Clay & Leyendecker, Inc.

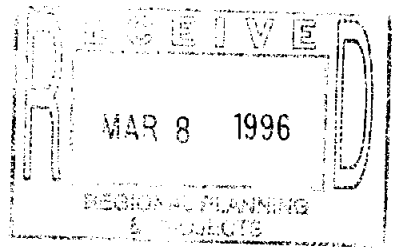
Consulting Engineers
and Surveyors

A STUDY OF

FLOOD PROTECTION PLANNING

FOR THE

CITY OF KATY, TEXAS



Prepared by:
Clay & Leyendecker, Inc.

In Association with:
WSBC Civil Engineers, Inc.

March, 1996

City of Katy, Texas
Texas Water Development Board

6701 Hwy. Blvd. Katy, Texas 77494 (713) 391-0173

Clay & Leyendecker, Inc.	A Study of Flood Protection Planning for the City of Katy, Texas	City of Katy TWDB

Clay & Leyendecker, Inc.

Consulting Engineers
and Surveyors

March 5, 1996

Mr. Abu Sayeed
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

Re: TWDB Contract No. 95-483-091
Flood Protection Planning Study
City of Katy, Texas

Dear Mr. Sayeed:

Enclosed you will find ten (10) bound copies of the final report on the above referenced project. We have incorporated the Water Development Board comments into the final report.

Very truly yours,

David Leyendecker

David Leyendecker, P.E.

DL/mm

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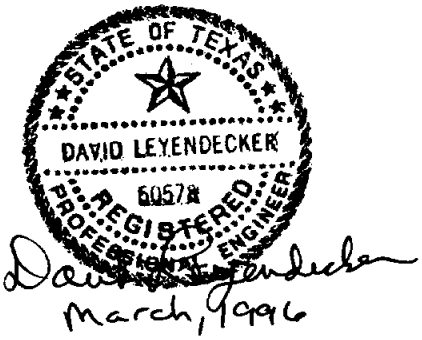

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A STUDY OF
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for the
CITY OF KATY, TEXAS

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1.0 EXECUTIVE SUMMARY

1.1 SCOPE OF WORK

The City of Katy, in association with the Texas Water Development Board, has authorized Clay & Leyendecker, Inc. in association with WSBC Civil Engineers, Inc. to perform a preliminary flood protection study for Katy. In order to formulate a flood protection plan for the City of Katy, the existing condition of the watersheds were investigated, future development projections were reviewed, and alternatives were proposed to address existing and future flood protection problems. A draft revenue generating plan to fund the proposed flood protection facilities was developed as part of the study.

1.2 DESCRIPTION OF THE PROJECT AREA

The flood protection planning area for the City of Katy is comprised of three independent drainage jurisdictions (Brookshire - Katy Drainage District, Harris County Flood Control District, and Fort Bend County Drainage District) and two watersheds (Cane Island Branch of Buffalo Bayou and Mason Creek), as shown on Exhibits 1 and 2. The planning area is located upstream of the Barker Reservoir operated by the U.S. Army Corps of Engineers. The Corps has restricted upstream channel improvements by governmental agencies up to the headwaters of the reservoir. Fort Bend County has restricted outflows from the City of Katy to avoid increased flooding while complying with Corps regulations. The Corps of Engineers policy assists them in limiting discharges into Buffalo Bayou downstream of the Barker Reservoir to reduce flooding of downtown Houston.

1.3 STATEMENT OF THE PROBLEM

The area along Cane Island Branch has a history of flood problems. These problems are aggravated by the bridges over Cane Island Branch at the Missouri - Kansas - Texas Railroad Bridge, U.S. Highway 90 Bridge, and the Interstate - 10 Bridge, which have insufficient hydraulic capacity to pass storms of 10- year frequency and higher. The 100-year floodplain limits are shown on Exhibit 3.

In the past ten years, the Brookshire - Katy Drainage District cleared Cane Island Branch from Highway 90 to Morton Road and from Clay Road to the upstream limit of Cane Island Branch. At the same time, Harris County Precinct 3 improved tributaries to Cane Island Branch in the same vicinity. The upstream reach of the clearing improved drainage of the farmland upstream of Katy. The reach of Cane Island Branch that was not cleared and grubbed (from Morton Road to Clay Road) is the portion of the channel lying within northern

boundaries of the extraterritorial jurisdiction limits of Katy. The increased inflow to the City is slowed down and attenuated by the densely vegetated channel that was not cleared within the northern extraterritorial jurisdiction limits of Katy.

A portion of the City of Katy is located at the upstream limits of the Mason Creek watershed. The Mason Creek watershed does not have a history of flooding within Katy City Limits due to the Creek. The area does have a localized flooding problem due to inadequate storm sewer. No floodplain is reported in the area.

1.4 ALTERNATIVES

Fourteen alternatives were evaluated with respect to flood protection of the City of Katy. The alternatives consisted of combinations of detention basins, structural buyouts, channel improvements, diversions, and bridge modifications. The alternatives were ranked based on flood protection effectiveness, economic considerations, and maintenance concerns. Detailed information on each alternative is found in Appendix A.

1.5 RECOMMENDED PLAN

Facilities

The recommended short term flood protection plan consists of two detention basins along Cane Island Branch: one south of Interstate - 10, and one north of downtown Katy. The plan is shown on Exhibit 4. The basin south of Interstate - 10 should be designed primarily to offset impact caused by development in the area south of Interstate-10. The basin north of downtown should also be designed primarily to offset impact caused by development in the 100- year storm. In lesser rainfall events, the basin north of downtown should be designed to alleviate existing flooding conditions, if possible. Continuation of the present policy of on - site detention is recommended to be maintained in the Mason Creek watershed. The recommended plan is implemented in phases to address financial feasibility. The revenue generating plan proposed provides an intermittent fund generation schedule.

Cane Island Branch between Clay Road and Morton Road should not be cleared until adequate detention is provided to offset the increased flows due to upstream clearing.

A recommended long term goal is to divert the northern portion of Cane Island Branch to the Snake Creek watershed by constructing a new ditch along Pitts Road. The diversion should be detained so as to not impact the Snake Creek watershed. The Snake Creek diversion could be combined with the

recommended alternative by starting construction of the proposed diversion channel at the detention basin north of downtown. The detention basin would be regraded to the west and begin conveying flow towards Pitts Road. This alternative would be highly effective, but may not be financially achievable by the City of Katy at present because construction could not be phased such that flood protection would be provided at early phases while revenue is being generated.

Construction Cost Estimate

An order of magnitude construction cost estimate was developed through preliminary siting and sizing of the proposed facilities.

Preliminary siting was based on the availability of undeveloped land adjacent to Cane Island Branch and the projected location of future development. Preliminary storage volume calculations were performed based on maximizing available depth of the basin, maintaining a one foot outfall clearance to the channel flowline, and 15- feet maintenance berms. All detention basins were designed as earthen, with 3:1 side slopes and bottom slopes in accordance with Harris County Flood Control District criteria. The calculated dimensions for each detention basin is as follows:

North of Downtown Katy:	840' wide x 1105' long x 10' average depth*
South of Interstate - 10:	900' wide x 1330' long x 10' average depth*

*Includes maintenance berms

The total estimated cost of the short term plan is approximately $ 1,312,000.

Prior to implementation, the City of Katy should initiate preliminary engineering services for the project. The preliminary engineering services will finalize the sizing of the detention basin, determine the outfall structure configuration, and verify the development acreage served estimated in this report. As funds begin to be collected by developers, the basin final design services should be initiated.

The City of Katy, by virtue of its participation in the National Flood Insurance Program, and in accordance with Section 16.236(d) (3&4) of the Texas Water Code, has approval authority for the project. The City will have an in-depth hydraulic design data analysis and have the construction plans prepared necessary to implement the recommendations prior to taking the project into the construction phase. Construction of the recommended project is likely to be eligible for Texas Water Development Board loans.

1.6 PROPOSED REVENUE GENERATION PLAN

The City of Katy does not have revenue available to fund the project. The revenue generating plan recommends developers contribute to funding for the proposed flood improvement projects in lieu of their construction of separate on-site detention facilities. Flood protection will be required for each developer prior to their development so as not to impact flooding. Based on the location of the proposed development, it is possible that minor channel improvements or clearing may be required to offset the impact of the development in the reach between the development and the detention basin site.

Funds for regional detention will be assessed to developers based on the acreage to be developed. This will be a one time fee. Developer fees (per acre) were estimated by dividing the total estimated cost of the flood protection plan divided by the acreage served.

The recommended development fee is $3800 per acre of development. This fee is comparable to other local flood control impact fees. Harris County Flood Control District charges a fee of $3,000 per acre of development for projects in the Sims Bayou watershed and $7,000 per acre in the Brays Bayou watershed.

Both developers and the City of Katy will benefit from this program. Developers will not need to provide on-site detention and related maintenance for their developments, and the City of Katy residents will have a comprehensive and efficient flood control and flood protection plan. The City of Katy will be responsible for providing future maintenance to the detention basins.

Appendix B contains comments on the flood protection plan from the public in response to the presentation of the plan to Katy City Council in a public meeting.

If the City of Katy decides to adopt the regional detention plan, a preliminary engineering report including flood modeling of Cane Island Branch will be required. The basin sizes shown in this report are preliminary. Preparation of design plan sets will be required as well.

2.0 INTRODUCTION

2.1 SCOPE OF WORK

The flood protection planning area for the City of Katy is comprised of three independent drainage jurisdictions (Brookshire - Katy Drainage District, Harris County Flood Control District, and Fort Bend County Drainage District) and two watersheds (Cane Island Branch of Buffalo Bayou and Mason Creek). It is shown on Exhibits 1 and 2. The planning area is located upstream of the Barker Reservoir operated by the U.S. Army Corps of Engineers. The Corps has restricted upstream discharges by Fort Bend County to the headwaters of the reservoir. Fort Bend County has restricted outflows from the City of Katy to assist in achieving compliance with Corps regulations. The Corps of Engineers restricts discharges into Barker Reservoir because discharges to Buffalo Bayou downstream of the reservoir are limited to reduce flooding of downtown Houston.

A flood protection plan is needed to control increased runoff to the City of Katy from upstream development and from development within the City of Katy. Short term goals of the plan should include recommendations for facilities to improve flood protection of existing development.

The City of Katy, in association with the Texas Water Development Board, has authorized Clay & Leyendecker, Inc. in association with WSBC Civil Engineers, Inc. to perform a preliminary flood protection study for Katy. The scope of work specified for the study includes the following tasks:

- Review of previous reports.
- Site Reconnaissance of existing drainage systems and recent physical changes to the system.
- Documentation of governing drainage entities' flood protection requirements for development.
- Estimation of location of projected future development.
- Evaluation, qualitatively, of drainage system deficiencies.
- Development and evaluation of flood protection alternatives for the City of Katy.
- Preparation of an estimated construction cost estimate for the proposed plan.
- Submit draft revenue generating plan to the City of Katy.
- Use input from the public to finalize report recommendations.
- Summarize proposed plan.

The purpose of this report is to assist the City of Katy to develop a preliminary flood protection plan that will benefit both the current and future residents of the area.

2.2 HISTORY OF FLOODING

The western one - third of the City of Katy is located within the 100 - year floodplain, all within the Cane Island Branch watershed. The downtown business district and several hundred residences are included in this area. Exhibit 3 shows historical flooding in the City of Katy. The drainage area upstream of the City of Katy (Brookshire - Katy Drainage District) is experiencing growth, resulting in increased runoff to the Katy drainage system along Cane Island Branch. Currently, on-site detention is required for the upstream development, but there is no regional mitigation in place.

No stream gauges are located along Cane Island Branch. Therefore, there is no historical data pertaining to peak discharges. The inflows to the City of Katy are perceived to be steadily increasing each year.

The Missouri - Kansas - Texas Railroad Bridge, Highway 90 Bridge, and the Interstate - 10 Bridge constrict flow along Cane Island Branch. These constrictions have a dam- like effect on the floodplain in Katy. Backwater at the Missouri - Kansas - Texas Railroad Bridge create a 100- year floodplain that reaches to approximately Tenth Street, almost three quarters of a mile upstream of the bridge through downtown Katy.

In the past ten years, the Brookshire - Katy Drainage District performed clearing and grubbing of Cane Island Branch from Highway 90 to Morton Road and from Clay Road to the upstream reach of Cane Island Branch, as shown on Exhibit 1. Harris County Precinct 3 improved flow conditions to the northern tributaries of Cane Island Branch upstream of Katy. The upstream portion of the project improved drainage of the farmland upstream of Katy. The reach of the channel that was not cleared and grubbed (from Morton Road to Clay Road) is the portion of Cane Island Branch lying within the northern extraterritorial jurisdiction limits of Katy. Lack of drainage easements did not allow the Brookshire - Katy Drainage District to clear that reach. The City of Katy was concerned the increased channel inflows would cause additional flooding of downtown Katy. The increased inflow to the City is slowed down and attenuated by the densely vegetated channel that was not cleared. Flooding does occur on a regular basis at the downstream channel clearing limits of Clay Road due to the insufficient storage capacity of the cleared channel. This flooding adversely affects a residence adjacent to the channel at low frequency storms.

Portions of the City of Katy are located at the upstream reach of the Mason Creek watershed. The Mason Creek watershed does not have a history of flooding within Katy City Limits due to the Creek. The area does have a localized flooding problem due to inadequate storm sewer. No floodplain is reported in the area.

2.3 PREVIOUS STUDIES

Seven studies addressing the City of Katy's drainage were reviewed. These studies are:

- Flood Insurance Study - City of Katy, Texas - Harris, Waller, and Fort Bend Counties. Federal Emergency Management Agency. February, 1983.
- Comprehensive Study of Drainage for Metropolitan Houston For County of Harris - Section VIII - Buffalo Bayou Watershed Above Addicks and Barker Dams. Turner, Collie, & Braden, Inc. (Harris County). June, 1980.
- The Comprehensive Plan - Katy, Texas - 1980 Update With Notions for 1983 Zoning. O'Malley & Clay, Inc. (The City of Katy). 1983.
- Master Drainage Plan - Upper Buffalo Bayou Watershed - Waller County . Charles A. Kalkomey Engineering Company, & Turner Collie & Braden, Inc. (Brookshire - Katy Drainage District). December, 1985.
- Plan Formulation - Cane Island Branch. U.S. Army Corps of Engineers. 1988.
- Fort Bend County Master Drainage Plan for Buffalo Bayou / Willow Fork, Long Point Slough, Keegans Bayou, and Clear Creek Watersheds . Espey, Huston & Associates, Inc. (Fort Bend County). 1987.
- Mason Creek Extension Study Report - Harris County Flood Control District Unit T101-00-00. Wilbur Smith Associates (Harris County Flood Control District). September, 1992.

The following paragraphs summarize the major findings of the above studies as they pertain to regional flood protection planning for the City of Katy. The findings were field verified throughout the study period.

The Katy region is extremely flat, and the climate is typical of the Gulf Coast region: temperate and humid. The economy of the area has historically been based on agriculture and natural resources. Natural gas is abundant, and just north of Katy is the Hockley division salt mine. Rice is the major crop in the area. Soybean farming and cattle production are also important to the agricultural base of the community. The City of Katy itself is experiencing rapid

development, and is becoming less and less agriculturally based. However, areas north and west of Katy remain agriculturally based.

Generalized drainage patterns in the vicinity are from northwest to southeast. Cane Island Branch receives runoff from the farmland to the north of Katy prior to entering city limits. In high frequency storms, the Cypress Creek watershed located north of Katy overflows into Cane Island Branch. In addition, the City of Katy comprises a portion of the upstream limits of the Mason Creek watershed. The Cane Island Branch watershed drainage area upstream of the confluence with Willow Fork ranges from 13 to 25 square miles, depending upon which analysis is quoted. The channel is over 8 miles long.

The Cane Island Branch watershed is surrounded by the Snake Creek watershed to the West, the Willow Fork / Buffalo Bayou watershed to the South, the Mason Creek watershed to the East, the South Mayde Creek watershed to the Northeast, and the Cypress Creek watershed to the North. Cane Island Branch discharges converges with Willow Fork to form Buffalo Bayou which leads to Barker Reservoir. The Mason Creek watershed is surrounded by the South Mayde Creek watershed to the North and East, and the Cane Island Branch / Willow Fork watershed to the South and West. Mason Creek discharges directly into Barker Reservoir. Exhibit 2 shows the watershed locations with respect to Katy.

The inflows to Cane Island Branch from the north and west of Katy City Limits are from Harris and Waller Counties. The Cypress Creek overflow is also from Harris and Waller Counties. Therefore, the drainage entities that have jurisdiction over inflows to the City of Katy are the Brookshire - Katy Drainage District and the Harris County Flood Control District. Within the City of Katy, inflows to Cane Island Branch are from Harris, Waller, and Fort Bend Counties. Therefore, the Brookshire - Katy Drainage District, the Harris County Flood Control District, the Fort Bend County Drainage District, and the City of Katy have jurisdiction over the City of Katy inflows. Cane Island Branch outflows from the City of Katy in Fort Bend County. The Fort Bend County Drainage District has authority over outflows. The Fort Bend County Drainage District must restrict outflows from Cane Island Branch due to U.S. Army Corps of Engineers regulations imposed on Fort Bend County limiting inflows to the Barker Reservoir. Cane Island Branch and Mason Creek outfall to the Barker Reservoir.

The western one - third of the City of Katy is contained within the FEMA 100 - year floodplain. Approximately 2,738 acres are located within the 100- year floodplain along Cane Island Branch, including the downtown Katy business district and several hundred residences. According to the Corps of Engineers'

channel improvements recommended along the entire stream, expanding channel bottom widths from 10 to 75 feet at a slope of 0.06% with 3:1 side slopes. This would require proposed right - of - ways ranging from 160 to 230 feet in width. Right - of - way acquisition is required to implement these recommendations.

The Plan Formulation - Cane Island Branch by the U.S. Army Corps of Engineers published in 1988 proposes 25- year protection along Cane Island Branch. It combines 5.2 miles of channel improvements from the mouth of Cane Island Branch to Clay Road and a detention basin north of Clay Road. The channel improvements include channel deepening and enlarging without concrete lining. Proposed bottom widths range from 100 to 120 feet. The detention basin would be approximately 12 feet deep discharging into the deepened channel. The plan requires acquisition of approximately 1,068 acres of right - of - way through developed areas. One railroad bridge and 8 roadway bridges would require replacement or modification, and 28 pipeline crossings would require modification. The U.S. Army Corps of Engineers does not recommend their plan based on the cost - benefit analysis performed as part of the report. No other plans were evaluated for Cane Island Branch in this report.

The Fort Bend County Master Drainage Plan for Buffalo Bayou / Willow Fork, Long Point Slough, Keegans Bayou, and Clear Creek Watersheds prepared by Espey, Huston & Associates, Inc. for Fort Bend County in 1987 reaches conclusions concerning flood protection along Willow Fork. The plan recommends channelization of Willow Fork within Fort Bend County. No improvements were recommended for the segment of Cane Island Branch located within Fort Bend County. The effect of channel improvements along Willow Fork on Cane Island Branch would be the lowering of tailwater elevations at the confluence of the two ditches.

