

VINCE AND LITTLE VINCE BAYOUS, TEXAS

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED APRIL 30, 1962, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON A REVIEW OF THE REPORTS ON VINCE AND LITTLE VINCE BAYOUS, TEXAS, REQUESTED BY A RESOLUTION OF THE COMMITTEE ON PUBLIC WORKS, HOUSE OF REPRESENTATIVES, ADOPTED JULY 1, 1958



JUNE 18, 1962.—Referred to the Committee on Public Works and ordered to be printed with three illustrations

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON : 1962

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LETTER OF TRANSMITTAL



DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C.

IN REPLY REFER TO:

May 28, 1962

Honorable John W. McCormack
Speaker of the House of Representatives


Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 30 April 1962, from the Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on a review of the reports on Vince and Little Vince Bayous, Texas, requested by a resolution of the Committee on Public Works, House of Representatives, adopted 1 July 1958.

In accordance with Section 1 of Public Law 534, 78th Congress, and Public Law 85-624, the views of the Governor of Texas and the Department of the Interior are set forth in the inclosed communications. The views of the Department of Agriculture are inclosed also.

The Bureau of the Budget advises that there is no objection to the submission of the proposed report to the Congress; however, it states that no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation. A copy of the letter from the Bureau of the Budget is inclosed.

Sincerely yours,


Elvis J. Stahr, Jr.
Secretary of the Army

1 Incl
Rept w/accomp
papers & illus

COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT

BUREAU OF THE BUDGET

WASHINGTON 25, D. C.

May 21, 1962

Honorable Elvis J. Stahr, Jr.
Secretary of the Army
Washington 25, D. C.

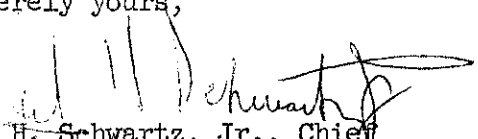
Dear Mr. Secretary:

Assistant Secretary Schaub's letter of May 8, 1962, submitted the proposed report of the Chief of Engineers on Vince and Little Vince Bayous at and in the vicinity of Pasadena, Texas, requested by resolution of the Committee on Public Works, House of Representatives, adopted July 1, 1953.

The Chief of Engineers recommends improvement of Vince and Little Vince Bayous for flood control by channel enlargement and realignment and appurtenant works at an estimated cost of \$4,180,000, of which \$2,224,000 would be Federal for construction and \$1,956,000 would be non-Federal for specific requirements of local cooperation. The benefit-cost ratio is estimated at 1.2.

I am authorized by the Director of the Bureau of the Budget to advise you that there would be no objection to the submission of the proposed report to the Congress. No commitment, however, can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation.

Sincerely yours,


Carl H. Schwartz, Jr., Chief
Resources and Civil Works
Division

COMMENTS OF THE GOVERNOR OF TEXAS



EXECUTIVE DEPARTMENT
AUSTIN 11, TEXAS

PRICE DANIEL
GOVERNOR

March 5, 1962

Maj. Gen. Keith R. Barney
Acting Chief of Engineers
United States Army
Washington 25, D. C.

Dear General Barney:

This has further reference to your letter of January 8, 1962, transmitting copy of the proposed report of the Chief of Engineers on the Vince and Little Vince Bayous, Texas.

At my request, the Texas Water Commission reviewed this report and approved its feasibility, as evidenced by the attached copy of a Commission Order. I concur in the findings and conclusions of the Commission.

Sincerely yours,

A handwritten signature in cursive script that reads "Price Daniel".

PD:gs

Enclosure

cc: Hon. Joe D. Carter, Chairman
The Texas Water Commission
Capitol Station, Box 2311
Austin 11, Texas

TEXAS WATER COMMISSION



AN ORDER approving the feasibility of the
United States Army Corps of Engineers
Flood Control Project for Vince and
Little Vince Bayous, Harris County, Texas.

BE IT ORDERED BY THE TEXAS WATER COMMISSION:

Section 1. Statement of Authority. Article 7472e, Vernon's Annotated Civil Statutes of Texas, provides that upon receipt of any engineering report submitted by a Federal Agency seeking the Governor's approval of a Federal Project, the Texas Water Commission shall study and make recommendations to the Governor as to the feasibility of the Federal Project. The Commission shall cause a public hearing to be held to receive the views of persons or groups who might be affected should the Federal Project be initiated and completed.

Section 2. Statement of Jurisdiction. (a) By letter dated January 15, 1962, the Honorable Price Daniel, Governor of Texas, requested the Texas Water Commission to review the report of the Chief of Engineers, United States Army, covering the project for flood control on Vince and Little Vince Bayous, Harris County, Texas, entitled Review of Reports on Houston Ship Channel and Buffalo Bayou (Vince and Little Vince Bayous), Texas, and to enter its order finding said project to be feasible or not feasible. (b) In accordance with Article 7472e, the Commission caused a public hearing, after due notice by publication, to be held on February 27, 1962, at 2:00 o'clock P.M., in the offices of the Texas Water Commission, 201 East 14th Street, Austin, Texas, on the Vince and Little Vince Bayous, Harris County, Texas, Project, and at which time all those interested or who may be affected should the project be initiated and completed were requested to come forward and give testimony.


Section 3. After fully considering all the evidence and exhibits presented by persons and groups who may be affected should the Federal Project be initiated and

completed, including the matters set forth in Section 4 of Article 7472e, the Commission finds that the project is feasible and that the public interest will be served thereby.

Section 4. It is further ordered that a certified copy of this Order be transmitted to the Governor.


Section 5. This Order shall take effect from the 27th day of February, 1962 the date of its passage, and it is so ordered.

SIGNED IN THE PRESENCE OF THE
TEXAS WATER COMMISSION



Joe D. Carter, Chairman

ATTEST:



Ben F. Looney, Jr., Secretary

I certify that the foregoing order was adopted by the Texas Water Commission at a meeting held on the 27th day of February, 1962, upon motion of Commissioner Dent, seconded by Commissioner Beckwith, Commissioner Dent voting "aye", Commissioner Beckwith voting "aye", and Chairman Carter voting "aye".



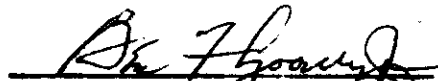
Ben F. Looney, Jr., Secretary

STATE OF TEXAS |

COUNTY OF TRAVIS |

I, Ben F. Looney, Jr., Secretary of the Texas Water Commission, do hereby certify that the foregoing is a true and correct copy of an Order of said Commission, the original of which is filed in the permanent records of said Commission.

Given under my hand and the seal of the Texas Water Commission, this the 27th day of February, A. D., 1962.



Ben F. Looney, Jr., Secretary

COMMENTS OF THE DEPARTMENT OF THE INTERIOR



UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

April 5, 1962

Lt. General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

In accordance with a request contained in your letter of January 8, we have reviewed the reports on Vince and Little Vince Bayous, Texas. The recommended improvements consist of major channel improvements to provide flood protection for Pasadena and vicinity.

We are advised by the Fish and Wildlife Service that the proposed construction would not affect the limited fish and wildlife resources of the area and would not provide opportunities for enhancement of these resources.

The interests of this Department would not be adversely affected by the adoption of your report.

Sincerely yours,

A handwritten signature in black ink, appearing to be "K. A. He", written over a horizontal line.

Assistant Secretary of the Interior

COMMENTS OF THE DEPARTMENT OF AGRICULTURE



DEPARTMENT OF AGRICULTURE
WASHINGTON 25, D. C.

26 April 1962

Honorable Elvis J. Stahr, Jr.
Secretary of the Army

Dear Mr. Secretary:

This is in reply to the Acting Chief of Engineers' letter of January 8, 1962, transmitting for our review and comment his proposed review survey report on the Houston Ship Canal and Buffalo Bayou with particular reference to Vince and Little Vince Bayous, Texas.

The report recommends the improvement of Vince and Little Vince Bayous by channel enlargement and realignment and appurtenant works. According to the report the proposed improvements will afford protection against damaging floods to affected areas in the city of Pasadena, Texas, and permit further developments in the flood plain.

The report indicates that all of the benefits from the proposed improvements will accrue to urban and industrial developments. Therefore, the proposed project will not affect projects or programs of this Department.

Thank you for providing this report for our review.

Sincerely yours,

A handwritten signature in cursive script, reading "Frank J. Welch".

Frank J. Welch
Assistant Secretary

VINCE AND LITTLE VINCE BAYOUS, TEXAS

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY



IN REPLY REFER TO

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

ENG CW-PD

30 April 1962

SUBJECT: Vince and Little Vince Bayous, Texas


TO: THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers, in response to a resolution of the Committee on Public Works of the House of Representatives, United States, adopted 1 July 1958, concerning the advisability of undertaking improvements for flood control on Vince and Little Vince Bayous at and in the vicinity of Pasadena, Texas.

2. The District and Division Engineers recommend the improvement of Vince and Little Vince Bayous, Texas, for flood control at Pasadena and vicinity by channel enlargement and realignment and appurtenant works, at an estimated cost of \$4,180,000, of which \$2,224,000 would be the Federal cost for construction and \$1,956,000 would be the non-Federal cost for lands, easements, rights-of-way, spoil disposal areas, and modifications and relocations of certain structures and utilities; provided local interests agree to maintain and operate the improvements and meet other indicated conditions of cooperation. The benefit-cost ratio is 1.2.

3. The Board concurs generally in the findings of the reporting officers and recommends the improvement subject to local cooperation.

4. I concur in the recommendations of the Board.


W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS



CORPS OF ENGINEERS, U. S. ARMY
BOARD OF ENGINEERS FOR RIVERS AND HARBORS
WASHINGTON 25, D. C.

ENGBR

14 November 1961

SUBJECT: Vince and Little Vince Bayous, Texas

TO: Chief of Engineers
Department of the Army

1. Authority.--This report is in response to the following resolution adopted 1 July 1958:

Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Houston Ship Channel and Buffalo Bayou, Texas, printed in House Document No. 456, 75th Congress, Second Session, and other reports, with a view to determining the advisability of undertaking improvement of Vince Bayou and its tributary, Little Vince Bayou, flowing through Pasadena, Texas, in the interest of flood control and related purposes at this time.

2. Basin description.--Vince Bayou is a minor tributary of Buffalo Bayou in the San Jacinto River basin on the upper gulf coast of Texas. The watershed of Vince Bayou and its tributary, Little Vince Bayou, lies entirely within Harris County. It drains an area of about 17 square miles in and near the city of Pasadena. The area is relatively flat, the watershed divide being, in places, less than 5 feet above the tops of stream banks. The soils are poorly drained and consist of stiff, sandy clays with layers of sand and silty sand. Tides affect Vince Bayou for a distance of about 1.5 miles above its mouth, and Little Vince Bayou for about 0.5 mile. The present capacities of these streams near their confluence are 2,000 and 1,500 cubic feet per second, respectively. The city of Pasadena is basically a residential area with many of its residents employed in industrial plants in the Houston-Baytown area. Located nearby are petroleum refineries, chemical plants, a synthetic rubber plant, and a paper mill. The population of Pasadena was about 58,400 in 1960.

3. Existing and authorized improvements.--A project for improvement of Buffalo Bayou and its tributaries above the Houston turning basin, to protect against floods and prevent deposition of silt, was authorized by the River and Harbor Act of 20 June 1938, and modified by the Flood Control Acts of 11 August 1939 and 3 September 1954. It provides for Barker Dam, completed in February 1945; Addicks Dam and downstream channel rectification, completed in October 1948; and channel rectification in Brays, White Oak, and Buffalo Bayous, now under design or construction. An existing navigation project for the Houston Ship Channel provides for a channel 36 to 40 feet deep extending from the Houston turning basin to the lower end of Galveston Bay. The Harris County Flood Control District improved the channel of Vince Bayou in 1947 and 1949, and the channel of Little Vince Bayou in 1949, at a total cost of \$185,000. Property owners along Little Vince Bayou have constructed a short section of concrete channel lining near Tatar Street at an estimated cost of \$3,000.

