



**CITY OF TEXAS CITY  
REGULAR ZONING COMMISSION MEETING**

**AGENDA**

**TUESDAY, DECEMBER 17, 2024 – 5:00 P.M.  
ENGINEERING & PLANNING BUILDING – CONFERENCE ROOM 2  
7800 Emmett F. Lowry Expressway  
Texas City, TX 77591**

**PLEASE NOTE:** Public comments and matters from the floor are generally limited to 3 minutes in length. If you would like to request to speak, please make your request in advance of the meeting by filling out a Request to Address Zoning Commission form and providing it to Ms. Brianna Galicia, Administrative Assistant.

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**(1) ROLL CALL**

**(2) APPROVAL OF MINUTES – November 19, 2024**

**(3) PUBLIC COMMENTS**

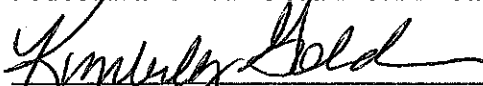
**(4) PRELIMINARY ZONING APPROVAL** - Consider and take action on a Zoning Change Request from CastleRock Communities to rezone from District "A" (Single Family Residential) to District "I" (Planned Unit Development) to construct Willow Wood Subdivision – a Master Planned Community within the City of Texas City. Located southeast of SH 3 and south of FM 1764. (Tabled from the November 19, 2024 meeting)

**(5) GENERAL UPDATES**

**(6) OTHER BUSINESS** (Any conceptual development proposal requesting to come before the Zoning Commission)

**(7) ADJOURNMENT**

I, THE UNDERSIGNED AUTHORITY, DO HEREBY CERTIFY THAT THIS NOTICE OF MEETING WAS POSTED ON THE BULLETIN BOARDS AT CITY HALL, 1801 9TH AVENUE NORTH, TEXAS CITY, TEXAS, AT A PLACE CONVENIENT AND READILY ACCESSIBLE TO THE GENERAL PUBLIC AND ON THE CITY'S WEBSITE ON DECEMBER 12, 2024, PRIOR TO 5:00 P.M. AND REMAINED SO POSTED CONTINUOUSLY FOR AT LEAST 72 HOURS PRECEDING THE SCHEDULED TIME OF SAID MEETING.

  
\_\_\_\_\_  
Kimberly Golden, Secretary




*Texas City*  
EST. 1911

ENGINEERING & PLANNING

## STAFF REPORT

To: Zoning Commission - Regular Meeting – December 17, 2024

From: Kim Golden, P.E., City Engineer 

CC: Doug Kneupper, P.E.

Date: December 11, 2024

RE: Willow Wood Subdivision - Master Plan and request to rezone from District A - Single Family Residential to District I – Planned Unit Development

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**Background:** At its regular meeting on November 19, 2024, the Zoning Commission held a public hearing on the request from Castlerock Communities to rezone 80 acres located southeast of SH3 and south of FM 1764 from District A - Single Family to District I – Planned Unit Development. After receiving comments from the public and concluding the public hearing the Zoning Commission tabled consideration of the request to allow additional time for the applicant to provide additional information.

### **Response to comments received at public hearing:**

**1) Drainage Issue:** Concerns were expressed regarding existing drainage issues in the area and a suggestion that the City undertake a comprehensive approach to mitigate and improve the area for economic development.

**Response:** Galveston County Drainage District No. 2 has jurisdiction over the watershed at issue and has approved the detention improvements proposed by the developer based upon a comprehensive study of the entire watershed. At the request of the District, the Developer engaged Burton L. Johnson, P.E. to study and provide a Floodplain Mapping and Modeling Report for the Ditch 7 Watershed (Ditch 7, Ditch 7A, Ditch 7B). The watershed encompassed the entirety of the watershed which was more than the 80 acres of Developer's site being considered by the Zoning Commission. The study computed flood flows and flood inundation in the Ditch 7 watershed for the 5-year, 10-year, 25-year, 50-year, 100-year and 500-year event using HEC-HMS and a coupled 1d/2d HEC-RAS model. The models were developed in consideration of the guidance by the U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) and the Harris County Flood Control District's *Two- Dimensional Modeling Guidelines*. The District also required the Developer to provide a Drainage Impact Analysis (DIA) specific for the detention proposed for the subdivision. The DIA used the floodplain mapping and modeling to **conclude the proposed development, including full development and Phase I development, could be constructed as proposed by the Developer without adversely impacting the drainage and flood risk upstream, adjacent to, and downstream of the project.** The GCDD#2 Engineer recommended, and the Board approved the DIA at its meeting on June 13, 2024.

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*"the place where COMMUNITY MATTERS"*

1801 9th Avenue North \* P.O. Drawer 2608 \* Texas City, TX 77592-2608

(409) 948-3111 \* [www.texascitytx.gov](http://www.texascitytx.gov)

**Transparency:** Copies of the District Engineer's recommendation and the Minutes of the GCDD#2 Board meeting are enclosed in the Zoning Commission agenda packet and will be posted on the City's website for general availability to the public. The entirety of the two reports provided to and reviewed by the GCDD#2 will also be posted on the City's website for general availability. Hard copies can be obtained via Public Information Requests.

**2) Ingress Egress into Subdivision:** Concerns were expressed regarding the single entrance via Phillips Street into the subdivision. **Response:** Willow Street, identified as N. Pine St. on Google Maps, is an existing local street which runs through the site providing connections to FM 1764 to the north and Phillips Street to the south. Willow Street will be the access for both east and west sections of the project. As noted in the previous staff report, the Developer has expressed an intent to obtain additional property to provide a second point of ingress egress upon approval of the Phase I Master Plan and PUD. Developer has been advised that the number of building permits issued may be limited by the Fire Marshal and Building Officials until a second entrance is provided.

**3) Look, feel and vision of the finished product:** Concerns were expressed regarding the look, feel and vision of the finished product which is understood to refer to the housing product. **Response:** Castlerock Communities is a well-known developer in Texas City having developed the Pearlbrook and Steed Landing subdivisions in Texas City and producing many houses in the Lago Mar planned community. Developer will present examples of its housing products to the Zoning Commission and provide example renderings of the proposed amenities and landscaping enhancements which will be required by the terms of the PUD. Developer indicates a willingness to adhere to the 60% masonry content reflected in the Development Agreement when approved in 2007. Developer also indicates it does not allow copper clad aluminum wire in the construction of homes and has no objection to such requirement in the Development Agreement.

**4) Adjacent existing livestock uses:** Concerns were expressed about the uses of adjacent undeveloped property as pasturage for livestock by existing owners. **Response:** It should be noted that pasturage for livestock is not an allowed principal use in the existing District A – Single Family Residential district. It is an allowed principal use only in the District O-Open Space which is reserved for undeveloped acreage. It is understood that actual land uses transition within a zoning district as development occurs over time, with higher value uses replacing lower value uses in response to market trends and forces. Even so, as an added measure of safety the Developer is proposing to add new barbed wire fencing adjacent to the development's perimeter fencing as needed.

**5) Future Land Use Plan:** Concerns were expressed regarding whether the proposed use was the highest and best use for the area and consistent with the City's comprehensive plans and goals. **Response:** The Planning Board considered the master plan and re-zoning application at its regular meeting on October 7, 2024 and

unanimously recommended approval of the proposed Master Plan. The site is one of the few remaining large open spaces served by existing utilities which is also situated within the Texas City ISD boundaries. The TCISD is challenged with declining enrollment. The development of new conventional subdivisions likely to serve growing families aligns with the City's vision to support a thriving school district. At full buildout the 213 new homes could be estimated to provide additional annual revenue of \$1,171,500 to the school district based upon projected student enrollment of 0.5 students per household. In addition, the property is south of the area designated as an activity corridor which the future land use plan describes as "parallel to freeway and highways with higher intensity land uses. These uses are primarily region serving and include malls, commercial, and open display retailing, wholesale, distributing and warehousing operations, restricted light industry, business offices, hotels and motels, and higher density residential development." The proposed master plan will not detract from the purpose of the activity corridor and therefore serves the city's long-term goal to diversify the tax base with commercial, retail and other non-residential uses along the Emmett F. Lowry Expressway.

**6) Community Benefits/Amenities:** Concerns were noted regarding proposed benefits for the community such as parks and recreational facilities. **Response:** An important component of a viable residential development is providing parks and meaningful open spaces. The PUD Application and Exhibit B Conceptual Master Plan incorporates walking/jogging trails as well as 7.1 acres in parks in greenspace. Four dual amenity/detention ponds located to the north, south and east exceeds the requirements of the Subdivision Ordinance of one-half acre per 100 homes. Exhibit D-1 illustrates the Park and Trail Plan with Exhibit D-2 providing examples of the representative amenities.

The PUD Application and Development Agreement require the creation of a Homeowner's Association that will be responsible for maintenance of parks and common areas. The HOA document should include strong language regarding the HOA's ability to keep the subdivision clean, attractive, and sustainable by abating nuisance and property maintenance type issues.

**7) Infrastructure:** Concerns were noted regarding adequate infrastructure such as roads, schools and utilities. **Response:** Water and sewer facilities are readily available to this project and can be extended from existing mains. Detailed engineering for the extension of services within the subdivision are part of the platting process and are not required with the master plan.

**8) Impact on Property Value -** Concerns were noted regarding the impact of the development on existing property values. **Response:** Property values are increasing in Texas City as a result of the balanced residential and non-residential growth in the area. This is likely to continue whether the Willow Wood or other developments move forward at the particular site.

**RECOMMENDATION:** The Planning Board considered and unanimously recommended approval of the Master Plan and PUD at its regular meeting on October 7, 2024. City staff have reviewed this Subdivision Masterplan, Development Agreement and PUD Application and has no objections to approval of the masterplan or to the zoning change request. Staff recommends provision be made in the PUD to allow amendment of the PUD to incorporate the additional property when acquired by the developer to provide for the construction of a second entrance. A limit should be determined for the number of permits which will issue until a second entrance is added to the master plan.

Ms. Kimberly Golden Planning Director -

Mr. Perry O'Brien Chairman, Texas City Zoning Commission & Zoning Commission Members

City of Texas City Engineering-Planning-Building & Inspection Department

7800 Emmett F Lowry Expressway

Texas City, Texas 77591

Mr. Willie Carroll, Living Trust

7305 Blue Jay Drive

Texas City, Texas 77591

*November 25, 2024*

Re: ***Willie Carroll's Living Trust Formal Response (To the Rezoning Proposal for Castlewood Development Company)***

***80 Acres PUD Master Planned Residential Subdivision (213 Lots).***

Ms. Kim Golden Planning Director

Ms. Golden, please find our formal response and summary of the planning issues that we would like to see addressed by the developer and City Commission. We offer no objection provided that the planning issues cited can be addressed. We will be in attendance for the workshops and subsequent Public hearings. We asked that our written response be reviewed by the Zoning and City Commission. Thank you.

Sincerely,

Mr. Willie Carroll &

*Willie Carroll*

*11/25/24*

Donald Carroll

*Donald Carroll*

Encls: 2-attachments



WC  
DC

**Site Development Issues & Recommendations to be Considered**

**from**

**Willie Carroll's Living Trust**

- a) ***Drainage Issue with GCDD No 55 aka Bayou Pierre (Raised by Zoning Commissioner Bruce Clawson during the PH). This has been an issue before and even since the formulation of the City's Comprehensive Plan G2k ( Land Use Plan Analysis). With this development synergy and interests, this is an opportunity to effectively work on mitigating and improving this area for economic development (addressing an affordable housing need). The City may want to establish a Public Private Partnership with the developer(s) and the property owners in the area to help revitalize and repurpose the area for meaningful development opportunities. This could be a very good economic development opportunity with a strategic plan (the creation of a superior design opportunity that will advance sustainability and resilience, and this approach is a win-win opportunity for all parties). This area has a draining issue and a development challenge that will not go away until it is addressed incrementally with the start of the development process or as recommended by (the City's Drainage Plan)?***
- b) ***Ingress Egress into the subdivision: The one entrance into the subdivision is not sufficient and whatever the incremental plan is as to how this will be addressed between Staff and developer should be declared now before approval for transparency, good faith and so the interested parties adjacent property owners will have all of the development intel needed to make an intelligent decision to be in favor of the development or to oppose the plan. Additionally, concerning the look, feel, and vision concept of the finished product I believe most adjacent property owners want to know what the finished product will look like. This is a part of the full disclosure and established site planning process for Texas City.***

These are the remaining concerns after we reviewed the PUD Application Packet provided during this Rezoning PH held on November 19, 2024. I have discussed this with Willie Carroll and siblings (Sisters Beth and Dianna). We will offer no objections once we can get assurances that the developer adheres to all development agreements provided in the packet and that we are provided the illustrations and elevation details concerning how the finished product will look. Lastly, if we could suggest we do believe that with enhanced code enforcement this is a good development intent.

WC  
DC

## ***Remaining Research Question & Planning Notes For Willie Carroll's Living Trust Rezoning Request PUD 80 Acres Subdivision***

### ***1. Background and Overview***

***Good morning. Last Tuesday I attended a Rezoning Public Hearing at the request of my Dad I am a part of the Willie Carroll Living Trust and Will. The Developer is proposing to develop 80 acres totaling 213 residential lots. Lot size range from 6000 sf to 1300 sf. The price range is \$ 275K to \$375K.***

### ***2. AI Response:***

***Good morning! That sounds like a significant development project. Attending the hearing must have been quite insightful. Here are a few things to consider regarding the proposed development:***

- a) Impact on Property Value: New residential developments can potentially increase the value of surrounding properties, including those in the Willie Carroll Living Trust.***
- b) Community and Infrastructure: Ensure that the developer has plans to support the new housing with adequate infrastructure, such as roads, schools, and utilities.***
- c) Environmental Concerns: Check if there are any environmental assessments or impact studies. Large developments can affect local ecosystems.***
- d) Zoning and Planning: Make sure that zoning changes align with the community's long-term planning goals and that the development is in accordance with local zoning laws.***
- e) Community Benefits: Look into whether the developer has proposed any benefits for the community, such as parks, recreational facilities, or affordable housing options.***

### ***3. Would you like more specific information or assistance with any aspect of the development project?***

***Bravo and yes! All of the issues raised /cited are spot on. The Developer application is not bad, but it lacks documentation that would help their approval cause and address legitimate questions that the property owners have, and it seems somewhat elusive without this missing information.***

- 4. It is because of this that I have one research question remaining. It is because of the concerns raised by one of the Zoning Commissioner in attendance presiding over the Public Hearing. it deals with drainage on-site /offsite this area is relatively flat and historically has some significant drainage issues. There is a statement that the***

Handwritten initials or signature in the top left corner.

*Drainage Regulating Authority has blessed the Planned Unit Proposal but the property owners within 200 feet of the site have not seen this. To add to the confusion the developer asserts that with their development of 80 acres as proposed there will be No-Net Drainage Impact. The development intent is not a bad proposal. It is an opportunity to Repurpose an area needing some enhancements. That aside, the drainage issue needs to be better explained and clarified for the Rezoning Request to move forward with transparency. Do you agree with this assessment and is there anything that I am missing for reasonableness and fairness to my Dad's interests?*

5. *AI Response: I agree with your assessment. Ensuring transparency and clarity in addressing drainage issues is crucial for the rezoning request to move forward smoothly. Here are a few additional points to consider:*
  - a) *Detailed Drainage Plan: Request a comprehensive drainage plan from the developer, including both on-site and off-site drainage solutions. This should include maps, technical specifications, and mitigation measures.*
  - b) *Third-Party Review: Suggest that an independent third party review the drainage plan to ensure it meets all regulatory standards and addresses community concerns.*
  - c) *Public Disclosure: Advocate for the developer to share the drainage plan with property owners within 200 feet of the site, as well as the broader community, to ensure transparency and build trust.*
  - d) *No-Net Drainage Impact: Ask the developer to provide a clear explanation of what "No-Net Drainage Impact" means in the context of this project and how it will be achieved.*
  - e) *Community Feedback: Encourage the developer to hold additional public meetings or forums to gather feedback from residents and address any remaining concerns.*

June 11, 2024

Board of Directors  
Galveston County Drainage District No. 2  
5000 F.M. 1765  
La Marque, Texas 77568  
Via email: [office@gcdd2.org](mailto:office@gcdd2.org)

**Re: District Engineer's Recommendation for Approval**  
Construction Plans entitled "Willowood Subdivision DIA."  
Prepared by Burton Johnson Engineering, Inc. dated 4/2/2024.  
GCDD2 Review Number: 2024-009 Ditch 7

Dear Board of Directors:

Pape-Dawson Engineers is in receipt of the above referenced "Willowood Subdivision DIA" review on behalf of Galveston County Drainage District No. 2 ("District"). Based on the submitted plan, approximately **116 acres** of development will be drained to the District's Ditch 7a and 7b system via four detention ponds. The detention ponds provide overall detention rates of 0.94 ac-ft per ac for the Ditch 7a ponds and 0.75 ac-ft per acre for the Ditch 7b pond. Additionally, the development provide 1:1 floodplain mitigation volume based on the district's preliminary Atlas 14 10-0eyar floodplain as identified in the report entitled "Ditch 7 Watershed," dated April 6, 2024 and prepared by Burton Johnson Engineering, Inc..

The drainage report as submitted is hereby recommended for approval by the District board. Please note that district approval for Drainage Impact Analysis is good for 2 years. Be advised that the District approval is only for the design area to be drained to the ditch. Internal storm sewer design, extreme event routing to prevent future structures from being flooded by a rainfall event exceeding the storm sewer capacity, and necessary perimeter swales designed to convey offsite sheet flow away from the proposed development are the responsibility of the local city municipality. If you have any questions or require any additional information, please feel free to contact me at 713-428-2400 or by email at [swilcox@pape-dawson.com](mailto:swilcox@pape-dawson.com).

Sincerely,  
**Galveston County Drainage District No. 2**  
**Pape- Dawson - District Engineer**



J. Stephen Wilcox, P.E., CFM  
Vice President – Hydrology & Hydraulics

cc: Mr. Landry Cravens, GCDD2 District Manager  
Ms. Kim Golden, PE, City of Texas City Engineer [kgolden@texascitytx.gov](mailto:kgolden@texascitytx.gov)  
Mr. Burton Johnson, PE, Burton Johnson Engineering, Inc [bjohnson@bdengineering.com](mailto:bjohnson@bdengineering.com)

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# Galveston County Drainage District # 2



- Wayne Hobgood                      Chairman / Director
- Angel Murphy                         Secretary / Director

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## REGULAR MEETING MINUTES

of the Board of Directors

### June 13, 2024

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The Board of Directors (the "Board" or "Directors") of Galveston County Drainage District # 2 (the "District") met in regular session on the 13<sup>th</sup> day of June, 2024 at 4:00 p.m. in the meeting room of the District at 5000 F.M. 1765, La Marque, TX, 77568, pursuant to notice of said meeting posted in accordance with Chapter 551 of the Texas Government Code, whereupon the roll was called of the members of the Board, to-wit:

There being two members of the Board present, thus constituting a quorum.

In attendance were:

- Mr. Landry Cravens, District Manager
- Ms. Candace Warren, Records Management Officer / Office Administrator for the District
- Mr. Steven Wilcox, P.E., CFM of Pape-Dawson Engineers
- Mr. Dean Oliver, Operator for the District
- Detective Matthew Cypert
- Ms. Claudia Redden, Gulf Coast Bookkeeping.
- Mr. Thomas Owens, Owens 5 Installs LLC.

1. **Call Meeting to Order**  
After finding that notice of the meeting was posted as required by law, Director Hobgood determined that a quorum of the Board was present, calling the meeting to order at 4:00 p.m., and declaring it open for such business as may regularly come before it.
2. **Public Comments**  
There being no public comments, the Board proceeded with the agenda.
3. **Old Business:**  
There being no old business to discuss, the Board proceeded to the next topic on the agenda.
4. **New Business:**
  - a. *Approval of the Regular Meeting Minutes from May 9, 2024.*  
Director Hobgood motioned to approve the minutes, with Director Murphy seconding the motion for

the approval of the Regular Meeting Minutes from May 9, 2024.

5. **Bookkeepers' Report**

a. *Presentation and Approval of Bookkeeper Report.*

Ms. Redden gave the monthly report. The bills were presented and Director Hobgood motioned to approve the bills as submitted, which was seconded by Director Murphy.

b. *Discussion and Approval of ACH Report, Credit Card Reports, Purchases, Payroll Report, and Directors' Fees of Office*

Ms. Redden explained in detail the Bookkeepers' report, where the breakdown of the various reports, number of deposits, amount of ACH withdrawals, transfer activity, and checks written were discussed. A copy of the Bookkeeper's report for June is attached hereto.

c. *Discussion and Approval of Money Market Transfer to General Operating Fund, Sweep Account to Texas Class, and Closer of Sweep Account.*

Director Hobgood opted to return to this topic later in the meeting and to continue reviewing the checks and invoices that had been provided for review. No motion was made to approve anything at this time.

d. *Discussion of Positive Pay*

Ms. Redden stated she had asked Ms. Christian Carner, bookkeeper for Gulf Coast Bookkeeping, whether the Districts' accounts had Positive Pay, and added that this was a subject discussed in the recent PFIA seminar. She added that in her experience with her water district clients, if a fraudulent check comes into the account, or when ACH transactions come in, a certain amount of time is granted to call the bank to let them know the transactions are wrong. She added that Ms. Carner was in touch with the bank agent concerning the transactions of the District. Director Hobgood stated that any decisions and discussions would need approval by all members of the Board.

6. **Engineers' Report**

a. *2024-009 Ditch 7 – Willowood Subdivision DIA*

Mr. Wilcox stated that Willowood Subdivision DIA exceeded all of the Districts' requirements necessary for approval. He recommended the approval of the Willowood Subdivision DIA, and Mr. Cravens agreed as well. Director Hobgood made a motion to approve Willowood Subdivision DIA, and Director Murphy seconded it.

b. *2024-011 Ditch 1 – Gas Station and C Store @ 5304 Hwy. 3, Dickinson, TX*

Mr. Wilcox stated that the Gas Station and C Store @ 5304 Hwy. 3, Dickinson, TX met all requirements necessary for approval. He recommended the approval of the project, and Mr. Cravens agreed that it should be approved. A motion was made to approve the Gas Station and C Store @ 5304 Hwy. 3, Dickinson, TX, which Director Murphy seconded.

Mr. Wilcox outlined the Master Drainage Plan for Ditch 12, 13, 15 and 16. He presented the Board with a draft copy of the Master Drainage Plan, and if anyone would like to view the book that Mr. Wilcox provided, it will be here at the District office.

7. **District Managers' Report**

*District property, facilities, infrastructures, vehicles, equipment, projects, developments, compliance, reporting, and personnel matters.*

Mr. Cravens stated on the maintenance side that the ditches mowed were Ditch 13B, 13C, 13E,

15A, 14C, Ditch 5A, and 5B, and Ditch 7A. On the operating side, the operators were continuing with the excavation on Ditch 6. He stated that this month has been rain-filled, but a lot of work was done. The guys had to clear debris, which was a tree from Ditch 1, and also cleared a trampoline from Ditch 9.

