintenance of production at present levels.

Water transportation, with or without a superport, will continue to be very important in Texas. Many cargos do not require the larger vessels and will continue to be transported by vessels which will use existing facilities.

The contributions of water transportation have been important in attracting industry and commerce on the Texas Coast. Along with growth, however, came demands for housing, good surface transportation facilities, waste disposal, drinking water, and a myriad of other needs spawned by urbanization and industrialization. When proper planning is not applied to meet these needs, problems such as urban sprawl, inefficient sewage disposal facilities, polluted streams from industrial and urban discharges, inadequate public transportation, and general environmental degradation may result.

Because of the large population in this region and expectations for its continued growth, it is likely that future energy needs will be met by the construction of nuclear power plants. Water used for cooling purposes for these plants is a potential source of new environmental problems. However, the Gulf is already conditioned to temperature variances and if such variances are not too great, the discharge of heated water into the Gulf itself can be accommodated.

An as yet undetermined quantity of fresh water flowing into bays and estuaries is needed to maintain the environment necessary to sustain fish and marine life. Concerns are expressed that present dams upstream and other proposed water control measures may change the flow of fresh water to the extent that fish and marine life will be damaged.

Many of these land use problems have been in existence for some time, and some have been satisfactorily resolved. In recent years, however, the problems seem to have grown more acute. Careful planning and extensive cooperation among the principals involved will be necessary to achieve optimum results for the benefit of this region.

Region III--South Texas, Alamo (a) and (b), Concho Valley, Permian Basin, Upper Rio Grande

Probably the most significant factors influencing the use of land in Region III are the location and availability of water. In the past, water resources have been sufficient to support the growth and development of cities such as San Antonio, Laredo, Del Rio, El Paso, Midland, Odessa, and San Angelo. However, these cities are separated by vast stretches of semiarid land, sparsely populated and used primarily for ranching or recreational activities such as hunting, camping or guest ranches. Scant rainfall and lack of water resources continue to inhibit development of these extensive land areas.

Two major water supplies in this region are: (1) the Rio Grande on which are located the Falcon and Amistad Reservoirs. These sources of water are utilized by El Paso, Del Rio, and Laredo as well as Mexican cities situated along the River; (b) the Edwards underground aquifer underlying the surface of several counties in the region. This aquifer produces water of such high quality that it does not require purification by San Antonio and the other cities whose municipal water systems are supplied by this source.

Neither of these sources of water is unlimited, and when their maximum utilization has been attained, continued growth of the areas which they supply will be stifled unless additional water sources are developed. El Paso is already using all of the water available to it from the Rio Grande and will be hard pressed to sustain any significant growth in the future. San Antonio is concerned that possible surface development above the Edwards Aquifer will adversely affect its recharge capabilities or possibly pollute this water to such an extent that expensive purification measures will be necessary. There have been projections that even under the best circumstances, the aquifer will not be able indefinitely to support the present rate of growth in the greater San Antonio metropolitan area. Additional water will be required in the future--probably in the form of impounded surface water which will require treatment.

Another problem significant to certain counties in Region III and to some adjoining counties in Region II, is the effect of strip mining operations employed in exploration for uranium. Damage to land surfaces is much more extensive than that resulting from strip mining for coal. Great pits and unsightly spoil banks are left behind when the mining operations are completed, usually rendering the land unsuitable for other uses. Reclamation procedures have not been economically feasible in the past due to the narrow profit margins within which the uranium producer operates. If the expected increase in the production of nuclear energy occurs, and demands for uranium increase, then profits from uranium mining may be able to absorb land reclamation measures. If they cannot, the problem will probably get worse as uranium mining accelerates to meet growing demands.

Region IV--South Plains, Panhandle, West Central Texas, North Texas

The area included in Region IV is considered by many people as one of the more unique areas of the State. Climatically, it is the area where snow and ice storms usually occur, even though the remainder of the State may be experiencing a mild winter. Conversely, heat waves in the area often produce the State's hottest temperatures in the summer. Oil and gas production, ranching, and intensive agricultural operations have provided the major economic stimuli which have sustained cities such as Wichita Falls, Abilene, Lubbock, and Amarillo, along with numerous smaller communities. Land resources are abundant, but the problem of the decline in water resources will

significantly affect land use and economic development of this area in the future.

During the past several decades, abundant agricultural yields from this region have been made possible by the use of irrigation techniques in farming operations. Underground water-bearing strata were tapped by drilling wells and pumping water to the surface for both municipal and irrigation uses. These farming operations have been so successful that the use of irrigation water has increased substantially in the past and is extensively employed at the present time.

Unfortunately, the recharge of these aquifers has occurred at a slower pace than withdrawals have been made, resulting in the lowering of the water table at an ever-increasing rate. Without new sources of water, or vastly improved methods of water uses to slow or reverse the decline of those underground supplies, current farming practices may have to be curtailed and dry land farming reinstated. The farmers would certainly be adversely affected. So too would all other sections of the economy not only of the region, but of the State and nation as well.

The net result is that land use patterns could be changed radically in both rural and urban areas of the region. Water alone may not be able to account for the creation of economic and population growth; but once a supply of water is depended upon and then removed, there will likely be a direct link to economic stagnation or decline. This relationship underscores the importance of water to this region.

A less imminent problem, but one which could have serious consequences for the future, is the absence of a suitable location for a nuclear energy plant due to the lack of a constant water supply necessary for cooling purposes. If oil or natural gas reserves decline to the point that nuclear power is necessary for the generation of electricity, the resulting power shortage would have serious consequences to this region. Even if a suitable site can be found, there will still be the problem of transmitting this power over long distances to the electrical generating plants which will be served in the area.

Region V--North Central Texas (a) and (b), Central Texas (a) and (b), Capital, Brazos Valley

The area designated as Region V for purposes of this study may well experience the most dynamic growth of

any region in Texas during the next two decades. Most of the elements necessary to support such growth are already in existence, and others are in the planning or early development stage. Within the confines of this region are found intensive commercial and industrial activities, highly developed highway, rail and air transportation systems, abundant water supplies, extensive agricultural operations and many historical and recreational sites. Construction of a major new airport to serve the Dallas-Ft. Worth area, plans for nuclear energy plants, and the proposed Trinity River barge canal will provide even further impetus for increased population and economic development.

It is expected that the most significant growth patterns will occur along the corridor from the Dallas-Ft. Worth area to San Antonio, and along the route of the proposed Trinity River Canal. While these are only prospects, they may add to land use problems already in existence in this area.

Some of the more significant problems in this area will be related to increased urbanization of both large cities and smaller towns in the region. Urban sprawl and strip development along major traffic arteries are problems already in existence and are likely to increase. Since this type of development all but precludes the use of present modes of public transportation, a further dependence on automobiles will occur, taxing existing freeway systems and creating the need for more downtown parking space.

The older, central portions of existing cities will be subject to increasing pressures which combine to threaten these areas with deterioration and decline. Both commercial and residential structures have experienced aging and obsolescence, while the competitive force of outlying developments provides newer housing, modern shopping facilities, new schools, and improved utility services. Despite deterioration, these inner city areas are valuable because of the existing physical facilities and community infrastructure (streets, utilities, etc.). Renovation and alternate uses of structurally sound buildings are a possible solution, particularly in the larger cities. However, the market for this type of redeveloped property is somewhat limited in smaller towns.