The Mason Creek Extension Study Report - Harris County Flood Control District Unit T101-00-00 was completed by Wilbur Smith Associates for the Harris County Flood Control District in September, 1992. The study calls for an extension of Mason Creek Tributary T101-00-00 approximately two miles into Katy City Limits, as proposed in the Turner, Collie, and Braden's 1980 study. At this time, Harris County Flood Control District has not authorized design phase services for this project. Representatives indicate it is not likely to be constructed in the near future.

None of the proposed plans in the referenced studies have been implemented.

3.0 EXISTING FLOOD PROTECTION POLICIES OF GOVERNING ENTITIES

Prior to initiation of this report, meetings were held between the City of Katy, Harris County Flood Control District, Brookshire - Katy Drainage District, Fort Bend County Drainage District, and the U.S. Army Corps of Engineers. It was concluded that the City of Katy should take a leading role in developing a flood protection plan to protect the citizens of Katy.

In the interim, each of the three drainage districts would continue requiring on - site detention for new development. The detention should be designed for 100- year storm events with a 25- year tailwater in the receiving system. Since on- site detention is required, none of the drainage districts charge impact fees to developers for storm drainage.

Fort Bend County requires that 100- year outflows from the City of Katy along Willow Fork (including Cane Island Branch flows) be limited to existing conditions. Fort Bend County has limited outflows to comply with U.S. Army Corps of Engineers limits on inflows into Barker Reservoir from Fort Bend County.

The upper reaches of Cane Island Branch through the City of Katy weave in and out of Harris and Waller Counties. Both the Harris County Flood Control District and the Brookshire - Katy Drainage District agreed that a sensible approach to maintenance of the channel would be to have one responsible entity. The Brookshire - Katy Drainage District agreed to be that entity. The Harris County Flood Control District remains interested in the channel, but the interest lies more in planning.

The Harris County Flood Control District, the Brookshire - Katy Drainage District, the Fort Bend County Drainage District, and the U.S. Army Corps of Engineers have received draft copies of this report and were invited to comment on the conceptual plan proposed. Their comments, as well as comments from two public hearings, are located in Appendix B of this report. Drainage improvements, future studies, and development within the watershed should be coordinated with entities directly impacted by the actions.

None of the drainage districts currently have proposed projects for the City of Katy.

4.0 ALTERNATIVES ANALYSIS

4.1 INTRODUCTION OF ALTERNATIVES

Development in the City of Katy is projected to occur primarily in the northwest corner (south of Clay Road), and south of Interstate - 10. These projections are based on the location of incoming plans and plats to the Katy City Planning and Zoning Commission. Areas of projected development are noted on Exhibit 5.

Since there are no known flood protection problems in the Mason Creek watershed within Katy City limits that pertain to Mason Creek itself, all alternatives include the present policy of on-site detention for this watershed.

The Cane Island Branch watershed does experience flood protection problems. Potential alternatives were identified to provide flood protection to existing development, to offset increased flows created by future development, and to comply with restrictions placed on the area by both FEMA and the U.S. Army Corps of Engineers (through the Fort Bend County Drainage District).

Fourteen alternatives were identified during the brainstorming phase of this study. The alternatives consisted of combinations of detention basins, diversions, structural buyouts, channel improvements, and bridge widenings. Items considered in the evaluation of each alternative included technical feasibility, effectiveness, economic concerns, land acquisition availability, and environmental issues pertaining to the alternative.

Many drainage districts are discovering that on-site detention is not proving effective as a flood protection measure in offsetting increased flows due to development. Numerous small basins that are not planned to work together as a unit cannot effectively offset all impacts. If each basin is detaining an increased peak discharge down to existing rates, it means the basin is reshaping a peak hydrograph that has an increased runoff volume associated with it. When all these reshaped, higher volume hydrographs are combined, it is likely that the total peak flow will increase due to the increased runoff volume and disjointed design of the timing of each basin. Therefore, a regional solution, such as the ones proposed below, will be of benefit to the City of Katy and will be more effective than the current policy of on-site detention.

A brief description of each alternative is listed below:

Alternative	Description
1	Cane Island Branch: One detention basin south of Interstate-10. On-site detention required for new development north of Interstate-10. Mason Creek: Require on - site detention for new development.
2	Cane Island Branch: One large basin south of Interstate- 10, and four bridge modifications: Missouri - Kansas - Texas Railroad Bridge, U.S. Highway 90 Bridge, Stockdick Road Bridge, and Interstate- 10 Bridge. Mason Creek: Require on-site detention for new development.
3	Cane Island Branch: One large detention basin south of Interstate- 10, four bridge modifications: Missouri - Kansas - Texas Railroad Bridge, U.S. Highway 90 Bridge, Stockdick Road Bridge, and Interstate- 10 Bridge, and concrete lining of Cane Island Branch through downtown Katy. Mason Creek: Require on-site detention for new development.
4	Cane Island Branch: One large detention basin south of Interstate- 10, four bridge modifications: Missouri - Kansas - Texas Railroad Bridge, U.S. Highway 90 Bridge, Stockdick Road Bridge, and Interstate- 10 Bridge, and enlarged channel through downtown Katy. Mason Creek: Require on-site detention for new development.
5	Cane Island Branch: One large detention basin south of Interstate- 10, four bridge modifications: Missouri - Kansas - Texas Railroad Bridge, U.S. Highway 90 Bridge, Stockdick Road Bridge, and Interstate- 10 Bridge, and expansion and concrete lining of Cane Island Branch through downtown Katy. Mason Creek: Require on-site detention for new development.
6	Cane Island Branch: Two detention basins: one south of Interstate- 10, and one large basin just north of downtown and its adjacent development. Mason Creek: Require on-site detention for new development.

7	Cane Island Branch: One detention basin south of Interstate- 10, and underground storage provided by oversized storm sewers with constricted outfall throughout downtown Katy. Mason Creek: Require on - site detention for new development.
8	Cane Island Branch: A detention basin south of Interstate-10, and a detained diversion of upstream flow to Mason Creek watershed. Mason Creek: Require on - site detention for new development.
9	Cane Island Branch: A detention basin south of Interstate-10, and a detained diversion west - southwest of upstream flow to the Snake Creek watershed. Mason Creek: Require on - site detention for new development.
10	Cane Island Branch: A detention basin south of Interstate-10, and a detained diversion south and west using existing ditch along Pitts Road of upstream flow to the Snake Creek watershed. Mason Creek: Require on - site detention for new development.
11	Cane Island Branch: One large detention basin south of Interstate- 10, cross flow culverts beneath the Missouri - Kansas - Texas Railroad trestle coupled with a ditch south of and adjacent to the railroad conveying flow to Cane Island Branch, and three bridge modifications: U.S. Highway 90 Bridge, Stockdick Road Bridge and Interstate- 10 Bridge. Mason Creek: Require on - site detention for new development.
12	Cane Island Branch: One large detention basin just north of downtown and its adjacent development. On - site detention would be required for new development south of the Missouri - Kansas - Texas Railroad. Mason Creek: Require on- site detention for new development.
13	Cane Island Branch: Buyout of structures in the floodplain. Mason Creek: Require on- site detention for new development.

14	Cane Island Branch: On- site detention will be required for all new development. Mason Creek: Require on- site detention for new development.

The preferred short term alternative is Alternative 6. Refer to Exhibit 4. Alternative 6 consists of a detention basin south of Interstate - 10, and a mid-reach detention basin between Morton and Franz Roads. On-site detention is proposed for the Mason Creek watershed. Alternative 6 will be analyzed further in Section 4.3.

Alternative 10 is the most effective long term flood protection alternative explored. Refer to Exhibit 7. It consists of a detention basin south of Interstate - 10 and a detained diversion of approximately 4,000 cfs (in the 100- year event) to the Snake Creek watershed from Cane Island Branch along Pitts Road. On-site detention is proposed for the Mason Creek watershed.

Cane Island Branch between Clay Road and Morton Road should not be cleared until adequate detention is provided to offset the increased flows due to upstream clearing.

4.2 ALTERNATIVE EVALUATION CRITERIA AND METHODOLOGY

Table 1 lists the primary economic and non-economic evaluation factors used in analyzing each alternative: technical feasibility, potential effectiveness in offsetting future development, potential effectiveness in protecting existing development, overall project cost, cost - benefit relationship, the ability of the project to be phased while providing incremental flood protection, and future maintenance concerns. Each factor was given a maximum point rating, related to its weighted importance with respect to the other factors. Each alternative was then given points for each factor, with a higher score reflecting a more desirable alternative. The points and rank assigned to each alternative was based on qualitative evaluation by the engineering team. The maximum rating is 100 points.

Technical feasibility is an evaluation factor to determine if the alternative can be physically accomplished. It is only given a maximum rating of one point because if the alternative is not technically feasible (0 points), it is not evaluated any further.

TABLE 1
ALTERNATIVE COMPARISON CHART
CITY OF KATY FLOOD PROTECTION PLAN

Category:	Max. Rating*	ALTERNATIVE 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Technical Feasibility**	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1
Potential Effectiveness in Offsetting Future Development	20	15	15	15	15	15	15	15	n/a	n/a	20	15	8	0	4
Potential Effectiveness in Protecting Existing Development	20	0	15	16	16	18	16	8	n/a	n/a	20	15	16	20	0
Overall Project Cost ***	10	9	5	4	4	3	8	7	n/a	n/a	4	3	6	2	3
Cost - Benefit Rating***	15	10	9	9	9	9	12	6	n/a	n/a	11	8	9	3	3
Ability of Project to be Phased While Providing Flood Protection	20	18	3	3	3	3	18	18	n/a	n/a	3	3	19	18	20
Future Maintenance Concerns ****	14	12	12	12	12	12	11	5	n/a	n/a	9	5	13	14	8
TOTAL	**100**	**65**	**60**	**60**	**60**	**61**	**81**	**60**	**0**	**0**	**68**	**50**	**72**	**58**	**39**

* Maximum rating is the maximum number of points the alternative can receive. The higher the rating, the better the alternative.
** If the alternative is not technically feasible, the alternative is not explored further.
*** Consideration of on-site detention costs included.
**** Consideration of on-site detention maintenance included.

Offsetting the flood impact of future development is a primary goal of the desired flood protection plan. The alternatives are given up to 20 points based on their ability to offset the impact of future development at optimal design.

Protecting existing development from flooding via drainage improvements in low intensity storm events is a primary goal of the proposed plan. The alternatives are given up to 20 points based in their projected ability to improve existing flooding conditions in low frequency storms at optimal design.

The overall project cost is an economic factor of importance in analyzing alternatives. The more expensive a project is, the fewer points the project receives. A maximum of 10 points is awarded in this category to each alternative. The overall cost includes consideration of the cost of on- site detention to the developer.

A category called cost - benefit rating was used to analyze alternatives. This category grants points based on a subjective evaluation of effectiveness per dollar spent (including money spent on on- site detention by individual developers). The higher the point value awarded, the more flood control benefits are expected per dollar spent. A maximum of 15 points is awarded to each alternative.

A necessary funding consideration is the ability of the project to be phased, while providing incrementally increasing flood protection with each phase. We have been informed that the City of Katy does not have revenues available to fund the entire project at the start. Developers will be assisting in funding for the flood improvement projects in lieu of their on- site detention requirements. Therefore, flood protection must be provided for each developer prior to development so as not to impact flooding. This can be accomplished if payment for project construction can be phased as development occurs. A maximum of 20 points is awarded to each alternative based on the phasing ability of the project.

Future maintenance concerns are important to the City to consider in choosing a plan. The alternatives were given a maximum of 14 points in this category.

The preferred alternative, Alternative 6, received 81 points out of a possible 100 points. The second best alternative, Alternative 12, received 72 points.

Results are summarized in Table 1. Detailed evaluations for each alternative are provided in Appendix A.

4.3 RECOMMENDED SHORT TERM ALTERNATIVE

The recommended short term alternative is Alternative 6, consisting of a detention basin south of Interstate - 10, and a mid- reach detention basin between Morton and Franz Roads. Cane Island Branch should not be cleared between Clay Road and Morton Road until detention is provided to offset the recent clearing of the upstream channel. No flood control structures are proposed for the Mason Creek watershed, but on -site detention should be required for new development within the watershed, as shown on Exhibit 4.

This alternative is judged to be highly effective technically at offsetting new development and providing flood protection to downtown in lower frequency storms. It is ranked as the second best alternative financially because of the moderate range cost and the ability to phase the project.

A brief description of the evaluation of Alternative 6 is presented below:

Rating (Table 1): 81 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative will provide regional detention to offset future development south of Interstate - 10 and north of downtown Katy. This alternative will demonstrate moderate effectiveness in improving existing flooding conditions in downtown Katy. The mid reach basin (located north of downtown) will be of greatest benefit to the City if it is designed to provide effective flood protection to downtown Katy in lower frequency storms, rather than designed for the 100-year event. In the 100-year event, the entire storage volume provided in the basin will be devoted to offsetting the impact of development. The proposed revenue generating plan requires that all the detention is allotted to offsetting future development, unless additional funding is to be provided by the City of Katy to subsidize the developer's funds.

Phasing of Project: The project can be phased for detention basins to be constructed independently.

Cost Considerations: Ranked second lowest. A great benefit of this alternative is that its implementation can be phased, thus not requiring all funding at the start of the project.

Objective: The basin south of Interstate - 10 offsets increased runoff due to expected development south of Interstate - 10. The goal of this basin is to provide detention and outlet control such that final discharges into Willow Fork

do not violate Fort Bend County's discharge criteria. The City of Katy has acquired land in the area that could be utilized for this purpose. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

The basin north of downtown serves as storage to decrease flooding of the downtown area, as well as storage to offset development in the northwest portion of Katy. In the first phase of the project, the basin should be designed to not increase flooding in the 100- year event due to development, as well as be optimized to protect against downtown area flooding for a lesser rainfall events. There is undeveloped land between Franz and Morton Roads off Cane Island Branch that may be utilized for the purpose of drainage and flood control. Design phase services should evaluate if the acquired land is located close enough to downtown to effectively decrease flooding, or if another site should be purchased closer to the downtown area.

Localized flooding will not be affected in the 100- year event due to the alternative. The basins will serve to eradicate impacts from future development for storm events up to and including the 100- year event. Additionally, the basins will be designed to decrease existing flooding in storm events less than the 100- year event.

Sizing of Detention Basins: Preliminary siting and sizing of the detention basins was determined by the amount of undeveloped land available and the estimated storage capacity for each basin. Storage volumes were estimated using the Harris County Flood Control Design Criteria Manual.

To determine the acreage of development a basin offsets, a modified County Flood Control District empirical formula was used. Harris County Flood Control District's Criteria Manual for the Design of Flood Control and Drainage Facilities states that for drainage areas less than 50 acres, the recommended detention storage volume in acre-feet is equal to the acres to be developed multiplied by a factor ranging from 0.45 to 0.55. This formula was empirically developed based on on-site detention and detention of the impacted flow. A regional detention basin violates the on-site detention assumption, as well as potentially violating the assumption that the flow impacted is the flow detained. Based on discussions with a representative from the Harris County Flood Control District, a safety factor of 2 was applied to the empirical formula to correct estimated storage volumes for a regional detention basin.

Both detention basins are assumed to be earthen with 3:1 side slopes and surrounding 15- feet maintenance berms. The basin flowline was determined as

1-foot higher than the approximate flowline of Cane Island Branch found in the Master Drainage Plan - Upper Buffalo Bayou Watershed (Waller County) prepared by Charles A. Kalkomey Engineering Company, in association with Turner, Collie & Braden, Inc. on December 1985. The 1-foot differential was used to limit sedimentation in the basin outfall pipe. Natural ground elevations were taken from the same report. For typical sections of detention basins see Exhibit 6.

a. Basin north of Downtown Katy:

Acreage Required =	21.3 Acres
Effective Storage Volume =	167 Acre-ft
Acreage Development Served =	151.8 Acres

Top Length* =	1105 ft
Top width* =	840 ft
Average Depth =	10 ft

* Includes 15- foot maintenance berms

b. Basin south of Interstate - 10:

Acreage Required =	27.5 Acres
Effective Storage Volume =	219.3 Acre-ft
Acreage Development Served =	200.0 Acres

Top Length*=	1330 ft
Top Width*=	900 ft
Average Depth =	10 ft

* Includes 15- foot maintenance berms

Cost Estimate: Quantities calculated for preliminary cost estimate included excavation, hydromulch seeding, outfall structures and right-of-way. Costs provided for each item reflect current land and construction costs in the area and are derived from bid documents on recent construction projects in the area. The bid documents used were received from the City Engineer of Katy and the Harris County Flood Control District. Preliminary cost estimate totals are summarized in Table 2.

The estimated project cost of this alternative is $1,312,000.

TABLE 2
COST ESTIMATE FOR ALTERNATIVE 6
CITY OF KATY FLOOD PROTECTION PLAN

ITEM	DESCRIPTION	UNIT	UNIT PRICE	BASIN 1 QTY	BASIN 1 $	BASIN 2 QTY	BASIN 2 $	TOTALS QTY	TOTALS $
1	Excavation	CY	$ 1.10	301995	$ 332,194.50	395524	$ 435,076.40	697519	$ 767,270.90
2	Hydromulch Seeding	ACRE	$ 2,200.00	19.64	$ 43,208.00	25.49	$ 56,078.00	45.13	$ 99,286.00
3	Outfall Structures (incl. Piping)	EACH	$ 40,000.00	1	$ 40,000.00	1	$ 40,000.00	2	$ 80,000.00
4	Right-of-Way	ACRE	$ 3,000.00	21.3	$ 63,900.00	27.5	$ 82,500.00	48.8	$ 146,400.00
	SUBTOTAL				$ 479,302.50		$ 613,654.40		$ 1,092,956.90
	Contingency (20%)				$ 95,860.50		$ 122,730.88		$ 218,591.38
	TOTALS				$ 575,163.00		$ 736,385.28		**$ 1,311,548.28**

4.4 RECOMMENDED LONG TERM ALTERNATIVE

Alternative 10 consists of a detention basin located south of Interstate- 10 and a detained diversion of upstream flow from the Cane Island Branch watershed to the Snake Creek watershed heading west, beginning between Franz and Morton Roads, then south along the Pitts Road/ Snake Creek ditch. The diversion will require reconstruction of bridges at the Missouri - Kansas - Texas Railroad and U.S. 90, along with modifications of the Franz Road culvert crossing. On -site detention should be required for new development in the Mason Creek watershed, as shown on Exhibit 7.

A detained diversion to the Snake Creek watershed via a new ditch along Pitts Road is the most technically effective alternative considered. It diverts approximately 4,000 cfs in the 100- year storm off Cane Island Branch. (Cane Island Branch currently reports 5,300 cfs at the Fort Bend/ Waller County Line.) In addition, the ditch could provide additional protection to the City when the Snake Creek watershed develops. Based on topography, the Snake Creek watershed is projected to overflow into the Cane Island Branch watershed upon ultimate development. The proposed ditch could divert the overflow away from downtown Katy.

