US Army Corps
of Engineers

Water Resources Development in Texas 1991

ON THE COVER: COOPER LAKE – The Cooper Lake and Channels Project, is a multi-purpose project located in northeast Texas. When complete, it will provide flood control to downstream agricultural lands and water supply to the North Texas Municipal Water District, the Sulphur River Municipal Water District and the city of Irving. The lake will also provide recreational opportunities to an estimated 1.2 million visitors annually.

WATER RESOURCES DEVELOPMENT

IN TEXAS 1991

Water resource activities assigned to the Corps of Engineers in the Southwest are administered by the Fort Worth, Albuquerque, Galveston, Little Rock, and Tulsa Districts. Together, the five districts comprise and are under the direction of the Southwestern Division, which has its office in Dallas, Texas. The division office reports to the Office of the Chief of Engineers in Washington, D.C. The following chapters contain short descriptions of civil works projects in Texas. For more complete information regarding any project, inquiries should be directed to the district engineer of the appropriate district. The name of the district with jurisdiction is indicated in the text of each project. Addresses of the district offices are given below.

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Dallas, Texas 75242-0216

U.S. Army Corps of Engineers
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Galveston, Texas 77553-1229

U.S. Army Corps of Engineers
ALBUQUERQUE DISTRICT
P.O. Box 1580
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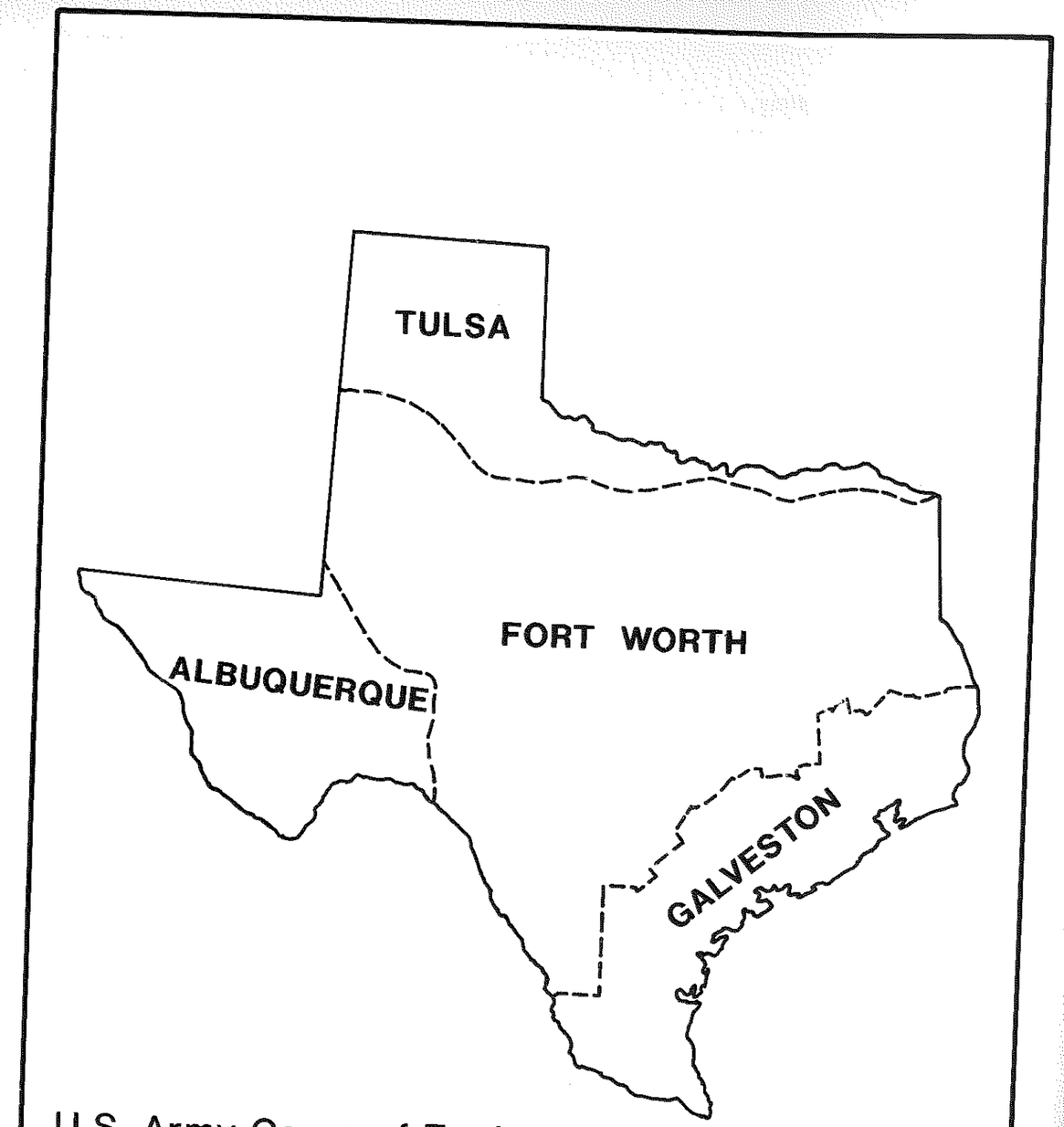
U.S. Army Corps of Engineers
LITTLE ROCK DISTRICT
PO. Box 867
Little Rock, Arkansas 72203-0867

U.S. Army Corps of Engineers
FORT WORTH DISTRICT
P.O. Box 17300
Fort Worth, Texas 76102-0300

U.S. Army Corps of Engineers
TULSA DISTRICT
P.O. Box 61
Tulsa, Oklahoma 74121-0061



U.S. Army Corps of Engineers
DISTRICT Boundaries
in the State of Texas

US Army Corps
of Engineers

To Our Readers:

For more than 216 years, the missions and accomplishments of the U.S. Army Corps of Engineers have closely reflected the needs and wants of a growing, changing nation. For much of this time, the Corps has played a major role in our nation's water resources development, including navigation, flood control, water quality and supply, recreation and related projects.

Although the driving force behind our water resources development mission has remained constant--there have been several challenging adjustments in how we meet this requirement.

One such change was the introduction of non--Federal cost sharing in the Water Resources Development Act. Though legislatively reaffirmed in the subsequent acts is 1988 and 1990, the true value of cost-shared development can be measured by the many successful projects of this partnership and the healthy water resources program it ensures for the future.

Another challenge we have faced recently is the increased public concern for their environment. We have always complied with environmental laws and regulations and managed our projects as a trust we hold for the future. Compliance, however, is no longer enough. We are taking an active position to not only protect but enhance our fragile environment.

The Secretary of the Army has been directed to include environmental protection as one of our primary missions, and the Water Resources Development Act of 1990 established a "no net loss" policy as an essential part of all water resources development. In addition to making environmental considerations as important as engineering and economic considerations for new start projects, we are taking a new look at existing projects to determine how they can be environmentally improved.

Looking ahead to the needs of our nation, we are taking a lead role in helping rebuild our nation's aging infrastructure. The U.S. Army Corps of Engineers has always been at the forefront of infrastructure development in the United States--exploring new territory for settlement, surveying transportation routes and opening rivers to navigation. While we work to restore and strengthen the vital links in our infrastructure, we are also exploring new methods to meet increasing and varying national requirements. One such effort is a joint Federal, non-Federal demonstration project to determine the feasibility of a U.S. developed and built high-speed magnetic levitation transportation system.

We have also been working actively with the construction industry on a cost-shared Construction Productivity Advancement Research Program. This program has the double benefits of increasing the U.S. construction industry's competitive ability in the international market while providing more effective techniques, equipment and processes for Federal and non-Federal projects in the United States.

With these initiatives, we are building on the Corps' traditions of professionalism and service to meet the needs of our nation for another 200 years. We are proud of the partnerships we have forged, and look forward to an exciting, rewarding future in water resources development.

This booklet is one in a series detailing water resources programs in the 50 states and U.S. possessions. I hope you find it interesting and feel some pride of its ownership.

H. J. HATCH
Lieutenant General, USA
Chief of Engineers

FORWARD

The U.S. Army Corps of Engineers has a long and proud history of applying its expertise in engineering and related disciplines to meet the Nation's needs. Over the years, those needs have evolved, from such 19th Century activities as exploration, path finding and lighthouse construction to such modern missions as hazards and toxic waste removal and environmental improvement. The central focus of its Civil Works mission, however, has, from its earliest days, been development of the Nation's water resources.

The water resource projects developed by the Corps of Engineers, in cooperation with the State and local project sponsors, have proven themselves time and again as wise investments of public funds, returning to the public in benefits--low cost transportation, flood damages prevented, etc.--far more than their cost to plan, build and operate. As a result, the Civil Works program enjoys a high degree of credibility within the Administration, and with Congress. With a program of more than $3.5 billion in Fiscal Year 1991, the Civil Works program was one of the very few "domestic discretionary" activities of the Federal government to receive an increase in funding that year.

Yet, proud as we are of the respect this program commands within the Federal government, we are even prouder of the trust that our partners--the States, local governments, port authorities, water management districts and other local project sponsors--place in us.

Each Corps of Engineers project is the product of an orderly study and design process. Under provisions of the Water Resources Development Act of 1986, sponsors demonstrate their commitment early in the project development process by agreeing to joint funding of the feasibility study upon which a project's construction authorization will be based, and to cost sharing of the project's construction once it is authorized. To date, more than 150 non-Federal sponsors have signed Local Cooperation Agreements for studies or congressionally authorized projects.

The engineering expertise and responsiveness of the Corps of Engineers, gained in the Civil Works and Support for Others programs as well as in its military construction role, has stood the Nation in good stead from Alaska, where it participated in the oil spill cleanup; to Puerto Rico, the Virgin Islands and the Southeastern States, where it spearheaded recovery efforts after Hurricane Hugo; to California in the aftermath of Loma Prieta Earthquake; to the Midwest and California as they deal with continuing drought; to Panama and the Middle East in Operations JUST CAUSE and DESERT SHIELD/DESERT STORM.; to dozens of other locations. Whatever challenges arise in the years and decades ahead, I have no doubt that the Army Corps of Engineers will be equal to the task.

G. EDWARD DICKEY
Acting Principal Deputy Assistant
Secretary of the Army (Civil Works)

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INTRODUCTION

INTRODUCTION

The U.S. Army Corps of Engineers is an engineer consultant agency to Congress. Most Corps' water resources projects are developed under specific congressional authorization. When local interests think a need exists for construction or improvement of a water resources project, they petition their representatives in Congress. The senator or congressman then requests that the appropriate congressional committee direct the Corps of Engineers to make a survey and determine if a viable solution exists. Authority for the survey study is provided either in the form of a resolution adopted by the appropriate Senate or House committee or by a congressional act. After approval, congressional appropriations are required to provide funding for the Corps to initiate the survey study.

With the passage of the Water Resources Development Act of 1986 (Public Law 99-662), new changes to the planning process occurred. The most significant is the two phase planning process: (1) reconnaissance phase and; (2) feasibility phase. The reconnaissance phase is all federally funded whereas the feasibility phase is cost-shared 50 - 50 by Federal and non-Federal interests. The Water Resources Development Act of 1988 Public Law 100-676) reaffirmed the increased cost sharing requirements of the Water Resources Development Act of 1986; and reestablished the two-year authorization cycle.

The reconnaissance phase has as its goals to identify a feasible project with Federal interest, and to identify a non-Federal interest to share the cost of feasibility studies and eventual construction.

The feasibility study assembles data that help to determine economic, environmental and engineering solutions of the problem and their associated impacts on the environment. During the preparation of the study, public meetings are held to determine the wishes of local interests. The desires of local interests are fundamental not only because of the effects of construction on the local area, but also because under specific conditions, the law requires them to participate in certain features of the project. During the preparation of the study, other Federal and non-Federal agencies concerned with any phase of the resources planning or development are contacted to avoid conflict with their program or to incorporate features of their program into Corps projects. When all the data are analyzed and determination made of the fullest possible use of the natural resources, the study with its recommendation is submitted to Congress. If approved, the recommended projects become authorized for construction by an act of Congress. After authorization, the projects still require congressional appropriations before preconstruction engineering and design can begin.

After a project has been authorized for construction and subsequently receives congressional appropriations, the project enters the preconstruction engineering and design stage. During this stage, detailed design is accomplished and plans and specifications are prepared for construction, of the project. After preconstruction engineering and design is completed, the project is eligible for consideration as a construction staff along with other worthy water resource projects throughout the nation.

Some studies are confined to a small area and have a comparatively simple solution. Other studies may involve a complex urban area or cover an entire river basin and require consideration of navigation, flood control, erosion control, hurricane flood protection, water supply, water quality control, hydroelectric power, streambed flow regulations, major drainage, irrigation, recreation, fish and wildlife mitigation and enhancement or other water and land use purposes.

After Congress makes funds available for construction, the Corps of Engineers prepares to award the first construction contract and supervise construction. The completed projects may be operated and maintained by the Corps or they may be transferred to another agency or to local interests to operate and maintain.

Congress has provided general authority in several laws which permit the Secretary of the Army and the Chief of Engineers to authorize projects of limited scope within fiscal year appropriations specified by law. These general authorities are briefly described below.

SMALL FLOOD CONTROL PROJECTS

Section 205, Flood Control Act of 1948 as amended

This legislation authorizes the Chief of Engineers to approve the construction of small flood control projects not specifically authorized by Congress. The Federal share in such projects may not exceed $5 million. These projects must constitute a complete solution to the flood problem involved so as not to commit the United States to additional improvements to ensure effective operation. Such projects are subject to the same requirement of feasibility and economic justification as the larger flood control projects which require specific authorization by Congress. Operation and maintenance of the project is a local responsibility once construction is completed.

SMALL NAVIGATION PROJECTS

Section 107, River and Harbor Act of 1962 as amended

This legislation authorizes the Corps of Engineers to construct small river and harbor improvement projects not specifically authorized by Congress when they will result in substantial benefits to navigation. The Federal share in such projects may not exceed $4 million and these projects must be complete within themselves and not commit the United States to any additional improvements to ensure successful operation. Such projects are also subject to the same requirements of feasibility and economic justification as the larger navigation projects which require specific authorization by Congress.

Based on current Federal budgets, this program is being phased out in order to concentrate limited resources on solutions to problems that are more clearly beyond the capability of local entities to carry out themselves. On this basis, no new projects are being considered at this time under this legislation.

SMALL BEACH EROSION CONTROL PROJECTS

Section 103, River and Harbor Act of 1962 as amended

This legislation provides for construction of small shore and beach restoration and protection projects not specifically authorized by Congress, when such works are advisable in the opinion of the Chief of Engineers. The Federal share in such projects may not exceed $2 million. These projects must be operationally complete within themselves. Such projects are subject to similar requirements of feasibility, economic justification and cost sharing as the larger shore and beach erosion restoration and protection projects which require specific authorization by Congress.

EMERGENCY BANK PROTECTION

Section 14, Flood Control Act of 1946 as amended

Under this authority, the Corps of Engineers may spend up to $500,000 in one locality during any one fiscal year for the repair, restoration and modification of emergency stream bank and shoreline protection to prevent damages to highways, bridge approaches and other public works endangered by bank erosion.

SNAGGING AND CLEARING – EMERGENCY WORK

Section 3, River and Harbor Act of 1945 as amended

This act authorizes the Corps of Engineers to undertake emergency work, within a limit of $1 million, to clear or remove unreasonable obstructions from rivers, harbors and other waterways in the interest of navigation.

Based on current Federal budgets, this program is being phased out in order to concentrate limited resources on solutions to problems that are more clearly beyond the capability of local entities to carry out themselves. On this basis, no new projects are being considered at this time under this legislation.

SNAGGING AND CLEARING

Section 208, Hood Control Act of 1945 as amended

The Corps of Engineers is authorized under this act to spend up to $500,000 on any single tributary during any one fiscal year for removal of accumulated snags and other debris, and for the clearing and straightening of stream channels when the Chief of Engineers determines such work is in the interest of flood control.

FLOOD AND COASTAL STORM EMERGENCIES

33 U.S.C. 701n, 69 Stat. 186, Public Law 84-99 as amended

An emergency fund authorized to be expended at the discretion of the Chief of Engineers for: flood emergency preparation; flood fighting and rescue work; repair or restoration of flood control works threatened, damaged, or destroyed by flood; emergency protection of federally authorized hurricane or shore protection projects damaged or destroyed by coastal storm. The law, as amended, includes provision of emergency supplies of clean water where sources are contaminated and authorizes the construction of wells and the transport of water within drought areas. Emergency assistance is supplemental to state and local efforts and repair projects are subject to cost sharing (80 percent Federal/20 percent non-Federal).

REMOVAL OF WRECKS AND OBSTRUCTIONS

Public Law 55-189 as amended

Under this law, the Corps of Engineers is authorized to investigate wrecked vessels and other obstructions to navigation, and to ensure removal at the expense of the owner. Under certain specific conditions, the Federal government may assume the expense.

FLOOD PLAIN MANAGEMENT SERVICES

Section 206, Flood Control Act of 1966 as amended

This legislation provides authority for the Corps of Engineers to compile and disseminate requested information to states and local communities to aid them in providing for the use and regulation of flood plain areas. The work done by the Corps under this authority involves surveying and mapping of flood plain areas, hydrology and frequency studies necessary to establish the flood damage potential, flood heights and the extent of inundation of the flood plain areas involved. Except in special cases, work under this program has been replaced by studies conducted under the National Flood Insurance Program. The Water Resources Development Act of 1990 modified the previous authority to require recovery of the costs of flood plain studies done by the Corps of Engineers for other Federal agencies or private individuals or institutions. The cost of such studies must be fully reimbursed by the recipient. studies for state or local government agencies may still be accomplished at Federal expense, provided that funds are available.

TECHNICAL AND PLANNING ASSISTANCE SERVICES

The Corps under the Flood Plain Management Services Program provides technical and flood plain management planning assistance to state and local governments upon request. The assistance activities include:

1) evaluation of flood hazards;
2) floodway determinations;
3) assistance in the preparation of rules and regulations for flood proofing;
4) architectural and engineering assistance for flood proofing;
5) assistance in the preparation of flood emergency preparedness plans;
6) flood hazard evaluations to comply with the Executive Order 11988;
7) assistance in the preparation of regulations for flood hazard areas and;
8) other flood-related issues, such as hydrology studies and coordination, urbanization effects on stream flows and flood damages

The information and guidance are intended for wise and informed decision making at the local level. Technical services and guidance constitute a major portion of the total effort. Contacts with local governments are encouraged not only because of specific concern with floods but also as they relate to local planning problems and the preparation of flood plain regulations. Professionals and elected officials are assisted in interpreting flood data. The limits of the flood areas and corresponding flood heights of specific design floods are defined. Where reports are not available, technical assistance can involve a comparably short, localized study to provide the essential information. Such assistance is also provided Federal agencies. Assistance to private organizations and individuals is limited to provision and interpretation of available information. The cost recovery provisions described above for the Flood Plain Management Services program are also applicable to the Technical Services Program.

FLOOD INSURANCE STUDIES

Prior to the authorization of the National Flood Insurance Program in 1968, the Department of Housing and Urban Development concluded an agreement with the Corps of Engineers whereby the latter agency was authorized to conduct pilot studies in seven areas chosen nationwide. The purpose of

these studies was to determine the feasibility of establishing a government-sponsored flood insurance program.

Responsibility for administration of this program was transferred to the Federal Emergency Management Agency in 1979.

Under the National Insurance Act of 1968 (Public Law 90 448), FEMA is authorized to establish and carry out the National Flood Insurance Program. Under this act, FEMA makes studies and investigations to establish the risk premium rates for flood insurance in communities. In carrying out this responsibility, FEMA is authorized to use the services of the Department of the Army, Department of the Interior, Department of Agriculture, Department of Commerce and Tennessee Valley Authority to the maximum extent feasible on a cost reimbursable basis.

In response to requests from FEMA, the Corps of Engineers prepare flood insurance studies which include hydrology, hydraulics, surveying, flood elevations, insurance zone determinations and report preparation. Based on these reports, FEMA then prepares flood insurance rate maps for each individual community studied.

At the initiation of the National Flood Insurance Program, flood insurance studies conducted by the Corps of Engineers generally were limited by FEMA to single governmental units such as incorporated communities or the unincorporated areas within a county. As the program progressed, FEMA requested that the Corps of Engineers undertake studies of a larger scope. The first of these studies was initiated in January 1976 by the Galveston District and covered Harris County, Texas. Thirty reports were completed during this study of the 1,732 square mile county area, including one on Houston, the nation's fifth largest city (1980 census). This approach to flood insurance studies not only incorporated economies of scale, but also contributed to greater accuracy in the flood information developed by the study. This is generally true because study units were increased to entire watersheds instead of limited stream segments. Using this approach, the Galveston District conducted a flood insurance study of a major portion of Brazoria County, Texas. The Fort Worth District has completed similar studies for Dallas, Tarrant, Tom Green, Travis and other counties.

During FY 92 all mapping required for local communities and county governments to enter into the regular phase of the Flood Insurance Program (FIP) will be complete. The FIP will then be in the maintenance phase and maps will be updated as needed when heavy development or other conditions dictate a change.

COMPREHENSIVE PLANNING COOPERATION

Planning Assistance to States Program
Section 22, Public Law 93-251

This legislation provides for authority for cooperating with any state in preparation of comprehensive plans for the development, utilization, and conservation of the water and related resources of basins located within the boundaries of such state. In September of 1983, the State of Texas through the Texas Department of Water Resources requested that a program be initiated in fiscal year 1984 to conduct a series of studies of designated high flood hazard areas. The Corps of Engineers is conducting studies of high flood hazard areas in selected communities in Texas. The principal purpose of these analyses is to identify and collect pertinent data on potential flood problem areas, The data collected is intended to aid the state and local communities in the best use of flood prone areas and evaluate solutions to alleviate local flood problems. The State of Texas plans to use the reports as a base to provide leadership and assistance to communities in the abatement and prevention of flood damage and related problems. The reports will also be used to assist in the establishment and administration of flood plain management activities throughout the State. This planning program has recently been expanded to include aquatic habitat analysis for reservoir projects and coastal planning issues such as beach erosion.

The Water Resources Development Act of 1990 (PL 101-640) required cost sharing by the states participating in this program. The State of Texas will pay 10, 30 and 50 percent of study costs in 1991, 92 and 93 respectively. After 1993 the state's share will remain constant at 50 percent.

CONSTRUCTION OF RECREATION FACILITIES

Public Law 89-72

One of the main purposes of Public Law 89-72 is to encourage non-Federal public bodies to administer

project lands and water areas for recreation and fish and wildlife enhancement purposes; specifically, to share construction costs and to operate, maintain and replace facilities provided for these purposes in conjunction with Federal water resource projects. On new projects, Federal participation in the development of recreation facilities is limited by the nature and extent of the benefits, and the degree to which the facilities use the opportunities created by the water resources project. When the recreation benefits derived are primarily local and involve extensive construction, the relative importance of the land and related water resource is diminished, thereby reducing Federal interest.

If a satisfactory agreement for local participation in recreation development at new reservoir projects does not exist, recreation facilities provided by the Federal government are limited to the minimum needed for public health and safety.

REGULATORY FUNCTIONS

The Corps of Engineers exercises regulatory authority over work in or affecting navigable waters of the United States under Section 10 of the River and Harbor Act of 1899 and the construction of any dam or dike across such waters under Section 9 of the Act. In addition, the Corps regulates the discharge of dredged and fill material into all waters of the United States under Section 404 of the Clean Water Act and the transportation of dredged material for the purpose of ocean dumping under Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972. Other laws directly related to the procedures for processing permit applications include the Fish and Wildlife Coordination Act of 1958, National Environmental Policy Act of 1969, Coastal Zone Management Act of 1972, National Historic Preservation Act of 1966 and Endangered Species Act of 1973.

Permits issued by the Corps of Engineers are typically required for structures or activities such as dams, piers, wharfs, docks, mooring buoys, excavation, filling, disposal of dredged material, riprap, groins, cables over the water, fishing reefs, bank stabilization, clearing and snagging, channel connection, intake and outfall pipes, navigational aids, and transportation of dredged material for ocean dumping and similar activities.

Navigable waters of the United States are those which are subject to the ebb and flow of the tide and are susceptible to use for interstate or foreign commerce. The concept of what constitutes navigable waters of the United States has become very broad through administrative and judicial interpretation. In administration of the permit program, the Corps considers permits required for work on structures in all tidal areas below the plane of mean high water. In non-tidal rivers, streams, lakes and isolated bodies of water (i.e., playa lakes) which have evidence of past, present or potential use for interstate or foreign commerce, a Corps of Engineers permit is required for activities or structures below the ordinary high water mark.

Waters of the United States include all navigable waters described above including adjacent wetlands, all tributaries to navigable waters including adjacent wetlands, interstate waters and their tributaries including adjacent wetlands, all other waters such as isolated wetlands, intermittent streams, prairie potholes or playa lakes and other waters whose degradation or destruction of which could effect interstate commerce.

The Corps of Engineers evaluates each permit application to determine the benefits which reasonably may be expected to accrue from the proposal. Such benefits are then balanced against potential damages or losses. In applying the general balancing process, all factors which may be relevant to the proposal are considered. Among the factors considered are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shore erosion and accretion, recreation, water supply, conservation, water quality, energy needs, safety, food and fiber production, mineral needs and consideration of property ownership; in general, the needs and welfare of the people. A permit will be granted unless the district engineer determines that it would be contrary to the public interest.

RECREATION AND RESOURCE MANAGEMENT

The Corps of Engineers' civil works program also encompasses recreation and resource management of the waters and lands of projects. This authority has been granted by Congress to the Secretary of the Army and through this office to the Chief of Engineers, under the directive of laws dealing with public recreation and the conservation, management and enhancement of fish and wildlife.

As the demand for recreation opportunities continues to grow, the Corps of Engineers' twin tasks of recreation and resource management assumes a greater importance. To meet this challenge, the Corps of Engineers' philosophy emphasizes diversification in recreation opportunities to satisfy as many different types of users as possible while balancing these needs against the need to preserve and enhance the environment.

A protected natural environment is not only the key to public enjoyment, but is also necessary for the sound functioning of the project ecosystem.

INVENTORY AND INSPECTION OF DAMS

National Dam Inspection Act of 1972
Public Law 92-367 as amended

Public Law 92-367 authorized the Secretary of the Army, acting through the Chief of Engineers to undertake a national program to inventory all Federal and non-Federal dams and to inspect non-Federal dams.

The law applies to all dams that are 25 feet or more in height or which impound more than 50 acre-feet of water. Excluded are dams which are less than six feet in height, regardless of storage capacity, or have a storage capacity of less than 15 acre-feet, regardless of height. The law authorized the Chief of Engineers to inspect all dams in the United States, except for certain dams already being inspected by Federal agencies and those which do not pose any threat to human life and property.

Before December 1, 1977, the activities performed under authority of Public Law 92-367 consisted of developing a national inventory of dams and conducting a survey of each state and Federal agency's capabilities, practices and regulations regarding the design, construction, operation and maintenance of dams. No inspections were actually performed. While the National Dam Inspection Act of 1972 provided for the inspection of non-Federal dams, funds were not provided for such inspections. The activities performed by the Fort Worth District, Corps of Engineers under the National Dam Inspection Program consisted of compiling an inventory of about 4,200 dams within the state of Texas.

The collapse of Kelly Barnes Lake Dam near Toccoa, Georgia on November 6, 1977, which caused the loss of 39 lives, prompted President Carter to pledge that the non-Federal dam inspections would not be postponed any further. On December 2, 1977, the President announced that he had directed the Secretary of the Army to begin at once the inspection of more than 9,000 non-Federal dams which, if they were to fail, would present a high potential for loss of life and property. He stated that the inspection program would be administered by the Corps of Engineers and would take approximately four years for completion.

The objectives of the National Dam Inspection Program were to: (1) perform technical inspection and evaluation of non-Federal dams; (2) identify actual hazardous conditions to permit timely connection by non-Federal interests; (3) provide data for a better definition of viable dam safety program and (4) encourage and prepare states to initiate quickly an effective dam safety program for all non-Federal dams.

The inspection program for the non-Federal dams in Texas was initially administered by the Fort Worth District, Corps of Engineers. The Fort Worth and Galveston Districts, the state of Texas (Texas Department of Water Resources) and architect/engineering firms, under Corps of Engineers supervision, conducted initial inspections. Involvement by the Texas Department of Water Resources increased as it took more responsibilities for performing inventory and inspection activities. Total inventory activities as of October 1, 1981 resulted in verifying or revising data for 4,237 known dams and adding 1,310 dams to the inventory for a total of 5,547. As of October 1, 1981, 515 dams had been inspected and evaluated. Of these 515 dams, it was determined that 130 dams were hydraulically inadequate. However, there are no indications that these dams are unsafe as designed and constructed. Design criteria in use when these dams were designed and built is deficient in comparison with today's standards. Remedial measures were recommended to eliminate the potential for over-topping of these dams. As of October 1, 1981, the Corps no longer has responsibilities under the National Dam Inspection Program.

LEVEE REPAIRS

Flood Control Act of August 1941

Emergency levee repairs authorized by the 1941 Flood Control Act were initiated in Texas in 1944. Approximately $7.0 million has been expended since 1944 on emergency levee repairs in the Trinity River watershed by the Corps of Engineers. The repaired levees afford protection to real property amounting to $50 million. Another $579,200 has been spent on emergency levee repairs in the Brazos River basin. No monetary value has been set on local cooperation, rights-of-way, etc.

During the flood seasons of 1957 and 1958, the Corps of Engineers expended $171,000 in flood fighting work and compiling post-flood data, mostly on the East Fork of the Trinity River. Completed levee repairs in levee improvement districts along the Trinity basin in Dallas, Kaufman, Henderson and Navarro Counties during this period totaled $401,660. Brazos River repairs during the same period totaled $18,587.

In 1958, the Corps of Engineers constructed flood protection works consisting of levees and floodwalls along the Sabine River from Little Cypress Bayou to the lower end of the U.S. Navy Station at Orange. This work was financed by the U.S. Navy. Cost was $213,700. The works provide a considerable measure of flood protection to the city of Orange as well as affording protection to the Naval Station.

Following Hurricane Carla in September 1961, levee repairs were made by the Corps of Engineers under Public Law 99, at three locations. Severe damage was repaired on the Freeport levee in Brazoria County, and the levee was also extended to afford better protection. Federal funds in the amount of $1.3 million were spent on the work. Emergency repairs were also made on a flood protection levee on the west side of Port Acres in Jefferson County at a cost of $33,888. In Matagorda County, emergency repairs were made by the Corps of Engineers to a recently completed ring levee around the city of Matagorda at a cost of $74,921.

In 1962, the Corps of Engineers completed repairs to a levee at Victoria, Texas, which was undetermined and damaged by floods on the Guadalupe River in November 1960. The levee was relocated and restored at a Federal cost of $11,023.

In 1976, the Corps of Engineers completed repairs to the drainage structure and concrete lined channels in Harris County, which had been damaged by floods. Cost to the Federal government was $2.3 million.

In 1976, the Corps of Engineers completed repairs to a local protection levee at Liberty, Texas, which had been breached and damaged by floods on the Trinity River in 1973. Cost to the Federal government was $658,115.

In 1977, the Corps of Engineers completed repairs to the levees on the channel to Victoria which had been breached and damaged by floods on the Guadalupe River. Cost to the Federal government was $44,095.

In 1978, the U.S. Army Corps of Engineers completed repairs to levees in Ellis County which had been damaged by floods in the Trinity River Basin. The total cost to the Federal government was $239,858.

The levee, constructed by the Ellis County levee Improvement District No. 4, is located about seven miles south of Ennis, Texas. Following floods occurring on October 18-19, 1985, the Corps of Engineers again rebuilt damaged levees in Ennis County. The work was completed in August 1986.

In September 1966, a levee was constructed along a 1.27 mile segment of Big Fossil Creek, a tributary of West Fork, Trinity River, in the city of Richland Hills, Texas. This improvement was one of several construction features in which the Federal cost was $1.9 million and non-Federal share $200,900.

In 1983, the Corps of Engineers completed repairs to levees along the Sulphur River which had been damaged by floods in 1981 and 1982.

In 1989 the Corps of Engineeers initiated repairs to levees along the East Fork and Trinity Rivers which were damaged by flooding in May and June 1989. The total cost to the Federal Government was $542,000.

Repairs to the levees damaged during 1989 were nearing completion when flooding during May and June 1990 damaged the levees as well as many others or the East Fork Trinity and Trinity Rivers. Following the 1990 flood, the Corps of Engineers initiated repairs on thirteen levees contained in twelve levee districts and one city located along the Trinity River basin in Cooke, Dallas, Ellis,

Henderson, Houston, Kaufman, and Navarro counties. The total cost to the Federal Government was $3.4 million.

Through the year contact is maintained with the local interests by periodic inspection of the levees to document their condition, operation and maintainance. To qualify for Federal assistance, the owner/operator of the levee must maintain the levee in accordance with guidelines provided by the Government.

ENVIRONMENTAL PROTECTION MISSION

Section 306, Water Resources Development Act of 1990

The passage of the Water Resources Development Act of 1990 (WRDA 90) added new areas of responsibility in water resource development for the Corps. Environmental protection has been elevated to primary mission status, on equal footing with navigation and flood control, and is to be considered in planning, designing, constructing, operation, and maintaining water resource projects. Under the general requirement that projects enhance the quality of the total environment, preservation and enhancement of the environment are identified as specific factors to be addressed in planning.

WETLANDS

Section 307, Water Resources development Act of 1990

As part of the Corps water resources development program, WRDA 90 established an interim goal of no overall net loss of the Nation's wetland base, as defined by acreage and function. The long term goal is to increase the quality and quantity of wetlands. The Wetland Restoration and Enhancement Demonstration Program is authorized to establish a limited number of demonstration wetlands restoration, enhancement, and creation areas in districts of the Corps for the purpose of evaluating the technical and scientific long-term feasibility of such areas as a means of contributing to the attainment of the wetland goals.

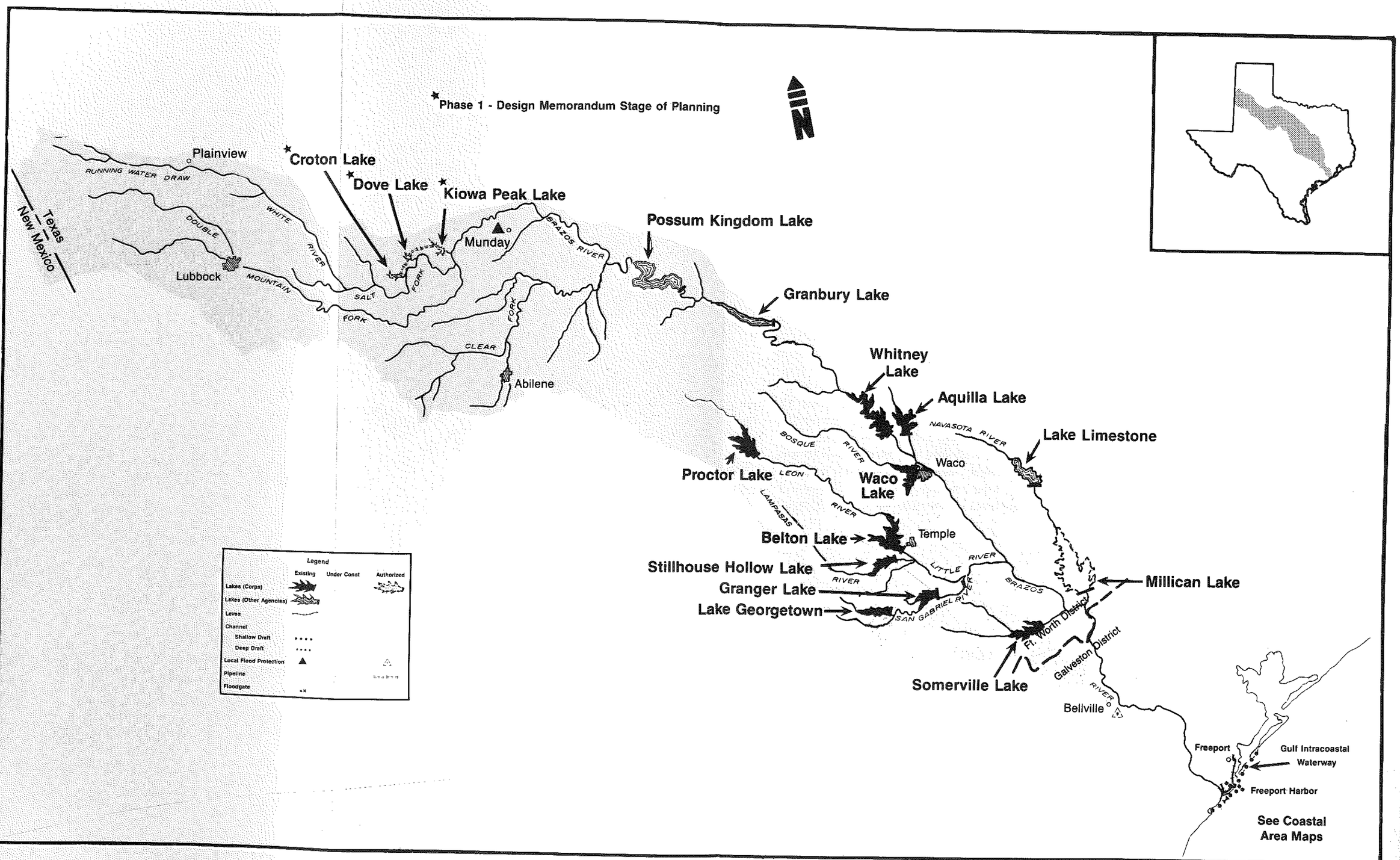
PROJECT MODIFICATIONS FOR IMPROVEMENT OF ENVIRONMENT

Section 1135, Water Resources Development Act of 1986, amended WRDA 90, Section 304

This legislation authorizes the review of the operation of water resources projects to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest. This program authorizes making such modifications in structures and operations of water resources projects which are feasible and consistent with the authorized project purposes. A feasibility study for such a project is currently in progress for Lake o' the Pines, in the Red River Basin.