4. Floods and damages.--Floods are caused by local thunderstorms of short duration, general storms extending over a period of several days, and torrential rainfall associated with hurricanes and other tropical disturbances. Since 1928, at least six damaging floods have occurred on Vince and Little Vince Bayous. A recurrence of the maximum known flood, which occurred in 1945, under present conditions, would result in damages estimated at \$3,410,000. The average annual damages on both bayous under existing conditions are estimated at \$169,000, and for conditions of full development anticipated by 1976, at \$253,000.

5. Improvements desired.--Local interests desire improvement of Vince and Little Vince Bayous, including concrete channel lining in Vince Bayou from mile 1.5 to mile 7.78, and in Little Vince Bayou from mile 0.5 to mile 5.5, to provide adequate flood control.

6. Plan of improvement.--The District Engineer finds that the most suitable solution of the flood problem would consist of major channel improvement of Vince Bayou from its mouth to a point about 7.3 miles upstream, and of Little Vince Bayou from its mouth to a point about 4.2 miles upstream. The proposed improvement would protect against the standard project flood of 10,450 cubic feet per second at the mouth of Vince Bayou and 3,600 cubic feet per second at the mouth of Little Vince Bayou. The improved channels would have bottom widths of 10 and 15 feet in concrete-lined sections and of 20 to 50 feet in the unlined reaches.

The work would require alterations and relocations of bridges, pipelines, and utilities. Suitable spoil-disposal areas would be needed for disposition of excavated materials.

7. Economic evaluation.--Using January 1961 prices, the District Engineer estimates the first cost of the proposed improvements at \$4,200,000, of which \$2,244,000 would be Federal, including \$20,000 for preauthorization studies, and \$1,956,000, non-Federal. He estimates the annual carrying charges at \$200,300, including \$27,000 for operation and maintenance, and the annual benefits at \$237,000 for the prevention of flood damages. The benefit-cost ratio is 1.2. The District Engineer therefore recommends improvement for flood control in accordance with his plan, subject to certain local cooperation. The Division Engineer concurs.

8. Public notice.--The Division Engineer issued a public notice stating the recommendations of the reporting officers and affording interested parties an opportunity to present additional information to the Board. No communications have been received.

Views and Recommendations of the Board of Engineers for Rivers and Harbors.

9. Views.--The Board of Engineers for Rivers and Harbors concurs in general in the views and recommendations of the reporting officers. It agrees that major channel improvements along Vince and Little Vince Bayous are needed to provide flood protection for Pasadena and areas in the vicinity. The proposed plan is suitable and the prospective benefits justify the costs.

10. Recommendations.--The Board therefore recommends the improvement of Vince and Little Vince Bayous, Texas, for flood control at Pasadena and vicinity by channel enlargement and realignment and appurtenant works extending from the mouth of Vince Bayou upstream for about 7.3 miles and from Vince Bayou upstream on Little Vince Bayou for about 4.2 miles; generally in accordance with the plans of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable; at an estimated cost to the United States of \$2,224,000 for construction; provided that prior to construction local interests furnish assurances satisfactory to the Secretary of the Army that they will:

a. Provide without cost to the United States all lands, easements, rights-of-way, and spoil-disposal areas necessary for construction of the project;

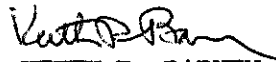
b. Provide without cost to the United States all relocations and alterations of bridges, buildings, structures, pipelines, sewers, utilities, and other improvements, except railroad bridges, made necessary by construction of the project.

c. Hold and save the United States free from damages due to the construction works;

d. Prevent any encroachment on the flood-carrying capacities of the improved channels; and

e. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army.

FOR THE BOARD:


KEITH R. BARNEY
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

REVIEW OF REPORTS ON HOUSTON SHIP CHANNEL AND BUFFALO BAYOU (VINCE AND LITTLE VINCE BAYOUS), TEXAS

SYLLABUS

This report comprises the results of an investigation of the flood problems along Vince and Little Vince Bayous which flow through Pasadena and South Houston, Texas. It was found that:

a. Flooding of Vince and Little Vince Bayous causes extensive damages in a large section of Pasadena and a smaller section of South Houston. Damages from occurrence of a standard project flood are estimated at \$6,387,000 and average annual damages from flooding of these streams under existing conditions are estimated at \$169,000.

b. Construction of the channel enlargement and rectification improvements proposed in this report would eliminate all damages from floods as large as the standard project flood and would materially reduce damages from larger floods. Average annual benefits during the life of the project are estimated at \$237,000 and the proposed improvements would be justified with a benefits to costs ratio of 1.2.

Accordingly, it is recommended that a Federal project be authorized for providing flood protection to Pasadena and vicinity, Texas, by construction of enlargement and rectification improvements to the channels of Vince and Little Vince Bayous, generally as described in this report.

The estimated first cost to the United States of the recommended new work is \$2,224,000, excluding \$20,000 which has been expended for preauthorization survey and study costs. The recommendation is subject to certain provisions of local cooperation.

U. S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

July 21, 1961

SUBJECT: Review of reports on Houston Ship Channel and Buffalo Bayou
(Vince and Little Vince Bayous), Texas

TO: Chief of Engineers, Department of the Army
Washington, D. C., through
Division Engineer, U. S. Army Engineer Division, Southwestern
Dallas, Texas

AUTHORITY

1. Authority.- This review of reports on Houston Ship Channel and Buffalo Bayou (Vince and Little Vince Bayous), Texas, is submitted pursuant to a resolution adopted July 1, 1958 by the Committee on Public Works, House of Representatives, United States:

"Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the reports on the Houston Ship Channel and Buffalo Bayou, Texas, printed in House Document No. 456, 75th Congress, Second Session, and other reports, with a view to determining the advisability of undertaking improvement of Vince Bayou and its tributary, Little Vince Bayou, flowing through Pasadena, Texas, in the interest of flood control and related purposes at this time."

EXTENT OF INVESTIGATION

2. Description of studies.- This investigation comprises a study of survey scope to determine the advisability of flood control improvements in the Vince Bayou watershed. Consideration is given to the main watershed area of Buffalo Bayou only to the extent necessary to develop the economics of improvements on Vince and Little Vince Bayous. Detailed field surveys and office studies were made to determine the most practicable plan of improvement. The detailed field investigations consisted of surveys for delineation of the flood plains; surveys to obtain channel profiles and cross sections and details of bridges; culverts, utilities, and other

channel crossings; borings to determine subsurface conditions for proposed channel improvements; and an economic survey to determine the character and value of the physical property in the flood plains and the damages resulting from floods.

3. The views of local interested parties regarding the need for improvements to Vince and Little Vince Bayous for flood control purposes were obtained at a public hearing held at Pasadena, Texas, on December 16, 1959. During the course of the investigation, the District Engineer made a reconnaissance of the watershed and held conferences with local interests to discuss the plan of improvement being considered and the probable requirements of local cooperation.

PRIOR REPORTS

4. Reports reviewed.- The congressional authorization for this review of reports requests a review of the report contained in House Document No. 456, 75th Congress, 2d session. The report under review presented the results of studies relative to protection of the Houston Ship Channel from the deposit of silt and protection of the lands adjacent to Buffalo Bayou and its tributaries from floods. The report did not recommend or consider improvements to Vince and Little Vince Bayous since the flood plains for the streams contained little development and no serious flood problem existed at that time. The report recommended improvements to Buffalo Bayou and its tributaries upstream from the Houston turning basin for control of floods, protection of Houston from flood damages, and prevention of silt deposition in the turning basin. The recommended improvements were authorized by the Flood Control Act of September 3, 1954.

5. Other reports.- All reports on Buffalo Bayou and its tributaries and the Houston Ship Channel, which have been submitted to Congress subsequent to House Document No. 250, 83d Congress, 2d session, consider only navigation improvements and are not pertinent to this review.

DESCRIPTION

6. Location and extent.- Vince Bayou is a minor tributary of Buffalo Bayou in the San Jacinto River basin located on the upper Gulf coast of Texas. The watershed of Vince Bayou and its tributary, Little Vince Bayou, lies entirely within Harris County. The watershed, roughly a trapezoid, with area of about 17 square miles, is about 8 miles long and varies in width from about 0.1 mile at its lower and northern end to about 5 miles at its midpoint. A considerable part of the city of Pasadena is located near the center of the watershed, and parts of the cities of Houston and South Houston are in the western edge. The location and extent of Vince Bayou watershed is shown on plate 1. The area also is shown on United States Geological Survey topographic maps.

7. Topography.- The land surface of Vince Bayou watershed slopes gently downward in a northerly direction from a maximum elevation of about 45 feet to an elevation of about 10 feet. The only significant irregularities in the slope are the valleys cut by the two bayous and a partially drained clay pit excavation. Because of the relatively flat terrain, the watershed divide is not well defined and, in places, is less than 5 feet above the tops of stream banks. All elevations in this report refer to U. S. Coast & Geodetic Survey mean sea level datum.

8. Geology and soils.- The geologic formations which outcrop on the watershed are of the Pleistocene Age. The streambeds of the two bayous are entrenched in the Beaumont clay formation. Soils within the watershed are of the coastal prairie series and generally consist of stiff, sandy clays with a few layers of sand and silty sand. In the lower reaches of the bayous, considerable soft organic clay is encountered. Bank erosion has been a problem along certain reaches of the two bayous. The soils are poorly drained and relatively impervious.

9. Streams.- Vince Bayou flows northward, in a partially rectified channel, for about 7.5 miles to the north limit of the city of Pasadena. At that point, it is joined by Little Vince Bayou and flows, in a relatively wide channel, for an additional distance of about 0.5 mile to the Houston Ship Channel (Buffalo Bayou). Tides affect Vince Bayou for a distance of about 1.5 miles above its mouth. The channels of Vince and Little Vince Bayous were improved to some extent in 1947 and 1949 by local interests.

10. Little Vince Bayou, located in the easterly portion of Vince Bayou watershed, originates in the community of Golden Acres. The stream meanders northwestward for about 5.2 miles through the city of Pasadena to its confluence with Vince Bayou. It is tidal for a distance of about 0.5 mile.

11. Stream characteristics.- The streambed of Vince Bayou slopes from south to north on grades varying from about 0.8 foot per thousand feet in the upper reaches to about 2.7 feet per thousand feet in the center section, thence to about 0.6 foot per thousand feet near the mouth. The height of the existing banks above the streambed varies from about 4 to 20 feet. The top width between banks varies from about 35 to 100 feet. The present flow capacity at bank full stage of approximately 2,000 cubic feet per second at the mouth decreases rapidly above mile 1.9 to approximately 500 cubic feet per second in the remaining upper portion of the bayou.

12. The streambed of Little Vince Bayou slopes from southeast to northwest on a grade of about 0.9 foot per thousand from the upper reaches to a point below the center section, thence on a grade of about 2.8 feet per thousand feet to its mouth. The height of the existing banks above the streambed of Little Vince Bayou varies from about 5 to 12 feet, and the top width varies from about 20 to 75 feet. The present flow capacity at bank full stage of approximately 1,500 cubic feet per second, from the mouth to about mile 1.8, decreases rapidly to about 200 cubic feet per second at mile 2.5, and continues with that capacity in the remaining upper reach of the bayou. Profiles of Vince Bayou and Little Vince Bayou are shown on plate 3.