The construction of the alternative could not be phased while providing flood protection benefits at early phases. The proposed method of project funding requires that flood protection benefits be available at early phases of construction to offset increased flows due to development. Alternative 10 is ranked as the third most costly alternative. Implementation of this alternative will be effective in solving long term flooding problems for Katy. If funding were to come available in the future, the Snake Creek detained diversion is the recommended long range flood protection alternative.

A brief description of the evaluation of Alternative 10 is presented below:

Rating (Table 1): 68 points

Technical Feasibility: This alternative is technically feasible. There is approximately ten feet of available drop between the flowlines of Cane Island Branch and Snake Creek. The diversion length is approximately 6,100 feet. This means a channel could be constructed at an approximate maximum slope of 0.16%, which is well within standard slope limitations.

Effectiveness: This alternative is judged to be the most effective toward reducing the City of Katy's flooding problems. Based on the Brookshire - Katy Drainage District's Master Drainage Plan - Upper Buffalo Bayou Watershed -

Waller County (December, 1985), in the 100- year rainfall event approximately 4,000 cfs would be diverted off Cane Island Branch to the Snake Creek watershed. The same report states the existing 100- year flow at the Fort Bend/ Waller County line to be 5,300 cfs (which includes the 4,000 cfs proposed to be diverted). Diversion of 4,000 cfs will decrease downstream flooding in downtown Katy. The report used as a source for the flows quoted is approximately 10 years old. Therefore, the flows may have changed. Further study of the exact quantity of flow to be diverted will be required in the next phase of analysis for the alternative.

Phasing of Project: No, project cannot be phased. This will make the project economically unfeasible at present.

Cost Considerations: This alternative ranked as the third most costly alternative.

Other Factors: The detention basin proposed south of Interstate - 10 offsets increased runoff due to expected development south of Interstate - 10. This basin should regulate the final discharges into Willow Fork as to not violate Fort Bend County's discharge criteria. The City of Katy has already acquired some land in the area that could be utilized for this purpose. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

The diversion to the Snake Creek watershed will be effective in decreasing flooding within the Katy area. Although the Snake Creek watershed is undeveloped, objectives for the design of the diversion include designing to provide adequate capacity in the proposed channel, and that the diversion does not increase peak flows into the Snake Creek watershed. This must be done for two reasons. The first reason pertains to the discharge criteria along Willow Fork set forth by the Fort Bend County Drainage District. Snake Creek discharges into Willow Fork just upstream of Cane Island Branch. Therefore, the same discharge requirements set on Cane Island Branch are applicable to Snake Creek. Secondly, the Snake Creek watershed and proposed diversion channel will overflow into the Cane Island Branch watershed when it is overloaded. Therefore, if adequate detention is not provided in the diversion, the diverted flow will overflow back into the Cane Island Branch watershed. This diversion must be coordinated with the Brookshire - Katy Drainage District and the Fort Bend County Drainage District.

The proposed diversion will have minimal effect on the Snake Creek watershed. The proposed detained diversion route runs along Pitts Road, which is the Cane Island Branch- Snake Creek watershed divide as defined by the Brookshire -

Katy Drainage District. Little flow will be diverted out of the Snake Creek watershed into the diversion channel. The diversion channel enters Snake Creek close to Snake Creek's confluence with Willow Fork, and therefore, cannot impact the majority of the Snake Creek watershed in terms of flows. In preliminary engineering, it should be determined that the design proposed does not have any negative impacts on the Snake Creek watershed.

The City of Katy recently acquired land located near Morton Road, off Cane Island Branch, that may be utilized for the purpose of drainage and flood control. Undeveloped land exists surrounding the acquired land to enlarge the site. Additional undeveloped right - of - way will need to be acquired alongside the Pitts Road ditch for the entire reach to Snake Creek.

The proposed bridge modifications required by this alternative will be costly, and will require coordination with various transportation and railroad entities. No preliminary sizing of proposed structures or cost estimate was prepared for this alternative. The overall cost of the project is judged to be the third most expensive.

5.0 PROPOSED REVENUE GENERATION PLAN

5.1 METHODOLOGY

The City of Katy does not presently have designated revenues available to fund the flood protection program in its entirety. The revenue generating plan calls for developers to provide the funds for the proposed flood improvement projects in lieu of their on- site detention requirements. Flood protection will be required for each developer prior to their development so as not to impact flooding. Based on the location of the proposed development, it is possible that minor channel improvements or clearing may be required to offset the impact of the development in the reach between the development and the detention basin site. The City of Katy will be responsible for future maintenance of the basins.

Funds for regional detention will be provided by developers based on the acreage to be developed. This will be a one time fee. Developer fees (per acre) were calculated by dividing the total estimated cost of the flood protection plan divided by the acreage served.

5.2 RECOMMENDATION

The proposed developer flood protection plan fee is $3800 per acre of development. This fee is comparable to other local flood control authorities'. For example, Harris County Flood Control District charges a fee of $3,000 per acre of development for projects in the Sims Bayou watershed and $7,000 per acre in the Brays Bayou watershed. The experience of the Harris County Flood Control District is that the developer impact fee tends to be less expensive than the cost of an on-site detention basin, which should encourage developers to support the plan. Additionally, developers will not be responsible for the maintenance of an on-site detention basin. The City of Katy will be responsible for the maintenance of the regional basin.

The City of Katy, by virtue of its participation in the National Flood Insurance Program, and in accordance with Section 16.236(d) (3&4) of the Texas Water Code, has approval authority for the project. The City will have an in-depth hydraulic design data analysis and have the construction plans prepared necessary to implement the recommendations prior to taking the project into the construction phase. Construction of the recommended project is likely to be eligible for Texas Water Development Board loans.

Both developers and the City of Katy will benefit from this program. Developers will not need to provide on-site detention and related maintenance for their developments, and the City of Katy residents will have a comprehensive and efficient flood control and flood protection plan.