Mr. Cravens added that it is time once again for the Truth in Taxation, and Ms. Cheryl Johnson, of the Galveston County Tax Assessor office sent the District the Information Worksheet for the Tax Rate. Correspondence from the Galveston County Tax Office was sent to Director Hobgood and Director Ellison Jr. notifying them of the need to complete the document. Ms. Warren will be completing the Information Worksheet for the Tax Rate for the District since the deadline to submit the form is July 8, 2024.

#### **5. Continuation of Section 5 Bookkeepers' Report Discussion**

Director Murphy stated that Owens 5 Installs' invoice would not be paid, based on needing a further explanation of the services provided. The invoice stated work was completed as warranty work, and she requested additional information to be added to the invoice.

Mr. Cravens expressed his concern and requested that all copies and receipts be given to the District office regarding Directors' Fees of Office, for transparency. He requested that Director Murphy provide a copy of the receipts from the recent seminar she attended for the PFI class taken on May 15, 2024, in Fort Worth. The District office did not receive a copy of those receipts.

Director Hobgood stated to Ms. Redden that Ms. Carner would not receive her check nor would it be signed until he spoke with her.

Director Hobgood also stated that he would like a full Board to be present before a decision is made on the sweep account transfer to Texas Class and then closer of sweep accounts. As far as the transfer of \$100,000.00 from the Money Market account to the General Operating Fund account, Director Hobgood stated that was acceptable to be able to pay the District employees. Director Hobgood then made a motion to approve, and Director Murphy seconded the motion to approve the transfer of \$100,000.00 from the Money Market account to the General Operating Fund.

#### **8. Attorney's Report**

*a. Acceptance or Conveyance of Drainage Dedications, Easements, Deeds, or Consents to Encroachment (PAS, LLC)*

Mr. Cravens stated that he spoke with Mr. Mark Ciavaglia, Attorney with Linebarger, Goggan, Blair & Sampson, LLP who is heading up the Sheriff's sale, and he has agreed to put the property on hold for the District, and that he will wait for Mr. Steve Bonjonia with PAS, LLC to get back with him on this.

*b. Annual Performance Evaluation of District Manager - tabled.*

Director Hobgood stated that without the attorney present, he would table b, c, and d until a full Board is present.

*c. Review and Discussion of Agreement with Owens 5 Install - tabled.*

*d. Resolution Amending Director Fees of Office and District Reimbursement Policy - tabled.*

#### **9. Director's Report**

Director Hobgood stated that a contract for Owens 5 Installs, and the check that was owed to Mr. Owens for service should be tabled until there is a full Board present.

Director Murphy stated that Ditch 11 has an issue, and the water is standing. Mr. Wilcox said that he would check out the area where there appeared to be an issue.

Director Hobgood inquired about the pictures of the ditches being uploaded to the District's website, and Ms. Warren stated that they would be on the website by June 17, 2024.

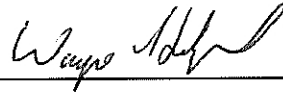
10. **Executive Session**

There was no executive session held.

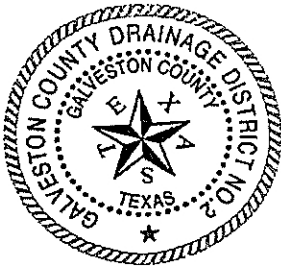
11. **Adjournment**

There being no further business the meeting was adjourned. The time was 5:30 p.m.

PASSED, APPROVED, and ADOPTED this the 25<sup>th</sup> day of June 2024.



\_\_\_\_\_  
Director





# Ditch 7 Watershed (Ditch 7, Ditch 7A, Ditch 7B)

## Floodplain Mapping and Modeling

Galveston County Drainage District Number Two

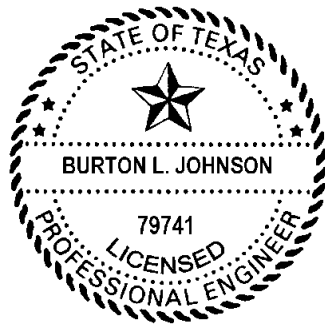
April 6, 2024



# Floodplain Mapping and Modeling Report

## **Ditch 7 Watershed (Ditch 7, Ditch 7A, Ditch 7B)**

Galveston County Drainage District Number Two



A handwritten signature in cursive script that reads "Burton L. Johnson".

April 6, 2024

Burton Johnson Engineering, Inc.  
4611 Waterbeck St  
Fulshear, TX 77441  
281-773-7184  
TPBE No. 10781

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## EXHIBITS

### ATTACHMENT 1 – Galveston County Drainage District Number Two Map

Note: Survey data and computer models may be downloaded at the following link within 90 days of date of report:

<https://www.dropbox.com/s/vv570wu2n86gdz3/Ditch%207%20Study%20-%20Models.zip?dl=0>

## 1.0 Executive Summary

This report describes and summarizes the computation of flood flows and flood inundation in the Ditch 7 watershed in Galveston County. Specifically, flood flows and inundation were computed for the 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year events using HEC-HMS and a coupled 1d/2d HEC-RAS model. The resultant inundations are presented in Exhibits 9, 10, and 11 of the report.

The analysis and supporting hydrologic and hydraulic modeling were performed in consideration of the Galveston County Drainage District Number Two (District) criteria, which currently defers to the methodology described in the Harris County Flood Control District's *Policy Criteria & Procedure Manual (PCPM)*, dated July 2019. This version of the PCPM includes updates to consider ATLAS 14 rainfall, and as such the study includes recognition of ATLAS 14 rainfall.

The hydraulic modeling includes a coupled 1d/2d model. The models were developed in consideration of guidance by the U.S. Army Corps of Engineers Hydrologic Engineering Center (HEC) and the Harris County Flood Control District's *Two-Dimensional Modeling Guidelines*.

The study is based on current land use and channel conditions, and also considers currently planned and imminent developments. Specifically, the proposed Willowood Subdivision, a 118-acre proposed single family residential development adjacent to and between Ditch 7A and Ditch 7B that includes four detention basins, is included in the evaluation. The floodplain modeling and mapping of Ditch 7A and Ditch 7B described herein have been prepared for the District as part of the development evaluation. The Drainage Impact Analysis for Willowood Subdivision is prepared under a separate report.

This report and supporting models will be submitted to Galveston County Drainage District Number Two (District) for their consideration and potential adoption.

## 2.0 Introduction

The Ditch 7 watershed is one of the nine watersheds within the boundaries and jurisdiction of Galveston County Drainage District Number Two (District). The Ditch 7 system consists of several ditches, with the main ditches being two major forks of Ditch 7 known as Ditch 7A and Ditch 7B along with Ditch 7 as it drains to Moses Lake. To date, there are no known hydrologic and hydraulic studies of Ditch 7, Ditch 7A, and Ditch 7B. This report describes and summarizes a study conducted using HEC-HMS and HEC-RAS to determine peak flowrates and inundations along these ditches. The HEC-RAS model utilized a combined one-dimensional/two-dimensional (1d/2d) model, with the channels modeled using the 1d regime and the overbank and overflow areas modeled using a 2d regime.

### 2.1 Description of Project Area

The Ditch 7 watershed is mostly within the City of Texas City, however a southern portion of the watershed is within the City of La Marque. Ditch 7, Ditch 7A, and Ditch 7B are all located within the City of Texas City. Exhibit 1 depicts the location of the Ditch 7 watershed and the primary ditches. The District's Watershed Map is provided as Attachment 1. The hydrologic study considers the portion of the watershed upstream of Loop 197 North (25<sup>th</sup> Avenue). There is a small portion of the watershed downstream of Loop 197 North, however this area is dominated by the tidal influence of Moses Lake and has a negligible influence on flood flows and flood elevations.

Exhibit 2 provides an aerial photograph of the Ditch 7 watershed from the District Map. The upper half of the watershed is developed, with the development consisting primarily of residential neighborhoods along with some multi-family and commercial areas along the main corridors. The lower half is mostly undeveloped, with the development consisting of the major transportation corridors along with intermittent industrial, commercial, and residential development. According to the District map, the watershed drains an area of 2.91 square miles at Loop 197 North.

There major roadways in the watershed are Loop 197 North, State Highway 146, FM 1764, State Highway 3, and FM 1765. FM 1765 forms the boundary between the Cities of Texas City and La Marque. There is a Union Pacific Rail Line that runs generally parallel and west of State Highway 146.

Exhibit 2 also depicts the limit of the channel study. Ditch 7A and Ditch 7B are both studied from State Highway 3 downstream to their confluence with Ditch 7. Ditch 7 is studied downstream to Loop 197 North. Although the hydrologic calculations for Ditch 7 terminate at Loop 197 North, the HEC-RAS study was continued a short distance downstream into Moses Lake to capture the influence of the Loop 197 North crossing.

### 2.2 FEMA Special Flood Hazard Areas

According to FEMA Flood Insurance Rate Map (FIRM) Panel No. 48167C0265G, dated August 15, 2019, the watershed is entirely in the Shaded Zone "X", which represents areas subject to flooding from a 0.2% annual probability event (also known as the 500-year event). A portion of the area is also in the Zone AE floodplain, which represents areas subject to inundation from the 1% annual probability event (also

known as the 100-year event) that have computed Base Flood Elevations. Exhibit 3 depicts these Special Flood Hazard Areas.

Based on a review of the FIRM Panel and FEMA's *Flood Insurance Study, Galveston County and Incorporated Areas*, dated August 15, 2019, the inundation depicted on the FIRM is from coastal surge flooding and does not represent riverine flooding from rainfall in the watershed. The coastal elevations are computed along transect lines which are shown on the exhibit. The 100-year coastal surge elevation is shown as a Base Flood Elevation on the FIRM Panel and is also shown, as elevation 5.0, on Exhibit 2. Transect Line 86 runs through the project area. The 100-year coastal surge elevation is 5.0. Based on a profile presented in the *Flood Insurance Study* and the 500-year coastal surge elevation is between elevation 15.0 and 17.0 within the Ditch 7 watershed.

The information provided on the FIRM panels and within the *Flood Insurance Study* confirms that Ditch 7 and its tributaries are not FEMA studied streams.

## 2.3 Elevation Data

All source elevation data and all elevations cited in this report are in feet above Mean Sea Level based on the 1988 North American Vertical Datum (NAVD 88).

Elevation data for this analysis is a blend of the Upper Coastal Lidar data acquired by a partnership between the Texas Water Development Board, Houston-Galveston Area Council, and United States Geologic Survey in 2018; and survey data acquired by Costello, Inc. (now part of Pape Dawson) in the fall of 2023.

The lidar data was utilized for most of the elevation data, including overland areas and portions of the channel cross sections. The survey data was used to augment the lidar data in consideration of the limitations of the lidar data – specifically the capture of specific details and elevations associated with bridge and culvert crossings and the capture of bathymetry in areas where the lidar was unable to penetrate a water surface.

The survey included incremental channel cross sections along Ditch 7, Ditch 7A, and Ditch 7B, including elevations below the water surface. The locations of these sections are shown on Exhibit 4. These cross sections were utilized to develop a TIN and subsequent digital elevation model using ArcGIS software. There are software limitations to this method, however the resultant digital elevation model (DEM) was accurate at the location of the cross sections – and was used to develop a one-dimensional HEC-RAS geometry for the surveyed channel. Within HEC-RAS, RAS Mapper was utilized to convert the one-dimensional geometry into a DEM for the surveyed channel. This channel DEM was then merged with the lidar DEM to develop an integrated surface that considers the bathymetry along the channels.

Exhibit 5 depicts the resultant blended DEM. This elevation data was incorporated into the HEC-RAS model and was also used in the verification and determination of drainage boundaries and in the computation of hydrologic parameters (see Section 3.0).

## 3.0 Hydrology

Hydrographs were developed for each of the subareas in accordance with the methodology described in the Harris County Flood Control District's *Policy Criteria & Procedure Manual (PCPM)*, dated July 2019, as the Galveston County Drainage District Number Two criteria defers to the Harris County Flood Control District Criteria until Galveston County releases an updated Drainage Criteria Manual.

### 3.1 Watershed Boundary and Drainage Sub-watersheds

The watershed boundary from the District map was reviewed in consideration of the Lidar topography and drainage infrastructure, and portions of the boundary were amended to reflect ground conditions. Based on the revised drainage determination, the total drainage area is computed to be 3.22 square miles, which is 0.31 square miles greater than the watershed area depicted on the District map (of this approximately 0.10 square miles is due to extending the downstream boundary slightly downstream). The District and updated drainage area boundaries are depicted in Exhibit 6.

The watershed was further subdivided into six sub-watershed areas to facilitate the hydrologic analysis. This includes three sub-watersheds that drain to Ditch 7A (sub-watersheds 7A1, 7A2, and 7A3), four sub-watersheds to Ditch 7B (sub-watersheds 7B1, 7B2, 7B3, and 7B4) and a single sub-watershed to Ditch 7 (Sub-watershed 7). These sub-watersheds are also depicted on Exhibit 6. The Ditch 7 watershed drains a total of 3.22 square miles. Ditch 7A drains 0.84 square miles, and Ditch 7B drains 1.88 square miles.

### 3.2 Hydrologic Methodology

The Harris County Flood Control District legacy hydrology uses the Clark Unit Hydrograph methodology and the Green and Ampt loss method to compute runoff hydrographs for a 24-hour ATLAS 14 based hypothetical event. The Clark Unit Hydrograph utilizes two parameters, Time of Concentration (TC) and Storage (R) to define the shape of the hydrograph. Historically, the Flood Control District's empirically developed Clark Unit Hydrograph equations were utilized to develop the Clark TC and R parameters. Recently, the Flood Control District has shifted to a different method, the Basin Development Factor, to develop Clark Unit Hydrograph parameters. Both of these methods were developed from the evaluation of gauge data, and the Flood Control District notes that neither method is appropriate for sub-watersheds less than one square mile in area.

For drainage areas between 50 acres and 640 acres (one square mile), the PCPM recommends the use of the Flood Control District's Site Runoff Curves. These curves compute the peak flowrate based on the drainage area and percentage of impervious cover and have been updated in consideration of ATLAS 14 rainfall. The curves are described in Section 3.3 of the PCPM and presented graphically for the 2-year, 10-year, 100-year, and 500-year events in Exhibits 3-1, 3-2, 3-3, and 3-4 of the PCPM. They can also be developed using the following equation:

$$Q = bA^m$$

- Where Q = peak flowrates (cfs)  
 A = drainage area (acres)  
 m = 1.0 for A = 1-20, 0.786 for A = 20-640  
 b = variable dependent on impervious cover, see Table 1

**Table 1: Harris County Flood Control District Site Runoff Curves  
 Determination of “b” Parameter**

Impervious Cover	2-Year		10-Year		100-Year		500-Year	
	≤ 20 Ac	> 20 Ac	≤ 20 Ac	> 20 Ac	≤ 20 Ac	> 20 Ac	≤ 20 Ac	> 20 Ac
0%	0.7	1.4	1.3	2.4	2.4	4.6	3.6	6.8
10%	0.9	1.8	1.6	3.0	2.9	5.5	4.3	8.1
20%	1.2	2.2	1.9	3.6	3.4	6.5	5.0	9.5
30%	1.4	2.7	2.3	4.4	4.1	7.7	5.8	11.0
40%	1.7	3.3	2.8	5.2	4.7	8.9	6.6	12.6
85%	2.3	4.3	3.5	6.6	5.7	10.9	8.0	15.1

Note: Apply linear interpolation between b value with the 85% impervious cover value the maximum

Runoff hydrographs were computed for the 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year events using the software package HEC-HMS version 4.11. The primary inputs for the HEC-HMS model are the precipitation, runoff losses, and unit hydrograph parameters. The following sub-sections describe the determination of the input parameters and the HEC-HMS hydrologic modeling.

### 3.2.1 Land Use and Peak Flowrates (Site Runoff Curves)

Exhibit 7 shows the sub-watershed delineations along with the land use and longest flowpath for each sub-watershed. The sub-watersheds determined for the Ditch 7 watershed are all less than one square mile in size, therefore the Site Runoff Curves were utilized to determine the peak flowrates. The land use was determined from aerial photographs and the proposed development plans for the Willowood Subdivision. The land use was used to determine the percentage impervious for each of the sub-watersheds using the assumed impervious cover values presented in Table 2.

**Table 2: Land Use vs. Impervious Cover**

Land Use	Impervious
Woods	0%
Grass/Range	0%
Road Right-of-Way	80%
Greenspace	15%
Water	100%
Subdivision - 1 Ac Lots	25%
Subdivision - 1/6 Ac Lots	40%
Multi-Family	85%
Commerical	85%
Industrial	65%

### 3.2.2 Precipitation

The *Criteria Manual* provides precipitation data based on the NOAA TP-40 report from 1961, however this has been superseded and replaced by the NOAA ATLAS-14 rainfall data published in 2018. Table 3 summarizes the NOAA ATLAS 14 point rainfall precipitation estimate, which was obtained from the National Weather Service ATLAS 14 online Precipitation Frequency Data Server for a location (Latitude: 29.3907°, Longitude: -94.9717°) at the center of the Ditch 7 watershed.

**Table 3: NOAA ATLAS 14 Precipitation**

Duration	Point Rainfall (inches)					
	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
5 min	0.755	0.866	1.07	1.22	1.37	1.75
10 min	1.20	1.41	1.70	1.94	2.18	2.76
15 min	1.52	1.78	2.14	2.42	2.72	3.58
30 min	2.17	2.53	3.03	3.42	3.83	4.95
1 hr	2.91	3.42	4.13	4.68	5.27	6.98
2 hr	3.77	4.54	5.68	6.6	7.64	10.6
3 hr	4.32	5.30	6.76	7.99	9.39	13.3
6 hr	5.28	6.60	8.62	10.4	12.4	18.1
12 hr	6.27	7.89	10.4	12.5	15.0	22.5
24 hr	7.31	9.22	12.2	14.7	17.7	26.9

### 3.2.3 Loss Parameters

The Green and Ampt method was utilized to determine rainfall losses due to ground infiltration, evaporation, depression storage, and other mechanisms. While the PCPM is silent on the selection of the loss methodology, the Flood Control District has utilized the Green and Ampt method since the Tropical Storm Allison Recovery Project in the early 2000's. Green and Ampt loss function is an empirical method that determines an initial loss (or initial abstraction) and then a cumulative loss over time.

The input parameters utilized in this study are taken from the methodology described in the *Dickinson Bayou Watershed, Regional Drainage Plan, Drainage Criteria Manua*, dated August 1992. The parameters are described below:

**Initial Deficit (DTHETA):** Also known as the “soil moisture deficit”, the difference between the maximum amount of moisture which a soil can hold and the given amount of moisture present in the soil at any given time. Expressed as a ratio. *Dickinson Bayou Value: DTHETA = 0.36*

**Suction (PSIF):** Also known as “wetting front suction” and represents the capillary suction which draws water into the soil, measured at the wetting front, or the limit of penetration of water into the soil. The wetting front separates wet soil from the dry soil. Expressed in inches. *Dickinson Bayou Value: PSIF = 11.20 in*

**Conductivity (XKSAT):** hydraulic conductivity of saturated soil, the ratio of the rate of flow of water through a soil to the energy gradient causing that flow. Hydraulic conductivity is a measure of soil permeability. Expressed in inches per hour. *Dickinson Bayou Value: XKSAT = 0.02 in/hr*

**Impervious Cover:** The percentage of impervious cover in the sub-watershed, see Table 5.

### 3.2.3 Clark Unit Hydrograph Parameters and Peak Sub-Watershed Flowrates

Clark Unit Hydrograph parameters TC and R are used to determine the shape of hydrographs given the contributing drainage area and excess runoff (precipitation less rainfall infiltration and other losses). These parameters are defined as follows:

**Time of Concentration (TC):** The time required for storm runoff to flow from the most remote point in a subarea to the outlet point, in hours.

**Watershed Storage Coefficient (R):** Indicator of the available stormwater storage volume within a watershed, in hours. This storage volume may be provided in depressions or low areas, ponds, or in the channel and flood plain of the stream under consideration. The relative amount of storage volume within a watershed varies directly with the storage coefficient, i.e., the higher the storage coefficient, the greater the storage volume.

For this study, the time of concentration (TC) was determined based on the travel time along the longest flowpath in the sub-watershed. The NRCS TR-55 methodology was applied, which calls for the determination of travel time associated with sheet flow, shallow concentrated flow, pipe flow, and channel flow. Table 4 summarizes the TC for each of the sub-watersheds.

**Table 4: Time of Concentration (Clark Parameter TC)**

Subarea	7A1	7A2	7A3	7B1	7B2	7B3	7B4	70
<b>Sheet Flow</b>								
Length (ft)	300	130	190	300	300	250	300	300
Surface	Woods	Range	Woods	Range	Range	Range	Range	Range
N	0.40	0.13	0.40	0.13	0.13	0.13	0.27	0.40
Slope (ft/ft)	0.0020	0.0050	0.0074	0.0033	0.0020	0.0020	0.0020	0.0067
2-Yr 24-Hr Precip (in)	5.32	5.32	5.32	5.32	5.32	5.32	5.32	5.32
Travel Time (min)	100.7	14.6	41.5	33.4	41.0	28.0	73.6	62.2
<b>Shallow Concentrated Flow</b>								
Length (ft)	1920	1190	4010	4490	1360	1250	4060	920
Surface	Unpaved	Paved	Unpaved	Unpaved	Unpaved	Unpaved	Unpaved	Unpaved
Slope (ft/ft)	0.0032	0.0050	0.0020	0.0021	0.0020	0.0020	0.0020	0.0024
Velocity (fps)	0.92	1.44	0.72	0.75	0.72	0.72	0.72	0.79
Travel Time (min)	34.9	13.8	92.6	100.3	31.4	28.9	93.8	19.4
<b>Ditch Flow</b>								
Length	1690		5740	1430	2580		3750	5850
Slope (ft/ft)	0.0012		0.0003	0.0028	0.0004		0.0001	0.0009
Velocity (fps)	2		2	2	2		2	2
Travel Time (min)	14.1		47.8	11.9	21.5		31.3	48.8
<b>Time of Concentration (TC)</b>								
Tc (min)	149.7	28.4	182.0	145.6	93.9	56.9	198.6	130.4
TC (hr)	2.50	0.47	3.03	2.43	1.57	0.95	3.31	2.17

The value for TC, along with the drainage area, Green and Ampt parameters, and ATLAS 14 precipitation were input in HEC-HMS. initial values for the Clark Unit Hydrograph value R were assumed for each sub-

watershed. A 100-year event was executed, and the R value was then adjusted until the HEC-HMS simulation returned 100-year peak flowrates that matched the peak flowrates computed using the Site Runoff Curves. The resultant TC and R values were applied for all frequencies.

Table 5 summarizes the TC and R values and supporting parameters. Table 6 presents the computed peak flowrates for each sub-watershed for the 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year events, and also presents a comparison of the 10-year and 100-year events using the Site Runoff Curves.