ECONOMIC DEVELOPMENT

13. The city of Pasadena, Texas, is one of several incorporated communities in the Houston-Galveston-Baytown industrial complex. The city is basically a residential community, with many of its residents employed in the numerous industrial plants in the greater Houston area and along the Houston Ship Channel. In the two decades 1940 to 1960, the population increased from 3,436 to over 58,000, while manufacturing employment in the Houston-Baytown area increased from 73,000 in 1950 to over 95,000 in 1960. The considerable expansion and diversification of industry in adjacent areas is directly reflected in the growth and development of the city.

14. The city has several modern shopping centers, sixteen elementary schools, four junior high schools, two senior high schools, as well as a substantial commercial district which provides the goods and services required by a residential community. The city is served by the Southern Pacific railroad and several bus and truck lines. The community has adequate all weather streets and highways. There is every indication that Pasadena and the surrounding area will continue to grow and develop. Based on expected growth rates, the undeveloped land, which is about 42 percent of the flood plain on Vince Bayou and 20 percent on Little Vince Bayou, should be completely developed by about 1976 and 1971, respectively.

CLIMATOLOGY

15. Climatological data.- Vince Bayou watershed lies in a humid region with warm summers and mild winters. The proximity of this watershed to the Gulf of Mexico, the prevalence of southerly winds, and the absence of marked topographic relief features result in high relative humidity and uniformity in climate. Freezing temperatures are infrequent and of short duration. Data from the city station of the United States Weather Bureau at Houston, Texas, which is about 11 miles from the Vince Bayou watershed, indicates that the mean annual temperature is 70.0 degrees Fahrenheit. Temperatures at this station have ranged from a summer maximum of 108 degrees to a winter minimum of 5 degrees. January, the coldest month, has an average minimum temperature of 44.9 degrees, and August, the warmest month, has an average maximum temperature of 92.5 degrees. Additional climatological data are given in appendix I.

16. The prevailing winds are from the south or southeast during all but the winter months when high pressure air masses approaching from the north causes the winds to shift and come from that direction.

17. Precipitation.- The nearest official U. S. Weather Bureau precipitation gage to the Vince Bayou watershed is at the Houston airport station, about 6 miles away. This station is non-recording and rainfall intensities for periods less than 24 hours are not available. The nearest recording station is the Houston city station. The mean annual precipitation at Houston is 45.4 inches, based on 60 years of records for the city station from 1900 through 1959. The annual precipitation has ranged from a maximum of 72.86 inches in 1900 to a minimum of 17.66 inches in 1917. Maximum precipitation recorded at Houston for selected durations is shown in the following tabulation:

MAXIMUM RECORDED RAINFALL INTENSITIES AT HOUSTON, TEXAS 1900 THROUGH 1959

<u>Date</u>	<u>Duration period</u>	<u>Rainfall in inches (1)</u>	<u>Rainfall intensity in inches/hour</u>
Aug 11, 1926	5 minutes	0.84	10.08
Aug 11, 1926	10 "	1.52	9.12
Aug 11, 1926	15 "	2.00	8.00
Dec 10, 1923	30 "	2.92	5.84
Nov 1, 1943	1 hour	4.36	4.36
Nov 1, 1943	2 "	6.05	3.02
Nov 1, 1943	3 "	6.54	2.18
Nov 1, 1943	6 "	8.67	1.44
Nov 1, 1943	12 "	9.92	0.83
Nov 1, 1943	24 "	10.83	0.45
Aug 27, 1945	24 "	15.65 (2)	0.65

- (1) All records from city station unless otherwise noted.
 (2) Houston airport station (28 years of record).

18. The area is subject to intense local thunderstorms of short duration, general storms which extend over a period of several days, and to torrential rainfall associated with hurricanes and other tropical disturbances. The maximum 24-hour rainfall recorded in the vicinity was 15.65 inches at the Houston airport in August 1945. This maximum rainfall resulted from a hurricane which originated in the Gulf of Mexico, moved inland at Palacios, Texas, and passed about 50 miles to the west of the Vince Bayou watershed. The rainfall from this storm produced the maximum known flood stages on Vince and Little Vince Bayous.

19. Runoff.- There are no stream gages on Vince and Little Vince Bayous. Normal stream flow is from slight to intermittent. Urban development on the watershed in recent years has greatly increased the amount of roof and paved areas. Local interests constructed channel clearing and excavation improvements on Vince Bayou in 1947, and on both Vince and Little Vince Bayous in 1949. Although these improvements partially offset the higher stages that increased runoff would produce under present conditions, a recurrence of the August 1945 storm would cause flood stages and peak discharges much higher than those that actually occurred during that storm. Because of the probability of complete urban development of the entire watershed within a comparatively short time, a low infiltration index of 0.05 inch per hour with initial loss of 1.00 inch was adopted for hydrologic studies.

20. Flood history.- Based on available records and information furnished by local interests, damaging floods occurred on Vince and Little Vince Bayous in 1929, 1935, 1945, 1954, 1957, and 1959. No records of discharges for these floods are available. However, computed estimates for the maximum known flood of August 1945 indicate that it produced a peak discharge of about 7,000 cubic feet per second at the mouth of Vince Bayou.

21. Flood frequencies.- Flood frequency studies were based on an analysis and frequency study of rainfall records at Houston, Texas, covering a 60-year period from 1900 through 1959. Peak discharge rates for floods were computed from the 24-hour rainfall values by the Snyder Synthetic Unit Hydrograph Method, as described in appendix I. Floods equal to the August 1945 flood of record are estimated to have a frequency occurrence of once in about 150 years.

22. Standard project flood.- Computations of a standard project flood for the Vince Bayou watershed are described fully in appendix I. A standard project rainfall totaling 26.6 inches over a four-day period was estimated for the 17 square mile watershed, with the maximum 24-hour rainfall of 22.4 inches occurring on the first day. Based on this rainfall, the peak discharge of the standard project flood was estimated at 10,450 cubic feet per second at the mouth of Vince Bayou and at 3,600 cubic feet per second at the mouth of Little Vince Bayou.

23. Other floods investigated.- Flows from floods of lesser intensity than the standard project flood were estimated in a manner similar to that used for the standard project flood. Storms having a frequency of occurrence of once in about 100 years and 170 years were estimated. These storms were estimated to have peak discharges at the mouth of Vince Bayou of about 6,300 cubic feet per second and 8,200 cubic feet per second, respectively.

EXTENT AND CHARACTER OF FLOODED AREAS

24. Area subject to flooding.- The flood plain of the standard project flood on Vince Bayou watershed includes portions of the cities of Pasadena, Houston, and South Houston, and the community of Golden Acres. The area subject to flooding totals about 3,375 acres, of which 65 percent is either fully or partially developed and 35 percent is undeveloped. Development within the flood plain includes commercial and residential properties, streets and bridges, utilities, parks, and a cemetery. The flood plain is crossed by one state highway and several thoroughfares providing access to industrial plants and commercial developments in adjacent areas. Flooding of these transportation routes causes extensive rerouting and delays to traffic. Most of the presently undeveloped areas within the flood plain are being held for future housing developments. Based on the expected growth rate for the area, it is estimated that full development of the remaining undeveloped land within the flood plain would be substantially completed by 1976. This development would further increase the flood damage potential.

25. Information for analyzing the economic aspects of the flood problem was obtained through a survey which involved personal interviews with property owners, municipal and county officials, engineers, and residents of the area subject to flooding. The flood plain was investigated in detail and inspections were made of all property subject to flood damage. The total value of physical property within the flood plain of the standard project flood under existing conditions is estimated at \$99,749,000, based on January 1961 prices. A breakdown of this value by principal classes of property is given in table 1. By 1976, when the expected growth will have completely developed the flood plain, the total value of all physical property therein based on 1961 price levels, will total \$149,445,000.

TABLE 1

VALUE OF PHYSICAL PROPERTY IN THE FLOOD PLAIN
OF THE STANDARD PROJECT FLOOD
VINCE AND LITTLE VINCE BAYOUS
(January 1961 price level)

Item	:	:	Little Vince Bayou	:	Total
Residential	\$41,200,000		\$33,015,000		\$74,215,000
Commercial	1,645,000		5,367,000		7,012,000
Industrial	50,000		50,000		100,000
Churches	1,238,000		1,539,000		2,777,000
Schools	1,515,000		1,200,000		2,715,000
Municipal	4,334,000		3,366,000		7,700,000
Utilities	2,236,000		2,994,000		5,230,000
Totals	52,218,000		47,531,000		99,749,000

26. Flood damages.- The flood-damage data obtained through the field economic survey formed the basis for estimating the average annual damages. A recurrence of the maximum known flood, which occurred in 1945, under the present flood plain development would result in damages estimated at \$3,410,000. The damages that would result from occurrence of a standard project flood are estimated at \$6,387,000. Details of those damages are shown in appendix II. Based on backwater computations for selected rates of discharge and estimates of damages at various elevations of flooding, a stage-damage relationship was developed and is shown by the curves on exhibits 1 and 2 of appendix II. Rainfall records, synthetic unit hydrographs, and historical flood information furnished by local interests and observed by personnel of the Galveston District, were used to establish a relationship between peak stages and frequency which is expressed as the estimated number of times the various stages would be equaled or exceeded in 100 years. These curves are shown as exhibits 3 and 4 of appendix II. Damage-frequency curves, shown as exhibits 5 and 6 of appendix II, were constructed by plotting damage-frequency coordinates, which were determined from the mutual stage relationships of the stage-damage curves and the stage-frequency curves. The average annual damages were then computed from the damage-frequency curves. The average annual damages under existing conditions were computed to be \$88,000 for Vince Bayou and \$81,000 for Little Vince Bayou, or a total of \$169,000 for both bayous. By 1976, when it is expected that full development of the flood plain will have occurred, the average annual flood damages will amount to \$152,000 on Vince Bayou and \$101,000 on Little Vince Bayou, or a total of \$253,000 on both bayous.

EXISTING CORPS OF ENGINEERS' PROJECTS

27. Existing flood control project.- The existing project for improvement of Buffalo Bayou and its tributaries above the Houston turning basin to protect the city of Houston from floods and prevent deposition of silt in the turning basin was authorized by the River and Harbor Act approved June 20, 1938, and modified by the Flood Control Acts approved August 11, 1939, and September 3, 1954. The existing project includes the following elements: Barker Dam and Reservoir, Addicks Dam and Reservoir, and rectification of the channels of Brays Bayou, White Oak Bayou, and Buffalo Bayou. On June 30, 1960, the total estimated cost of the project was \$93,700,000, including \$54,000,000 Federal cost and \$39,700,000 non-Federal cost. On June 30, 1960, the existing project was 42 percent completed. Barker Dam was completed in February 1945. Addicks Dam and 7.4 miles of channel rectification downstream from Addicks and Barker dams, including 6.2 miles on Buffalo Bayou and 1.2 miles on South Mayde Creek, were completed in October 1948. Channel rectification of Brays Bayou was started in May 1956 and is scheduled for completion in the latter part of 1963. Work remaining under the existing project consists of completing the construction in Brays Bayou and completing the design and construction of channel rectification for White Oak and Buffalo Bayous. The average annual Federal cost of maintenance and operation of Barker and Addicks Dams and Reservoirs, during the 5-year period ending June 30, 1960, was \$58,000. The improvement of Vince and Little Vince Bayous for flood control purposes would not affect the existing flood control project for Buffalo Bayou and Tributaries, Texas. The location of Vince Bayou watershed with respect to the existing flood control project is shown on plate 1.