BRAZOS RIVER BASIN

Brazos River Basin



BRAZOS RIVER BASIN

The Brazos River watershed extends from eastern New Mexico southeasterly across the state of Texas to the Gulf of Mexico. It has an overall length of about 640 miles, a maximum width of 120 miles, and a total area of about 44,600 square miles, of which 1,800 square miles are in New Mexico.

The Brazos River, the longest of the eight major rivers in Texas, is formed by the confluence of Salt Fork and Double Mountain Fork near the eastern boundary of Stonewall County at a distance of about 923 river miles above its mouth. The Brazos River and tributaries flow southeastward from the High Plains for 1,210 river miles, entering the Gulf of Mexico at Freeport, southwest of Houston.

The Brazos River has seven principal tributaries. Two of these, Salt Fork and Double Mountain Fork, are the headwater tributaries that join to form the main stem. The other principal tributaries joining the Brazos River are, in downstream order, the Clear Fork, Bosque River, Little River, Yegua Creek and Navasota River.

Whitney, Belton, Proctor, Waco, Somerville, Granger, Georgetown, Aquilla and Stillhouse Hollow dams and lakes have been completed and are in operation by the Corps of Engineers in the Brazos River Basin. Of these, Whitney Dam was authorized by the Flood Control Act of August 1941. Belton was authorized by the Flood Control Act of July 1946 and modified by the Act of September 1954. The Flood Control Act of 1954 authorized construction of the Proctor, Waco, Somerville and Stillhouse Hollow projects which were built in cooperation with the Brazos River Authority, an agency of the state of Texas. Two other projects, Ferguson and Laneport dams were also authorized by the 1954 act.

A restudy of the Ferguson project resulted in the authorization of two lakes in lieu of Ferguson Lake by the Flood Control Act of 1968. These are the Millican and Navasota Lakes, neither of which have been constructed. Navasota Lake has been deauthorized.

The Aquilla Dam and Lake was also authorized for construction by the Flood Control Act of 1968. Aquilla Lake construction was completed in 1983 and deliberate impoundment of water began in April of that year. The lake reached conservation level in March 1985.

A restudy of the Laneport project resulted in the authorization, in the Flood Control Act of 1962, of two additional dams - one on the north fork and one on the south fork of the San Gabriel River, together with modification of Laneport Lake for flood control, water conservation and recreation. In accordance with Public Law 93-631 dated January 3, 1975, Laneport was renamed to Granger Dam and Lake, and Public Law 96-575 dated December 22, 1980, renamed North Fork Lake to North San Gabriel Dam and Lake Georgetown. Construction has not been funded for South Fork Lake.

A channel improvement project for the city of Abilene was authorized in 1964. The project was deauthorized in 1977.

The Water Resources Development Act of 1976 authorized a Phase I study for the Natural Salt Pollution Control Project in the Brazos River Basin.

COMPLETED FEDERAL PROJECTS

Aquilla Lake
Belton Lake
Lake Georgetown
Granger Lake
Proctor Lake
Somerville Lake
Stillhouse Hollow Lake
Waco Lake
Whitney Lake

AUTHORIZED FEDERAL PROJECTS

Millican Lake
Natural Salt Pollution Control Project - Phase I Study

COMPLETED NON-FEDERAL PROJECTS

Abilene Lake
Alcoa Lake
Brazoria Lake
Bryan Utilities Lake
Camp Creek
Cisco Lake
Daniel Lake
Davis Lake
Fort Phantom Hill Lake
Graham Lake
Lake Creek
Lake Stamford
Limestone
Mexia Lake
Millers Creek Lake
Mineral Wells Lake
Palo Pinto Lake
Pat Cleburne Lake
Possum Kingdom Lake
Smithers Lake

Granbury Lake
Hubbard Creek Lake
Kirby Lake
William Harris Lake
Squaw Creek Lake
Sweetwater Lake
White River Lake

FLOOD INSURANCE STUDIES

Albany	December 1984
Granbury	July 1986
Brazos County	1986
Roscoe County	1987
Plainview	1987
Austin County	1988
Whitney LMMP	1988

ACTIVE PLANNING STUDIES

Little River Watershed
Abilene, Texas, Local Flood Protection
Graham, Texas, Local Flood Protection
Bosque Lake

HIGH FLOOD HAZARD AREA STUDIES

Abilene	1985
Round Rock	1986
Williamson County	1986
Albany	1988
Parker-Brazos River	1988
Breckenridge	1988
Graham	1988
Shackelford	1988
Stephens	1988
Young	1988
Lake Jackson	1988

FLOOD PLAIN INFORMATION REPORTS

Reconnaissance Report- Brushy Creek, Round Rock	February 1982
Reconnaissance Report- Lake Creek, Round Rock	February 1982

AQUILLA LAKE

Fort Worth District

The dam is located at mile 23.3 on Aquilla Creek in Hill County, 10.2 miles southwest of Hillsboro, Texas.

It is a multipurpose project for flood control, water supply, and recreation, including fish and wildlife enhancement. Aquilla Lake was formed by an earth-fill dam approximately 11,890 feet long and a maximum height above the streambed of 104.5. A 1,200-foot overflow spillway is located on the left abutment. At top of conservation pool, elevation 537.5, the lake covers 3,280 surface acres. At top of flood control pool, elevation 556.0, the lake would cover 7,000 surface acres.

Total storage capacity is 146,000 acre-feet. Of this 86,700 acre-feet is allocated to flood control storage, 33,600 acre-feet for conservation storage and 25,700 acre-feet are for sediment reserve, On June 29, 1976, the Assistant Secretary of the Army approved a contract which authorized the Brazos River Authority to utilize the conservation storage space in the lake.

The approximate cost of this project was $46.1 million.

Construction began in July 1977 with the relocation of FM Highway 310, and was completed in 1983.

Deliberate impoundment began in April 1983. The project was dedicated in 1985.

Aquilla Lake has five access areas with only minimal development including restrooms, parking areas, and two boat ramps.

The cumulative damages prevented through December 1990 amounted to $5.1 million.

During 1990 the visitation was 95,900 recreation days of use.

BELTON LAKE

Fort Worth District

The lake is located on the Leon River near Belton and Temple, Texas. The length of the dam is 3,800 feet. The maximum height above streambed is 192 feet. A 1,300-foot spillway is located on the left abutment.

The lake controls floods from 3,560 square miles of drainage area. It contains 372,700 acre-feet of conservation storage space, 640,000 acre-feet of flood control storage space and an additional 84,900 acre-feet of storage space for sediment reserve.

At top of conservation pool, elevation 594.0, the lake covers 12,300 surface acres. At top of flood control pool, elevation 631.0, the lake would cover 23,600 surface acres.

Construction of the project began in 1949 and was completed in 1954. The initial Federal project cost was $13.6 million. Modification of the existing lake to raise the conservation pool 25 feet was essentially completed in 1972 at an estimated Federal cost of $2.2 million. Belton Lake provides flood control for the Leon and Little River watersheds. In the spring of 1957 alone, it prevented $10.9 million in damages. The cumulative damages prevented through December 1990 amounted to $127.4 million.

The Brazos River Authority has contracted for storage rights to the bulk of the conservation storage space, of which a maximum 45,000 acre-feet are earmarked by Congress for irrigation or municipal industrial uses in the Leon, Lampasas and Little River valleys. Of the balance of the conservation storage, 12,000 acre-feet have been allocated for water supply purposes for Fort Hood and 131 acre-feet for the city of Temple, Texas.

Belton Lake, with an average depth of 28 feet and 136 miles of shoreline has 14 public use areas and provides a variety of recreational activities such as boating, fishing, swimming, skiing, picnicking and camping. The project is also managed for wildlife with 3,900 acres open for hunting.

During 1990, the visitation was 2,321,800 recreation days of use.

COASTAL PROJECTS

Galveston District

See the Section titled *Coastal Areas* for information on shallow draft and deep draft navigation projects and Federal flood protection projects.

GRANGER LAKE

Formerly Laneport Reservoir
Fort Worth District

The dam is located on the San Gabriel River about seven miles east of Granger, Texas. Granger Lake is part of a three project system which includes Lake Georgetown and South Fork Lake (not yet constructed) for flood control on the San Gabriel River.

The project provides flood control, water conservation, general recreation, fishing and hunting. Construction activities began in October 1972 and the ,project was placed in operation on January 21, 1980.

The dam, including the spillway, is 16,320 feet long with a maximum height of 115 feet. At top of conservation pool, elevation 504.0, the lake covers 4,400 surface acres. At top of flood control pool, elevation 528.0, the lake will cover 11,040 surface acres. The lake has a total storage capacity of 244,200 acre-feet. Of this amount, 162,200 acre-feet is for flood control storage, 37,900 acre-feet is for conservation storage (all under contract with Brazos River Authority) and 44,100 acre-feet is allocated to sediment reserve.

The project cost $62 million. Average annual benefits are estimated at $7 million. Flood damages prevented through December 1990 are $19.2 million. Texas Parks and Wildlife Department manages 10,600 acres of land outside the parks for wildlife and hunting recreation. Hunting and fishing are allowed under state laws for Williamson County, Texas. In 1990, the visitation was 206,200 recreation days of use.

LAKE GEORGETOWN

Formerly North Fork Lake
Fort Worth District

The dam is located on the north fork of the San Gabriel River about 3.5 miles west of Georgetown, Texas, in Williamson County. Lake Georgetown is part of a three-project system for flood control on the San Gabriel River. The other two projects in the system are Granger Lake and South Fork Lake.

Construction on the Lake Georgetown project began in October 1972 and the project was placed in operation on March 3, 1980. Construction was completed in fiscal year 1982.

The dam has a length of 6,947 feet (including spillway) with a maximum height of 165 feet. At top of conservation pool, elevation 791.0, the lake covers 1,310 surface acres and provides 29,200 acre-feet of conservation storage which is under contract to the Brazos River Authority. At top of flood control pool, elevation 834.0, the lake covers 3,220 surface acres and provides 87,600 acre-feet of flood control storage. Sediment reserve is 14,000 acre-feet. The cost of the project was approximately $38.8 million, Average annual benefits are $658,000. Cumulative flood control benefits through December 1990 are $5.4 million. In 1990, the visitation was 589,400 recreation days of use.

STILLHOUSE HOLLOW LAKE

Formerly Lampassas Reservoir
Fort Worth District

The dam is located at river mile 16.0 on the Lampasas River about five miles southwest of Belton, Texas. The project is located within Bell County. The lake provides flood control and future water storage facilities for he surrounding central Texas area. It provides flood protection to about 1,400 acres of land along the Lampasas River below the dam and reduces flood damages to about 69,100 acres of land along the Little River and to about 1.1 million acres along the Brazos River below the mouth of the Little River.

The Lampasas River watershed is about 80 miles long and 10 miles wide and has a drainage area of 1,508 square miles. Approximately 80 percent of the area (1,318 square miles) is controlled by the Stillhouse Hollow Dam. The principal tributaries of the Lampasas River are Salado, Sulphur, Simms and Bennet Creeks.

The dam is an earth-fill embankment, including a separate outlet works, with an uncontrolled spillway section located within the right abutment of the dam. The overall length of the dam, including the spillway and dike section, is 15,624 feet. The dam has a maximum height of 200 feet above the streambed.

At elevation 622.0 top of conservation pool, the lake has 204,900 acre-feet of storage capacity for conservation purposes and covers a surface area of 6,430 acres. At elevation 666.0, top of flood control pool, the lake has flood control storage capacity for 390,600 acre-feet and would cover a surface area of 11,830 acres. An additional 34,900 acre-feet is for sediment reserve. On April 13, 1962, the Secretary of the Army approved a contract which authorized the Brazos River Authority to utilize the conservation storage capacity in the lake.

Construction of Stillhouse Hollow Dam began in July 1962 and impoundment of water began in February 1968. The initial Federal cost of the project was $19.9 million. The savings in flood control benefits through December 1990 were $28.1 million.

Stillhouse Hollow has an average depth of 37 feet and 58 miles of shoreline. There are six developed park areas for recreational use. There are 4,581 acres in six areas available for hunting or nature and wildlife observation.

In 1990, the visitation was 616,000 recreation days of use.

WACO LAKE

Fort Worth District

The dam is located on the northwest edge of Waco, Texas, in McLennan County, below the confluence of the North, South and Middle Bosque Rivers and controls run-off from 1,670 square miles of drainage area.

The multipurpose flood control and water conservation lake incorporates the former Lake Waco. The city of Waco turned over to the Federal government its interest in the former Lake Waco in exchange for an equivalent amount of conservation storage in the new lake. The city also contracted with the Brazos River Authority, official agents for the state of Texas in the project, for purchase of an additional amount of storage allocated to conservation storage.

The project has an earth-fill dam with a concrete spillway on its left bank. The dam, including the spillway, is 24,618 feet long and has a maximum height above streambed of 140 feet. The lake has 104,100 acre-feet of conservation storage capacity (elevation 455.0); 553,300 acre-feet of flood control storage capacity (elevation 500.0); with an additional 65,100 acre-feet of storage capacity for sediment reserve. At top of conservation pool elevation, the lake covers a surface area of 7,270 acres and, at flood pool elevation, the lake would cover a surface area of 19,440 acres. On September 28, 1984, the Secretary of the Army's office approved an additional contract with the Brazos River

Authority which provides for the conservation pool to be raised to 462.0, creating an additional 47,526 acre feet of storage for water supply purposes. The Brazos River Authority will bear all costs related to this action. The date for the modification to begin will be selected by them.

Construction of the first portion of the dam began in July 1958 and the project was placed in operation in February 1965.

The initial Federal cost of the project was $49.5 million, including $250,000 contributed by local interest and $2.5 million other non-Federal costs.

The savings in flood control benefits through December 1990 were $71.2 million.

Waco Lake has an average depth of 21 feet and 60 miles of shoreline. There are eight developed public use areas with facilities for both day use and overnight camping. There are two areas, comprising about 3,000 acres, which are available for hunting and nature observation.

In 1990 the visitation was 2,028,000 recreation days of use.

WHITNEY LAKE

Fort Worth District

Whitney Lake was the first Corps of Engineers project completed in the Brazos River basin starting with construction in May 1947 and deliberate impoundment of water in December 1951. The dam is located 19 miles southwest of Hillsboro, Texas. State Highway 22 is routed across the dam and a portion of the embankment.

The dam consists of a concrete gravity structure flanked by compacted earthen embankments. The overall length is 17,695 feet including 1,674 feet in the concrete section, 8,201 feet in the embankment section and 7,820 feet of dikes. It is 159 feet high at the highest point. The spillway section is located across the streambed and is controlled by 17 tainter gates, each 40 feet wide by 38 feet high. Sixteen conduits, 5 feet wide and 9 feet high, control low flow discharges through the dam itself. Two penstocks, 16 feet in diameter, guide the flow of water through two 15,000 kilowatt generating units.

The lake has a storage capacity of almost 2 million acre-feet which includes 1.6 million acre-feet for flood control and 133,900 acre-feet for conservation. The conservation storage consists of 381,900 acre feet for power and 245,200 acre-feet for sediment and power head. Within the conservation storage, there is also an amount of 50,000 acre-feet of water supply currently under contract to the Brazos River Authority. At top of conservation pool, elevation 533.0, the lake covers 23,560 surface acres.

At the top of the flood control pool, elevation 571.0, the lake would cover 49,820 surface acres.

Whitney Dam is a multiple-purpose project for flood control, water conservation, generation of hydroelectric power and other purposes. This is the only Corps of Engineers power project in the Brazos River basin.

The dam was completed in 1951 and the project became operational for flood control and water conservation. Hydroelectlic power facilities were completed during 1953. Raising of power pool 13.0 feet was completed in 1972. Through September 1988, there have been 18.5 million megawatt hours of electrical energy generated.

Impoundment of water in the Whitney Lake began in December 1951. In 1957, the dam was put to test by a record-breaking flood which raised its water level within three inches of the top of the flood control pool. The cumulative savings in flood control benefits through September 1990 were $171.2 million.

The initial Federal project cost was $40.6 million. Raising the power pool was at a Federal cost of $672,600.

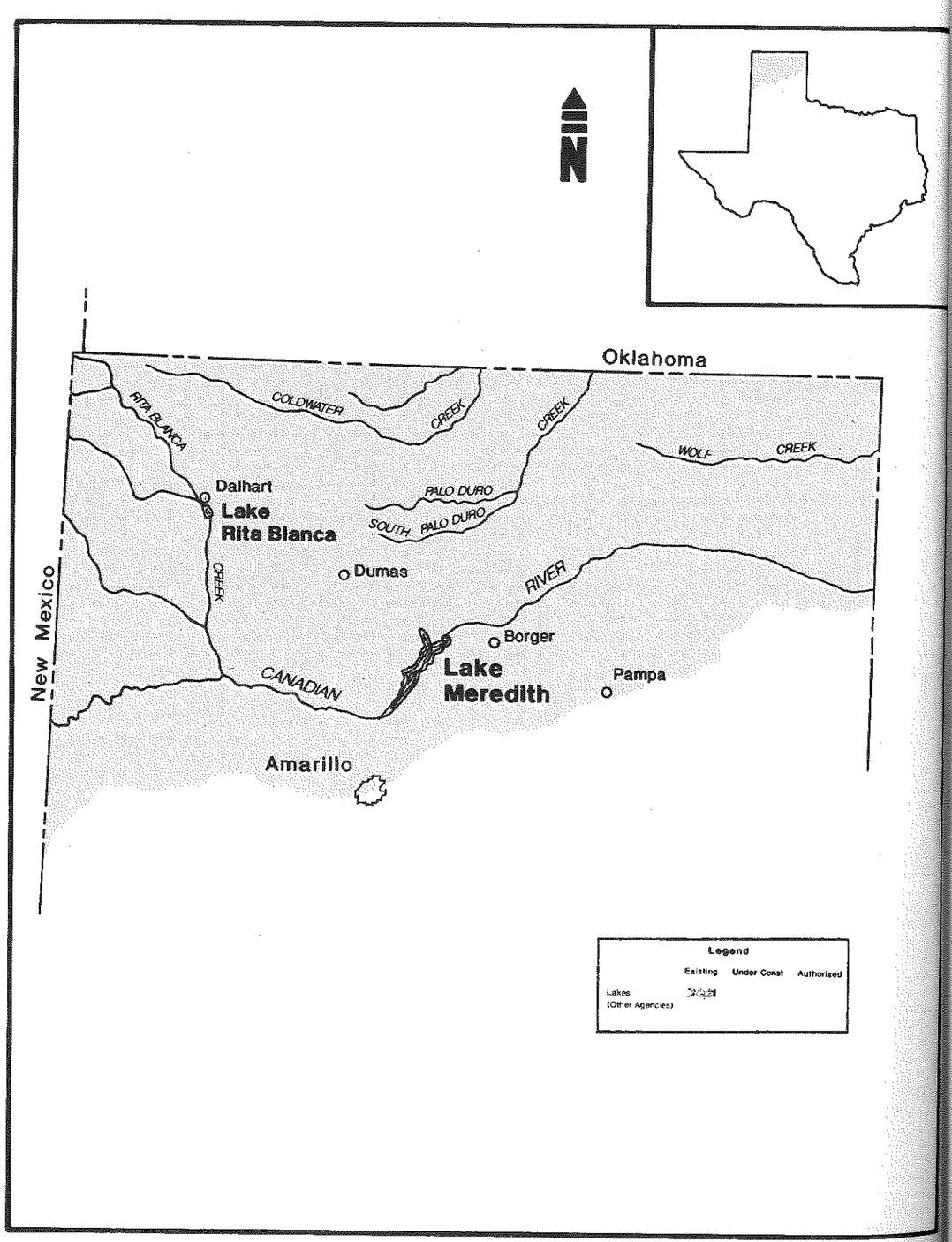
Whitney Lake has an average depth of 24 feet with 190 miles of shoreline. There are 15 public use areas providing both day and overnight use. One park area is under the jurisdiction of the Texas Parks and Wildlife Department. A total of 14,000 acres are available for hunting and nature observation. A 2,500 acre area near McCown Valley Park accommodates hunters as well as field trials.

In 1990, the visitation was 1,738,800 recreation days of use.

In addition to the facilities constructed by the Corps of Engineers and the Texas Parks and Wildlife Department, other local governmental agencies and concessionaires have developed park and recreation areas and marinas for use by the general public.

CANADIAN RIVER BASIN

Canadian River Basin



CANADIAN RIVER BASIN

The Canadian River heads in northeastem New Mexico, flows eastward across the Texas Panhandle into Oklahoma, and merges with the Arkansas River in eastern Oklahoma. Major streams joining the Canadian River in Texas are Punta de Agua Creek near the northeast comer of Oldham County, Big Blue Creek near Borger, and Palo Duro Creek 20 miles southwest of Perryton.

Total basin drainage area in Texas is about 12,700 square miles.

There are presently two major reservoirs in the Canadian River Basin in Texas. Rita Blanca Lake is on Rita Blanca Creek and Lake Meredith is on the Canadian River.

COMPLETED FEDERAL PROJECTS

Lake Meredith (U.S. Bureau of Reclamation)
Lake Rita Blanca Lake (U.S. Soil Conservation Service)

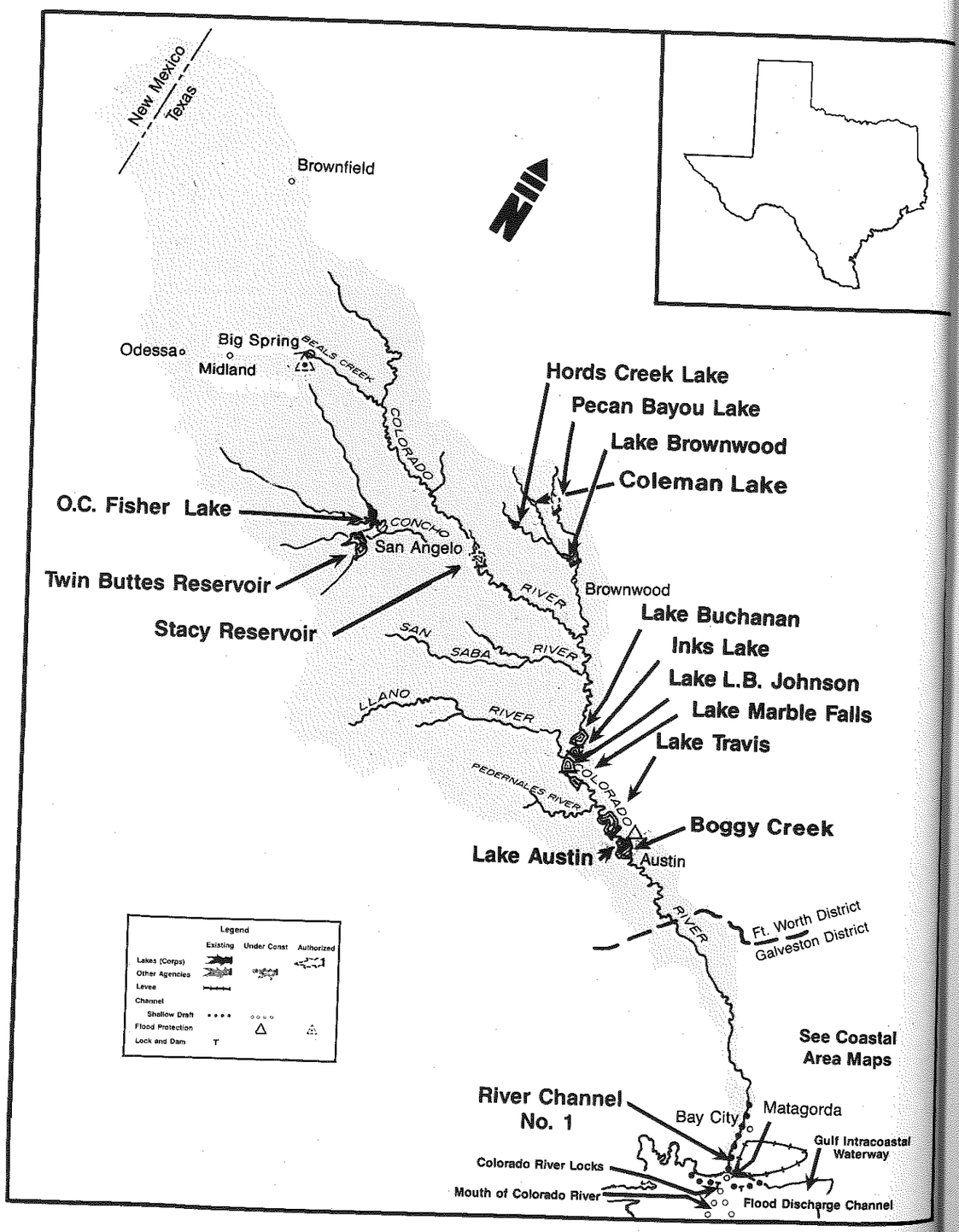
LAKE MEREDITH

Formerly Sandford Reservoir
Tulsa District

Lake Meredith was completed in 1965 by the Bureau of Reclamation. It is located on the Canadian River about eight miles northwest of Borger, Hutchinson County, Texas. The dam is an earth-fill structure with gated flood control outlet works. The reservoir has a total capacity of 1.4 million acre-feet, of which 462,100 acre-feet are flood control and 945,500 acre-feet are for conservation use and sediment reserve. An aqueduct system will deliver water for municipal and industrial purposes to a number of cities in the general area of the reservoir. In accordance with Section 7 of 1944, regulation of the flood control storage in Lake Meredith is the responsibility of the Corps of Engineers.

COLORADO RIVER BASIN

Colorado River Basin



COLORADO RIVER BASIN

The Colorado River basin extends from the Lea-Chavez County line in the southeast portion of New Mexico some 600 miles southeasterly across the state of Texas to the Gulf of Mexico in the vicinity of Matagorda, Texas. The basin is bounded on the east and north by the San Bernard and Brazos River basins and on the west and south by the Pecos, Nueces, Guadalupe and Lavaca River basins. It is about 85 miles wide in the extreme upper part, increasing gradually to about 170 miles wide near Milburn, Texas. It then decreases to a width of 30 miles at Austin, maintaining this width to Columbus. Below Columbus, the width diminishes toward the Gulf of Mexico. The basin has a total area of 42,344 square miles. However, the upper portion lies in the Great Plains, a flat semi-arid region with numerous closed basins, of which 12,667 square miles do not contribute to the Colorado River drainage.

The Colorado system consists principally of the main stream and six major tributaries. These tributaries enter the Colorado River above Austin-Pecan Bayou from the left bank and Beals Creek, Concho, San Saba, Llano and Pedernales Rivers from the right bank. Throughout its length, the Colorado River follows a tortuous course, meandering from one side of the valley to the other for a distance of some 890 miles from the noncontributing area to the Gulf of Mexico.

Initial authorization for the Corps of Engineers development of water resources in the Colorado River basin was contained in the Flood Control Act of Aug. 18, 1941. This Act authorized the construction of Hords Creek Lake and the enlargement of the existing Lake Brownwood in the Pecan Bayou watershed. The 1941 Act also authorized the construction of the San Angelo Lake on the North Concho River.

The Flood Control Act of 1968, approved Aug. 13, 1968, authorized construction of Lake Brownwood Dam Modification, Pecan Bayou Lake, and Brownwood Channel Improvement. The Brownwood Channel Improvement and the Lake Brownwood Dam Modification have been deauthorized.

COMPLETED FEDERAL PROJECTS

Hords Creek Lake
Lake Travis (Bureau of Reclamation)
O.C. Fisher Lake
Twin Buttes Reservoir (Bureau of Reclamation)

AUTHORIZED FEDERAL PROJECTS

Boggy Creek Flood Protection
Beals Creek Flood Protection
Pecan Bayou Lake

COMPLETED NON-FEDERAL PROJECTS

Lake Austin
Ballinger Lake
Bastrop Lake
Brady Creek Lake
Lake Brownwood
Lake Buchanan
Champion Creek Lake
Clyde Lake
Coleman Lake
Colorado City Lake
Eagle Lake
E.V. Spence Lake
Inks Lake
J.B. Thomas Lake
Lyndon B. Johnson
Marble Falls Lake
Nasworthy Lake
South Texas Project
Town Lake
Oak Creek Lake
Walter E. Long Lake
Winters Lake

FLOOD INSURANCE STUDIES

Burnet	July	1985
Menard	February	1986
Menard County	March	1986
Granite Shoals	August	1987
Marble Falls	August	1987
Odessa		1987
Ballinger		1988
Burnet		1988
Colorado County	January	1988
Ector		1988
Austin		1989
Midland		1989
Midland County		1989
San Angelo		1990
Tom Green		1990
Travis County		1990

ACTIVE PLANNING STUDIES

Colorado Basinwide (unfunded)
Lake Walnut
Shoal Creek

FLOOD PLAIN INFORMATION REPORTS

Expanded Flood Plain Information Study, Walnut and Williamson Creeks, city of Austin and Travis (3 Volumes) ..... May 1980
Special Flood Hazard Information Study, Pedernales Falls State Park, Blanco County . February 1984

HIGH FLOOD HAZARD AREA STUDIES

Austin	1985
San Angelo	1985
Travis County	1986
Colorado River	1988
Wharton	1988
Bastrop	1989
Highland Lakes, Burnet Co.	1989
Highland Lakes, Llano Co.	1989
Smithville	1989

BEALS CREEK FLOOD PROTECTION PROJECT

Fort Worth District

The project, located on Beals Creek in Big Spring, Texas, authorized in October 1972 under provisions of Section 201 of the 1965 Flood Control Act.

A Phase I General Design Memorandum Study was initiated in fiscal year 1976 and completed in fiscal year 1978. The authorized project and alternatives thereto were found to be economically unfeasible. A Reevaluation Study was completed in FY89 and identified a feasible channel project which provided a 10-year level of flood protection. The General Design Memorandum is scheduled to be completed in FY91.

BOGGY CREEK FLOOD PROTECTION PROJECT

Fort Worth District

This project is currently under construction in southeast Austin, Texas. The project, authorized for construction by the Supplemental Appropriations Act of 1985 and the Water Resources Development Act of 1986, consists of approximately 0.9 mile of grass-lined channel and 2.0 miles of concrete and gabion-lined channel. Construction began on the first increment in May 1987 and the last increment is scheduled for completion in October 1991. The project is designed to provide 100-year flood protection and includes a 54 acre tract of land for mitigation and enhancement. A one mile trail will be included in the mitigation/enhancement area.

The Federal cost of construction is estimated to be $16,700,000 and the city of Austin will provide an estimated $8,500,000.

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Shallow Draft and Deep Draft Navigation Projects and Federal Flood Protection Projects.

HORDS CREEK LAKE

Fort Worth District

Hords Creek Lake was the first Corps of Engineers project in the District to be placed in operation within the state of Texas. Construction began in January 1947 and was completed in June 1948. This flood control project also provides conservation storage for the water supply of Coleman, Texas. Its cost was $2.3 million including local contributions of $105,000.

The earthen embankment is 6,300 feet in length and 91 feet high above the streambed. There is an uncontrolled emergency spillway 500 feet long on the south abutment of Hords Creek.

At top of conservation pool, elevation 1900.0, the lake covers 510 surface acres and provides 5,780 acre-feet of conservation storage. The storage is under contract to the Central Colorado River Authority for water supply At elevation 1920.0, top of flood control pool, the lake covers 1,260 surface acres and contains flood control storage space for 16,670 acre-feet of water. Another 2,860 acre-feet is for sediment reserve. The dam controls a drainage area of 48 square miles.

The flood control outlet works consist of one uncontrolled inlet with inverts at elevation 1900.0 and two controlled inlets with inverts at elevation 1856.0, each equipped with a 4-foot by 6-foot slide gate. All three inlets discharge through one 8-foot diameter conduit. A separate intake structure with

inverts at three different levels and a 24-inch conduit through the dam, completed by a slide gate, connects with a pipeline to the city of Coleman, Texas, for its water supply.

The cumulative savings in flood control benefits through Dec. 1990 were $937,000.

Hords Creek, one of the smallest Federal lakes, has an average depth of 17 feet and 11 miles of shoreline. It has three park areas with all the standard recreational facilities. There are 1200 acres open for hunting by permit.

In 1990 the visitation was 83,800 recreation days of use.

PECAN BAYOU LAKE

Fort Worth District

Located in Coleman County on Pecan Bayou, approximately 17 miles north of Coleman, Texas, the lake would provide 93,500 acre-feet of conservation storage at elevation 1637.0, top of conservation pool, and would cover 5,150 surface acres. At elevation 1653.0, top of flood control pool, the lake would provide 102,700 acre-feet of flood control storage and would cover 8,030 surface acres. An additional 10,100 acre-feet of storage space is for sediment reserve. Proposed is the construction of a 14,700-foot dam (including 5,400-foot dike on the right bank), with a maximum height of 107 feet above streambed, which would control the run-off from 316 square miles of drainage area. The project is estimated to cost $52.5 million. Average annual benefits are estimated to be $2.5 million. This project is active but no funds have been appropriated to initiate preconstruction planning.

O.C. FISHER LAKE

Formerly San Angelo Reservoir
Fort Worth District

O.C. Fisher Lake is another unit of the overall flood control plan of the Colorado River basin. Construction of the $15.2 million dam and lake started in May 1947 and the project was placed in operation m February 1952. The dam is located on the North Concho River just above San Angelo, Texas and is designed to protect the city from floods similar to the disastrous one of September 1936.

The dam is a compacted, impervious earthen embankment, about 7.1 miles in length with a maximum height of 128 feet. It has an uncontrolled spillway, two 18-foot conduits for the discharge of floodwaters and two 30-inch-diameter conduits for the release of water stored for conservation purposes. The lake, which controls 1,511 square miles of drainage area, has 80,400 acre-feet of conservation storage space at elevation 1908.0, top of conservation pool and, covers a surface area of 5,440 acres; has 277,200 acre-feet of flood control storage at elevation 1938.5 and covers a surface area of 12,700 acres; and 38,800 acre-feet of storage which serves as sediment reserve.

The cumulative savings in flood control benefits through December 1990 were $2.4 million.

The Upper Colorado River Authority has contracted with the Federal government for the purchase of the entire conservation storage space in this lake.

O.C. Fisher Lake will have an average depth of 22 feet and 27 miles of shoreline when it reaches the conservation pool level. There are four public use areas available. Some 4,645 acres have been leased to Angelo State University for a wildlife and ranching demonstration area. Hunting and nature observation is available on 4,000 acres. Hunting is by permit only.

In 1990, the visitation was 778,100 recreation days of use.

COLORADO RIVER AND TRIBUTARIES WASTEWATER MANAGEMENT PROGRAM

Congress directed the Corps of Engineers to review the reports on the Colorado River and tributaries with a view to determining the feasibility of regional water supply and wastewater management facilities including measures for water quality control, wastewater collection, purification and/or reuse.

The Fort Worth District acted as the study manager for the state of Texas in the preparation of the wastewater management plan for the Colorado River and Tributaries, Texas. This planning program represented the largest basin effort in geographic size undertaken by the Corps of Engineers in the wastewater management field to meet the requirements of Public law 92-500. Federal regulations required that the funding for the study be based on a 50/50 Federal-state effort sharing

basis. The state of Texas assumed the non-Federal effort sharing responsibility. The governor of Texas appointed a planning committee called the Colorado River Water Quality Management Study Committee. It was composed of representatives of Federal, state, regional and local government units, as well as the general public. This committee provided an overall planning direction and assured that the study reflected the views of the broad cross section of the general public. The study resulted in a plan which is intended to protect and enhance the water quality of the Basin's lakes and streams and to provide high quality wastewater for agriculture (irrigation) needs, many industrial needs, and in-stream uses; thereby releasing limited supplies of higher quality natural surface and ground water for people-oriented use. This plan was certified by the governor of Texas on Sept. 14, 1973, and was approved by the Environmental Protection Agency on Dec. 4, 1973. Approval of the plan has established the eligibility of the communities in the basin to apply for Federal grants for construction of wastewater treatment facilities. Numerous municipalities in the basin have been awarded Federal grants on the basis of the study. This study was the first wastewater management plan in the nation to be approved by the Environmental Protection Agency in which the Corps of Engineers acted as the study manager and in which 50 percent of the study effort was provided by non-Federal interests.

LAKE TRAVIS

Formerly Marshall Ford Reservoir and
Mansfield Dam
Fort Worth District

Lake Travis is located on the Colorado River about 28 miles upstream from Austin, Texas, and controls the run-off from 26,915 square miles of drainage area. The project was constructed by the U.S. Bureau of Reclamation under an agreement with the Lower Colorado River Authority of Texas. The reservoir is a multiple-purpose project designed for power development, stream flow regulation and flood control. Storage below elevation 681.0 feet msl is allocated primarily for power generation. The reservoir storage between elevation 681.0 and 714.0 feet msl, spillway crest, amounting to 779,800 acre-feet, is reserved for flood control purposes. The reservoir capacity at elevation 681.0 is 1.2 million acre-feet and at elevation 714.0, the capacity is 2 million acre-feet. In accordance with Section 7 of the Flood Control Act of 1944, regulation of flood control storage in Lake Travis is the responsibility of the Corps of Engineers. Cumulative flood damages prevented through December 1991 were $192.4 million.