**Table 5: HCFC Site Runoff Curves and Clark Unit Hydrograph Parameters**

Subarea				HCFC Site Runoff Curves					Clark Unit Hydrograph	
Name	Area (acres)	Area (sm)	% Impervious	b10	b100	m	10-Yr (cfs)	100-Yr (cfs)	TC (hr)	R (hr)
7A1	139.4	0.2178	25.4%	4.03	7.14	0.786	195.2	346.1	2.50	2.186
7A2	69.7	0.1089	37.0%	4.96	8.54	0.786	139.3	239.9	0.47	1.416
7A3	330.8	0.5169	15.2%	3.31	6.02	0.786	316.3	575.0	3.03	4.240
7B1	514.2	0.8034	42.6%	5.28	9.01	0.786	713.8	1218.7	2.43	2.476
7B2	243.0	0.3797	31.6%	4.53	7.90	0.786	339.9	592.4	1.57	2.514
7B3	75.4	0.1178	42.1%	5.27	8.99	0.786	157.4	268.9	0.95	1.240
7B4	368.3	0.5755	13.2%	3.19	5.82	0.786	332.2	605.7	3.31	4.600
70	319.3	0.4989	26.3%	4.11	7.26	0.786	381.6	674.7	2.17	3.153

**Table 6: Computed Subarea Peak Flowrates**

Subarea	Peak Flowrate (cfs)						Difference from Site Runoff Curves (cfs)	
	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr	10-Yr	100-Yr
7A1	155.1	192.3	247.6	293.8	346.1	495.1	-2.9	0.0
7A2	119.0	143.6	179.2	208.0	239.9	330.9	4.3	0.0
7A3	242.2	305.8	401.8	482.6	575.0	842.1	-10.5	0.0
7B1	547.3	677.5	871.9	1034.4	1218.8	1745.6	-36.3	0.1
7B2	270.9	333.9	427.5	504.7	592.4	844.3	-6.0	0.0
7B3	133.3	160.9	200.7	233.1	268.9	371.3	3.5	0.0
7B4	252.2	319.5	421.3	507.3	605.7	890.7	-12.7	0.0
70	297.5	370.6	479.9	571.0	674.7	973.2	-11.0	0.0

## 4.0 Hydraulic Analysis (Combined 1D/2D HEC-RAS)

A coupled 1d/2d unsteady flow HEC-RAS model was utilized to compute peak flowrates and inundations for the 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year events. The hydrographs described in Section 3.0 were introduced into HEC-RAS as boundary conditions. The physical channel network, bridges and culverts, and overland flow areas are described in the geometry. This section describes the HEC-RAS model development.

### 4.1 Geometry Data

Exhibit 8 presents a schematic of the HEC-RAS model. The model uses a one-dimensional flow regime to model flow within the channels, including areas within the channel banks and the near overbank extents. The two-dimensional regime was utilized to model the overbank areas away from the channel. The two-dimensional model component was selected because of potential overflows between Ditch 7A and Ditch 7B.

#### 4.1.1 Channel Cross Sections

Channel cross sections were developed for HEC-RAS along Ditch 7, Ditch 7A, and Ditch 7B from RAS Mapper using the terrain model from the hybrid lidar and surveyed bathymetry. RAS Mapper was used to compute reach lengths along the main channel. The main overbank areas were modeled in the two-dimensional regime, although there are some small overbank areas within the one-dimensional regime that are reflected in the cross sections. The overbank areas are near to the main channel section, and therefore the channel reach length was also used for the right overbank and left overbank reach lengths.

The channels modeled in this study are all subject to maintenance and in good condition. For Ditch 7A, a Manning's "n" value of 0.04 was used to reflect the maintained condition of the trapezoidal channel. Ditch 7 and Ditch 7B have larger tidal areas that lack vegetation, and therefore the Manning's "n" value was decreased slightly relative to Ditch 7A. For these channels, an "n" value of 0.035 was assigned for the main channel. For all channels, an overbank "n" value of 0.05 was used. These values were only applied in locations proximate to the channel cross section that are typically well maintained as most of the overbank areas are modeled in the two-dimensional regime.

The confluence of Ditch 7A and Ditch 7B was modeled as a storage area. This is a more stable method than the HEC-RAS junction and returns similar results. A small storage area was determined and a stage vs. storage relationship was developed from the hybrid terrain data.

#### 4.1.2 Bridges and Culverts

The roadway, railroad, and canal crossings were modeled using survey data obtained from the Costello survey with some augmentation with lidar data (to confirm top of road elevations). Table 3 lists the bridges and culverts in the model. The survey data did not capture information for the box culverts at Loop 197 North along Ditch 7 or at Oak Street (the very upstream portion of Ditch 7A and 7B). The crossings are generally at the modeling boundaries and were estimated from field visits, online imagery, and lidar data. Any inaccuracies from this are negligible to model results.

There are a few small pipeline crossings along Ditch 7B and one along Ditch 7. These were not introduced into the model, as their overall impact is negligible.

**Table 4: Bridge and Culvert Crossing**

Channel	Station	Crossing	Description	Data Source*
Ditch 7	1585	Loop 197 North (25 <sup>th</sup> St N)	3 – 10' x 9' Concrete Box Culverts	1,3,4
Ditch 7	2827	SH 146 NB Access Rd	3-Span Bridge	1,2,3,4
Ditch 7	2975	SH 147 Mainlanes	3-Span Bridge	1,2,3,4
Ditch 7	3122	SH 146 SB Access Rd	3-Span Bridge	1,2,3,4
Ditch 7	4279	Union Pacific RR	3-Span RR Bridge	1,2,3,4
Ditch 7A	3258	GCWA Canal	2 - 60" Reinforced Concrete Pipes	1,2,3,4
Ditch 7A	3773	Unnamed Crossing	1 - 72" Steel Culvert	1,2,3,4
Ditch 7A	5565	FM 1764 Emmett Lowry Expwy	3 – 5' x 6' Concrete Box Culverts	1,2,3,4
Ditch 7A	7941	Unnamed Crossing	2 – 48" Corrugated Metal Pipes	1,2,3,4
Ditch 7A	10376	Oak St	1 – 60" Steel Culvert	
Ditch 7B	3400	FM 1764 Emmett Lowry Expwy WB Access Rd	3-Span Bridge	1,2,3,4
Ditch 7B	3550	FM 1764 Emmett Lowry Expwy Mainlanes	3-Span Bridge	1,2,3,4
Ditch 7B	3700	FM 1764 Emmet Lowry Expwy EB Access Rd	3-Span Bridge	1,2,3,4
Ditch 7B	5406	N. Pine Rd	3-Span Bridge	1,2,3,4
Ditch 7B	6801	5 <sup>th</sup> Ave North	2-Span Bridge	1,2,3,4
Ditch 7B	9434	Oak St	3 – 10' x 10' Concrete Box Culverts	1,3,4

\*1-Lidar 2-Costello Survey 3-Online Imagery 4-Field Observation

### 4.1.3 Two-Dimensional Flow Areas

The overbank areas were modeled in the two-dimensional regime. HEC-RAS 2D Areas were delineated and a mesh was defined on 80-foot spacings. Breaklines were established and enforced at high points in the terrain to prevent flow from “leaking” between cells. Table 5 lists the three 2D Areas.

**Table 5: HEC-RAS 2D Areas**

2D Area	Description
East_2d	Area in the east overbank area of Ditch 7 and Ditch 7B
West_2d	Area in the west overbank area of Ditch 7 and Ditch 7A
Middle_2d	Area between Ditch 7A and Ditch 7B

A shapefile representing land use was developed and imported into the HEC-RAS model to establish Manning’s “n” values for the two-dimensional regime. Exhibit 8 displays the land use assignments and the Manning’s “n” values. Table 6 summarizes the Manning’s “n” values used for the two-dimensional area.

**Table 6: Manning’s “n” Values – 2D Areas**

Land Use	Manning’s “n”	HCFC2d Modeling Guidelines (Range/Recommended)
Commercial	0.03	0.02-0.06/0.03 <sup>1</sup>
Grass	0.22	0.15-0.30/0.22 <sup>2</sup>
Industrial	0.03	0.02-0.06/0.03 <sup>1</sup>
Multi-Family	0.06	0.02-0.06/0.03 <sup>1</sup>
Right-of-Way	0.02	0.02-0.06/0.03 <sup>1</sup>
Subdivision	0.16	0.06-0.20/0.16 <sup>3</sup>
Subdivision – Large Lot	0.18	0.06-0.20/0.18 <sup>4</sup>
Woods	0.25	0.18-0.30/0.25 <sup>5</sup>

*HCFC2d Modeling Guidelines Land Categories: 1 – Developed High Intensity, 2 – Pasture/ Grasslands, 3 – Developed Medium Intensity, 4 – Developed Low Intensity, 5 – Forest/Shrubs*

#### 4.1.4 Lateral Weirs

Lateral weirs were utilized to connect the one-dimensional and two-dimensional regimes. There are spoil areas adjacent to the channel banks along much of the channel network, and the lateral weirs were generally aligned with the top of these spoil banks. A weir coefficient of 0.50 was applied for the lateral weirs.

There are two 48” storm pipes that collect runoff in a swale west of Willow Street just south of its intersection with 5<sup>th</sup> Avenue N. These pipes run along the south side of 5<sup>th</sup> Avenue N to Ditch 7B and have been included in the modeling of the lateral weir along the west side of this portion of Ditch 7B.

#### 4.1.5 Willowood Subdivision and Detention Basins

Willowood Subdivision is an ongoing 116-acre development in the center of the watershed located along and between Ditch 7A and Ditch 7B. Four detention basins are proposed – two located along Ditch 7A (Pond 1 and Pond 2), one located along Ditch 7B (Pond 3), and a fourth located west of Willow Street (Pond 4) that will drain under Willow Street into Pond 3. The land use in the hydrology includes the proposed development. Additionally, fill will be placed in the developed areas to raise the lot areas above the 100-year flood levels (the high banks of the detention areas will also be elevated, however the high banks for the two basins in the Ditch 7B will be elevated but not above the 100-year flood elevation.

Details of the Willowood Subdivision and its drainage features are described in a separate report prepared by Burton Johnson Engineering, Inc. entitled *Willowood Subdivision Drainage Impact Analysis, Galveston County Drainage District No. Two, City of Texas City, Texas*. The detention basins were modeled as storage areas. Ponds 1, 2, and 3 were connected to the adjacent streams with lateral structures, while Pond 4 was connected to Pond 3 using a storage area connection. The stage vs. storage relationships for each basin along with the outfall structure are the same as those utilized in the Drainage Impact Analysis.

#### 4.1.6 Boundary Conditions

Boundary Conditions utilized in the HEC-RAS model consist of the hydrographs computed in HEC-HMS and described in Section 3.0 as well as an internal 2D boundary condition upstream of a culvert that drains

areas east of Willow Street to Ditch 7B. In addition, external 2D boundary conditions are defined at the perimeters of portions of the 2D Areas. These external 2D boundary conditions are necessary to manage flow at the perimeter of the 2D flow areas. Without a boundary condition, flow will consider the perimeter of the 2D area as a wall.

The downstream boundary condition for the model is based on normal depth flow. As noted in Section 2.2 of this report, the project area is influenced by coastal elevations in Moses Lake and Galveston Bay. This analysis and subsequent mapping only considers the impact and inundation from riverine flooding resulting from a rainfall event over the area. The analysis and mapping does not consider coastal flooding or a combined probability analysis. While a combined analysis will provide a more accurate depiction of flood risk, the riverine model prepared for this project is more appropriate for evaluating potential impacts from development and formulating riverine floor risk mitigation measures.

The sub-watershed hydrographs were assigned to locations within the HEC-RAS model. Most hydrograph assignments were prorated portions of the sub-watershed. The prorations were determined by identifying subareas of each sub-watershed that define a smaller area to a channel reach or detention basin, and then developing a HEC-HMS model recognizing these subareas. These prorate areas are illustrated in Exhibit 8. The parent sub-watershed TC and R values were applied, however the actual impervious cover was computed for each subarea. The HEC-HMS output includes the total runoff volume for each subarea. The subarea volume was compared to the parent sub-watershed volume to develop the prorate percentage of flow. Table 7 summarizes the determination of the pro-rate percentages for each sub-watershed subarea.

**Table 7: Sub-Watershed Hydrograph Prorata Calculation**

Subwatershed (Parent)			Subwatershed Subarea (Child)					Prorata Volume %
Name	Area (sm)	Volume (ac-ft)	Name	Area (ac)	Area (sm)	% IMP	Volume (ac-ft)	
7A1	0.2178	186.3	7A1_1	69.1	0.1079	42.1%	94.4	50.7%
7A1	0.2178	186.3	7A1_2	33.3	0.0521	7.8%	43.5	23.3%
7A1	0.2178	186.3	7A1_3	37.0	0.0578	9.8%	48.4	26.0%
7A2	0.1089	94.6	7A2_1	18.4	0.0288	1.3%	23.8	25.2%
7A2	0.1089	94.6	7A2_P1	24.9	0.0389	50.6%	34.4	36.4%
7A2	0.1089	94.6	7A2_P2	26.3	0.0412	49.1%	36.4	38.5%
7A3	0.5169	435.8	7A3_1	64.0	0.1000	47.3%	88.1	20.2%
7A3	0.5169	435.8	7A3_2	266.8	0.4169	7.4%	347.7	79.8%
7B1	0.8034	703.6	7B1	514.2	0.8034	42.6%	703.6	100.0%
7B2	0.3797	323.6	7B2_1	177.9	0.2779	29.6%	239.1	73.9%
7B2	0.3797	323.6	7B2_C	62.2	0.0972	37.0%	84.5	26.1%
7B3	0.1178	107.2	7B3_1	13.4	0.0210	6.2%	17.5	16.3%
7B3	0.1178	107.2	7B3_P3	24.7	0.0386	61.8%	34.7	32.4%
7B3	0.1178	107.2	7B3_P4	40.2	0.0628	42.2%	55.0	51.3%
7B4	0.5755	483.9	7B4_1	187.9	0.2936	16.4%	248.0	51.3%
7B4	0.5755	483.9	7B4_2	180.4	0.2819	9.9%	235.9	48.7%
70	0.4989	427.3	70_1	257.3	0.4021	31.2%	346.7	81.1%
70	0.4989	427.3	70_2	62.0	0.0968	6.2%	80.6	18.9%

Table 8 summarizes the internal boundary conditions, which consist of the inflow hydrographs; and Table 9 summarizes the external boundary conditions, which consists of normal depth flow.

**Table 8: Internal Boundary Conditions**

1D/2D	HEC-RAS Location	Type	Sub-watershed	Subarea	% of Subwatershed Hydrograph
<b>Ditch 7A</b>					
1D	10400	Flow Hydrograph	7A1	7A1_1	50.7%
1D	10297 - 8696	Uniform Lateral Inflow	7A1	7A1_2	23.3%
1D	8597	Lateral Inflow	7A1	7A1_3	26.0%
1D	8384 - 6917	Lateral Inflow	7A2	7A2_1	25.2%
1D	Pond 1	Lateral Inflow	7A2	7A2_P1	36.4%
1D	Pond 2	Lateral Inflow	7A2	7A2_P2	38.5%
1D	8531 - 6241	Uniform Lateral Inflow	7A3	7A3_1	20.2%
1D	5317 - 667	Uniform Lateral Inflow	7A3	7A3_2	79.8%
<b>Ditch 7B</b>					
1D	9477	Flow Hydrograph	7B1	7B1	100%
1D	9225 - 7101	Uniform Lateral Inflow	7B2	7B2_1	73.9%
2D	Middle_L1: B20	Lateral Inflow	7B2	7B2_C	26.1%
1D	6446 - 5771	Uniform Lateral Inflow	7B3	7B3_1	16.3%
1D	Pond 3	Lateral Inflow	7B3	7B3_P3	32.4%
1D	Pond 4	Lateral Inflow	7B3	7B3_P4	51.3%
1D	5074 - 3832	Uniform Lateral Inflow	7B4	7B4_1	51.3%
1D	3194 - 499	Uniform Lateral Inflow	7B4	7B4_1	48.7%
<b>Ditch 7</b>					
1D	4313 - 1728	Uniform Lateral Inflow	70	70_1	81.1%
1D	1419 - 528	Uniform Lateral Inflow	70	70_2	18.9%

**Table 8: 2D Boundary Conditions (External)**

1D/2D	HEC-RAS Location	Type	Descriptive Location	Slope (ft/ft)
2D	West_2d: West1	Normal Depth	Northwest Perimeter	0.0005
2D	West_2d: DS_Left	Normal Depth	Left Overbank at Mouth	0.0005
2D	East_2d: East 1	Normal Depth	Southeast Perimeter	0.0005
2D	East_2d: East 2	Normal Depth	East Perimeter	0.0005
2D	East_2d: DS_Right	Normal Depth	Right Overbank	0.0005
1D	Ditch 7: XS 328	Normal Depth	Mouth of Ditch 7	0.0005

## 5.0 Results

The resultant coupled 1d/2d HEC-RAS model was executed using HEC-RAS version 6.3.1. The results are presented in this section.

### 5.1 Inundation

Exhibit 9 depicts the inundation for the 5-year, 10-year, 25-year, 50-year, 100-year, and 500-year events. As the exhibit indicates, the inundation results in large floodplains. There are overflows and out of bank flooding even during the 5-year event. This inundation mapping, as well as the inundations presented in Exhibits 10 and 11 only reflect riverine flood risk and do not incorporate coastal flooding.

Exhibit 10 shows the 100-year inundation shaded by the computed 100-year water surface elevation. The map also includes 100-year elevation lines (similar to Base Flood Elevation lines on a FEMA Flood Insurance Rate Map). Exhibit 11 shows a 100-year depth grid based on the 100-year riverine model.

### 5.2 Computed Water Surface Elevations

Table 9 presents the computed water surface elevations along Ditch 7, Ditch 7A, and Ditch 7B. These elevations are based on a normal depth downstream boundary condition and do not consider the influence of Galveston Bay, which has a 100-year elevation of 5.0.

**Table 9: 1D Computed Water Surface Elevations (Without Galveston Bay Influence)**

Stream	RAS XS	Computed Water Surface Elevation (ft, NAVD 88)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7	328	1.69	2.03	2.37	2.60	2.82	3.33	Moses Lake
Ditch 7	528	1.79	2.12	2.47	2.70	2.92	3.42	
Ditch 7	766	1.97	2.31	2.66	2.89	3.11	3.63	
Ditch 7	1030	2.03	2.36	2.71	2.95	3.17	3.68	
Ditch 7	1272	2.04	2.37	2.71	2.95	3.16	3.66	
Ditch 7	1419	2.18	2.50	2.84	3.07	3.29	3.80	
Ditch 7	1543	2.14	2.46	2.79	3.01	3.21	3.72	
Ditch 7	1639	2.60	3.00	3.46	3.81	4.18	4.99	Loop 197 North
Ditch 7	1728	2.66	3.08	3.54	3.91	4.30	5.11	
Ditch 7	1985	2.83	3.24	3.71	4.07	4.45	5.23	
Ditch 7	2269	3.01	3.41	3.86	4.22	4.59	5.36	
Ditch 7	2578	3.25	3.63	4.06	4.40	4.76	5.51	
Ditch 7	2795	3.43	3.82	4.25	4.58	4.93	5.66	
Ditch 7	2861	3.45	3.84	4.27	4.61	4.95	5.69	SH 146 NB Access Rd
Ditch 7	2913	3.46	3.85	4.28	4.61	4.96	5.70	
Ditch 7	3041	3.49	3.88	4.31	4.64	4.99	5.72	SH 146 Mainlanes
Ditch 7	3090	3.50	3.89	4.31	4.65	5.00	5.73	
Ditch 7	3163	3.51	3.90	4.32	4.66	5.01	5.74	SH 146 SB Access Rd
Ditch 7	3247	3.51	3.90	4.32	4.66	5.01	5.74	
Ditch 7	3834	3.64	4.03	4.45	4.79	5.13	5.86	
Ditch 7	4025	3.73	4.11	4.53	4.87	5.20	5.92	
Ditch 7	4219	3.79	4.17	4.59	4.92	5.25	5.94	
Ditch 7	4232	3.80	4.17	4.59	4.92	5.25	5.94	
Ditch 7	4313	3.88	4.28	4.74	5.11	5.47	6.21	Union Pacific RR
Ditch 7	4328	3.89	4.29	4.76	5.13	5.49	6.23	
Ditch 7A	10	3.89	4.29	4.76	5.13	5.49	6.23	Confluence Ditch 7
Ditch 7A	667	4.11	4.49	4.89	5.23	5.56	6.28	

**Table 9: 1D Computed Water Surface Elevations (Without Galveston Bay Influence)**

Stream	RAS XS	Computed Water Surface Elevation (ft, NAVD 88)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7A	1397	4.31	4.67	5.06	5.36	5.68	6.37	
Ditch 7A	2061	4.48	4.82	5.19	5.47	5.77	6.44	
Ditch 7A	2858	4.71	5.03	5.38	5.63	5.89	6.54	
Ditch 7A	3161	4.81	5.12	5.45	5.69	5.94	6.57	
Ditch 7A	3360	5.81	6.15	6.51	6.75	6.96	7.59	GCWA Canal
Ditch 7A	3428	5.84	6.17	6.53	6.76	6.97	7.59	
Ditch 7A	3645	5.87	6.20	6.55	6.78	6.99	7.60	
Ditch 7A	3746	5.88	6.21	6.56	6.79	6.99	7.61	
Ditch 7A	3801	6.56	6.75	6.94	7.07	7.20	7.68	Unnamed Crossing
Ditch 7A	3879	6.56	6.75	6.93	7.07	7.20	7.68	
Ditch 7A	4523	6.60	6.79	6.97	7.10	7.23	7.72	
Ditch 7A	5245	6.64	6.82	7.01	7.15	7.28	7.79	
Ditch 7A	5313	6.64	6.83	7.01	7.15	7.29	7.79	
Ditch 7A	5351	6.64	6.83	7.01	7.15	7.29	7.80	
Ditch 7A	5765	6.77	6.97	7.15	7.27	7.40	7.86	FM 1764
Ditch 7A	5994	6.79	6.99	7.18	7.31	7.44	7.88	
Ditch 7A	6241	6.84	7.06	7.27	7.41	7.56	8.01	
Ditch 7A	6531	6.88	7.13	7.38	7.53	7.71	8.19	
Ditch 7A	6917	6.92	7.18	7.46	7.62	7.80	8.30	
Ditch 7A	7417	7.09	7.40	7.70	7.88	8.06	8.56	
Ditch 7A	7879	7.17	7.50	7.81	7.99	8.17	8.66	
Ditch 7A	7920	7.19	7.52	7.84	8.01	8.19	8.68	
Ditch 7A	7968	8.14	8.75	9.13	9.31	9.45	9.77	Unnamed Crossing
Ditch 7A	8024	8.15	8.76	9.13	9.30	9.44	9.77	
Ditch 7A	8187	8.16	8.78	9.15	9.32	9.45	9.76	
Ditch 7A	8384	8.20	8.82	9.22	9.40	9.54	9.87	
Ditch 7A	8597	8.24	8.87	9.28	9.47	9.63	9.97	
Ditch 7A	8696	8.25	8.88	9.29	9.48	9.64	9.98	
Ditch 7A	8878	8.27	8.90	9.31	9.51	9.67	10.01	
Ditch 7A	9071	8.29	8.92	9.35	9.55	9.71	10.07	
Ditch 7A	9304	8.33	8.96	9.39	9.60	9.78	10.16	
Ditch 7A	9540	8.54	9.18	9.66	9.91	10.15	10.66	
Ditch 7A	9731	8.56	9.20	9.68	9.95	10.19	10.71	
Ditch 7A	10029	8.62	9.25	9.75	10.02	10.27	10.82	
Ditch 7A	10297	8.71	9.33	9.83	10.12	10.38	10.95	
Ditch 7A	10332	8.71	9.33	9.83	10.10	10.37	10.93	
Ditch 7A	10396	9.88	10.48	11.34	12.05	13.00	118.95	Oak St
Ditch 7A	10400	9.88	10.48	11.34	12.05	13.00	118.95	Study Limit
Ditch 7B	109	3.89	4.29	4.76	5.13	5.49	6.23	Confluence Ditch 7
Ditch 7B	499	4.05	4.45	4.92	5.29	5.65	6.35	
Ditch 7B	1230	4.22	4.61	5.09	5.45	5.81	6.48	
Ditch 7B	1784	4.31	4.71	5.19	5.55	5.90	6.56	
Ditch 7B	2517	4.46	4.86	5.36	5.72	6.06	6.71	
Ditch 7B	3194	4.58	4.97	5.48	5.84	6.16	6.79	
Ditch 7B	3354	4.60	4.99	5.51	5.88	6.20	6.83	
Ditch 7B	3441	4.63	5.04	5.58	5.97	6.31	7.01	FM 1764 WB Access Rd
Ditch 7B	3494	4.64	5.04	5.59	5.97	6.32	7.03	
Ditch 7B	3638	4.66	5.07	5.62	6.02	6.37	7.09	FM 1764 Mainlanes
Ditch 7B	3671	4.66	5.07	5.62	6.02	6.37	7.09	
Ditch 7B	3760	4.69	5.11	5.68	6.10	6.47	7.26	FM 1764 EB Access Rd
Ditch 7B	3832	4.70	5.11	5.68	6.10	6.47	7.25	
Ditch 7B	4292	4.74	5.15	5.75	6.19	6.58	7.42	