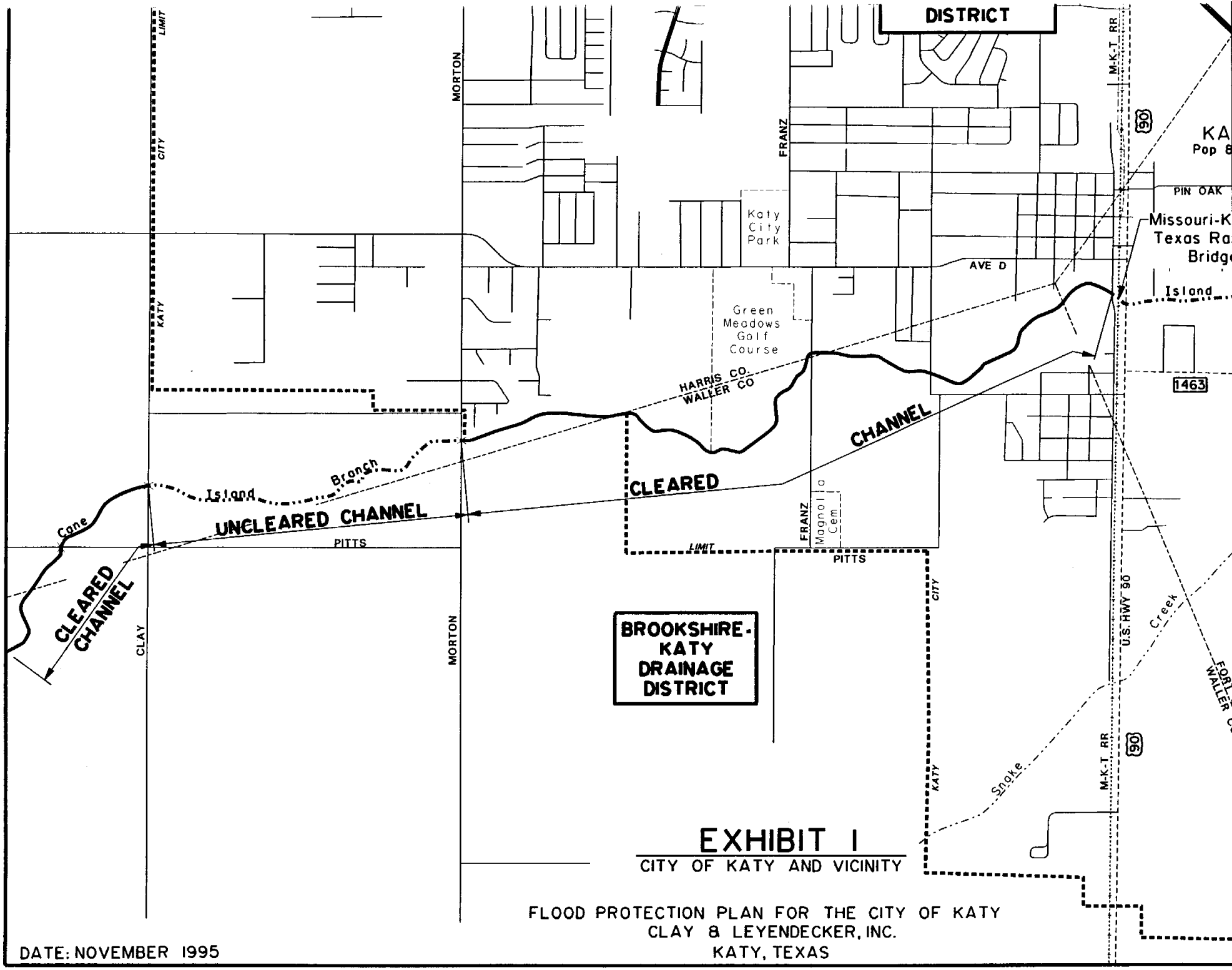


EXHIBIT I

CITY OF KATY AND VICINITY

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

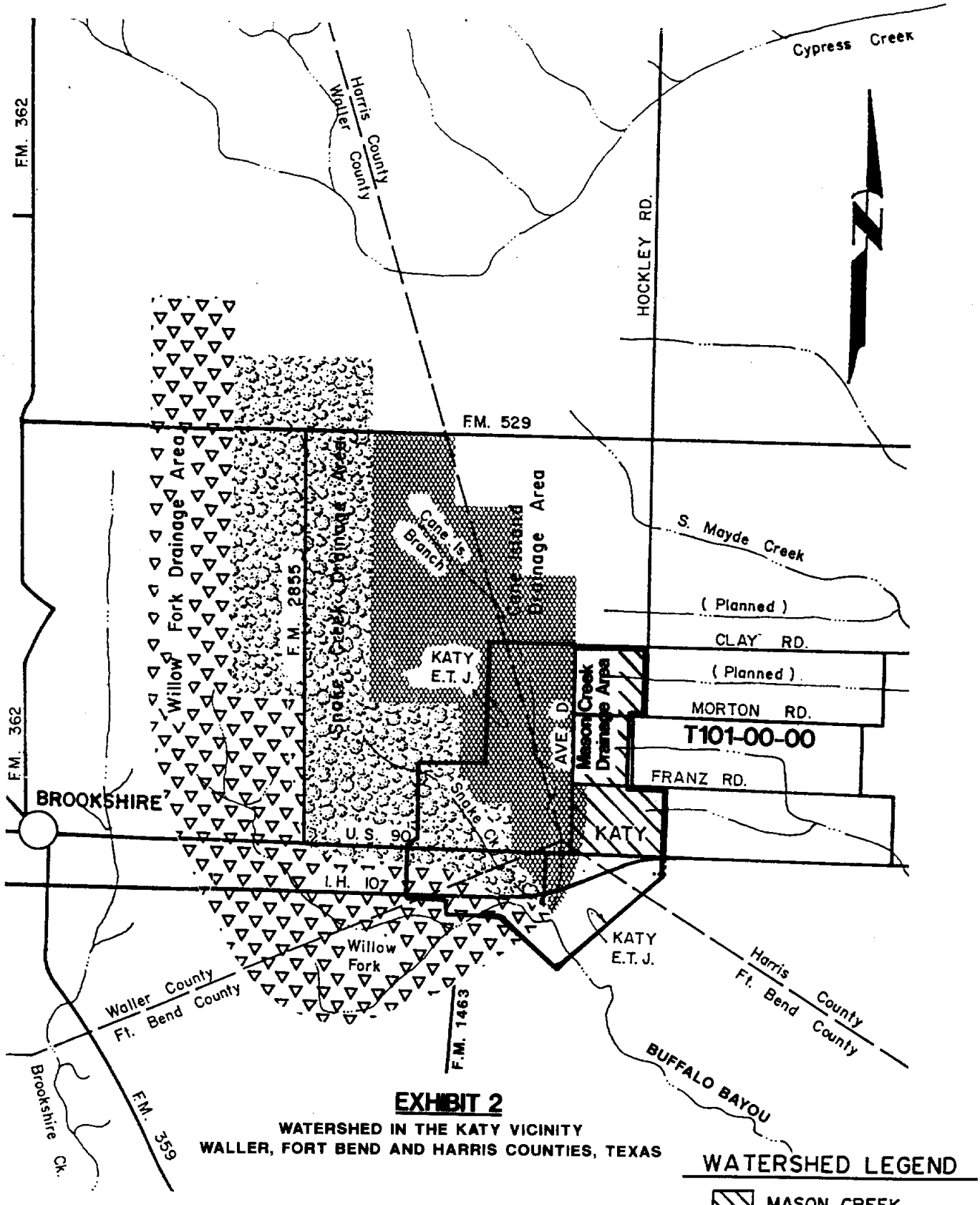


EXHIBIT 2

WATERSHED IN THE KATY VICINITY
WALLER, FORT BEND AND HARRIS COUNTIES, TEXAS

CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

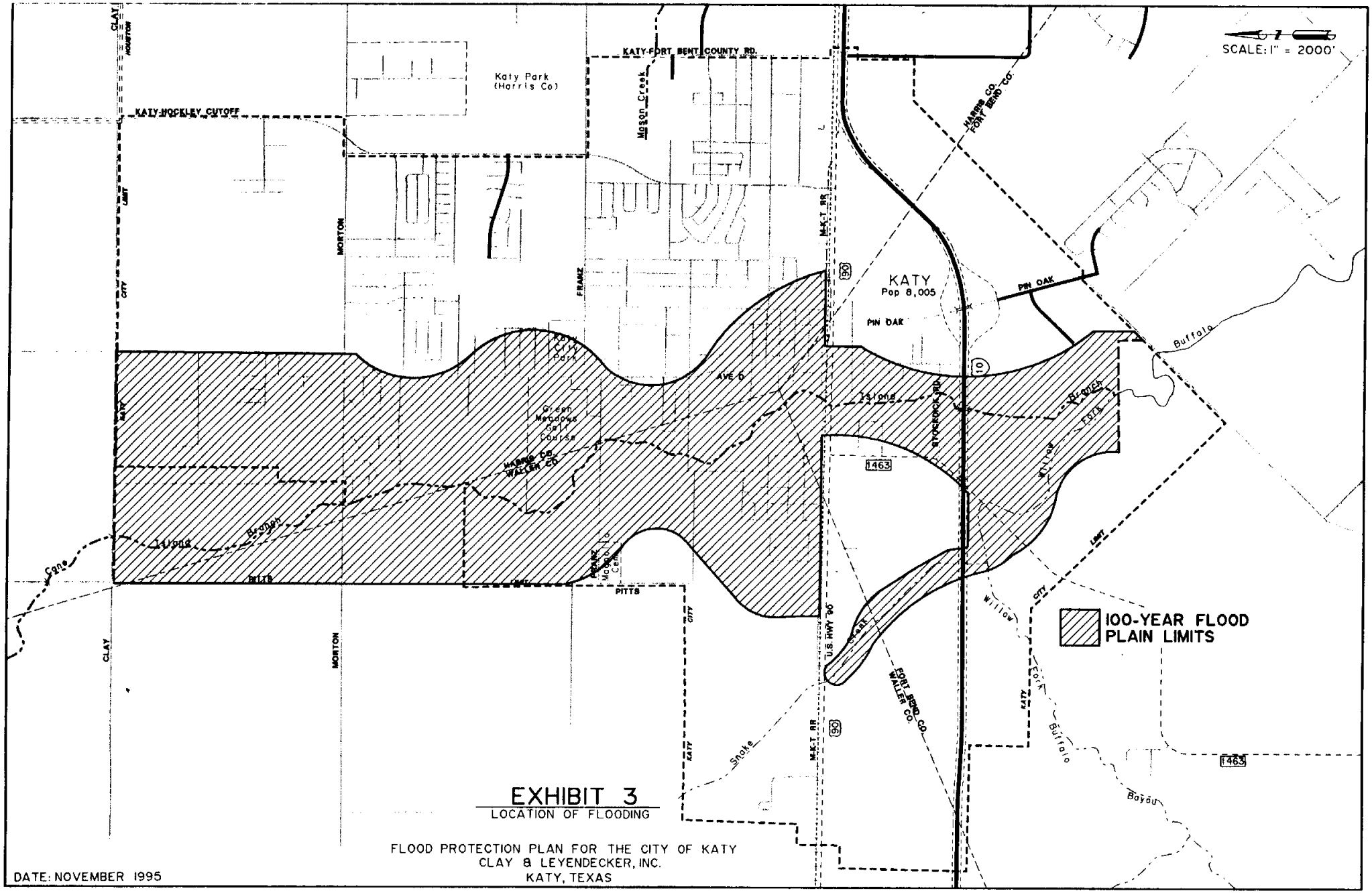


EXHIBIT 3

LOCATION OF FLOODING

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

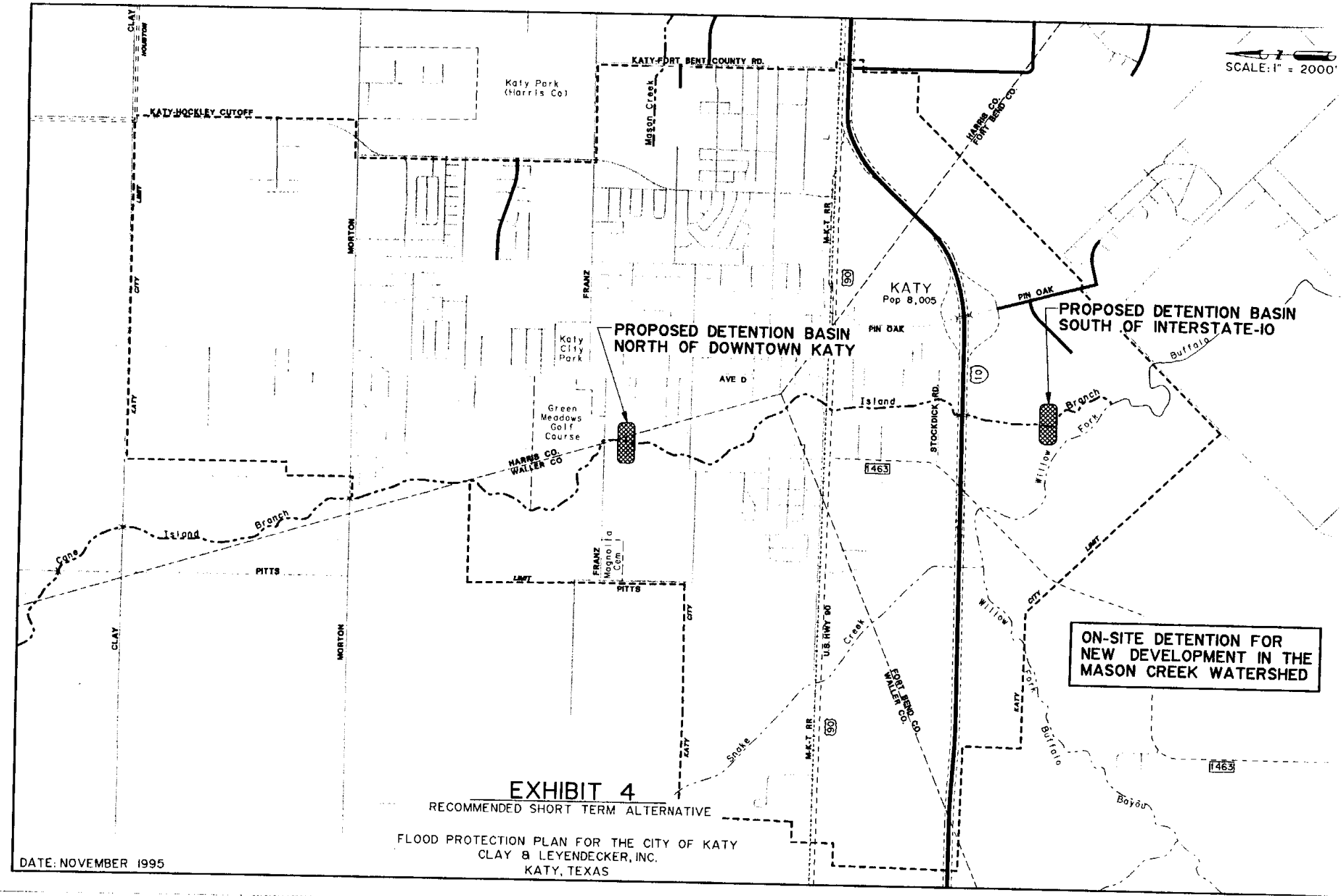


EXHIBIT 4

RECOMMENDED SHORT TERM ALTERNATIVE

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

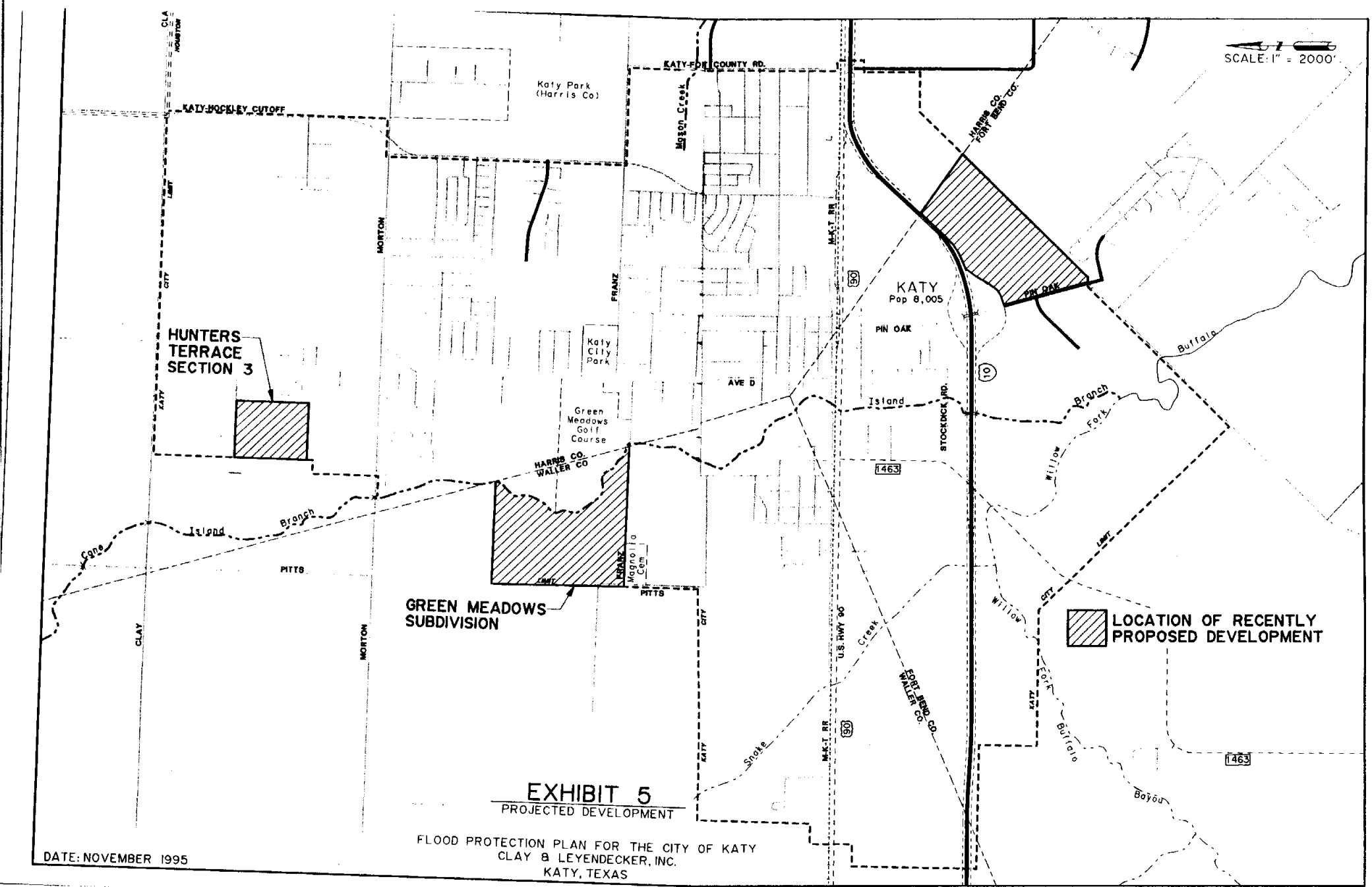


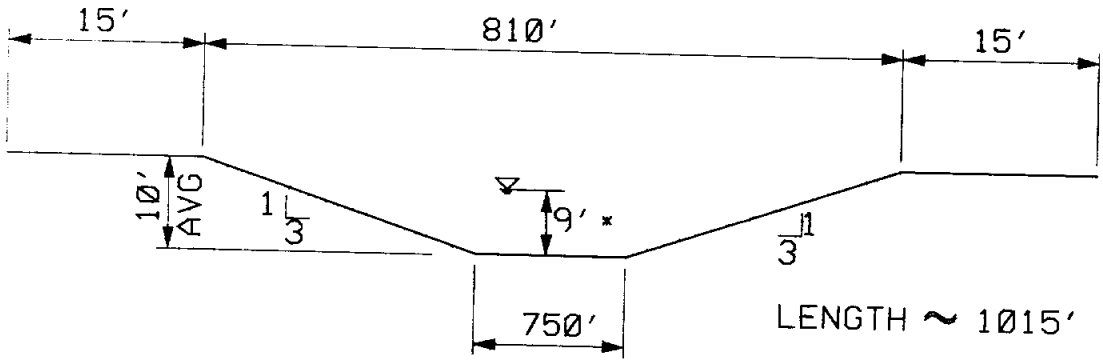
EXHIBIT 5

PROJECTED DEVELOPMENT

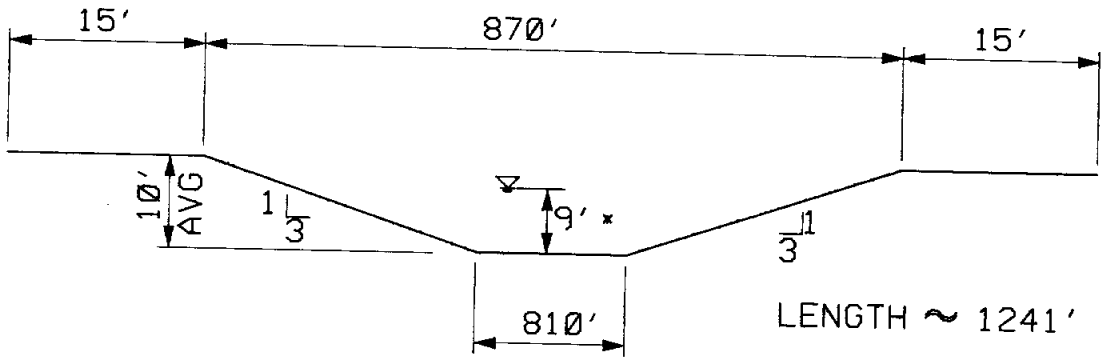
FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

DETENTION BASIN 1 - NORTH OF DOWNTOWN KATY



DETENTION BASIN 2 - SOUTH OF INTERSTATE-10



* HIGHWATER ELEVATIONS ARE BASED ON HCFCD FREEBOARD REQUIREMENTS

NOTE: DIMENSIONS NOT TO SCALE

WSBC CIVIL ENGINEERS, INC.

ALTERNATIVE NO 6
TYPICAL SECTIONS

EXHIBIT 6

DATE: 1995
SCALE: 1in/400'

10/24/95a \COK\KATYP00\EXHIBITS\XSECT.DGN

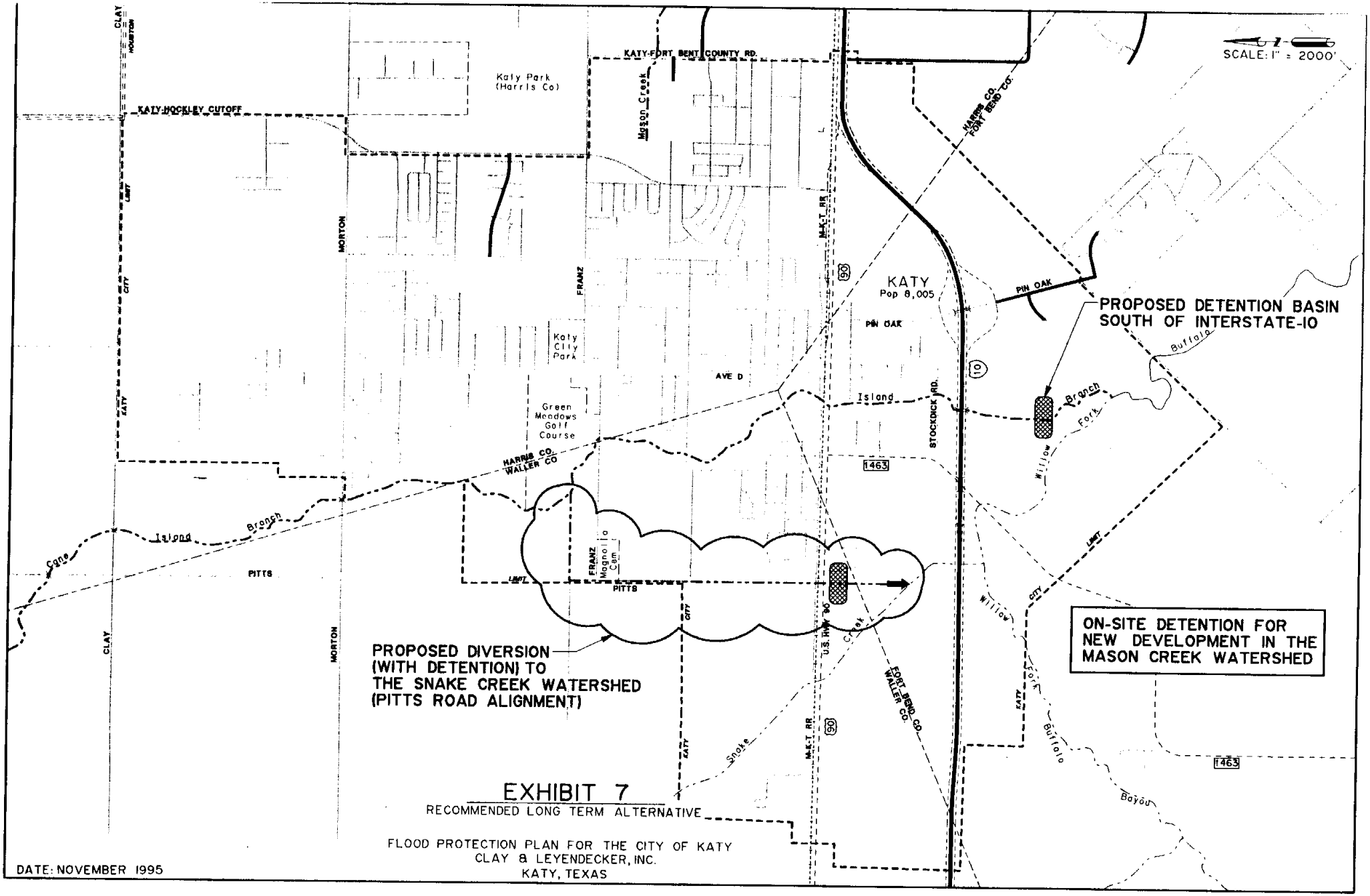


EXHIBIT 7

RECOMMENDED LONG TERM ALTERNATIVE

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

APPENDIX A

DESCRIPTION AND EVALUATION OF ALTERNATIVES

ALTERNATIVE NO. 1

Exhibit No. A1

Description: Alternative 1 consists of one detention basin along Cane Island Branch: to be located south of Interstate-10. On -site detention should be required for new development in the Mason Creek watershed and in the Cane Island Branch watershed north of Interstate-10.

Rating (Table 1): 65 points

Technical Feasibility: This alternative is technically feasible.

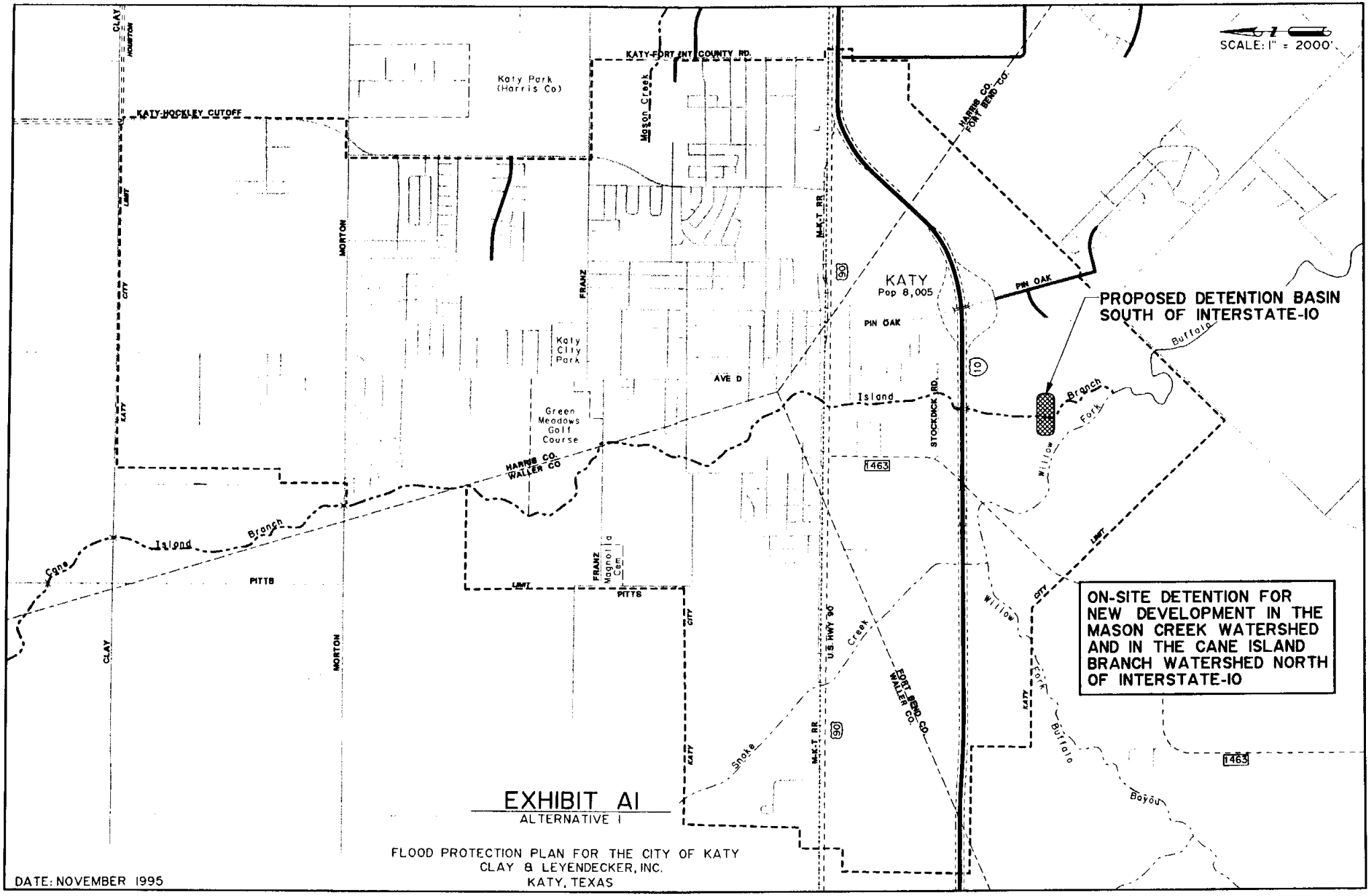
Effectiveness: This alternative will prove effective in providing regional detention to offset future development proposed south of Interstate- 10. This alternative will do nothing to relieve existing flooding in downtown Katy.

Phasing of Project: The construction of the project can be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the least cost alternative. A great benefit of this alternative is that its implementation can be phased, thus not requiring all funding at the start of the project.

Other Factors: The detention basin will offset increased runoff due to expected development south of Interstate - 10. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. The City of Katy has acquired land in the area that could be utilized for this basin. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

This alternative's shortfall is that it does not provide relief to the flooding in downtown Katy and the surrounding residential area, nor does it provide a regional detention alternative for development occurring north of Interstate-10. The plan is a good start, but does not take flood protection far enough.