28. Existing navigation project.- The existing navigation project for the Houston Ship Channel, Texas, provides for a channel 40 feet deep extending from Bolivar Roads, at the lower end of Galveston Bay, via the San Jacinto River and Buffalo Bayou to Brady Island, thence 36 feet deep to, and including, the Houston turning basin; for a channel width of 400 feet between Bolivar Roads and Boggy Bayou, thence 300 feet to the Houston turning basin; for turning points on the deep-draft channel near Clinton Island and at the mouth of Hunting Bayou; for a light-draft channel 10 feet deep and 60 feet wide from the Houston turning basin to the mouth of White Oak Bayou; for a branch channel 10 feet deep and 60 feet wide in the old channel of Buffalo Bayou behind Brady Island; for a cutoff channel 10 feet deep and 60 feet wide at Turkey Bend; and for a channel 8 feet deep and 125 feet wide at 5-Mile Cut in Galveston Bay. The project also provides for construction of certain cutoffs and easing of sharp bends, and for construction of a pile dike 26,000 feet long to protect the channel in upper Galveston Bay. Construction of the pile dike and the light-draft channel from the Houston turning basin, excepting a 0.9-mile reach of the old channel at Turkey Bend, are inactive. On June 30, 1960, the existing project was 52 percent completed, exclusive of the inactive portions. Work remaining consists of improvements under the

40-foot project from Bolivar Roads to Brady Island. The improvement of Vince and Little Vince Bayous for flood control purposes would not affect materially the existing navigation project for Houston Ship Channel, Texas. The location of Vince Bayou watershed with respect to the existing navigation project is shown on plate 1.

IMPROVEMENTS BY OTHER FEDERAL AND NON-FEDERAL AGENCIES

29. Improvements by other Federal agencies.- No improvements have been constructed by other Federal agencies in the Vince Bayou watershed in the interest of flood control, drainage, navigation, or other related purposes.

30. Improvements by non-Federal agencies and others.- The Harris County Flood Control District enlarged and rectified the channel of Vince Bayou in 1947 and 1949 to increase its discharge capacity. The improved channel has a fairly uniform cross section with a top width and depth that varies from approximately 20 feet and 4 feet, respectively, in the upper reaches to approximately 50 feet and 15 feet, respectively, in the lower reaches of the stream. Little Vince Bayou south of State Highway 225 was enlarged and rectified by the flood control district in 1949. The improved channel has a cross section with a top width and depth that varies from approximately 20 feet and 4 feet, respectively, in the upper reaches to approximately 50 feet and 10 feet, respectively, in the lower reaches. These improvements provide sufficient capacity to contain the standard project storm in the upper reaches of both bayous, above mile 7.3 on Vince Bayou and above mile 4.2 on Little Vince Bayou. The flood control district reports that it has spent about \$185,000 for improvement of Vince and Little Vince Bayous. Property owners along Little Vince Bayou in the vicinity of Tatar Street have constructed a short section of concrete channel lining at an estimated cost of about \$3,000.

IMPROVEMENTS DESIRED

31. Improvements desired by local interests.- A public hearing was held at Pasadena, Texas, on December 16, 1959, to ascertain the desires and views of local interests regarding improvements for flood control on Vince and Little Vince Bayous. There were 44 persons present including Federal, State, County, and local officials, representatives of civic organizations, business interests, property owners and other interested persons.

32. The Harris County Flood Control District requested that the existing channels of Vince and Little Vince Bayous be improved to provide adequate flood control and presented a brief describing a plan for improvement of the two streams. The suggested plan would provide for enlargement and rectification of the channels of both streams; for concrete channel lining of Vince Bayou from mile 1.5 to mile 7.78, the proposed upper project limit; and for concrete channel lining of Little Vince Bayou from mile 0.5 to mile 5.5, its proposed upper project limit. The flood control district estimated the total first cost of the improvements suggested in its plan at \$10,291,000, with annual charges of \$390,000. Benefits consisting of prevention of flood damages, disruption of business and loss of wages were evaluated at \$819,000 annually and the ratio of benefits to costs was estimated at 2.1. The Harris County Flood Control District, in its brief, stated that it would provide the required local cooperation if a Federal flood control project for Vince and Little Vince Bayous were authorized. The request of the flood control district was indorsed and supported by representatives of Harris County Commissioners Court, city of Pasadena, city of South Houston, the Pasadena and South Houston Chambers of Commerce, and numerous business representatives and property owners. No opposition to the proposed improvements was expressed at the public hearing.

FLOOD PROBLEMS AND SOLUTIONS CONSIDERED

33. Flood problems.- The principal flood problem on the Vince Bayou watershed is in the commercial and residential areas of the cities of Pasadena and South Houston. Flooding in these areas results principally from inadequate capacities of the existing channels to contain floods originating on the watershed and from the backwater effects of storm tides and Buffalo Bayou floods in the Houston Ship Channel. Both Vince and Little Vince Bayous are crossed by numerous bridges and aerial pipelines, which restrict the passage of floodwaters and materially increase flood stages. Some of the lower bridges and pipelines are completely submerged during flood periods.

34. Solutions considered.- The relatively flat terrain and the high degree of development in the Vince Bayou watershed precludes the use of storage or detention reservoirs as a practicable means of flood control within the watershed. The absence of adequate, well-defined runoff channels in adjacent areas and extensive development along possible channel routes precludes diversion of flood waters as a practicable measure. Extensive development within the flood plain would make the costs of evacuation and resettlement prohibitive. The demand for additional residential and commercial sites throughout the area prevents restriction by flood plain zoning. As the urban area of Pasadena and vicinity has developed, practically all surface and underground drainage facilities have been designed and constructed to use the channels of Vince and Little Vince Bayous as terminal outlets. Accordingly, the only feasible solution to flood problems on Vince Bayou watershed would be through improvement of the existing channels by enlarging and rectifying the channels or by providing concrete lining to improve the flow characteristics of the channels.

35. Local interests requested at the public hearing that the channels of both Vince Bayou and Little Vince Bayou be fully concrete lined throughout their lengths, except in the lower tidal reaches. Fully lined channels need not be as large as unlined channels to pass a given flow. Although less earth excavation is required, lined channels generally are more costly than unlined channels because of the relatively high cost of the concrete lining. Exhibits 5 and 6 of appendix III show the many residential areas which have developed along the stream banks. Rights-of-way costs for unlined channels in these reaches would be prohibitive because of large severance damage costs in the highly developed areas. In other reaches there is little or no development along the channel banks, and additional construction costs for concrete lining in these reaches would not be warranted.

36. Accordingly, in general, the most feasible plan would provide for enlarged and rectified channels, lined in reaches where rights-of-way costs would be prohibitive, and unlined in the remaining reaches.

37. Project formulation.- Floods occurring in relatively flat, coastal watersheds, such as that of Vince and Little Vince Bayous, usually follow extended periods of heavy rainfall ranging up to 24 or more hours. Runoff to the stream channels develops at a slowly increasing rate and produces a correspondingly slow rise in flood stages. Residents in the flood plain usually have ample warning during the precedent period of rainfall. The flood plain of Vince and Little Vince Bayous lies almost entirely within an urban area and is expected to be fully utilized with urban development by about 1976.

38. Economic analyses were made of several plans providing protection against floods ranging from a flood with a recurrence interval of once in about 100 years to a standard project flood. This determination is shown in appendix II. All plans investigated had favorable ratios of estimated average annual benefits to annual costs. The plan providing the maximum excess of benefits over costs was found to be one which provided capacity to contain a flood with a discharge of 8,200 cubic feet per second at the mouth of Vince Bayou, having an estimated recurrence interval of once in about 170 years. However, the analysis indicated that a plan providing protection against a standard project flood would be only slightly less favorable than the optimum plan. Furthermore, the flood control projects authorized for Brays, Buffalo and White Oak Bayous, which also are in the Houston area and have similar character of watershed development as that of Vince and Little Vince Bayou, provide for standard project flood protection. It is believed that no lesser degree of protection should be provided for Vince and Little Vince Bayous than for the other projects in the general area. Accordingly, since protection from a standard project flood was found to be fully justified, this degree of protection was adopted. Plan C would provide capacity to contain the standard project flood with a discharge of 10,450 feet per second at the mouth of Vince Bayou and is the most economical plan that would provide full protection from the standard project flood. Accordingly, Plan C hereafter is considered as the plan of improvement.

PLAN OF IMPROVEMENT

39. The plan of improvement for Vince and Little Vince Bayous provides for enlarging and rectifying the channel of Vince Bayou from its mouth to a point about 7.3 miles upstream and Little Vince Bayou from its mouth to a point about 4.2 miles upstream, a total distance in both streams of about 11.5 miles. The proposed improved channels would be trapezoidal in cross section with bottom widths of 10 and 15 feet in concrete lined reaches and varying from 20 feet to 50 feet in unlined reaches. In the concrete lined reaches, side slopes would be 1 vertical on 2 horizontal. In the unlined reaches, the banks would be sodded and side slopes would vary from 1 on $2\frac{1}{2}$ to 1 on 3.

40. The general plan of improvement is shown on plate 2. Pertinent data on design criteria, principal features, and requirements of the proposed plan are presented in appendix I and are summarized in table 5 of appendix III. Profiles of the proposed channel improvements and typical cross sections for the lined and unlined channel reaches are shown on plate 3.

41. Construction of the plan of improvement would require alterations to 2 railroad bridges, 30 highway bridges, 6 foot bridges, and 80 pipelines and sewer lines of various sizes ranging in diameter from 2 inches to 60 inches. Twenty-two of the pipelines are underground, 58 are either supported or suspended above ground across the bayou channels, and 4 cross Little Vince Bayou on existing bridges. Profiles of the railroad and highway bridges are shown on exhibits 3 and 4 of appendix III. The railroad bridges, highway bridges, foot bridges and pipelines are listed in detail and noted as to the type of alteration required in table 5 of appendix III.

42. Excavated material from the lower reach of Vince Bayou would be disposed of on lands adjacent to the channel or would be used, where necessary, for the construction of training levees. Excess material not needed for other purposes can be wasted in the abandoned clay pit area near mile 2.3. In the middle and upper reaches of Vince Bayou and throughout Little Vince Bayou, a large portion of the excavated material can be utilized for filling and leveling low-lying areas or can be wasted on lands adjacent to the channel. Disposal areas for the balance of the excavated material can be obtained within reasonable haul distances from the channels. The channel improvement cost estimates include allowances for hauling some material to areas removed from the channel. Construction of the proposed improvements would require about 131 acres of rights-of-way for construction and about 90 acres of spoil disposal areas for disposal of excavated materials.

43. The proposed improved channels have been designed, generally to carry the flow from a standard project flood, as described in appendix I, with a minimum freeboard of one foot above the design water surface and with a water surface elevation of 10.4 feet above mean sea level in Buffalo Bayou at the mouth of Vince Bayou. Along most of the improved channel, the water surface would be well below the bank line; however, in the extreme upper reaches of both streams only the minimum freeboard requirement would be maintained. In some short reaches, small localized depressions in the general bank lines would require a slight raising of grade by placement of excavated materials for maintenance of minimum freeboard.

44. In the vicinity of mile 2.3 on Vince Bayou, a rectified cutoff channel would be provided through an area of abandoned pits, which were excavated as a source of commercial clays. Under natural conditions, the stream has breached its banks near mile 2.3 and practically all low flow of the bayou is in a meandering channel through the clay pit area. Under the proposed improvement, the natural channel would be plugged at its upstream confluence with the improved cutoff channel and training levees would be provided along the cutoff channel to confine flood waters and maintain channel alignment. Gravity drainage structures with flapgates would be provided to drain areas behind the training levees. The downstream end of the natural channel would be left open as a drainage outlet for the adjacent area. Locations of the cutoff channel, training levees and drainage structures are shown on plate 2.