There are other problems which will appear with increased urbanization.

▲ The amount of solid waste to be disposed of will require space for sanitary landfills, which usually elicits strong objections from surrounding property owners.

▲ It is difficult for minority groups and for persons with low or moderate incomes to move to the suburbs. Some observers feel that the absence of social and economic mix in suburbia stimulates polarization and hostility between segments of our society.

▲ Air and water pollution problems will increase as their causes multiply.

The loss of agricultural land to urban development is not yet a major problem. However, as urban development pressures increase, land values are based on the potential for development, rather than on use as cropland or open space. Urban fringe farm land is taxed on its potential as a subdivision, increasing overhead costs without an increase in productivity and return.

Some land may be sold for development purposes to compensate for increased costs. While the individual farm owner might fare well economically, area agricultural activity is diminished incrementally until it ceases to exist. Similarly, urban development pressures adversely affect agricultural supporting services such as farm implement dealers, feed mills, veterinary services, and financing services. Without these necessary services, and with a diminishing supply of farm labor due to competition by urban employment opportunities, individual farms in urbanizing areas find it increasingly difficult to remain economically operative.

The proposed Trinity River canal will have a considerable land use impact, both at its terminus and along its route to the Gulf. The Trinity flood plain areas in Dallas and Fort Worth would be better protected and could be developed to provide docking and loading facilities and accompanying commercial and industrial installations. Automotive and rail traffic patterns would be somewhat altered in order to tranship raw materials and manufactured goods.

The area traversed by the present course of the river is primarily composed of agricultural, timber and marsh lands. There are differing opinions as to the ecological effects this canal may have on present environments. There would undoubtedly be intensive industrial and commercial development along this waterway following its completion. Good planning and the use of adequate

controls can minimize expected problems such as water pollution, adverse ecological effects, and destruction or loss of prime agricultural lands.

IV. URBANIZATION AND ITS RELATIONSHIP TO LAND USE

At the end of the decade of the 1960's, Texas, with 11,196,730 inhabitants, moved from sixth to the fourth most populous state in the nation. Census figures for 1970 reveal that the population grew by 1,617,053 persons--an increase of 16.9 percent--being somewhat higher than the national growth rates of 13.3 percent.

This population growth continued the trend established in the post-World War II era, reflecting the great movement of rural people to the cities. In 1960, over 75 percent of the State's population was classified as urban. This figure rose to nearly 80 percent in 1970.

Six of Texas' 24 Standard Metropolitan Statistical Areas--Houston, Dallas, San Antonio, Fort Worth, El Paso, and Austin--realized over 90 percent of the state's total growth between 1960 and 1970. For the first time, the pattern of urban growth that has characterized other major urbanizing areas of the nation seems to be occurring in Texas. Instead of fairly uniform urban growth throughout the state, a pattern of highly concentrated growth in only a few of the state's major metropolitan areas is evident. This trend also indicates the areas where land use problems associated with urbanization are most likely to occur.

The existing villages, towns, and cities of Texas occupy a relatively small area--about 3 percent--of the state's land. It is in these existing rural and urban settlements, however, where most of the state's population, structual development, and property values lie.

The smaller, rural communities are often subject to the general shift of population from outlying areas to metropolitan complexes. The viability and livability of smaller communities diminish as people migrate out, as job opportunities decrease, and as essential or desired goods and services become more difficult to obtain locally.

The continued decline of these towns will result in wasteful underuse of the physical structures and community facilities and services which comprise these areas.

This underuse diminishes the economic wealth of both the cities and their residents--contributing to even further decline--and indirectly increasing the relative costs of government at all levels.

Even those smaller cities which remain relatively stable or have experienced recent growth have the problem of deteriorating older residential and business districts. New building methods and materials accompanied by increasing affluence have created a desire by people for new houses in newly developed residential areas. The older homes are often sold or rented, sometimes for commercial purposes, and a gradual decline of formerly desirable residential areas has occurred. The market for alternative uses of these properties is limited, and those which are not converted are often allowed to fall into disrepair resulting in blighted conditions.

The redistribution of people within the state poses serious problems not only for those communities decreasing in population but also those experiencing significant increases. Physical growth of Texas cities and the associated patterns of population density, changing requirements of housing, and a variety of dynamic social and economic trends all convey significant impacts.

The 1970 census revealed that while out-migration did occur from many rural areas, the inner core of large cities did not increase proportionately. It was in the metropolitan suburbs and satellite cities that population growth was greatest. Additionally, the land areas annexed by cities between 1950 and 1970 increased at a higher rate than did their residents. Consequently population densities are now lower in incorporated metropolitan areas than they were twenty years ago.

The ability of existing cities to grow spatially matched the desire of people to avail themselves of urban lifestyles. Not only did this occur in the areas included in the corporate limits of major cities, but also in towns such as Irving, Garland, Mesquite, Arlington, Pasadena, and others located in close proximity to large cities. Accompanying this suburban growth, however, were attendant urban problems such as dense traffic and shortage of parking space, rising crime rates, increased solid waste to be collected and disposed of, air pollution, and a host of others. Some specific examples of urban problems can be cited.

▲ A few large metropolitan areas are expanding into huge low density developments sprawling across vast

areas of land. Unique natural areas and important archeological sites are sometimes lost in the process, and prime agricultural lands have been converted to residential development.

▲ Land in unregulated areas outside the corporate limits of cities is often prematurely and inefficiently developed, resulting in urban sprawl. Excessive expenditures of public funds are required for the purchase of existing facilities such as water systems, or for the installation and maintenance of public facilities when these areas are eventually annexed by neighboring cities. For instance, it will cost the city of San Antonio several million dollars to buy established water and sewer systems in formerly unincorporated areas which have recently been annexed. While this does not pose a problem to the developers or residents of these areas, it imposes a financial burden on the taxpayers of San Antonio--a burden which would not have been so large if development had occurred in a more orderly fashion.

▲ Major cities and their suburbs have experienced a degradation of environmental quality because of increased solid waste accumulation, air, water and noise pollution and other related environmental problems. Smog caused by industrial and automotive emissions into the air has increased to such an extent that smog-air ratios are broadcast regularly in Dallas and Houston.

▲ The older, central portions of existing cities are subject to increasing pressures which combine to threaten these areas with decline. Both commercial and residential structures have experienced aging and obsolesence, while the competitive force of outlying developments provides newer housing, modern shopping facilities, new schools, and improved utility services.

Many of these older sections are characterized by deterioration of residential neighborhoods with the accompanying loss of tax bases, loss of purchasing power, social and economic segregation. The percentage of nonwhite and other minority groups is increasing in the central cities of Dallas, Fort Worth, and Houston, which tends to stimulate polarization between segments of our society.

▲ Inadequate planning and few provisions for relocation assistance have tended to place unwarranted hardships on families displaced by major public programs such as urban renewal projects. Low cost replacement housing is often unavailable because of unrealistic uniform building

standards which, in effect, raise costs to the point where low income groups cannot afford the resulting rental or purchase prices.

Lack of proper housing and building codes, poor quality control standards, and similar deficiencies in unregulated outlying areas have permitted the widespread construction of housing that will quickly deteriorate and become substandard. Also inadequate or nonexistent controls over mobile home developments have encouraged the rapid spread of poorly planned and inadequately served mobile home communities throughout the state.