TWIN BUTTES RESERVOIR

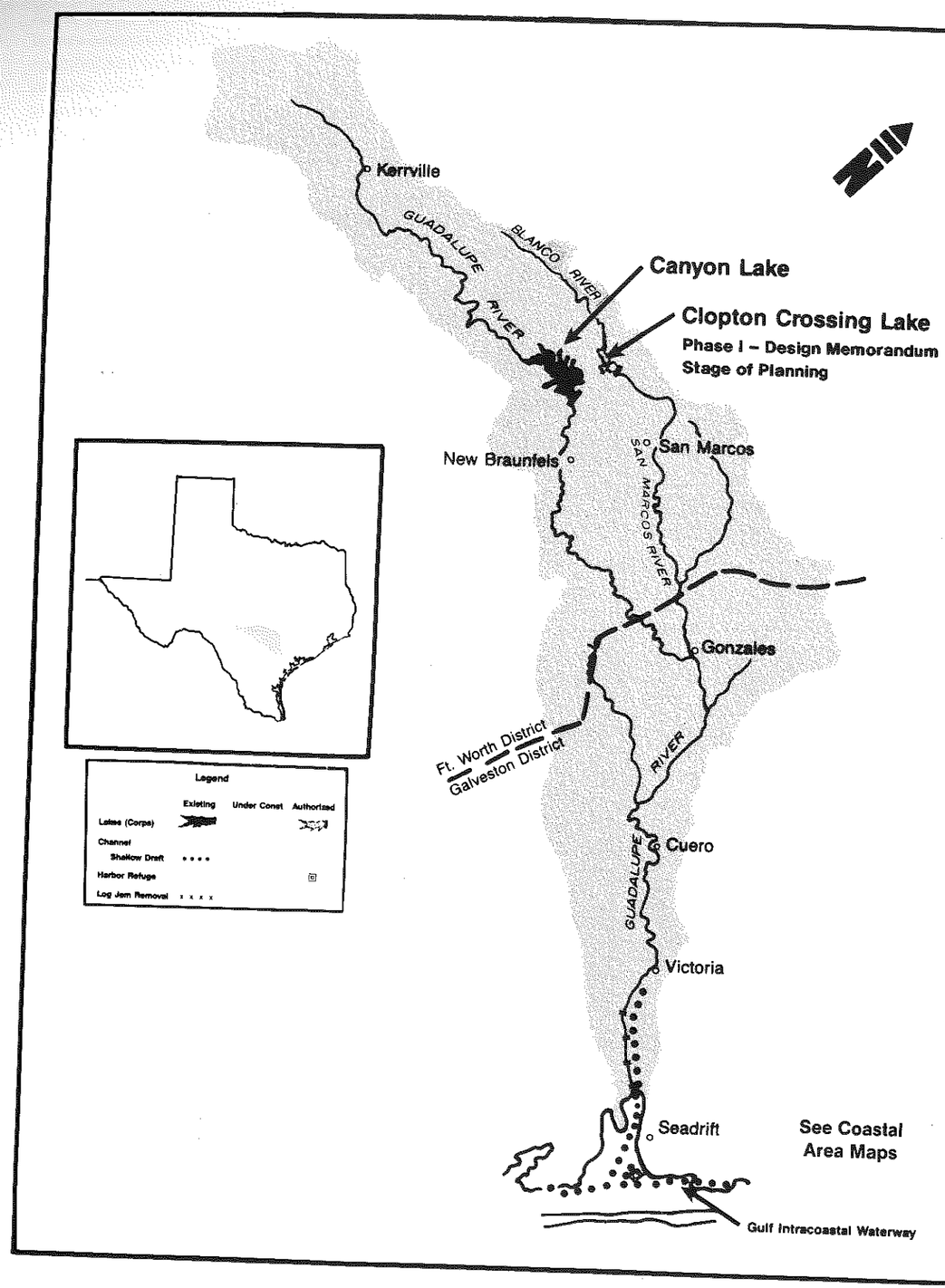
Fort Worth District

Twin Buttes Reservoir, constructed by the U.S. Bureau of Reclamation, is located on the Middle and South Concho Rivers about nine miles southwest of San Angelo, Texas.

The dam is 37,430 feet long with a maximum height of 131 feet above the streambed. An accompanying dike is 4,831 feet long. The reservoir has a controlled storage capacity of 640,000 acre feet, of which 454,000 acre-feet are allocated for flood control; 150,000 for conservation; and 36,200 for sediment reserve. In accordance with Section 7 of the Flood Control Act of 1944, regulation of flood control storage in Twin Buttes Reservoir is the responsibility of the Corps of Engineers.

GUADALUPE RIVER BASIN

Guadalupe River Basin



GUADALUPE RIVER BASIN

The Guadalupe River Basin is bounded on the north by the Colorado River Basin, on the east by the Lavaca River Basin and the Lavaca-Guadalupe Coastal Basin, and on the west and south by the Nueces and San Antonio River Basins, respectively. The total basin drainage area is 6,070 square miles. Headwaters of the Guadalupe River form in southwestern Kerr County at an elevation of approximately 2,360 feet. The river flows easterly to Gonzales and then southeasterly into Guadalupe Bay, part of the San Antonio Bay system. The Blanco and San Marcos Rivers are the principal tributaries of the Guadalupe River. Three major projects for flood control and allied purposes have been authorized by Congress for the Guadalupe River Basin. Two of the projects were authorized for construction and one for Phase I studies. Canyon Lake was authorized in the River and Harbor Act of March 1945 and modified by the Flood Control Act of September 1954 also authorized construction of Gonzales Lake. The Water Resources Development Act of 1974 authorized a Phase I study for Clopton Crossing Lake.

COMPLETED FEDERAL PROJECTS

Canyon Lake

AUTHORIZED FEDERAL PROJECTS

Clopton Crossing Lake - Phase I Study

FLOOD INSURANCE STUDIES

San Marcos	1988
Hays County	1989

HIGH FLOOD HAZARD AREA STUDIES

San Marcos	1985
Guadalupe County	1987
Kerr County	1987
Kerrville	1987
Seguin	1987
Comal-Guadalupe River	1987
New Braunfels	1988
Victoria	1989
Victoria County	1989

CANYON LAKE

Fort Worth District

The dam is located on the Guadalupe River approximately 14 miles west of San Marcos and 12 miles northwest of New Braunfels, Texas. It serves flood control and water conservation purposes. At top of conservation pool, elevation 909.0, it provides 366,400 acre-feet of conservation storage space and covers a surface area of 8,240 acres. At top of flood control pool, elevation 943.0, it provides 346,400 acre-feet of flood control storage and covers 12,890 acres of surface area. An additional 28,100 acre-feet is for sediment reserve. The dam controls run-off from 1,425 square miles of drainage area.

The main dam is the highest earthen dam built by the Corps of Engineers in Texas, towering 224 feet above streambed at its maximum point and is 4,410 feet in overall length. The uncontrolled spillway is 1,260 feet long. The outlet works consist of a 10-foot-diameter conduit passing under the dam, with two 5'8" by 10' hydraulic slide gates for controlled releases of water.

Construction of the project started in July 1958. Impoundment of water began in June 1964.

Initial Federal cost of the project was $20.2 million including local interests' contribution of $1.4 million during construction. The Guadalupe-Blanco River Authority, the official representative of the state of Texas in matters concerning Canyon Lake, has a contract with the Federal government for payment of the remainder of the costs allocable to local interest for which it will be permitted to utilize the water impounded for water conservation.

In August 1978, a record amount of rain fell in the area, causing extensive flooding. Damages prevented by Canyon Dam amounted to more than $24 million, with about $15 million in New Braunfels and Seguin alone. The highest pool at Canyon came after heavy rain fell in May - June 1987. The lake came within four inches of going over the spillway which is at

elevation 943 feet. The savings in flood control benefits through December 1990 were $58.9 million.

In 1990, the visitation was 1,520,500 recreation days of use.

Canyon Lake is one of the deepest lakes in Texas, having an average depth of 47 feet and 80 miles of shoreline. It is also one of the cooler water lakes. Walleye and smallmouth bass have been stocked in the lake and there is an established trout fishery below the dam. Deer are abundant and may be observed in the park areas. No hunting is allowed.

In February 1989, the Guadalupe-Blanco River Authority completed construction of a hydroelectric power generating plant downstream of Canyon Dam. This plant consists of two 3,000 kilowatt generating units and uses normal low-flow water releases from Canyon Lake to generate electricity.

CLOPTON CROSSING LAKE

Fort Worth District

The lake was recommended by the "Survey Report on the Edwards Underground Reservoir, Guadalupe, San Antonio and Nueces Rivers and Tributaries, Texas, " dated Dec. 22, 1964 which was published as House Document No. 92-364 dated Sept. 25, 1972. The proposed project would be located at river mile 32.5 on the Blanco River in Hays County about two miles southwest of Wimberley and eleven miles northwest of San Marcos, Texas.

Project purposes are flood control, water supply, recreation, and fish and wildlife enhancement. The lake would have a total storage capacity of 404,000 acre-feet including 119,900 acre-feet for flood control, 274,900 acre-feet for water supply, and 9,200 acre-feet for sediment reserve. The lake would have a water surface area at the top of conservation and flood control pools of 6,060 and 7,730 acres, respectively.

A Phase I General Design Memorandum Study was authorized by the Water Resources Development Act of 1974. A Phase I General Design Memorandum was completed by the Fort Worth District in fiscal year 1979. The project was found to be economically unfeasible. Therefore, it was recommended that construction not be authorized. This report was reviewed by the Board of Engineers for Rivers and Harbors in 1980. The project is currently in the deferred category.

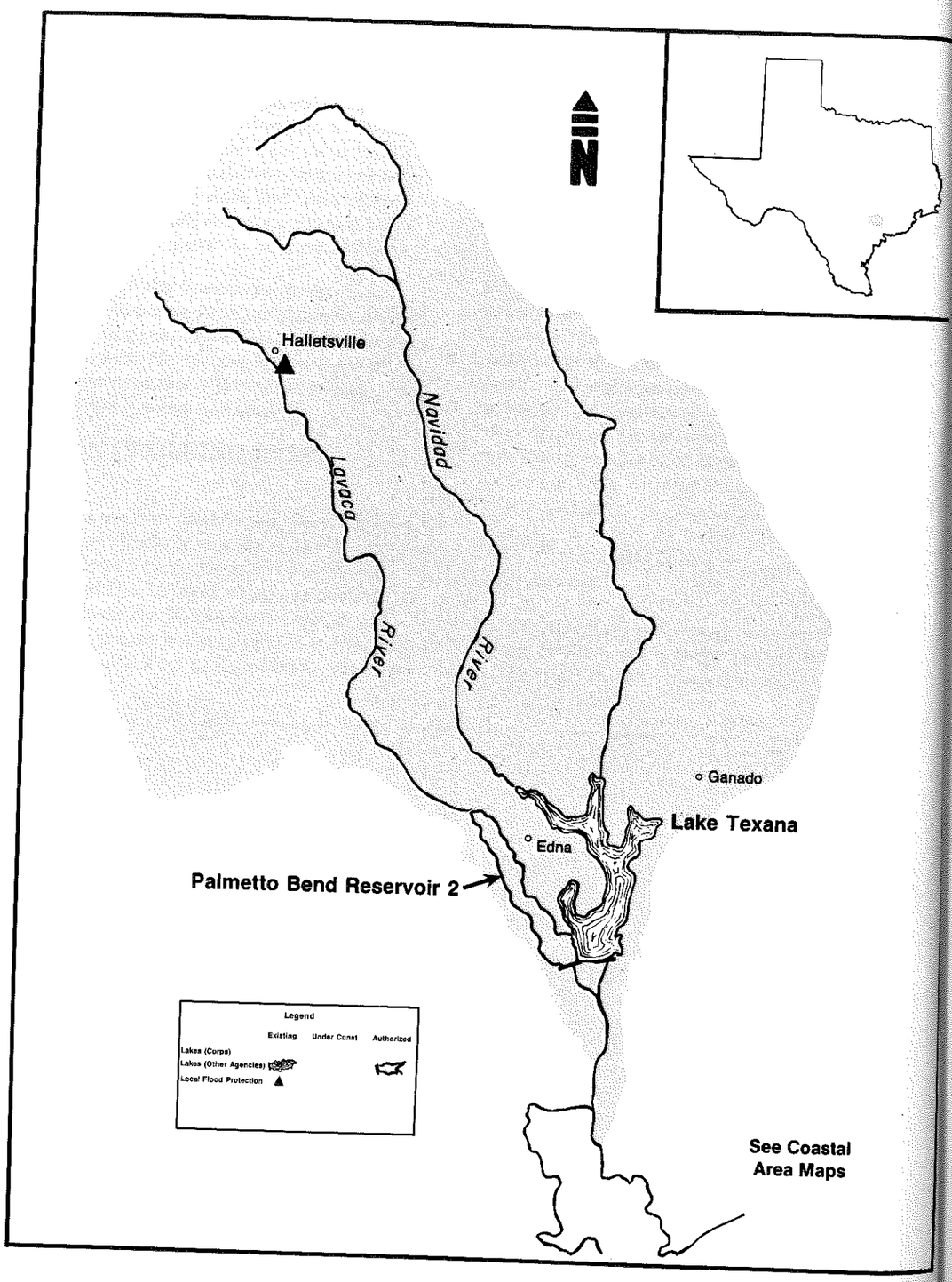
COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on shallow draft and deep draft navigation projects and Federal flood protection projects.

LAVACA RIVER BASIN

Lavaca River Basin



LAVACA RIVER BASIN

The Lavaca River basin is bounded on the east by the Colorado River basin and Colorado-Lavaca Coastal basin, and on the west by the Guadalupe River basin and Lavaca-Guadalupe Coasal basin.

The Lavaca River heads in Fayette County at an elevation of about 400 feet and drains south into Lavaca Bay. The total drainage area at the mouth of the river is 2,409 square miles.

COMPLETED FEDERAL PROJECTS

Channel Rectification at Hallettsville
Lake Texana (Bureau of Reclamation)

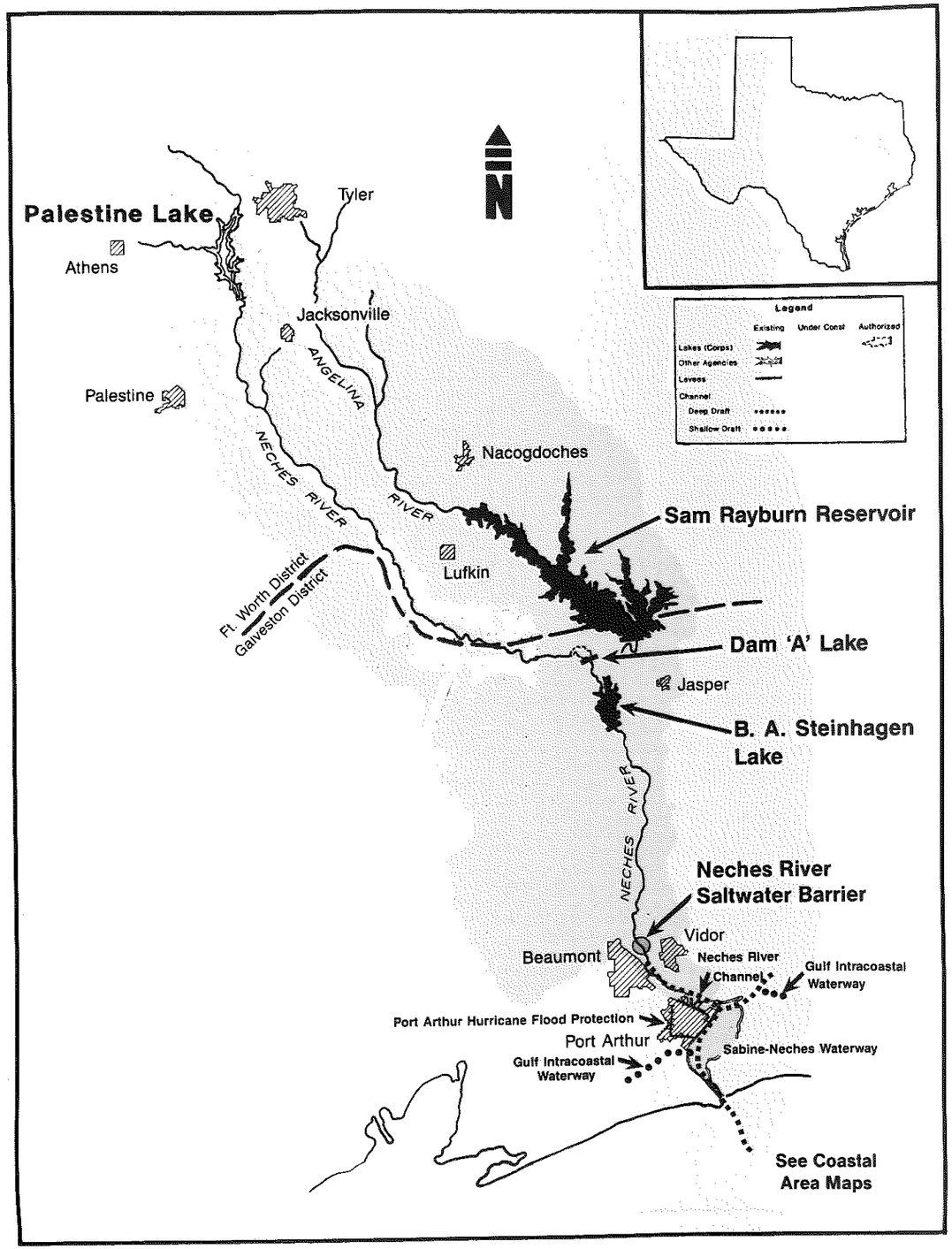
CHANNEL RECTIFICATION AT HALLETTSVILLE (Lavaca-Navidad Rivers)

Galveston District

The rectification was authorized as part of a project for improving Lavaca River at Hallettsville and channel clearing, straightening and enlargement for flood control upstream on the Lavaca and Navidad Rivers and tributaries. The improvement upstream on the Lavaca and Navidad Rivers and tributaries is an inactive project. The improvement at Hallettsville, which is located about 88 miles above the mouth of the Lavaca River, was completed in September 1960 at a cost to the Federal government of $277,129 and an estimated non-Federal cost of about $20,000. About 14,000 feet of the Lavaca River channel through Hallettsville was rectified and enlarged to a bottom width of 100 feet. The cumulative savings in the flood damages prevented through FY90 was $687,000.

NECHES RIVER BASIN

Neches River Basin



NECHES RIVER BASIN

The Neches River rises southeast of Dallas at an elevation of more than 500 feet and flows generally southeastward 416 miles to Sabine Lake near Beaumont. The principal tributary, the Angelina River, joins the main stream about 125 miles above its mouth. The basin ranges in width from 8 miles near the mouth to 70 miles in the central portion and is more than 200 miles long.

Four projects were authorized by Congress in the River and Harbor Act of March 1945 for the Neches River basin: Sam Rayburn Reservoir, Rockland Lake, Dam "A" and B.A. Steinhagen Lake (formerly Dam "B", also known as Town Bluff Dam). The projects are designed to serve for flood control and the development of the water resources of this basin. Sam Rayburn Reservoir and B.A. Steinhagen Lake have been completed and are in operation. Construction of Dam "A" has been deferred until justified by future conditions and Rockland Lake has been deauthorized.

COMPLETED FEDERAL PROJECTS

Sam Rayburn Reservoir
B.A. Steinhagen Lake

AUTHORIZED FEDERAL PROJECTS

Dam "A" Lake

COMPLETED NON-FEDERAL PROJECTS

Lake Palestine

HIGH FLOOD HAZARD AREA STUDIES

Lumberton

FLOOD INSURANCE STUDIES

Henderson 1990
Rusk County 1990

COASTAL PROJECTS

Galveston District

See the section on *Coastal Areas* for information on Gulf Intracoastal Waterway (Shallow Draft); Port Arthur Hurricane Flood Protection; and Sabine-Neches Waterway (Deep Draft).

DAM "A" LAKE

Fort Worth District

The dam would be located approximately 18 miles west of Jasper, Texas, on the Neches River. It would be used as a run-of-river plant for the generation of power and to regulate power surges from the proposed Rockland Lake. The last estimate of the project cost was $3.2 million in 1954. The project is classified as deferred.

NECHES RIVER SALT WATER BARRIER

Galveston District

The barrier would be located approximately one-half mile upstream from the Interstate 10 bridge at Beaumont, Texas. Its function would be to prevent salt water from contaminating the surface water supplies of the Lower Neches Valley Authority and the city of Beaumont. The plan of improvement provides for the construction of an overflow dam in the Neches River at the authorized barrier location with a diversion channel 1,200 feet long, 344 feet wide and 20 feet deep through the adjacent peninsula. The diversion channel will have a gated saltwater barrier with five 56.0 by 24.5 foot tainter gates. A navigation gate, consisting of two sector gates and providing a clear opening 56 feet wide and 16 feet deep over the sill, will be located in a navigation bypass channel (parallel to the diversion channel) 2,500 feet long, 16 feet deep, and 76 feet wide on the bottom. An access road will be provided on top of a levee 2,500 feet long extending from the navigation gate to high ground north of Interstate Highway 10. The plan includes some widening of the Bairds Bayou Channel and an auxiliary dam with two 30.0 by 8.6 foot vertical lift gates in a canal which drains the southern end of Bairds Bayou. Also, the plan includes using excess excavated material to create a marsh area in the river upstream of the overflow dam.

The latest estimate of the project cost is $44.3 million, of which local interests would be required to contribute $13.1 million. In addition, Temple-Eastex, Inc. is to relocate an effluent outfall from its paper mill to a new location downstream from Interstate Highway 10 at an estimated cost of $6.9 million.

Estimated average annual benefits to be derived from the project are $8.1 million.

The project is currently inactive.

SAM RAYBURN RESERVOIR

Formerly McGee Bend Reservoir
Fort Worth District

Sam Rayburn Reservoir was the second project constructed in the plan of improvement for this watershed. It is located on the Angelina River approximately 10 miles northwest of Jasper, Texas. It controls run-off from 3,449 square miles of drainage area. The project was designed to control floods, generate hydroelectric power and conserve water for municipal, industrial and agricultural uses. The Lower Neches Valley Authority and the city of Lufkin agreed to fulfill the requirements of local interests and have contracted for water storage. The initial Federal cost of the project was $68.7 million, including $3 million contributed by local interests. Savings in flood control benefits through December 1990 totaled $232.5 million.

The plan of improvement provided for construction of an earth-fill embankment, concrete saddle spillway, outlet works and earthen dikes totaling 19,430 feet in length. Total storage capacity of Sam Rayburn Reservoir is approximately 4 million acre-feet. At top of conservation pool (elevation 164.4), the lake contains about 1.5 million acre-feet for power storage and water supply and covers a surface area of 114,500 acres. The lake serves as a source of water supply for the city of Lufkin. At top of flood control pool, elevation 173.0, the lake contains 1.1 million acre-feet for flood control storage and covers 142,700 surface acres. An additional 1.5 million acre-feet is for sediment storage and head for power generation.

The Southwestern Power Administration is the marketing agency for power. As of August 1989 Sam Rayburn Power Plant has generated 2.5 million megawatt hours.

Construction of the project began in September 1956 and deliberate impoundment of water began in March 1965.

Sam Rayburn Reservoir is one of the largest in Texas, extending into parts of five counties. It has an average depth of 25 feet and 560 miles of shoreline. The Corps of Engineers provides 12 developed recreational areas and the U.S. Forest Service provides six areas. One area is operated by the Texas Parks and Wildlife Department. There are about 1,600 acres available for hunting and nature observation. .

In 1990, the visitation was 2,262,500 recreation days of use.

B.A. STEINHAGEN LAKE - TOWN BLUFF DAM

Formerly Dam "B"
Fort Worth District

Town Bluff Dam near Jasper, Texas, was the first unit in the plan of improvement to be constructed in this basin. Construction began in March 1947 and the project was placed in operation in April 1951. The Lower Neches Valley River Authority, an agency of the state of Texas, contributed $2 million toward construction of this project. The river authority is authorized to draw water from the lake at a maximum rate of 2,000 cubic feet per second. .

The dam is 6,698 feet long and 45 feet high. The gate-controlled spillway is located in the original river channel and has six tainter gates 40 feet wide and 35 feet high for the release and control of high water. There are two 4-foot by 6-foot conduits for release of low flows. The drainage area upstream from the dam covers an area of 7,573 square miles. At top of conservation pool, elevation 83.0, the lake would contain 94,200 acre-feet of storage, of which 77,600 acre-feet would be for conservation storage. Also, of the 94,200 acre-feet, 16,600 acre-feet is for sediment reserve. Initial cost of Town Bluff was $8.7 million.

B.A. Steinhagen Lake has an average depth of seven feet and 160 miles of shoreline. It has eight developed park areas, three of which are under the jurisdiction of the Texas Parks and Wildlife Department. About 9,300 acres are licensed to the Texas Parks and Wildlife Department for wildlife management and another 4,000 acres have been set aside for Angelina-Neches Scientific Area #1.

A feasibility report was completed in March 1981 and a detailed evaluation report was completed in March 1983. The reports indicated installation of hydropower at this project is economically feasible. Plans and specifications were completed in fiscal year 1986. Initiation of construction began in July 1986 on the turbine-generator supply contract. The powerhouse contract was awarded in February 1987 and tile project completed in November 1989.

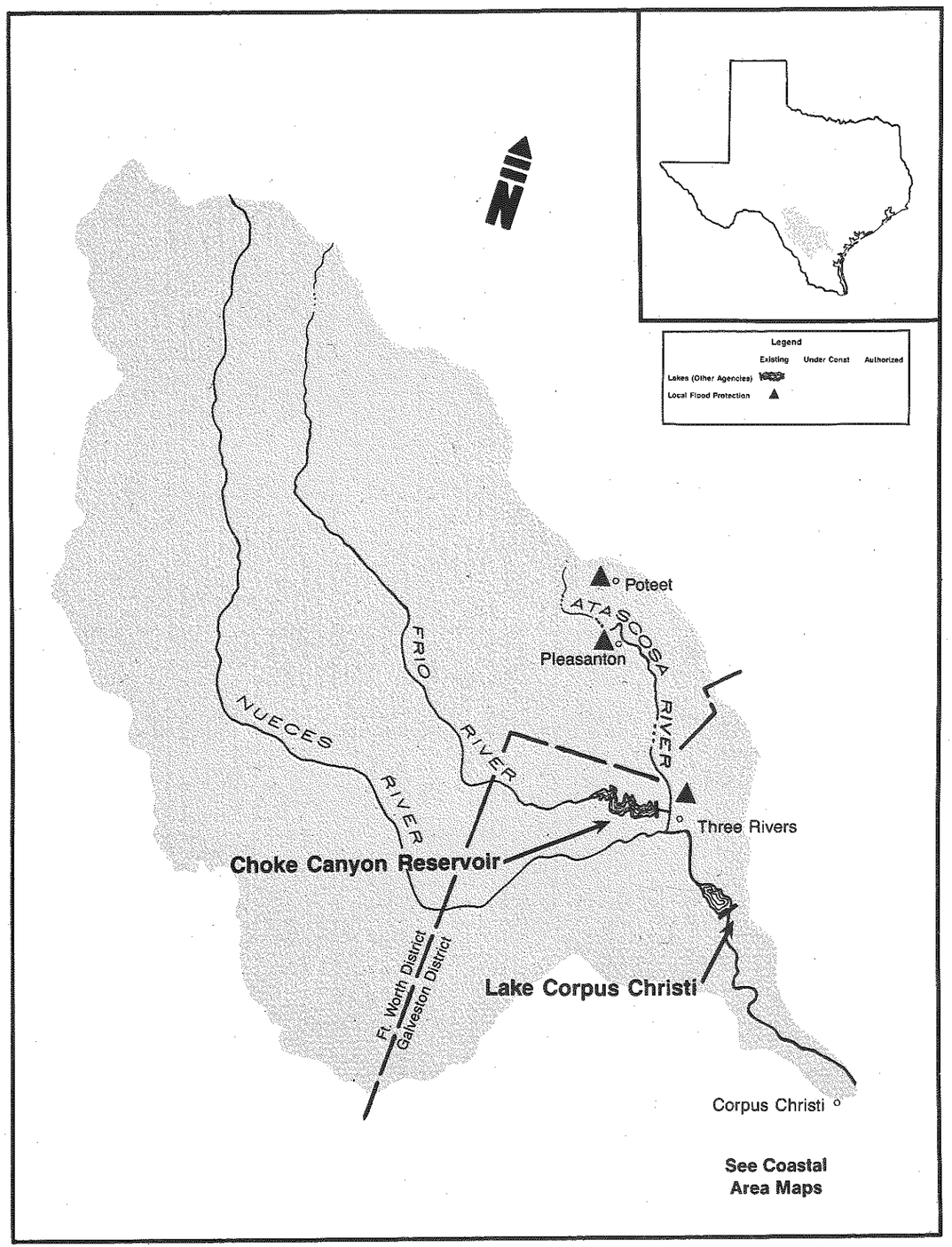
This hydropower project was constructed at an estimated cost of $18.1 million using non-Federal funds contributed by the Sam Rayburn Municipal Power Agency. The Corps will operate and maintain the project. The Sam Rayburn Municipal Power Agency will reimburse the Federal government for operation and maintenance through the Southwestern Power Administration.

The hydropower plant was officially named the Robert Douglas Willis Hydropower Plant by House Document 223-101 ST, Congress, dated February 7, 1989.

In 1990, the visitation was 476,900 recreation days.

NUECES RIVER BASIN

Nueces River Basin



NUECES RIVER BASIN

The Nueces River basin lies in the southern part of Texas. It has a length of 235 miles, a maximum width of 115 miles and a total drainage area of 17,075 square miles. The Nueces River rises in Edwards County and flows across the Coastal Plain into Corpus Christi Bay.

COMPLETED FEDERAL PROJECTS

Pleasanton Flood Control
Three Rivers Flood Control
Poteet Area Flood Protection
Choke Canyon Reservoir (Bureau of Reclamation)

COMPLETED NON-FEDERAL PROJECTS

Lake Corpus Christi

HIGH FLOOD HAZARD AREA STUDIES

Brownsville 1985
Port Isabel, South Padre Island 1985

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Shallow Draft and Deep Draft Navigation Projects and Federal Flood Protection Projects.

PLEASANTON FLOOD PROTECTION

Fort Worth District

The project was completed in 1953 under Section 205 of the Corps Continuing Authorities program. It consisted of the construction of a levee 1,970 feet long along the left bank of Bonita Creek and a channel enlargement of the Atascosa River for a distance of 3,900 feet with a bottom width of 15 feet. About 146,000 cubic yards of excavation was involved. The project is designed to prevent the recurrence of floods similar to the one July 1949 which caused damages estimated at $22,000.

The Federal cost of the floodway project was $123,801 plus an additional $23,000 in non-Federal contributions.

POTEET AREA FLOOD PROTECTION

Fort Worth District

Located on Rutledge Hollow Creek and completed in September 1969 under Section 205 of the Corps Continuing Authority program, the project provided for the following: construction of channel improvements for flood protection for the city of Poteet; channel enlargement on Rutledge Hollow Creek for a length of about one mile through Poteet; construction of two grade transfer structures; building up banks of improved channel; construction of four low water crossings; and slope protection to prevent erosion.

The Federal cost of construction was $105,300 and non-Federal cost was $75,000. Average annual benefits are estimated at $10,200.

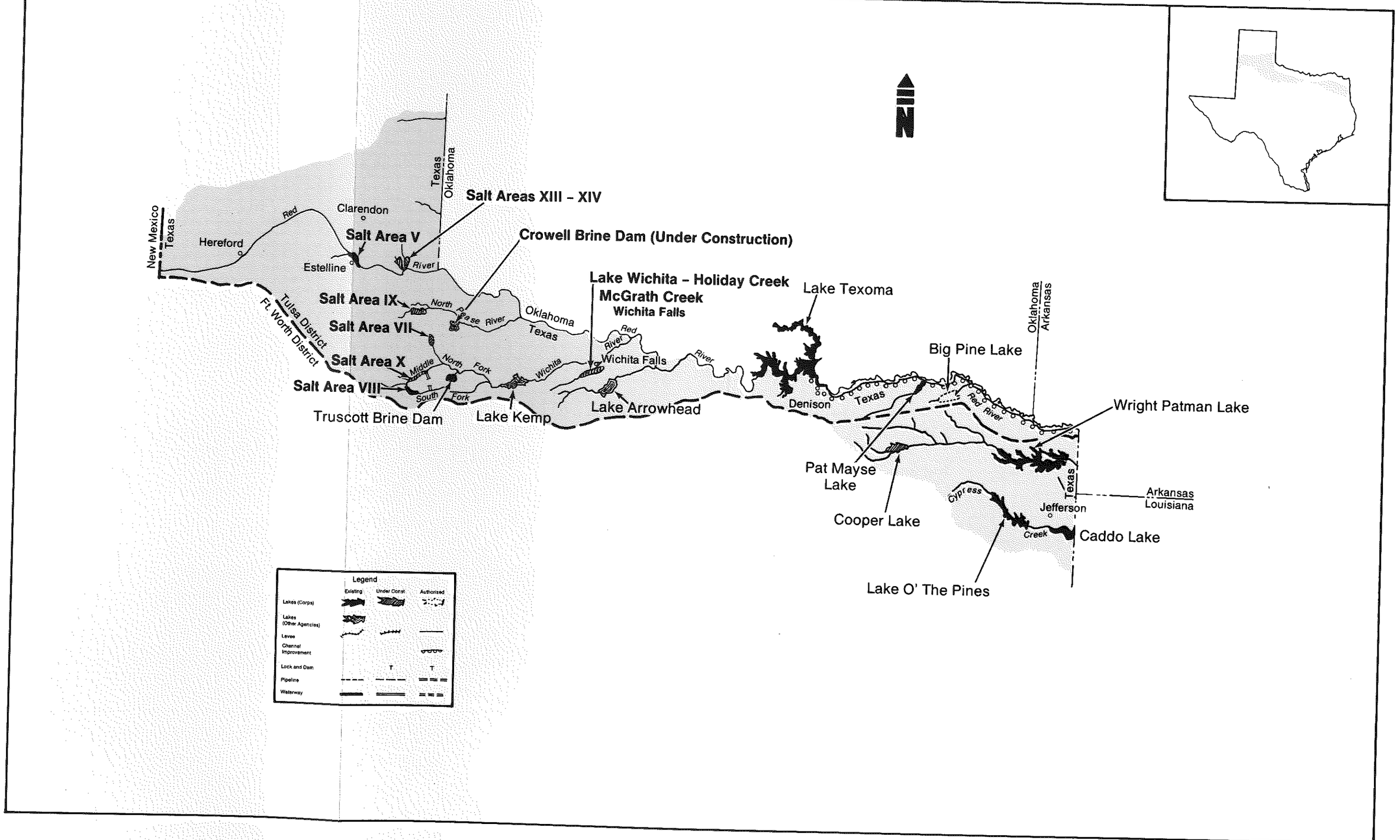
THREE RIVERS FLOOD PROTECTION

Galveston District

The project is located in the city limits of Three Rivers, located midway between San Antonio and Corpus Christi, in Live Oak County, Texas. The project, authorized by the Chief of Engineers under provisions of Section 201 of the Flood Control Act of 1965, consists of the following to provide flood protection to the city; 4.6 miles of levees on the left bank of the Frio River; 650 feet of concrete floodwall between the Frio River and the sewage treatment plant; appurtenant water control and drainage works; and alteration to U.S. Highway 281 and Missouri Pacific Railroad levee crossing. Actual construction started in April 1981 and was completed in June 1982.

RED RIVER BASIN

Red River Basin



RED RIVER BASIN

The 1,360-mile long Red River rises in the high plains country of eastern New Mexico, flows eastward across the Texas Panhandle and forms 440 miles of the boundary between Texas and Oklahoma.

The total drainage area of the Red River, exclusive of the Ouachita-Black River system, is 69,200 square miles. Drainage from the upper 39,700 square miles is controlled by Lake Texoma near Denison, Texas.

The area of the basin below Lake Texoma, exclusive of the Ouachita-Black River basin, includes 29,500 square miles.

The portion of the Red River basin below Lake Texoma and above Fulton, Arkansas, has a drainage area of 12,580 square miles covering pans of southwestern Arkansas, southeastern Oklahoma, and northeastern Texas.

COMPLETED FEDERAL PROJECTS

Area V, Red River Basin Chloride Control Project
Area VIII, Red River Basin Chloride Control Project
Caddo Dam Replacement
Lake O' The Pines
Lake Texoma
Pat Mayse Lake
Wright Patman Lake

AUTHORIZED FEDERAL PROJECTS

Big Pine Lake
Cooper Lake
Lake Wichita and Holliday Creek
McGrath Creek
Red River Bank Stabilization
Red River Basin Chloride Control Project - Remaining Areas

COMPLETED NON-FEDERAL PROJECTS

Lake Kemp
Lake Arrowhead

FLOOD INSURANCE STUDIES

Burkburnett	1981
Canyon	1981
Iowa Park	1981
Lake Tanglewood	1981

FLOOD INSURANCE STUDIES (Continued)

Pleasant Valley	1981
Randall County	1981
Wichita County	1981
Archer County	1987
Wichita Falls, Type 19	1988
Booker	1988
Clay County	1988
Grayson County	1988
Montague County	1988
Bowie County	1990

ACTIVE PLANNING STUDIES

Lake Texoma (Restudy)
Red River Basin, Arkansas, Texas, Louisiana and Oklahoma

HIGH FLOOD HAZARD AREA STUDIES

Canyon	1985
Lake Tanglewood	1985
Randall County	1985
Wichita County	1985
Wichita Falls	1985
Amarillo	1986
Paris	1986
Sherman	1986
Denison	1987
Grayson County	1987

RED RIVER BASIN CHLORIDE CONTROL PROJECT

Tulsa District

Natural mineral pollutants in the upper reaches of the Red River basin are degrading the streams to such an extent that the waters downstream are unusable for most purposes.