ESTIMATES OF FIRST COST

45. Detailed estimates of first cost for constructing the proposed plan of flood protection for Vince and Little Vince Bayous are shown in table 3 of appendix III and are summarized in the following table 2. The estimates are based on January 1961 price levels. The division of first costs is based on the requirements of local cooperation set forth in paragraph 51.

TABLE 2
ESTIMATES OF FIRST COSTS
VINCE AND LITTLE VINCE BAYOUS

Item	Costs		
	<u>Vince Bayou</u>	<u>Little Vince Bayou</u>	<u>Total for watershed</u>
<u>Federal first cost</u>			
Relocations (RR bridges)	0	\$ 30,000	\$ 30,000
Channels	<u>\$977,000</u>	<u>851,000</u>	<u>1,828,000</u>
Subtotals	977,000	881,000	1,858,000
Preauthorization studies	10,000	10,000	20,000
Engineering and design	89,000	80,000	169,000
Supervision and administration(1)	<u>98,800</u>	<u>98,200</u>	<u>197,000</u>
Total Federal first cost	1,174,800	1,069,200	2,244,000
<u>Non-Federal first cost</u>			
Lands and damages (acquisition)	869,000	511,000	1,380,000
Relocations (utilities and bridges)	<u>251,000</u>	<u>325,000</u>	<u>576,000</u>
Total Non-Federal first costs	1,120,000	836,000	1,956,000
Total estimated first cost	2,294,800	1,905,200	4,200,000

(1) Includes Federal title review for lands and damages.

ESTIMATES OF ANNUAL CHARGES

46. Detailed estimates of investments and annual charges for the plan of improvement are given in table 4 of appendix III and are summarized in the following table 3.

TABLE 3
ESTIMATES OF INVESTMENT AND ANNUAL CHARGES
VINCE AND LITTLE VINCE BAYOUS

Item	: Vince Bayou	: Little : Vince Bayou	: Total
Investment:			
Federal first cost	\$1,174,800	\$1,069,200	\$2,244,000
Interest during construction	<u>30,800</u>	<u>28,100</u>	<u>58,900</u>
Federal investment	1,205,600	1,097,300	2,302,900
Non-Federal first cost	1,120,000	836,000	1,956,000
Interest during construction	<u>42,300</u>	<u>30,200</u>	<u>72,500</u>
Non-Federal investment	<u>1,162,300</u>	<u>866,200</u>	<u>2,028,500</u>
Total investment	2,367,900	1,963,500	4,331,400
Annual charges:			
Federal			
Interest and amortization	43,600	39,700	83,300
Maintenance and operation	<u>None</u>	<u>None</u>	<u>None</u>
Subtotal, Federal	43,600	39,700	83,300
Non-Federal			
Interest and amortization	52,300	37,700	90,000
Maintenance and operation	<u>14,000</u>	<u>13,000</u>	<u>27,000</u>
Subtotal, Non-Federal	66,300	50,700	117,000
Total annual charges	109,900	90,400	200,300

ESTIMATES OF BENEFITS

47. Benefits.- The benefits to be derived from the proposed flood control improvement would consist of the flood damages that would be prevented during the life of the project. These benefits would increase proportionately with the development in the flood plain that would occur during this period.

48. Prevention of damages.- The average annual damages from inundation and scour, under existing conditions of protection and development in Pasadena, are estimated in appendix II at \$169,000. About \$88,000 would be sustained on Vince Bayou and \$81,000 would be sustained on Little Vince Bayou. These estimates include the primary physical damages to property from flood inundation and scour and the primary non-physical losses incurred, including loss of wages, interruption to traffic and costs related to recovering from flood emergencies. The proposed project would prevent most of these damages in the areas to be protected. There would be some residual damages within the lowest portions of the protected areas from inundation, scour and interruption to traffic resulting from floods exceeding the standard project flood. The residual damages that would remain after construction of the plan of improvement are estimated at \$4,000 annually for Vince Bayou and about \$2,000 annually for Little Vince Bayou. The difference in the estimated damages that are expected under existing channel conditions and the damages that would be expected under improved channel conditions is the estimate of damages that would be prevented by the proposed improvements. The prevention of these damages is a benefit that would accrue to the proposed improvements, and is estimated at \$84,000 annually for Vince Bayou and \$79,000 annually for Little Vince Bayou or a total of \$163,000 annually for both bayous. The estimated benefits from the prevention of damages to existing developments would be increased by the prevention of damages to additional properties that would be constructed during the life of the project. The allowance for increase in benefits from prevention of damages to expected developments expressed in terms of annual equivalent benefits is estimated at \$55,000 for Vince Bayou and \$19,000 for Little Vince Bayou, or a total of \$74,000 for both bayous.

49. Summary of benefits.- The total average annual benefits that would accrue from the proposed flood protection improvements proposed in this report including allowance for normal future growth and development are estimated at \$237,000 annually, of which \$139,000 annually would be credited to improvement of Vince Bayou and \$98,000 annually would be credited to improvement of Little Vince Bayou.

COMPARISON OF BENEFITS AND COSTS

50. The estimated average annual benefits, the annual charges, and the ratio of benefits to charges for the proposed improvement of Vince and Little Vince Bayous, based on January 1961 price levels, are given below:

	<u>Vince Bayou</u>	<u>Little Vince Bayou</u>	<u>Total</u>
Average annual benefits	\$139,000	\$98,000	\$237,000
Annual charges	110,000	90,000	200,000
Ratio of benefits to charges	1.3	1.1	1.2

PROPOSED LOCAL COOPERATION

51. Proposed local cooperation.- The improvement of Vince and Little Vince Bayous proposed herein would be a local flood protection project subject to the requirements of local cooperation generally specified by law for such projects. It is proposed that local interests shall be required to participate in the project as follows:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary, and spoil-disposal areas for construction of the project.

b. Provide without cost to the United States all relocations and alterations of bridges, except railroad bridges, and of all buildings, structures, pipelines, sewers, and utilities made necessary by construction of the project.

c. Hold and save the United States free from damages due to the construction works.

d. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

e. Agree to prevent any encroachment on the flood carrying capacities of the channels.

52. The plan for flood protection on Vince and Little Vince Bayous proposed in this report has been discussed with Harris County Flood Control District officials. They have stated that the flood control district would furnish the required local cooperation for the project when and as required. A copy of a letter from the flood control district is included as exhibit 9 of appendix III.

APPORTIONMENT OF COSTS AMONG INTERESTS

53. The apportionment of first costs of the proposed improvements between the Federal Government and the local interests would be in accordance with Federal law applicable to local flood protection projects and with the proposed requirements of local cooperation set forth in paragraph 51. Under these requirements, the first costs of all lands, easements and rights-of-way necessary for construction of the project would be borne by local interests. The costs of all necessary relocations and alterations of structures, including buildings, pipelines, sewers, utilities, and bridges, except railroad bridges, would be borne by local interests. No land enhancement would result from the proposed plan of improvement. All first costs for construction of the proposed improvements, alteration of railroad bridges, and all preauthorization survey costs would be borne by the Federal Government. All costs of maintenance and operation of the proposed improvements would be borne by local interests. The proposed apportionment of the estimated first cost and annual maintenance cost of the proposed improvements is shown in table 4.

TABLE 4

APPORTIONMENT OF FIRST COST AND ANNUAL MAINTENANCE
VINCE AND LITTLE VINCE BAYOUS

Item	Federal	Non-Federal	Total
<u>First cost</u>			
Construction	\$2,164,000	None	\$2,164,000
Lands	24,000	\$1,380,000	1,404,000
Relocations	<u>36,000</u>	<u>576,000</u>	<u>612,000</u>
Total first cost	2,224,000	1,956,000	4,180,000
Preauthorization surveys and studies	<u>20,000</u>	<u>None</u>	<u>20,000</u>
Total cost	2,244,000	1,956,000	4,200,000
<u>Annual cost of maintenance and operation</u>	None	27,000	27,000

COORDINATION WITH OTHER AGENCIES

54. Copies of the notice of public hearing, held in Pasadena, Texas, on December 16, 1959, were sent to all known Federal, State and local agencies that were believed to have a possible interest in flood control improvements for Vince and Little Vince Bayous.

55. The Bureau of Sport Fisheries and Wildlife of the United States Fish and Wildlife Service and the Texas Game and Fish Commission were advised by letters of the proposed improvements and the views and comments of those agencies were requested. The Southwest Regional Director, Bureau of Sport Fisheries and Wildlife, in a letter report dated March 2, 1960, stated that the proposed improvements would neither affect adversely nor offer opportunities for enhancement of the relatively minor fish and wildlife resources of the area. The Executive Secretary, Texas Game and Fish Commission, in a letter dated February 24, 1960, stated that the proposed improvements would have little, if any, effects on marine fishery resources. Further, he expressed the opinion that increased flow rates from Vince and Little Vince Bayous might aid in diluting industry effluents now entering the Houston Ship Channel and would reduce the silt load discharged into the ship channel. These benefits, however, were not evaluated. Copies of the Bureau of Sport Fisheries and Wildlife letter and the Texas Game and Fish Commission letters are included as exhibits 7 and 8, respectively, to appendix III of this report. The United States Department of Agriculture, Soil Conservation Service, has been furnished a copy of this report for review.

DISCUSSION

56. This report comprises the results of an investigation of the flood problems along Vince Bayou and Little Vince Bayou, flowing through the cities of Pasadena and South Houston, Harris County, Texas. Vince and Little Vince Bayous have a total drainage area of about 17 square miles and empty into Buffalo Bayou (Houston Ship Channel) just southeast of the city of Houston. The watershed comprises mostly the urban areas of Pasadena, Houston, South Houston, and the unincorporated community of Golden Acres. The areas subject to flooding are confined almost entirely to Pasadena and South Houston. At the present time about 65 percent of the flood plain is developed for residential and commercial use. The remaining areas in the flood plain generally are being held for residential and commercial purposes and it is expected that development will occupy all but the lowest areas by 1976.

57. The largest known flood occurring on Vince and Little Vince Bayous was that of August 1945. No estimate of flood damages was made at that time. Extensive additional development of the flood plain has taken place since 1945 and local interests have constructed some channel improvements along both Vince and Little Vince Bayous. It is estimated that occurrence of a flood equal to that of August 1945 would cause damages of about \$3,410,000 under present conditions, while a standard project flood would produce damages estimated at \$6,387,000. Average annual damages under existing conditions are estimated at \$169,000.

58. To alleviate damages in Pasadena and South Houston, Texas, caused by periodic flooding of Vince and Little Vince Bayous, local interests request that the channels of both streams be improved to provide adequate flood control. The local interests suggested a plan for enlarging and rectifying the existing channels of both streams, with full concrete lining to be provided for the channels in the upper 6.3-mile reach of Vince Bayou and the upper 5-mile reach of Little Vince Bayou. Local interests estimated the total first cost of the proposed improvements at \$10,291,000, annual charges at \$390,000, annual benefits at \$819,000 and a ratio of benefits to costs of 2.1.