SCALE: 1" = 2000'
KATY-FORT BEND COUNTY RD.
Katy Park (Harris Co)
KATY-HOCKLEY CUTOFF
Mason Creek
HARRIS CO. FORT BEND CO.
M-K-T RR
MORTON
FRANZ
KATY
Pop 8,005
PIN OAK
PROPOSED DETENTION BASIN SOUTH OF INTERSTATE-10
Buffalo
Katy City Park
AVE D
Green Meadows Golf Course
HARRIS CO. WALLER CO
Island
Branch
Fork
Willow
STOCKDICK RD.
1463
Cane
Island Branch
PITTS
FRANZ Magnolia Cem.
LIMIT
CITY
CLAY
ON-SITE DETENTION FOR NEW DEVELOPMENT IN THE MASON CREEK WATERSHED AND IN THE CANE ISLAND BRANCH WATERSHED NORTH OF INTERSTATE-10
U.S. HWY 90
FORT BEND CO. WALLER CO.
Creek
Snake
Bayou
EXHIBIT A1
ALTERNATIVE 1
FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS
DATE: NOVEMBER 1995

ALTERNATIVE NO. 2

Exhibit No. A2

Description: Alternative 2 consists of bridge modifications to the Missouri - Kansas - Texas Railroad Bridge, the U.S. Highway 90 Bridge, the Interstate - 10 Bridge, and the Stockdick Road Bridge and one detention basin along Cane Island Branch: to be located south of Interstate- 10. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 60 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative has the potential of being highly effective at both relieving existing flooding problems and offsetting future development south of Interstate - 10. Its effectiveness is primarily dependent upon the extent of the bridge widenings accomplished.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the fifth least cost alternative considered. The bridge openings are likely to require such modifications that replacement would be required. In addition, the project could not be phased; all project funding would be required at the start of the project. In summary, the cost of this alternative is prohibitive at this time.

Other Factors: The detention basin proposed south of Interstate - 10 will offset increased runoff due to expected development south of Interstate - 10, as well as increased flows carried under the new, unrestricted bridge openings. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection for offsetting new development. The City of Katy has acquired land in the area that could be utilized for this purpose. It is likely that not enough land will be available to construct a detention basin large enough to reduce flooding in the downtown area without condemnation of existing development.

This alternative has potential to be highly effective technically. However, this alternative's shortfall is that it is expensive and is socially undesirable. It is not socially desirable because land acquisition for the southern detention basin is

likely to require condemnation of developed land. It is not economically feasible because bridge reconstruction is expensive and project construction cannot be phased.

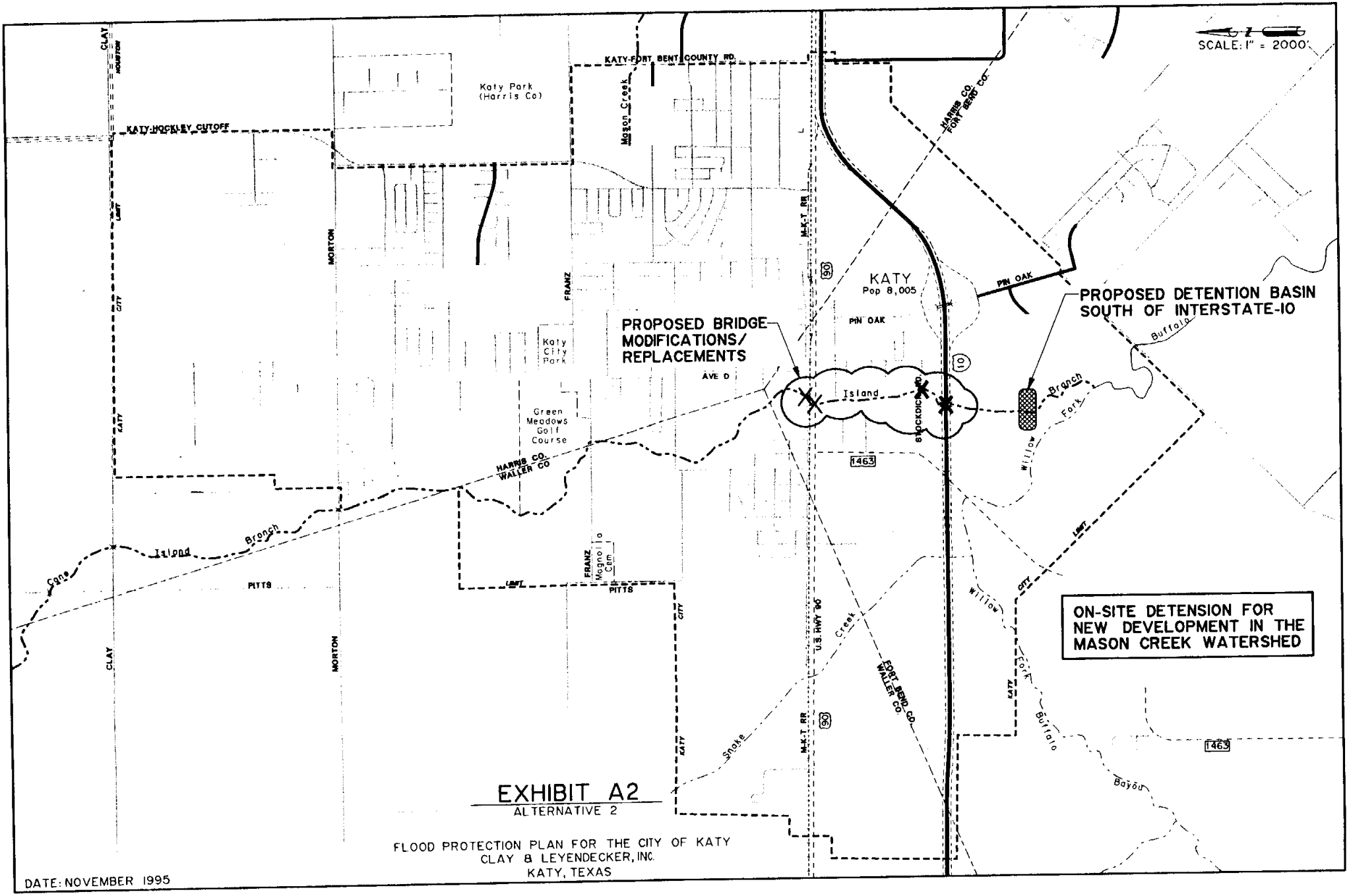


EXHIBIT A2

ALTERNATIVE 2

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 3

Exhibit No. A3

Description: Alternative 3 consists of bridge modifications to the Missouri - Kansas - Texas Railroad Bridge, the U.S. Highway 90 Bridge, the Interstate - 10 Bridge, and the Stockdick Road Bridge and one large detention basin along Cane Island Branch: to be located south of Interstate- 10. In addition, Cane Island Branch is concrete lined through downtown Katy. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 60 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative has the potential of being highly effective at both relieving existing flooding problems and offsetting future development south of Interstate - 10. Its effectiveness is primarily dependent upon the extent of the bridge widenings accomplished. It is a better alternative, technically, that Alternative 2 because it will convey floodwaters out of downtown Katy quicker.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the fifth most expensive alternative considered. The bridge openings are likely to require such modifications that replacement would be required. In addition, the project could not be phased, except for the concrete lining of the channel through downtown; the majority of project funding would be required at the start of the project. In summary, the cost of this alternative is prohibitive at this time.

Other Factors: The detention basin will offset increased runoff due to expected development south of Interstate - 10, as well as increased flows carried under the new, unrestricted bridge openings and more efficient upstream channel. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection, but would need to be of substantial size to cause positive impact to existing development. The City of Katy has already acquired land in the area that could be used for this purpose. However, it is likely that not enough land will be available to create a detention basin of size enough to

alleviate flooding in the downtown area without condemnation of existing development.

This alternative has potential to be highly effective technically. However, this alternative's shortfall is that it is not socially desirable nor economically feasible. It is not socially desirable because land acquisition required for both the channel improvements and for the southern detention basin is likely to require condemnation of developed land. It is not economically feasible because it is very expensive and cannot have project costs phased.

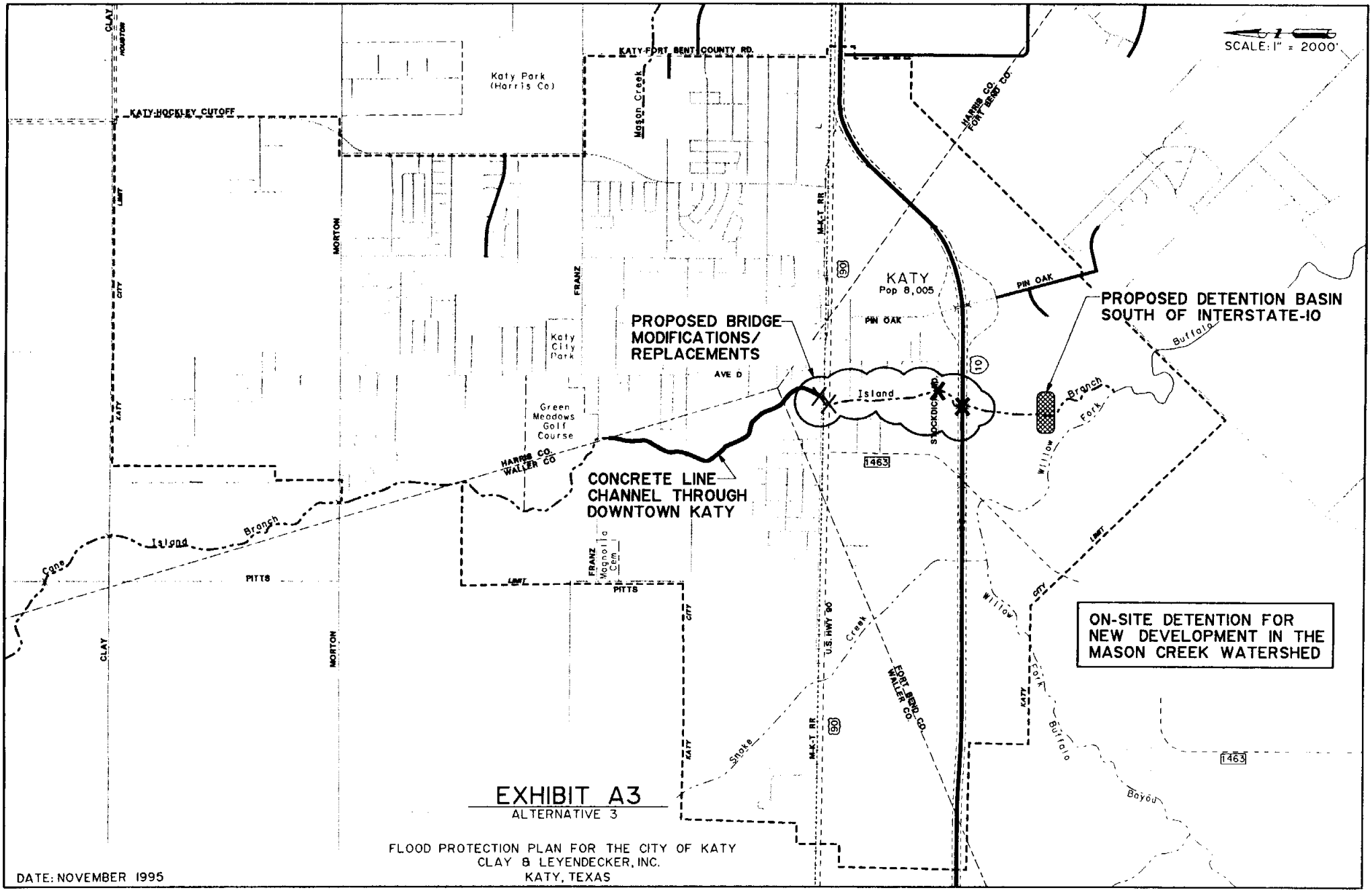


EXHIBIT A3

ALTERNATIVE 3

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 4

Exhibit No. A4

Description: Alternative 4 consists of bridge modifications to the Missouri - Kansas - Texas Railroad Bridge, the U.S. Highway 90 Bridge, the Interstate - 10 Bridge, and the Stockdick Road Bridge and one large detention basin along Cane Island Branch to be located south of Interstate- 10. In addition, Cane Island Branch should be enlarged through downtown Katy. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 60 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative has the potential of being highly effective at both relieving existing flooding problems and offsetting future development south of Interstate-10. Its effectiveness is primarily dependent upon the extent of the bridge widenings accomplished. It is a better alternative, technically, than Alternative 2 because Cane Island Branch will have the capacity to convey more flows in the downtown Katy area.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the fifth most expensive alternative considered. The bridge openings are likely to require such modifications that replacement would be required. In addition, the project could not be phased, except for channel expansion through downtown; the majority of project funding would be required at the start of the project. In summary, the cost of this alternative is prohibitive at this time.

Other Factors: The detention basin proposed south of Interstate -10 will serve specific and necessary purposes. The basin will offset increased runoff due to expected development south of Interstate - 10, as well as increase flows carried under the new, unrestricted bridge openings and more efficient upstream channel. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection, but would need to be of substantial size to cause positive impact to existing development. The City of Katy has already acquired land in the area that could be utilized for this purpose. However, it is likely that

not enough land will be available to create a detention basin of size enough to alleviate flooding in the downtown area without condemnation of existing development.

Land acquisition required to expand the existing channel through downtown Katy will require condemnation of existing development.

This alternative has potential to be highly effective technically. However, this alternative's shortfall is that it is not socially desirable nor economically feasible. It is not socially desirable because land acquisition for the southern detention basin is likely to require condemnation of developed land. It is not economically feasible because it is very expensive and cannot have project costs phased.

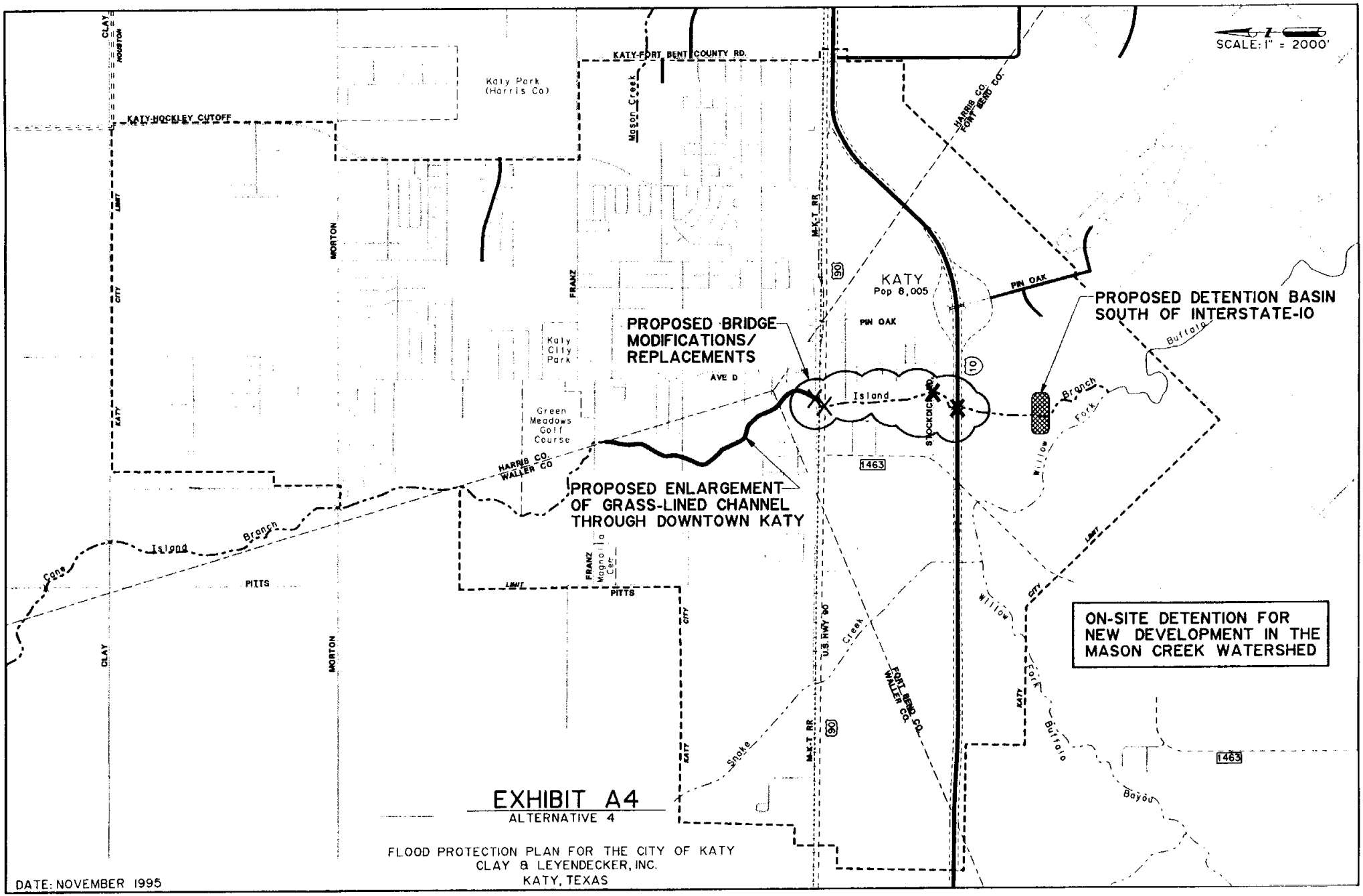


EXHIBIT A4

ALTERNATIVE 4

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 5

Exhibit No. A5

Description: Alternative 5 consists of bridge modifications to the Missouri - Kansas - Texas Railroad Bridge, the U.S. Highway 90 Bridge, the Interstate - 10 Bridge, and the Stockdick Road Bridge and one large detention basin along Cane Island Branch to be located south of Interstate- 10. In addition, Cane Island Branch should be enlarged and concrete lined through downtown Katy. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 61 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative has the potential of being highly effective at both relieving existing flooding problems and offsetting future development south of Interstate - 10. Its effectiveness is primarily dependent upon the extent of the bridge widenings accomplished. It is a better alternative, technically, that Alternatives 2, 3, and 4 because Cane Island Branch will have the capacity to convey more flow quicker through the downtown Katy area.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits except for channel expansion and concrete lining through downtown.

Cost Considerations: This alternative is judged to be the second most expensive alternative considered. The bridge openings are likely to require such modifications that replacement would be required. The majority of project funding would be required at the start of the project. In summary, the cost of this alternative is prohibitive at this time.

Other Factors: The detention basin proposed south of Interstate - 10 will serve specific and necessary purposes. The basin will offset increased runoff due to expected development south of Interstate - 10, as well as increase flows carried under the new, unrestricted bridge openings and more efficient upstream channel. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection, but would need to be of substantial size to cause positive impact to existing development. The City of Katy has already acquired

land in the area that could be utilized for this purpose. However, it is likely that not enough land will be available to create a detention basin of size enough to alleviate flooding in the downtown area without condemnation of existing development.

Land acquisition required to expand the existing channel through downtown Katy will require condemnation of existing development.

This alternative has potential to be highly effective technically. However, this alternative's shortfall is that it is not socially desirable nor economically feasible. It is not socially desirable because land acquisition for the southern detention basin is likely to require condemnation of developed land. It is not economically feasible because it is highly expensive and cannot have project costs phased.