In a joint study begun in 1957, the U.S. Public Health Service and the Tulsa District, Corps of Engineers located the natural pollution areas and

determined the contribution of pollutants from the individual areas to the Red River. It was determined that ten natural salt source areas located in the basin contribute a daily average of about 3,600 tons of salt (as NaCl) to the Red River. The primary pollutants are chlorides and sulfates.

Structural measures to control the chloride pollution at eight of the ten sites were authorized in the Flood Control Acts of 1962, 1966 and 1970 (as modified by the Water Resources Development Act of 1970, PL 91-611). The first chloride control project constructed was Area V, an experimental project near Estelline, Hall County, Texas. Authorized by the Flood Control Act of 1962, construction was started in 1963 and the structure was completed and placed into permanent operation in January 1964. It consisted of a ring dike, 9 feet high and 340 feet in diameter, around Estelline Springs. The second project placed into construction was that of Area VIII, which consists of two low-flow collection dams on the South Fork of the Wichita River for collecting brine to be pumped to Truscott Brine Lake on Bluff Creek, a tributary of the North Fork of the Wichita River. Authorized by the Flood Control Act of 1966, construction was initiated in 1977 and the first of the two low-flow dams is complete. It was put into full operation in May 1987. The second is to be constructed after initial operation of the first to determine the design parameters.

The Water Resources Development Act of 1986 (PL 99-662) authorized the construction of the remaining areas of the Red River Chloride Control Project pending transmittal of a report to the Secretary of the Army and to the Committee on Environment and Public Works of the Senate and the Committee on Public Works and Transportation of the House of Representatives of a favorable finding of the effectiveness of the operation of Area VIII. Public Law 99-662 established a panel to assess the improvement in water quality downstream of Area VIII as a measure of its effectiveness. In August, 1988, the panel submitted a favorable report to the Assistant Secretary of the Army and the Civil Works committees of both the House and Senate recommending authorization to continue construction of the Red River Chloride Control Project. Congress appropriated funds in Fiscal Year 1991 to continue construction.

BIG PINE LAKE

Tulsa District

Big Pine Dam was authorized for construction on Big Pine Creek in Red River County, Texas, by the Flood Control Act of 1962 but was a deferred project in January 1984. The project would provide for an earthen dam 10,190 feet long with a maximum height of 80 feet above streambed. Top of conservation pool would be at elevation 434.5 and top of flood control pool would be at elevation 446.5. The total storage capacity of the lake would be 174,400 acre-feet. Project purposes would be supply, flood control, water supply, recreation and fish and wildlife conservation.

CYPRESS BAYOU AND WATERWAY

Vicksburg District

Cypress Bayou and Waterway, between Jefferson, Texas, and Shreveport, Louisiana, was authorized in 1872 and modified in 1910. It provides for channel improvement between Red River at Shreveport, Louisiana, and Jefferson, Texas, a distance of approximately 66 miles, of which 20 miles are in Texas, and for the construction of Caddo Lake Dam in Louisiana. The improvement was completed in 1914 at a cost of $202,817.

This lake has a shoreline of 170 miles. A new dam was built to replace the original one. The major portion of the shoreline is privately owned. There are 30 commercial camps operating on the waterway furnishing cabins, boats and other recreation facilities.

The project has been included in the authorized project, Red River Waterway, Louisiana, Arkansas, Oklahoma and Texas.

CADDO DAM (LOUISIANA) REPLACEMENT

Vicksburg District

The original Caddo Dam was authorized in 1910 and completed in 1914 by the Corps of Engineers at a cost of $100,853. It is located in Caddo Parish, Louisiana, about 19 miles northwest of Shreveport, Louisiana, at the foot of Caddo Lake and at the head of Twelve-Mile Bayou.

Caddo Dam Replacement was authorized by the Flood Control Act of Oct. 27, 1965 so that continued existence of Caddo Lake, which is used for municipal and industrial water supply and recreation, would be assured.

Construction of the new dam was initiated in June 1968 and completed in June 1971. The dam consists of 2,400 linear feet of concrete L-type wall, with the central 860 feet of crest at elevation 168.5 ft. National Geodetic Vertical Datum (NGVD) and the remaining 1,540 feet at 170.5 ft. NGVD. An earthen embankment 1,200 feet long, with top at elevation 176.0, ties the concrete dam to the hill line at one end; at the opposite end, the concrete dam abuts the hill line. The earthen embankment has a maximum height of 36 feet above the streambed. The lake provides a total storage of 129,000 acre-feet for conservation. The surface area at elevation 168.5 feet mean sea level, the top of the conservation pool, is 26,800 acres.

The cost of the project was $3.5 million, including $228,000 non-Federal costs. The completed project was turned over to the Caddo Lake Levee District on April 12, 1972, for assumption of ownership and for operation and maintenance responsibilities. The Water Resources Development Act of 1976 transferred the operation and maintenance of the dam from a local responsibility to a Federal responsibility.

COOPER LAKE

Fort Worth District

Cooper Lake was authorized for construction by the Flood Control Act of August 3, 1955. This project consists of a multiple-purpose lake for flood control, water supply and recreation on the South Sulphur River, south of Cooper, Texas, and channel improvements, levees and appurtenant drainage works along the Sulphur River and its tributaries upstream from Wright Patman Lake.

This project provides for sediment reserve storage of 37,000 acre-feet, a water supply pool of 273,000 acre-feet and a flood control pool of 131,400 acre feet. The total storage capacity will be 441,400 acre-feet. At the top of conservation pool, elevation 440.0 GVD, the surface area will be 19,305 acres. At top of flood control pool, elevation 446.2 NGVD, the surface area will be 22,740 acres. The dam will be an earthen embankment with a 700-foot uncontrolled concrete spillway. The maximum dam height will be 78.5 feet and the dam length will be 28,070 feet.

Contracts signed in July 1968 by the Sulphur River Municipal Water District, the North Texas Municipal District and the city of Irving for water supply, and the Texas Water Development Board relative to the Department's participation in the Cooper project, required modification as a result of the withdrawal of the Texas Water Development Board. By supplemental agreements, the three remaining water supply users agreed to assume the costs of the water supply storage that were relinquished by the Texas Water Development Board. These supplemental agreements were approved by the Acting Assistant Secretary of the Army (Civil Works) on Nov. 4, 1977.

Funds were first made available and preconstruction planning was initiated in fiscal year 1957. Construction of the channel and levee improvement was initiated in July 1958 and proceeded intermittently as rights-of-way and funds have been made available. A contract for construction of levee and channel improvements on the Sulphur River was stopped by court order in May 1971 pending the filing of an environmental impact statement in compliance with the National Environmental Policy Act of 1969. Up to that time, 64 percent of the levees and 85 percent of the channel work had been completed. The final statement was filed with the Council on Environmental Quality on June 24, 1977. The U.S. District Court for the Eastern District of Texas on Dec. 8, 1978, declared the Environmental Impact Statement to be legally inadequate and enjoined the project until deficiencies were corrected. A supplemental statement was prepared and filed with the Environmental Protection Agency in March 1981. The recommended plan of improvement consists of the multipurpose lake, 0.9 miles of levee and the acquisition of 25,500 acres of wildlife mitigation lands. All remaining channel and levee work was deleted from the recommended plan. The Supplemental Environmental Statement was filed with the court in July 1981 and in March 1983 the court issued an amended memorandum opinion and permanent injunction against the construction of the lake. An appeal was started in May 1983 and m July 16, 1984, the New Orleans Fifth Circuit Court of Appeals reversed the District Court's opinion and dissolved the injunction against the construction of Cooper Lake.

Construction of the project has proceeded since that time and deliberate impoundment is scheduled for 1991. The acquisition of mitigation lands was authorized by the Water Resources Development Act of 1986 and work on master planning is progressing.

The estimated cost of the project is $134.2 million, which includes $50.7 million of estimated cost for water supply chargeable to local interests and $227,000 which the local interests have already paid for flood control. The completed project will reduce flood damages over an area of 12,900 acres of improved land.

WHITE OAK CREEK MITIGATION AREA

Fort Worth District

To mitigate for loss of bottomland hardwoods and wildlife habitats by construction of Cooper Lake, 25,500 acres of land were acquired along White Oak Creek, 60 miles below Cooper Dam and within Wright Patman Lake flowage easement. The land will be designated as wildlife management area and protected from future development. A moist soil management area will be constructed in the Sciara Farms – Caney Creek area to attract and provide food for a wide variety of wildlife. Some previously cleared areas will be used for food plots and planted in cereal grain crops. Other areas will be allowed to vegetate naturally. The mitigation area can be used for hiking, nature study, horseback riding, hunting, fishing, and boating. Trail access and boat ramps will be provided, consistent with the primary purpose of wildlife mitigation.

LAKE TEXOMA

Tulsa District

Lake Texoma is located in Texas and Oklahoma, on the Red River, about five miles northwest of Denison, Texas. The lake is 57 miles long from east to west. At some points, the Oklahoma and Texas shores are less than a mile apart and at others they are as far as 10 miles apart. Denison Dam, which forms Lake Texoma, was built in the early 1940's and, at that time, was the largest rolled earth-filled dam in the United States. It controls run-off from a drainage area of 39,700 square miles and provides flood protection to portions of Texas, Oklahoma, Arkansas, and Louisiana. Denison Dam was operational for flood control in January 1944. Its project purposes are flood control, hydropower, water supply, recreation, regulation of stream flows, and improvement of navigation in the lower reaches of the Red River.

The Denison power plant, the first hydroelectric power installation in the Tulsa District, produces a major block of electric energy. The power plant consists of two Francis turbine-generators with an installed capacity of 35,000 kilowatts each. The first hydroelectric turbine was placed on line in March 1945 and a second unit in September 1949. The power intake structure will permit future installation of three additional units. The power generating facilities have produced over 9.7 billion kilowatt-hours of electrical energy since 1945.

The full power pool, at elevation 617.0 feet, covers an area of 88,000 acres and forms a shoreline of 580 miles. At the top of the flood control pool, elevation 640.0 feet, the lake has an area of 144,000 acres with a storage capacity of 5.4 million acre-feet of water. The water supply portion of the storage will yield 150 million gallons daily. Currently, contracts are in effect with the city of Denison, Texas Power and Light Company, Red River Authority of Texas and North Texas Municipal Water District for 114,956 acre-feet of water supply storage.

Lake Texoma's wide expanse of blue water and miles of cove-studded shoreline provide a wide variety of recreational opportunities for the millions of visitors it attracts annually. In 1990, 4.6 million visitor-days of recreational use were recorded. Through Fiscal Year 1990, the project has prevented over $100 million in flood damages on the Red River, including $33.3 million during the May 1990 flood.

Forty-two recreational areas have been developed by the Corps of Engineers. The Corps manages 28 of these areas, concession operators manage 10 parks, and Texas and Oklahoma each maintain a large state park. The 405-acre Eisenhower State Park, located a mile west of the south end of Denison Dam, has a large marina, camping and pubic use parks. Texoma State Park is a 1,844-acre facility on U.S. Highway 70, midway between Durant and Kingston, Oklahoma. h features a lodge, modern cabins, trailer spaces and camping sites.

The Corps, in conjunction with state wildlife agencies, is installing fish attractors in the lake to improve the fish habitat. The "Texoma National Sand Bass Festival" is held annually on Lake Texoma. The festival features a fishing tournament

and other recreational activities that attract over 25,000 people to the weeklong event.

About 80,000 acres of Lake Texoma project lands are open for public hunting. The state of Oklahoma has license to 26,000 acres for intensive wildlife management purposes and the Corps manages about 54,000 acres for wildlife. Wildlife management practices conducted by the Corps include construction of wood duck-nesting boxes, food plot planting, tree and shrub planting for wildlife cover, improvement of shoreline habitat and regulation of grazing to improve habitat. Principal game species include white-tailed deer, bobwhite quail, mourning dove, waterfowl, cottontail rabbits and squirrel. Migrating ducks and geese take full advantage of two wildlife refuges on opposite ends of Lake Texoma – Tishomingo National Wildlife Refuge (Oklahoma) on the north end, and Hagerman National Wildlife Refuge (Texas) on the south end. Both are managed by the U.S. Fish and Wildlife Service, Department of the Interior and provide food and rest for flights of ducks and geese passing through the Central Flyway.

LAKE O' THE PINES

Formerly Ferrells Bridge Dam
Fort Worth District

Lake O' the Pines, located on Cypress Creek in Marion, Harrison, Upshur, Morris, Camp and Titus Counties, Texas, is a part of the comprehensive plan for flood control in the Red River basin below Denison Dam. The project was authorized by the Flood Control Act of July 1946. The lake contains a flood control pool of 587,200 acre-feet with an area of 38,200 acres, and a water supply pool of 251,100 acre-feet with an area of 18,700 acres. Total lake capacity is 842,100 acre-feet. The tops of flood control with conservation pools are at elevation 249.5 feet and 230.0 feet, respectively. It is designed for the storage of water for the Northeast Texas Municipal Water District and for the retention of flood waters from 880 square miles of Cypress Creek drainage area. The flood waters are held until they can be released without contributing to flooding downstream.

The dam is located about eight miles west of Jefferson, Texas. It consists of approximately 4 million cubic yards of rolled earth embankment and is about 10,600 feet in length, with a maximum height of about 77 feet above the original streambed. The outlet structure, located on the east bank of the original stream, consists of twin 10-foot diameter conduits, each with an 8-foot by 12.5-foot gated opening. An uncontrolled concrete spillway, 200 feet in width, is located at the east end of the dam.

Lake O' the Pines was in partial operation for flood control during the 1958 flood, and stages on Red River below Shreveport were reduced by an average of about one foot. The gates were closed to fill the water supply pool in February 1960 and a full water supply pool, elevation 228.5 feet was attained on Nov. 1, 1960.

Construction of the project was started in 1955 and the lake was placed in operation in December 1959. Cost of the project was $14 million, of which $12.4 million was Federal cost and $1.7 million was local interests' cash contribution. Included in the Federal cost is $4 million for recreational facilities. The cumulative savings in flood control benefits through December 1990 are $28.3 million. Water supply costs will be contributed by the Northeast Texas Municipal Water District, a state agency created by the Texas legislature to administer the water supply features of the project.

Lake O' the Pines, at water supply pool level, has an average depth of 14 feet and a shoreline of 144 miles. It is a recreation spot for boating, fishing, hunting, swimming, skiing, picnicking and camping. Eight concession sites have been leased directly to private individuals and organizations for development of commercial facilities to supplement the fourteen recreation areas provided by the Corps of Engineers, and four boat ramp accesses managed by counties.

Hunting is allowed on 2,000 acres.

In 1990, the visitation was 1,444,600 recreation days of use.

LAKE KEMP

Tulsa District

Lake Kemp is a non-Federal lake which was reconstructed and expanded by the Federal government by raising the dam 16 feet and providing a new spillway and outlet works. It is located on the Wichita River about 40 miles southwest of Wichita Falls, Texas. The project is owned, operated and

maintained by Wichita County Water Improvement District No. 2 and the city of Wichita Falls.

Reconstruction of the Lake Kemp project was authorized by the Hood Control Act of 1962 to make it safe for future operation and to provide a specific allocation of storage for flood control. The reconstruction began in May 1970 and was completed in March 1974 at a total cost of $7.7 million. Local interests furnished the additional lands needed for thee reconstruction at a cost of $1.4 million and retained ownership after completion. They also agreed to reimburse the Federal government approximately $2 million for the reconstruction cost allocated to conservation storage. The Federal government will in turn reimburse local interests annually for the operation and maintenance on the basis of cost allocated to flood control storage. The reconstruction project has a total storage of 502,900 acre-feet. At the top of the flood control pool, elevation 1156.0 feet, there are 125 miles of shoreline.

The Corps of Engineers does not have recreational areas on Lake Kemp; however, 19,000 acres are available for hunting. That area is managed by the Texas Parks and Wildlife Department and licenses for hunting and fishing are obtained from them.

LAKE WICHITA AND HOLLIDAY CREEK

Tulsa District

A report recommending channel improvements on Holliday Creek and modification of the existing Lake Wichita, in the interest of flood control, was approved by the Board of Engineers for Rivers and Harbors in January 1978. It was approved by the Secretary of the Army and forwarded to the U.S. House of Representatives on April 25, 1984. The report is published in House Document 98-219. Preconstruction planning and engineering studies were completed m Fiscal Year 1985. The project was authorized for construction by PL 99-662. A local cooperation agreement with the City of Wichita Falls was executed in June 1987. The first construction contract was awarded in September 1988. Construction is expected to be complete in June 1994.

McGRATH CREEK

Tulsa District

McGrath Creek is a tributary of Holliday Creek in Wichita Falls, Texas. Feasibility studies for McGrath Creek were conducted as part of the preconstruction planning and engineering studies for the Lake Wichita, Holliday Creek Project. A feasibility report was prepared by the Tulsa District in July 1985. The recommended plan consists of a .7-mile concrete-lined channel and a new spillway at Sikes Lake. The estimated cost is 11.6 million based on October 1990 prices and the project has a benefit-to-cost ratio of 1.6.

The project was authorized for construction by the Water Resources Development Act of 1988 (PL 100-676) and preconstruction engineering and design studies began in October 1989.

PAT MAYSE LAKE

Tulsa District

Pat Mayse Lake is located on Sanders Creek, a tributary of the Red River in Lamar County, Texas. It was authorized for construction by the Hood Control Act of 1962. The dam is 12 miles north of Paris, Texas, and just west of U.S. Highway 271.

Construction began in March 1965 and the project was placed in full flood control operation by September 1967. Total cost of the project was $9.3 million.

Surrounding the lake are 10,000 acres of land available for pubic hunting and wildlife management. The Corps oversees 3,000 acres and the state of Texas manages the remaining area. Wildlife habitat improvement and food plot establishment are the principal techniques being implemented on the Corps-managed lands, benefiting many game and nongame species of birds and mammals.

Numerous artificial fish attractors have been installed by the Corps of Engineers. Five recreation areas are managed by the Corps at Pat Mayse Lake.

At the normal pool elevation of 451.0 feet NGVD, the 6,000-acre lake has a shoreline of 67 miles. Most of the water below elevation 451.0 feet is used for water supply, principally by the city of Paris, Texas. The city of Paris has reserved 109,600 acre-feet of storage by contract with the Federal government.

RED RIVER BELOW DENISON DAM, TEXAS, OKLAHOMA, ARKANSAS AND LOUISIANA

This project, as authorized by the Flood Control Act of July 1946 and subsequently modified by the Flood Control Acts of 1955 and 1958 and the River and Harbor Act of 1968, is a comprehensive plan for flood control in the Red River Valley below Denison Dam. The plan provides for the construction of seven lakes in Oklahoma, four in Arkansas, five in Texas and two in Louisiana; The enlargement and strengthening of the Red River levee system; the construction of channel stabilization and bank protective works at locations where levee setbacks are impossible or uneconomical; and the incorporation of several projects previously authorized in the comprehensive plan. Because of the wide scope of the project, each of its several features has been treated as a separate project.

These projects are:

Boswell, Oklahoma ..... See pamphlet for Oklahoma
Pat Mayse Lake, Texas ..... Complete
Hugo Lake, Oklahoma .... See pamphlet for Oklahoma
Tuskahoma Lake,
Oklahoma ..... See pamphlet for Oklahoma
Sardis Lake, Oklahoma .... See pamphlet for Oklahoma
Millwood Lake, Arkansas .. See pamphlet for Arkansas
Pine Creek Lake,
Oklahoma ..... See pamphlet for Oklahoma
Lukfata Lake,
Oklahoma ..... See pamphlet for Oklahoma
Broken Bow Lake,
Oklahoma ..... See pamphlet for Oklahoma
DeQueen Lake, Arkansas .. See pamphlet for Arkansas
Gillham Lake, Arkansas ... See pamphlet for Arkansas
Dierks Lake, Arkansas .... See pamphlet for Arkansas
Wright Patman Lake, Texas ..... Complete
Lake O' the Pines, Texas ..... Complete
Red River Levees and Bank Stabilization,
Texas, Arkansas and Louisiana ..... Under way
Walnut Bayou, Arkansas ... See pamphlet for Arkansas
Maniece Bayou,
Arkansas ..... See pamphlet for Arkansas
McKinney Bayou and Barkman Creek,
Arkansas and Texas ... Authorized for construction
..... See pamphlet for Arkansas
Posten Bayou, Arkansas ..... Authorized
..... See pamphlet for Arkansas
Cooper Lake and Channels, Texas ..... Under way
East Point, Louisiana ..... See pamphlet for Louisiana
Campti-Clarence Levee,
Louisiana ..... See pamphlet for Louisiana
Bayou Bodcau and Tributaries,
Louisiana ..... See pamphlet for Louisiana
Caddo Dam Replacement, Louisiana ..... Complete
Garland City, Arkansas .... See pamphlet for Arkansas
Bayou Pierre in vicinity of Shreveport,
Louisiana ..... See pamphlet for Louisiana
Day's Creek and Tributaries
Arkansas and Texas ... Authorized for Phase I
..... AE & D planning
..... See pamphlet for Arkansas

INCORPORATED PROJECTS

Hempstead County Levee
District No. 1,
Arkansas ..... See pamphlet for Arkansas
Red River Parish,
Louisiana ..... See pamphlet for Louisiana
Colfax-Grant Parish,
Louisiana ..... See pamphlet for Louisiana
Colfax-Grant Parish,
Louisiana ..... See pamphlet for Louisiana
Aloha-Rigolette Area, Grant and Rapides Parishes,
Louisiana ..... See pamphlet for Louisiana
Pineville, Louisiana ..... See pamphlet for Louisiana
Natchitoches Parish,
Louisiana ..... See pamphlet for Louisiana
Saline Point, Louisiana .... See pamphlet for Louisiana
Red River in vicinity of
Shreveport, Louisiana . See pamphlet for Louisiana
Bodcau Reservoir,
Louisiana ..... See pamphlet for Louisiana
Wallace Lake, Louisiana ... See pamphlet for Louisiana
Bayou Pierre, Louisiana ... See pamphlet for Louisiana
Bayou Bodcau, Red Chute and Loggy Bayou,
Louisiana ..... See pamphlet for Louisiana

RED RIVER LEVEES AND BANK STABILIZATION PROJECT

New Orleans District

This project provides for raising and strengthening the existing levees below Denison Dam to provide provide protection against a flood equivalent to that of 1945 and for bank protection and stabilization works in highly developed areas where levee relocations are impossible or uneconomical.

The estimated Federal cost of this project for work between Denison Dam and the vicinity of Alexandria, Louisiana, is $51.6 million. The 9.2 miles of levee in Bowie County, which comes under this project, are adequate to meet the project requirements and no work will be required in the state of Texas. Federal funds in the amount of $39.6 million have been appropriated through September 1978. Estimated non-Federal costs of the project are $1.3 million.

The project has been modified by the authorized project, Red River Waterway, Louisiana, Arkansas, Oklahoma and Texas.

RED RIVER WATERWAY, LOUISIANA, ARKANSAS, OKLAHOMA AND TEXAS

Fort Worth, Tulsa and Vicksburg Districts

The River and Harbor Act of 1968 authorized the following improvements:

(1) As modification of the project "Red River below Fulton, Arkansas and Louisiana," a plan for navigation on the Red River from the Mississippi River to Shreveport, Louisiana, consisting of a navigation channel 9 feet deep and 200 feet wide, in Red River, utilizing five locks and dams;

(2) As a modification of the project "Cypress Bayou and Waterway between Jefferson, Texas, and Shreveport, Louisiana," a plan for navigation on Twelve Mile and Cypress Bayous, from Shreveport, Louisiana, to Daingerfield, Texas, consisting of a navigation channel 9 feet deep and 200 feet wide, utilizing three (two existing) dams and three navigation locks;

(3) As a modification of the project "Red River Levees and Bank Stabilization below Denison Dam, Texas, Arkansas and Louisiana," a comprehensive plan for bank stabilization on the Red River from Denison Dam to the Mississippi River.

Construction was initiated in July 1973 on the reach between the Mississippi River and Shreveport, Louisiana.

The works was authorized for construction in Texas include approximately 52.5 miles of navigation improvements, 202.5 miles of channel stabilization and various recreational facilities.

Preconstruction planning, initiated in fiscal year 1977 for bank stabilization work on the Shreveport, Louisiana, to Index Arkansas reach, is presently continuing. Bank stabilization in the reach from Index, Arkansas, to Denison Dam, Texas is under the jurisdiction of the Tulsa District. Preconstruction Engineering and Design Studies are currently under way and include reevaluation of the authorized project and non-Federal cost sharing.

Funds were provided by the Congress in Fiscal Year 1989 to continue preconstruction planning efforts for the navigation to Daingerfield project. The funds (Daingerfield) provided by Congress for Fiscal Year 1991 will be used to continue the reevaluation studies. The reanalysis of the transportation economics for the extension to Daingerfield and the 21-year time lapse since project authorization require a complete reevaluation to assure that the project implemented is the best from an engineering perspective and conforms to current economic and environmental criteria.

WRIGHT PATMAN LAKE

Formerly Lake Texarkana
Fort Worth District

Located on Sulphur River in Bowie, Cass, Morris, Red River and Titus Counties, Texas, Wright Patman Lake is a part of the comprehensive plan for flood control in the Red River basin below Denison Dam. The project was authorized by the Flood Control Act of July 24, 1946. The lake contains 145,300 acre-feet of conservation storage at elevation 227.0 feet msl with an area of 20,300 acres; and 2.5 million acre-feet of flood storage at elevation 259.5 feet msl an area of 119,700 acres. The total storage capacity is 2.5 million acre-feet. It is designed for the retention of floodwaters from approximately 3,400 square miles of Sulphur River watershed. During periods of high water in this area, the structure provides the means by which water can be released at a controlled rate, thereby reducing potential flooding which is caused by high water stages of the Red River. Two contracts with the Government permit withdrawal of water in amounts of 16 MGD and 84 MGD for use by the cities of Texarkana in Arkansas and Texas. Allowable water supply withdrawals vary from 9.8 million gallons per day in January and February to 17.9 million gallons per day in August.

The dam located about eight miles southwest of Texarkana, consists of approximately 7.4 million cubic yards of rolled earth embankment, about 18,500 feet long with a maximum height of about 100 feet above the original streambed. The outlet structure, located near the south end of the dam, consists of two 20-foot-diameter conduits, each having two 10-foot by 20-foot gated openings. An uncontrolled concrete spillway, 200 feet in width, is located just south of the main embankment. A dike approximately one mile long was constructed across a depression in the hill line about one mile south of the main dam.

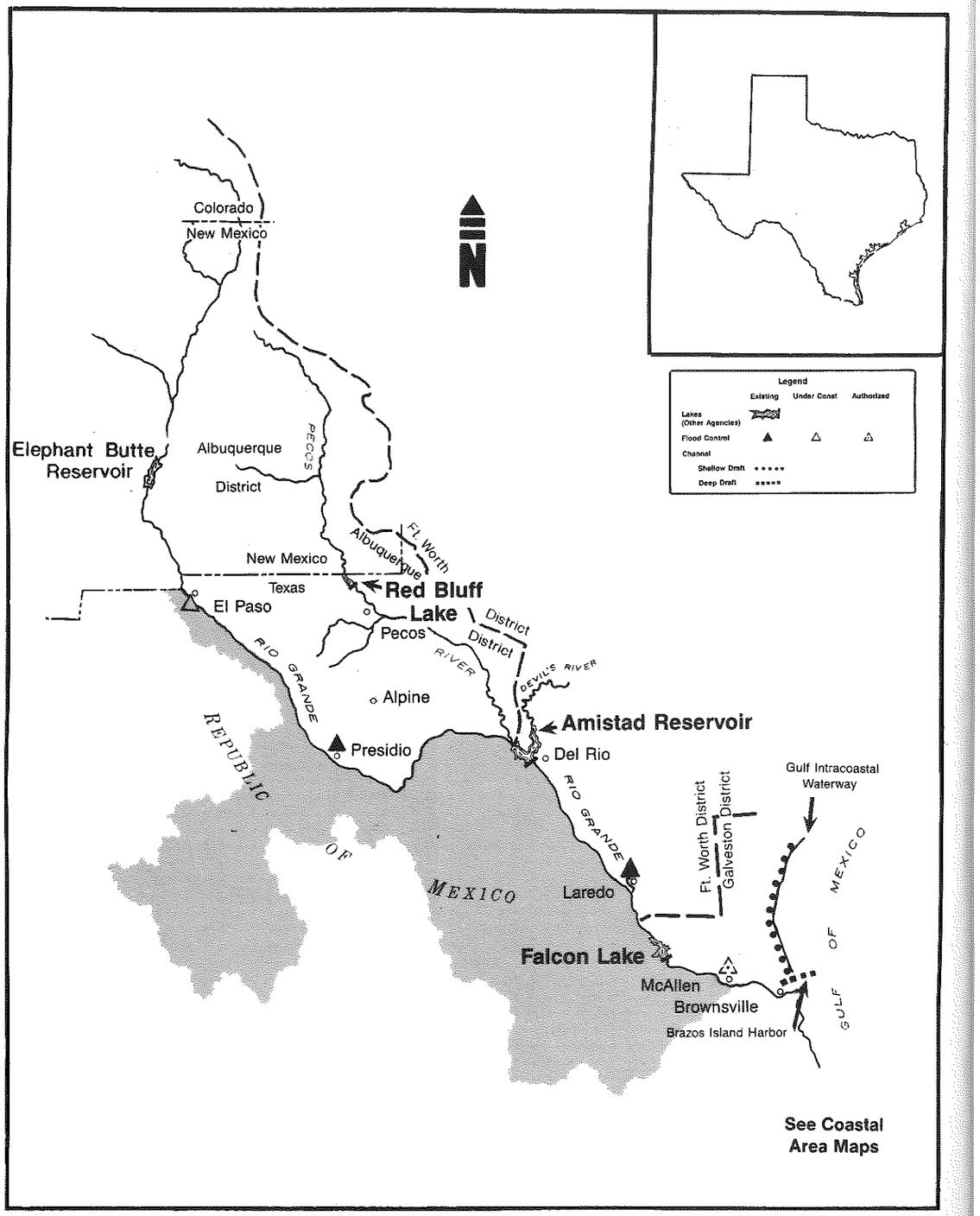
The gates of the dam were closed in July 1956 and the top of the conservation pool, 227.0 feet msl, was reached in February 1957. The project was in partial operation for flood control during the 1957 flood and in full operation for flood control during 1958.

When Cooper Lake is completed, 120,000 acre-feet of flood control storage space in Wright Patman Lake may be reallocated to other uses. This storage space may be made available to the city of Texarkana, Texas, for municipal and industrial water supply. An additional water supply contract with the city of Texarkana, Texas, covering the storage that may be converted when Cooper Lake is completed, was signed in April 1968 and approved by the Secretary of the Army on July 11, 1968. The Wright Patman Lake conversion would require the purchase of additional real estate in easement lands and additional protection at the St. Louis Southwestern Railroad, county roads, state highways and recreational facilities. These modifications would be required to protect the interest of the Government because of the increased frequency of flooding resulting from the conversion of flood control storage to municipal and industrial water supply. Funds for the conversion at Wright Patman Lake will be requested if an independent study indicates that conversion is feasible.

Construction of the project was initiated in August 1948 and deliberate impoundment of water began on June 27, 1956. The estimated cost of the project was $51.9 million (October 1976), which included $13.1 million as the estimated cost to be reimbursed by the city of Texarkana, Texas, for the municipal and industrial water supply space. Included in the Federal costs are $5.4 million for recreational facilities. Savings in flood control benefits through December 1990 amounted to $13.9 million.

Wright Patman Lake, has an average depth of 12 feet and 165 miles of shoreline at the summer recreational pool elevation. Facilities include those for boating, fishing, hunting, swimming, skiing, picnicking and camping. One site in the lake area has been licensed to the state and developed as Atlanta State Park. Four other park sites are leased to local counties and three sites are leased to private individuals for development of facilities to supplement the eleven recreational areas provided by the U.S. Army Corps of Engineers. In 1990, the visitation was 2,084,700 recreation days of use.

RIO GRANDE BASIN



RIO GRANDE BASIN

The Rio Grande rises at an elevation of over 12,000 feet in the San Juan Mountains of southern Colorado. It flows 182 miles in a southeasterly direction through Colorado, and then 465 miles southward across New Mexico to El Paso, Texas, from where it flows southeasterly to the Gulf of Mexico. For more than 1,200 miles, it marks the international boundary between Texas and Mexico, from El Paso to Brownsville, Texas. For flood control and other water resources purposes, the portion of the basin forming the international boundary is under the jurisdiction of the International Boundary and Water Commission for the United States and Mexico. The portion in the United States, other than the boundary portion, is within the Albuquerque District of the Corps of Engineers.

COMPLETED FEDERAL PROJECTS

El Paso Flood Control (partially complete)
Presidio Flood Protection
Laredo Flood Protection

AUTHORIZED FEDERAL PROJECTS

Improvements to Lower Rio Grande Basin

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Shallow Draft and Deep Draft Navigation Projects and Federal Flood Protect Projects.

EL PASO FLOOD PROTECTION

Albuquerque District

This border city is subject to severe flooding from tributary arroyos on the eastern, southern and western slopes of the Franklin Mountains overlooking the city and its sister city, Juarez, Mexico. As authorized by the 1965 Flood Control Act, El Paso's flood improvement plan consists of a single purpose flood control system of detention dams, diversion dikes and channels to collect, regulate and discharge arroyo run-off into the fabled Rio Grande, which forms the United States - Republic of Mexico international boundary at El Paso. The project is comprised of three areas, the northwest, central and the southeast. Area flood control improvements are designed to work in conjunction with each other to capture and divert arroyo floodflow through and around El Paso into the Rio Grande. These flood control improvements are further designed to operate and retain flood flow independently, thereby controlling inflow into the Rio Grande, as required.

Construction on the central area began in 1970 and was essentially complete in 1974. Construction on the northwest area began in 1974 and was essentially complete in 1987. Range and Northgate Dams, with their adjacent diversion channels, have been completed, as has the conduit for carrying water from the Fort Bliss Sump to Pershing Dam. Mountain Park and Sunrise Dams, Pershing Dam, McKelligen Dam, the Government Hill Outfall Conduit and the Fort Bliss Diversion Channel have also been completed.

The completed dams are functional and are providing some measure of protection for the city.

Design work for Fillmore and Van Buren Dams is complete. However, due to development, incomplete features are being re-evaluated.

The Oxidation Pond Dam, Buena Visa Diversion and the Oxidation Pond Outlet are complete. Other completed projects include Mulberry, Thorn and Mesa Dams.

Preconstruction planning on the southeast area was initiated in fiscal year 1981. Funds were appropriated in fiscal year 1988 to initiate construction and the first contract is scheduled to be awarded in mid-1988.

A most interesting facet of this project was the discovery of the remains of an ancient Indian village at the project's Range Dam site in the central area. Archaeologists from the Federal government, and the. state of Texas made preliminary studies and tentatively dated the site to the ninth century. The sites has been entered on die National Register of Historical Places to be preserved and protected. Construction for Range Dam was modified to be in harmony with this situation.

Total cost of El Paso's flood control project is presently estimated to be $104.2 million, of which $31.7 million is non-Federal. Annual benefits expected to accrue from this project amount to $4.2 million.

PRESIDIO FLOOD PROTECTION

Albuquerque District

This section 205 project comprised a left bank levee of 1.3 miles long and 0.7 mile of right bank levee to provide standard project flood protection to the urban area of Presidio against floods originating on Cibolo Creek. Construction was initiated in April 1982 and completed in fiscal year 1983.

LOWER RIO GRANDE BASIN (Authorized)

Galveston District

The Water Resources Development Act (WRDA) of 1974; authorized the Corps to undertake Phase I design studies of a three-phase drainage and flood control plan developed by the Soil Conservation Service (SCS) for the Lower Rio Grande Basin in Willacy, Hidalgo, and Cameron Counties, Texas. In November 1986 the project was authorized for construction by WRDA of 1986. The authorized project consists of three separable elements - Arroyo Colorado, South Main Channel, and the Raymondville Drain. These elements function independently of each other and therefore, will be economically, functionally, and hydraulically addressed and constructed separately.

Phase I of the authorized project consists of three major outlet channels; the Raymondville Drain, South Main Channel, and the Arroyo Colorado; 157 miles of floodwater channels including three major outlet channels; and flood protection measures for the cities of Edinburg, McAllen, Raymondville, Edcouch, La Villa and Lyford, Texas.

Phase II and III improvements consist of lateral drains and on-farm measures to be provided by local interests in cooperation with the SCS.

The overall fully funded project cost for the Lower Rio Grande Basin project is currently estimated at $306,739,000 ($200,646,000 Federal and $106,093,000 non-Federal).

Pre-construction, Engineering and Design (PED) studies were initiated in FY 90. The Arroyo Colorado is the first priority for the Local Sponsor; therefore, the initial PED funds were allocated primarily for preparing a Reevaluation Report for this feature of the authorized project.