59. It is apparent from consideration of the topography and development of the watershed of Vince and Little Vince Bayous that the only practicable means of affording flood control to the area would be by channel enlargement and rectification. Various degrees of protection were studied during the course of the investigation. The plans investigated would provide protection against floods ranging from one with a recurrence interval of about 100 years to the standard project flood. It was found that a flood slightly less than the standard project flood has the maximum excess of benefits over costs; however, current policies provide that urban areas should be afforded the maximum practical protection. Plan C was developed as the most economical combination of lined and unlined channels that would provide full protection against a standard project flood with an estimated discharge of 10,450 cubic feet per second at the mouth of Vince Bayou and was adopted as the plan of improvement. The plan, which is a modification of the plan proposed by local interests, generally, would provide for enlargement and rectification of the existing channels. In certain reaches, the channel bottom and side slopes would be lined with concrete. In other reaches, the channel bottom would be unlined earth and side slopes would have a sod covering. Numerous bridges, pipelines and other structures, which now obstruct flows in the bayous, would be relocated or altered as necessary.

60. The total first cost of the proposed improvements is estimated at \$4,200,000, of which \$2,244,000 would be Federal cost and \$1,956,000 would be non-Federal, in accordance with the apportionment of costs described in paragraph 53. The total annual charges are estimated at \$200,000. The proposed improvements would prevent practically all of the flood damages which now occur within the flood plains of Vince and Little Vince Bayous. Small amounts of residual damages would still be experienced in the lowest parts of the flood plains from floods larger than the standard project flood. Total average annual benefits from the proposed improvements are estimated at \$237,000. The benefits to costs ratio is estimated at 1.2.

61. The requirements of local cooperation are described in paragraph 51. The Harris County Flood Control District has indicated its willingness to meet the requirements of local cooperation.

62. The improvements proposed in this report would have no material value for recreational purposes, nor any appreciable effects on fish and wildlife resources or navigation.

63. Additional information called for by Senate Resolution 148, 85th Congress, adopted January 28, 1958, is contained in an attachment to this report.

CONCLUSIONS

64. Based upon the findings of this investigation, it is concluded that:

a. A serious flood problem exists on the Vince Bayou watershed where existing residential and commercial areas of Pasadena and South Houston, Texas, are subject to extensive damages from flooding of Vince and Little Vince Bayous.

b. Enlargement and rectification of the existing channels of Vince and Little Vince Bayous, as described in the plan of improvement proposed in this report, would provide a high degree of protection to the cities of Pasadena and South Houston. Damages from floods larger than a standard project flood would be substantially reduced.

c. The improvements proposed herein would have estimated total annual charges of \$200,000, annual benefits of \$237,000 and a benefits to costs ratio of 1.2, based on January 1961 price levels.

d. The total first cost of the improvements proposed herein is estimated at \$4,200,000, of which the Federal share would be \$2,244,000, including \$20,000 which has been expended for preauthorization survey and costs. The non-Federal share would be \$1,956,000. The total annual cost of maintenance and operation, estimated at \$27,000, would be assigned to the local interests.

RECOMMENDATIONS

65. Accordingly, it is recommended that a Federal project be authorized to provide flood protection to Pasadena and vicinity, Texas, by improvement of the channels of Vince Bayou and Little Vince Bayou, generally as described in the plan of improvement section of this report, and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated total first cost to the United States of \$2,224,000 for new work, and subject to the condition that the local interests agree to:

a. Provide without cost to the United States all lands, easements and rights-of-way and spoil disposal areas necessary for construction of the project;

b. Provide without cost to the United States, all relocations and alterations of bridges, except railroad bridges, and of all buildings, structures, pipelines, sewers and utilities made necessary by construction of the project;

c. Hold and save the United States free from damages due to the construction works;

d. Prevent any encroachment on the flood carrying capacities of the improved channels, and

e. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

3 Incls
1. Plates
2. Appendixes I thru III
3. Attachment

HAROLD C. BROWN
Colonel, CE
District Engineer

[First endorsement]

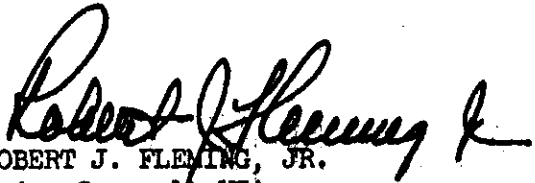
SWDGW-4

SUBJECT: Review of Reports on Houston Ship Channel and Buffalo Bayou
(Vince and Little Vince Bayous), Texas

United States Army Engineer Division, Southwestern, Dallas, Texas
July 26, 1961

TO: Chief of Engineers, Department of the Army, Washington, D.C.

I concur in the conclusions and recommendations of the District
Engineer.


ROBERT J. FLEMING, JR.
Major General, USA
Division Engineer



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
P. O. BOX 1306

SOUTHWEST REGION
(REGION 2)
ARIZONA
COLORADO
KANSAS
NEW MEXICO
OKLAHOMA
TEXAS
UTAH
WYOMING

ADDRESS ONLY THE
REGIONAL DIRECTOR

ALBUQUERQUE, NEW MEXICO

March 2, 1960

2-RBS

District Engineer
Corps of Engineers, U. S. Army
P. O. Box 1229
Galveston, Texas

Dear Sir:

Based on survey studies being made by the Corps of Engineers, the Bureau of Sport Fisheries and Wildlife presents herein its comments on the effects the proposed plans of improvement for Vince and Little Vince Bayous, Texas, will have on fish and wildlife resources. This report, prepared in accordance with the Fish and Wildlife Coordination Act, 48 Stat. 401, as amended; 16 U.S.C. et seq., has received concurrence of the Texas Game and Fish Commission by letter from Executive Secretary H. D. Dodgen, dated February 25, 1960.


It is our understanding by letter of January 15, 1960, from Mr. Kenneth Heagy, Chief, Engineering Division, Galveston District, Corps of Engineers, that improvements will include such features as enlargement and rectification of natural channels, concrete lining of channels within the city of Pasadena, and clearing and grading of bank slopes.

Vince and Little Vince Bayous drain an area of about 17 square miles in and near the city of Pasadena. The watershed is extensively developed with residential, commercial, and industrial improvements; there is minor agricultural land in the upper portion of the watershed. The bayous, which are intermittent and flow only during periods of runoff, flow in a northerly direction and enter the Houston Ship Channel about five miles southeast of the Houston turning basin. Vince Bayou is tidal in the lower $1\frac{1}{4}$ -mile reach and Little Vince Bayou, in the lower 0.5-mile reach. No significant fishery exists in either bayou. Developments throughout the watershed and to the banks of the bayou have practically eliminated all wildlife habitat.

EXHIBIT 7
APPENDIX III

The proposed project will have no effects nor offer any opportunities for enhancement to the relatively minor fish and wildlife resources of the project area.

Sincerely yours,


John C. Gatlin
Regional Director

Copies (10)

Distribution:

- (1) Executive Secretary, Texas Game and Fish Commission, Austin, Texas
- (1) Director, Marine Laboratory, Texas Game and Fish Commission, Rockport, Texas
- (1) Mayor, City of Pasadena, Pasadena, Texas
- (2) Regional Engineer, Region VII, Public Health Service, Departments of Health, Education, and Welfare, Dallas 2, Texas
- (1) Director, Biological Laboratory, Bureau of Commercial Fisheries, Galveston, Texas
- (1) Regional Director, Bureau of Commercial Fisheries, St. Petersburg Beach, Florida

EXHIBIT 7
APPENDIX III

HOWARD CARNEY
ATLANTA

ROBERT G. CARR
SAN ANGELO

J. F. CORLEY
HOUSTON

CARL L. DUPUY
LUFKIN

FRANK M. WOOD, CHAIRMAN
WICHITA FALLS

GAME AND FISH COMMISSION

HOWARD D. DODGEN
EXECUTIVE SECRETARY
AUSTIN



W. J. CUTBIRTH, JR.
ASST. EXECUTIVE SEC'Y
AUSTIN

HAL PETERSON
KERRVILLE

W. O. REED
DALLAS

BEN F. VAUGHAN, JR.
CORPUS CHRISTI

H. A. WALSH
EL PASO

AUSTIN, TEXAS

February 24, 1960

Mr. Kenneth Heagy, Chief
Engineering Division
U. S. Army Engineer District
606 Santa Fe Building
Galveston, Texas

Ref: SWNGW

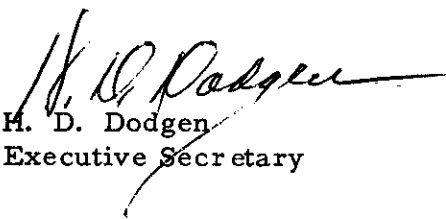
Dear Mr. Heagy:

Under date of January 15, 1960, you wrote this office regarding a survey report being prepared by your office on proposed improvements to Vince and Little Vince Bayous flowing through Pasadena, Texas. You requested our comments on the proposed work.

The Director of our Marine Fisheries Division has reviewed the area in question and advises that the proposed improvements would have little, if any, effect on the marine fishery resources of the area. He adds that it is possible that increased flow from Vince and Little Vince Bayous would aid in dilution of industry effluents now entering the Houston Ship Channel and that the development would reduce the silt load discharged at this point.

We concur in his findings, but cannot place a monetary estimate on this effort at this time.

Very truly yours,


H. D. Dodgen
Executive Secretary

HDD:mw

Cc: Mr. Howard T. Lee, Director
Marine Fisheries Division
Game and Fish Commission
Rockport, Texas

EXHIBIT 8
APPENDIX III

BILL ELLIOTT
COUNTY JUDGE HARRIS COUNTY
HOUSTON, TEXAS

July 13, 1961

Colonel H. C. Brown
District Engineer
Corps of Engineers, U. S. Army
P. O. Box 1229
Galveston, Texas

Dear Colonel Brown:

Receipt of advance copies of the review of reports on Houston Ship Channel and Buffalo Bayou (Vince and Little Vince Bayous), Texas, transmitted with your letter dated June 22, 1961, is acknowledged and said copies are returned herewith. It is requested that six (6) copies of the final report be reserved for Harris County Flood Control District.

As stated in the brief which was submitted at the public hearing on the subject project, Harris County Flood Control District is authorized and will act for local interests in all matters pertaining to the Vince and Little Vince Bayous project. The project, as recommended in this report, is acceptable to the Flood Control District and all items of local cooperation will be provided by the District at such time as funds are made available, from bonds voted by the residents of Harris County, to cover the \$1,956,000. local portion of the \$4,200,000. project.

I wish to take this opportunity to express appreciation for your fine cooperation and diligence in the preparation of this report.