**Table 9: 1D Computed Water Surface Elevations (Without Galveston Bay Influence)**

Stream	RAS XS	Computed Water Surface Elevation (ft, NAVD 88)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7B	4354	4.74	5.16	5.75	6.19	6.58	7.42	
Ditch 7B	4426	4.75	5.16	5.75	6.19	6.59	7.42	
Ditch 7B	4555	4.76	5.18	5.77	6.20	6.60	7.44	
Ditch 7B	4729	4.79	5.21	5.79	6.23	6.63	7.46	
Ditch 7B	4932	4.83	5.25	5.82	6.25	6.64	7.47	
Ditch 7B	5074	4.84	5.26	5.82	6.25	6.64	7.47	
Ditch 7B	5292	4.89	5.31	5.85	6.26	6.65	7.46	
Ditch 7B	5468	5.12	5.59	6.12	6.47	6.81	7.57	N. Pine Rd
Ditch 7B	5771	5.13	5.61	6.15	6.49	6.84	7.58	
Ditch 7B	6446	5.25	5.72	6.26	6.55	6.87	7.59	
Ditch 7B	6730	5.31	5.77	6.27	6.53	6.85	7.58	
Ditch 7B	6867	5.54	6.07	6.59	6.85	7.15	7.83	5th Ave North
Ditch 7B	7101	5.60	6.13	6.65	6.91	7.22	7.91	
Ditch 7B	7892	5.81	6.33	6.86	7.15	7.48	8.14	
Ditch 7B	8213	5.89	6.40	6.92	7.21	7.53	8.17	
Ditch 7B	8699	6.15	6.68	7.23	7.56	7.88	8.55	
Ditch 7B	9084	6.53	7.12	7.75	8.14	8.49	9.21	
Ditch 7B	9225	6.57	7.17	7.80	8.20	8.54	9.24	
Ditch 7B	9346	6.62	7.22	7.87	8.28	8.63	9.35	
Ditch 7B	9469	6.58	7.22	7.95	8.45	8.93	10.13	Oak St
Ditch 7B	9477	6.57	7.20	7.92	8.41	8.88	10.06	Study Limit

### 5.3 Peak Flowrates and Hydrographs

Table 10 presents the computed peak flowrates along the one-dimensional reaches. These flowrates only consider the flow in the one-dimensional regime. Flow in the floodplain that is modeled in the two-dimensional regime are not considered.

**Table 10: 1D Peak Flowrates**

Stream	RAS XS	Peak Flowrate (cfs)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7	1,189	1,248	1,409	1,594	1,728	1,856	2,180	Moses Lake
Ditch 7	1,198	1,250	1,412	1,594	1,731	1,864	2,195	
Ditch 7	1,183	1,233	1,390	1,567	1,698	1,826	2,146	
Ditch 7	1,168	1,223	1,378	1,551	1,693	1,820	2,146	
Ditch 7	1,154	1,213	1,361	1,524	1,656	1,793	2,074	
Ditch 7	1,144	1,206	1,355	1,526	1,665	1,809	2,075	
Ditch 7	1,139	1,204	1,353	1,526	1,662	1,811	2,026	
Ditch 7	1,139	1,204	1,353	1,527	1,662	1,813	2,026	Loop 197 North
Ditch 7	1,133	1,203	1,348	1,514	1,638	1,772	1,978	
Ditch 7	1,124	1,184	1,320	1,461	1,577	1,684	1,944	
Ditch 7	1,114	1,162	1,293	1,427	1,538	1,636	1,876	
Ditch 7	1,102	1,137	1,263	1,396	1,508	1,608	1,838	
Ditch 7	1,094	1,119	1,244	1,388	1,514	1,638	1,923	
Ditch 7	1,094	1,119	1,244	1,388	1,514	1,641	1,923	SH 146 NB Access Rd
Ditch 7	1,096	1,116	1,240	1,385	1,515	1,636	1,909	
Ditch 7	1,096	1,116	1,240	1,385	1,515	1,636	1,909	SH 146 Mainlanes
Ditch 7	1,094	1,109	1,231	1,373	1,502	1,625	1,905	
Ditch 7	1,094	1,109	1,231	1,373	1,502	1,625	1,905	SH 146 SB Access Rd
Ditch 7	1,090	1,104	1,226	1,366	1,495	1,612	1,870	

**Table 10: 1D Peak Flowrates**

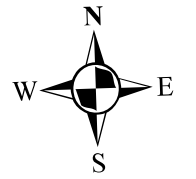
Stream	RAS XS	Peak Flowrate (cfs)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7	1,067	1,056	1,163	1,287	1,394	1,489	1,581	
Ditch 7	1,059	1,040	1,146	1,266	1,377	1,473	1,575	
Ditch 7	1,074	1,024	1,127	1,246	1,371	1,495	1,661	
Ditch 7	1,073	1,023	1,126	1,242	1,365	1,487	1,649	
Ditch 7	1,073	1,023	1,127	1,244	1,370	1,487	1,651	Union Pacific RR
Ditch 7	1,074	1,023	1,128	1,248	1,376	1,493	1,664	
Ditch 7A	263	271	298	304	309	301	370	Confluence Ditch 7
Ditch 7A	262	271	300	327	319	336	385	
Ditch 7A	240	241	265	287	285	290	299	
Ditch 7A	220	214	231	246	253	255	295	
Ditch 7A	197	182	190	197	200	195	210	
Ditch 7A	188	170	174	177	177	172	168	
Ditch 7A	188	170	175	177	178	175	177	GCWA Canal
Ditch 7A	185	167	171	175	178	180	212	
Ditch 7A	177	155	154	153	153	157	196	
Ditch 7A	161	132	120	109	107	114	170	
Ditch 7A	161	132	121	109	108	115	171	Unnamed Crossing
Ditch 7A	188	160	158	155	159	169	226	
Ditch 7A	170	143	153	170	192	219	325	
Ditch 7A	167	131	162	190	224	252	292	
Ditch 7A	170	134	168	201	240	273	322	
Ditch 7A	181	148	191	225	266	304	357	
Ditch 7A	181	149	191	242	269	308	364	FM 1764
Ditch 7A	191	158	212	283	317	370	468	
Ditch 7A	186	158	213	285	323	372	480	
Ditch 7A	180	112	153	208	233	265	341	
Ditch 7A	172	128	164	201	220	236	281	
Ditch 7A	151	124	159	181	195	206	240	
Ditch 7A	142	123	161	192	210	223	268	
Ditch 7A	142	123	158	185	201	214	249	
Ditch 7A	142	126	162	190	206	219	251	Unnamed Crossing
Ditch 7A	148	127	177	221	247	265	292	
Ditch 7A	138	131	174	232	265	293	353	
Ditch 7A	130	132	174	231	268	302	363	
Ditch 7A	149	98	129	172	200	228	275	
Ditch 7A	147	97	130	172	200	229	294	
Ditch 7A	118	95	128	171	203	238	318	
Ditch 7A	110	94	125	168	201	238	327	
Ditch 7A	105	91	122	164	198	233	323	
Ditch 7A	80	76	102	139	165	196	272	
Ditch 7A	76	75	99	135	161	190	269	
Ditch 7A	70	72	95	129	154	182	258	
Ditch 7A	64	70	92	124	148	174	247	
Ditch 7A	64	70	92	124	148	174	247	
Ditch 7A	64	79	97	126	149	175	247	Oak St
Ditch 7A	64	79	97	126	149	175	247	Study Limit
Ditch 7B	927	700	774	898	980	1,068	1,140	Confluence Ditch 7
Ditch 7B	924	700	775	901	967	1,043	1,092	
Ditch 7B	896	670	742	873	931	982	1,098	
Ditch 7B	881	646	721	873	958	999	1,130	
Ditch 7B	836	614	682	814	901	942	1,062	
Ditch 7B	863	595	674	862	1,027	1,144	1,521	

**Table 10: 1D Peak Flowrates**

Stream	RAS XS	Peak Flowrate (cfs)						Note
		5-Yr	10-Yr	25-Yr	50-YR	100-Yr	500-Yr	
Ditch 7B	862	596	675	862	1,031	1,167	1,541	
Ditch 7B	862	596	675	863	1,038	1,206	1,586	FM 1764 WB Access Rd
Ditch 7B	864	597	676	863	1,039	1,208	1,587	
Ditch 7B	864	597	676	864	1,042	1,213	1,596	FM 1764 Mainlanes
Ditch 7B	866	598	676	864	1,043	1,214	1,613	
Ditch 7B	866	598	676	864	1,045	1,222	1,636	FM 1764 EB Access Rd
Ditch 7B	906	613	703	872	1,068	1,256	1,675	
Ditch 7B	864	562	639	664	713	773	843	
Ditch 7B	844	558	647	662	710	761	818	
Ditch 7B	868	570	664	689	740	800	868	
Ditch 7B	853	562	663	649	678	724	765	
Ditch 7B	837	546	644	612	605	620	619	
Ditch 7B	816	524	619	589	553	529	475	
Ditch 7B	826	526	627	610	578	554	523	
Ditch 7B	827	536	648	682	660	659	718	
Ditch 7B	827	544	651	783	732	705	740	N. Pine Rd
Ditch 7B	1,011	639	692	785	637	583	633	
Ditch 7B	987	657	729	744	726	795	1,033	
Ditch 7B	975	663	731	913	957	1,053	1,267	
Ditch 7B	975	685	783	932	1,050	1,168	1,334	5th Ave North
Ditch 7B	962	690	783	939	1,065	1,181	1,361	
Ditch 7B	924	669	771	926	1,055	1,174	1,427	
Ditch 7B	977	613	753	924	1,054	1,172	1,466	
Ditch 7B	975	601	744	922	1,065	1,187	1,494	
Ditch 7B	904	550	684	876	1,038	1,186	1,582	
Ditch 7B	891	542	673	864	1,026	1,202	1,676	
Ditch 7B	891	543	674	866	1,030	1,208	1,735	
Ditch 7B	891	542	674	869	1,032	1,214	1,744	Oak St
Ditch 7B	891	542	674	868	1,032	1,215	1,744	Study Limit

Exhibit 11 shows Hydrograph Computation lines that represent hydrographs computed across Profile Lines in RAS Mapper. Four Hydrograph Computation Lines are identified along both Ditch 7A and Ditch 7B, and three Hydrograph Computation Lines are identified along Ditch 7. Exhibit 12 shows the hydrographs computed across the Hydrograph Computation Lines for the 5-year, 10-year, 25-year, 100-year, and 500-year events.



# Exhibits

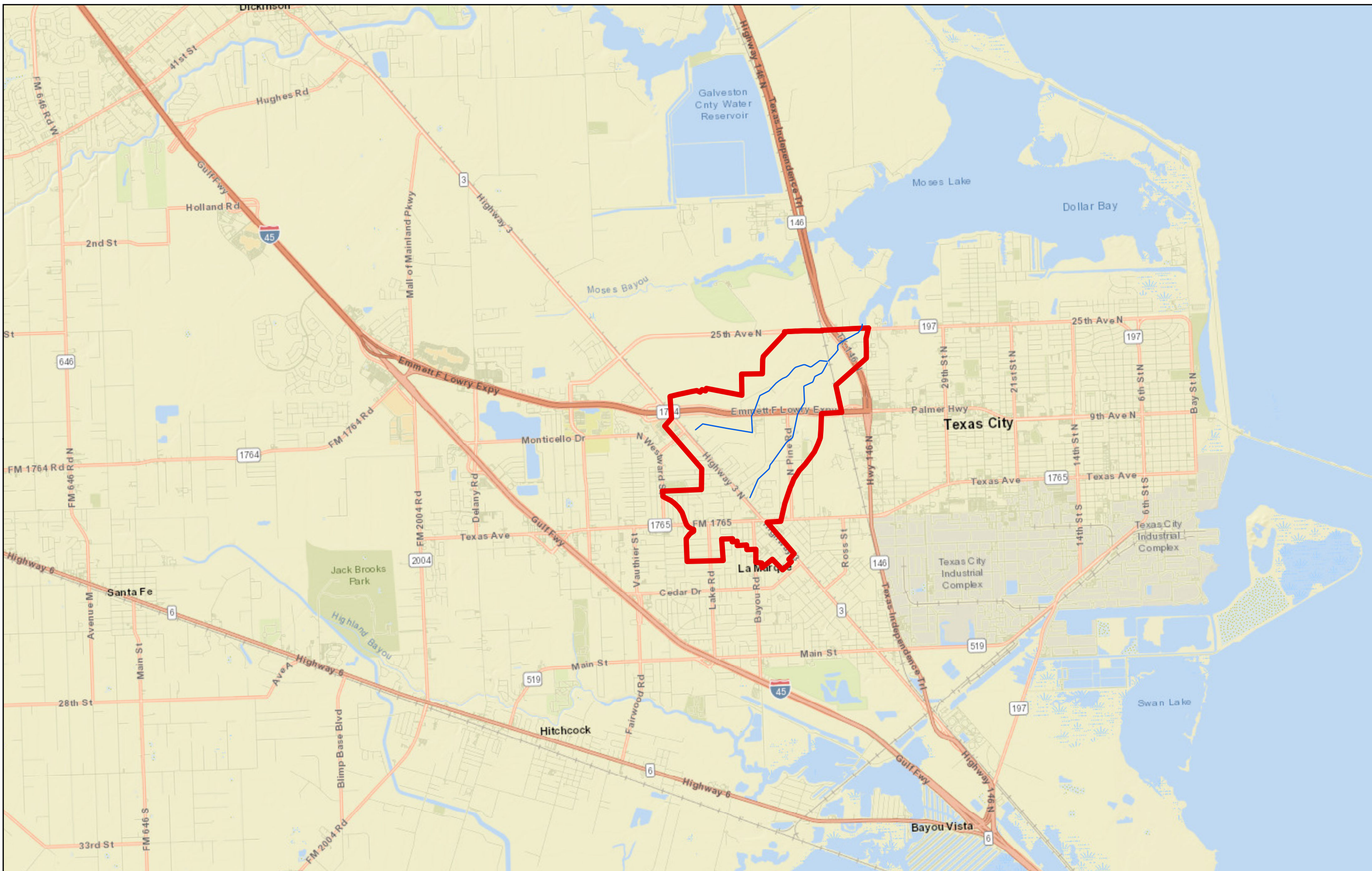


0 0.5 1 Miles

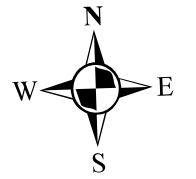
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

-  Ditch 7 Channels
-  Ditch 7 Watershed



# Exhibit 1 - Location Map



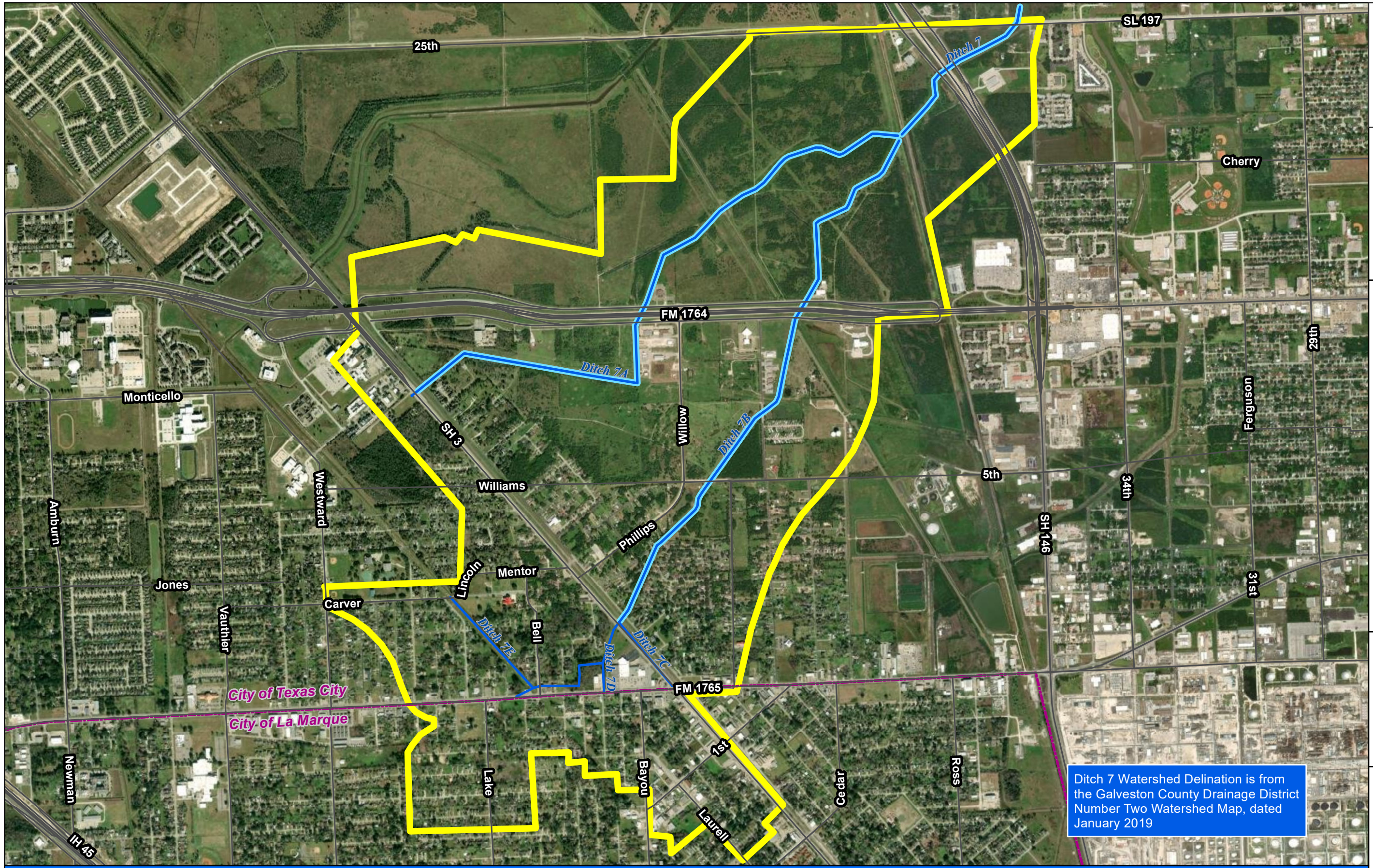
0 750 1,500 Feet

**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

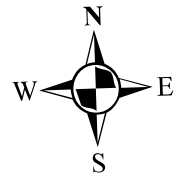
**Floodplain  
Modeling &  
Mapping**

- Roads
- Ditch 7 Channels
- Studied Channels
- City Limits
- Ditch 7 Watershed

Ditch 7 Watershed Delineation is from the Galveston County Drainage District Number Two Watershed Map, dated January 2019



# Exhibit 2 - Ditch 7 Watershed



0 1,000 2,000 Feet

**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

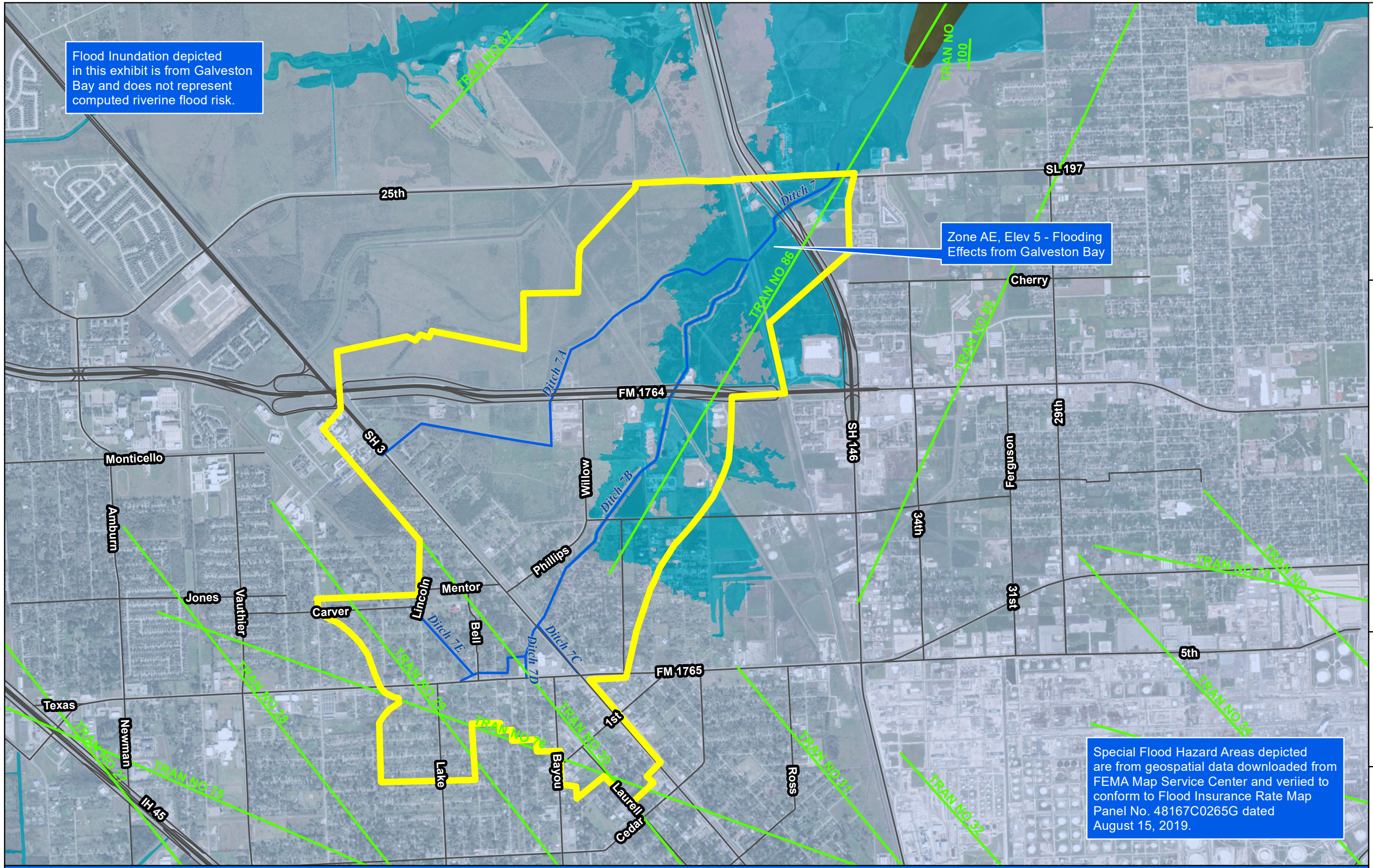
**Floodplain  
Modeling &  
Mapping**

- Ditch 7 Watershed
- S\_CST\_TSCT\_LN
- Roads
- Ditch 7 Channels
- Zone AE (1%)
- Shaded Zone X (0.2%)

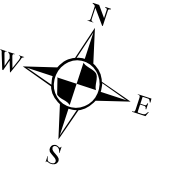
Flood Inundation depicted in this exhibit is from Galveston Bay and does not represent computed riverine flood risk.