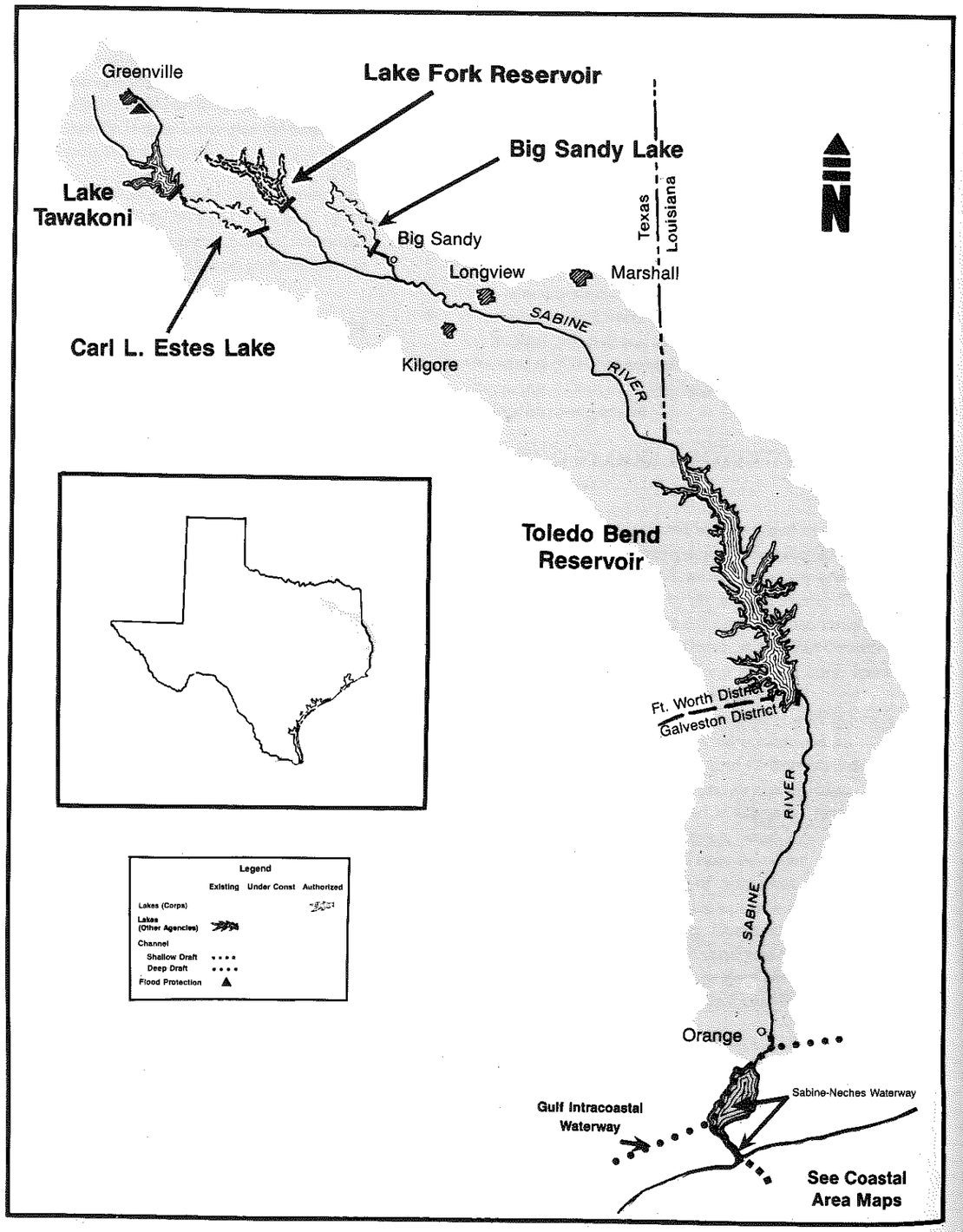
LAREDO FLOOD PROTECTION

Fort Worth District

The project was authorized by the Chief of Engineers under the provisions of Section 205 of the Flood Control Act of 1962, as amended, to provide flood protection to the city of Laredo, Texas. The plan of improvement includes an improved channel from the mouth of Zacate Creek at the Rio Grande up to about Calton Street, along with an open space greenbelt with recreational facilities from Matamoros-Guadalupe Streets up to the Missouri Pacific Railroad. New bridges were required at Clark-Park Streets, Marcella and Calton Streets and at the Missouri-Pacific Railroad bridge. Bridge modifications will be required at Corpus Christi Washington, Sanchez-Gustavus, Sounders-LaFayene Streets and the Texas-Mexican Railroad bridge. All lands and rights-of-way were provided by local interests who will also operate and maintain the completed improvements. Construction of the project began in August 1980 and was completed in May 1982. The final Federal project cost was $2.9 million and the non-Federal cost is estimated at $1.3 million.

SABINE RIVER BASIN

Sabine River Basin



SABINE RIVER BASIN

The Sabine River basin lies in the eastern part of Texas and the western part of Louisiana. It is bounded by the basins of the Neches River on the west, the Trinity River on the northwest, the Red River on the north and northeast, and Calcasieu River on the east. It extends in a general northwest to southeast direction from eastern Collin and Rockwall Counties about 35 miles northeast of Dallas,Texas, about 165 miles to the eastern boundary of the state thence southerly in Texas and Louisiana about 145 miles to the head of Sabine Lake, a natural lake near the confluence of the Neches and Sabine Rivers. It is located midway between Port Arthur and Orange, Texas.

The basin is about 300 miles long and varies in width from 16 miles to 48 miles. Its drainage area is about 9,756 square miles, of which 2,330 square miles are in Louisiana and 7,426 square miles are in Texas.

Big Sandy, Lake Fork Reservoir, Carl L. Estes Lake and Greenville Local Flood Protection were authorized in the Hood Control Act of 1970. Since a non-Federal agency completed construction on Lake Fork Reservoir in 1980, it was deauthorized as a Federal project by the Water Resource Development Act of 1986.

COMPLETED FEDERAL PROJECTS

Greenville Local Hood Protection
Gulf Intracoastal
Waterway ..... See Coastal Areas
Sabine-Neches Waterway

COMPLETED NON-FEDERAL PROJECTS

Lake Fork Reservoir
Lake Tawakoni
Toledo Bend Reservoir

AUTHORIZED FEDERAL PROJECTS

Big Sandy Lake
Carl L. Estes Lake

FLOOD INSURANCE STUDIES

Canton March 1985
Gregg County 1988

BIG SANDY LAKE

Fort Worth District

Big Sandy Dam would be located at mile 15.3 on Big Sandy Creek about six miles northwest of Big Sandy, Texas. The lake would be virtually contained in Wood County, with a small area extending into Upshur County. This project would be formed by an earth- and rock-fill dam with a maximum height of 94.5 feet above streambed and a total length of 6,200 feet, including the concrete spillway. The spillway is a 100-foot uncontrolled broad-crested weir; and the outlet works is a 9-foot-diameter conduit controlled by two 4.25 by 9-foot slide gates. Big Sandy Lake would have a total controlled storage of 418,200 acre-feet and a water surface area of 16,580 acres at elevation 382.0, top of flood control pool. At elevation 367.5, top of conservation pool, the lake would have an area of 10,810 acres and a storage capacity of 221,200 acre-feet. Total allowance for a 100-year accumulation of sediment would be 6,900 acre-feet. Estimated cost for recreation and redevelopment are estimated at $8.4 million. Preconstruction planning was initiated in fiscal year 1979, but terminated by the Corps of Engineers in May 1982. The Bureau of Reclamation initiated studies for water supply at the site in 1983. The study was completed in 1990.

CARL L. ESTES LAKE

Formerly Mineola Lake
Fort Worth District

The dam would be located at river mile 479.7 on the Sabine River, about 34.8 miles downstream from the existing Iron Bridge Dam, and about eight miles upstream from U.S. Highway 80. The lake would be in parts of Wood, Rains and Van Zandt Counties. The project would be formed by an earth- and rock-fill dam with a maximum height of 108.5 feet

above streambed and a total length of 15,830 feet, including a concrete spillway. The spillway, with a

net opening of 200 feet would be located on the right abutment and would be an uncontrolled ogee weir. The outlet works would consist of one 15-foot conduit controlled by two 7-foot by 15-foot slide gates.

The lake would have a total controlled storage of 1.2 million acre-feet and a water surface area of 44,000 acres at elevation 403.0, top of flood control pool. Top of the conservation pool would be at elevation 379.0 with an area of 24,900 acres and a capacity of 393,000 acre-feet. Total allowance for a 100-year accumulation of sediment would be 20,400 acre-feet. The project cost is estimated to be $218 million (October 1979). Average annual benefits for flood control, water supply, recreation and redevelopment are estimated at $17.1 million. Preconstruction planning studies completed in 1979 revealed construction of the lake should be delayed until the extensive lignite deposits underlying the lake area are mined. The project was classified in the "inactive" category in April 1979.

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Shallow Draft and Deep Draft Navigation Projects and Federal Flood Protection Projects.

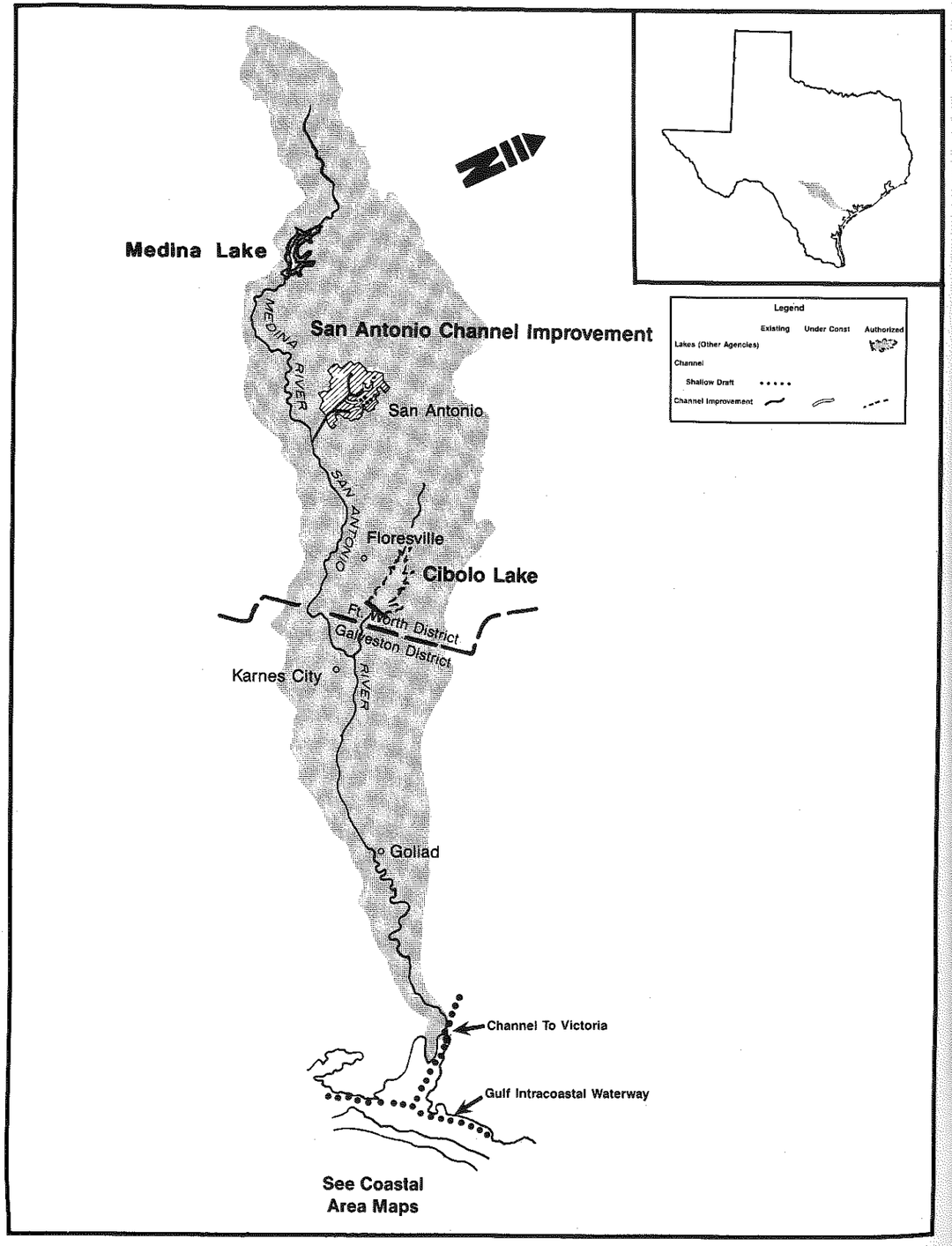
GREENVILLE LOCAL FLOOD PROTECTION

Fort Worth District

The project is located on Long Branch, a tributary of the Cowleech Fork of the Sabine River, in the city of Greenville, Texas. The project consists of 3.34 miles of channel realignment and enlargement from 3,600 feet below Interstate Highway 30, upstream to O'Neal Street, and construction of two drop structures. Channel construction started in March 1978 and was completed in fiscal year 1982. Cost of project is $1.3 million of which $991,000 is Federal and $259,000 is non-Federal. In addition, a cost sharing recreation development plan was completed in fiscal year 1982.

Average annual benefits for flood control are estimated at $84,000.

SAN ANTONIO RIVER BASIN



SAN ANTONIO RIVER BASIN

The San Antonio River basin is located in the south central part of Texas, extending northwesterly from San Antonio Bay, an estuary of the Gulf of Mexico. The basin has an overall length of approximately 210 miles. There are 4,225 square miles in the San Antonio River watershed.

The Flood Control Act of September 1954 authorized construction of Gonzales Lake and the San Antonio Channel Improvement for flood control and other related purposes. The Water Resources Development Act of 1976 modified the San Antonio Channel Improvement project by authorizing construction of flood control measures to preserve and protect the historic Espada Acequia Aqueduct, located in the vicinity of Six Mile Creek. Gonzales Lake was deauthorized by the Water Resources Development Act of 1974, PL 93-251.

COMPLETED FEDERAL PROJECTS

San Antonio Channel Improvement
(partially complete)

COMPLETED NON-FEDERAL PROJECTS

Medina Lake

FLOOD INSURANCE STUDIES

Bandera LMMP 1988

FLOOD PLAIN INFORMATION REPORTS

Special Flood Hazard Information Study, Guadalupe River State Park, Kendall and Comal Counties. ..... September 1982

HIGH FLOOD HAZARD AREA STUDIES

Bandera	1986
Bandera County	1986
Bexar County	1986
San Antonio	1986

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Channel to Victoria (tributary channel to Gulf Intracoastal Waterway); Gulf Intracoastal Waterway Main Channel (Shallow Draft); Guadalupe River Log Jam Removal; and Seadrift Harbor of Refuge.

SAN ANTONIO CHANNEL IMPROVEMENT

The project is in progress and consists of clearing, widening, deepening and straightening the channel of the San Antonio River and tributaries in and near the city of San Antonio, Texas. As a part of the comprehensive plan of development for the San Antonio River basin, its purpose is to relieve the city's flooding problem created by convergence of the Pedro, Apache, Alazan and Martinez Creeks within the Espada Acequia Aqueduct located in the vicinity of Six Mile Creek.

The project is scheduled in units, of which construction on the first, on the San Antonio River, was started in October 1957. Work on the second unit, San Pedro Creek, got underway in 1959. Excavation on the Alazan Creek portion of the project started in July 1962; excavation of Apache Creek began in March 1966; and work began on the Martinez Creek portion of the project in June 1969. A construction contract for protection of the Espada Acequia Aqueduct was awarded in July 1979.

On the San Antonio River, construction has been completed on Unit I (from Ashley Road to the mouth of San Pedro Creek); Unit 8-1 (from the mouth of San Pedro Creek to Lone Star Blvd.); Unit 8-2 (from Lone Star Blvd. to Alamo Street); Unit 8-3-1 (from Alamo Street to Johnson Street); Unit 8-3-2 (Johnson Street to Nueva Street); and Unit 9 (from .8 mile below Loop 410 to Ashley Road).

On Martinez Creek, construction has been completed on Unit 3 (from Culebra Street to Sherwood Drive); and Unit 4-3 (from the mouth of Martinez Creek to Culebra Street). The East Fork

of Martinez Creek (Unit 6-1) has been completed from the confluence near Capitol Avenue to Hildebrand Avenue.

On Alazan Creek, construction has been completed on Unit 4-1 (from the mouth of the Alazan creek to Buena Vista Street); and Unit 4-2 (from Buena Vista Street to Josephine Tobin Drive).

On Apache Creek, construction has been completed on Unit 5-1 (from mouth of Apache Creek to Trinity Street); Unit 5-2 (from Trinity Street to Southwest 19th Street); and on Unit 5-3 (from Southwest 19th Street to General McMullen Drive). Completion of Apache Creek, Units 5-2 and 5-3, provides a floodway channel with a park-like green belt winding along the channel banks within the developed Model Cities Neighborhood from Trinity Street to General McMullen Drive.

In San Pedro Creek work has been completed on Unit 2 (from the mouth of San Pedro Creek to the mouth of Alazan Creek); on Unit 7-1 (from the mouth of Alazan Creek to Alamo Street); Unit 7-2-1 (from Arsenal Street to Durango Street); and Unit 7-2-2 (from Alamo Street to Arsenal Street).

Total length of the improved channel is about 34.9 miles, with bottom widths varying from 12 to 280 feet.The project includes 14.4 miles along the San Antonio River, 5 miles along San Pedro Creek, 4 miles along Apache Creek, 4.3 miles along Alazan Creek, 6.7 miles along Martinez Creek and one-half mile along Six Mile Creek. The project requires about 11.5 million cubic yards of excavation. Also involved is the construction of concrete and steel piling floodwalls and culverts. Deep tunnels beneath the downtown area in lieu of surface channels were found to be more cost effective and to have fewer environmental impacts. Preparation of plans and specifications for the first increment of the tunnel plan was completed in fiscal year 1986 and a contract awarded on September 22, 1986, Phase II of the tunnel project was awarded on September 23, 1987, and includes the underground tunnels and vertical shafts for both the San Pedro Creek and San Antonio River projects. Phase III consists of the intake and outlet structures for the San Pedro Creek Tunnel and was awarded in October 1989. Phase IV covers the intake and outlet structures for the San Antonio River Tunnel and was scheduled for award in February 1991. Construction of the remaining unit 7-3-2, San Pedro Creek Channel, is now scheduled for the second quarter of fiscal year 1992; unit 6-2, North Fork Martinez Creek was awarded in May 1991.

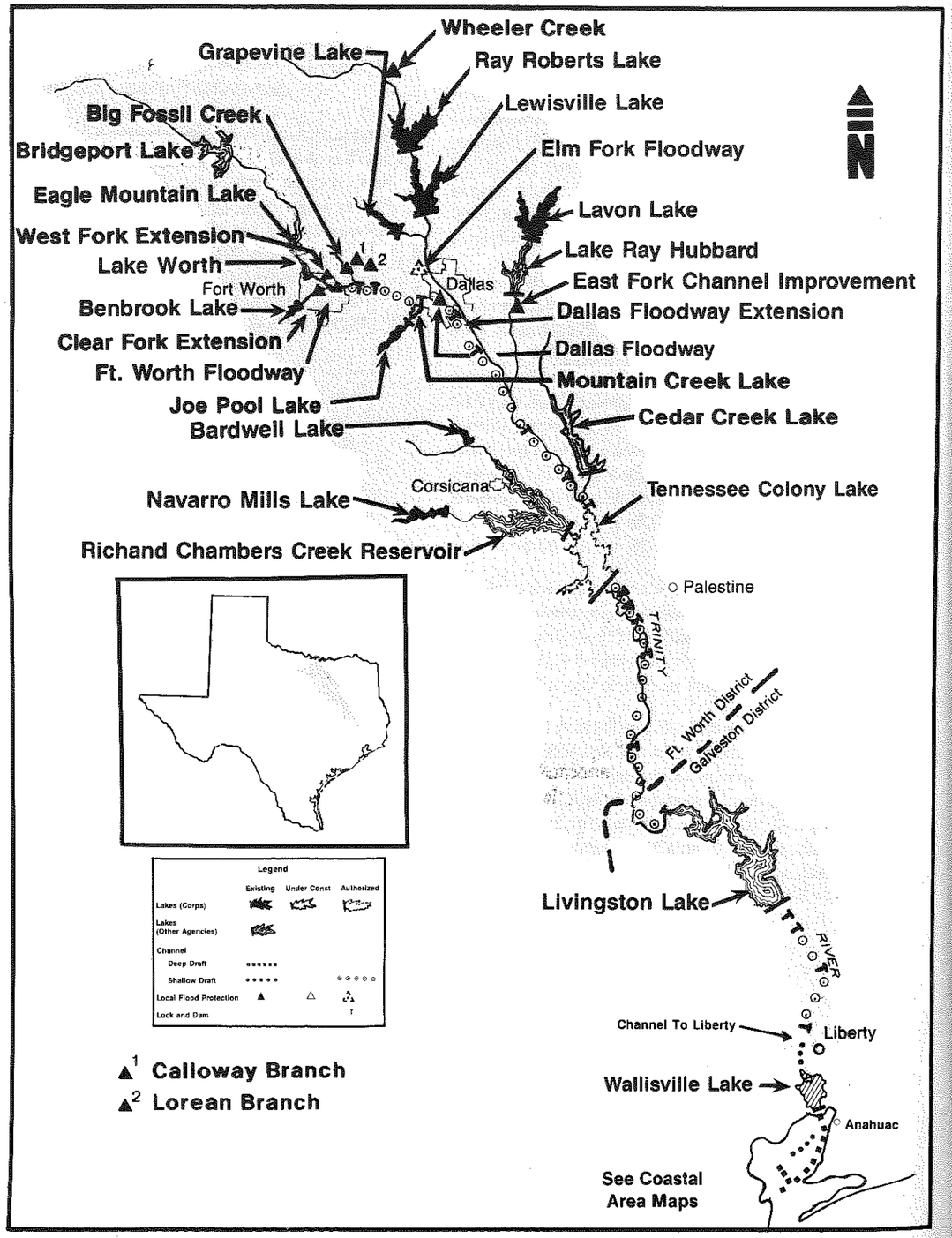
The cost to the government of the proposed improvement is estimated at $132 million as of May 1990, in addition to which local interests, represented by the San Antonio River Authority, would make a cash contribution of approximately $3.0 million. Cooperation of local interest also includes provision of necessary rights-of-way and easements; modification of utilities; reconstruction of five channel dams; construction of 14 new low-water crossings and 81 new bridges; and modification of five existing bridges, all of which are expected to cost an estimated $94.0 million.

Funds in the amount of $109.2 million have been allotted toward construction costs for this project through fiscal year 1991. The project is approximately 80 per cent physically complete and is scheduled for completion in June 1995.

In 1972, the Fort Worth District was awarded the Chief of Engineers' Award of Merit for the design of the San Antonio Channel Improvement, and in 1978 received the Chief of Engineers' Landscape Architect Design Award for Apache Creek, Unit 5-3. In 1983, the district received an Honor Award for the preservation of the Espada Aqueduct. In 1991 the district received an honor award for Unit 8 - 3 - 2.

TRINITY RIVER BASIN

Trinity River Basin



TRINITY RIVER BASIN

The Trinity River is about 715 miles long, dropping some 1,250 feet from its source in north central Texas to its mouth at the Gulf of Mexico. The West Fork joins the Clear Fork at Fort Worth, while the main stem is formed at Dallas by the confluence of the West Fork and Elm Fork. The river flows in a meandering, southeastward course and enters Galveston Bay at Anahuac. The major tributaries in the upper reaches are the East Fork, Cedar Creek and Richland Creek. Although the Trinity River basin is only about 360 miles long, the river itself, because of its meandering course, is almost twice that length. The maximum width of the basin, near its upper end, is about 100 miles.

In the River and Harbor Act of March 1945, Congress authorized construction of the first elements of the comprehensive program for the development of the water resources of the Trinity River basin, consisting of four multiple-purpose lakes -- Benbrook, Grapevine, Lewisville and Lavon -- and two floodway projects -- one at Dallas and the other at Fort Worth. These six projects have been completed. They more than paid for their combined cost of construction in flood damages prevented during the unprecedented floods of 1957. In Flood Control Acts of 1954, 1960, 1962 and Public Law 86-339, Congress authorized construction of a number of additional projects that became elements of the comprehensive plan. These other projects are Navarro Mills Lake, Bardwell Lake and the modification of Lavon Lake to provide additional storage for conservation of water supply, the improvement of the channel of the East Fork of the Trinity River downstream from Lavon Dam, two extensions to the existing Fort Worth Floodway project, and a channel improvement project through the city of Richland Hills, adjacent to Fort Worth.

A basinwide plan of improvement for the Trinity River basin was authorized by the River and Harbor Act of 1965. The Trinity River Project plan provided for the construction of the following features:

- Five local flood protection projects - West Fork Floodway, Elm Fork Floodway, Dallas Floodway Extension, Duck Creek Channel Improvements and Liberty Levee;

- Four multiple purpose lakes - Lakeview Lake (now Joe Pool Lake), Roanoke Lake, Aubrey Lake (now Ray Roberts Lake) and Tennessee Colony Lake;

- A multiple-purpose channel along the Trinity River from the Houston Ship Channel to Fort Worth, Texas, and;

- A water conveyance system from Tennessee Colony Lake to Benbrook Lake to improve water quality.

Duck Creek Channel Improvement, Roanoke Lake, and Liberty Local Flood Protection were deauthorized by PL 99-662 in November 1986.

The Flood Control Act of 1970 authorized construction of a road to improve access to the Wolf Creek Park Area of Navarro Mills Lake.

A General Design Memorandum (GDM) completed in 1981 recommended consolidation of several authorized elements. The projects currently recommended for continued study are Dallas Floodway Extension, Tennessee Colony Lake and the Multiple-Purpose Channel to Liberty. The GDM recommended no Federal action for the West Fork Floodway. The Wallisville Lake project was not covered by this GDM. A Regional Environmental Impact Statement was completed in October 1987 and was accomplished under the Corps' Section 404 regulatory authority.

COMPLETED FEDERAL PROJECTS

Bardwell Lake
Benbrook Lake
Big Fossil Creek Channel Improvement
Calloway Branch Channel Improvement
Dallas Floodway
Fort Worth Floodway Extension, Clear Fork
Fort Worth Floodway Extension, West Folk
Fort Worth Floodway
Grapevine Lake
Joe Pool Lake
Lavon Lake
Lewisville Lake
Lorean Branch
Navarro Mills Lake
Ray Roberts Lake
West Fork of the Trinity River-Sanitary Landfill
West Fork of the Trinity River-Myers Road
Channel Improvement
Wheeler Creek Channel Improvement

AUTHORIZED FEDERAL PROJECTS

Dallas Floodway Extension
East Fork Channel Improvement (partially complete)
Tennessee Colony Lake
Wallisville Lake (partially complete)
West Fork Floodway

COMPLETED NON-FEDERAL PROJECTS

Lake Bridgeport	Mountain Creek Reservoir
Cedar Creek Reservoir	Lake Ray Hubbard
Eagle Mountain Lake	Richland Chambers Creek
Lake Bridgeport	Reservoir
Lake Livingston	Lake Worth

FLOOD INSURANCE STUDIES

Dallas, Dallas County	April	1980
Watauga, Tarrant County	May	1980
Dallas County	July	1980
Dalworthington Gardens, Tarrant County	October	1980
Colleyville, Tarrant County	November	1980
Grapevine, Tarrant and Dallas Counties	January	1981
Keller, Tarrant County	January	1981
Southlake, Tarrant County	February	1981
Edgecliff Village	March	1982
Kennedale	December	1982
Bedford		1983
Mansfield	January	1983
West Fork of the Trinity River, Tarrant County	January	1983
Euless, Tarrant County	March	1983
Richland Hills, Tarrant County	June	1983
River Oaks, Tarrant County	July	1983
Hurst, Tarrant County	August	1983
Westover Hills	October	1983
Westworth Village, Tarrant County	December	1983
North Richland Hills, Tarrant County	December	1983
Fort Worth.		1984
Shady Shores	January	1984
The Colony	January	1984
Lake Dallas	February	1984
Cornith	February	1984
Azle	February	1984
Denton County		1985
Willow Park	February	1985
Weatherford	February	1985
Denton	March	1985
Burleson, Johnson County	September	1985

FLOOD INSURANCE STUDIES (Continued)

Arlington	September	1985
Haskell	April	1986
Jacksboro	August	1986
Springtown		1986
Benbrook LMMP		1997
Lewisville, Elm Fork of the Trinity River, Plano, Garland, Allen	September	1997
Haltom City		1989

ACTIVE PLANNING STUDIES

Dallas Floodway
Five Mile Creek, Dallas
Upper Trinity River Basin
Dallas Floodway Extension Reevaluation
Lower Trinty

FLOOD PLAIN INFORMATION REPORTS

Special FHI Report -
Lower White Rock Creek . August 1980

HIGH FLOOD HAZARD AREA STUDIES

Arlington	1985
Benbrook	1985
Carrollton	1985
De Soto	1985
Duncanville	1985
Everman	1985
Fort Worth	1985
Garland	1985
Irving	1985
Mesquite	1985
Plano	1985
Richardson	1985
Watauga	1985
Cooke County	1986
Dallas	1986
Dallas County	1986
Gainesville	1986
Weatherford	1986

BARDWELL LAKE

Fort Worth District

The dam is located on Waxahachie Creek five miles above its confluence with Chamber Creek and about five miles south of Ennis, Texas. The project controls the run-off from 178 square miles of drainage area.

Total storage capacity of the lake is 140,000 acre-feet, of which 79,600 acre-feet is allocated to flood control, 42,800 acre-feet is allocated to water conservation, and 17,600 acre-feet is for sediment reserve. At conservation pool, elevation 421.0, the lake covers a surface area of 3,570 acres and at flood control pool, elevation 439.0, the lake would cover a surface area of 6,040 acres. Conservation storage is under contract to the Trinity River Authority for water supply.

The dam, with a maximum height of 82 feet above the streambed, consists of 15,400 feet of earth-fill embankment, including a 350-foot wide uncontrolled spillway. Flood releases will be made through one 10-foot conduit controlled by two 5-foot wide by 10-foot high gates.

Construction of the $10.9 million project was initiated in August 1963 and deliberate impoundment began in November 1965. The savings in flood control benefits through December 1990 were $9.3 million.

The 1990 visitation was 407,500 recreation days of use.

Bardwell Lake has access roads, launching ramps, swimming beaches, sanitary facilities, picnic and camping sites. The lake has an average depth of 15 feet and 25 miles of shoreline. There are six public recreation areas and eight wildlife management areas providing 2,528 acres for hunting and nature observation.

BENBROOK LAKE

Fort Worth District

The dam is located about 10 miles southwest of Fort Worth on the Clear fork of the Trinity River and controls the run-off from about 429 square miles of drainage area.

Rising to a maximum height of 130 feet above the streambed and 9,130 feet in length, the earth-fill embankment has an uncontrolled emergency spillway with a 100-foot notch in its center, a flood control outlet conduit 13 feet in diameter controlled by two 30-inch outlets for the release of water stored for conservation purposes. Total storage capacity of the lake is 258,600 acre-feet, of which 170,350 acre-feet is allocated to flood control; 72,500 acre-feet is for conservation storage; and 15,750 acre-feet is for sediment reserve. At conservation pool, elevation 694.0, the lake covers a surface area of 3,770 miles; and at flood control pool, elevation 724.0, the surface area would be 7,630 acres.

Construction began in May 1947 and the project was completed for beneficial use in September 1952. Estimated initial Federal cost of the project was $14.5 million.

The Benbrook project is designed to prevent floods similar to the one of May 1949 when vital business and residential areas of Fort Worth were inundated and eleven persons lost their lives. Monetary losses were estimated at $11 million. By preventing this flood alone, the Benbrook project would almost have been paid for. During the April-May 1957 floods, the lake, combined with the Fort Worth Floodway, prevented damages estimated at $9.3 million. Also, during the October and December 1971 floods, an estimated $10.7 million in flood damages were prevented. In 1990, North Texas experienced heavy rainfall resulting in major flooding. The damages prevented during the floods resulted in a savings in flood control benefits for FY 90 of $858.1 million. Cumulative flood control benefits through Dec 1990 were $960.7 million for the Benbrook project and the Fort Worth Floodway.

In 1956, Congress passed legislation enabling the city of Fort Worth to purchase conservation storage space in Benbrook Lake. Contracts have been approved with the city of Fort Worth and the Benbrook Water and Sewer Authority for the use of portions of the navigation storage for water supply purposes until such storage is required for Trinity River navigation.

In 1990, the visitation was 895,000 recreation days of use.

Benbrook Lake is a metropolitan lake having 40 miles of shoreline and an average depth of 23 feet. The six park areas receive very heavy day-use compared to the more rural lakes. One of the special facilities is a 7.3 mile horseback and nature trail. Hunting requires a free permit from the project office. Nearly 1,400 acres are managed for hunting.

BIG FOSSIL CREEK CHANNEL IMPROVEMENT

Fort Worth District

The project consisted of straightening, enlarging, realigning, installing interior drainage facilities and construction of about 1.27 miles of levees along the left bank of Big Fossil Creek in the city of Richland Hills.

Total cost of the project was $2.1 million, of which $200,900 was borne by non-Federal interest.

Construction of the project began in May 1964 and was completed in December 1988. The savings in flood control benefits through December 1990 were 6.3 million.

COASTAL PROJECTS

Galveston District

See the section titled *Coastal Areas* for information on Shallow Draft and Deep Draft Navigation Projects and Federal Flood Protection Projects.

CHANNEL TO LIBERTY

Galveston District

Channel to Liberty is a channel 7 feet deep (below mean low tide datum), 80 feet wide and 6,700 feet long. It was constructed from Anahuac channel, through Browns Pass, to deep water in the Trinity River under the River and Harbor Act of March 1905. The River and Harbor Act of July 1912 provided a channel 6 feet deep (below mean tide datum) and of navigable width from the mouth of the Trinity River upstream to Liberty at river mile 41.4. This project was modified by the River and Harbor Act of March 1945 and July 1946, which provide a navigation channel 9 feet deep (below low mean tide datum) and 150 feet wide from Houston Ship Channel to Liberty with a turning basin at Liberty and a protective embankment along the west side of the channel in Trinity Bay. The 6-foot channel was completed to Liberty in 1925 and maintained until 1940. Maintenance of the 6-foot project channel was resumed in 1968.

The 9-foot project channel and protective embankment were completed from the Houston ship channel to a point about a mile below Anahuac in 1950 and an earthen dam was constructed across the upper end of the completed channel to prevent salt water intrusion into the Trinity River. A draft supplement to the GDM on the Channel to Liberty was completed in September 1987. The report recommended deferral of any future work until economic conditions in the area stabilize. Accordingly, the project is classified inactive.

DALLAS FLOODWAY

Fort Worth District

Construction was initiated in January 1953 and completed in May 1960. The project provided for the strengthening of approximately 23 miles of existing levees, clearing the floodway channel and improvement of interior drainage facilities. The area within the levee system totals approximately 10,500 acres in the heart of Dallas near the confluence of the Elm Fork and West Fork of the Trinity River. Important businesses,industries, warehouses, transportation and communication facilities and residential property are protected by the project.

The existing levees and floodway improvements of Dallas were constructed by local interests during the period 1928 to 1932. Cost of the original project, including rights-of-way, bridges, utilities, etc., has been estimated by local interests at $20 million. The cost to the Federal government of the completed improvement was $8.3 million. Local cooperation cost was $1.5 million, of which $300,000 was a cash contribution. Flood control benefits for the Dallas Floodway includes Lakes Grapevine, Lewisville and Ray Roberts. The cumulative savings in flood control benefits through December 1990 were $4.2 billion.

DALLAS FLOODWAY EXTENSION

Fort Worth District

The extension will provide flood protection for the area on the Trinity River at Dallas, Texas, from the end of the existing Dallas Floodway downstream to Five Mile Creek, including the lower end of White Rock Creek. The project proposes the extension of the existing Dallas Floodway by enlargement and realignment of about 9 miles of the Trinity River, about 9.6 miles of tributary channels, and construction of related levees. The estimated Federal cost is $68 million and non-Federal cost is $63 million.

ELM FORK FLOODWAY

Fort Worth District

The floodway would extend from the mouth of the Elm Fork of the Trinity River in the Dallas Floodway upstream to Lewisville Lake, a distance of

approximately 30 miles, and on Denton Creek from its confluence with the Elm Fork upstream to Grapevine Lake. The project would include realignment and enlargement of the Elm Fork channel from its mouth upstream to Lewisville Lake, realignment and enlargement of the Denton Creek channel from its mouth to river mile 3.7, and a parallel levee system from the existing levee system upstream to near the Dallas and Denton County line, The estimated Federal cost of the project is $57.1 million and non-Federal cost is $81.1 million. Average annual benefits are estimated to be $5.8 million. Preconstruction planning is delayed pending agreement among several local interests on objectives.

FORT WORTH FLOODWAY

Fort Worth District

The floodway, partner to Benbrook Lake, provides flood protection for the leveed areas in the flood plains of the West Fork and Clear Fork of the Trinity River.

The project, which was begun in 1950 and completed in 1957, provided for widening and straightening the existing Clear Fork channel from Lancaster Street Bridge to its junction with the West Fork channel between University Drive and Riverside Drive, and flood protection for the Crestwood-Brookside areas on the upper reaches of the West Fork.

Excavation in the floodway channel required the removal of approximately 7 million cubic yards of material which is almost as much as was used in the construction of the Benbrook darn. Numerous highway and railroad bridges and public utilities have been altered to conform to the improved floodway channel which is 9.9 miles long. The levees vary in height but average 13 feet above natural ground.

Cost of the project to the Federal government was $3.9 million while local interests furnished lands, rights-of-way, etc., and a cash contribution of $395,928 for a total project cost of $9.5 million. Extensions of the completed floodway up the West Fork to near Lake Worth and up the Clear Fork to near Benbrook Lake were completed in 1971. The combined cumulative flood control benefits through Dec 1990 amounted to $960.7 million.