Yours very truly,

/s/ Bill Elliott
BILL ELLIOTT

BE:lf

EXHIBIT 9
APPENDIX III

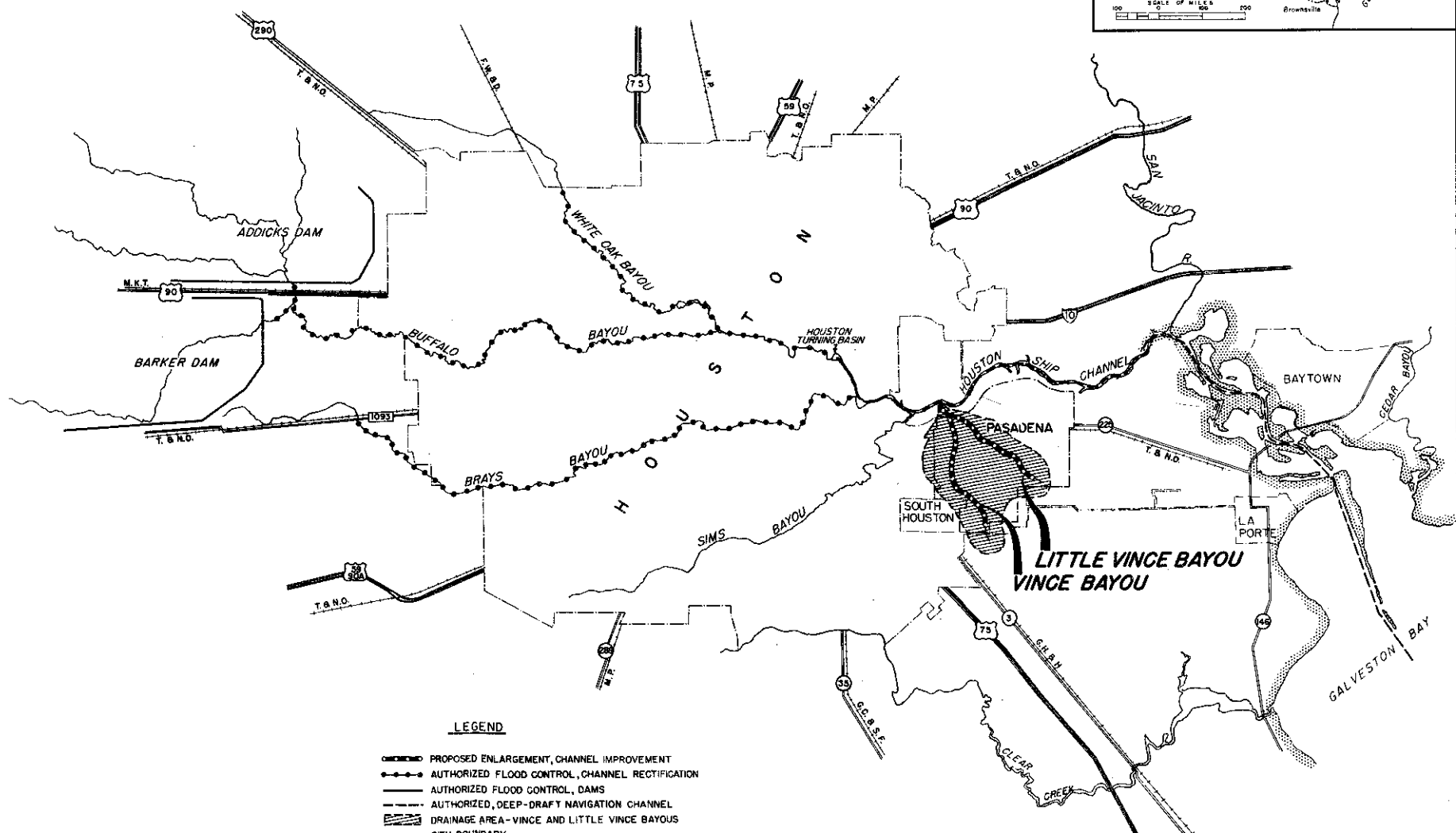
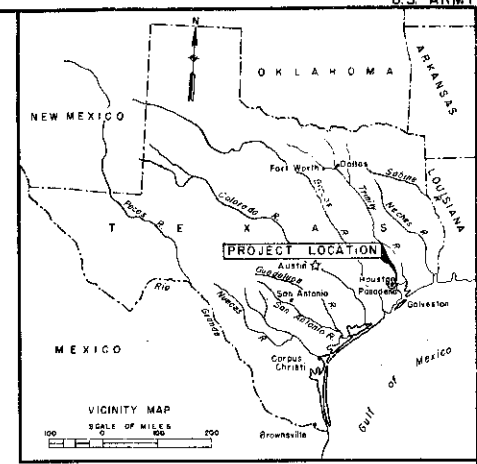
REVIEW OF REPORTS
ON
HOUSTON SHIP CHANNEL AND BUFFALO BAYOU
(VINCE AND LITTLE VINCE BAYOUS), TEXAS

INFORMATION CALLED FOR BY
SENATE RESOLUTION 148, 85TH CONGRESS
ADOPTED JANUARY 28, 1958

1. Authority.- The following information is furnished in response to Senate Resolution 148, 85th Congress, adopted January 28, 1958.

2. Requests by local interests.- At a public hearing held in Pasadena, Texas, on December 16, 1959, the Harris County Flood Control District requested the construction of local flood protection improvements that would protect the Pasadena area against flooding from Vince and Little Vince Bayous.

3. Local flood protection improvements considered.- The flood protection improvements requested by local interests were carefully considered and were found, with certain modifications, to afford the most feasible means of providing local flood protection to Pasadena and vicinity. The principal modification is in the proposed length of concrete lined channel. The relatively high cost of concrete lining is not warranted in reaches where there is little or no development along the channel banks and adequate rights-of-way can be obtained at relatively low cost for enlarging the earth channels. Along reaches where extensive development has occurred and many improvements are located close to the stream banks, a smaller channel with concrete lining is more economical because of the high cost of lands and damages for acquisition of rights-of-way for larger earth channels. The plan presented in this report proposes a combination of unlined channel in reaches where rights-of-way costs would not be prohibitive and lined channel in reaches where the rights-of-way costs would be high. Adequate flood protection is proposed with unlined channels for undeveloped reaches where rights-of-way costs are low. The cross section area for the unlined channel reaches will be sufficient to provide protection to these reaches when they are developed.



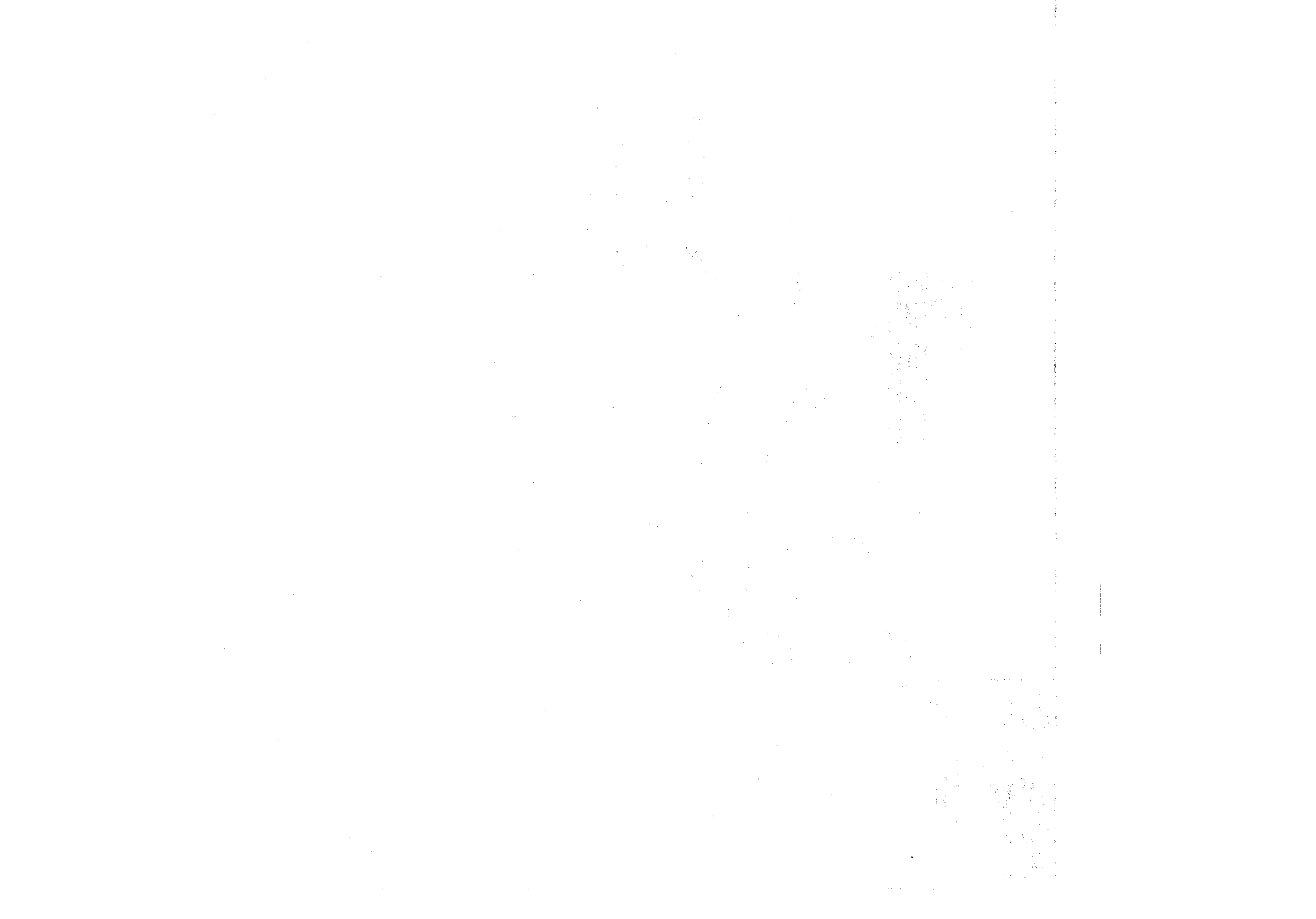
LEGEND

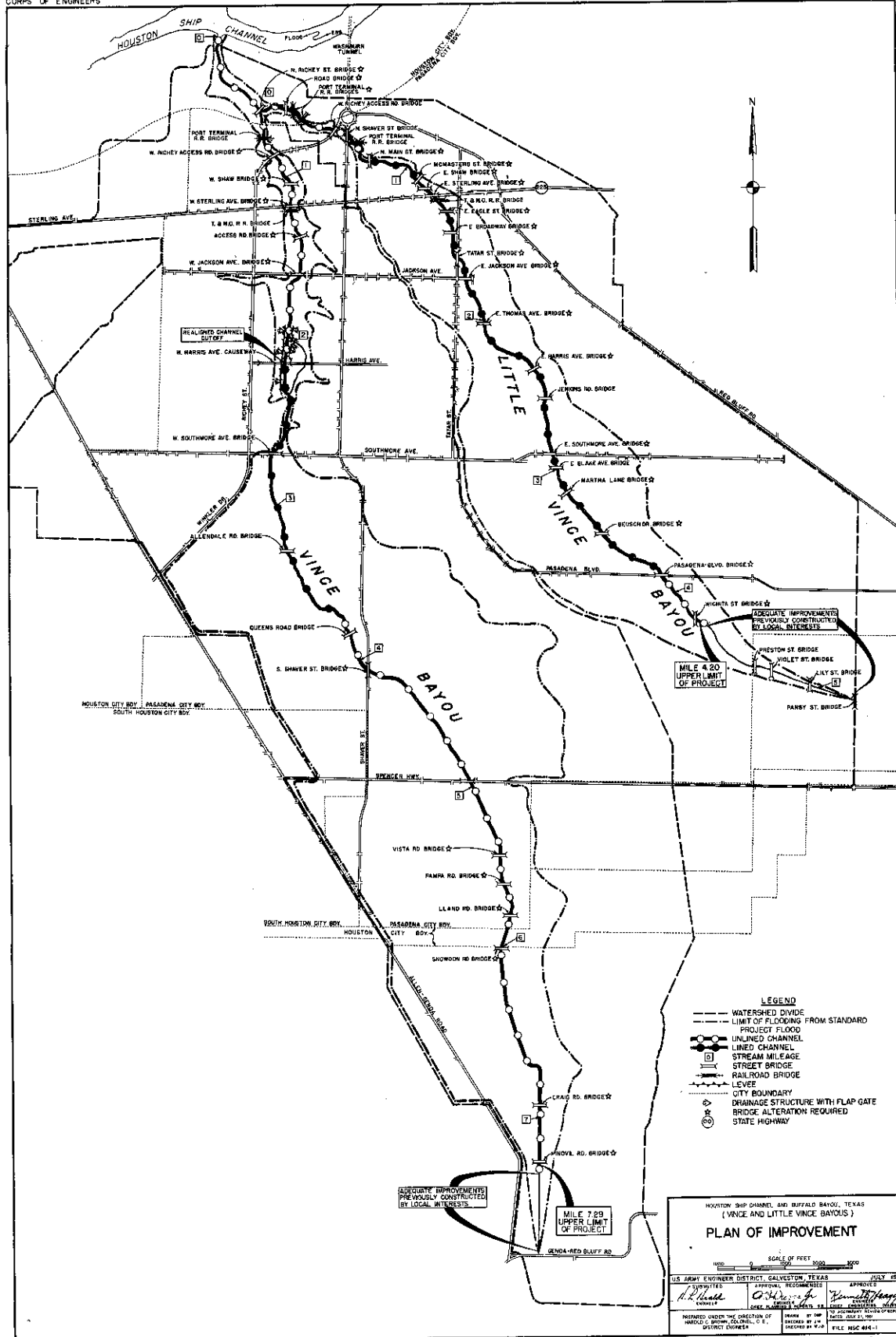
- PROPOSED ENLARGEMENT, CHANNEL IMPROVEMENT
- AUTHORIZED FLOOD CONTROL, CHANNEL RECTIFICATION
- AUTHORIZED FLOOD CONTROL, DAMS
- AUTHORIZED, DEEP-DRAFT NAVIGATION CHANNEL
- ▨ DRAINAGE AREA - VINCE AND LITTLE VINCE BAYOUS
- CITY BOUNDARY
- RAILROAD
- Ⓜ U.S. HIGHWAY
- Ⓜ INTERSTATE HIGHWAY
- Ⓜ STATE HIGHWAY