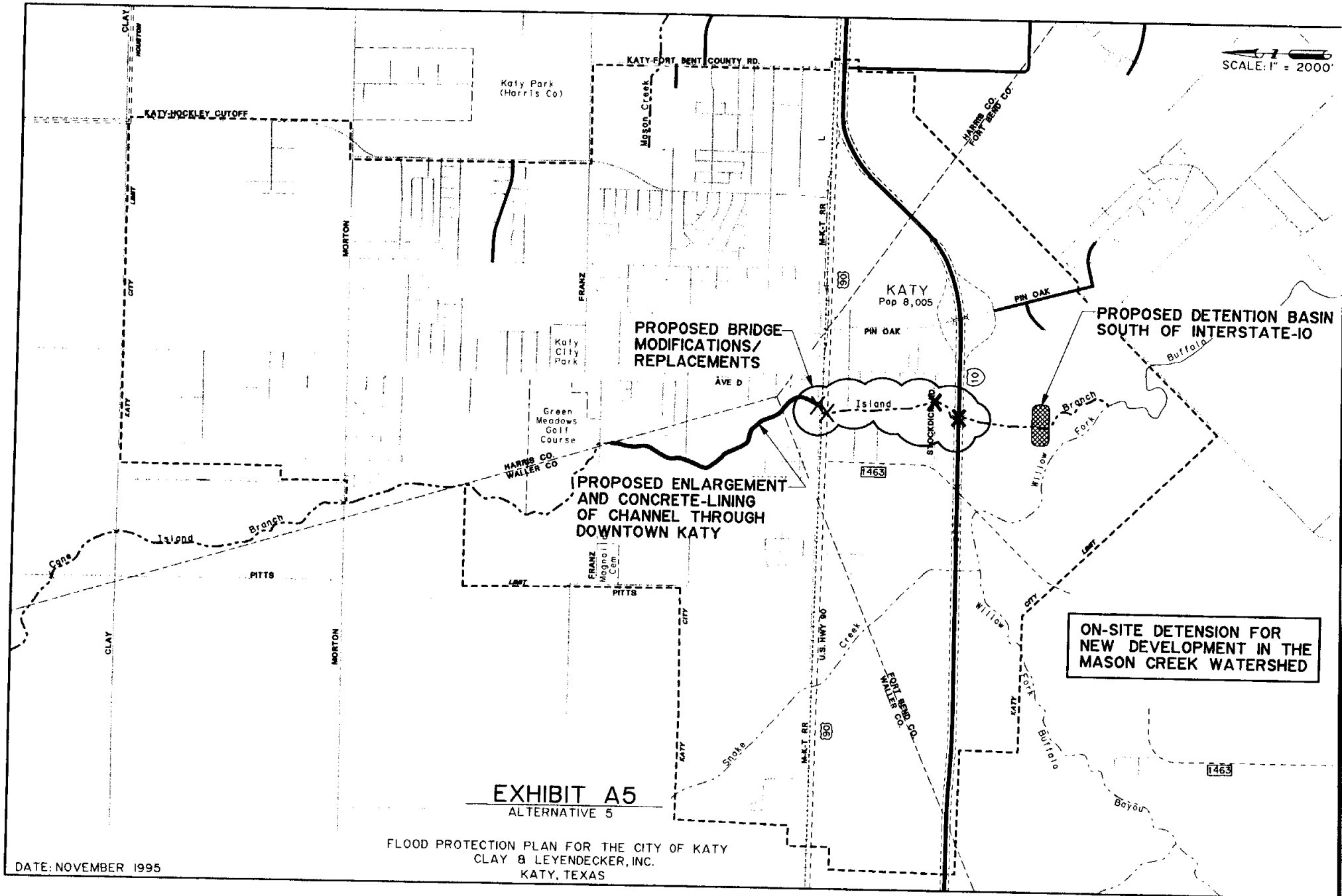


EXHIBIT A5

ALTERNATIVE 5

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 6

Exhibit No. A6

Description: Alternative 6 consists of two detention basins along Cane Island Branch: one to be located south of Interstate-10, and one to be located north of downtown Katy. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 81 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative will provide regional detention to offset future development proposed south of Interstate-10. This alternative will demonstrate moderate effectiveness in preventing existing flooding in downtown Katy. The effects of the basin to future development will only be potentially experienced in storm events less than the 100-year event due to the revenue generating mechanism to be used. The basin proposed north of downtown Katy will be of greatest benefit to the City if it is designed to provide effective flood protection to downtown Katy in lower frequency storms and fully offset development in the 100-year event.

Phasing of Project: The construction of the project can be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the second least expensive alternative considered. A great benefit of this alternative is that its implementation can be phased, thus not requiring all funding at the start of the project.

Other Factors: The basin south of Interstate-10 offsets increased runoff due to expected development south of Interstate-10. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. The City of Katy has already acquired land in the area that could be utilized for this purpose. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

The basin north of downtown serves as storage to decrease flooding of the downtown area in low frequency storms, as well as to offset development in the northwest portion of Katy. It will be virtually impossible to provide enough

storage to affect downtown's flooding in the 100- year event. The 100-year floodplain through Katy will be unchanged due to this project. Therefore, this basin's design should not increase flooding in the 100- year event, but should be optimized for a lesser rainfall. There are potential undeveloped sites for the detention basin that may be investigated. In the next phase of design, it should be determined if the acquired land is situated close enough to downtown to positively impact flooding, or if another site must be purchased closer to the downtown area.

This alternative has potential to be highly effective technically at offsetting new development and providing flood protection to downtown in lower frequency storms. It is also economically feasible because of the moderate range cost and ability to phase the project.

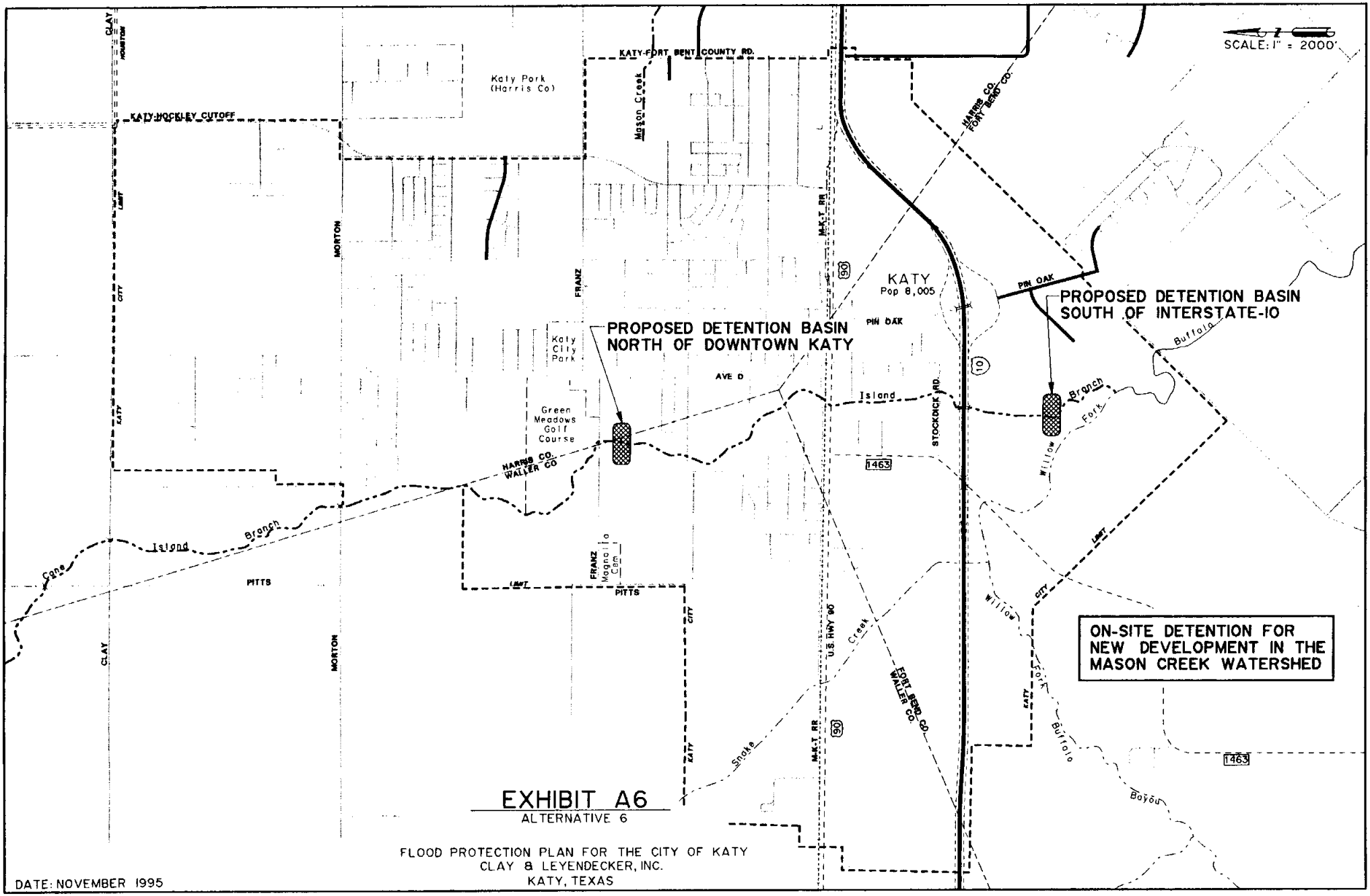


EXHIBIT A6

ALTERNATIVE 6

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 7

Exhibit No. A7

Description: Alternative 7 consists of one detention basin along Cane Island Branch: to be located south of Interstate-10. In addition, underground storage should be provided by oversized storm sewers with constricted outfalls through downtown Katy. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 60 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative will prove effective in providing regional detention to offset future development proposed south of Interstate-10. This alternative will demonstrate little effectiveness in preventing existing flooding in downtown Katy. It is unlikely that enough storage can be provided in the storm sewer system to mitigate flood conditions. This alternative does not fully meet project goals in that it will not mitigate proposed development unless the development is located adjacent to areas of existing development with proposed oversized sewers.

Phasing of Project: The construction of the project can be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the third least expensive alternative considered. A great benefit of this alternative is that its implementation can be phased, thus not requiring all funding at the start of the project.

Other Factors: The detention basin proposed south of Interstate - 10 will serve specific and necessary purposes. The basin will offset increased runoff due to expected development south of Interstate - 10. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. The City of Katy has already acquired land in the area that could be utilized for this purpose. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

The over-sized storm sewers proposed in the downtown area will cause a large maintenance concern to the City of Katy. Flow through the sewers will rarely

meet the minimal velocities desired to clean the sedimentation that will deposit on the bottom of the pipe. In addition, other deposits from urban runoff may cause pipe corrosion. Without regular cleaning, these pipes will not serve their purpose of providing additional storage capacity for floodwaters.

This alternative is only moderately effective technically. Its shortfall is twofold. First, it does not offset the increased flows due to development in most cases. Second, it does not provide significant relief to a primary flooding concern in the area: the flooding in downtown Katy and the surrounding residential area. It does provide relief to downtown Katy in lower frequency storms, though. It is economically feasible because of the moderate range cost and ability to phase the project.

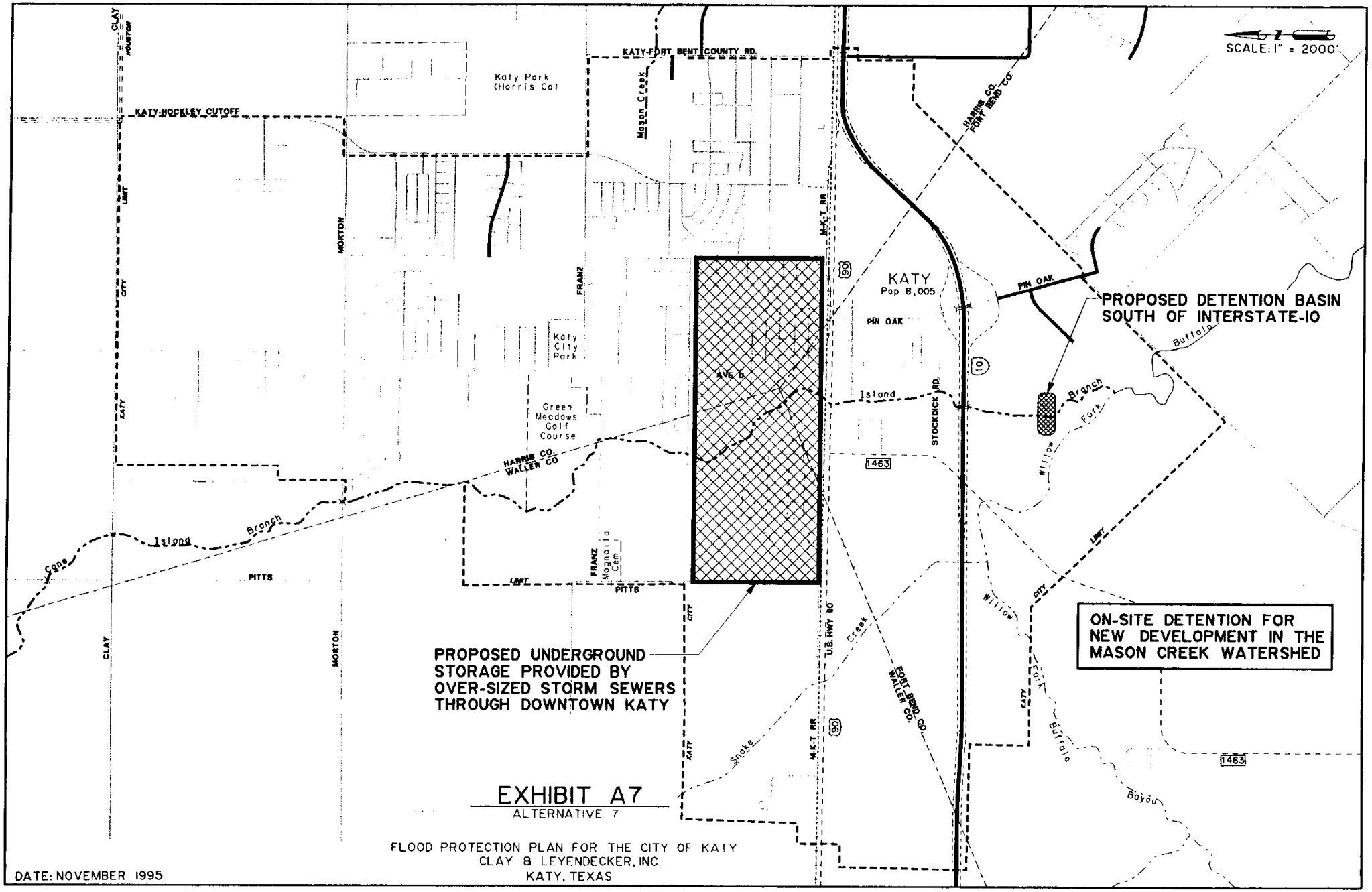


EXHIBIT A7

ALTERNATIVE 7

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 8

Exhibit No. A8

Description: Alternative 8 consists of a detention basin located south of Interstate- 10, and a detained diversion of upstream flow to the Mason Creek watershed. On -site detention should be required for new development in the Mason Creek watershed if the detained diversion is not located in the vicinity of Katy's Mason Creek watershed area.

Rating (Table 1): 0 points (Not feasible)

Technical Feasibility: This alternative is not technically feasible. Mason Creek and its tributaries do not have available depth to divert enough flow without pumping from the City of Katy.

The pumping alternative was not further explored. A pumping system would require substantial maintenance.

Even if pumping were not a maintenance issue, the alternative would still be inadvisable because of its high cost and potential impact on the already developed Mason Creek watershed. The diversion would be costly because of the length of channel that would have to be constructed, as well as the cost of land for new channel right - of - way. The Mason Creek watershed is already developed. The addition of flow to the watershed, even if it is detained, is undesirable.

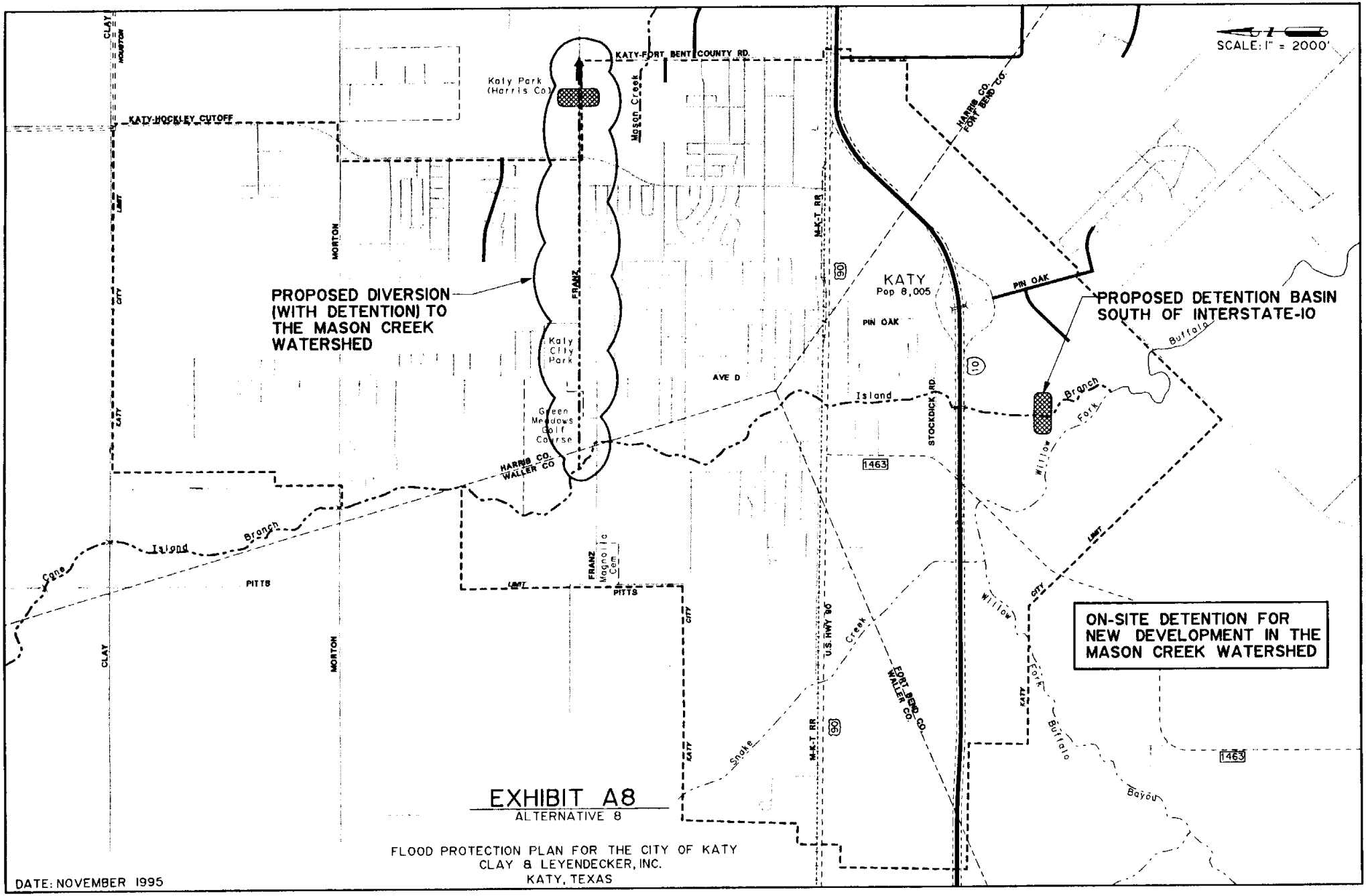


EXHIBIT A8

ALTERNATIVE 8

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 9

Exhibit No. A9

Description: Alternative 9 consists of a detention basin located south of Interstate- 10 and a detained diversion of upstream flow from Cane Island Branch to the Snake Creek watershed heading west - southwest, beginning between Franz and Morton Roads. The diversion is likely to head in a west - southwesterly direction and require a new bridge over Franz Road. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 0 points (not feasible)

Technical Feasibility: This alternative is not technically feasible without pumping. The flowline of Cane Island Branch is approximately 6.5 feet lower than that of Snake Creek at their minimum separation in the vicinity of 4,500 feet.