▲ Exclusionary zoning to large tract, single family residences in many communities is further complicating the problem of urban sprawl characterized by low population densities. The City of Westlake Hills lying adjacent to Austin's western boundaries provides one interesting example of this issue.

The City of Westlake Hills is primarily a residential community. Its terrain is hilly, heavily wooded, and provides a setting of great natural beauty. Studies have indicated that the construction of a sewage collection system for this city would be difficult because of serious engineering problems whose solutions would be very expensive as well as damaging to the aesthetic quality of the area. Consequently, Westlake Hills opted for the use of septic tanks for sewage disposal. In order to prevent ground and water pollution problems, the city has passed zoning ordinances which require building sites of at least one acre for residential construction, thereby restricting the number of houses which could be built and assuring a low density of septic tanks.

This was the solution desired by most residents of the area, but was unsatisfactory to those land owners and developers who would have preferred the construction of a sewer system to allow more houses on given tracts of land.

▲ In the opposite extreme, a trend has developed in many Texas cities to concentrate large multifamily housing units in relatively compact areas, often overlooking the capacity of existing public facilities to meet the requirements of large numbers of people. This can result in problems such as congested traffic conditions in overtaxed transportation arteries, inadequate sewage facilities or insufficient utility services.

These are but a few aspects of urban growth in Texas which highlight areas of concern. An understanding of these changing patterns and the significant trends which are developing will perhaps indicate policies needed for the future.

V. WATER RESOURCES AND THEIR RELATIONSHIP TO LAND USE

Any discussion of land or land use must recognize the inherent relationship between land and water. Land settlement and population distribution patterns can be logically discussed only with reference to water, or more specifically, to its availability. This relationship is easily typified by the development patterns that exist across the State.

In the early development of Texas water availability had a tremendous influence on settlement patterns and development of the various economic sectors. Although settlement was not significantly prohibited by the availability of water in those early years, it certainly influenced the extent and type of development that took place throughout the State.

The Gulf Coast, with access to the sea as well as to an abundance of fresh water, experienced early growth with strong economic ties to shipping and fishing interests. Other sections developed in a manner more closely aligned with land-based activities such as business, farming, and ranching.

As growth patterns began to emerge throughout the State, it became clear that the availability and management of water had become an increasingly important factor influencing the development of an area. It also became apparent that the water resources available for increased development were limited. The majority of these resources are located in the East Texas river basins where there is a surplus of water available to meet future needs of the area. By contrast, the western and southwestern areas of the State have increasing water requirements that cannot be met by present water supplies which are limited, and in some cases, diminishing.

As the limitations of water supply became more apparent, it was recognized that wise use of the available water resources was vital to the future growth and economic vitality of Texas. Study and planning efforts at

the State level were begun during the 1950's and were intensified in 1964 when Governor John Connally and the 58th Texas Legislature authorized the Texas Water Commission to conduct an extensive investigation of water needs and problems, and to develop a State Water Plan for Texas extended to the year 2020. This action culminated in the presentation of the Texas Water Plan to the Governor and the Legislature by the Texas Water Development Board in November, 1968. However, this plan has not yet been officially adopted.

The importance to the State of water resources and their relationship to land use has been placed in its proper perspective. Not only are lakes, canals, rivers, and large reservoirs users of land, it is self-evident that their availability strongly influences the manner in which most land is used. This relationship also holds true for underground aquifers and coastal waters as well.

In examining these relationships, three broad categories have been selected with which land use and water related issues can be identified. These categories are concerned with the supply of water; the quality of water; and the control of floods.

Water Supply

Since water is essential to the maintenance of life, it is only natural that population concentrations and economic growth will occur in areas where water supplies are sufficiently adequate to support such development. Water alone, however, will not necessarily create economic and population growth. Other resources and amenities must also be available to attract industry, commerce, and related activities which provide a means of livelihood.

Limited water availability will, perhaps, limit population growth and economic activity, even though other resources might be readily accessible. An obvious example of this situation can be illustrated by comparing low population densities common in West Texas where water is scarce to the Eastern and Gulf Coast regions which have abundant water and a correspondingly higher density of population and intensity of land use.

In the past, most Texas metropolitan areas have been able to provide adequate water resources necessary to sustain their growth and development. These water supplies are not unlimited, however, and as they reach capacity

utilization, additional supplies will have to be provided if these cities are to continue to prosper.

The large-scale movement of water from areas of abundance to more arid regions is one alternative for meeting these future water demands. This will of necessity have to be balanced against other economic, social and ecological considerations. The land use implications of such major resource development plans are many and varied and would have an economic impact of significant proportions.

This type of project could also produce additional problems, however. If tributary flows into bays and estuaries are appreciably altered, commercial and sports fishing activities will be adversely affected in direct proportion to the damage which is caused to nursery and spawning grounds.

The population and economic stimulus provided by the availability of water has resulted in the concentration of many activities within relatively compact areas. While this may have been economically beneficial to the affected area, it has created ecological problems and detrimental effects on fish and wildlife resources. These concepts can be illustrated by examination of the following issues which are representative of water resources and their effect on the manner in which land is used.

▲ Land subsidence has occurred in parts of the Gulf Coast causing some lands in low lying ares to become submerged or inaccessable. The land in the vicinity of the San Jacinto Monument has subsided as much as 8 to 10 feet and continues to do so at the rate of about 6 inches annually. In nearby Baytown, several hundred homes have been lost or threatened as a result of land subsidence. This has been caused by excessive use of underground water supplies for industrial and municipal purposes, causing the water-bearing strata supporting the surface to become depleted and ultimately compacted.

▲ Cities and towns dependent upon underground aquifers for their water supplies may stagnate and be unable to achieve expected growth when these water supplies can no longer support expansion. Groundwater aquifers presently supply about 75 percent of the water used in Texas. The Houston area has already found it necessary to develop surface storage to supplement the underground supplies which have been used in the past. The San Antonio area will probably have to make similar provisions for additional water in order to meet the needs generated by expected growth.

▲ In the High Plains area of West Texas, water from the Ogallala Aquifer is used for both municipal and irrigation purposes. These water tables are steadily declining, which means that unless supplementary supplies can be acquired, agricultural practices will be forced to revert to dry land farming. Agriculture is one of the mainstays of both urban and rural areas of this region, and its decline would have a marked influence on cities such as Lubbock, Amarillo, Plainview, Lamesa and others.

▲ Shoddy or makeshift structures which blight an area often appear in the vicinity of water bodies that are amenable to recreational uses. This type of development usually occurs in unregulated areas along rivers, lakes, or the coast where hunting or fishing shacks are to be found in abundance. Since they are subject to damage by the elements, they are usually constructed haphazardly for temporary use.

▲ Water deficient areas west of the 100th meridian have only limited potential for accommodating future growth until their water supply problems are solved. Tom Green County falls within this water-deficient area. Several attempts have been made to impound water near San Angelo to alleviate this situation, the most notable of which was the construction of the Twin Buttes Dam and Reservoir. To date, none of these efforts have been successful because rainfall in amounts sufficient to fill the reservoirs has not occurred in the watershed areas.