HOUSTON SHIP CHANNEL AND BUFFALO BAYOU, TEXAS
(VINCE AND LITTLE VINCE BAYOUS)

INDEX MAP
SCALE IN MILES
0 1 2 3 4

U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS			JULY 1961	
APPROVED	RECOMMENDED	APPROVED		
<i>H. C. Brown</i>	<i>W. M. Healy</i>	<i>W. M. Healy</i>		
DISTRICT ENGINEER	ENGINEER	ENGINEER		
PREPARED UNDER THE DIRECTION OF HAROLD C. BROWN, COLONEL, C. E., DISTRICT ENGINEER			DRAWN BY D.M.R. CHECKED BY J.M. CHECKED BY W.J.D.	TO ACCOMPANY REVIEW OF REPORTS DATED: JULY 27, 1961 FILE: HSC 414-1





- LEGEND**
- WATERSHED DIVIDE
 - - - - - LIMIT OF FLOODING FROM STANDARD PROJECT FLOOD
 - UNLINED CHANNEL
 - LINED CHANNEL
 - STREAM MILEAGE
 - STREET BRIDGE
 - RAILROAD BRIDGE
 - LEVEE
 - CITY BOUNDARY
 - DRAINAGE STRUCTURE WITH FLAP-GATE
 - BRIDGE ALTERATION REQUIRED
 - STATE HIGHWAY

HOUSTON SHIP CHANNEL AND BUFFALO BAYOU, TEXAS
(VINCE AND LITTLE VINCE BAYOUS)

PLAN OF IMPROVEMENT

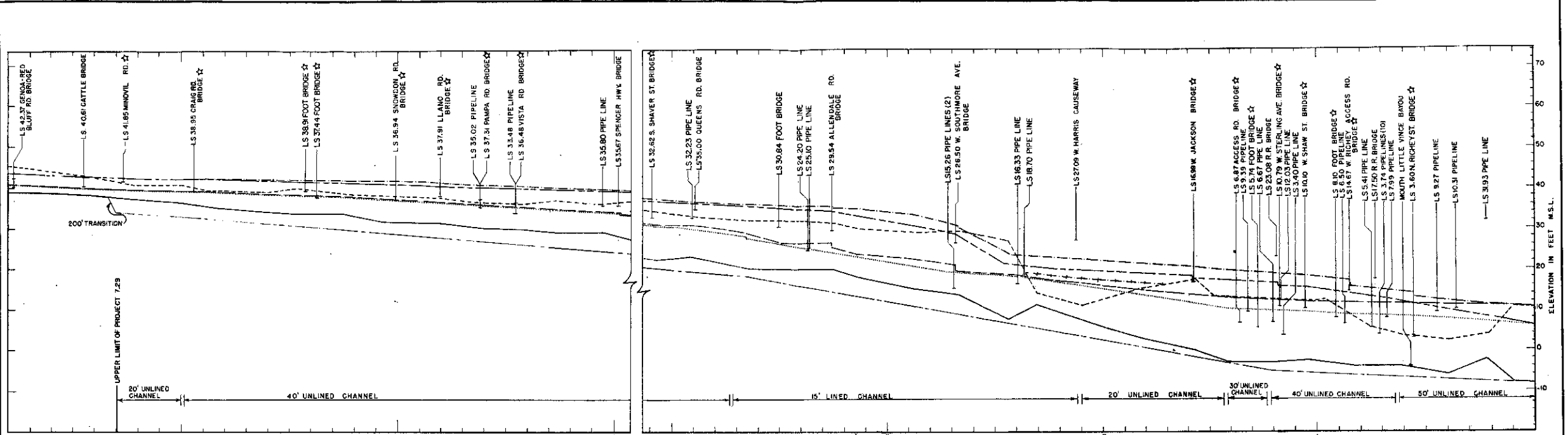
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U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS JULY 1951

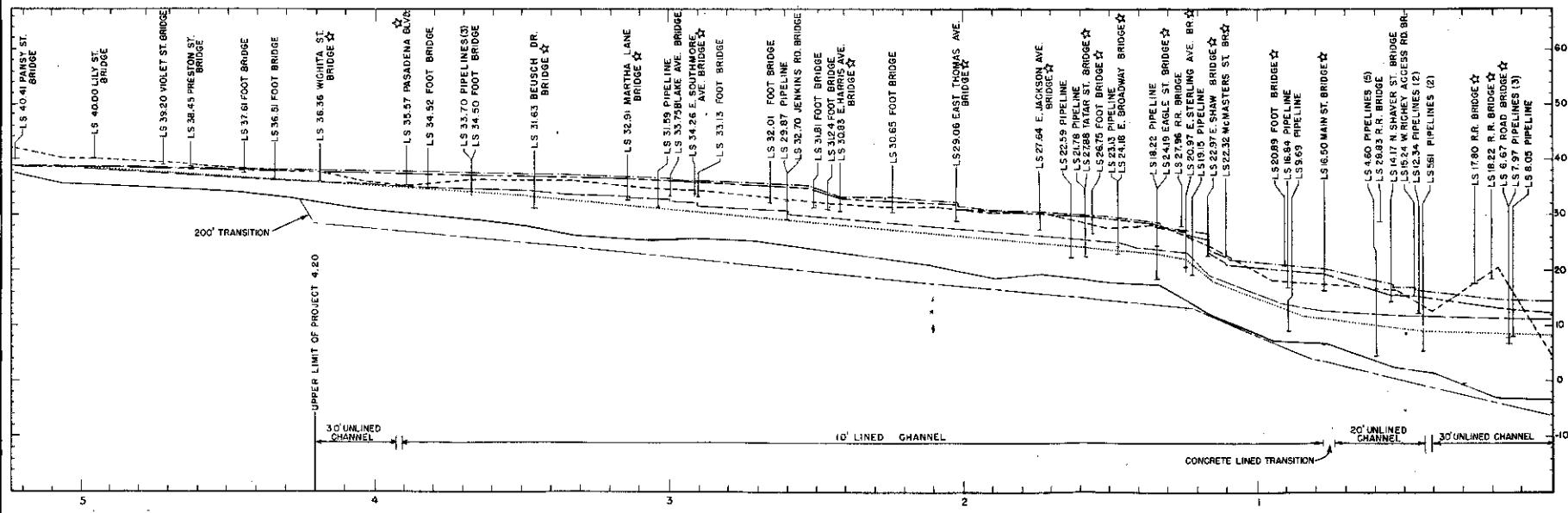
DESIGNED BY: *A.R. Hulse* APPROVED: *A.R. Hulse*
 CHECKED BY: *C.H. ...* APPROVED: *C.H. ...*
 DRAWN BY: *...* CHECKED BY: *...*

PERMITTED UNDER THE PROVISIONS OF
 HARRIS COUNTY ORDINANCE NO. 1111
 PASSED JULY 23, 1951

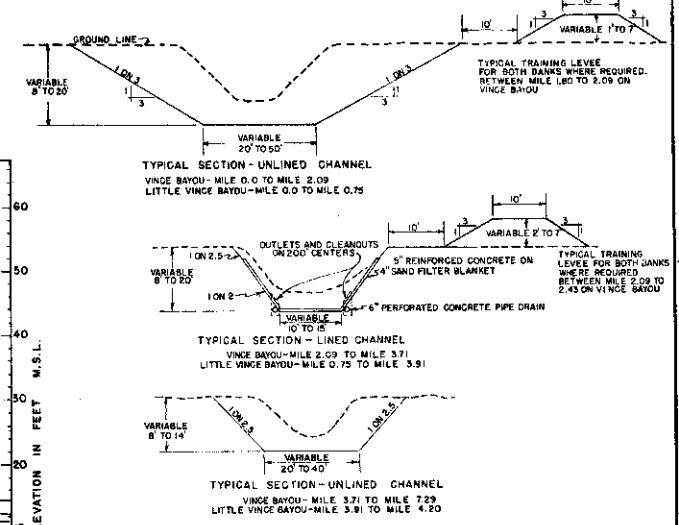
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PLATE 2



REALIGNED CHANNEL MILEAGE ABOVE MOUTH
VINCE BAYOU



REALIGNED CHANNEL MILEAGE ABOVE MOUTH
LITTLE VINCE BAYOU



- LEGEND**
- LOW BANK PROFILE
 - PROPOSED CHANNEL BOTTOM PROFILE
 - DESIGN FLOOD WATER SURFACE (EXISTING CONDITIONS)
 - DESIGN FLOOD WATER SURFACE (IMPROVED CONDITIONS)
 - PROFILE OF FLOOD OF RECORD (UNDER EXISTING CONDITIONS)
 - PROFILE OF FLOOD WATER SURFACE FOR FLOOD OF RECORD (IMPROVED CONDITIONS)
 - LS 0.00 LOW POINT ON STRUCTURE (ELEVATION)
 - TRAINING LEVEES PROPOSED
 - EXISTING CHANNEL BOTTOM PROFILE
 - BOTTOM WIDTH TRANSITION SECTION
 - BRIDGE ALTERATION REQUIRED

HOUSTON SHIPCHANNEL AND BUFFALO BAYOU, TEXAS
(VINCE AND LITTLE VINCE BAYOUS)
CHANNEL PROFILES AND TYPICAL SECTIONS

U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS		JULY 1961	
SUBMITTED <i>H. H. Hall</i> ENGINEER	APPROVAL RECOMMENDED <i>Robert J. ...</i> CHIEF PLANNING & REPORTS BR.	APPROVED <i>Herbert ...</i> CHIEF ENGINEERING DIVISION	
PREPARED UNDER THE DIRECTION OF HAROLD C. BROWN, COLONEL, C. E., DISTRICT ENGINEER		DRAWN BY: O. J. ... CHECKED BY: W. J. ... TO ACCOMPANY REVIEW OF REPORTS DATED: JULY 21, 1961	
		FILE: HSC 414-1	