FORT WORTH FLOODWAY EXTENSION, CLEAR FORK

Fort Worth District

The project provides flood protection to the area between the existing Fort Worth Floodway and Benbrook Lake. The project consists of construction of 6.5 miles of channel improvement; 2.3 miles of levee; appurtenant drainage facilities and 1.0 mile of diversion channels. The project also provides for relocation and alteration of various urban utilities and removal and reconstruction of three existing concrete channel dams. Local interests provided, without cost to the government, all lands and rights-of-way for this project and operate and maintain the completed improvements. The cost of this project was $8.7 million with the Federal cost amounting to $4.1 million. The project was completed in 1971.

FORT WORTH FLOODWAY EXTENSION, WEST FORK

Fort Worth District

The project provides protection to the flood problem area of the West Fork upstream from the existing Fort Worth Floodway project to the vicinity of Lake Worth.

The project provided for enlargement and realignment of about 6.0 miles of channel improvement on the West Fork, including 0.4 mile of channel improvement for the lower reach of Farmers Branch and approximately 1.5 miles of diversion channel diverting local drainage around Westworth Village, construction of about 2.1 miles of levee along the left bank and about 4.1 miles of levee along the right bank of the proposed channel, and construction of appurtenant drainage structures. The total cost of the project was $7.7 million with Federal cost amounting to $3.3 million. Local interests provided, without cost to the government, all lands, easements and rights-of-way necessary for construction and also operate and maintain the project.

GRAPEVINE LAKE

Fort Worth District

The dam is located on Denton Creek, a tributary of Elm Fork of the Trinity River, near the city of Grapevine, about 20 miles northwest of Dallas, Texas. It controls the run-off from about 695 square miles of drainage area.

Construction of the project began in January 1948 and was completed for beneficial use in July 1952.

The 12,850-foot dam consists of an earth-fill embankment 137 feet in height above the streambed and a 500-foot uncontrolled concrete spillway. There are two 6.5-foot by 13-foot gates regulating the release through a circular discharge conduit, 13 feet in diameter, for the release of flood waters. Two 30-inch gated conduits provide for the release of conservation storage. An elevation 535.0 top of conservation pool, the lake covers 7,380 surface acres; and at elevation 560.0 top of flood control pool, die lake covers a surface area of 12,710 acres. Total storage capacity of the lake is 425,500 acre-feet, of which 238,250 acre-feet is for flood control storage; 161,250 acre-feet is for conservation storage; and 36,000 acre-feet is for sediment reserve. Eighty-five thousand acre-feet of conservation storage space in the lake have been acquired by the city of Dallas; 50,000 acre-feet by Park Cities; and 1,250 acre-feet by the city of Grapevine to serve their respective municipal water supplies. Twenty-five thousand acre-feet in the conservation pool are reserved for navigation purposes and are also under contract to the city of Grapevine for interim use as water supply storage until needed for navigation of the Trinity River.

The total cost of the project was $10.2 million, including $2 million contributed by local interests for water supply storage. This project provides flood protection to the flood plain below the dam, including parts of the city of Dallas.

In 1990, the visitation was 1,303,600 recreation days of use.

In 1990 North Texas experienced heavy rainfall resulting in major flooding. The savings in flood control benefits for Grapevine Lake, Ray Roberts, Lewisville Lake and the Dallas Floodway System for FY 90 were about $3 billion. Grapevine Lake has nine public use areas and 60 miles of shoreline. It has an average depth of 26 feet. Hunting is permitted on an 800-acre wildlife management area..

JOE POOL LAKE

Formerly Lakeview Lake
Fort Worth District

The dam site, as authorized, is located at river mile 7.2 on Mountain Creek about 3.1 miles above the existing Mountain Creek Dam. During preconstruction planning, the dam site was moved four miles upstream to river mile 11.2. The lake is formed by an earth-fill dam with a maximum height of 108.5 feet above the streambed and a total length of 4.2 miles, including a concrete spillway 50 feet wide. The lake has an initial total controlled storage of 304,000 acre-feet (of which 123,100 acre feet is for flood storage), and a water surface area of 10,940 acres at elevation 536.0, top
of flood control pool. At elevation 522.0, top of conservation pool, it will have an area of 7,470 acres and an initial storage capacity of 142,900 acre-feet. This storage is under contract to the Trinity River Authority of Texas for water supply (approved June 15, 1977). The estimated total 100-year accumulation of sediment is 38,000 acre-feet.

The total conservation storage is sufficient to provide a dependable yield of 14.0 million gallons per day under 2085 conditions of watershed development during a recurrence of the most severe drought of record. Land requirements for construction of the dam and operation of the lake and recreational purposes total about 17,692 acres. Although preconstruction planning of the Joe Pool project was completed in fiscal year 1971, Congress provided additional funds in fiscal year 1973 to further assess alternative project plans of reduced size and scope. Construction funds were appropriated in fiscal year 1975. Land acquisition began in September 1977. Construction began in March 1979 with the relocation of FM Highway 1382. Construction of the outlet works began in December 1979. The project was completed in 1986.

On June 15, 1977, the Secretary of the Army approved a contract with the Trinity River Authority of Texas for cost-sharing in the development of recreation areas on the lake. On March 21, 1980, the Secretary of the Army approved a contract with the state of Texas for cost-sharing in the development of Cedar Hill State Park on the east side of Joe Pool Lake making the State an alternate local recreation sponsor along with the Trinity River Authority. Cedar Hill State Park was opened in 1991. In 1990, the visitation was 512,000 recreation days of use.

Estimated cost of the project is $204.5 million, and the average annual benefits are estimated at $213 million. In 1990 North Texas experienced heavy rainfall resulting in major flooding, bringing the total savings in flood control benefits for Joe Pool Lake for FY 90 to $91.6 million. Cumulative flood control benefits through Dec 1990 amounted to $119.3 million.

LAVON LAKE

Fort Worth District

The dam is located on the East Fork of the Trinity River between Wylie and Lavon, in Collin County, about 22 miles northeast of Dallas, Texas. The project was started in January 1948 and completed for beneficial use in September 1953. Modification of the dam is discussed in the following paragraphs.

LAVON LAKE MODIFICATION AND EAST FORK CHANNEL IMPROVEMENT

Fort Worth District

This lake modification and channel modification will help solve the water supply and flood problems in the area. The project provides flood control for the rich East Fork and Trinity River farmlands as well as conservation storage for municipal and industrial purposes. During the floods of May and June 1989, the lake prevented damages at $19.6 million.

The enlarged dam is 19,493 feet long (including spillway) and its height has been increased from 69 to 81 feet above the streambed. The lake provides 275,600 acre-feet of flood control storage at elevation 503.5 with a surface area of 29,450 acres; 380,000 acre-feet of conservation storage (an increase of 280,000 acre-feet) at elevation 492.0, top of conservation pool, and a surface area of 21,400 acres; and 92,600 acre-feet of sediment storage, a total storage capacity of 748,200 acre-feet.

Lavon Lake now has an average depth of 14 feet and 121 miles of shoreline with the completion of the modification. The lake has 16 public use areas, including two with facilities designed for the handicapped. There are three wildlife management areas totaling 6,500 acres available for both hunting and nature observation.

In 1990, the visitation was 1,809,700 recreation days of use.

The East Fork Channel Improvement authorized by Public Law 89-298, provides protection on the East Fork of the Trinity River. The improvement consists of 9.8 miles of channel enlargement, 19.1 miles of levee improvement and straightening of the East Fork between river miles 0.0 and 10.8; the rehabilitation, replacement, strengthening and raising of existing railway and highway bridges and gas and power lines.

Local interest will furnish all lands and rights of way and will operate and maintain the completed improvements. Construction on Increment I, the portion from river mile 0.0 to river mile 10.8, was completed in 1984. Construction on Increment II, the portion from river mile 10.8 to river mile 31.8, has not been initiated because the local sponsor has not provided lands and rights of way.

The estimated cost of the entire project is $70.2 million of which $2.2 million is non-Federal for lands, damages and relocations. In addition, the North Texas Municipal Water District has two approved contracts to reimburse the Federal government an estimated $33.5 million for costs allocated to water supply at Lavon Lake. The average annual benefits of the Lavon dam modification and East Fork Channel Improvement are estimated to be $4.3 million. In May and June 1989, North Texas experienced heavy flooding resulting in a savings in flood control benefits for Lavon Lake in FY 89 of $19.6 million. Lavon dam modification is complete and East Fork Channel improvement Increment I is complete.

LEWISVILLE LAKE

Formerly Garza-Little Elm Lake
Fort Worth District

The dam is located on the Elm Fork of the Trinity River between Dallas and Denton near the city of Lewisville, Denton County, Texas. The lake incorporates the former Lake Dallas and controls the run-off from 1,660 square miles of drainage area.

The main structure, consisting of an earth-fill embankment and a concrete uncontrolled emergency spillway, is about 6.2 miles long with a maximum height of 125 feet above streambed. The lake has a total storage capacity of 981,800 acre-feet including 436,000 acre-feet at elevation 515.0 for conservation storage with a surface area of 23,210 acres; 525,200 acre-feet at elevation 532.0 for flood control with a surface area of 39,170 acres; mid 20,500 acre-feet of storage for sediment reserve. Upon completion of Ray Roberts Lake, flood control storage in Lewisville Lake will be relocated. The flood control outlet consists of a circular conduit 16 feet in diameter with three 6.5-foot by 13-foot regulating gates. There are two 60-inch-diameter gated outlets for the release of conservation storage.

The cities of Dallas and Denton have conservation storage space in the lake in the amounts of 415,000 and 21,000 acre-feet, respectively, and pay a share of

the construction and annual cost of operation and maintenance.

Construction of the project was started in November 1948 and completed for beneficial use in November 1954. The initial cost of the project was $20.6 million including $3.7 contributed by local interests.

Under a major rehabilitation program, a contract was awarded in 1979 to add upstream stability berms, which were completed in 1980. Over $200 million in flood damages was prevented by the Ray Roberts, Lewisville and Grapevine Lakes and the Dallas Floodway system during the record-breaking floods of October 1981. Lewisville provided a savings in flood control benefits of about $1.7 billion through December 1990.

In 1990, the visitation was 2,050,200 recreation days of use.

Lewisville Lake has an average depth of 21 feet and 183 miles of shoreline. It is one of the most popular boating lakes in the Fort Worth District. There are 14 public use areas available, two of which are operated as year-round user fee campgounds with electrical hookups for trailers. One park is operated by the Texas Parks and Wildlife Department and five others are operated by local municipalities. Although the lake is located in a metropolitan area with many adjacent subdivisions, there are 6,120 acres in four wildlife management areas available for both hunting and nature observation.

NAVARRO MILLS LAKE

Fort Worth District

Navarro Mills is a multiple-purpose project located about 16 miles southwest of Corsicana, Texas, on Richland Creek, a tributary of the Trinity River. It was authorized by the Flood Control Act of September 1954 and modified by the Flood Control Act of July 1958, to provide needed flood control, water conservation and allied benefits. The project, which controls run-off from 320 square miles of drainage area, consists of a 7,570-foot earthen dam, including spillway, with a maximum height of 81.7 feet above streambed. Total storage capacity of the lake is 212,200 acre-feet of which 143,000 acre-feet is allocated to flood control; 53,200 acre-feet is allocated to water conservation; and 15,800 acre-feet of space is for sediment reserve. At elevation 424.5, top of conservation pool, the lake would cover a surface area of 5,070 acres; and at elevation 443.0, top of flood control pool, the lake covers 11,700 surface acres. The Trinity River Authority has contracted for the purchase of storage space for the conservation of water for municipal and industrial uses.

The initial cost of the project was $13.1 million, including local interests' contribution of $300,000 toward construction of the project for benefits that will accrue as a result of the higher utilization of downstream valley land.

Construction of the project began in January 1960. Impoundment of water began in March 1963. Navarro Mills Lake has an average depth of 12 feet and 38 miles of shoreline. It has four public use areas available for both day use and overnight camping. There are 3,500 acres available for both hunting and nature observation. In 1990, the visitation was 856,300 recreation days of use.

Through 1990, the savings in flood control benefits for Navarro Mills were approximately $29.4 million.

RAY ROBERTS LAKE

Formerly Aubrey Lake
Fort Worth District

Ray Roberts Lake is authorized for flood control, water supply, water-quality control, recreation and fish and wildlife enhancement. Public Law 96-94, effective Jan. 4, 1981, changed the name of Aubrey Lake to Ray Roberts Lake. The dam is located at river mile 60.0 on the Elm Fork of the Trinity River between Sanger and Aubrey in Denton County, Texas. The cities of Dallas and Denton are the cooperating local agencies. The dam is approximately 30 miles upsteam from the existing Lewisville Dam. The project will provide 260,800 acre-feet of flood control storage at elevation 640.5, top of flood control pool, and covers a surface area of 36,900 acres, the lake will contain 749,200 acre-feet of conservation storage at elevation 632.5, top of conservation pool, and covers a surface area of 29,350 acres. An additional 54,600 acre-feet is for sediment reserve. Construction funds were appropriated in fiscal year 1975. The project was completed in 1987.

The dam structure is 15,250 feet long with a maximum height of 141 feet above streambed. The dam will control run-off from a drainage area of approximately 692 square miles. The project is estimated to cost $285.3 million and average annual benefits are estimated to be about $21.5 million. Upon completion of Ray Roberts Lake, a portion of the flood control storage in Lewisville Lake was relocated and the top of conservation pool raised seven feet. The cities of Dallas and Denton have contracted with the government for this added storage for water supply purposes.

The savings in flood control benefits for Ray Roberts Lake during FY 90 were approximately $887.7 million cumulative benefits through Dec 1990 amounted to $990.8 million.

RAY ROBERTS LAKE GREENBELT

Fort Worth District

This multiple purpose project, originally authorized by section 301 of the Rivers and Harbors Act of 1965, consists of a 6-mile corridor along the Elm Fork of the Trinity River, between Ray Roberts Lake and Lewisville Lake. The greenbelt would encompass about 8 river miles and the associated riparian corridor, for a total of approximately 1,600 acres. The greenbelt would provide many unique recreation opportunities such as canoeing, primitive camping, and hiking and equestrian trails, taking advantage of the diverse stream-oriented terrestrial resource of the greenbelt corridor. This project also protects fish and wildlife resources from future encroachment and development.

RAY ROBERTS LAKE WETLANDS

Fort Worth District

Included in the Master Plan for Lake Ray Roberts is the plan to construct wetlands at Lake Ray Roberts. Five developed wetland compartments, creating shallow impoundments on approximately 150 acres, will be constructed on Range Creek, at the upper end of the lake, during FY 91-92. These wetlands are expected to improve waterfowl habitat and also will be beneficial to other wildlife. The wetlands will be managed by the Texas Parks and Wildlife Department.

TRINITY RIVER PROJECT

Fort Worth District

As authorized in the River and Harbor Act of 1965, Public Law 89-298, the Trinity River Project is made up of eleven components: West Fork Floodway, Elm Fork Floodway, Dallas Floodway Extension, Duck Creek Channel Improvements, Liberty Levee, Lakeview (Joe Pool) Lake, Roanoke Lake, Aubrey (Ray Roberts) Lake, Tennessee Colony Lake, a multiple-purpose channel along the Trinity River from the Houston Ship Channel to Fort Worth, Texas, and a water conveyance system from Tennessee Colony Lake to Benbrook Lake to improve water quality.

At the time of authorization, Congress requested a restudy of the navigation features of the project to reaffirm the economic feasibility of that portion of the project. The restudy, which was completed and furnished to Congress in 1968, indicated that the navigation features would be a favorable portion of the total project.

The latest studies indicate that extension of the multiple-purpose channel to any point above Liberty is not economically feasible at this time and development of the West Fork Floodway is not feasible without the multiple-purpose channel through that reach. The Multiple-Purpose Channel to Liberty, Tennessee Colony Lake and the Dallas Floodway Extension comprise the remaining components of the Trinity River project.

The estimated total cost for the overall Trinity River project is $1.2 billion, of which $81 million is for non-Federal lands, damages and relocations. Average annual benefits of the project are estimated at $65.4 million.

Specific components of the Trinity River project are discussed at various locations in this section.

TENNESSEE COLONY LAKE

Fort Worth District

The dam site is located at river mile 341.7 on the Trinity River about 24 miles west of Palestine, Texas. The lake would lie in parts of Anderson, Freestone, Henderson and Navarro Counties. The dam would be an earth-fill structure with a maximum height of 123 feet above streambed and a total length of 41,250 feet including a spillway 720 feet long. The concrete spillway would have 12 tainter gates 60 feet wide by 40 feet high. The lake would have a total

controlled storage of 3.5 million acre-feet and a water surface area of 114,400 acres at elevation 291.0, top of the flood control pool. At elevation 265.0, top of the conservation pool, the lake would have an area of 68,100 acres and a storage capacity of 1.1 million acre-feet. The total allowance for a 100-year accumulation of sediment would be 145,500 acre-feet. The total conservation storage is to have a dependable yield of 247 million gallons per day under conditions of watershed development that would exist in the year 2090 during a recurrence of the severest drought of record. The estimated initial cost of the Tennessee Colony Lake feature is $1 billion. The project is currently inactive. Extensive lignite deposits exist in the lake area. If commercially mined, the lignite would be exhausted by the year 2030 when the water supply need of the area would reactivate interest in the project again.

WEST FORK FLOODWAY

Fort Worth District

This multiple-purpose channel consists of a combination channel and floodway for navigation and flood control from the mouth of the Trinity River in the existing Dallas Floodway to the end of the Fort Worth Floodway at the Riverside Street bridge in Fort Worth, Texas. The channel would be approximately 31 miles long with accompanying levees and sump areas as needed. The estimated Federal cost of this feature is $52 million and the non-Federal cost is $114 million (as of October 1987).

The 1981 GDM recommended no Federal action based on lack of a multiple-purpose channel through this reach.

WEST FORK OF THE TRINITY RIVER - SANITARY LANDFILL

Fort Worth District

This is an existing emergency streambank protection project (Sec. 14) at the city (of Grand Prairie's sanitary landfill which consists of a 700-foot channel cutoff, 600 feet of levee restoration and installation of two low flow conduits. The project is designed to cutoff an oxbow of the Trinity River allowing only low flows to circulate and to restore the eroded portion of the landfill's levee system. The Federal cost of the project is $250,000. The non-Federal portion is estimated to be $180,000.

WEST FORK OF THE TRINITY RIVER - MYERS ROAD

Fort Worth District

This is an existing small emergency streambank protection project (Sec. 14) in the city of Grand Prairie which consists of 500 feet of streambank stabilization utilizing a gabion toe in combination with a revetment mattress. The project is designed to restore the embankment and protect a portion of the highway from erosion by the river. The Federal cost of this project is $250,000.

WHEELER CREEK CHANNEL IMPROVEMENT

Fort Worth District

Wheeler Creek Channel Improvement was authorized to provide flood protection to the city of Gainesville, Texas. The project consists of straightening the creek channel and flush clearing the trees and brush from the side slopes to increase the water carrying capacity of Wheeler Creek originating 2,500 feet north of FM 678 and 4,000 feet east of the city of Gainesville, ending at a point 1,300 feet south of FM 678 and 1,500 feet east of the city of Gainesville. All land and rights-of-way were provided by local interests who will also operate and maintain the completed improvements. Construction of the project began in November 1983 and was completed in February 1984. The Federal cost was $248,000 and the non-Federal cost is estimated at $20,000.

CALLOWAY BRANCH CHANNEL IMPROVEMENT

Fort Worth District

Calloway Branch Channel Improvement was authorized under Section 205 of the Flood Control Act of 1948 to provide flood protection to the city of Hurst, Texas. The project consists of straightening about 2,000 feet of Calloway Branch and constructing concrete side-slopes with bottom width, at top of rock, varying from 60 to 70 feet to increase the water carrying capacity of Calloway Branch. All land and rights-of-way were provided by local interests who will also operate and maintain the completed improvements. Construction of the project began in June 1985 and it was completed in August 1986. The Federal cost was $945,117 and the non-Federal cost is approximately $1 million.

LOREAN BRANCH CHANNEL IMPROVEMENT

Fort Worth District

Lorean Branch Channel Improvement was authorized under Section 205 of the Hood Control Act of 1948 to provide flood protection to the city of Hurst, Texas. Special language is contained in Section III, Public Law 98-760 on local contributions. The project consists of 4,400 feet of grass-lined channel improvements and 2,400 feet of concrete-lined channel improvements in four separate reaches between the downstream limit at the CRI & P (MKT) Railroad and the upstream limit at Caqnnon Drive, a total distance of about 19,000 feet. The plan also includes modification to two city bridges and one state highway bridge.

Construction started in May 1988 and was completedin August 1990. A current cost estimate is about $5 million.

WALLISVILLE LAKE

Galveston District

Wallisville Dam is a multiple-purpose dam and lake on the Trinity River near Wallisville, Texas. It includes an overflow section and a lock 84 feet wide and 600 feet long and an approach channel. It was authorized for navigation, salinity control, water supply, recreation and fish and wildlife enhancement. As authorized, the lake would have had a normal pool elevation of four feet msl and would cover an area of 19,700 acres full, and have a capacity of 45,600 acre-feet. A contract for the lock access road, Big Hog intake canal, Big Hog intake structure, and intake canal bridge was completed in October 1968. A contract for the dam, diversion channel, floodway control and diversion structure, lock, levees and floodways, building, grounds and utilities was awarded on June 18, 1970. The overall project was about 75 percent complete in February 1973 when further work was prevented by an injunction in the Federal District Court. The Fifth Circuit Court of Appeals ruled that a supplemental environmental statement must be prepared covering deficiencies in the original environmental impact statement. As a result of the environmental studies, a small plan which would provide a pool of 5,600 acres was authorized by Public Law 98-63 in July 1983. The injunction has been lifted; however, construction has not been resumed.

COASTAL AREAS

COASTAL AREAS

COASTAL AREAS

At the direction of Congress, the Corps of Engineers has improved waterways, harbors and channels along the Texas Gulf Coast for nearly 100 years. The Corps of Engineers has jurisdiction over an expanding navigation program that includes the development of small-craft harbors as well as regulatory functions.

The Galveston District is conducting studies or has completed projects involving shallow-draft and deep-draft navigation, flood protection, beach restoration, salinity control, and aquatic plant control within the Gulf coast area. These activities are listed below by level of completion.

COMPLETED FEDERAL PROJECTS

Addicks and Barker Dams
Anahuac Channel
Aquatic Plant Control and Eradication Program (ongoing)
Barbour Terminal (Barbour Cut)
Buffalo Bayou
Buffalo Bayou and Tributaries
  Brays Bayou
  Clodine Ditch
Channel to Port Bolivar
Channel to Liberty
Channel Rectification at Hallettsville (Lavaca-Navidad Rivers)
Clear Creek Flood Protection
Clear Creek and Clear Lake
Corpus Christi Beach Restoration
Corpus Christi Ship Channel, 45' project
Dickinson Bayou
Double Bayou
Flood Protection at Alice
Flood Protection at Kingsville
Flood Protection at Matagorda
Freeport Harbor, 36' project
Freeport Hurricane – Flood Protection
Galveston Harbor and Channel
  Galveston Seawall
Guadalupe River Log Jam Removal
Gulf Intracoastal Waterway
  Channel to Aransas Pass
  Channel to Barroom Bay
  Channel to Harlingen
  Channel to Palacios
  Channel to Port Mansfield
  Channel to Rockport
  Channel to Seadrift
  Channel to Victoria
  Chocolate Bayou Channel
  Colorado River Channel
  Conn Brown Harbor
  Mouth of Colorado River
  Offatts Bayou Channel
  Port Isabel Side Channels
Highland Bayou Flood Project
Kirbyville Flood Control
Houston Ship Channel
  Houston-Galveston Navigation Channel (construction to begin 1995)
Matagorda Ship Channel, 36' project
  Port Lavaca to Red Bluff
Oyster Creek Channel
Port Arthur Hurricane-Flood Protection
Sabine-Neches Waterway
San Diego Creek (Alice)
Texas City Hurricane – Flood Protection
Texas City Channel, 40' project
Three Rivers Flood Protection
Tranquitas Creek
Vince and Little Vince Bayous
Wallisville Lake
White Oak Bayou

AUTHORIZED FEDERAL STUDIES

Brazos Island Harbor, 42' project
Buffalo Bayou and Tributaries
  Brays Bayou
  Carpenters Bayou
  Greens Bayou
  Halls Bayou
  Hunting Bayou
  Little White Oak Bayou
Channel to Victoria
Clear Creek
Cypress Creek
Falfurrias
Freeport Harbor, 45' project
Lower Rio Grande Basin
  Arroyo Colorado
  Raymondville Drain
  South Main Channel
Mouth of Colorado River

AUTHORIZED FEDERAL STUDIES (Continued)

Neches River and Tributaries Saltwater Barrier
Sims Bayou
Taylors Bayou
Texas City Channel, 50' project
Upper White Oak Bayou and Tributaries
Wallisville Lake

COMPLETED NON-FEDERAL PROJECTS

Little Bay

ACTIVE PLANNING STUDIES

Gulf Intracoastal Waterway, Section 216
  Aransas National Wildlife Refuge
  Sargent Beach
Matagorda Ship Channel

HIGH FLOOD HAZARD AREA STUDIES

Brookside Village and Pearland	1985
Brownsville	1985
Clear Lake Shores Kemah, El Largo Seabrook, Taylor Lake Village	1985
Friendswood	1985
Hitchcock and LaMarque	1985
Leaque City	1985
Port Isabel and South Padre	1985
Clear Creek	1985
Nassau Bay and Clear Creek Watershed	1985
Alvin	1986
Bolivar Peninsula	1986
Dickinson Bayou	1986
Port Arthur	1986
Angleton	1997
Baytown	1987
Galveston	1997
Harlingen	1997
Orange County	1989

COASTAL AREAS
SHALLOW DRAFT NAVIGATION

LEGEND

WATERSHED DIVIDE

GALVESTON DISTRICT BOUNDARY

COMPLETED

UNDER CONSTRUCTION

AUTHORIZED

GUADALUPE RIVER

SAN ANTONIO RIVER

NUECES RIVER

MISSION R.

ARANSAS R.

LAVACA RIVER

NAVIDAD RIVER

COLORADO RIVER

SAN BERNARD RIVER

BRAZOS RIVER

WEST FORK SAN JACINTO R.

TRINITY RIVER

NECHES RIVER

SABINE RIVER

TEXAS

LOUISIANA

HOUSTON

BEAUMONT

PORT ARTHUR

GALVESTON

FREEPORT

PORT OCONNOR

CORPUS CHRISTI

PORT ARANSAS

PORT MANSFIELD

HARLINGEN

BROWNSVILLE

RIO GRANDE

MEXICO

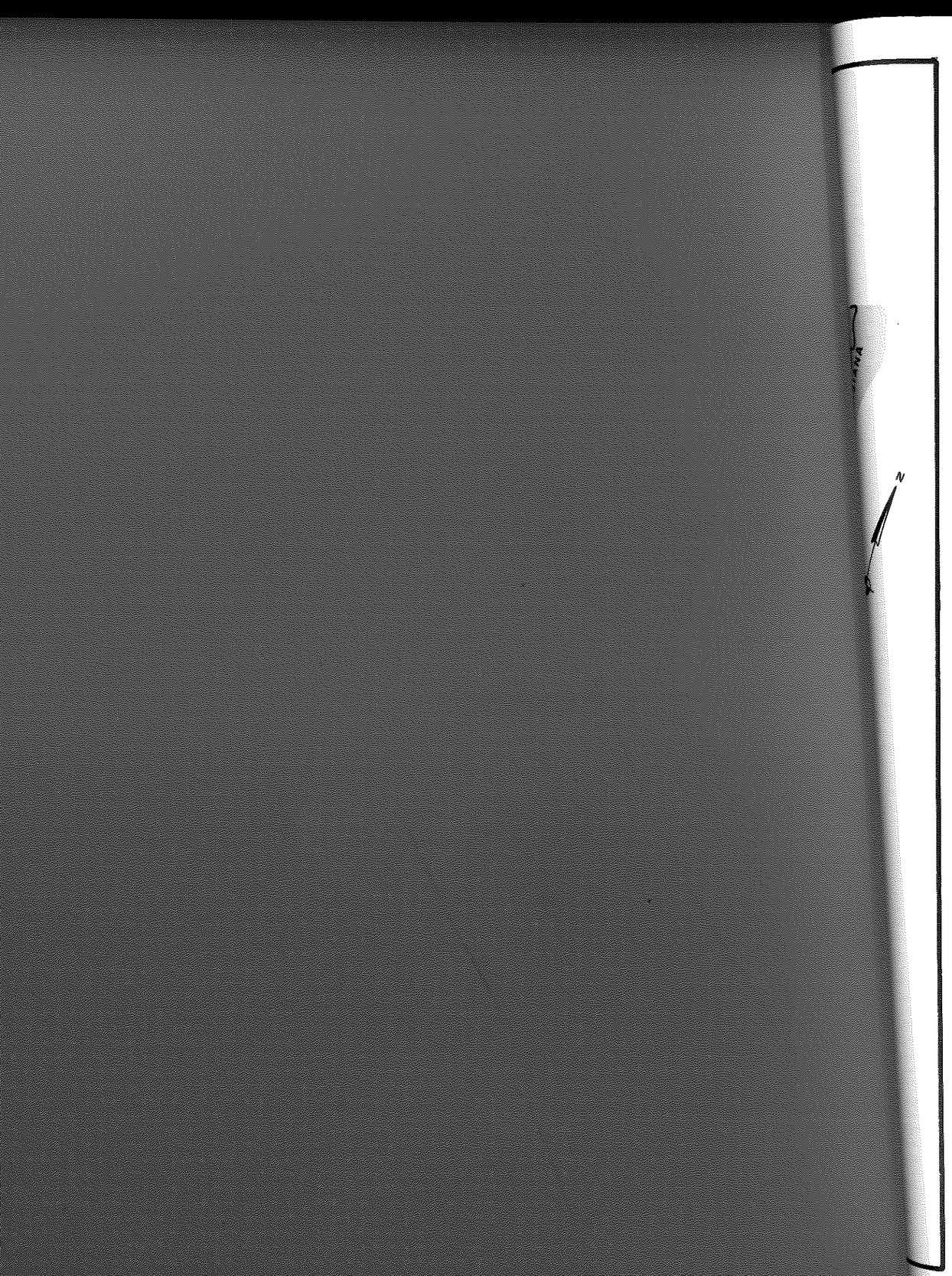
GULF OF MEXICO

1 CLEAR CREEK & CLEAR LAKE
2 DICKENSON BAYOU
3 DOUBLE BAYOU
4 GULF INTRACOASTAL WATERWAY
5 CHANNEL TO PALACIOUS
6 CHOCOLATE BAYOU CHANNEL
7 CHANNEL TO VICTORIA
8 CHANNEL TO ROCKPORT
9 CHANNEL TO ARANSAS PASS
10 CHANNEL TO PORT MANSFIELD
11 CHANNEL TO HARLINGEN
12 CHANNEL TO RED BLUFF
13 COLORADO RIVER CHANNEL
14 CHANNEL TO SEADRIFT
15 OFFATTS BAYOU CHANNEL
16 CONN BROWN HARBOR
17 PORT ISABEL SIDE CHANNELS
18 OYSTER CREEK
19 CHANNEL TO LIBERTY
20 CHANNEL IN GREENS BAYOU
21 CHANNEL TO PORT BOLIVAR
22 CHANNEL TO BARROOM BAY
23 MOUTH OF COLORADO RIVER
24 ANAHUAC CHANNEL

COASTAL NAVIGATION

SHALLOW DRAFT

GALVESTON DISTRICT, TEXAS



NAVIGATION PROJECTS

SHALLOW DRAFT

Anahuac Channel
Cedar Bayou
Channel to Port Bolivar
Channel to Liberty
Clear Creek and Clear Lake
Dickinson Bayou
Double Bayou
Gulf Intracoastal Waterway
- Channel to Aransas Pass
- Channel to Barroom Bay
- Channel to Harlingen
- Channel to Palacios
- Channel to Port Mansfield
- Channel to Rockport
- Channel to Seadrift
- Channel to Victoria
- Chocolate Bayou Channel
- Colorado River Channel
- Conn Brown Harbor
- Mouth of Colorado River
- Offatts Bayou Channel
- Port Isabel Side Channels

Little Bay (Non-Federal Project)
Port Lavaca Channel
Port Lavaca to Red Bluff
Oyster Creek
Wallisville Lake

ANAHUAC CHANNEL

Galveston District

There is no definite project for construction in Anahuac channel. However, a channel 6 feet deep (below mean low tide) and 100 feet wide meets present traffic requirements and is being maintained from the mouth of the Trinity River to the 6-foot contour in Trinity Bay, a distance of approximately 5.6 miles. Work was completed in 1911.

CEDAR BAYOU

Galveston District

Cedar Bayou, a small coastal stream 30 miles long, flows southward and empties into the northwest comer of upper Galveston Bay. The authorized navigation project provides for a channel 10 feet deep and 100 feet wide from Houston ship channel to a point on the bayou, 11 miles above its mouth. A three-mile reach of the channel has been completed from the Houston ship channel to the first bend in Cedar Bayou above its mouth. Two submerged stone and brush jetties are located at the mouth of the bayou. Construction of an additional two-mile reach was completed in 1974. The channel from 3 miles above the mouth to the upper end of the project, 11 miles above the mouth, was deauthorized in 1985. However, in April of 1988 it was authorized again under Section 107 of the Rivers and Harbors Act of 1960 as amended. Mile 3 to mile 11 is currently in the reconnaissance phase of study. The waterborne commerce in 1983 was 454,993 tons. Estimated cost of the project is $643,000, exclusive of contributed funds in the amount of $25,000. The project has been completed to mile 3 in 1975. Mile 33 to mile 11 was deauthorized under Public Law 99-66 in November 1986.

CHANNEL TO PORT BOLIVAR

Galveston District

The project provides for a channel 30 feet deep and 200 feet wide beginning at deep water in Galveston Harbor and extending to a 2,750-foot by 1,700-foot turning basin on Bolivar Peninsula. The channel and 1,000 feet of the basin length have been completed. Completion of the 600-foot long turning basin extension was not warranted by the prospective traffic, and has been deauthorized. Project dimensions are not being maintained since lesser depths are adequate for existing traffic. A 200-foot by 900-foot area in the basin at a state highway ferry landing is maintained to a depth of 20 feet.

CHANNEL TO LIBERTY

Galveston District

Channel to Liberty is a channel 7 feet deep (below mean low tide datum), 80 feet wide and 6,700 feet long. It was constructed from Anahuac channel, through Browns Pass, in the Trinity River under the River and Harbor Act of March 1905. The River and Harbor Act of July 1912 provided a channel 6 feet deep (below mean tide datum) and of navigable width from the mouth of the Trinity River upstream to Liberty at river mile 41.4. This project was modified by the River and Harbor Acts of March 1945 and July 1946, which provide a navigation channel 9 feet deep (below low mean tide datum)

and 150 feet wide from the Houston Ship Channel to Liberty with a turning basin at Liberty and a protective embankment along the west side of the channel in Trinity Bay. The 6-foot channel was completed to Liberty in 1925 and maintained until 1940. Maintenance of the 6-foot project channel was resumed in 1968.

The 9-foot project channel and protective embankment were completed from the Houston Ship Channel to a point about a mile below Anahuac in 1950 and an earthen dam was constructed across the upper end of the completed channel to prevent salt water intrusion into the Trinity River. A draft supplement to the GDM on the Channel to Liberty was completed in September 1987. The report recommended deferral of any future work until economic conditions in the area stabilize. Accordingly, this portion of the project is classified inactive. Commerce transported over the Channel of Liberty totalled 4,433 tons in 1988.

CLEAR CREEK AND CLEAR LAKE

Galveston District

The project consists of an entrance channel 7 feet deep and 75 feet wide from deep water in Galveston Bay to a new entrance to Clear Creek and a channel 7- feet deep and 60-feet wide from the old entrance to Clear Creek, at the north end of Seabrook Island, to the new entrance to Clear Creek, through Clear Creek and Clear Lake to the site of the old Galveston Road bridge at League City, Texas. Total channel length is 10 miles. This project was completed in June 1950 at a cost of $66,934.

DICKINSON BAYOU

Galveston District

The Dickinson Bayou project provides a dredged channel 6 feet deep and 60 feet wide through Dickinson Bay and Dickinson Bayou to the GH&H Railroad bridge at Dickinson, a distance of 11.4 miles. The project was completed in 1940 at a cost of $33,942. Commerce reported transported over the authorized channel amounted to 722,645 tons in 1988.

DOUBLE BAYOU

Galveston District

Double Bayou consists of a dredged channel 7 feet deep and 125 feet wide from the 7-foot contour in Trinity Bay to its intersection with the channel to Liberty, a distance of about 3.9 miles, then 7 feet deep and 100 feet wide, extending upstream and into the west fork of Double Bayou, a total distance of about 2 miles, with easing of two bends. The cost of the project was $294,000 including $227,000 Federal cost and $67,000 local cost. The 7-foot project was completed in February 1971. Commerce transported over Double Bayou totalled 2,850 tons in 1988.

GULF INTRACOASTAL WATERWAY

Main Channel

The Gulf Intracoastal Waterway (GIWW) system in Texas extends from the Sabine River to Brownsville, paralleling the Texas Gulf Coast for a distance of 423 miles. The waterway project, together with its tributary channels, comprises the major portion of shallow draft channels in Texas.

By improving and interconnecting the many natural coastal waterways along the Gulf Coast from Carabelle, Florida, to Brownsville, Texas, a distance of 1,066 miles, the main channel of the GIWW was completed to a depth of 12 feet and a bottom width of 125 feet in June 1949 and together with the Mississippi River system, provides a protected inland waterway from the Great Lakes to the Mexican border.