▲ Proposed water transfer systems from East Texas to water deficient areas of West and South Texas can result in undesirable environmental consequences along the Gulf Coast if proper land use management is not achieved concurrently with such development. A primary concern is the maintenance of sufficient fresh water supplies flowing into the bays. More than 2,100 square miles of open, relatively shallow bays must continue to be valuable for fish and shellfish production. The fresh water inflow from rivers supports the salinity gradient of the entire bay system, and has an especially pronounced impact upon the low salinity areas, or estuaries, immediately adjacent to the mouth. These marshes, grassflats and bays provide the nursery and habitat areas necessary to the propagation and maintenance of fish and marine life, as well as commercial and recreational activities of significant value.

Water Quality

The quality of water can be defined generally in terms of its chemical, physical, and biological characteristics. To these parameters may be added physiological and

aesthetic properties such as taste, color, and odor, which may result from the interrelationship of two or more of the major characteristics. The quality of the water resources of Texas varies widely across the state. Some supplies are of good quality but have an unpleasant taste, while others may have a high mineral content and require extensive treatment.

The availability of potable water is an important factor which affects population growth and distribution. The composition of water in a given area must be such that it lends itself easily to treatment which will produce water of sufficient quality to meet health standards, have at least a reasonably pallatible taste, and be relatively inexpensive to the consumer.

Pollution, from a variety of both natural and man-made sources, has become a major water quality problem. The presence of polluted surface waters in an area will tend to discourage residential and commercial development and thus affect the distribution of population.

The controlled spacing of septic tanks to protect water quality usually requires relatively large tracts of land for their installation. This creates low density residential development and thus a wider distribution of people.

The availability of good quality water is necessary to many industrial and commercial enterprises which support the economy of an area. However, the pollution of surface waters by some industries causes adverse economic conditions, public health hazards, and other losses to land owners whose property is rendered unsuitable for other kinds of development. To illustrate these points, several specific issues can be cited.

▲ Land areas located adjacent to bodies of water may be rendered less useful for residential, recreational, and certain commercial development because of unpleasant or unhealthy environment created by polluted waters. In areas of high population concentration and large scale economic activities, the disposal of municipal and industrial wastes overtaxes the capability of water to purify and recharge itself. This has resulted in severe pollution problems in areas such as the Trinity River downstream from Dallas and Fort Worth and in the ship channel below Houston.

▲ Desirable and orderly development above underground aquifers must be carefully planned to meet rigid standards because of concerns that these waters might

become polluted or that some of their recharge areas might be lost. Extensive study and planning efforts have preceded the development of San Antonio Ranch, a "new town" which is to be situated on land overlying the Edwards Aquifer. This is the present source of San Antonio's municipal water supply, and in order to assure its preservation, sophisticated engineering and building requirements had to be met before necessary approval of this development was granted by various regulatory agencies.

▲ Important underground and surface water supplies can be polluted by solid waste disposal sites, feed lots, or septic tanks located on improper soils or geologic formations. For instance, many soils in the Houston area are ill-suited for the disposal of solid wastes. The porosity of these strata allows seepage of pollutants into underground water supplies.

▲ Biotic communities are often seriously affected by water pollution from chemicals, improperly treated waste water, oil, pesticides, and heavy metals.

Concern over several of these issues relating to water quality has resulted in planning efforts and corrective action by State agencies such as the Health Department and the Texas Water Quality Board, and by local governing bodies as well.

Flood Control

Water, whether it be inland or coastal, has certain attributes which attract both human and wildlife populations, causing them to locate nearby. However, the direct tie between water as a life support system for humans is not as critical as it is for wildlife populations. Certain of these populations must be located in and along water and associated habitats in order to survive.

Early settlers of Texas, lacking the technology to transport large quantities of water, tended to locate near major water bodies both inland and on the Gulf Coast in order to insure an adequate source of water and to facilitate transportation. Early settlements inevitably suffered economic losses from flooding of housing and commercial interests which were located in the floodplains.

During these early periods, few alternatives were considered to building in floodplains. The individual who built in the floodplain to gain certain economic benefits also had to individually withstand the economic loss

attributed to flooding. Furthermore, development was so sparse that wildlife population suffered little damage from competition with human populations and related development.

As time passed, however, and developments increased both in magnitude and in cost, land use conflicts in flood prone areas began to result in the creation of significant problems.

Since 1900, a major hurricane has crossed the Texas Coast on an average of about every two years, resulting in the loss of over 450 lives and property damage in excess of a billion dollars. Despite this fact, the Coastal zone of Texas is expected to continue major expansion and growth in the future. Sophisticated hurricane warning systems have helped to decrease the dangers to human life, but property damage will probably increase in proportion to additional structural development. The federally sponsored floodplain insurance program has been only moderately successful in solving the problem of high economic losses which result from hurricane flooding.

The construction of several hurricane protection floodwalls has been authorized in recent years. While these are beneficial to the protected areas, they have raised certain problematic issues.

▲ Hurricane protection projects require large expenditures of public funds. The estimated cost of a project at Port Arthur in 1968 was $58.5 million; at Freeport, $19 million; at Texas City-LaMarque-Hitchcock, $44.7 million.

▲ They can destroy critical environments including wetlands and grassflats which are essential to maintenance of the estuaries that provide the habitats for various species of fish and wildlife.

▲ They can produce locally severe high tides in adjacent areas due to the constriction and concentration of the storm surge and restrict circulation of waters by compartmentalizing the bay.

▲ Inundation of inland floodplains continues to cause tragic loss of life and extensive property damage, despite the many flood control measures which have been adopted during this century. The most notable example in recent months was the flooding along the Guadalupe River and its tributaries below Canyon Dam in the New Braunfels-Seguin area.

This type of flooding presents problems significantly different to those experienced in the Coastal Plains caused by the surge of hurricane waters. The potential solutions to these problems are equally different. Flood control dams and storm drainage systems are most often the measures taken to minimize flooding in interior floodplain areas. However, the problems thus created are similar to those resulting from hurricane protection projects.

▲ A large expenditure of public funds is required to provide flood control devices to protect people and property situated in specific floodplain areas. A preponderance of those measures have been taken to protect metropolitan areas where their cost can more easily be justified, than in rural areas where the cost-benefit ratio is smaller.

▲ Dams and the reservoirs which they create can be detrimental to the environment of unique natural areas and areas of historical or archeological importance. Also altered fresh water flows into bays and estuaries create an ecological imbalance which adversely effects marine and wildlife species.

▲ Existing development that is located within the floodplain should be protected; however, new development that is unnecessarily located in the floodplain results in the expenditure of additional high levels of public investment which could be utilized to facilitate other types of economic development within the state.

▲ Properly utilized floodplains could serve as buffer zones, separating residential areas within a city from industrial and commercial development as well as major traffic arteries. In this manner floodplains can serve as natural barriers to development and thereby more evenly distribute population throughout the urban areas.

▲ Development of floodplains will usually result in the loss of our most valuable lands for wildlife habitat, unique natural areas, and many significant historical and archeological sites. Such development creates something of a paradox with respect to resource allocations, especially in relation to the goals and expectations that have emerged in the past twenty-five years. Much evidence points to the conclusion that people are demanding that more intensive efforts be made to provide and preserve additional recreational resources. These desires could be met to a great degree by prohibition of development within the floodplain which in actuality is not desirable for

development without the expenditure of tremendous amounts of public funds for protection from flooding. Yet development does occur; flood control structures are built; additional recreational resources are lost; and the public coffers are twice reduced.