Zone AE, Elev 5 - Flooding Effects from Galveston Bay

Special Flood Hazard Areas depicted are from geospatial data downloaded from FEMA Map Service Center and verified to conform to Flood Insurance Rate Map Panel No. 48167C0265G dated August 15, 2019.



# Exhibit 3 - FEMA Special Flood Hazard Areas



0 500 1,000 Feet

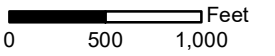
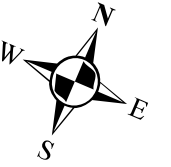
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

- Survey Sections
- Survey Points
- Roads
- Study Channels



**Exhibit 4 - Bathymetry and Survey**



**DITCH 7 WATERSHED STUDY  
(DITCH 7, DITCH 7A, DITCH 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

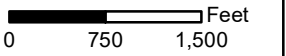
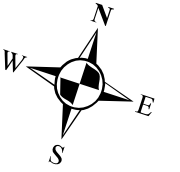
- Study Channels
- Elevation Contour
- Ditch 7 Watershed
- Roads

**DEM**

- Elevation**
- High : 40
  - Low : -10



**Exhibit 5 - Topography and Digital Elevation Model**

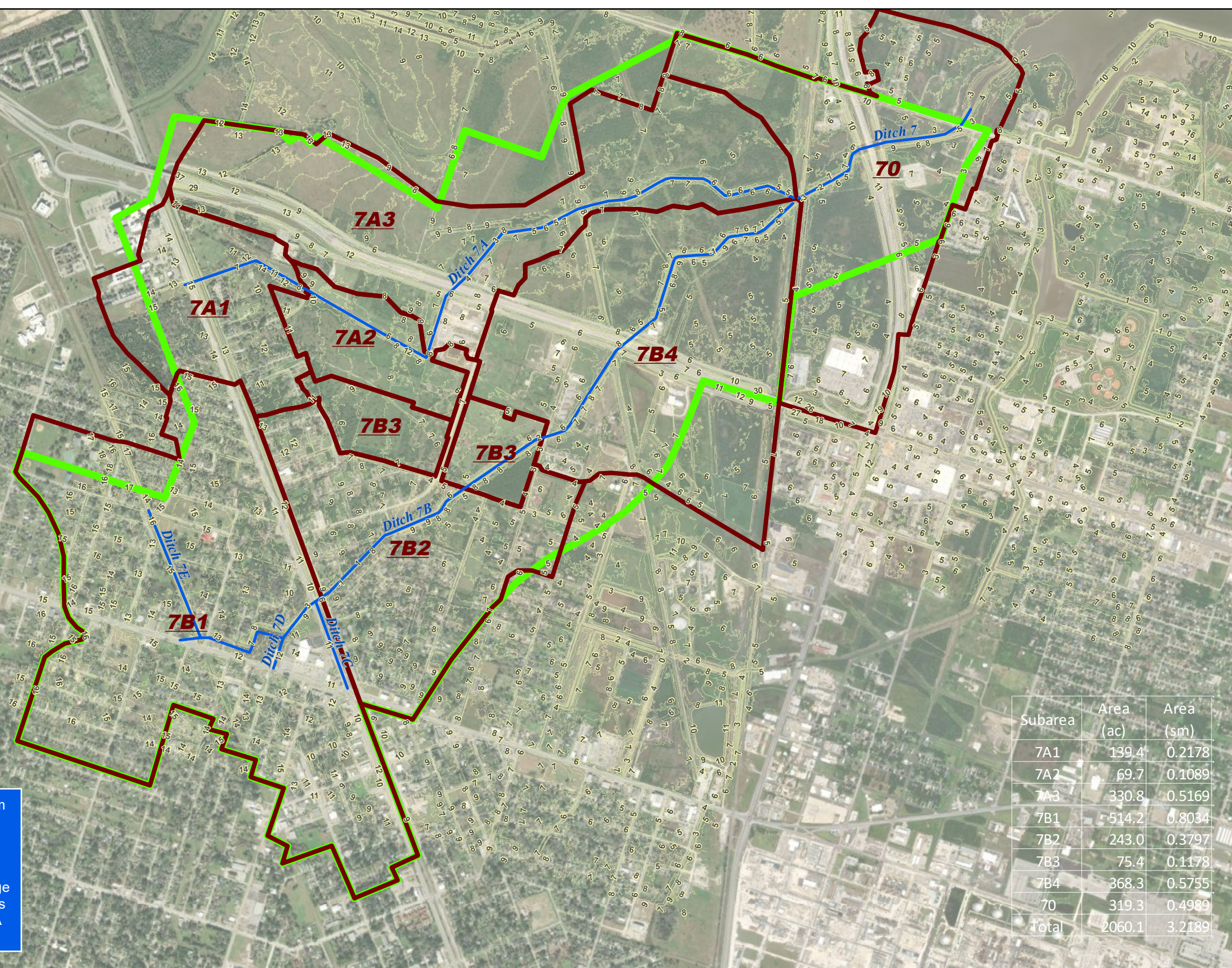


**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

Subarea	Area (ac)	Area (sm)
7A1	139.4	0.2178
7A2	69.7	0.1089
7A3	330.8	0.5169
7B1	514.2	0.8034
7B2	243.0	0.3797
7B3	75.4	0.1178
7B4	368.3	0.5755
70	319.3	0.4989
Total	2060.1	3.2189

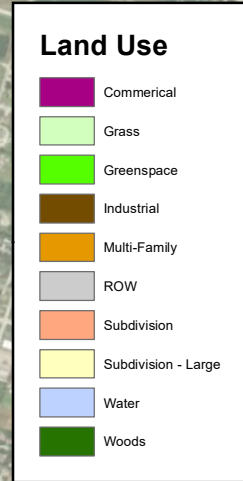
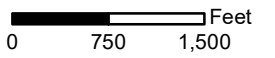
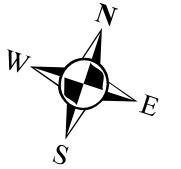
- Ditch 7 Channels
- Computed Drainage Area
- GCDD No. 2 Drainage Area
- Elevation Contour



GCDD No. 2 Drainage Areas are from the District's Watershed Map, dated January, 2019.

Computed Drainage Areas are from evaluation of topography and drainage infrastructure. The determination was coordinated with and assisted by LJA Engineering.

# Exhibit 6 - Subarea Map



Land Use Map considers the completed construction of the Willowood Subdivision, a proposed 116-Ac subdivision with four detention basins being planned at the time of this study.

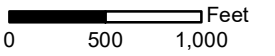
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

Subarea	(acres)	(sm)	% Imp	HCFCD Site Runoff Curves					Clark Unit Hydrograph		EC-HMS Computed Peak Flowrate (cfs)					
				b10	b100	m	10-Yr (cfs)	100-Yr (cfs)	TC (hr)	R (hr)	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	500-Yr
7A1	199.4	0.2178	25.4%	4.03	7.18	0.786	195.2	346.1	2.50	2.186	155.1	192.3	247.6	293.8	346.1	495.1
7A2	69.7	0.1089	37.0%	4.96	8.54	0.786	139.3	239.9	0.47	1.416	119.0	143.6	179.2	208.0	239.9	330.9
7A3	330.8	0.5169	15.2%	3.51	6.02	0.786	316.3	575.0	3.03	4.277	242.2	305.8	401.8	482.6	575.0	842.1
7B1	514.7	0.8134	42.6%	5.28	9.01	0.786	713.8	1218.7	2.43	2.470	547.3	677.5	871.9	1034.4	1218.8	1745.6
7B2	243.0	0.3797	31.6%	4.53	7.90	0.786	339.9	592.4	1.57	2.514	270.9	333.9	427.5	504.7	592.4	844.3
7B3	75	0.1178	42.5%	3.27	5.99	0.786	157.4	268.9	0.95	1.240	133.3	160.9	200.7	233.1	268.9	371.8
7B4	368.3	0.5755	13.2%	3.19	5.82	0.786	332.2	605.7	3.31	4.600	252.2	319.5	421.3	507.3	605.7	890.7
70	315.3	0.4989	26.3%	4.11	7.28	0.786	381.6	674.7	2.17	3.153	297.5	370.6	479.9	571.0	674.7	973.2
<b>Total</b>	<b>2060.1</b>	<b>3.2189</b>	<b>27.7%</b>													

- Longest Flowpath
- Ditch 7 Channels
- Subwatershed Areas

# Exhibit 7 - Hydrology



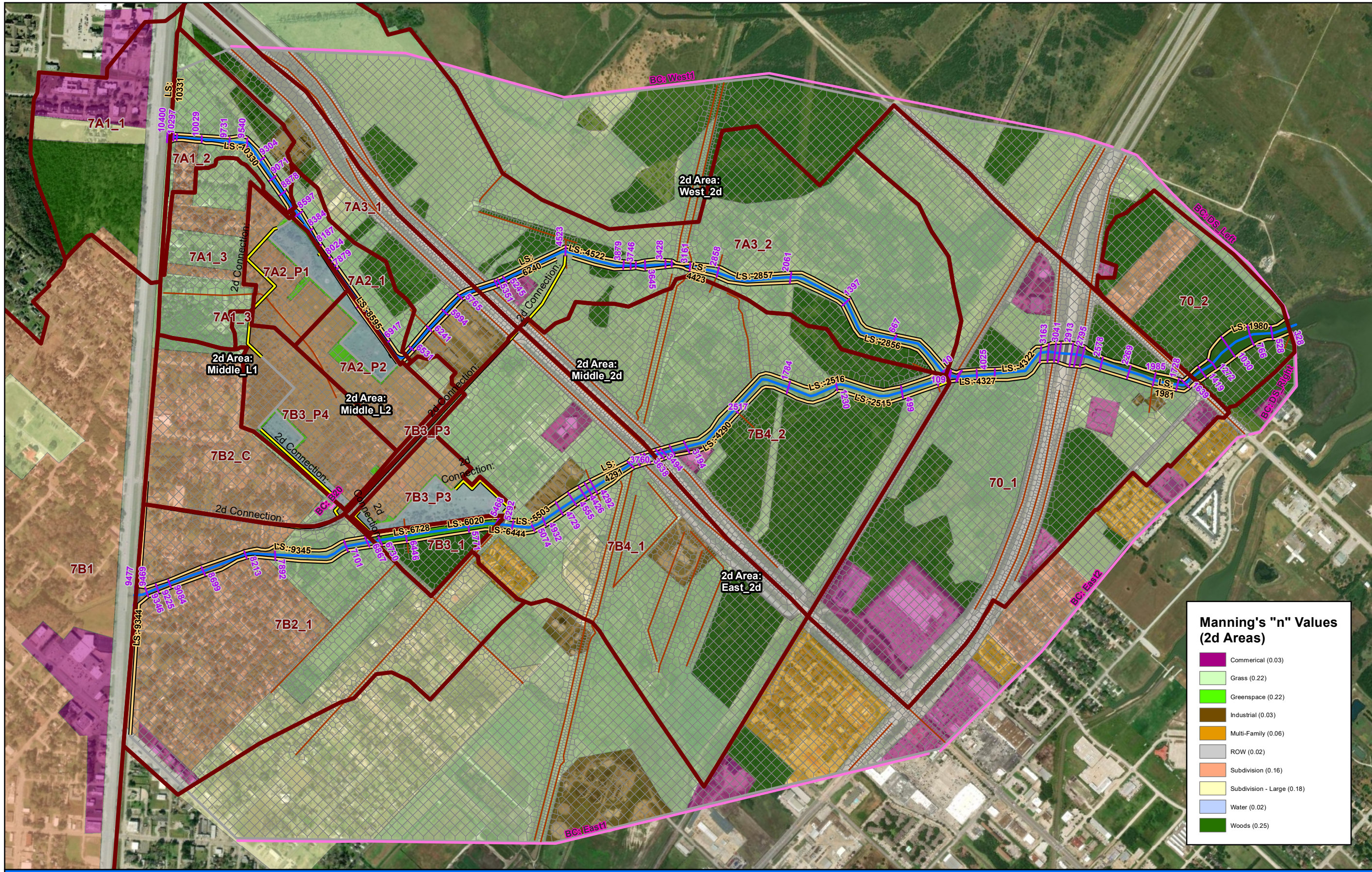
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

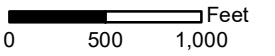
**Manning's "n" Values  
(2d Areas)**

	Commercial (0.03)
	Grass (0.22)
	Greenspace (0.22)
	Industrial (0.03)
	Multi-Family (0.06)
	ROW (0.02)
	Subdivision (0.16)
	Subdivision - Large (0.18)
	Water (0.02)
	Woods (0.25)

	Subwatershed Subarea
	XS
	Lateral Structure
	Channel
	Bridge/Culvert
	2d Boundary Condition
	2d Connection
	Breaklines
	2d Area Boundary
	2d Cells



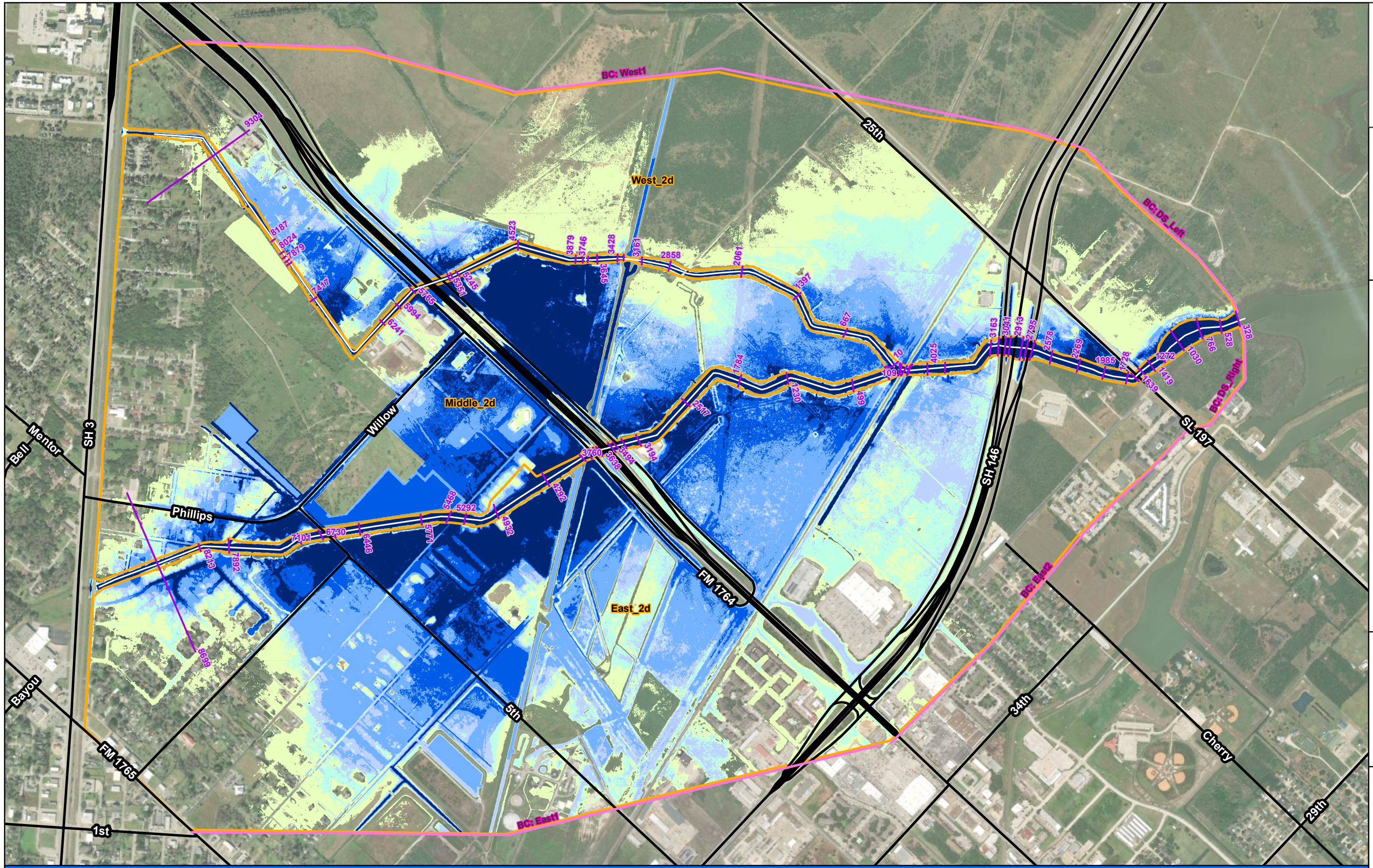
**Exhibit 8 - 1d/2d HEC-RAS Model**



**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

- XS
- Channel
- 2d Boundary Condition
- Roads
- 2d\_Area
- 5-Yr Inundation
- 10-Yr Inundation
- 25-Yr Inundation
- 50-Yr Inundation
- 100-Yr Inundation
- 500-Yr Inundation



**Exhibit 9 - Inundation Map**

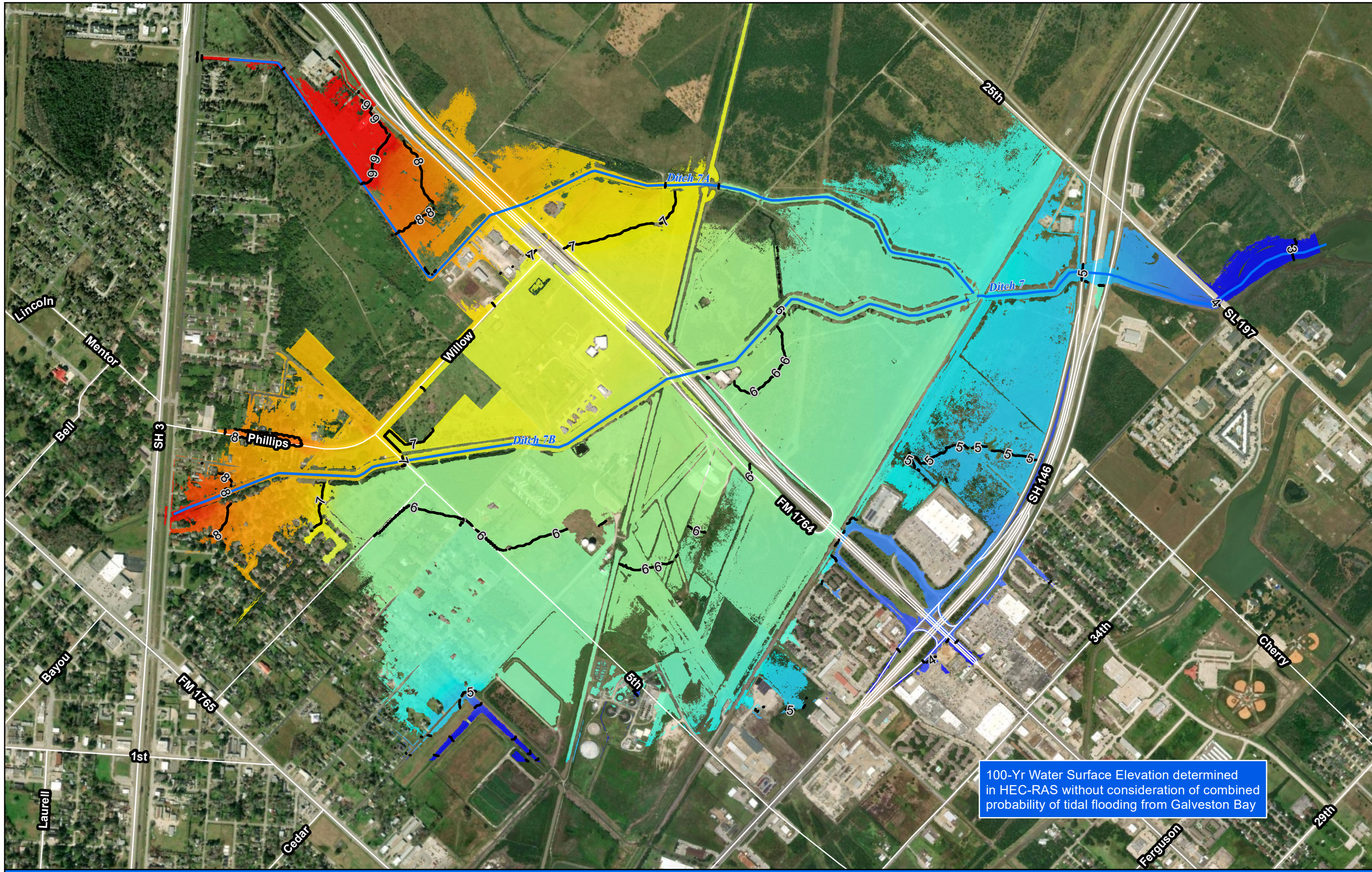


0 500 1,000 Feet

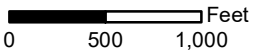
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