The Texas section of the GIWW was first considered in congressional planning by authorization of a survey to connect the inland waters from Louisiana to the Rio Grande in 1873. From this survey, a proposal was made to construct a 6-foot deep by 60-foot wide canal using the navigable bayous, lakes, and bays near the coast and connecting them along the shortest routes available. The first segment of a navigable canal in Texas was the enlargement of an existing channel through West Galveston Bay which was completed in 1895. This channel was constructed to a depth of 3 to 3.5 feet and a width of 100 to 200 feet. In 1902, an 11-mile canal, 6 feet deep and 100 feet wide from the Brazos River to Oyster Bay (now called Christmas Bay) was purchased by the Federal government, providing a continuous alternate route from Galveston to the Brazos River.

In 1905, the area between Louisiana and the Rio Grande was again surveyed and it was found that a major portion of the routes originally proposed in 1873 were still viable. Segments of the waterway

from Corpus Christi to Aransas Pass, Aransas Pass to Pass Cavallo, and the Brazos River to West Galveston Bay were completed in 1909 to a depth of 5 feet and a width of 40 feet. The Brazos River to Matagorda Bay reach was authorized in 1910, providing an uninterrupted channel from Galveston to Corpus Christi with depths of 5 feet.

In 1923 the segment from the Sabine River to Galveston Bay was proposed as a landlocked reach, departing from the earlier principle of dredging through open bays. The segment from the Sabine River to Galveston Bay was completed in 1934, providing the Louisiana and Texas portions of the GIWW with a 9- by 100-foot channel.

In 1942, the waterway was completed from Louisiana to Corpus Christi at these 9 by 100-foot dimensions. This same year the waterway was authorized to 12 by 125 feet and approved to be extended to the Mexican border. After renovation of the main channel to the larger dimensions was complete, dredging operations encompassing the final segment from Corpus Christi to Port Isabel began in 1945 and were completed on June 18, 1949.

Floodgates were installed at the Brazos River in 1946 to control sand and silt deposition at the intersection of the river and the GIWW, and provide traffic control across the river. At the Colorado River, floodgates were installed in 1944 and then converted to locks in 1955.

An alternate route of the main channel between Bolivar Peninsula and the Galveston Causeway was completed in 1954, and realignment of the main channel between Rockport and Ingleside Terminal near the city of Aransas Pass was completed in 1960.

Modifications to the Texas section of the waterway authorized by the River and Harbor Act of October 1962 provided for improvements in selected reaches of the main channel, including enlargement to dimensions of 16 feet by 150 feet from the Sabine River to the Houston Ship Channel; relocations in Matagorda and Corpus Christi Bays at dimensions of 12 feet deep by 125 feet; and resumption of maintenance in Lydia Ann Channel between Aransas Bay and Aransas Pass, Texas, to provide an alternative channel with dimensions of 12 feet by 125 feet. The 16-foot by 150-foot channel improvement from the Sabine River to the Houston Ship Channel has been placed in the inactive category. Relocation of the channel in Matagorda Bay has been deauthorized. Construction of the relocation of the channel in Corpus Christi Bay was initiated in May 1976 and completed in September 1976 at a cost of $630,000.

Reconnaissance studies addressing problems and needs from both an operational and environmental standpoint along the entire Texas section of the GIWW were completed in November 1989 under authority of Section 216 of the 1970 Flood Control Act. The reconnaissance report also addressed two other areas of immediate concern, Sargent Beach and the Aransas National Wildlife Refuge. A 7-mile segment of the GIWW in the vicinity of Sargent Beach has only a narrow strip of land protecting it from the Gulf of Mexico and its wave action. Erosion along this portion of the Texas Coast is the worst in the state, threatening to sever the waterway and isolate shallow draft ports south of Freeport. This would result in major economic impacts from shipping delays and alternative modes of transportation. A 31-mile portion of the GIWW crosses the critical habitat of the rare and endangered whooping crane, including a 13.25-mile reach of the Aransas National Wildlife Refuge. Habitat losses of 2 acres per year are caused by combinations of vessel traffic in the GIWW, wind generated waves, and to some extent, dredged material disposal practices. This critical habitat loss adversely impacts the whooping crane which is re-establishing itself along the Texas Coast after nearing extinction in the 1940's. Feasibility studies are underway for both of these areas.

Tributary Channels

The River and Harbor Act of August 1937 authorized a suitable flood discharge channel in the Colorado River from the Gulf Intracoastal Waterway to the Gulf of Mexico. Dimensions for the project were not specified. The flood discharge channel was authorized for the purpose of reducing silt deposition and traffic interruptions on the waterway. The channel was last dredged in December 1973. The River and Harbor Act of August 1968 authorized modification of the Gulf Intracoastal Waterway project to provide a channel 12 feet deep and 100 feet wide from the Gulf Intracoastal Waterway at Matagorda, Texas, to, and including, a jettied entrance channel 15 feet deep and 200 feet wide in the Gulf of Mexico. The authorized modification also includes recreation facilities, a turning basin at Matagorda, and

diversion of the Colorado River into Matagorda Bay. Estimated cost for this work is $33.6 million, of which $28.9 million is Federal cost and $4.7 million is non-Federal cost. Construction of jetties at the mouth of the Colorado River is complete, and construction of the harbor and turning basin is underway.

Construction of a harbor of refuge at Seadrift with dimensions of 9-foot by 200-foot by 1,000-feet and a connecting channel from the Seadrift turning basin was authorized by the River and Harbor Act of 1954. This work is in the inactive category.

Another modification to the waterway was authorized by the River and Harbor Act of October 1965 to enlarge and incorporate the tributary channel in Chocolate Bayou, Texas. This modification authorized construction of a channel 12 feet deep and 125 feet wide from the main channel of the Gulf Intracoastal Waterway through Chocolate Bay and Chocolate Bayou to project channel mile 8.2 (Reach I); for dredging a channel 9 feet deep and 100 feet wide from mile 8.2 to a turning basin 9 feet deep by 600 feet square near project mile 13.4 (Reach II); and for construction of a salt water barrier in Chocolate Bayou near project mile 16.9. The Reach II portion of the project has been deauthorized. The estimated cost for the active portion of the Chocolate Bayou modification is $4.2 million, which includes $3.4 million Federal and $860,000 non-Federal. Construction was initiated in 1979 and completed in 1981. A prior authorization provided for a channel 4 feet deep and 100 feet wide extending from the Gulf Intracoastal Waterway in Chocolate Bay to 4-foot depth of water in Chocolate Bayou. The channel was completed at the 4-foot depth over a 60-foot bottom width. In 1962, Monsanto Chemical Company, under a Department of the Army permit, dredged a channel 10 feet by 100 feet wide along the Federal channel alignment in Chocolate Bay and Chocolate Bayou to its plant site located about 8.5 miles from the Gulf Intracoastal Waterway. Federal cost of the completed portion of the 4-foot project is $6,512.

The Port Isabel Small Boat Basin, authorized by the Chief of Engineers under Section 107, Public Law 86-645, includes an entrance channel 7 feet deep by 75 feet wide extending from the main channel of the Gulf Intracoastal Waterway to inside the entrance channel to the East Harbor basin; and an irregular shaped harbor basin 6 feet deep having a surface area of about 7 acres. Construction was completed in September 1965. This shallow-draft channel has been incorporated under the Gulf Intracoastal Waterway system for future maintenance. The construction cost is included in the Gulf Intracoastal Waterway project estimate.

Modifications to the project for the Port Isabel side channels were authorized in August 1969 under the provisions of Section 107 of the 1960 River and Harbor Act. The improvements provided for deepening to 12 feet an existing 6- foot by 60-foot channel and for the removal of submerged bars at the ends of a narrow island between the channel to be enlarged and the Gulf Intracoastal Waterway main channel to a depth of 12 feet. The Federal cost of these improvements was $8,400. The improvements were completed in February 1972.

A tributary channel 12 feet deep by 125 feet wide and 2.2 miles into Offatts Bayou at Galveston, Texas, was completed in 1974 under Section 107 of the River and Harbor Act of 1960, as amended. Construction cost was $389,000.

Modifications to the project for the tributary Channel to Aransas Pass were authorized in August 1974 under provisions of Section 107 of the 1960 River and Harbor Act. The improvements authorized provide for deepening the existing 12-foot project to 14 feet, and for widening a reach of the channel from 125 feet to 175 feet. The approved cost was $659,000. Construction was completed in 1979.

Completed tributary waterways are the San Bernard River, 9 feet deep, 100 feet wide and 28 miles long; Channel to Rockport, 9 feet deep, 200 feet wide and 2 miles long with a turning basin of the same depth; Channel to Aransas Pass, 12 feet deep, 125 feet wide and 6 miles long, including a main turning basin and a second turning basin at Conn Brown Harbor; Channel to Port Mansfield, 14-16 feet deep with varying widths extending from the Gulf through a jettied entrance channel, across Padre Island and Laguna Madre to and including three basins at Port Mansfield, Texas; Channel to Harlingen 12 feet deep, 125 feet wide, and 26 miles long terminating at a turning basin; the side channels at Port Isabel with dimensions 12 by 125 feet; the Colorado River Channel, 9 feet deep and 100 feet wide in the Colorado River, extending from the Gulf Intracoastal Waterway upstream a distance of about

15.5 miles and terminating at a turning basin of the same depth, 400 feet wide and 500 feet long, in the vicinity of Bay City, Texas; the Channel to Victoria by way of Seadrift, 9 feet deep, 100 feet wide and 35 miles long with a turning basin; and the 17- mile long Channel to Palacios, 12 feet deep, 125 feet wide, with two turning basins protected by breakwaters.

The Water Resources Development Act of 1988 authorized enlargement of the existing Channel to Victoria from a depth of 9 feet and width of 100 feet to a depth of 12 feet and a width of 125 feet, with disposal of the dredged materials in upland areas. Estimated cost of this work is $24.1 million, of which $15.1 million is Federal cost and $9.0 million is non-Federal cost.

Total tonnage transported over the Texas coast portion of the Gulf Intracoastal Waterway was 81.6 million in 1988.

LITTLE BAY

Galveston District

The Little Bay at Fulton, Texas project consists of an 8-foot by 100-foot entrance channel and a turning or harbor basin 200 feet wide by 1,400 feet long with 8-foot depth. It was constructed by local interest under a Department of Army permit in 1955 at no cost to the Federal government.

PORT LAVACA CHANNEL

Galveston District

See information presented under Matagorda Ship Channel, Deep Draft Navigation Section.

PORT LAVACA TO RED BLUFF

Galveston District

See information presented under Matagorda Ship Channel, Deep Draft Navigation Section.

OYSTER CREEK CHANNEL

Galveston District

Oyster Creek Channel was completed in 1911 at a cost of $6,942. It was dredged 5 feet deep and 40 feet wide from the Galveston and Brazos canal, now the Gulf Intracoastal Waterway, to a point about two miles upstream in Oyster Creek. However, the project is not maintained because of lack of reported commerce or traffic by commercial vessels.

WALLISVILLE LAKE

Galveston District

Wallisville Dam is a multiple-purpose dam and lake on the Trinity River near Wallisville, Texas. It includes an overflow section and a lock 84 feet wide and 600 feet long and an approach channel. It was authorized for navigation, salinity control, water supply, recreation and fish and wildlife enhancement. As originally authorized, the lake would have had a normal pool elevation of four feet msl and would cover an area of 19,700 acres full, and would have a capacity of 45,600 acre-feet. A contract for the lock access road, Big Hog intake canal, Big Hog intake structure, and intake canal bridge was completed in October 1968. A contract for the dam, diversion channel, floodway control and diversion structure, lock, levees and floodways, building, grounds and utilities was awarded on June 18, 1970. The overall project was about 75 percent complete in February 1973 when further work was prevented by an injunction in the Federal District Court. The Fifth Circuit Court of Appeals ruled that a supplemental environmental statement must be prepared covering deficiencies in the original environmental impact statement. As a result of the environmental studies, a small plan which would provide a pool of 5,600 acres was authorized by Public Law 98-63 in July 1983. The injunction has been lifted; however, construction has not been resumed. A pair of endangered bald eagles was found to be nesting on the project site. The planned reservoir pool has been further reduced to 3,800 acres at a normal pool elevation of two feet msl. Construction will resume upon approval of the Endangered Species Act consultation findings.

COASTAL AREAS
DEEP DRAFT NAVIGATION

LEGEND

WATERSHED DIVIDE

GALVESTON DISTRICT BOUNDARY

COMPLETED

UNDER CONSTRUCTION

AUTHORIZED

GUADALUPE RIVER

SAN ANTONIO RIVER

NUECES RIVER

MISSION R.

ARANSAS R.

LAVACA RIVER

NAVIDAD RIVER

COLORADO RIVER

SAN BERNARD RIVER

BRAZOS RIVER

WEST FORK SAN JACINTO R.

TRINITY RIVER

NECHES RIVER

SABINE RIVER

TEXAS

LOUISIANA

RIO GRANDE

MEXICO

HOUSTON

BEAUMONT

PORT ARTHUR

GALVESTON

FREEPORT

PORT O'CONNOR

CORPUS CHRISTI

PORT ARANSAS

PORT MANSFIELD

HARLINGEN

BROWNSVILLE

GULF OF MEXICO

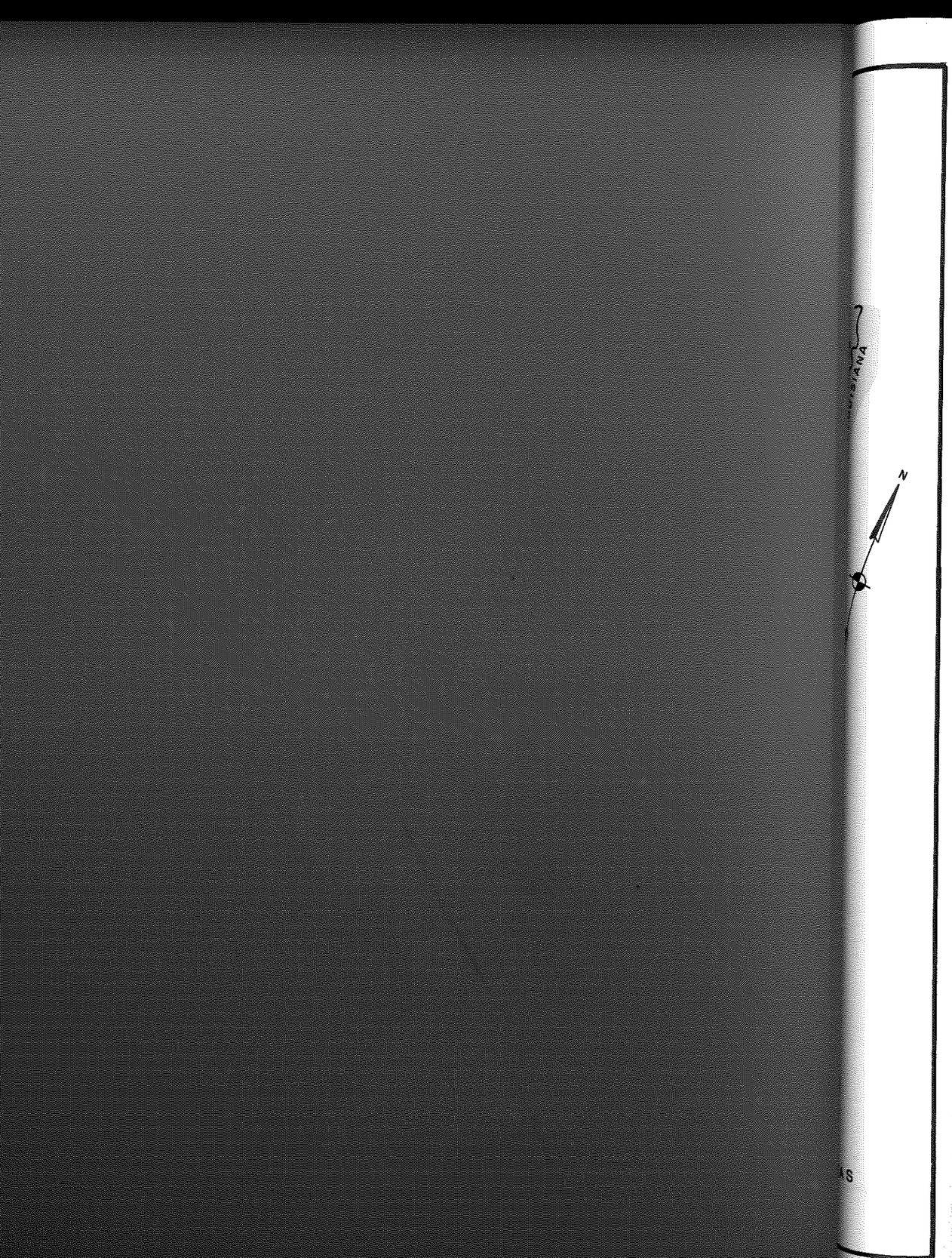
N

1 BRAZOS ISLAND HARBOR
2 TEXAS CITY CHANNEL
3 CORPUS CHRISI SHIP CHANNEL
4 FREEPORT HARBOR
5 GALVESTON HARBOR & CHANNEL
6 HOUSTON SHIP CHANNEL
7 MATAGORIDA SHIP CHANNEL
8 SABINE–NECHES WATERWAY
9 BARBOUR TERMINAL

COASTAL NAVIGATION

DEEP DRAFT

GALVESTON DISTRICT, TEXAS



NAVIGATION PROJECTS

DEEP DRAFT

Barbour Terminal (Barbour Cut)
Brazos Island Harbor
Corpus Christi Ship Channel, 45' project
Freeport Harbor, 36' project
Galveston Harbor and Channel
Houston Ship Channel
Matagorda Ship Channel, 36' project
Sabine-Neches Waterway
Texas City Channel, 40' project

BARBOUR TERMINAL

Galveston District

Barbour Terminal, also referred to as Barbours Cut Channel, is located at Morgan's Point, Texas, and connects with the Houston Ship Channel at mile 26. The Federal project for Barbours Cut was authorized by Section 107 of the River and Harbor Act of 1960 and provided for a channel 16 feet deep, 100 feet wide, and 6,700 feet long, with a turning basin of the same depth, 1,100 feet wide and 1,000 feet long. Construction of this shallow draft channel was completed in 1963.

The Port of Houston has maintained the channel at a depth of 40 feet and a width of 300 feet under permit authorized since the early 1970's to accommodate deep draft vessels. Federal assumption of maintenance of the channel at a 40-foot depth was authorized by the 1986 Water Resources Development Act. Commerce transported over Barbour Terminal totalled 3.7 million tons in 1988.

BRAZOS ISLAND HARBOR

Galveston District

This project provides for a channel 38 feet deep extending from the Gulf of Mexico through a jettied entrance at Brazos Santiago Pass in the vicinity of Port Isabel, Texas; then 36 feet deep to Port Isabel and Brownsville, Texas. The project channels, with a total length of 22 miles, were completed to authorized dimensions in 1960. The River and Harbor Act of 1960 provided for enlargement of the 300-foot wide 1.3-mile turning basin extension to 500-feet wide; enlargement of the Brownsville turning basin; maintenance of an existing 15-foot deep fishing harbor; construction of a third basin at the fishing harbor to a depth of 15 feet, extension of Brazos Santiago Pass north jetty 1,000 feet seaward; and enlargement of the 3.2-mile channel reach from the former Goose Island passing basin to the turning basin extension from 200 to 300 feet. Work under this authorization was completed in 1980, except for the 1,000-foot extension of the north jetty which has been authorized. The additional basin in the fishing harbor was constructed by local interests with an Economic Development Agency grand and loan, with work completed in November 1968. The total estimated cost of the project is $43.3 million, exclusive of expenditures of contributed funds and the amounts expended on previous projects.

Brownsville Navigation District dredged a 30-foot wide shelf to a depth of 25 feet along the southerly slope of the 200-foot wide navigation channel (Jetty Channel to Turning Basin Extension) to accommodate the large barges used for the transport of materials, equipment and supplies needed for the construction and servicing of offshore drilling rigs. This work was completed in June 1972.

The Water Resources Development Act of 1986 provides for enlargement of the entrance channel from deep water in the Gulf of Mexico to the Laguna Madre to a depth of 44 feet and a width of 400 feet enlargement of the inshore channel from the Laguna Madre to the Turning Basin Extension to a depth of 42 feet and a width of 300 feet; enlargement of the Turning Basin Extension to a point 800 feet beyond the grain elevator to a depth of 42 feet at widths varying from 325 to 400 feet; removal of Brownsville Navigation District Wharves 5, 6 and 9 to permit widening of the adjacent portion of the Turning Basin to 1,200 feet at a depth of 36 feet; construction of asphalt walkways with handrails on the crown of the North and South Jetties; and construction of park-type public use facilities at the inner end of the North jetty. The total estimated project cost is $31.9 million. Tonnage transported over Brazos Island Harbor is approximately 1.5 million tons. Subsequent project design studies have determined that recreational facilities are no longer warranted and that the Brownsville Channel can be optimized. The proposed project provides for a deepened 300-foot wide entrance channel and a deepened 250-foot wide channel from the Laguna Madre to the Turning Basin Extension. The Turning Basin wharf removal and Turning Basin remain as authorized.

The project has an estimated cost of $34.9 million. Commerce transported over Brazos Island Harbor totalled 4.5 million tons in 1988.

CORPUS CHRISTI SHIP CHANNEL

Galveston District

The Corpus Christi Ship Channel extends from the Gulf of Mexico, through a jettied entrance near Port Aransas, to Corpus Christi, Tule Lake and Viola turning basin, a distance of 33.2 miles. The original project, adopted by Congress in 1879, provided for the improvement of Aransas Pass, a natural pass between St. Joseph and Mustange Island. Turning basins have been dredged at Harbor Island, Corpus Christi, Avery Point, Tule Lake and Viola. Additionally, another turning basin identified as "Chemical Turning Basin" has been dredged near Avery Point. A branch channel extends along the north shore of Corpus Christi Bay six miles to, and including, a turning basin La Quinta. Commerce transported over this waterway totalled 57.9 million in 1988.

The project was modified by the River and Harbor Act of 1958 to provide for a depth of 42 feet in the outer bar channel and 40 feet in all other deep-draft channels and basins, except the branch channel to La Quinta, which was authorized to a 36-foot depth. Channel widths range from 700 feet in the outer bar channel to 400 feet as far inland as the Avery Point turning basin, and 200 feet from Avery Point to the Viola turning basin, and 200 feet from Avery Point to the Viola turning basin near the suntide Refinery at Corpus Christi. Local interests dredged the Viola channel to partial dimension of 35 by 125 feet in January 1961 and the Federal government completed the channel and turning basin to its 200-foot width and to a depth of 36 feet in October 1962. The 40-foot project was completed in 1965.

The project was further modified by the River and Harbor Act of 1968 to provide generally for a deep-draft project depth of 45 feet; widening the main channel to 500 feet between Harbor Island and the La Quinta channel junction; widening to provide a minimum connecting channel width of 300 feet between turning basins; and enlargement to provide turning diameters of 1,200 feet in all basins except Avery Point and the main turning basins. A 1,200-foot diameter turning area and deep-draft mooring area with dolphins was authorized near the La Quinta channel junction. The total cost is estimated at $69 million, including $10.2 non-Federal cost. The project is completed except for the construction of seven mooring dolphins at Port Ingleside which have been deferred.

The project also provides for shallow-draft improvements including a 12- by 100-foot channel to a 12- by 200- by 200-foot turning basin and a 12-foot deep anchorage basin in Turtle Cover at the city of Port Aransas; and enlargement of the locally dredged Jewel Fulton Canal and turning basin near Ingleside to 12 by 100 feet. The channel and basins at Port Aransas have been completed. Improvement of Jewel Fulton Canal and turning basin was completed in fiscal year 1963.

Total estimated cost of the existing project to the Federal government is $74.9 million, exclusive of the amounts expended on previous projects in addition to non-Federal costs totalling $19.1 million. This includes $7.8 million in contributed funds and value of useful work performed.

A modification of the existing channel to Port Aransas, authorized under Section 107 of the River and Harbor Act, provides for the construction of a breakwater at the entrance to the harbor area at Port Aransas, Texas, and for realignment of the existing 12-foot deep by 100-foot wide channel. The project was completed in 1973. The Federal cost of $457,000, and the non-Federal cost of $4,800 (which includes a cash contribution of $800) are included in cost reported in preceding paragraph.

FREEPORT HARBOR

Galveston District

This project provides for a 7-mile long channel extending from the Gulf of Mexico through a jettied entrance to Freeport, Texas. The improvements authorized by the River and Harbor Acts of May 1950 and July 1958 provided for an entrance channel with a depth of 38 feet, and for inside channels and turning basins with a depth of 36 feet, and provided for Federal assumption of responsibility for maintenance of a 30- by 200-foot Brazos Harbor channel and a 30-foot deep by 525- by 650-foot turning basin constructed by local interests in 1954. The authorized deepening was completed in June 1961. The total cost of the completed project was $1.8 million, exclusive of expenditures of $758,303 in contributed funds and of $677,697 for local interest cost.

The River and Harbor Act of December 1970 modified the project to provide for relocation of the

entrance channel and deepening to 47 feet; deepening to 45 feet and relocating the jetty channel; deepening and enlarging the inside main channel; enlarging the widened area at Quintana Point to provide a 750-foot diameter turning area with a depth of 45 feet; enlarging Brazosport turning basin to provide a 1,000-foot turning area with a depth of 45 feet; constructing a new 1,200-foot dismater by 45-foot deep upper turning basin (replaces existing upper turning basin); deepening Brazos Harbor channel and turning basin to 36 feet; enlarging the Brazos Harbor turning basin to 750 feet in diameter; relocating the north jetty; and rehabilitating the south jetty construction is underway.

The project was approximately 49 percent complete as of 1 January 1991. Estimated total project cost is $89.7 million, of which $60.0 million is Federal cost and $29.87 million is non-Federal cost. Commerce transported over Freeport Harbor totalled 15.1 million tons in 1988.

GALVESTON HARBOR AND CHANNEL

Galveston District

Galveston Harbor and Channel is a consolidation of the authorized improvements at Galveston, Texas, which includes the projects formerly known as Galveston Harbor, Texas; Galveston Channel, Texas; and the Galveston Seawall Extension. The project provides for an improved channel from deep water in the Gulf of Mexico to 43rd Street in the city of Galveston. The authorized project also provides for two rubblestone jetties extending from Galveston Island on the south and Bolivar Peninsula on the north into the Gulf of Mexico, for thirteen groins to protect the Galveston Seawall and for an extension of the existing seawall.

Galveston Harbor channel, which extends from the Gulf of Mexico through a jettied entrance to Bolivar Roads, a distance of eight miles, has been completed to a depth of 42 feet in the outer bar channel and 40 feet in the inner bar and bolivar Roads channel over a width of 800 feet. It is the common entrance channel sued by all deep-draft vessel traffic to and from Galveston, Texas City and Houston, Texas. It is an improvement of a natural pass between Galveston Island Bolivar Peninsula.

The authorized 40-foot by 1,200-foot Galveston channel extends from Bolivar Roads to the wharf front of Galveston and continues along the wharf front to 43rd Street, a distance of 4 miles. The project has been completed. Thirteen existing sheet pile groins on Galveston beach front were replaced in 1970 with 11 rubblestone structures.

Total estimated cost of the existing project was $20.7 million, exclusive of a cash contribution by, and other costs to, local interests which amounted to $3.6 million. Commerce transported on the Galveston Harbor and Channel totalled 12.3 million tons in 1988.

GALVESTON SEAWALL

Galveston District

The Galveston Seawall project was authorized under the Galveston Harbor and Channel project. The existing Galveston Seawall, which parallels the city's beach front, affords protection from hurricane floods and prevents erosion of the island and damage to the navigable channels in Galveston Bay. Extension of the seawall in a southwesterly direction from 61st Street for a distance of 16,300 feet has been completed. Of that extension, 5,400 feet were completed in 1953 with funds contributed by Galveston County, and the remainder was completed with Federal funds in 1962. The cumulative savings in flood damages prevented through FY 90 was $250,148,000.

HOUSTON SHIP CHANNEL

Galveston District

The Houston Ship Channel is a 51-mile long deep-draft waterway which extends from Bolivar Roads through Galveston Bay, San Jacinto River and Buffalo Bayou to a turning basin at Houston, Texas. The lower 47.5 mile reach of the main channel has been completed to a depth of 40 feet over widths varying from 400 feet in the bay section to 300 feet in the land-locked reaches.

The upper 3.5 miles of the main channel, and the turning basin at Houston, have existing depths of 36 feet. A 10-foot by 60-foot shallow-draft channel, which extends a distance of 6.7 miles above the turning basin to Jensen Drive is Houston, is completed.

Work under this authorization for deep-draft improvements was completed in March 1966.

An 8-foot by 125-foot channel through Five Mile Cut in Galveston Bay and a 10 foot by 60-foot

cutoff channel at Turkey Bend in the extension above the turning basin in Buffalo Bayou were also authorized by the 1958 River and Harbor Act. These shallow-draft improvements were completed in 1960.

A modification of the Houston Ship Channel was authorized by the River and Harbor Act of October 1965 to include a tributary channel in Greens Bayou. This modification provides for improvement of 2.81 miles of Greens Bayou from the Houston Ship Channel to the Port Terminal Railway Bridge. The improvements consist of restoring an existing locally dredged channel from mile 0 to mile 0.33 to a depth of 36 feet and a width of 175 feet; for dredging a channel 15 feet deep and 100 feet wide from mile 0.33 to mile 1.59; and for dredging a channel 12 feet deep and 100 feet wide from mile 1.59 to 2.84. The reach of channel from mile 1.59 to 2.84 has been deauthorized. The cost of the increment from the mouth to mile 1.59, completed in October 1970, was $424,100, of which $17,800 was non-Federal.

Commerce transported over the Houston Ship Channel totalled 124.9 million tons during 1988. In terms of tonnage, the Port of Houston ranks third in the nation. Total construction cost of the existing project was $31.7 million Federal, exclusive of amounts expended on previous projects, and $1.4 non-Federal.

The Water Resources Development Act of 1986 authorized Federal assumption of maintenance of Greens Bayou, Barbours Cut, and Bayport Ship Channels, three ancillary channels to the Houston Ship Channel which are currently maintained to a 40-foot depth by the Port of Houston.

HOUSTON – GALVESTON NAVIGATION CHANNELS

Galveston District

Preconstruction Engineering and Design (PED) for the Houston-Galveston Navigation Channels studies are underway to enlarge the Houston Ship Channel in a 2-phase construction to 50' x 600' to Boggy Bayou with additional widening to the Clinton Island Turning Basin. A Final Feasibility Report and Environmental Impact Statement were completed in July 1988 for the proposed channel enlargement. The Galveston Harbor and Entrance Channels will also be enlarged as part of this project, and a locally preferred dredged material disposal plan is being developed to replace the original disposal plan. Construction start is scheduled for October 1995 and total construction cost is estimated at $709.5 million ($435 million non-Federal).

MATAGORDA SHIP CHANNEL

Galveston District

The project was authorized by the River and Harbor Act of July 1958 and provides for an outer bar and jetty channel 38 feet deep, 300 feet wide, and about four miles long from the Gulf through a man-made cut across Matagorda Peninsula; an inner channel 36 feet deep, 200 feet wide, and about 22 miles long across Matagorda and Lavaca Bays to Point Comfort; a turning basin at Point Comfort 36 feet deep and 1,000 feet square; and dual jetties at the entrance from the Gulf of Mexico, the jetties extending to 24-foot water depth in the Gulf. Dredging of the channels was completed in August 1965, and construction of the jetties was completed in October 1966.

The Matagorda Ship Channel project also includes a channel 12 feet deep and 125 feet wide from the ship channel to and including a turning basin at Port Lavaca; a channel 6 feet deep and 100 feet wide from the Port Lavaca channel by way of Lavaca Bay and the Lavaca and Navidad Rivers to Red Bluff, a point approximately three miles upstream from the mouth of the Navidad River; a harbor of refuge 12 feet deep near Port Lavaca, with an approach channel of the same depth and 125 feet wide connecting to the Port Lavaca channel in Lavaca Bay. The Port Lavaca Channel and basin were dredged 12 feet deep and 125 feet wide in 1967. The 6-foot portion of the project in Lavaca Bay and the Lavaca and Navidad Rivers was completed in 1967. The two-mile long entrance channel and the L-shaped Harbor of Refuge, consisting of a north- south basin 300 feet by 1,500 feet and an east-west basin 250 feet by 1,750 feet, was completed to 12-foot depth in 1962.

Total estimated cost of the existing Matagorda Ship Channel project is $30.9 million, which includes $12.9 million non-Federal cost.

A reconnaissance study was completed in November 1989 which indicated that deepening the Matagorda Ship Channel to 42 feet would be economically justified. Feasibility studies are pending execution of the Feasibility Cost Sharing Agreement with the local sponsor, Calhoun Navigation District. Commerce transported on the Matagorda Ship Channel totalled 4 million tons in 1988.

SABINE-NECHES WATERWAY

Galveston District

The waterway extends from the Gulf of Mexico through a jettied entrance at the mouth of Sabine Pass to Port Arthur, Beaumont and Orange, Texas via the Sabine Pass channel, Port Arthur canal, Sabine-Neches Canal, and the Neches and Sabine Rivers, a total of approximately 75 miles. The authorized project provides for deep-draft channels 42 feet deep and 800 feet wide across the Sabine Pass outer bar; 40 feet deep and 500 to 800 feet wide through the jetty channel; 40 feet deep and 500 feet wide to Port Arthur; 40 feet deep and 400 feet wide to Beaumont via the Neches River; and 30 feet deep and 200 feet wide to Orange via the Sabine River. The project also provides for relocation of the highway bridge across the Sabine-Neches canal at Port Arthur; for a channel 12 feet deep, 100 feet wide, and 1.7 miles long in Adam Bayou; and for a channel 13 feet deep, 100 feet wide and about 7 miles long in Cow Bayou.

Work on the authorized project is complete.

The total estimated construction cost of the existing project was $51 million Federal and $2.1 million non-Federal. Tonnage transported on the Sabine-Neches Waterway totalled approximately 89 million tons in 1988.

TEXAS CITY CHANNEL

Galveston District

Texas City Channel extends 6.5 miles from Bolivar Roads to Texas City, Texas, with a protective rubblemound dike, 28,200 feet along the northerly side of the channel. The project provides a channel 40 feet deep by 400 feet wide with a turning basin 40 feet deep, 100 feet wide and 4,253 feet long, and for an industrial barge canal with depths of 12 to 16 feet and widths of 125 to 195 feet, about 1.9 miles long. Work under the 40-foot project authorization by the Federal government was completed in June 1967. Local interests constructed, under Department of Army permit, a 34-foot deep by 200-foot wide deep-draft channel and a 34-foot deep by 1,000-foot by 1,150-foot turning basin in early 1964 at the site of the authorized 12- to 16-foot industrial barge canal.

Further enlargements of the industrial canal and its maintenance as a Federal project was authorized in October 1972. As now modified, the Federal project will provide for deepening the industrial canal to 40 feet at widths of 400 feet for the first 0.6 mile and 300 feet for the remaining 1.3 miles, for deepening the turning basin at the upper end of the industrial canal to 40 feet and for easing the bend at the entrance to the canal. The 1972 authorization also provides for widening the turning basin for the existing 40-foot project to 1,200 feet for a length of 4,253 feet at its present depth of 40 feet. Construction was initiated in 1980 and completed in 1982 except for widening the Industrial Canal from 250 feet to 300 feet which is classified as deferred construction.

Work authorized by Water Resources Development Act of 1986 which would modify the project by providing for deepening the Texas City Channel generally to 50 feet has been placed in the deferred category at the request of the local sponsor. The project authorizing legislation calls for enlarging the 6.7-mile long Texas City Channel to 50 feet by 600 feet, deepening the existing 800- foot wide Bolivar Roads Channel and Inner Bar Channel to 50 feet, deepening the existing 800-foot wide Outer Bar and Galveston Entrance Channel to a 52- foot depth for 4.1 miles at a width of 800 feet and an additional reach at a width of 600 feet to the 52-foot contour in the Gulf of Mexico. Establishment of 600 acres of wetland and development of water-oriented recreational facilities on a 90-acre enlargement of the Texas City Dike area also proposed.

The total estimated cost of the modified project authorizing legislation was $200 million, of which $130 million is Federal and $70 million non-Federal cost. Tonnage transported on the Texas City Channel totalled approximately 42 million tons in 1988.