VI. ENERGY RESOURCES AND THEIR RELATIONSHIP TO LAND USE

Texas is fortunate to have within its boundaries many energy producing resources. These resources stem from the land, and the methods employed to produce, refine, and transport these resources require facilities which utilize many thousands of acres of land.

The presence in Texas of oil and gas in abundant quantities has provided a major stimulus to population growth and economic development in the state where massive oil refining and petrochemical industries have been developed, particularly on the Gulf Coast. They have brought with them an influx of people, economic growth, and a related demand for land to be put to a wide variety of uses. Land use problems caused by the development and utilization of oil and gas resources have been greatly overshadowed by the economic, social and technical benefits which have accrued.

The land use problems discussed here will be related to three categories of energy resources: fossil fuels; resources produced through strip mining; and nuclear energy.

Fossil Fuel Resources

▲ Exploration, production, and transportation methods used to produce and transport oil and gas have caused land use problems in the past. Land in the general area of petroleum drilling and production activities is often despoiled by slush pits, board roads, oil seepage, and salt water flows. Also, many thousands of acres of land have been converted from other uses to provide rights-of-way for the location of high pressure pipelines for the transportation of oil, gas, and their refined products.

However, problems such as these have been substantially outweighed by the resulting economic benefits which have accrued to individuals and to the state as a whole. Also, regulatory controls have been instituted which alleviate many of these conditions.

▲ Despite the abundance of these resources in past years, they have not proved to be limitless. High rates of consumption coupled with diminished drilling activity have resulted in declining domestic reserves of crude oil and natural gas. Consequently, an ever increasing amount of foreign petroleum must be imported. In order to achieve more economic transportation costs, the utilization of very large, deep draft tankers is increasing rapidly in international trade. The United States does not presently have port facilities capable of receiving these huge ships.

The expanding use of huge vessels will require the construction of deep water port facilities offshore from the Gulf Coast, since present ports in Texas are too shallow to accommodate these ships. Some types of land use problems are likely to accompnay such installations.

▲ The marine environment could be adversely affected by construction of ports and installation of pipelines necessary to transport the petroleum products to land-based storage and refining facilities.

▲ Beaches and wetlands will be subject to damage by accidental oil slicks caused by spills from tankers or leaks in pipelines.

▲ Terminal and storage facilities will be located in coastal areas and subject to damage from hurricanes.

▲ Some permits for expansion in petroleum processing have already been denied on the basis of air quality alone. Air quality considerations will probably provide the major constraint to the establishment of new or expanded refining and processing facilities.

If deep water ports are constructed in order to import foreign oil and gas necessary to meet increasing energy requirements, the effects of their locations will have a significant onshore land-use impact. The benefits expected to accrue to the State must be weighed against the land use problems which may occur.

Energy Resources Acquired by Strip-Mining

The two major energy resources in Texas which are extracted from the earth by strip mining are lignite and uranium. Though neither are extensively mined at the

present, the extraction of both products will increase for use in lieu of the declining oil and gas resources which are presently being used for the production of electric power. Some land use problems related to strip mining are:

▲ Land is temporarily scarred and denuded when lignite is being strip-mined. However, some lignite mining operators now provide a reclamation process when the mining operations are completed in an area, leaving the land in relatively good condition.

Some strip mining for lignite will probably occur in East Texas. Forest and wildlife resources in the actual area to be mined will be temporarily disturbed. This is not expected to be a permanent problem since the utility companies heading these operations have indicated that full reclamation procedures will be employed.

▲ Blowing dust, deep pits, and unsightly spoil banks are typical after effects of uranium strip mining, rendering the mined land virtually useless after the short-term mining operations have been completed. Reclamation efforts are not economically feasible due to the small profit margins within which uranium mining companies presently operate.

▲ Surrounding property values may be depressed and health and safety hazards created when these uranium mining sites have been abandoned. There have been isolated instances of water pollution when leaching processes have contaminated undeground aquifers.

The related land use problems would tend to have a negative effect on population growth in the mining area, since most residential development would be unlikely to take place in the immediate vicinity. Also, abandoned mine operations, particularly those from which uranium has been extracted, have debiliting effects on the land which has been mined. Because reclamation practices are lacking, thousands of acres of ranch land are being taken out of service and removed from consideration of virtually any other type of land use which may be needed in the future. Reclamation costs increase significantly over time when this mined land is not filled and restored.

Although this type of mining activity is short-term in nature, the use of uranium for the generation of nuclear energy will have long-term economic effects which must be balanced against the potential environmental problems.

Nuclear Energy

As oil and gas reserves diminish, nuclear energy is being recognized as a probable future source of power to be used in the generation of electricity. A site for a nuclear energy plant to serve the Dallas-Fort Worth area has been chosen near the community of Glen Rose. Another is being considered in Austin County near Bellville to serve the energy needs of the Houston area. Certain land use considerations and effects must be taken into account before site selections are reached:

▲ Sites for nuclear energy plants may not be readily available because of special requirements which are essential. The sites must be large--probably in excess of 3,000 acres--and must be able to support a water supply adequate to fulfill the cooling requirements of the plant. There must also be a channel--either natural or man-made--to carry off discharge water.

▲ Water and wetlands in close proximity to nuclear plant sites could experience some adverse environmental changes due to elevated water temperatures when warm discharge water is released, if adequate cooling methods are not employed.

▲ Large amounts of land will be restricted for many types of development because of the right-of-way requirements necessary for the transmission lines from the plants to the ultimate user.

The effects of siting a nuclear power reactor may have short-term positive effects on population growth in the vicinity of the plant due to an influx of people who might be needed in the construction process. The number of employees needed to operate the facility, however, is negligible.

The impact on population growth and economic development will be much greater in the cities utilizing nuclear energy to generate electric power. Areas which can provide consistent and abundant electrical power required for growth and expansion will attract outside industrial and commercial activities.

Nuclear plant sites and the water reservoirs necessary to sustain them will each occupy several thousand acres of land. In most instances, these will be lands which formerly supported agricultural operations and provided the habitat for various forms of wildlife. Marine

and wildlife resources could experience environmental changes due to the discharge of warm water used in the cooling process necessary to the production of nuclear energy. However, there are conflicting opinions as to whether these changes might be harmful or beneficial to the affected aquatic life.

VII. TRANSPORTATION CONSIDERATIONS RELATED TO LAND USE

Throughout the history of Texas there has been a strong interrelationship between land use in the state and compatible forms of transportation available at any given point in time. With the advent of railroads, animal-drawn vehicles gave way to trains, interurbans, and streetcars. Seaports prospered and expanded as rail transportation provided the means of transshipment and distribution of products and people.

Then came mass production of automotive vehicles which provided the genesis and continuation of the love affair between the American and his car. Nowhere have autos been more highly valued than in Texas.

Motor vehicle ownership rose almost three times as fast as population growth in the past twenty years. Only California has more than the 6.7 million motor vehicles registered in Texas.

While rail, automotive, and marine transportation developed in size and efficiency, air transportation was born and became highly sophisticated, as did transportation by pipeline. The most recent innovation in transportation which will have a significant impact on land use in Texas is the development of mammoth, deep draft shipping vessels.