The pumping alternative was not further explored. A pumping system would require substantial maintenance, and is not considered to be highly reliable. In addition, maintenance and regular upgrades of the pump station must be guaranteed so long as the diversion remains active, which is likely to be forever. The overall cost of the project, which could not be phased, is prohibitive at this time.

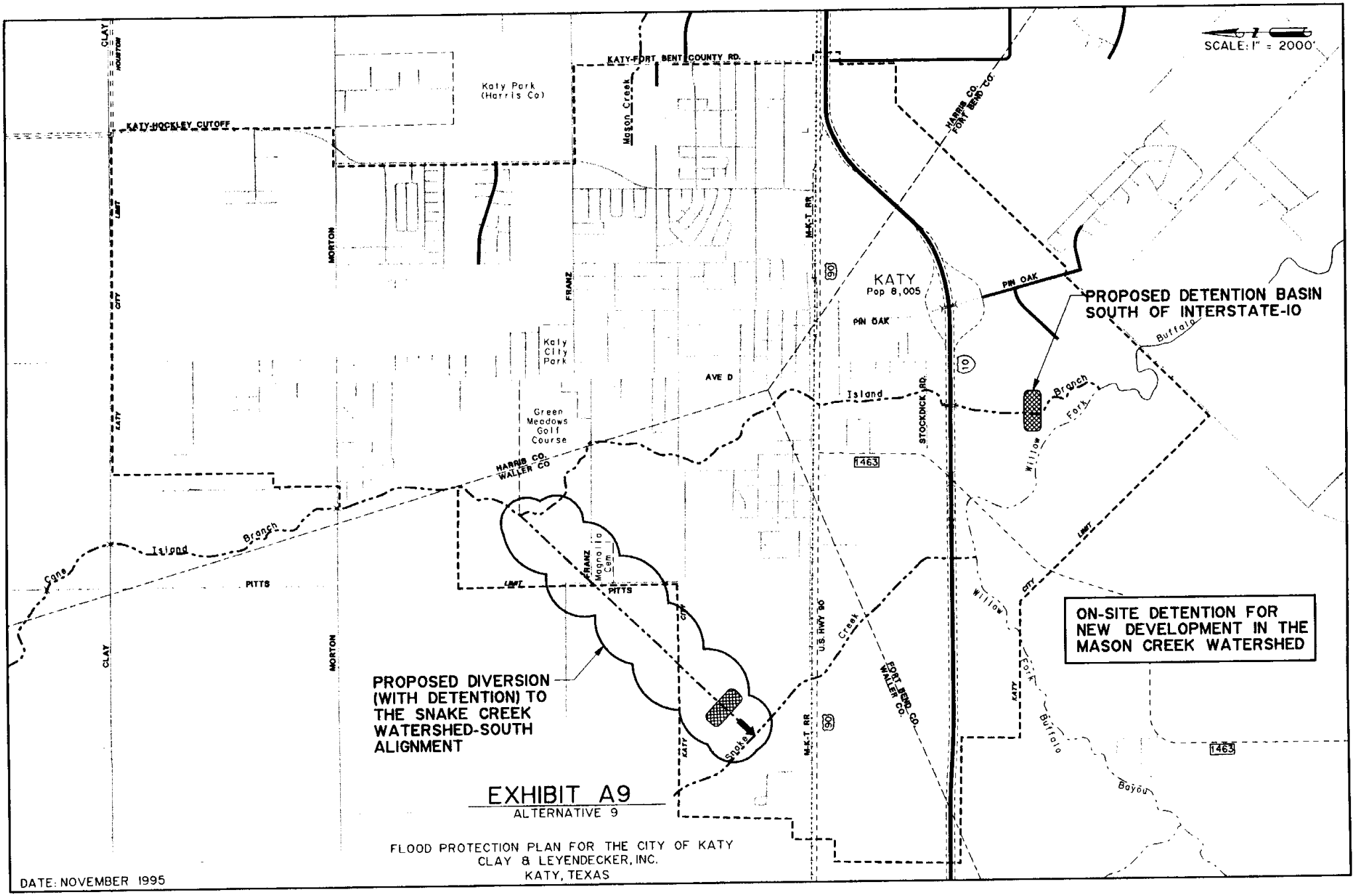


EXHIBIT A9

ALTERNATIVE 9

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 10

Exhibit No. A10

Description: Alternative 10 consists of a detention basin located south of Interstate- 10 and a detained diversion of upstream flow from Cane Island Branch to the Snake Creek watershed heading west, beginning between Franz and Morton Roads, then south along the Pitts Road/ Snake Creek ditch. The diversion is will require construction of bridges at the Missouri - Kansas - Texas Railroad and U.S. 90, along with modifications of the Franz Road culvert crossing. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 68 points

Technical Feasibility: This alternative is technically feasible. There is approximately ten feet of available drop between the flowlines of Cane Island Branch and Snake Creek. The diversion length is approximately 6,100 feet. This means a channel could be constructed at an approximate maximum slope of 0.16%, which is well within standard slope limitations.

Effectiveness: This alternative is judged to be the most effective toward reducing the City of Katy's flooding problems. Based on the Brookshire - Katy Drainage District's Master Drainage Plan - Upper Buffalo Bayou Watershed - Waller County (December, 1985), in the 100- year rainfall event approximately 4,000 cfs would be diverted off the Cane Island Branch watershed to the Snake Creek watershed. The same report states the existing 100- year flow at the Fort Bend/ Waller County line to be 5,300 cfs (which includes the 4,000 cfs proposed to be diverted). Diversion of 4,000 cfs will decrease downstream flooding in downtown Katy.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is ranked as the third most costly alternative proposed. The funding of this alternative cannot be phased. The project cost will be prohibitive at this time.

Other Factors: The detention basin proposed south of Interstate-10 offsets increased runoff due to expected development south of Interstate-10. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. The City of Katy has already acquired

land in the area that could be utilized for this purpose. Additional undeveloped land exists adjacent to the acquired land. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection.

The diversion to the Snake Creek watershed will be effective in decreasing flooding within the Katy area. Although the Snake Creek watershed is undeveloped, objectives for the design of the diversion include the diversion channel has adequate capacity, and that the diversion does not increase peak flows into the Snake Creek watershed. This must be done for two reasons. The first reason pertains to the discharge criteria along Willow Fork set forth by the Fort Bend County Drainage District. Snake Creek discharges into Willow Fork just upstream of Cane Island Branch. Therefore, the same discharge requirements set on Cane Island Branch are applicable to Snake Creek. Secondly, the Snake Creek watershed and proposed diversion channel will overflow into the Cane Island Branch watershed when it is overloaded. Therefore, if adequate detention is not provided in the diversion, the diverted flow will overflow back into the Cane Island Branch watershed. This diversion must be coordinated with the Brookshire - Katy Drainage District and the Fort Bend County Drainage District.

The proposed diversion will have minimal effect on the Snake Creek watershed. The proposed detained diversion route runs along Pitts Road, which is the Cane Island Branch- Snake Creek watershed divide as defined by the Brookshire - Katy Drainage District. Little flow will be diverted from the Snake Creek watershed into the diversion channel. The diversion channel enters Snake Creek close to Snake Creek's confluence with Willow Fork, and therefore, cannot impact the majority of the Snake Creek watershed in terms of flows. Therefore, the proposed diversion channel should not have any negative impacts on the Snake Creek watershed.

The City of Katy recently acquired land located between Franz and Morton Roads off Cane Island Branch that may be utilized for the purpose of drainage and flood control. Undeveloped land exists surrounding the acquired land to enlarge the site. Additional undeveloped right - of - way will need to be acquired alongside the Pitts Road ditch for the entire reach to Snake Creek.

The proposed bridge modifications required by this alternative will be costly, and will require coordination with various transportation and railroad entities. This alternative has potential to be extremely effective technically at offsetting new development and providing flood protection to downtown Katy. Economic limitations are likely to prevent implementation of this alternative. Proper

implementation of this alternative would, however, solve both short and long term flooding problems for Katy.

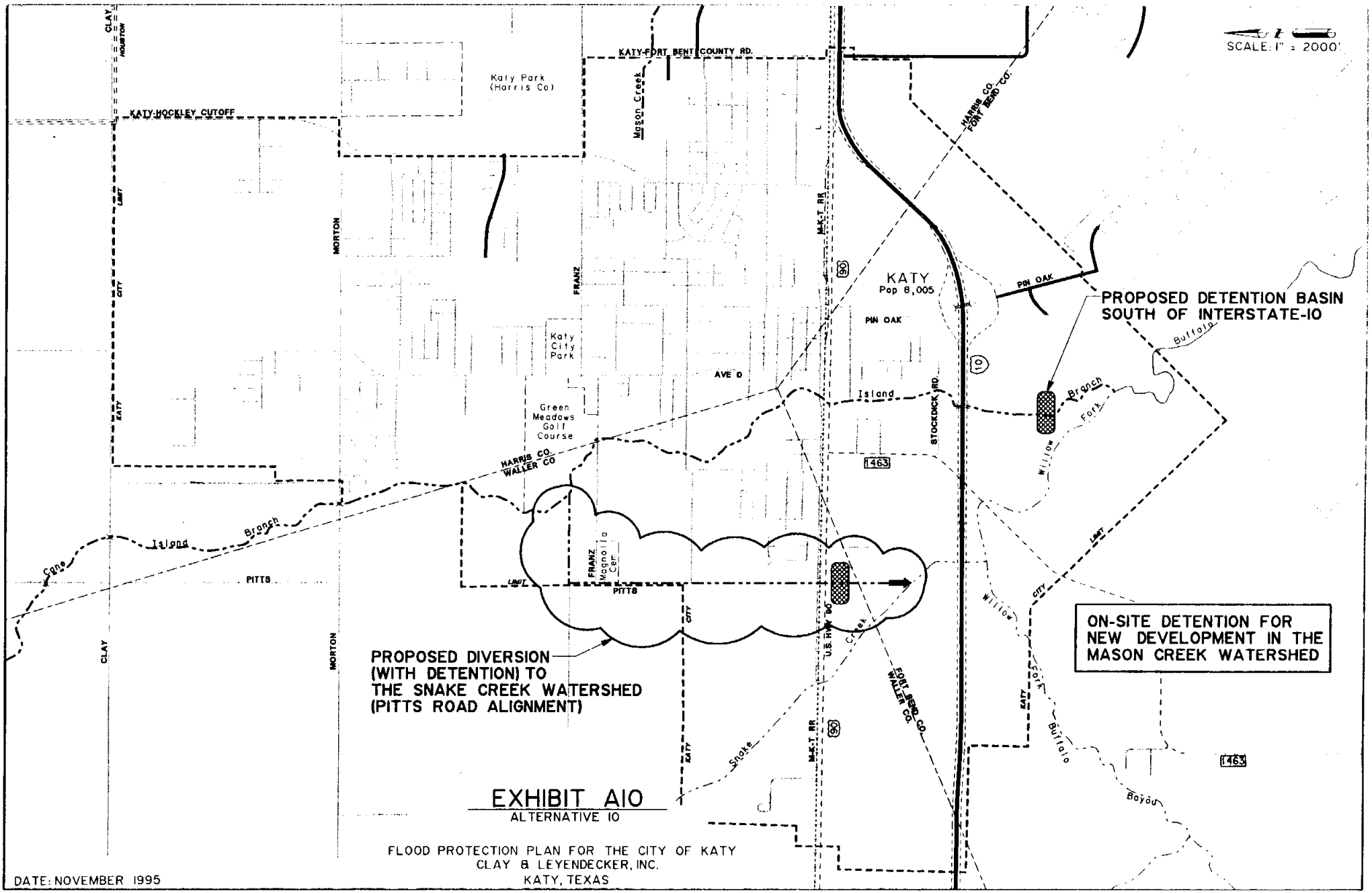


EXHIBIT A10

ALTERNATIVE 10

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 11

Exhibit No. A11

Description: Alternative 11 consists of bridge modifications to the U.S. Highway 90 Bridge, the Interstate-10 Bridge, and the Stockdick Road Bridge and one large detention basin along Cane Island Branch: to be located south of Interstate- 10. In addition, cross flow culverts should be regularly placed beneath the Missouri-Kansas-Texas Railroad trestle coupled with a ditch south of and adjacent to the railroad conveying flow to Cane Island Branch. On-site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 50 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative has the potential of being highly effective at both relieving existing flooding problems and offsetting future development south of Interstate - 10. Its effectiveness is primarily dependent upon the extent of the bridge widenings accomplished and size of the cross flow culverts, both of which will be restricted based on the size of the detention basin.

Phasing of Project: The construction of the project cannot be phased while providing incremental flood protection benefits.

Economic Considerations: This alternative is judged to be the second most expensive alternative considered. The bridge openings are likely to require such modifications that replacement would be required. In addition, the project could not be phased; all project funding would be required at the start of the project. In summary, the cost of this alternative is prohibitive at this time.

Other Factors: The detention basin proposed south of Interstate - 10 will serve specific and necessary purposes. The basin will offset increased runoff due to expected development south of Interstate - 10, as well as increase flows carried under the new, unrestricted bridge openings. This basin should be designed to restrict discharges into Willow Fork that do not violate Fort Bend County's discharge criteria. A regional detention basin in this area will be beneficial in providing an orderly and coordinated means for flood protection, but would need to be of substantial size to cause positive impact to existing development. The City of Katy has already acquired land in the area that could be utilized for this purpose. However, it is likely that not enough land will be available to create a

detention basin of size enough to alleviate flooding in the downtown area without condemnation of existing development.

Boring under the railroad trestle and creating a ditch south of the railroad to pick up the cross flow may be less costly than modifying the railroad bridge. Negotiations would have to be made with the railroad company to determine if this alternative would be acceptable to them. Extensive coordination with the railroad company would be required throughout the project.

This alternative has potential to be highly effective technically. However, this alternative's shortfall is that it is not socially desirable nor economically feasible. It is not socially desirable because land acquisition for the southern detention basin is likely to require condemnation of developed land. It is not economically feasible because it is very expensive and cannot have project costs phased.

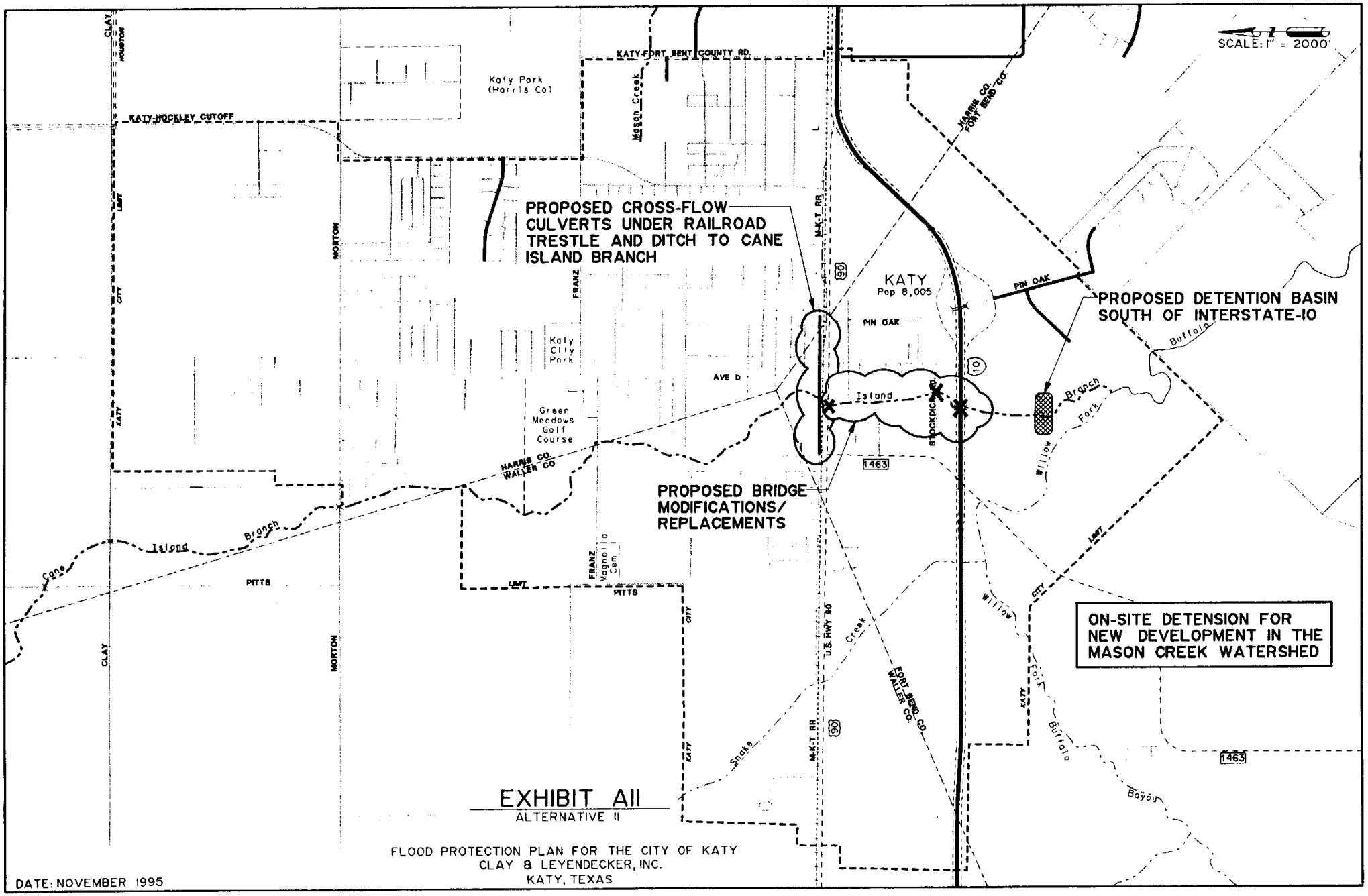


EXHIBIT AII

ALTERNATIVE II

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 12

Exhibit No. A12

Description: Alternative 12 consists of one detention basin along Cane Island Branch: to be located north of downtown Katy. On -site detention should be required for new development in the Mason Creek watershed and in the Cane Island Branch watershed for new development south of the Missouri-Kansas-Texas Railroad.