LEGEND

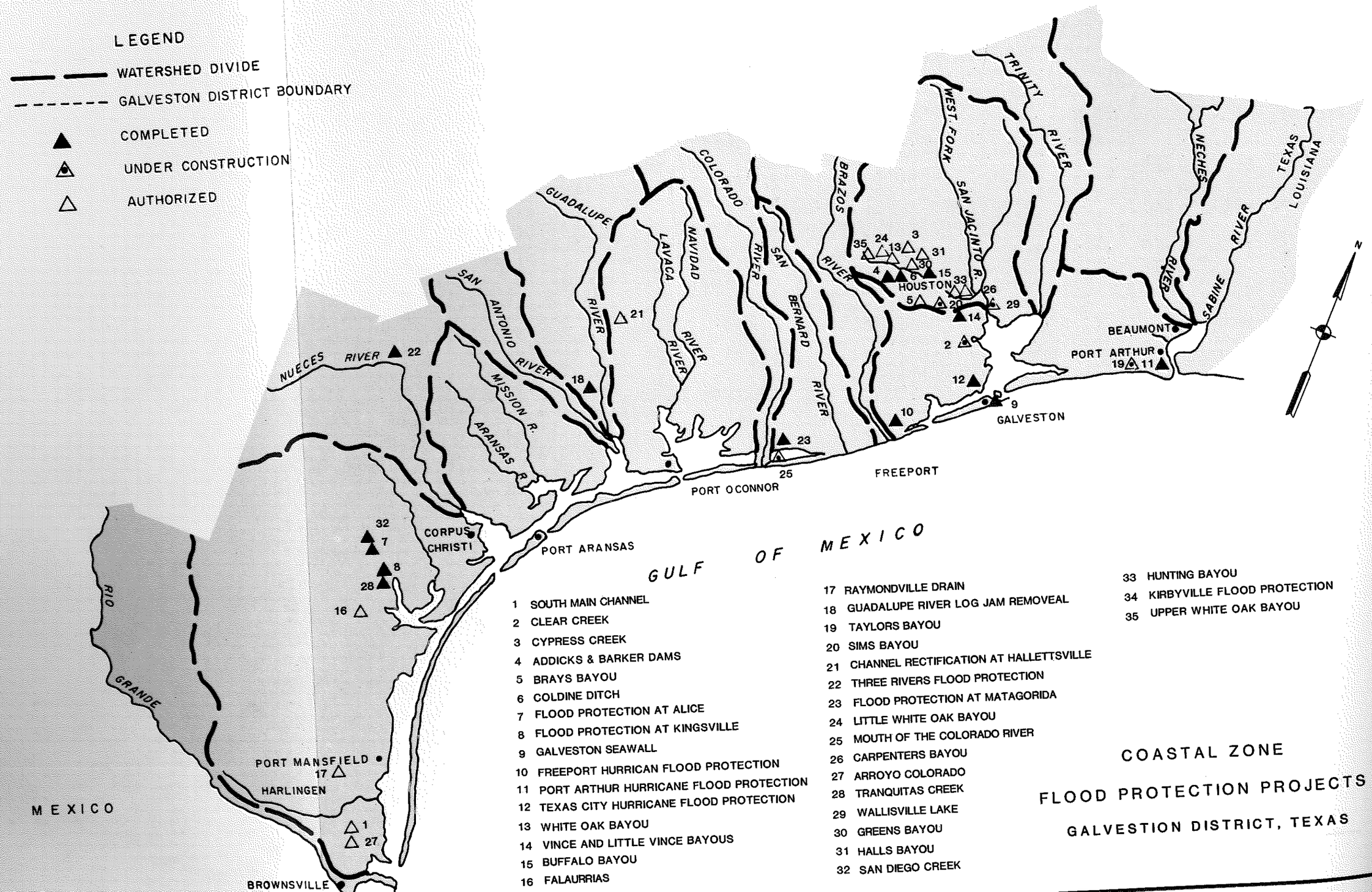
WATERSHED DIVIDE

GALVESTON DISTRICT BOUNDARY

COMPLETED

UNDER CONSTRUCTION

AUTHORIZED



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COASTAL ZONE
FLOOD PROTECTION PROJECTS
GALVESTON DISTRICT, TEXAS

FEDERAL FLOOD PROTECTION PROJECTS

Addicks and Barker Dams
Buffalo Bayou
Buffalo Bayou and Tributaries
    Brays Bayo
    Clodine Ditch
Channel Rectification at Halletsville
(Lavaca–Navidad Rivers)
Clear Creek Flood Protection
Cypress Creek Flood Protection (Authorized)
Falfurrias Flood Protection (Authorized)
Freeport Hurricane – Flood Protection
Flood Protection at Alice
Flood Protection at Kingsville
Flood Protection at Matagorda
Galveston Seawall
Guadalupe River Log Jam Removal
Highland Bayou Flood Project
Kirbyville Flood Control Project
Lower Rio Grande Basin, Texas (Authorized)
Port Arthur Hurricane-Flood Protection
San Diego Creek (Alice)
Sims Bayou (Authorized)
Taylors Bayou (Authorized)
Texas City Hurricane-Flood Protection
Three Rivers Flood Protection
Tranquitas Creek
Vince and Little Vince Bayous
White Oak Bayou

ADDICKS & BARKER DAMS

Galveston District

Addicks and Barker Dams, located on the upper end of the Buffalo Bayou watershed in far west Houston, are an intricate part of the Buffalo Bayou and Tributaries Flood Control Project. The dams along with the normally dry 26,000 acres of impoundment area, 13,500 acres behind Addicks Dam and 12,500 acres behind Barker Dam, are used to retain flood waters from the 279 square mile drainage area during heavy rains. Water is only impoundment long enough to permit their safe release without causing damage to property in the Houston area downstream.

Addicks Dam, located on a tributary of Buffalo Bayou, was completed in 1948 at a cost of $5.2 million. The 11.6 mile long dam consists of 8 miles of earthen main embankment and 3.6 miles of armorplated overflow spillway and has a maximum height of 49.7 feet above the stream bed. The dam has a storage capacity of 204,500 acre-feet.

Barker Dam, located on Buffalo Bayou, was completed in 1945 at a cost of $4.5 million. The 13.6 mile long dam consists of 10.9 miles of earthen main embankment and 2.7 miles of armorplated overflow spillway and has a maximum height of 38.8 feet above the stream bed. The dam has a storage capacity of 207,000 acre-feet.

A 6.2 mile rectified channel on Buffalo Bayou below Barker Dam along with a rectified channel connecting Addicks Dam to Buffalo Bayou was completed soon after completion of the dams at a cost of $1.5 million. The channel was turned over to the Harris County Flood Control District in fee title in 1962 for continued maintenance.

Because of extended retention of water at both Addicks and Barker Dams, and resultant seepage, extensive reinforcement of the dams was started in 1977. The work consisted of the construction of a slurry trench 3 feet wide extending 65 to 70 feet through the top of both dams for a distance of 3.5 miles along the main embankment of Addicks Dam and 1.9 miles along the main embankment of Barker Dam to impervious material. The work also included reinforcing the sides of both dams, spillway alterations, and related construction at a total cost of $13 million. The rehabilitation was completed in 1982.

Additional improvements to Addicks and Barker Dams began in 1986 to bring the dams up to current engineering standards. These improvements consisted of raising the main embankments of both dams 3 to 5 feet, armorplating the lower ends of both dams to serve as non-erodible spillways, a T-wall at each outlet work, improvements to road crossings, and landscaping. This work was completed in 1991 at a cost of $9 million. The cumulative savings in flood control benefits through FY 90 was $250,148,000.

The impoundment areas behind Addicks and Barker Dams are used extensively as recreation areas when the area is not inundated by flood waters. The City of Houston has leased 10,534 acres for Cullen Park and Harris County has leased 1,918 acres for Bear Creek Park behind Addicks Dam. Harris County has leased 7,800 acres for Cullen-Barker Park and Ft. Bend County has leased 1,961 acres for Cinco Ranch Park behind Barker Dam. Visitation to these

parks was in excess of 4 million visitors during FY 1990.

One thousand, three hundred and seventy one acres have been leased to the 5th Army for a local reserve training area behind Barker Dam.

BUFFALO BAYOU

Galveston District

This portion of the main stream of Buffalo Bayou extends from the Houston Ship Channel Turning Basin through the business district of Houston to near the mouth of Rummel Creek, a distance of about 27.2 miles. Stream improvements were authorized for construction by the 1939 Flood Control Act and later modified by the 1954 Flood Control Act. Only four short walls have been completed near the downtown area. Unresolvable local environmental objections have prevented completion of the project.

The project was re-evaluated as part of the comprehensive Buffalo Bayou and Tributaries Feasibility Study, completed in 1988 and discussed below. It was found that the project, with environmental features and mitigation, can no longer be economically justified for Federal participation. With local community and sponsor approval, the comprehensive Feasibility Report, authorized by the 1990 Water Resources Act, contained the appropriate language for project de-authorization. The project will not be constructed by the Federal government.

BUFFALO BAYOU AND TRIBUTARIES

Galveston District

This comprehensive flood control project was first authorized by the Rivers and Harbors Act of 1938, to provide flood protection for the City of Houston. Because of changed urban conditions this project was modified by Flood Control Acts of 1939, 1954, and 1965. The individual component plans, discussed separately in this section of the report, included Addicks and Barker flood detention reservoirs on Buffalo Bayou and for channel enlargements of Brays, White Oak, Buffalo, Vince, and Little Vince Bayous. All segments of the authorized plan have been completed, except for Buffalo Bayou, discussed previously.

Two additional interim studies have been completed and projects have been authorized for construction on Buffalo Bayou, tributaries of Upper White Oak Bayou and Sims Bayou. The Upper White Oak Bayou Interim Report was completed in 1976 and recommended extension of the existing 10.7-mile project an additional 9.2 miles upstream and for stream enlargement of 4.8 miles of Cole Creek and 4.5 miles of Vogel Creek. The project was authorized for construction by the 1986 Water Resources Development Act. However, because of the delay in authorization and previous local work accomplished, the local sponsor has declined local sponsorship and the Federal project will not be accomplished.

The Sims Bayou interim study was completed in 1982. The resultant project, discussed separately in paragraphs that follow, includes stream enlargement of 19.3 miles together with recreational development or flood control lands. The project was authorized for construction by the 1986 Water Resources Development Act and construction is scheduled to begin in Fiscal Year 1992.

The Final Feasibility Report, addressing the additional flood control needs of the Buffalo Bayou Watershed was completed in May 1988, and flood projection projects were authorized for six tributary watersheds by the 1990 Water Resources Development Act, at an estimated cost of $727 million. Project features include stream clearing, channel enlargement, flood detention, and diversion of stream flow. The projects also include recreational development in the form of trails, picnic and day-use outdoor leisure facilities on available flood control lands. Limited mitigation will be required for four of the watersheds for vegetation damage caused by construction. The tributary basins are Brays, Greens, Halls, Hunting, Carpenters, and Little White Oak Bayous. Planning, engineering and design studies were initiated in November 1989 and construction is tentatively scheduled to begin late in 1996.

BRAYS BAYOU

Galveston District

Brays Bayou is a portion of the Buffalo Bayou project which provided for improvements from the mouth of Brays Bayou to Westheimer Road, a total of 25.4 miles. The project provided for clearing, straightening, enlarging, and a partial concrete

lining of the 14-mile reach immediately upstream from the head of tidewater.

Construction was completed in 1970. The Federal cost was $25,828,000, the local interest cost for rights-of-way and relocations was $17,333,000. The cumulative savings in flood control benefits through FY 90 was $213,771,000. Improvements to the existing project were authorized for construction in the 1990 Water Resources Development Act.

Proposed improvements are in the Preconstruction, Engineering, and Design phase of the project development process and consist of 3 miles of channel improvements, 3 flood detention basins, and 7 miles of stream diversion. In addition, recreation features will be constructed on project lands. These features consist of about 7 miles of hike- and bike trails, numerous picnic facilities, 20 sports fields, comfort stations, and parking areas. No environmental mitigation is anticipated.

CLODINE DITCH

Galveston District

This improvement consisted of widening the upper 6,500 feet of existing Clodine Ditch, which was constructed in connection with Barker Dam, to a bottom width of 40 feet, and the next 14,800 feet to a bottom width of 15 feet. It was estimated that the channel improvement would reduce, by $22,600 the average annual damages caused by the run-off from Long Point Slough watershed which enters the upper end of Clodine Ditch. The work was completed in 1960 at a cost of $32,000, of which $12,900 was expended from Federal funds and $19,100 was contributed funds. Local interests were required to contribute $14,850 which was 46.4 percent of the first cost. Since Clodine Ditch was to become an integral part of the federally maintained Barker Dam project, local interests also contributed $4,254 which represented the capitalized value of the increase in annual maintenance cost for Barker Dam.

CHANNEL RECTIFICATION AT HALLETSVILLE (LAVACA-NAVIDAD RIVERS)

Galveston District

See information presented under same title, Lavaca River Basin.

CLEAR CREEK FLOOD PROTECTION

Galveston District

The Flood Control Act of 1968 authorized a plan of improvement for reducing flood damages along Clear Creek, a coastal stream which empties into Galveston Bay. The improvements consist of channel enlargement and bend easing to contain a 10-year frequency flood, and extend from mile 3.8 in Clear Lake to the Brazoria County line. Other project features include a second outlet channel with a gated structure between Clear Lake and Galveston Bay and more stringent regulations by the local sponsors restricting development of the 100-year flood plain. The total cost is estimated at $112.0 million, which includes $61.0 million Federal cost and $51.0 million non-Federal cost. Detailed preconstruction planning is in progress for the third reach of the upstream channel improvements. Construction on the gated structure was completed in May 1991.

CYPRESS CREEK FLOOD PROTECTION (Authorized)

Galveston District

The project is located north of Houston, Texas on Cypress Creek. The Water Resources Development Act of 1988 authorized the (1) enlargement of the lower 29.4 miles of the Cypress Creek Channel, incorporating grassed side slopes and channel bottom and appropriate erosion control measures; (2) application of floodplain management techniques, primarily to future development, in the residual floodplain; (3) construction of project-oriented recreation features, including 11.5 miles of hike-and bike trails and related facilities for health, safety, and public access; and (4) habitat management measures on 844 acres of Harris County Parkway Project land, creation of wooded and brush habitat along 70 acres of project right-of-way, acquisition of 329 acres of wildlife habitat along the creek, and creation of 64 acres of ponds and marshes. The estimated project cost is $160.0 million, of which $119.0 is Federal cost and $41.0 million is non-Federal cost.

FALFURRIAS FLOOD PROTECTION (Authorized)

Galveston District

The city of Falfurrias is located near the confluence of Palo Blanco and Cibolo Creeks in south Texas.

The Water Resources Development Act of 1988 authorized the construction of a levee and pilot channel to divert Standard Project Flood flows in Palo Blanco and Cibolo Creeks around the west side of Falfurrias to Baluarte Creek. The authorized plan includes a 5.6-mile long diversion levee; a 1.8-mile long pilot channel; a flowage easement of 11,000 acres of land subject to overflows from the pilot channel; and a 0.8-mile long ring levee around the sewage treatment plant. The estimated project cost is $40.6 million, of which $20.3 million is Federal cost and $20.3 million is non-Federal cost. The Local Sponsor has requested and was given a deferment in project development so that financing arrangements can be made to provide local share of costs.

FREEPORT HURRICANE-FLOOD PROTECTION

Galveston District

The Flood Control Act of 1962 authorized a project to provide protection from hurricane tides and accompanying waves to Freeport, Texas, and vicinity, located in the southern part of Brazoria County on the Gulf of Mexico. Freeport is about 4 miles from the Gulf and about 43 miles southwest of Galveston, Texas.

The authorized plan of improvement provides for rehabilitating, enlarging and extending existing earthen levees and for constructing an additional earthen levee connecting the north end of the protective system to high ground. The project includes about 37.9 miles of improved or rehabilitated earthen levees; about 2.1 miles of new levee; drainage structures, pumping plants, a tide control structure and ramps over the levees for roads and railroads. The cost was $41.8 million including $29.3 million Federal cost and $12.5 million non-Federal cost. Construction began in June 1965 and was completed in 1982. The cummulative savings in flood damages prevented through FY 90 was $8,000,000.

FLOOD PROTECTION AT ALICE

Galveston District

In 1955, a local flood protection project was completed at Alice, Texas, consisting of an improved channel in San Diego Creek, an earthen levee along the right bank of the creek, two concrete floodwall sections on the right bank forming a part of the levee system, riprap bank slope protection, scour protection under U.S. Highway 281 bridge, and sodding and seeding of levee and channel slopes. Approximately 3.41 miles of stream channel were improved; 16,332 feet of levee constructed; and 1,843 feet of concrete floodwall built. The project is designed to prevent recurrence of floods in Alice similar to that of April 1949 which caused damages estimated at $600,000. The total cost of the project, exclusive of local interest cost for right-of-way, easements and relocations, was $138,000, and local or non-Federal contributions were $3,290.

FLOOD PROTECTION AT KINGSVILLE

Galveston District

This local flood protection project was completed in 1956 and consisted of the enlargement of 14,955 lineal feet of Tranquitas Creek which traverses the City of Kingsville, Texas. The project consists of an excavated channel with an average depth of 7 feet over a bottom width of 80 feet, with concrete paving under three bridges. In addition, to channel enlargement, clearing was performed on approximately 3.5 miles of the stream downstream from the excavated channel. The total cost of the project, exclusive of local interests cost for rights-of-way, easements and relocations, was $130,000.

FLOOD PROTECTION AT MATAGORADA

Galveston District

This improvement consists of enlarging existing levees to protect the town of Matagorda, Texas, from floods on the Colorado River and from hurricane waves and surges from the Gulf of Mexico. The improvement consists of 6.8 miles of earthen levees encircling the town with top elevations varying from 17 feet to 18.75 feet, two road and two railroad crossings, and alterations to 11 drainage structures. The improvement was completed in April 1962 at a Federal cost of $274,000. The cumulative savings in flood damages prevented through FY 90 was $844,000.

GALVESTON SEAWALL

Galveston District

See information presented under Galveston Harbor and Channel, Deep Draft Navigation section.

GUADALUPE RIVER – LOG JAM REMOVAL

Galveston District

The project provides for removal of log jams from the lower Guadalupe River basin to reduce localized flooding of agricultural lands. Federal cost of the authorized work was $506,000. The project was authorized by Section 212 of the Flood Control Act of 1970, Public Law 91-611. Removal of the log jams was completed in June 1975. Burning of the logs was completed in January 1978.

HIGHLAND BAYOU FLOOD PROTECTION

Galveston District

The project provides for channel improvements to Highland Bayou, and for a diversion channel to handle the run-off from the upper part of the watershed to afford flood protection for La Marque and Hitchcock, Texas. The Highland Bayou channel was enlarged and rectified from mile 8.6 to a point about 11.7 miles upstream. The diversion channel was constructed from Highland Bayou at about channel mile 8.6 to West Bay. An earthen dam was constructed in the Highland Bayou channel at the point of diversion. The lower 8.6 miles of channel rectification in Highland Bayou is in the "inactive" category. Estimated Federal cost of the authorized work is $20.5 million. Local interests contributions of such items as lands and relocations are estimated at $6.1 million. Construction was completed in 1983.

KIRBYVILLE FLOOD CONTROL PROJECT

Galveston District

The Kirbyville project is being constructed under the authority of Section 205 of the Flood Control Act of 1948, as amended. It provides for clearing, snagging, mitigation of impacts on fish and wildlife habitat, and limited channel rectification on about 2.7 miles of Trout Creek in Kirbyville. Improved channel depths range from 5 to 12 feet, with a bottom width of 20 feet. The clearing and snagging features provides a 250-foot-wide strip along the improved channel selectively cleared of underbrush and trees smaller than 14 inches in diameter. The project is scheduled for completion in April of 1991 at a total cost of $2,273,000. The Federal share of the project cost is estimated at $1,488,000 and the non-Federal share at $785,000.

LOWER RIO GRANDE BASIN, TEXAS (Authorized)

Galveston District

The Water Resources Development Act (WRDA) of 1974; authorized the Corps to undertake Phase I design studies of a three-phase drainage and flood control plan developed by the Soil Conservation Service (SCS) for the Lower Rio Grande Basin in Willacy, Hidalgo, and Cameron Counties, Texas. In November 1986 the project was authorized for construction by the WRDA of 1986. The authorized project consists of three separable elements – Arroyo Colorado, South Main Channel, and the Raymondville Drain. The three elements function independently of each other and therefore, will be economically, functionally, and hydraulically addressed and constructed separately.

Phase I of the authorized project consists of three major outlet channels; the Raymondville Drain, South Main Channel, and the Arroyo Colorado; 157 miles of floodwater channels including the three major outlet channels; and flood protection measures for the cities of Edinburg, McAllen, Raymondville, Edcouch, La Villa and Lyford, Texas.

Phase II and III improvements consist of lateral drains and on-farm measures to be provided by local interests in cooperation with the SCS.

The overall fully funded project cost for the Lower Rio Grande Basin project is currently estimated at $306,739,000 ($200,646,000 Federal and $106,093,000 non-Federal).

Pre-construction, Engineering and Design (PED) studies were initiated in FY 90. The Arroyo Colorado is the first priority for the Local Sponsor; therefore, the initial PED funds were allocated primarily for preparing a Reevaluation Report for this feature of the authorized project.

PORT ARTHUR HURRICANE – FLOOD PROTECTION (Authorized)

Galveston District

The Flood Control Act of 1962 authorized a project to provide protection from hurricane flood tides to Port Arthur and vicinity, located in the extreme southeastern part of Texas on the west side of Sabine Lake, about 12 miles from the Gulf of

Mexico. The authorized plan of improvement provides for enlarging, strengthening and extending existing levees and floodwalls, and for constructing additional earthen levees connecting the north and south ends of the protection system to high ground. The project includes 23.3 miles of new and enlarged earthen levees with a top elevation varying from 14 to 19 feet; 6.6 miles of concrete and steel sheetpile floodwalls having a top elevation of 15.5 feet above mean sea level; drainage structures; pumping plants; and closure structures at openings left in the levees for railroads. The estimated first cost is $86.0 million including $59.9 million Federal and $26.1 million non-Federal. Construction was started in March 1966 and the project was essentially completed in 1984. The remaining item of work involves levee repair to restore the required line of protection in an area which very poor foundation conditions were encountered during construction and it was known that additional work would be required. Cumulative savings in flood damages prevented through FY 90 was $8,000,000.

SAN DIEGO CREEK, ALICE

Galveston District

In 1955, a local flood protection project was completed at Alice, Texas, consisting of an improved channel in San Diego Creek, an earthen levee along the right bank of the creek, two concrete floodwall sections on the right bank forming a part of the levee system, riprap bank slope protection, scour protection under U.S. Highway 281 bridge, and sodding and seeding of levee and channel slopes. Approximately 3.41 miles of stream channel were improved; 16,332 feet of levee constructed; and 1,843 feet of concrete floodwall built. The project is designed to prevent recurrence of floods in Alice similar to that of April 1949 which caused damages estimated at $600,000. The total cost of the project, exclusive of local interest cost for right-of-way, easements and relocations, was $138,000, and local or non-Federal contributions were $3,290. The cumulative savings in flood damages prevented through FY 90 was $2,908,000.

SIMS BAYOU (Authorized)

Galveston District

The project is located in Harris County, in the southern portion of Houston, Texas.

The project is authorized by the Water Resources and Development Act (WRDA) of 1986 and subsequently reauthorized by the Energy and Water Appropriations Act of 1990. Reauthorization was reviewed as current project cost estimate exceeded maximum limit set by WRDA of 1986. The plan of improvement provides for enlargement and rectification, with appropriate erosion control measures, of 19.3 miles of Sims Bayou to provide 25-year flood protection; environment measures and riparian habitat improvement along the entire alignment; and recreation development to include 27 miles of hike and bike trails connecting to existing public parks, together with picnic, playground, and other leisure facilities. Estimated cost for new work is $192 million Federal (Corps) and $89 million non-Federal and construction funding was received in 1990.

TAYLORS BAYOU, TEXAS (Authorized)

Galveston District

The project is located in the southeast Texas portions of Jefferson, Chambers, and Liberty Counties. The project was authorized by the Flood Control Act of 1965, Public Law 89-298, as described in House Document No. 206, 89th Congress, 1st Session.

The project provides both flood control and agricultural drainage for the Taylors Bayou watershed. The authorized improvements consist of constructing a diversion channel from the lower part of Taylors Bayou to the outfall canal and a gated salt water barrier in the diversion channel to prevent saltwater intrusion in the upstream waters. It also includes enlargement of a portion of the Gulf Intracoastal Waterway (GIWW), the outfall canal from Taylors Bayou to GIWW, part of Taylors Bayou, Hillebrandt Bayou, Pivitot Bayou, Bayou Din, Willow Marsh Bayou, North Fork and South Fork Taylors Bayous, and Mayhaw Bayou. Because of environmental concerns and at the request of the local sponsors, improvements to North Fork and South Fork Taylors Bayous and Mayhaw Bayou have been placed in the "inactive category".

The project is about 60 percent complete. The outfall canal, the gated structure, the diversion channel, the majority of the discharge channel in the GIWW, the Taylors Bayou reach, Hillebrandt Bayou, Stations 4 + 07.12 t0 81 + 00, Stations 103 + 60 to 313 + 00, and Stations 316 + 00 to 350 + 00, and the

Star Lake Water Control Structure are complete. The authorized project cost is $77,850,000 including $38,500,000 Federal cost and $39,350,000 non-Federal cost.

TEXAS CITY HURRICANE - FLOOD PROTECTION

Galveston District

The Flood Control Act of July 1958 authorized a project to provide hurricane- flood protection to Texas City, and La Marque, Texas, located on the southwest shore of Galveston Bay, about 9 miles northwest of Galveston, Texas. The project, as modified, provides for construction of about 1.3 miles of concrete walls and 15.7 miles of levees with crown elevations varying from 23 to 15 feet above mean sea level; related drainage and closure structures; railroad and highway ramps; tide control and navigation structure in Moses Lake; and two pumping plants. Construction began in 1962. The estimated cost of the project was $56.0 million, of which $17.0 million is non-Federal cost. This project is completed. The cumulative savings in flood damages prevented through FY90 was $10,614,000.

THREE RIVERS FLOOD PROTECTION

Galveston District

The project is located in the city limits of Three Rivers, located midway between San Antonio and Corpus Christi in Live Oak County, Texas. The project, authorized by the Chief of Engineers under provisions of Section 201 of the Flood Control Act of 1965, consists of the following to provide flood protection to the city; 4.6 miles of levees on the left bank of the Frio River; 650 feet of concrete floodwall between the Frio River and the sewage treatment plant; appurtenant water control and drainage works; and alteration to U.S. Highway 281 and Missouri Pacific Railroad levee crossing. Actual construction started in April 1981 and was completed in June 1982.

TRANQUITAS CREEK

Galveston District

The Tranquitas Creek Flood Control project, constructed under the authority of Section 205 of the Flood Control Act of 1948, as amended, provides flood protection for parts of the City of Kingsville. The project provides about 2.8 miles of improved channel with an average depth of 7 feet over a bottom width of 80 feet, concrete paving under three bridges, and clearing of about 3.5 miles of channel downstream of the improved channel. Project construction was completed in 1956 at a total cost of $130,239. The cumulative savings in flood damages prevented through FY90 was $5,333,000.

VINCE AND LITTLE VINCE BAYOUS FLOOD PROTECTION

Galveston District

The Flood Control Act of 1962 authorized channel improvements to Vince and Little Vince Bayous in the vicinity of Pasadena, Texas. The authorized improvements to Vince Bayou will extend from the mouth to a point about 7.3 miles upstream and will consist of 5.6 miles of enlarged channel and 1.6 miles of concrete-lined channel. The authorized improvement to Little Vince Bayou will extend from its mouth to a point about 4.2 miles upstream and will consist of 1.5 miles of concrete-lined channel. The Federal cost of the authorized work was $19.3 million. Local interests will provide for relocations and contribute such items as lands and rights-of-way at an estimated cost of $17.3 million. Construction is complete. The cumulative savings in flood damages prevented through FY90 was $6,262,000.

WHITE OAK BAYOU

Galveston District

This portion of the Buffalo Bayou project provides for improvement from its mouth to Cole Creek, approximately 10.6 miles, by clearing, straightening, enlarging, and partial concrete lining from mile 1 to Cole Creek.

Construction was completed during 1976. The Federal cost was $16.4 million. Estimated local interest cost for rights-of-way and relocations was $5.3 million.

COASTAL AREAS
BEACH RESTORATION

BEACH RESTORATION

BEACH RESTORATION

Under existing shore protection laws, Congress has authorized Federal participation in the cost or restoring and protecting the shores of the United States, its territories and possessions. The intent of this legislation is to prevent or control erosion caused by wind- and tital-generated waves and currents along the nation's coasts, shores, lakes, estuaries and bays directly connected therewith. Such adverse effect extends only the distance up tributary streams where it can be demonstrated that the dominanc causes of erosion are ocean tital action, Gulf of Mexico water motion and wind-generated waves. Shore protection legislation does not authorize correction of erosion at upstream locations caused by stream-flows. Shore or beach damage is primarily the result of erosion by persistent coastal processes and by the battering action of waves occurring during storms.

Federal participation in restoration is limited to the historic shoreline. It does not provide for Federal cost-sharing in extending a beach beyond its historic shoreline unless required for protection of upland areas.

CORPUS CHRISTI BEACH RESTORATION

Galveston District

Corpus Christi Beach Restoration was authorized under Section 12 of the Flood Control Act of 1965 by resolutions of the House and Senate Public Works Committees dated Dec. 15 and 17, 1970. This project provides for the restoration and periodic nourishment of 1.4 miles of beach along the eastern shore of Rincon Penisula within the corporate limits of the city of Corpus Christi, Texas. The restored beach has berm widths varying from 100 to 300 feet at a berm crest elevation of three feet above mean sea level. Federal participation in the beach restoration is limited to 50 percent of the initial construction costs plus 50 percent of the costs of nourishment for the first 10 years of project life. The total estimated cost for the project is $4.4 million and includes advance nourishment for the first five years. Of this amount, $2.2 million is Federal cost and the remaining $2.3 million will be borne by local interests. Construction was completed in April 1978 and periodic nourishment and construction of a sand retention groin was completed in November 1985. An operation and maintenance manual has been prepared for local monitoring and maintenance of the completed project.

A study was published in April 1990 that indicated that there is no economic justification for continued Federal participation in the program. Effective July 15, 1990 the responsibility of beach monitoring and maintenance was transferred to the City of Corpus Christi.

Annual visitation at Corpus Christi Beach in 1989 was 700,000.

COASTAL AREAS
SALINITY CONTROL

SALINITY CONTROL

CHOCOLATE BAYOU SALT WATER BARRIER

Galveston District

See information presented under Gulf Intracoastal Waterway (Chocolate Bayou), *Shallow Draft Navigation*.

NECHES RIVER SALT WATER BARRIER

Galveston District

See information presented under *Neches River Basin*.

TAYLORS BAYOU SALT WATER BARRIER

Galveston District

See information presented under Taylors Bayou, *Federal Flood Protection Project*.

WALLISVILLE LAKE

Galveston District

Per information presented under same title, *Shallow–draft Navigation*

COASTAL AREAS
AQUATIC PLANT CONTROL

AQUATIC PLANT CONTROL

AQUATIC PLANT CONTROL AND ERADICATION PROGRAM

Galveston District

This program, authorized in 1965 by Public Law 89-298, and amended by Public Law 99-662, provides for control and progressive eradication of waterhyacinth, alligatorweed, Eurasian watermilfoil, and other noxious aquatic plant growths from the navigable waters, tributary streams, connecting channels and other allied waters of the United States. Control of noxious aquatic weeds will benefit navigation, flood control, drainage, agriculture, fish and wildlife conservation, public health, recreation, and prevent depreciation of land values. The Galveston District's responsibility in the program includes all water areas of the State of Texas with the exception of Federal reservoirs. Viable treatment measures involve combinations of chemical and biological control for waterhyacinth and alligatorweed and chemical control of hydrilla and Eurasian watermilfoil, with mechanical harvesting and environmental manipulation as alternatives.

Research for development of the most effective and economic control measures is an integral part of the project. The Corps of Engineers is presently working with several universities and the U.S. Department of Agriculture in addition to conducting its own research for means to effectively control aquatic vegetation. Biological control of waterhyacinth and alligatorweed has been adapted to conditions in Texas as a direct result of this research. Biological control of hydrilla and waterlettuce is being initiated in 1991 by researchers at the Corps of Engineers Waterways Experiment Station in cooperation with the District program.

The project is administered by the Chief of Engineers under the direction of the Secretary of the Army and in cooperation with other Federal and state agencies. Local interests are required to participate to the extent of 50 percent of the cost of operation and are required to hold and save the United States free from claims that may occur from operations under the program. The Texas Parks & Wildlife Department provides the local cooperation and performs all control operations under contract with the Galveston District. The cost of work under this program in Texas is estimated at $3.5 million Federal and $1.5 million non-Federal.

GLOSSARY

GLOSSARY

GLOSSARY

Acre-foot	A volume of water equivalent to one acre of land covered to a depth of one foot.
Appropriation	The setting aside of money by Congress, through legislation, for a specific use.
Authorization	House and Senate Public Works Committee resolutions or specific legislation which provides the legal basis for conducting studies of construction projects. The money necessary for accomplishing the work is not a part of the authorization, but must come from an appropriation by Congress.
Bank and channel stabilization	The process of preventing bank erosion and channel degradation.
Basin	(1) Drainage area of a lake or stream, such as a river basin. (2) A naturally or artificially enclosed harbor for small craft, such as a yacht basin.
Breakwater	A wall built into the water to protect a shore area, harbor, anchorage or basin from the action of waves.
Compacted earthen embankment	An embankment in which earthen material is compacted by a mechanical process such as vibration or tamping or a combination of these.
Concrete-gravity structure	A type of concrete structure in which resistance to overturning is provided by its own weight.
Concrete-saddle spillway	A spillway that is not located in the dam area, but maybe located between two hills.
Confluence	The place where streams meet.
Degree of protection	The amount of protection that a flood control measure is designed for, as determined by engineering feasibility, economic criteria, and social, environmental and other considerations.
Dike	An embankment to confine or control water.
Diversion channel	(1) An artificial channel constructed around a town or other point of high potential flood damages to divert floodwater from the main channel to minimize flood damages. (2) A channel carrying water from a diversion dam.
Earthen dam	A dam, the main section of which is composed principally of earth, gravel, sand, silt and clay.
Emergency spillway	Any spillway the use of which is to be avoided as long as possible in order to prevent major damage to the spillway structure or erosion of downstream channels.
Encroachment	Development or filling in wetlands or the flood plain of a stream.
FY	Fiscal Year. The 12-month period from Oct. I to Sept. 30 that the Federal Government uses for bookkeeping purposes.
Flood capacity	The flow carried by a stream or floodway at bankfull water level. Also, the storage capacity of the flood pool at a reservoir.
Flood plain	Valley land along the course of a stream which is subject to inundation during periods of high water that exceed normal bankfull elevation.
Flood Proofing	Techniques for preventing flood drainage to the structure and contents of buildings in a flood hazard area.

Groin	A wall-like structure built perpendicular to the shore to trap sand and prevent beach erosion.
Habitat	The total of the environmenal conditions which affect die life of plants and animals.
Headwaters	(1) The upper reaches of a stream near its source. (2) The region where ground waters emerge top form a surface stream. (3) The water upstream of a structure.
Jetty	A structure, similar to a groin, built on a seashore to prevent erosion due to currents and tide.
Left or right bank of river	The left-hand or right-hand bank of a stream when the observer faces downstream.
Levee	A dike or embankment, generally constructed close to the banks of the stream, lake or other body of water, intended to protect the land side from inundation or to confine the streamflow to its regular channel.
LMMP	Limited Map Maintenance Program
Low flow augmentation	The increase of waterflows to more desirable volumes above the natural streamflows.
Mean sea level	The mean plane about which the tide oscillates; the average height of the sea for all stages of the tide.
Mitigation	To lessen the impacts of development, as in dedicating some portion of the involved property to fish and wildlife purposes to compensate for habitat losses.
Mouth of river	The exit or point of discharge of a stream into another stream, a lake or the sea.
Navigable waters of the United States	Those waters of the United States subject to the ebb and flow of the tide shoreward to the mean higher high-water mark.
NGVD	National Geodectic Vertical Datum
Penstock	The pipeline or conduit that carries water under pressure from theforebay or last free water surface to the turbines.
PL	Public Law
Power head	An actuating mechanism at the power end of a deep-well pump, which transmits the power for lifting the water.
Reach	A length, distance or leg of a channel or other watercourse.
Recreation day	The time period, not to exceed 24 hours, in which a person is engaged in the use of a recreational facility or participates in a recreational activity.
Reservoir	A pond, lake, tank, basin or other space, either natural or created, in whole or in part, by the building of a structure such as a dam, which is used for storage, regulation and control of water.
Revetment	(1) A facing of stone, concrete or sandbags to protect a bank of earth from erosion. (2) A retaining wall.
Revetted levee	A stone or concrete faced embankment raised to prevent a river from overflowing.

Riprap	A layer, facing or protective mound of randomly placed stones to prevent erosion, scour or sloughing of a structure or embankment. Also, the stone so used.
Rolled earthen embankment	An embankment in which selected material of proper moisture content is placed in thin layers and compacted by rolling.
Seawall	A concrete, stone or metal wall or embankment constructed along a shore to reduce wave erosion and encroachment by the sea.
Sediment reserve	Storage space allowance provided for deposition of sediment within reservoir limits during the assumed life of the project.
Setback levee	A levee that is constructed away from the water's edge.
Sill	(1) A horizontal beam forming the bottom of the entrance to a lock. (2) A low submerged damlike structure built to control riverbed scour and current speeds.
Slurry trench	A trench filled with a slurry or a heavy fluid consisting of a clay suspension similar to drilling mud. It is primarily used to impede the flow of water.
Spillway	A waterway, dam or other hydraulic structure used to discharge excess water to avoid overtopping of a dam.
Stability berms	An artificial ridge of earth placed to improve the stability of embankment slopes, cut slopes, etc.
Tainter gate	A crest gate the face of which is a section of a cylinder, that rotates about a horizontal axis downstream from the gate. The water pressure against the gate is concentrated in the axis; this arrangement reduces friction in raising and lowering the gate.
Tributary	A stream or other body of water that contributes its water to another stream or body of water.
Uncontrolled spillway	Spillway in which there are no gates, stoplogs, or other means of preventing free overflow when the reservoir exceeds the crest elevation; the terms "ungated" or "free overflow" are commonly used in the same sense.
Wetlands	Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support – and that under normal circumstances do support – a prevalence of vegetation typically adapted for life in saturated soil conditions.

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