The integral dependency of land resource development on transportation has limited or enhanced a variety of land uses. Some effects are temporary while others are long lasting. In this section, the current interrelationships will be explored to identify land use problems which are related to land, air, and water transportation.

Land Transportation

In this segment, land use problems involving various forms of land transportation will be identified. It should be noted, however, that efficient means of

transportation have not only been sought after, but demanded by people to serve their needs and desires. In satisfying these needs, various land use problems have been created and will be discussed in this context.

▲ The availability of transportation facilities has a direct bearing on the allocation of human, man-made and natural resources of the State. All of these resources must depend on some form of transportation to move from their points of origin to their ultimate destination. Transportation facilities not only are contributory influences to the manner in which land is developed, but are themselves voracious users of land resources. Rights-of-way for railroads, streets and highways, and pipelines account for the use of many hundreds of thousands of acres of land in the State.

▲ Automotive, rail and pipeline transportation are, of course, essential elements to the economic growth and stability which Texas enjoys. Coincidental with this general economic stimulation is the allocation of funds for construction and maintenance of transportation facilities.

Uncontrolled low density subdivisions checkerboard the urban fringe in a haphazard manner when freeway systems allow easy access to cities from outlying areas. When later annexed by major cities, the annexing city will often inherit financial problems in connection with the acquisition of poorly planned and inefficiently operated suburban developments. This type of development is characterized by a relatively inefficient use of land. It typically results in higher public costs for streets, electric utilities, and other services such as gas, sewage disposal and water whose transmission lines must traverse extended distances.

This type of leapfrog development has often resulted in the premature characterization of an area by the ill-timed establishment of residential areas, factories or commercial activities, which subsequently make the area unfavorable for anything but similar uses. This effectively precludes other types of development to which the area might be more appropriately suited. Such characterization may be the unintentional consequence of actions which are taken in efforts to avoid high land prices or restrictive regulations in previously developed or incorporated areas.

The availability of automobiles and the provision of adequate streets, highways and freeways have facilitated

the growth of outlying residential developments of low population densities--primarily single family dwellings. In order to live in these suburbs, families must be financially capable of maintaining their homes, owning and operating one or more automobiles, and parking them in downtown lots. Congested traffic arteries and lack of space for downtown parking have thus become significant problems, despite the fact that extensive land resources have been devoted to these purposes. One part of this problem is that efficient rapid transit systems have been precluded by low density residential development and the accompanying reliance by people on automobile transportation. In fact, while the population of urban areas has increased, transit riding has dropped appreciably since 1950.

The lack of an efficient rapid transit system, however, has created problems for persons who, for financial reasons or by choice, do not move to the suburbs and depend on public transportation systems to meet their in-city travel requirements.

▲ Intracity freeways are often routed through public parks, urban renewal, and other low income housing areas to minimize land acquisition costs. A manifestation of concern over this type of issue has delayed construction on a freeway in San Antonio for years because of objections to an elevated section which was scheduled to be built through a park. Whatever the final outcome, the expenditure of public funds will be considerably larger than would be the case if the issue had been decided before construction began.

▲ Detraction from scenic and other aesthetic values has resulted from a proliferation of unsightly billboards, signs, and junk yards along freeway and other transporation arteries. The drive from Houston to Galveston is a prime example.

▲ Some residential and recreational areas have been made less desirable because of safety hazards and air and noise pollution accompanying the location of a freeway through its midst.

Air Transportation

Large airports are definitely developments of greater than local impact. However, it is often difficult for interested governmental entities to agree on the site location and then make the necessary plans to assure

that the development which will automatically follow is desirable.

The effects of air transportation on population distribution and economic development have been significant. The availability of commercial airline service is a major factor in determining the location of business and industry and the people who are then employed by them. The most significant influence has been to further increase population growth in major cities. Even smaller cities, served by feeder airlines, will be similarly affected. Certainly the location of military air bases will cause an influx of population to operate such installations.

Land resources are obviously essential to the location of airports. As aircraft have become larger and faster, the amount of land needed for increased runway construction and larger terminals and hangar facilities has increased proportionately. Agriculture, timber and wildlife resources are those most likely to be displaced by the site location of an airport.

Land situated close to airports is made undesirable for some types of development because of air and noise pollution caused by both aircraft and motor vehicle traffic. The location of airports and flight patterns of aircraft will tend to disperse population from their immediate areas.

Water Transportation

Shipping lanes and port facilities have attracted industry and commerce, resulting in population growth and economic stimulation of widespread significance. Over the years activities related to shipping have created issues of both local and statewide concern.

▲ Water pollution and attendant despoiling of adjacent shorelines result from intentional or accidental discharges of pollutants from marine vessels and creates an unpleasant, and sometimes unhealthy environment for human, marine, and wildlife populations.

▲ Land erosion and a deterioration of water quality occurs when marine vessels create extreme turbulance while operating in confined channels and canals.

▲ Many Gulf Coast ports face economic difficulties and underutilization of port facilities because existing channels are too shallow to accommodate the increasing

number of deep draft vessels. At present, the deepest port in Texas can accommodate only 40 foot draft vessels, while the new types of supertankers require 80 to 100 feet of water depth.

To meet the requirements of these large ships, it is quite probable that a "superport" will be constructed somewhere offshore from the Texas Gulf Coast. The resulting ramification will be significant and are discussed in detail in the section of this report dealing with energy.

Another future water transportation system which seems likely to be developed is a system of canals and locks which will allow barge traffice to go from Trinity Bay on the Gulf of Mexico up the Trinity River to the Dallas-Fort Worth area. The effects of this project would further stimulate population growth in the areas to be served by the proposed waterway. Just the construction of this waterway would create an expenditure of several billions of dollars.

This project would also have a significant impact on the ecology of the area through which it passes. Farm and timber land will be inundated by lakes proposed as part of the system. Fish and wildlife habitats will be altered to an undetermined degree. All of these circumstances will have to be taken into account as this project is planned. Effective area and statewide planning and management of land resources should be an essential part of such large-scale development planning.

VIII. AGRICULTURE AND FORESTRY AND THEIR RELATION TO LAND USE

Agriculture

Texas is blessed with an abundance of land, much of which is capable of producing a wide variety of agricultural products. The significance of this production is reflected in the $7.3 billion dollar income generated by agribusiness operations in the State during 1971.

As agricultural technology is advanced, fewer people are required in farming operations to maintain and even exceed our production needs. This has resulted in increased population migration from rural to urban areas where jobs have been more readily available. Although agricultural production has not declined, many small towns and rural areas of the State are losing population, particularly young people, resulting in even smaller towns inhabitated mainly by older residents.

Both the Governor and the Legislature have reacted to the seriousness of the economic stagnation being experienced by these smaller communities by establishing the Texas Rural Development Commission and other economic programs and incentives for Texas' rural communities. This Commission is studying the problem of population and economic decline in rural areas in order to assist in reaching some of their solutions. At the federal level, Congress has passed the Rural Development Act of 1972 which will provide certain types of financial assistance to qualified rural towns or areas.