Rating (Table 1): 72 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative will demonstrate moderate effectiveness in preventing existing flooding in downtown Katy. The basin located north of downtown Katy will be of greatest benefit to the City if it is designed to provide effective flood protection to downtown Katy in lower frequency storms, rather than designed for the 100 - year event and offset the impact of future development in the 100-year event. The impact of future development south of the railroad bridge will be mitigated in an acceptable, but not optimal manner: on-site detention.

Phasing of Project: The construction of the project can be phased while providing incremental flood protection benefits.

Cost Considerations: This alternative is judged to be the fourth least expensive alternative considered. A great benefit of this alternative is that its implementation can be phased, thus not requiring all funding at the start of the project.

Other Factors: The detention basin proposed north of downtown will serve as storage to decrease flooding of the downtown area, as well as potentially offset some development in the northwest portion of Katy. It will be virtually impossible to provide enough storage to impact downtown's flooding in the 100- year event. Therefore, this basin's design should not increase flooding in the 100- year event, but should be optimized for a lesser rainfall. There are potential undeveloped sites adjacent to Cane Island Branch that could be investigated for purchase for flood control needs. In the next phase of design, it should be determined if the desired land is situated close enough to downtown to positively impact flooding, or if another site should be purchased closer to the downtown area.

Alternative 12 differs from Alternative 6 only in that it provides on-site detention for new development south of the Missouri-Kansas-Texas Railroad. Regional detention for that area would be more effective. As many drainage districts are discovering, on - site detention is not proving effective as a flood protection measure in offsetting increased flows due to development. Numerous small basins that are not planned to work together as a unit cannot effectively offset all impacts. If each basin is detaining an increased peak discharge down to existing rates, it means the basin is reshaping a peak hydrograph that has an increased runoff volume associated with it. When all these reshaped, higher volume hydrographs are combined, it is likely that the total peak flow will increase due to the increased runoff volume and disjointed design of the timing of each basin.

In addition, many on -site detention basins that are designed for 100- year storm events do not function in lesser rainfalls. Much of the City of Katy floods in lower frequency storms. A regional approach must be taken to flood protection for the City.

This alternative has potential to be effective technically at offsetting new development and providing flood protection to downtown in lower frequency storms. It is also economically feasible because of the moderate range cost and ability to phase the project. However, Alternative 6 would be recommended over this alternative.

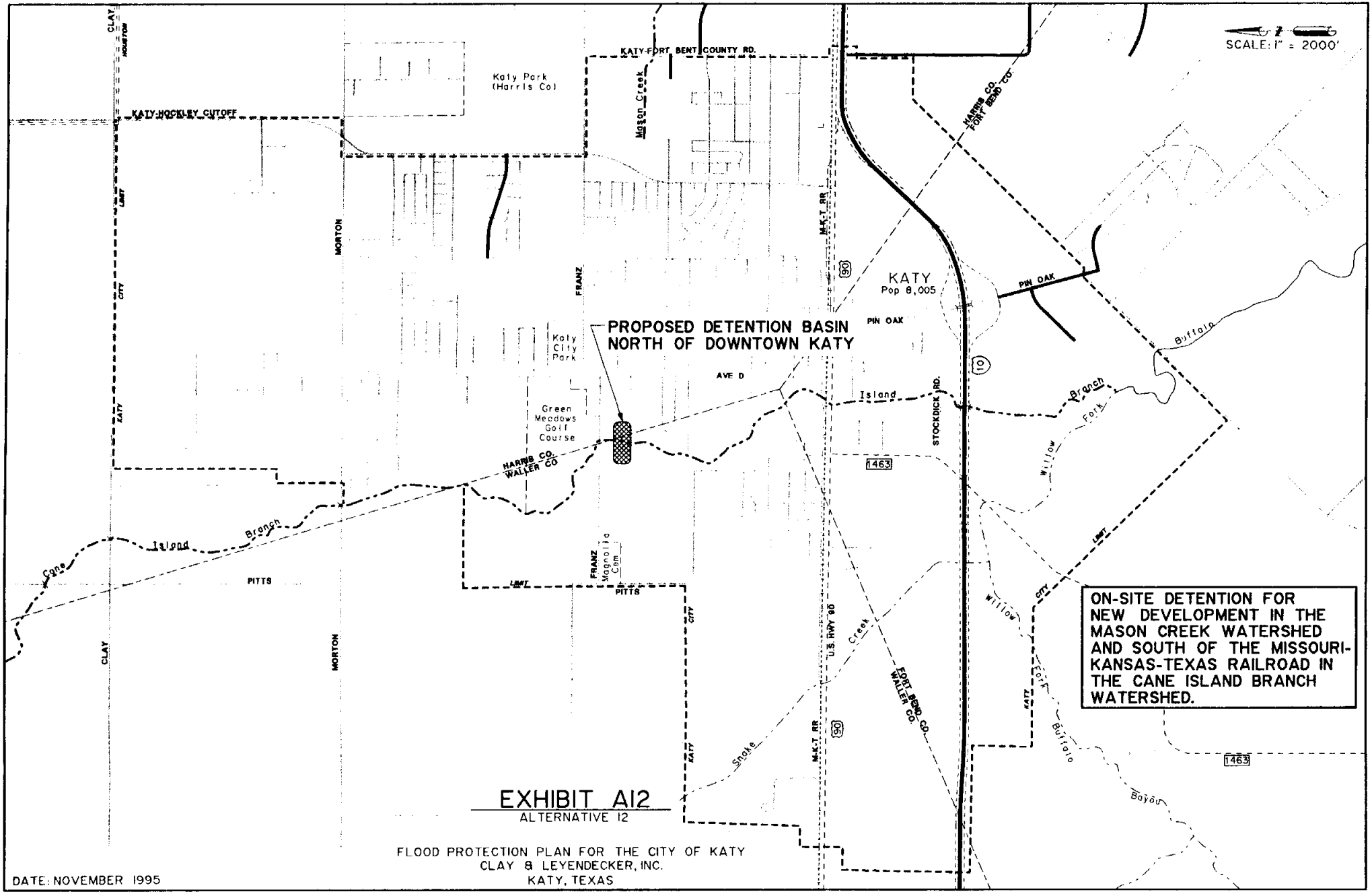


EXHIBIT A12

ALTERNATIVE 12

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 13

Exhibit No. A13

Description: Alternative 13 consists of buying out all structures within the 100-year floodplain within the Cane Island Branch watershed. On -site detention should be required for new development in the Mason Creek watershed.

Rating (Table 1): 58 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative would eliminate flooding of privately owned structures in the floodplain, but it would not address concerns related to future flood protection. Existing flood protection problems would be solved, but future development issues would not be addressed.

Cost Considerations: This alternative was ranked as the most expensive alternative considered.

Other Factors: This alternative is unacceptable. The heart of the City of Katy, its downtown area, as well as a large percentage of residences lie within the 100- year floodplain. Buyout of Katy's floodplain areas is not a viable alternative for social, political, and economic reasons.

Additionally, this alternative does not address the issue of offsetting increased flows caused by future development.

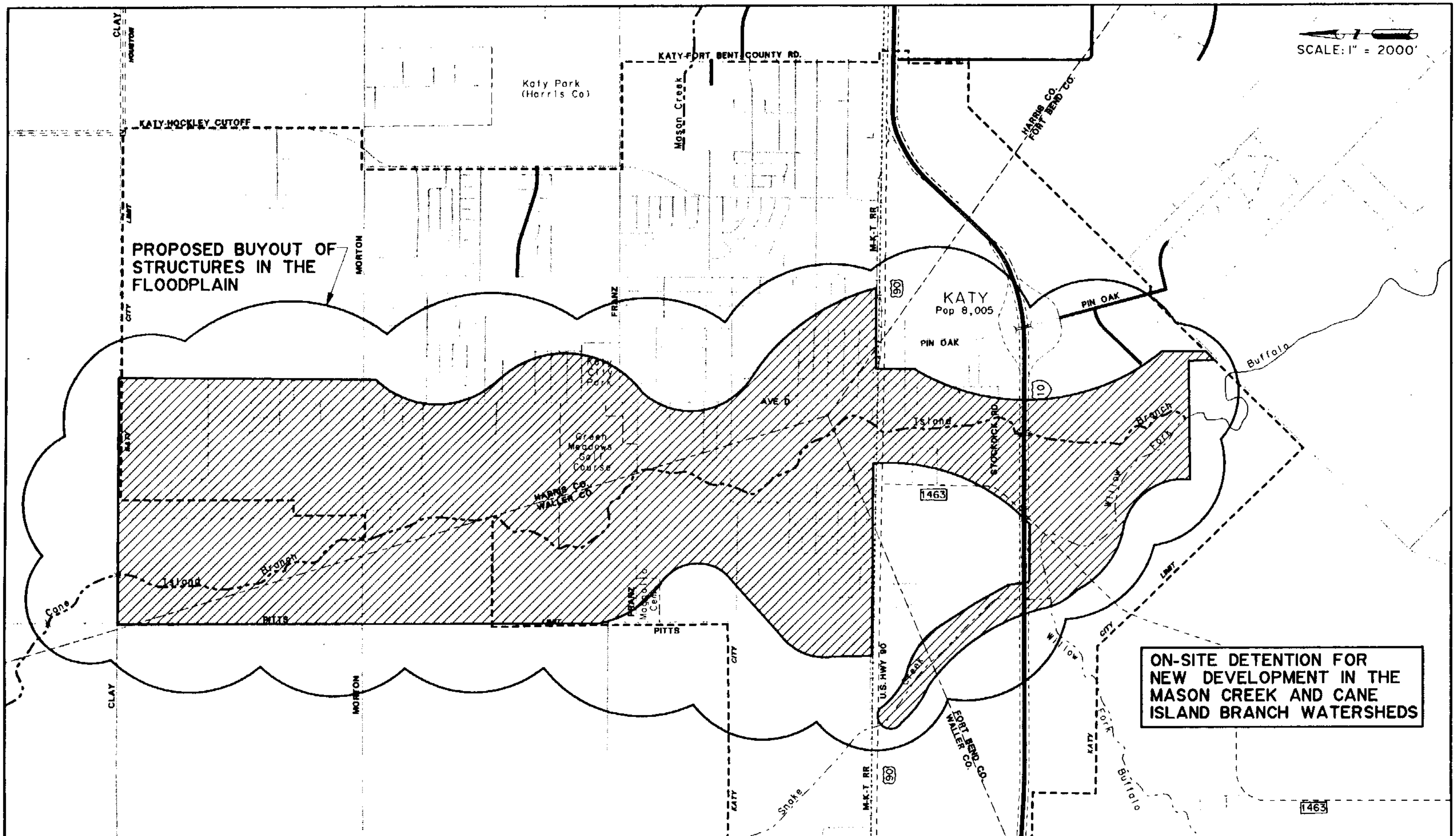


EXHIBIT A13

ALTERNATIVE 13

FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS

DATE: NOVEMBER 1995

ALTERNATIVE NO. 14

Exhibit No. A14

Description: Alternative 14 is the "do nothing" alternative. Maintain the current policy of on-site detention throughout the watershed. Do not mitigate increased inflows at Clay Road along Cane Island Branch.

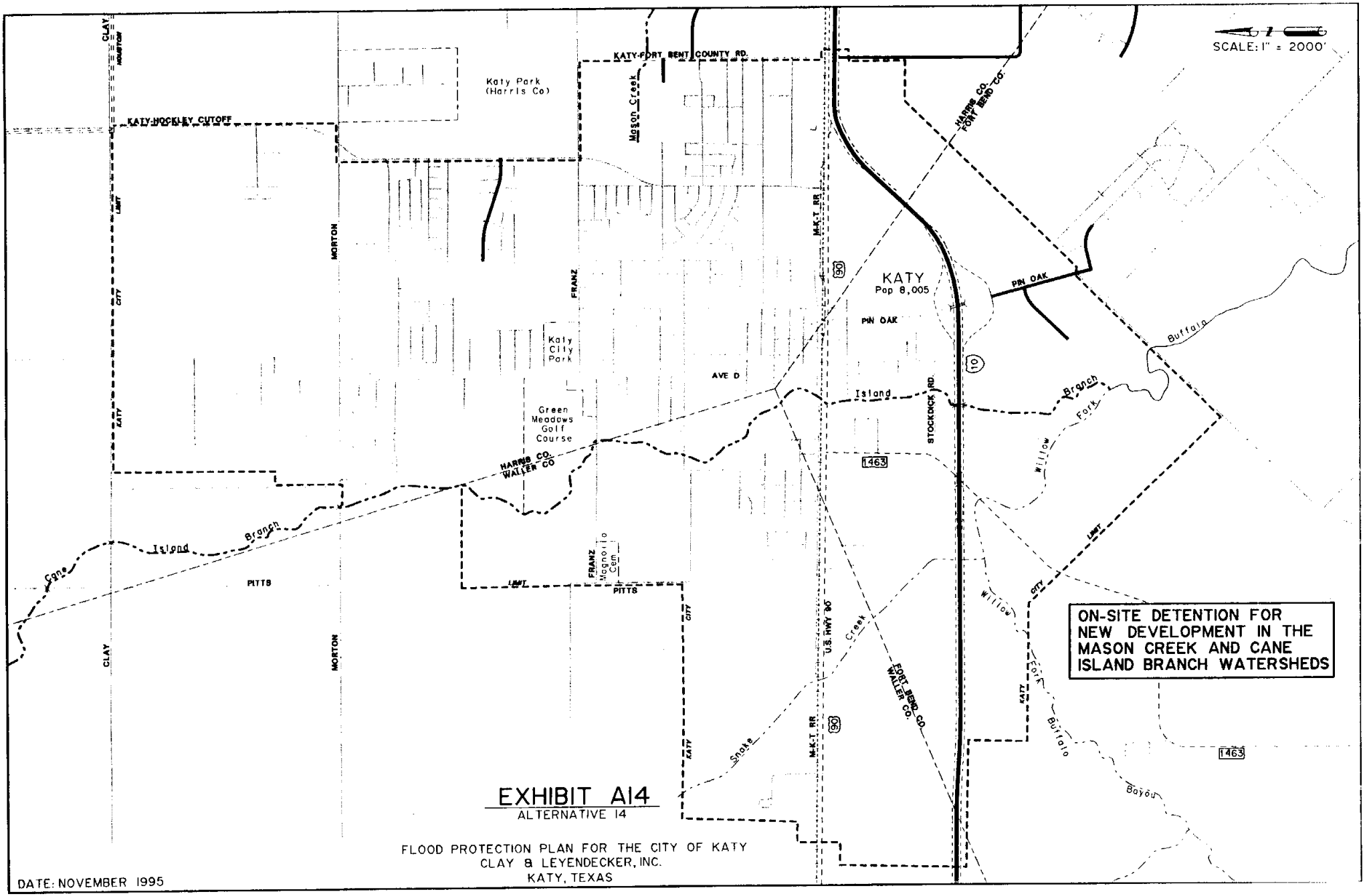
Rating (Table 1): 39 points

Technical Feasibility: This alternative is technically feasible.

Effectiveness: This alternative should not be selected because, as seen in previous alternatives, there are viable alternatives that provide more effective flood protection over existing protection levels.

Cost Considerations: This alternative does not cost anything to the City of Katy. In consideration of the overall cost to the City, as well as to the developer, the alternative was judged as being the second most expensive alternative considered.

Other Factors: Existing flood protection policies in the area are acceptable in the absence of a protection plan. In past drainage coordination meetings, local governmental drainage entities agreed that the City of Katy should take the lead in the development of a flood protection plan for Katy. Existing policies did not address issues of importance to the City of Katy, such as how to improve flooding conditions of its downtown area, and how to effectively mitigate impacts of rapid development. In addition, developers have supported the development of a revised plan to create regional solutions instead of on- site detention basins. Viable alternatives have been put forth in this report. Therefore, the "do nothing" option should not be selected.


SCALE: 1" = 2000'
KATY-FORT BEND COUNTY RD.
Katy Park (Harris Co)
Mason Creek
KATY-HOCKLEY CUTOFF
CLAY
MORTON
FRANZ
M-K-T RR
HARRIS CO.
FORT BEND CO.
KATY
Pop 8,005
PIN OAK
Buffalo
Bayou
Katy City Park
AVE D
Green Meadows Golf Course
HARRIS CO.
WALLER CO.
Cane Island Branch
Willow Fork
STOCKDICK RD.
1463
PITTS
Magnolia Cem.
U.S. HWY 90
FORT BEND CO.
WALLER CO.
Snake Creek
Willow Fork
Buffalo Bayou
ON-SITE DETENTION FOR NEW DEVELOPMENT IN THE MASON CREEK AND CANE ISLAND BRANCH WATERSHEDS
EXHIBIT A14
ALTERNATIVE 14
FLOOD PROTECTION PLAN FOR THE CITY OF KATY
CLAY & LEYENDECKER, INC.
KATY, TEXAS
DATE: NOVEMBER 1995

APPENDIX B

PUBLIC COMMENTS

Public Hearings on the City of Katy Flood Protection Planning Study were held on Thursday, November 9, 1995 at 6:30 p.m. and on Thursday, December 14, 1995 at 6:30 p.m. The following is a summary of the public comments solicited:

A. November 9, 1995:

No comments were made at the November 9 hearing. A letter was received from the Brookshire - Katy Drainage District (attached).

B. December 14, 1995:

David Minze of 6205 Franz Road, Katy, TX:
He previously served on the Brookshire - Katy Drainage District Board and currently lives adjacent to Cane Island Branch. His comments follow.

- The study is just a beginning of studying the problems. More study should be performed.
- Minze believes that the proposed detention basin north of downtown should address the drainage threat of runoff from North of the city limits. He encourages a larger basin to pick up that runoff. This will require coordination between the City of Katy, the Brookshire - Katy Drainage District, and the Harris County Flood Control District. He encourages the City to coordinate with those agencies.
- Minze noticed that the schematic shows the site of the northern basin on his property. It surprised him, though he understands that the basin has not yet been sited. He urged the City Council of Katy to coordinate and work with property owners prior to site selection.
- Minze believes the longer term solution, the Snake Creek Diversion, will cause problems west of the City.
- Minze stressed the need for coordination between public entities.

Highway 529. This has allowed more water to reach Cane Island Branch quicker, increasing the demands on the creek and adding to the need to improve that section of channel north of Morton Road.

4. The detention fee concept appears to be limited to the City of Katy instead of being applicable to including the entire watershed. Since drainage does not abide by political boundaries, any plan finally accepted should include the entire watershed. The District, as well as Harris County Flood Control District, should be included in the planning. In this way, fees can be assigned and assessed within the entire watershed, not just in the City of Katy. Additional funds can be collected to assist in the construction of detention improvements, as well as both Districts' possibly being able to provide in-kind services during the process.

Again, the District appreciates the opportunity to be a part of this work. We look forward to working within the City to put this plan into action.

Sincerely,

Charles A. Kalkomey, P.E.
Texas Registration No. 46208

CAK:blt

cc: Brookshire-Katy Drainage District
David Leyendecker, P.E.
Alisa S. Acheson, E.I.T.

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