- 100-Yr Flood Elev Line
- Channel
- 100-Yr Flood Elev (ft)**  
  
High : 13.0  
Low : 0.0



**Exhibit 10 - 100-Yr Water Surface Elevations**

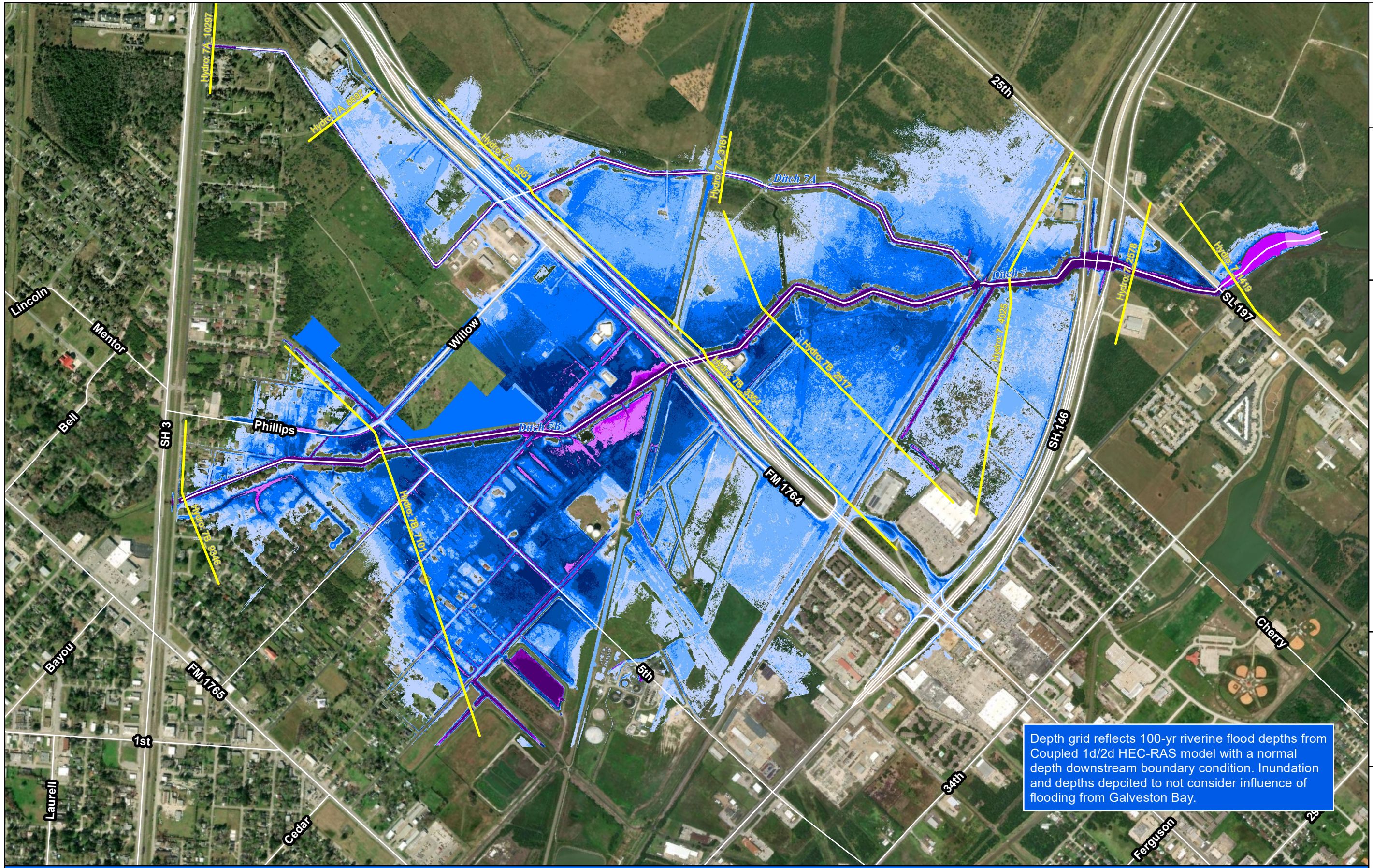


**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

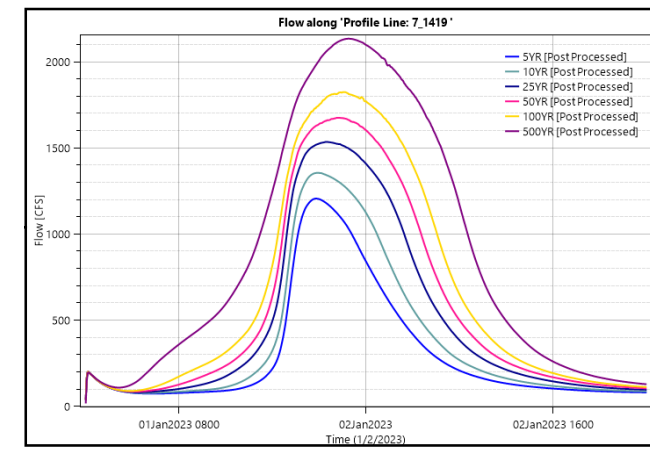
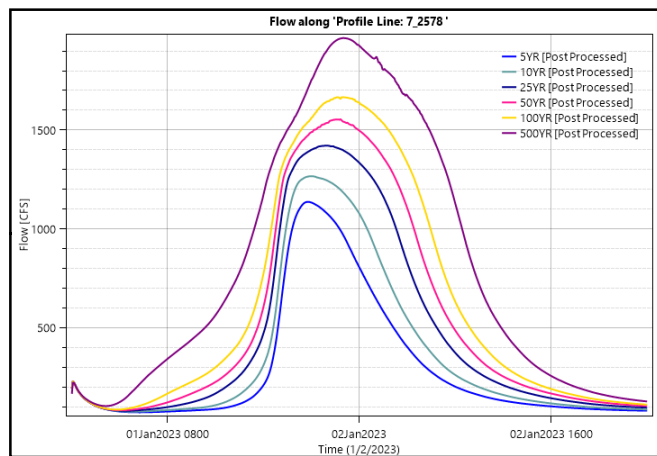
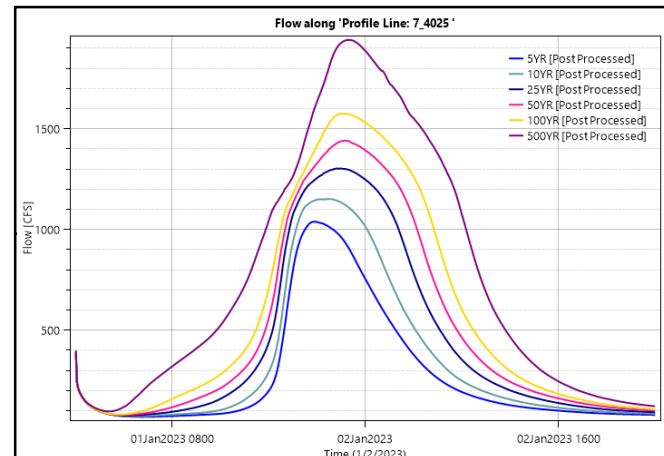
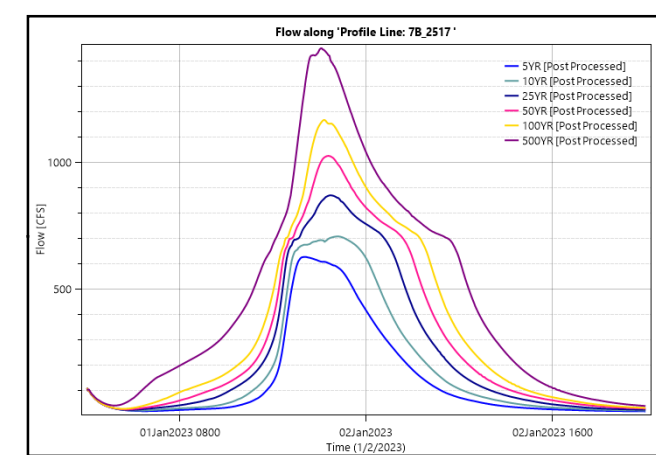
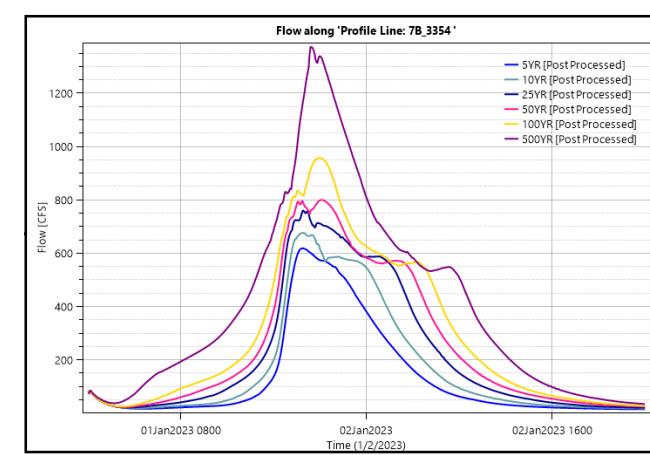
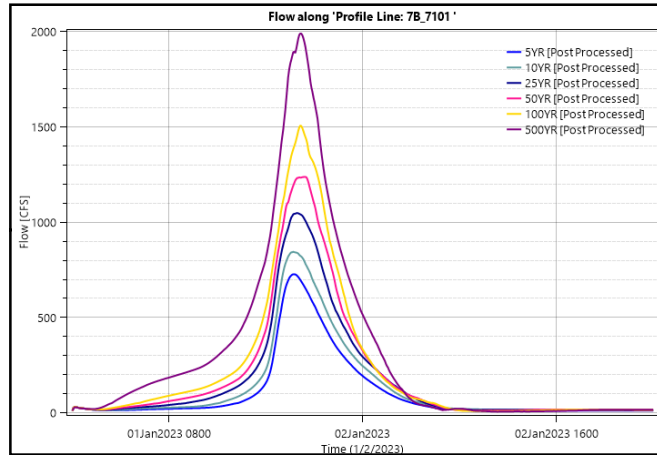
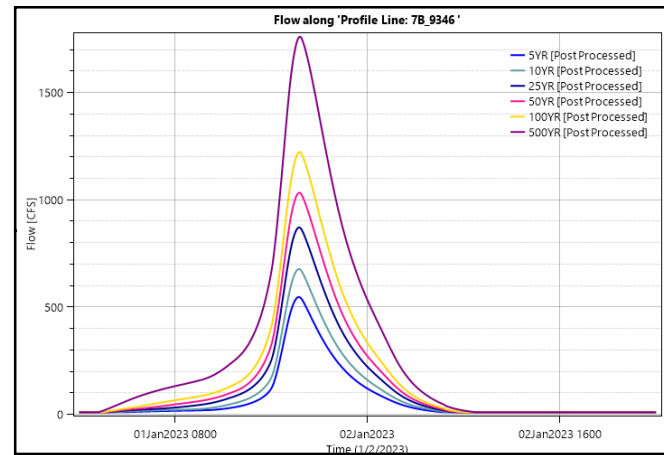
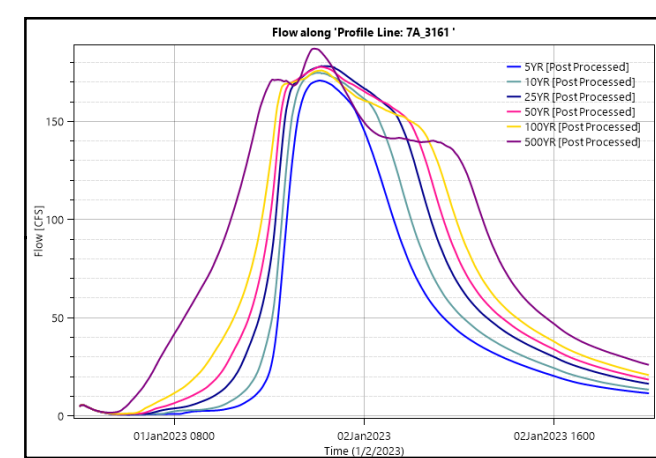
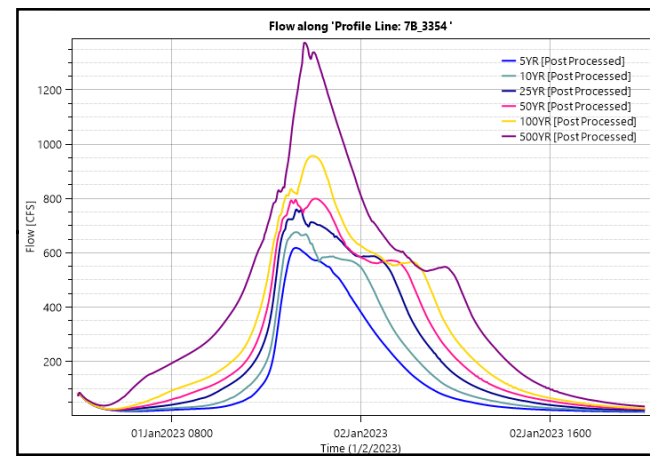
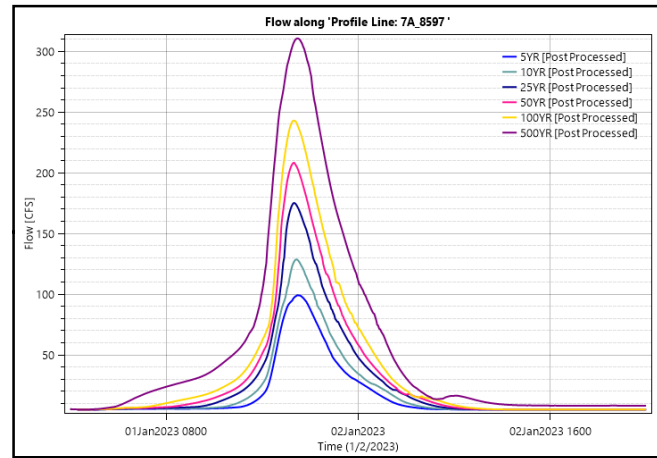
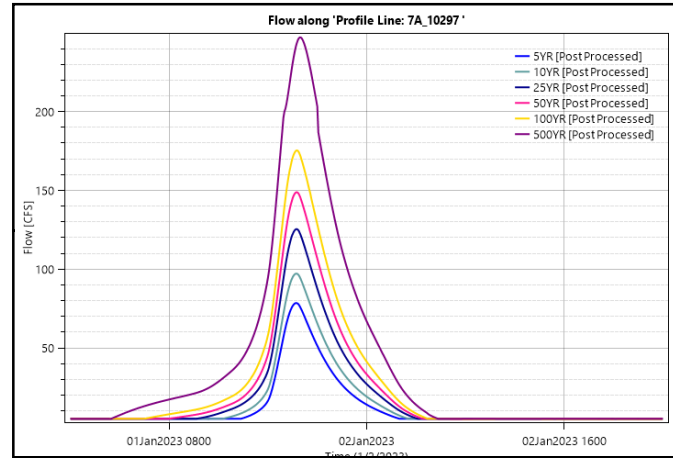
**Floodplain  
Mapping &  
Modeling**

Depth grid reflects 100-yr riverine flood depths from Coupled 1d/2d HEC-RAS model with a normal depth downstream boundary condition. Inundation and depths depicted to not consider influence of flooding from Galveston Bay.

- Hydrograph Lines
- Channel
- 100-Yr Depth**
- 0.0' - 0.5'
- 0.5' - 1.0'
- 1.0' - 1.5'
- 1.5' - 2.0'
- 2.0' - 2.5'
- 2.5' - 3.0'
- 3.0' - 3.5'
- 3.5' - 4.0'
- >4.0'



**Exhibit 11 - 100-Yr Depth & Hydrograph Lines**



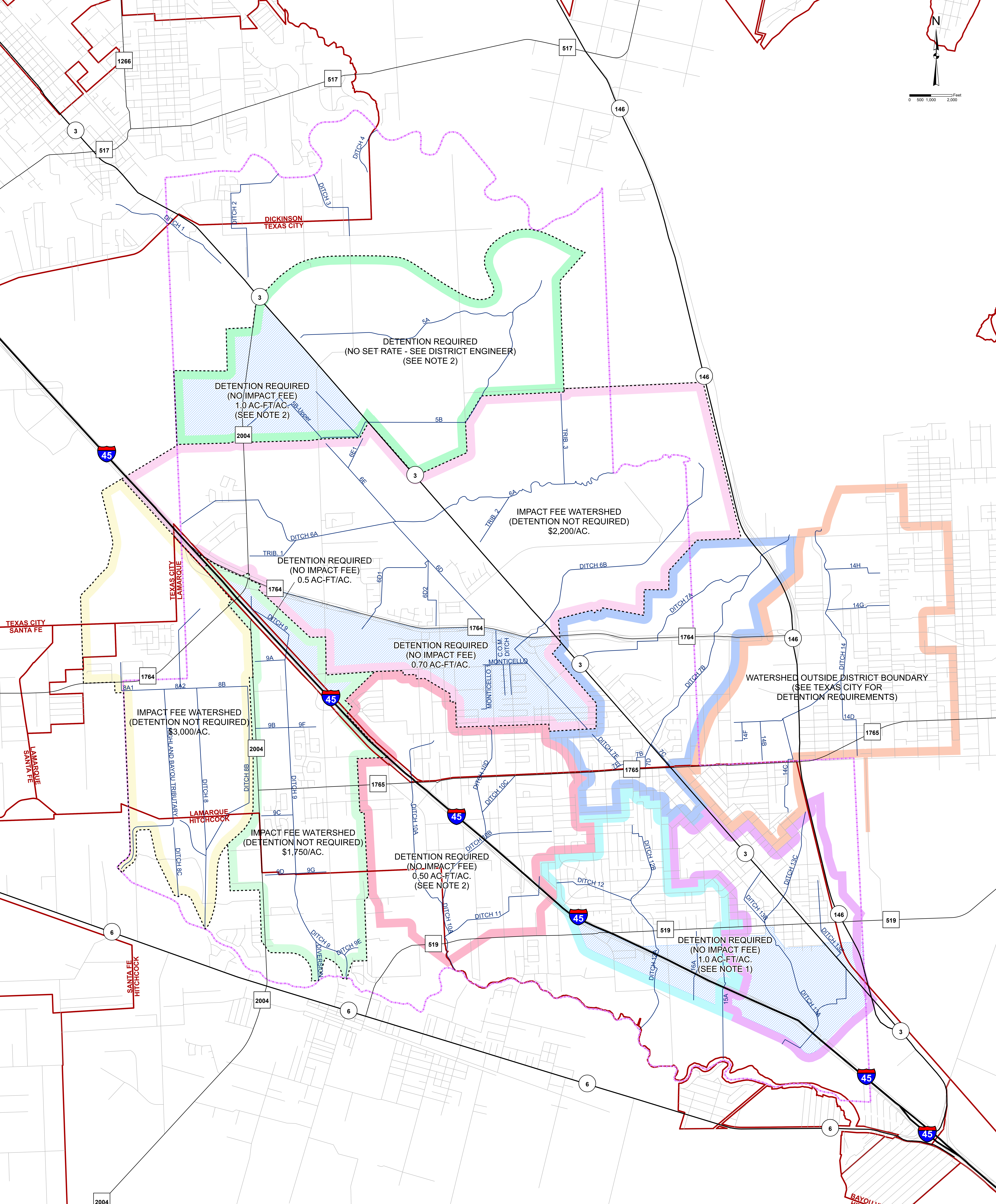
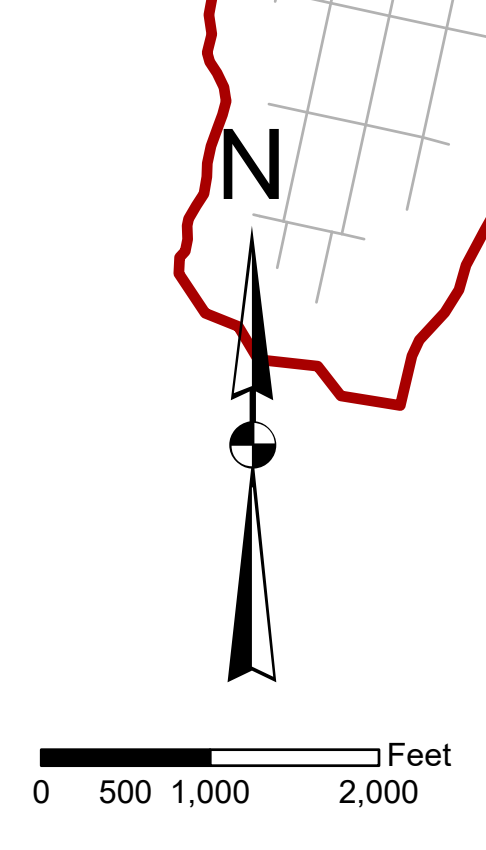
**DITCH 7 WATERSHED STUDY  
(DITCH 7, 7A, & 7B)  
Galveston County DD No. 2**

**Floodplain  
Modeling &  
Mapping**

**Exhibit 12: Hydrographs at Profile Lines**

# **Attachment 1**

## **Galveston County Drainage District No. 2 Watershed Map**



DETENTION REQUIRED  
(NO IMPACT FEE)  
1.0 AC-FT/AC.  
(SEE NOTE 2)

DETENTION REQUIRED  
(NO SET RATE - SEE DISTRICT ENGINEER)  
(SEE NOTE 2)

IMPACT FEE WATERSHED  
(DETENTION NOT REQUIRED)  
\$2,200/AC.

DETENTION REQUIRED  
(NO IMPACT FEE)  
0.5 AC-FT/AC.

DETENTION REQUIRED  
(NO IMPACT FEE)  
0.70 AC-FT/AC.

WATERSHED OUTSIDE DISTRICT BOUNDARY  
(SEE TEXAS CITY FOR  
DETENTION REQUIREMENTS)

IMPACT FEE WATERSHED  
(DETENTION NOT REQUIRED)  
\$3,000/AC.

IMPACT FEE WATERSHED  
(DETENTION NOT REQUIRED)  
\$1,750/AC.

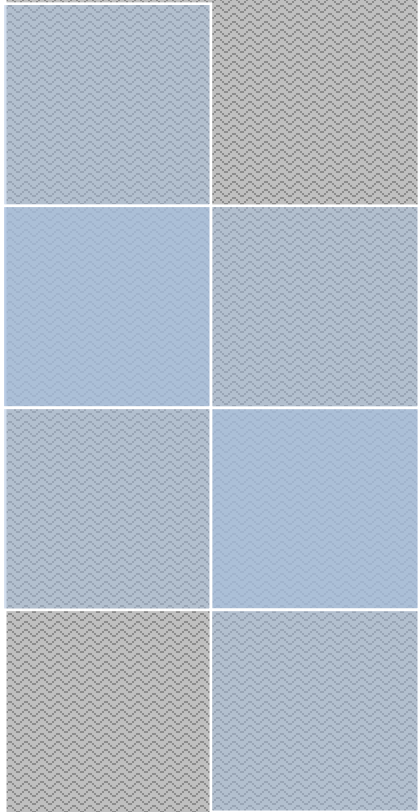
DETENTION REQUIRED  
(NO IMPACT FEE)  
0.50 AC-FT/AC.  
(SEE NOTE 2)

DETENTION REQUIRED  
(NO IMPACT FEE)  
1.0 AC-FT/AC.  
(SEE NOTE 1)

NOTE 1: MITIGATION FOR FILL WITHIN DEDICATED STORAGE AREA OF THE PUMP STATION WILL BE REQUIRED IN ADDITION TO THE DETENTION REQUIREMENT.

NOTE 2: FLOODPLAIN MITIGATION VOLUME REQUIRED ON A 1:1 BASIS FOR ANY FILL PLACED BELOW THE 100-YR WATER SURFACE ELEVATION.