Ever improving farming methods and new technology indicate that agricultural productivity can keep pace with food demands in the forseeable future, even if significant amounts of agricultural farm lands continue to be converted to other uses. There are well founded doubts, however, as to the validity of this assumption. There have been no really definitive studies made upon which future needs for agricultural land can be predicted. Although vastland areas exist in Texas, by no means all of them are suitable for intensive agricultural production, especially

for those crops which require particular soil types, climatic conditions, or water for irrigation. In this respect, there are certain issues concerning agricultural land use which may be problematic in the future.

▲ Some farming areas will undergo major changes in the future. Irrigated lands in West Texas may have to be converted to dry land farming unless new sources of water are developed to replace diminishing underground supplies. Concern has also been expressed over the use of certain types of chemical pesticides which are detrimental to fish and wildlife. This use is particularly serious in areas where these pesticides drain into bays, estuaries or public water supplies where the possibility of aquifer contamination exists.

▲ Agricultural land is being permanently converted to nonagricultural uses as our major metropolitan areas continue to expand. Housing and industrial developments, highways, freeways, utility easements and water storage are some of the uses to which this land is being changed at the rate of 100 to 200 thousand acres per year in Texas. Some of these lands are those formerly used in producing crops of a special nature such as rice in the Gulf Coast region. Once made, these commitments to urban uses are irreversible.

▲ As urban areas continue to expand, and as city, county, and school district needs for revenue increase, taxes on farm land often increase to the point that farming operations are no longer profitable. Such land is usually sold for development or to those who can afford to maintain it until it becomes even more valuable for nonagricultural purposes.

In addition, agricultural lands are increasingly being purchased for second home sites, private recreational areas and other nonagricultural uses, creating a further drain upon the state's agricultural resource base.

Since it is difficult to accurately predict future needs for prime agricultural land, options should remain open whenever possible in the allocation of this resource. Desirable alternative uses need to be examined when prime agricultural land is being considered for conversion to such relatively permanent facilities as transportation corridors, water reservoirs, or housing developments.

Forestry

The extensive lumber industry in Texas is called upon to produce the raw materials which are ultimately converted into a wide variety of products, the most notable of which are building materials and paper products. To this purpose, over eleven million acres are committed to the growth and regrowth of timber, primarily in East and Southeast Texas.

The forests of Texas have been capable of meeting the demands for wood products, and there is no apparent shortage of land resources necessary to support forestry operations. Yet, as in the case of agriculture, there are certain issues connected with forestry operations which are relevant to this study.

▲ Some forest lands are being converted from timber production to higher revenue producing uses such as residential subdivisions and commercial developments, even though nearby, less productive, sites are available.

This trend may become especially significant in the area north of Houston where lumbering operations have been extensive in the past. The location in recent years of the Houston International Airport, Lake Livingston, and Lake Conroe in this region has resulted in suburban, commercial and recreational development which is expected to increase.

▲ Taxation policies on forest lands have discouraged reforestation by some timber growers in recent years. According to a 1967 report in Texas Forest News, a tree farmer must develop, protect, and pay taxes on his timber for forty years before "harvesting" his crop. In East Texas, shrinking markets and increased taxes resulted in a sharp decline in reforestation during the 1960's.

▲ Certain unique natural areas and wildlife habitats are threatened by forestry practices. When forests of mixed hardwoods and pines are replaced by pure stands of pine, some wildlife species can no longer exist in that area. Hardwood trees produce acorns, berries, and leaves which are required to sustain deer, turkey, squirrels and water fowl.

If population and economic expansion occurs in Texas as predicted, demands for forestry products will increase proportionately. The result could be a shortage of these products with attendent higher costs, if excessive amounts of timber-rich lands are lost to competing uses.

Forecasts indicate that water rich East Texas is expected to be a major area of future growth in the State. It is necessary to employ sound planning and management techniques at an early stage so that orderly development can be achieved along with the maintenance of forest resources. Forestry management should always consider the effect of lumbering operations on wildlife and unique natural areas and make efforts to develop alternatives in order to maintain these environments.

IX. RECREATION AND ITS RELATIONSHIP TO LAND USE

Accompanying the population and economic growth experienced by Texas in the decade of the 1960's were the increased demands placed on the State's natural resources and environment. In the past, the market system has determined the allocation of most natural land resources. Supply and demand principles have guided the use of such resources in ways which provided the greatest economic return, or which resulted in a desired economic stimulus.

A market system alone, however, does not provide an adequate basis for the allocation of resources where intangible values are threatened, such as unique natural areas and wildlife habitats. It is difficult to put a price tag on aesthetics. As a result, those resources having intangible values do not always have the economic leverage necessary to compete adequately with other sectors of the economy. The present market system tends to create an imbalance that promotes development interests over those of conservation.

This imbalance is typified by the development along the shorelines of some Texas rivers and reservoirs. Waterline developments are profitable to the developer, but sometimes costly to the public in terms of limited access to the water and deteriorated aesthetic quality of the shoreline. Another example of this imbalance occurs along the Gulf Coast. The draining of marsh lands allows the land to be used for agriculture, housing, or industry, often causing destruction of significant wildlife habitat and unique natural areas.

A proper balance between economic development to provide for man's physiological needs, and the preservation of recreation areas to meet his psychological needs must be found to insure continued quality in our way of life.

Society is becoming more aware that it must come to grips with the conflicting demands of increasing population, a rising standard of living, and a public demand for preserving and enhancing the environment.

However, preservation of certain areas, merely for the sake of preservation, can be an obstacle to the orderly and desirable economic development of the State. The following issues are indicative of some of these conflicts.

Park and Recreation Areas

▲ The presence of park and open recreation areas within cities adds much to their aesthetic qualities and makes them more enjoyable places in which to live. They can serve to some degree as underdeveloped corridors between residential areas and major transportation arteries or commercial development. Property values have a tendency to increase in the vicinity of these facilities, particularly if they are attractive and well maintained. The Hike and Bike Trail which follows the meanderings of Shoal Creek in Austin is a delightful example of planned preservation of a scenic area which accomplishes the purposes stated above. However, park and recreation lands are often subordinated to other competing land uses having higher, short-range economic returns.

▲ The establishment of a large state park in an area will preclude the use of this land for other development. While this will usually result in lowering population densities, the economy is nevertheless stimulated by the tourism which these facilities attract. Unfortunately, some of the commercial or industrial operations which sometimes surround park development detract from the character of the area, thereby lowering the quality of the recreational experience which otherwise might be enjoyed.

For instance, the Houston Ship Channel in the vicinity of the San Jacinto Monument has experienced heavy industrialization during the past three decades with accompanying economic benefits to residents of this area and to the entire state. Some adverse effects on the San Jacinto State Park have resulted, however. Industrial and municipal use of underground water has been so great that the water-bearing strata have gradually been depleted and compacted to the extent that land subsidence has occurred. Certain areas of the park are so low that they become isolated and inaccessible. The Monument itself has subsided some 8 to 10 feet, and the process is continuing. Expensive bulkheading has been necessary to prevent complete flooding of the park.

Air and water pollution caused by the discharge of industrial and municipal wastes have seriously affected the aesthetic qualities of the park. Other park areas in

the State have also experienced difficulties. Possum Kingdom and General Zaragosa Birthplace State Parks are good examples.