HITCHCOCK  
TIKTI ISLAND



# Willowood Subdivision

## Drainage Impact Analysis

Galveston County Drainage District Number Two  
City of Texas City, Texas

April 2, 2024

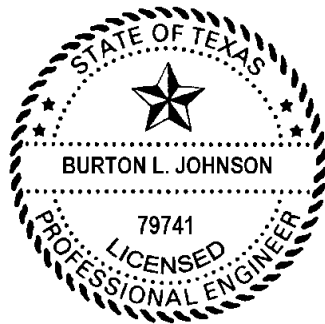


Drainage Impact Analysis

**Willowood Subdivision  
Drainage Impact Analysis**

Galveston County Drainage District Number Two

City of Texas City, Texas



*Burton L. Johnson*

April 2, 2024

Burton Johnson Engineering, Inc.  
4611 Waterbeck St  
Fulshear, TX 77441  
281-773-7184  
TPBE No. 10781

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  - 1.3 Elevation Data ..... 2
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  - 1.5 Proposed Project ..... 3
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EXHIBITS

ATTACHMENT 1 – Galveston County Drainage District Number Two Map

Note: Survey data and computer models may be downloaded at the following link within 90 days of date of report:

<https://www.dropbox.com/s/ovz48f69zd7lch3/Ditch%207%20Models.zip?dl=0>

## 1.0 Introduction

Willowood Subdivision is a proposed 116-acre single-family subdivision located within the City of Texas City and within the boundary of Galveston County Drainage District Number Two (District). This report summarizes and describes a drainage impact analysis for the proposed subdivision. This analysis has been conducted in consideration of the District's *Design Criteria Guidance*. This report considers the ultimate configuration of the proposed development in Section 2.0 and an initial phase of development referred to in this report as Phase One and is described in Section 4.0 (This initial phase consists of approximately 82.5 acres).

### 1.1 Description of Project Area

The Willowood Subdivision project is located on currently undeveloped properties generally south of the Emmett F. Lowry Expressway (FM 1764) and east of Highway 3. The location of the site is depicted in Exhibit 1. The project is entirely within the District's Ditch 7 system and is between Ditch 7A and Ditch 7B. These two ditches join to create Ditch 7 north of FM 1764. This confluence is approximately one mile downstream of the project. Ditch 7 then extends a short distance into Moses Lake.

Exhibit 2 provides an aerial photograph of the proposed development area. The project area is mostly undeveloped grassed areas with some intermittent wooded areas. The project is bisected by Willow Street (some maps label it as Phillips Street) a City of Texas City roadway that runs north-south through the site. The western portion of the north perimeter of the site is adjacent to the alignment of Ditch 7A, and the southeast perimeter of the site is along Ditch 7B. Small areas of the property are on the opposite (east) side of Ditch 7B. No development activity is proposed for these small tracts. A portion of the property east of Willow Street is bounded on the south by 5<sup>th</sup> Street. The remainder of the project to the south is bounded by older residential subdivisions, and portions to the north are adjacent to undeveloped property and an oil and gas facility.

There is a gravel farm road through the property. This road is labeled on maps as Roberts Road, as it is an extension of Roberts Road in the adjacent subdivision. This road is private and now owned or maintained by the City of Texas City.

### 1.2 FEMA Special Flood Hazard Areas

According to FEMA Flood Insurance Rate Map (FIRM) Panel No. 48167C0265G, dated August 15, 2019, the watershed is entirely in the Shaded Zone "X", which represents areas subject to flooding from a 0.2% annual probability event (also known as the 500-year event). A portion of the area is also in the Zone AE floodplain, which represents areas subject to inundation from the 1% annual probability event (also known as the 100-year event) that have computed Base Flood Elevations. Exhibit 3 depicts these Special Flood Hazard Areas.

Based on a review of the FIRM Panel and FEMA's *Flood Insurance Study, Galveston County and Incorporated Areas*, dated August 15, 2019, the inundation depicted on the FIRM is from coastal surge flooding and does not represent riverine flooding from rainfall in the watershed. The coastal elevations are computed along transect lines which are shown on the exhibit. The 100-year coastal surge elevation

is shown as a Base Flood Elevation on the FIRM Panel and is also shown, as elevation 5.0, on Exhibit 2. Transect Line 86 runs through the project area. The 100-year coastal surge elevation is 5.0. Based on a profile presented in the *Flood Insurance Study* and the 500-year coastal surge elevation is between elevation 15.0 and 17.0 within the Ditch 7 watershed.

The information provided on the FIRM panels and within the *Flood Insurance Study* confirms that Ditch 7 and its tributaries Ditch 7A and Ditch 7B are not FEMA studied streams.

### 1.3 Elevation Data

All source elevation data and all elevations cited in this report are in feet above Mean Sea Level based on the 1988 North American Vertical Datum (NAVD 88). Elevation data for this analysis is a blend of the Upper Coastal Lidar data acquired by a partnership between the Texas Water Development Board, Houston-Galveston Area Council, and United States Geologic Survey in 2018; and survey data acquired by Costello, Inc. (now part of Pape Dawson) in the fall of 2023. The lidar data was utilized for most of the elevation data, including overland areas and portions of the channel cross sections. The survey data was used to augment the lidar data in consideration of the limitations of the lidar data – specifically the capture of specific details and elevations associated with bridge and culvert crossings and the capture of bathymetry in areas where the lidar was unable to penetrate a water surface. For this study, the survey data in the channel was utilized to determine the outfall depth from the detention basins. All other calculations are based upon the lidar data.

Topographic contours utilized in the analysis are shown in Exhibit 4. Natural ground elevations generally range between elevation 10 (at the western perimeter) and elevation 5 near the eastern perimeter near Ditch 7B. There are some filled areas with elevations as high as elevation 14. The fill areas are spoil piles along the banks of Ditch 7A and Ditch 7B. There are also some fill areas related to the connection of the private road with Roberts Road in the adjacent subdivision. The drainage pattern is generally from west to east.

### 1.4 Galveston County Drainage District Number Two

The District has not completed a study of the Ditch 7 Watershed. A floodplain study of the Ditch watershed, including the computation of water surface elevations and flowrates for Ditch 7, Ditch 7A, and Ditch 7B has been prepared by Burton Johnson Engineering, Inc. under separate cover. This report, entitled *Ditch 7 Watershed (Ditch 7, Ditch 7A, Ditch 7B), Floodplain Mapping and Modeling* is dated April 3, 2024 and establishes 100-year water surface elevations in the vicinity of this project. The findings described in the report are based upon a combined 1d/2d HEC-RAS model using Atlas 14 rainfall.

The study described in this analysis considers the Willowood Subdivision and its supporting detention and floodplain fill mitigation, as described herein, as part of the existing watershed condition. As part of this Willowood Subdivision analysis, a pre-project 100-year floodplain was computed to determine the amount of floodplain fill to be mitigated. The resultant floodplain map is presented in Exhibit 5.

As part of the Ditch 7 analysis, it was recognized that Ditch 7A is not a natural drainage channel. It apparently was constructed to provide drainage to the State Highway 3 and/or other development in the area and does not have a “valley” section common to natural stream. When floodwaters exceed the

channel banks of Ditch 7A, they spill into the site and overflow toward Ditch 7B. The combined 1d/2d provided an opportunity to properly consider this overflow.

## 1.5 Proposed Project

The proposed project is illustrated in Exhibit 6. The area will be subdivided into residential lots with a minimum size of 6,000 square feet and an average lot size of about 1/6 acre. Four detention basins are proposed. Pond 1 and Pond 2 will outfall into Ditch 7A. Pond 4 will drain under Willow Street to Pond 3, and Pond 3 will outfall into Ditch 7B. The land will be elevated as required to ensure that it is above the 100-year flood elevation of Ditch 7A and Ditch 7B. The detention ponds will provide detention to offset runoff from the development and from the placement of fill in the computed 100-year floodplain.

## 1.6 Criteria

This analysis was conducted in consideration of the District's *Design Criteria Guidance*. This guidance defers to the Harris County Flood Control District's *Policy Criteria & Procedure Manual (PCPM)* for hydrologic methodologies and detention analyses. In addition, the District requires a minimum detention rate of 0.75 acre-feet per acre of development if using HCFCD Method 1 or 2, although this rate can be lowered to as low as 0.50 acre-feet per acre if a detailed study is performed (HCFCD Method 3). HCFCD recommends Method 2 for projects between 50 acres and 640 acres, therefore Method 2 was utilized in this study. This approach is discussed in greater detail in subsequent sections of this report.

## 2.0 Hydrology and Detention – Full Development

Hydrographs were developed for each of the subareas in accordance with the methodology described in the Harris County Flood Control District’s *PCPM* as described in the following sections.

### 2.1 Site Runoff Curves and Small Watershed Method

For Detention Method 2, The *PCPM* requires the use of the Harris County Site Runoff Curves to compute peak flowrates for watersheds up to one square mile. In 2019, these curves were updated to consider Atlas 14 rainfall. The curves compute the peak flowrates for the 10-year event and 100-year event based upon the size of the drainage area and the computed impervious cover.

The *PCPM* recommends the utilization of the Small Watershed Method developed by H.R. Malcom to develop runoff hydrographs. Also known as the “Malcolm Method”, this approach considers the computed peak flowrate, watershed area, and total runoff volume to develop a hydrograph shape.

Peak flowrates were developed for the pre-project and post-project 10-year and 100-year method using the Site Runoff Curves. The peak flowrate for the 25-year event was developed by interpolation using the relationship between 10-year, 25-year, and 100-year peak flowrates determined as part of the Ditch 7 watershed study. Runoff hydrographs for the post-project condition were developed using the Small Watershed Method. The runoff volume was determined from curves in the *PCPM* for Region 3, which includes the most southern Harris County watersheds.

### 2.2 Pre-Project Hydrology

There are four proposed detention basins and three outfall points. Ponds 1 and 2 drain to Ditch 7A, while Pond 3 drains to Ditch 7B and Pond 4 drains into Pond 3. For pre-project conditions, the drainage areas were determined for the areas to Ditch 7A (Area 12 recognizing post-project flows to Pond 1 and Pond 2) and Ditch 7B (Area 34 recognizing post-project flows to Pond 3 and Pond 4). These drainage areas and the assumed land use is presented in Exhibit 7. The determination of peak flowrates for the pre-project condition are summarized in Table 1. These peak flowrates establish the allowable post-project flowrate for the developed condition.

**Table 1: Pre-Project Peak Flowrates**

Drainage Subarea	P12	P34
Area (Ac)	32.6	65.1
Impervious (%)	0.1%	1.3%
<i>Site Runoff Curve: 10-Year</i>		
m	0.786	0.786
b	2.41	2.48
Peak Flowrate (cfs)	37.2	66.1
<i>Interpolate: 25-Year</i>		
Peak Flowrate (cfs)	49.5	87.6
<i>Site Runoff Curve: 100-Year</i>		
m	0.786	0.786
b	4.61	4.72
Peak Flowrate (cfs)	71.3	125.7

## 2.3 Post-Project Hydrology

Exhibit 6 also depicts the post-project land use assumption and drainage subareas for the development. Drainage subareas were assigned for each of the four detention basins as all developed condition runoff will be directed into one of the four basins. Table 2 summarizes the determination of the Post-Project peak flowrates and runoff volume for the 10-year, 25-year, and 100-year events.

**Table 2: Post-Project Peak Flowrates and Runoff Volume**

Drainage Subarea	P1	P2	P3	P4
Area (Ac)	26.4	26.3	21.6	38.7
Impervious (%)	49.9%	49.1%	64.7%	43.8%
<i>Site Runoff Curve: 10-Year</i>				
m	0.786	0.786	0.786	0.786
b	5.51	5.48	5.97	5.32
Peak Flowrate (cfs)	72.1	71.6	66.8	94.1
<i>Interpolate: 25-Year</i>				
Peak Flowrate (cfs)	90.2	89.6	83.0	118.0
<i>Site Runoff Curve: 100-Year</i>				
m	0.786	0.786	0.786	0.786
b	9.34	9.31	10.00	9.07
Peak Flowrate (cfs)	122.3	121.6	111.9	160.5
<i>Runoff Volume (inches)</i>				
10-Year	7.86	7.84	8.22	7.71
25-Year	10.92	10.90	11.25	10.79
100-Year	16.58	16.56	16.84	16.47

## 2.4 Detention Routing

The detention basins were initially sized and evaluated to ensure that the peak allowable flowrates from Table 1 and the minimum detention volumes (based on 0.75 acre-feet per acre) were provided for the 100-year event. These evaluations were performed in HEC-RAS. For Method 2, the PCPM requires a constant tailwater elevation at the top of the outfall pipe. As part of the analysis, the size of the basin and the configuration of the outfall structure was manipulated until a satisfactory result was obtained.

### 2.4.1 Detention Stage vs. Storage

The detention basins will be wet bottom basins with a permanent water surface. In this report, any references to the “bottom” of the basin refers to the permanent pool elevation, as all storage below the permanent pool does not contribute to the attenuation of runoff. The basins will all have 4:1 (h:v) side slopes and 30-foot maintenance berms.

Table 3 provides the stage vs. storage relationship for the four proposed detention basins.

**Table 3: Detention Basin Stage vs. Storage**

Pond 1		Pond 2		Pond 3		Pond 4	
Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)
2.0	0.0	0.5	0.0	0.5	0.0	0.5	0.0
3.0	3.7	1.0	1.6	1.0	3.8	1.0	1.0
4.0	7.7	2.0	5.0	2.0	11.8	2.0	3.3
5.0	11.8	3.0	8.6	3.0	20.1	3.0	5.8
6.0	16.2	4.0	12.4	4.0	28.7	4.0	8.5
7.0	20.7	5.0	16.4	5.0	37.7	5.0	11.5
8.0	25.5	6.0	20.7	6.0	47.1	6.0	14.8
9.0	30.5	7.0	25.1				
10.0	35.7	8.0	29.8				
		9.0	34.7				

Note that the storage volumes for Ponds 3 and Ponds 4 were increased by 100 acre-feet in the HEC-RAS model to facilitate the Pond 4 outfall pipe, which is below sea level. The resultant output was then decreased by 100 acre-feet.

#### 2.4.2 Detention Basin Control Structures

The control structures of each basin were modified to optimize the performance of the basin and to ensure no downstream impact. The control structure for Pond 1 and Pond 2 will include an orifice restrictor in front of an outfall pipe. This orifice may be constructed over the inlet to the outfall or in a manhole. No restrictor is required for Pond 3 and Pond 4. The outfall structures are described in Table 4 and in Exhibit 8.

Pond 1, Pond 2, and Pond 3 will have earthen overflow weirs to allow ponds to safely drain to the receiving channel if design elevations are exceeded. Willow Street is between Pond 4 and Pond 3 and will act as the overflow into Pond 3. Willow Street overtops at an elevation of 7.18 between Pond 3 and Pond 4. Prior to this overflow, flows will potentially flow south along Willow Steet and adjacent areas. However, this phenomenon exists today behind the existing 42-inch culverts that drain this area, and the additional storage will decrease this relative to current conditions.

#### 2.4.3 Detention Routing Results

The detention routing results are summarized in Table 4. The cumulative peak flow from Pond 1 and 2 was determined by adding the hydrographs for the basin outflow. This combined flow was compared to the pre-project peak flow for Area 12, as the ponds both outfall to Ditch 7A and they are in close proximity to each other. The peak outflow from Pond 3 was compared to the pre-project peak flowrate from Area 34, as Pond 4 drains into Pond 3 and does not have a separate outfall into Ditch 7B.

The detention configuration is shown in Exhibit 8.

**Table 4: Detention Basin Routing Results**

	Pond 1	Pond 2	Combined 1&2	Pond 3	Pond 4	Combined 3&4
Drainage Area (Ac)	26.4	26.3	52.7	21.6	38.7	60.3
Development Area (Ac)	26.4	26.3	52.7	21.6	36.2	57.8
Elev - Bottom of Storage Pool	2.0	0.5		0.5	0.5	
Elev -Top of Basin	10.0	9.0		5.8	6.0	
Control Structure Orifice Dia (in)	15	21		None	None	
Control Structure Orifice Invert Elev	2.0	0.5		n/a	n/a	
No. Outfall Pipes	1	1		3	2	
Outfall Pipe Diameter (in)	24	30		30	54	
Outfall Pipe Length (ft)	90	90		90	215	
Outfall Location	Ditch 7A	Ditch 7A	Ditch 7A	Ditch 7B	Pond 3	Ditch 7B
Outfall Pipe Elev US (Pond)	2.0	0.5		0.5	-4.0	
Outfall Pipe Elev DS	1.9	0.4		0.4	-4.00	
<b>10-Year Event</b>						
Stage Elevation	5.47	3.92		3.25	3.29	
Storage Volume (ac-ft)	13.9	12.1		22.2	6.6	
Allowable Peak Flowrate (cfs)			37.2			66.1
Proposed Peak Flowrate (cfs)	8.8	15.8	24.5	44.9	57.4	44.9
<b>25-Year Event</b>						
Stage Elevation	6.60	4.96		3.78	3.88	
Storage Volume (ac-ft)	18.9	16.3		26.8	8.2	
Allowable Peak Flowrate (cfs)			49.5			87.6
Proposed Peak Flowrate (cfs)	11.6	20.8	32.2	71.4	77.3	71.4
<b>100-Year Event</b>						
Stage Elevation	8.62	6.82		4.80	5.05	
Storage Volume Required* (Ac-Ft)	19.8	19.7	39.5	16.2	27.2	43.4
Storage Volume (ac-ft)	28.6	24.3	52.9	35.9	11.7	47.6
Allowable Peak Flowrate (cfs)			71.3			125.7
Proposed Peak Flowrate (cfs)	14.8	27.4	42.0	105.2	111.6	105.2

\*Based on 0.75 acre-feet per acre

## 2.4 Floodplain Fill and Detention Rate

The Ditch 7 model without the project was utilized to determine the 100-year elevations, floodplain fill volumes, and required slab elevations. The portion of the detention storage not required for floodplain fill mitigation was assigned as runoff mitigation, and the resultant detention rate was determined from the cumulative detention volume and development area. This rate was determined separately for areas to Ditch 7A (Pond 1 and 2) and Ditch 7B (Pond 3 and 4). This section summarizes these computations and presents the results.

### 2.4.1 Minimum Slab Elevations

The City of Texas City Floodplain Ordinance requires the lowest slab elevation to be 18 inches above the Base Flood Elevation as depicted on the Flood Insurance Rate Maps. As noted previously, a portion of the development is within the coastal flood zone and there is not a FEMA Base Flood Elevation representative of riverine flooding. However, it is recommended that new construction at the proposed development have slab elevations 18 inches above the 100-year flood elevation computed as part of the Ditch 7 analysis provided for the District. Exhibit 14 shows the 100-year floodplain and 100-year elevations from the Ditch 7 analysis along with the specification of minimum slab elevations for the proposed development.

### 2.4.2 Floodplain Fill

Floodplain fill volume was determined for the 100-year flood inundation associated with Ditch 7A and Ditch 7B. This includes the overflow area from Ditch 7A to 7B. This volume was determined from a HEC-RAS analysis of Ditch 7A without flow in Ditch 7B. The resultant inundation and corresponding floodplain fill was assigned to Ditch 7A and the remainder was assigned to Ditch 7B. Table 5 summarizes the floodplain fill and the resultant mitigation. Mitigation is provided by excess capacity (all capacity in addition to the 0.75 acre-feet per acre) in the detention basins below the 100-year flood elevation in the adjacent stream.

For Pond 3, the 100-year elevation of Ditch 7B will exceed the elevation of the pond high banks. During a riverine 100-year event, the pond will be inundated in a fashion similar to today. The adjacent development will be elevated above the 100-year elevation. The top of Pond 4 is also below the 100-year water surface of Ditch 7B. If the basin were to be elevated above the 100-year elevation it would potentially block sheet flow from the neighborhoods to the south. Most of Pond 4 is in areas with natural ground above the elevation of the top of the basin, and the excavation of the portion between the top of the basin (elevation 6.0) and the 100-year flood elevation will provide 8.4 acre-feet of additional floodplain excavation.

Floodplain fill and mitigation volumes were determined separately for Ditch 7A and Ditch 7B by combined calculations for Pond 1 and Pond 2 (Ditch 7A) and Pond 3 and Pond 4 (Ditch 7B). As the table indicates, there is adequate fill mitigation provided by the ponds and the excavation of the area “above” Pond 4 to offset the placement of fill in the floodplain of Ditch 7A and Ditch 7B.

The computed 100-year floodplain and floodplain mitigation table is provided as Exhibit 9.

**Table 5: Floodplain Fill Mitigation and Detention Rate**

	Pond 1	Pond 2	Combined 1&2	Pond 3	Pond 4	Combined 3&4
Floodplain Fill (Ac-Ft)	0.0	13.4	<b>13.4</b>	20.2	4.7	<b>24.9</b>
Fill Mitigation Available in Pond (Ac-Ft)	13.6	9.6	23.2	29.0	-12.4	16.7
Additional FP Excavation (Ac-Ft)	0.0	0.0	0.0	0.0	8.4	8.4
Total FP Fill Mitigation Available (Ac-Ft)	13.6	9.6	23.2	29.0	-4.0	25.0
Total FP Fill Mitigation Utilized (Ac-Ft)			<b>13.4</b>			<b>24.9</b>
Excess FP Fill Mitigation (Ac-Ft)			9.8			0.1
Required Detention (Ac-Ft)	19.8	19.7	39.5	16.2	27.2	43.4
Provided Detention (Ac-Ft)			49.3			43.5
Detention Rate (Ac-Ft/Ac)			<b>0.94</b>			<b>0.75</b>

The detention volume not required for floodplain mitigation is assigned to traditional stormwater detention in the determination of the total detention volume. This detention volume is then compared to the contributing development area to derive an effective detention rate. The resultant volumes and detention rates for Ponds 1 and 2 (Ditch 7A) and Ponds 3 and 4 (Ditch 7B) are also summarized in Table 5. For Ditch 7A, the project is providing detention at a rate of 0.94 acre-feet per acre; and for Ditch 7B, the project is providing detention at a rate of 0.75 acre-feet per acre.

### 3.0 Offsite Flow Considerations – Full Development

This section considers the management of offsite flow that the development may impact. These are illustrated in Exhibit 15.

#### 3.1 Swale West of Pond 1 (Area A)

There is an offsite area from the south that drains the west portion of the site toward Ditch 7A. The swale runs up against the location of Pond 1. The development must accommodate these offsite flows. A total of 41.5 acres flows from offsite areas, most developed, through the site. The computed peak 100-year flowrate of the full acreage is 121.5 cfs. The project must accommodate this flow, either through a pipe system through the neighborhood, a perimeter swale system, or both. Exhibit 15 depicts a swale around the perimeter of the site. The specific method of managing offsite flow and the design and computations related to it will be provided with any future construction plans. The calculations for the offsite flow at the nodes depicted on Exhibit 15 are provided in Table 6.

#### 3.2 Swale South and West of Pond 4 (Area B)

Area B consists of a small area at the rear of existing residential lots that currently drain toward the subject property. The total area is 1.7 acres. A perimeter swale will intercept this runoff and convey it to Pond 4.