▲ Some parks are underutilized because they are placed in inappropriate locations due to political decisions or inadequate planning. This results in the frustration of recreational needs and desires of people and renders inefficient the expenditure of public funds. Many city parks are underutilized in this manner, as are some state parks. Mother Neff State Park in Coryell County, though it was the first official state park in Texas, attracts few visitors because of its remote location.

Other parks are underutilized when their primary attraction is water-based outdoor recreation which is dependent on fluctuating water levels from man-made reservoirs. For example, the Martin Dies Jr. State Park is located adjacent to Dam B. Reservoir in Southeast Texas. This is a flood control and irrigation reservoir whose water level fluctuates in accordance with the needs of the entire system. When water levels are high enough, the Park is utilized to capacity. When levels are down, boat launching is difficult and water skiing hazardous. Consequently, the Park has few visitors during the summer when irrigation requirements are greatest and recreation needs most significant.

▲ Still other parks are overutilized when situated near areas of high population densities, resulting in a low park-to-people ratio. The Huntsville State Park, one of the more highly developed parks in the State Park System, is located within easy driving distance of metropolitan Houston. Its use is so intensive that destruction of vegetation has occurred, creating severe soil erosion. Since it is the only State park of this type in this area, it will probably continue to be overutilized.

Historical, Archeological, Wildlife, and Unique Natural Areas

▲ Continued population growth in metropolitan cities requires additional land for use by those components such as freeways and water reservoirs which accompany increased development or redevelopment of urban areas. In the past, some of the land so required has been of historical or unique biological importance.

The urban renewal program in San Antonio which provided the setting for Hemisfair in 1968 is exemplary of

this problem. Several old buildings representing various types of early Texas architecture were preserved and cleverly utilized within the fairgrounds or adjoining areas.

▲ As urban communities face added space requirements, the needs for additional water supplies increase. That a specific dam is built to relieve an urban water shortage may be self-evident and of wide public knowledge. But, the fact that a proposed reservoir may encompass unique historical or archeological sites, or the last habitat of an endangered species may be understood by only a few. As a consequence, valuable and sometimes irreplaceable natural areas and resources are committed to inappropriate uses, when alternative sites might be available.

▲ Some wildlife habitat areas are being lost to certain agricultural and forestry practices. Much of the wildlife habitat in the state is to be found on agricultural land which is grazed by livestock or is under cultivation. Grazing land has been increased through the clearing of brush and timber lands formerly inhabited by deer, turkey and quail, causing their migration, or in some cases, their destruction. However, this trend has slowed somewhat in recent years as many landowners have found it to their benefit to preserve wildlife habitats by following sound wildlife management practices. While the available habitat areas decreased, the demand for hunting and related recreational activities grew, increasing the profitability--and practice--of leasing land for hunting rights.

Another agricultural practice which has proved detrimental to some species of wildlife is the use of certain pesticides, particularly those which contain mercury or chlorinated hydrocarbons. Wildlife species, particularly waterfowl and shore birds, are known to be highly susceptible to DDT. The decline in populations of brown pelicans, bald eagles, and peregrine falcons has been attributed to their ingestion of DDT.

▲ Forestry practices which produce pure stands of pine trees are of little value to wildlife. Hardwood trees produce acorns, berries and leaves which are required to sustain deer, turkey, squirrels and waterfowl. Though efforts are being made by the timber industry to preserve or renew hardwoods, the number of these trees has declined when compared to the size of pure pine forests.

▲ Stream channelization projects to provide rapid runoff of surface water have been developed in order to help prevent flooding in certain localized areas. These projects often have detrimental effects on wildlife habitat areas. The removal of trees during the process of channelization destroys the habitat of many wildlife species and virtually eliminates fish production in the body of water concerned. When utilized as a part of swamp or marsh drainage projects, channelization results in the deterioration of the habitat of waterfowl and marine life species.

The primary impact of the problems discussed in this section is negative in its effect on resource allocation and economic development. If adequate provisions are not made to protect these reminders of our heritage, many of these important cultural or natural resources will be lost or rendered useless. On the other hand, if they are overprotected in marginal situations to the detriment of a needed alternate land use, economic progress may be delayed.

Fishing

Land use practices which result in diminished fishing activity will have implications relative to both economic development and resource allocation. Without protection of the fishing and spawning areas in the State, sport and commercial fishermen alike will be deprived of an important natural resource. Additionally, both commercial fishing interests and those business establishments which serve the needs of sport fishermen will suffer economically. Some problematic issues worthy of note are:

▲ The ability of streams, rivers, estuaries, and bays to properly support good sport and commercial fishing activities is impaired in waters which have been polluted by the discharge of improperly treated wastes from domestic, municipal and industrial sources. This problem is now being somewhat alleviated through the development of progressive and effective pollution abatement programs being pursued by the Texas Water Quality Board.

Sport and commercial fishing have become endangered in some areas because certain inland and coastal waters are no longer capable of sustaining fish and other aquatic life at acceptable levels. A major factor in this deterioration has been poorly planned and executed dredging operations (a) to recover sand, shell, and gravel; (b) to

maintain navigation channels; (c) for industrial, commercial and residential development.

▲ Sport and commercial fishing in some areas are also endangered by drainage from agricultural lands whose crops have been treated with certain chemicals that are harmful to marine life. The lack of juvenile sea trout in the Laguna Madre appears to stem from DDT, which causes infertility. The source of this pesticide is the drainage of irrigation water from the Rio Grande Valley where large quantities of chlorinated hydrocarbons are used to spray crops.

In addition, there exists a threat to the health of persons who consume fish from this area. State Health Department standards have established a maximum ratio of 5 parts per million of DDT in food (fish). Periodic sampling and monitoring of fish from these waters indicate that this level has nearly been reached on several occasions.

X. CONCLUDING OBSERVATIONS

A steady rise in population, a pattern of urbanization and sprawling subdivisions, a mushrooming appetite for the outdoors, and economic expansion all consume our limited land resources. Consequently, an awareness of the fundamental importance of land use to the quality of man's life has increased significantly in recent years, for it is through his use of land that he makes his most direct and lasting impact on the quality of his natural environment. It is also the means whereby he shapes his cities and structures his own habitat.

The problems and issues which have been raised in the foregoing sections of this report have been varied, both in subject matter and in importance. We have examined problems related to the urban environment--the levels of noise, the degree of congestion, pollution of the water and air, time spent commuting between home and work, the cost of providing public services, the convenience of shopping, the nearness of recreation areas, the protection of outstanding ecological systems--in short, those elements which are now so much a part of contemporary life.

We have also seen that activities which may provide a personal or economic benefit to one group may result in a use of land which would be detrimental to others. Unique natural or recreational assets are lost to competing land uses. Prime agricultural lands are converted to subdivisions. Old city residential and commercial centers deteriorate into slums. Some zoning practices tend to reinforce social polarization. Urban sprawl frustrates mass transit and sewer services.

These and other issues have been identified, and methods of approach to their solutions are suggested in ensuing reports of this study. "Significant Policies" deals with present governmental land use policies; "Needs for the Future" with the need for improving existing approaches to land resource management; "Management Approaches" suggests some alternative approaches to improving land use management; and "Role of Planning" examines the role of land use planning and management in resolving these issues.

In this manner, factual information and objective interpretation of issues are presented with the expectation that they will provide a basis for action by those private citizens or public officials who will have the responsibility to make land management decisions in the future.