**Table 6: Offsite Flow**

Swale	Area (ac)	Impervious	m	B	100 Yr Flowrate (cfs)
A1-A2	14.0	20%	1.000	3.4	47.6
A2-A3	30.0	20%	0.786	6.5	94.2
A3-A4	41.5	20%	0.786	6.5	121.5
B1-B2	1.7	20%	1.000	3.4	5.8

#### 3.3 Area South of Pond 4 (Area C)

Area C consists of approximately 51 acres that drain to the existing swale that feeds dual 42-inch pipes that convey flow under Willow Street and all the way to Ditch 7B. A portion of the existing swale is on the subject property. No additional infrastructure is required to accommodate this flow. The construction of the proposed project and Pond 4 will decrease the drainage area to this swale and the culverts considerably and should improve drainage associated with the undersized culverts.

#### 3.4 Area North of Site along Willow Street (Area D)

Willow Street north of and adjacent to the project drains toward the south, and the area west of Willow Street drains to the existing swale behind the dual 42-inch culvert under Willow Street. This drainage pattern will be maintained. As noted in the preceding paragraph, the drainage area to these culverts will be reduced with the proposed project. The design plans will include the sizing of roadside culverts at the subdivision entrance and potentially improvements to the roadside ditch.

## 4.0 Hydrology and Detention – Phase 1 Development

Phase 1 represents the initial development of the site. The total area of the Phase 1 development is approximately 82.5 acres, and it includes most of the area described as full development. Exhibit 10 shows the Phase 1 concept. The Phase 1 development includes all four detention basins, however Pond 1 and Pond 2 have a smaller configuration. Pond 3 also has a slightly smaller configuration, as it does not include a small portion of a tract along Ditch 7B.

The methodology utilized to analyze Phase 1 is the same as that described for the full project in Section 3.0.

### 4.1 Pre-Project Hydrology

There are four proposed detention basins and three outfall points. Ponds 1 and 2 drain to Ditch 7A, while Pond 3 drains to Ditch 7B and Pond 4 drains into Pond 3. For pre-project conditions, the drainage areas were determined for the areas to Ditch 7A (Area 12 recognizing post-project flows to Pond 1 and Pond 2) and Ditch 7B (Area 34 recognizing post-project flows to Pond 3 and Pond 4). These drainage areas and the assumed land use is presented in Exhibit 7. The determination of peak flowrates for the pre-project condition are summarized in Table 1. These peak flowrates establish the allowable post-project flowrate for the developed condition.

**Table 7: Pre-Project Peak Flowrates**

Drainage Subarea	P12	P34
Area (Ac)	18.7	64.6
Impervious (%)	0.0%	1.3%
<i>Site Runoff Curve: 10-Year</i>		
m	0.786	0.786
b	2.40	2.48
Peak Flowrate (cfs)	24.0	65.7
<i>Interpolate: 25-Year</i>		
Peak Flowrate (cfs)	31.9	87.0
<i>Site Runoff Curve: 100-Year</i>		
m	0.786	0.786
b	4.60	4.72
Peak Flowrate (cfs)	45.9	125.0

### 4.2 Post-Project Hydrology

Exhibit 11 also depicts the post-project land use assumption and drainage subareas for the development. Drainage subareas were assigned for each of the four detention basins as all developed condition runoff will be directed into one of the four basins. Table 2 summarizes the determination of the Post-Project peak flowrates and runoff volume for the 10-year, 25-year, and 100-year events.

**Table 8: Post-Project Peak Flowrates and Runoff Volume**

Drainage Subarea	P1	P2	P3	P4
Area (Ac)	15.1	12.8	21.0	34.1
Impervious (%)	51.8%	56.0%	63.7%	38.8%
<i>Site Runoff Curve: 10-Year</i>				
m	1.00	1.00	0.79	0.79
b	5.57	5.70	5.94	5.10
Peak Flowrate (cfs)	84.0	72.7	65.0	81.8
<i>Interpolate: 25-Year</i>				
Peak Flowrate (cfs)	104.9	90.7	80.9	102.8
<i>Site Runoff Curve: 100-Year</i>				
m	1.00	1.00	0.79	0.79
b	9.42	9.61	9.95	8.75
Peak Flowrate (cfs)	142.2	122.6	109.0	140.3
<i>Runoff Volume (inches)</i>				
10-Year	7.91	8.01	8.20	7.59
25-Year	10.96	11.06	11.23	10.68
100-Year	16.61	16.68	16.82	16.38

### 4.3 Detention Routing

The detention basins were initially sized and evaluated to ensure that the peak allowable flowrates from Table 1 and the minimum detention volumes (based on 0.75 acre-feet per acre) were provided for the 100-year event. These evaluations were performed in HEC-RAS. For Method 2, the PCPM requires a constant tailwater elevation at the top of the outfall pipe. As part of the analysis, the size of the basin and the configuration of the outfall structure was manipulated until a satisfactory result was obtained.

#### 4.3.1 Detention Stage vs. Storage

The detention basins will be wet bottom basins with a permanent water surface. In this report, any references to the “bottom” of the basin refers to the permanent pool elevation, as all storage below the permanent pool does not contribute to the attenuation of runoff. The basins will all have 4:1 (h:v) side slopes and 30-foot maintenance berms.

Table 3 provides the stage vs. storage relationship for the four proposed detention basins. Note that the storage volumes for Ponds 3 and Ponds 4 were increased by 100 acre-feet in the HEC-RAS model to facilitate the Pond 4 outfall pipe, which is below sea level. The resultant output was then decreased by 100 acre-feet.

**Table 9: Detention Basin Stage vs. Storage**

Pond 1		Pond 2		Pond 3		Pond 4	
Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)	Stage (elev)	Storage (ac-ft)
2.0	0.0	0.5	0.0	0.5	0.0	0.5	0.0
3.0	2.6	1.0	1.5	1.0	3.5	1.0	1.0
4.0	5.3	2.0	4.6	2.0	10.8	2.0	3.3
5.0	8.2	3.0	7.8	3.0	18.5	3.0	5.8
6.0	11.2	4.0	11.2	4.0	26.5	4.0	8.5
7.0	14.4	5.0	14.7	5.0	34.9	5.0	11.5
8.0	17.7	6.0	18.4	6.0	43.7	6.0	14.8
9.0	21.2	7.0	22.2				
10.0	24.8	8.0	26.2				
		9.0	30.4				

#### 4.3.2 Detention Basin Control Structures

The control structures of each basin were modified to optimize the performance of the basin and to ensure no downstream impact. The control structure for Pond 1 and Pond 2 will include an orifice restrictor in front of an outfall pipe. This orifice may be constructed over the inlet to the outfall or in a manhole. No restrictor is required for Pond 3 and Pond 4. The outfall structures are described in Table 4 and in Exhibit 12.

Pond 1, Pond 2, and Pond 3 will have earthen overflow weirs to allow ponds to safely drain to the receiving channel if design elevations are exceeded. Willow Street is between Pond 4 and Pond 3 and will act as the overflow into Pond 3. Willow Street overtops at an elevation of 7.18 between Pond 3 and Pond 4. Prior to this overflow, flows will potentially flow south along Willow Steet and adjacent areas. However, this phenomenon exists today behind the existing 42-inch culverts that drain this area, and the additional storage will decrease this relative to current conditions.

Note that the control structures for the basin are unchanged from the full development scenario described in Section 3.0.

#### 4.3.3 Detention Routing Results

The detention routing results are summarized in Table 4. The cumulative peak flow from Pond 1 and 2 was determined by adding the hydrographs for the basin outflow. This combined flow was compared to the pre-project peak flow for Area 12, as the ponds both outfall to Ditch 7A and they are in close proximity to each other. The peak outflow from Pond 3 was compared to the pre-project peak flowrate from Area 34, as Pond 4 drains into Pond 3 and does not have a separate outfall into Ditch 7B.

The detention configuration is shown in Exhibit 12.

**Table 10: Detention Basin Routing Results**

	Pond 1	Pond 2	Combined 1&2	Pond 3	Pond 4	Combined 3&4
Drainage Area (Ac)	15.1	12.8	27.8	21.0	34.1	55.1
Development Area (Ac)	15.1	12.7	27.8	20.8	26.8	47.6
Elev - Bottom of Storage Pool	2.0	0.5		0.5	0.5	
Elev -Top of Basin	10.0	9.0		5.8	6.0	
Control Structure Orifice Dia (in)	15	21		None	None	
Control Structure Orifice Invert Elev	2.0	0.5		n/a	n/a	
No. Outfall Pipes	1	1		3	2	
Outfall Pipe Diameter (in)	24	30		30	54	
Outfall Pipe Length (ft)	90	90		90	215	
Outfall Location	Ditch 7A	Ditch 7A	Ditch 7A	Ditch 7B	Pond 3	Ditch 7B
Outfall Pipe Elev US (Pond)	2.0	0.5		0.5	-4.0	
Outfall Pipe Elev DS	1.9	0.4		0.4	-4.00	
<b>10-Year Event</b>						
Stage Elevation	5.09	2.83		3.2	3.24	
Storage Volume (ac-ft)	8.5	2.8		120.1	6.2	
Allowable Peak Flowrate (cfs)			24.0			65.7
Proposed Peak Flowrate (cfs)	7.6	8.3	15.9	42.0	47.6	42.0
<b>25-Year Event</b>						
Stage Elevation	6.07	3.46		3.68	3.77	
Storage Volume (ac-ft)	11.5	9.4		123.9	7.9	
Allowable Peak Flowrate (cfs)			31.9			87.0
Proposed Peak Flowrate (cfs)	10.4	13.1	23.5	67.4	66.1	67.4
<b>100-Year Event</b>						
Stage Elevation	7.85	4.67		4.65	4.85	
Storage Volume Required* (Ac-Ft)	11.3	9.6	20.9	15.6	20.1	43.4
Storage Volume (ac-ft)	17.2	13.5	30.8	32.0	11.1	47.6
Allowable Peak Flowrate (cfs)			45.9			125.7
Proposed Peak Flowrate (cfs)	13.8	19.5	33.2	100.8	97.3	105.2

\*Based on 0.75 acre-feet per acre

## 4.4 Floodplain Fill and Detention Rate

The Ditch 7 model without the project was utilized to determine the 100-year elevations, floodplain fill volumes, and required slab elevations. The portion of the detention storage not required for floodplain fill mitigation was assigned as runoff mitigation, and the resultant detention rate was determined from the cumulative detention volume and development area. This rate was determined separately for areas to Ditch 7A (Pond 1 and 2) and Ditch 7B (Pond 3 and 4). This section summarizes these computations and presents the results.

### 4.4.1 Minimum Slab Elevations

See Section 3.4.1. The minimum slab elevations are applicable for the Phase 1 development.

#### 4.4.2 Floodplain Fill

Floodplain fill volume was determined for the 100-year flood inundation associated with Ditch 7A and Ditch 7B. This includes the overflow area from Ditch 7A to 7B. This volume was determined from a HEC-RAS analysis of Ditch 7A without flow in Ditch 7B. The resultant inundation and corresponding floodplain fill was assigned to Ditch 7A and the remainder was assigned to Ditch 7B. Table 5 summarizes the floodplain fill and the resultant mitigation. Mitigation is provided by excess capacity (all capacity in addition to the 0.75 acre-feet per acre) in the detention basins below the 100-year flood elevation in the adjacent stream.

For Pond 3, the 100-year elevation of Ditch 7B will exceed the elevation of the pond high banks. During a riverine 100-year event, the pond will be inundated in a fashion like today. The adjacent development will be elevated above the 100-year elevation. The top of Pond 4 is also below the 100-year water surface of Ditch 7B. If the basin were to be elevated above the 100-year elevation it would potentially block sheet flow from the neighborhoods to the south. Most of Pond 4 is in areas with natural ground above the elevation of the top of the basin, and the excavation of the portion between the top of the basin (elevation 6.0) and the 100-year flood elevation will provide 8.4 acre-feet of additional floodplain excavation.

Floodplain fill and mitigation volumes were determined separately for Ditch 7A and Ditch 7B by combined calculations for Pond 1 and Pond 2 (Ditch 7A) and Pond 3 and Pond 4 (Ditch 7B). As the table indicates, there is adequate fill mitigation provided by the ponds and the excavation of the area “above” Pond 4 to offset the placement of fill in the floodplain of Ditch 7A and Ditch 7B.

The computed 100-year floodplain and floodplain mitigation table is provided as Exhibit 13.

**Table 11: Floodplain Fill Mitigation and Detention Rate**

	Pond 1	Pond 2	Combined 1&2	Pond 3	Pond 4	Combined 3&4
Floodplain Fill (Ac-Ft)	0.0	12.7	<b>12.7</b>	20.2	1.1	<b>21.3</b>
Fill Mitigation Available in Pond (Ac-Ft)	11.9	20.3	32.1	29.7	-5.3	24.4
Additional FP Excavation (Ac-Ft)	0.0	0.0	0.0	0.0	8.4	8.4
Total FP Fill Mitigation Available (Ac-Ft)	11.9	20.3	32.1	29.7	3.1	32.7
Total FP Fill Mitigation Utilized (Ac-Ft)			<b>12.7</b>			<b>21.3</b>
Excess FP Fill Mitigation (Ac-Ft)			19.5			11.4
Required Detention (Ac-Ft)	11.3	9.6	20.9	15.6	20.1	35.7
Provided Detention (Ac-Ft)			40.3			47.1
Detention Rate (Ac-Ft/Ac)			<b>1.45</b>			<b>0.99</b>

The detention volume not required for floodplain mitigation is assigned to traditional stormwater detention in the determination of the total detention volume. This detention volume is then compared to the contributing development area to derive an effective detention rate. The resultant volumes and detention rates for Ponds 1 and 2 (Ditch 7A) and Ponds 3 and 4 (Ditch 7B) are also summarized in Table 5. For Ditch 7A, the project is providing detention at a rate of 1.45 acre-feet per acre; and for Ditch 7B, the project is providing detention at a rate of 0.99 acre-feet per acre.

## 5.0 Results

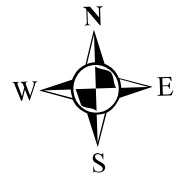
Based on the analysis presented herein, the proposed development, including the full development scenario and the Phase 1 scenario, can be constructed as described without adversely impacting drainage and flood risk upstream, adjacent to, and downstream of the project.

For the full development, the project provides 0.94 acre-feet of detention per acre of development in two detention basins for the portion of the project draining to Ditch 7A; and provides 0.75 acre-feet of detention per acre of development in two detention basins for the portion of the project drainage to Ditch 7B. The detention basins also have additional capacity to adequately mitigate the placement of fill in the computed 100-year floodplain of Ditch 7A and Ditch 7B.

For the Phase 1 development, the project provides 1.45 acre-feet of detention per acre of development in two detention basins for the portion of the project draining to Ditch 7A; and provides 0.99 acre-feet of detention per acre of development in two detention basins for the portion of the project drainage to Ditch 7B. The detention basins also have additional capacity to adequately mitigate the placement of fill in the computed 100-year floodplain of Ditch 7A and Ditch 7B.

As a result of the analysis I hereby certify the project will have no adverse impact to flood risk along Ditch 7, Ditch 7A, Ditch 7B and other drainage infrastructure in adjacent areas.

# Exhibits

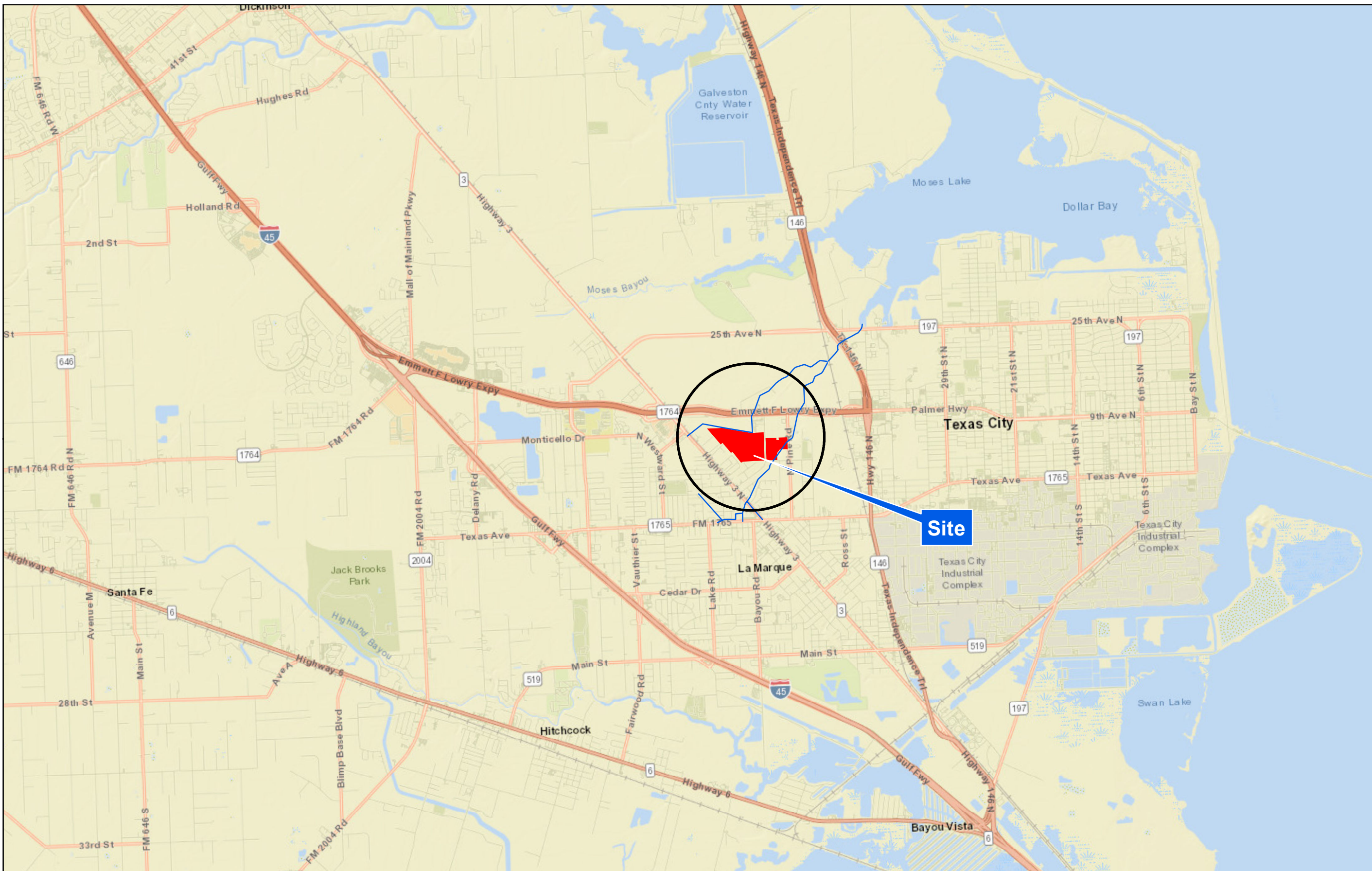


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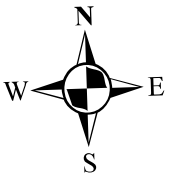
**WILLOWOOD DEVELOPMENT  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2**

**Drainage  
Impact  
Analysis**

 Site



**Exhibit 1 - Location Map**

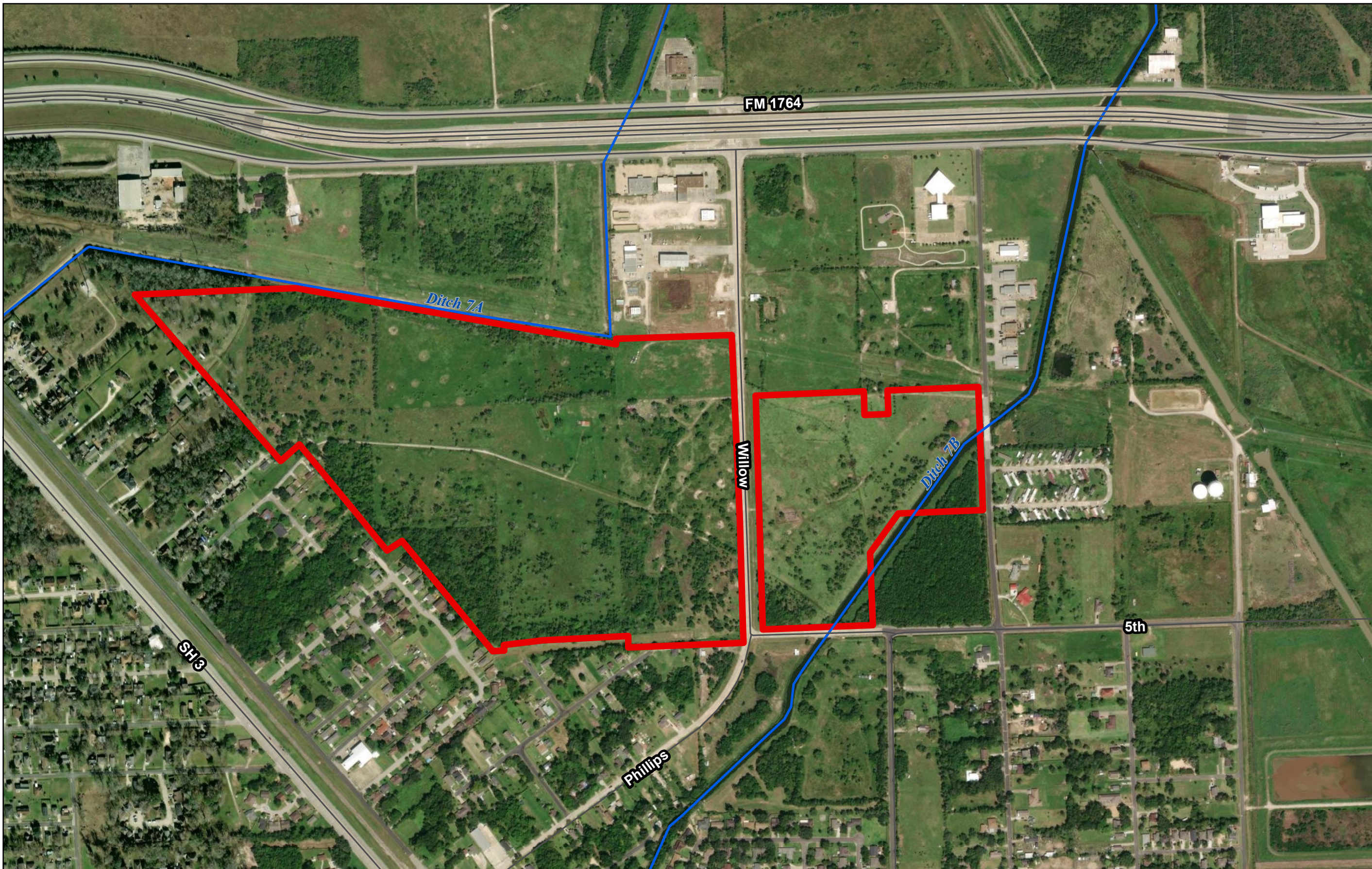


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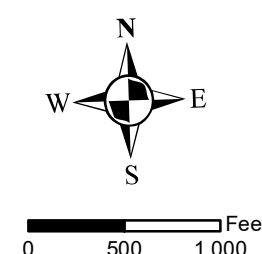
**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

**Drainage  
Impact  
Analysis**

- Roads
- Ditch 7 Channels
- ▭ Willowood Subdivision



**Exhibit 2 - Aerial Photo**



**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

**Drainage  
Impact  
Analysis**

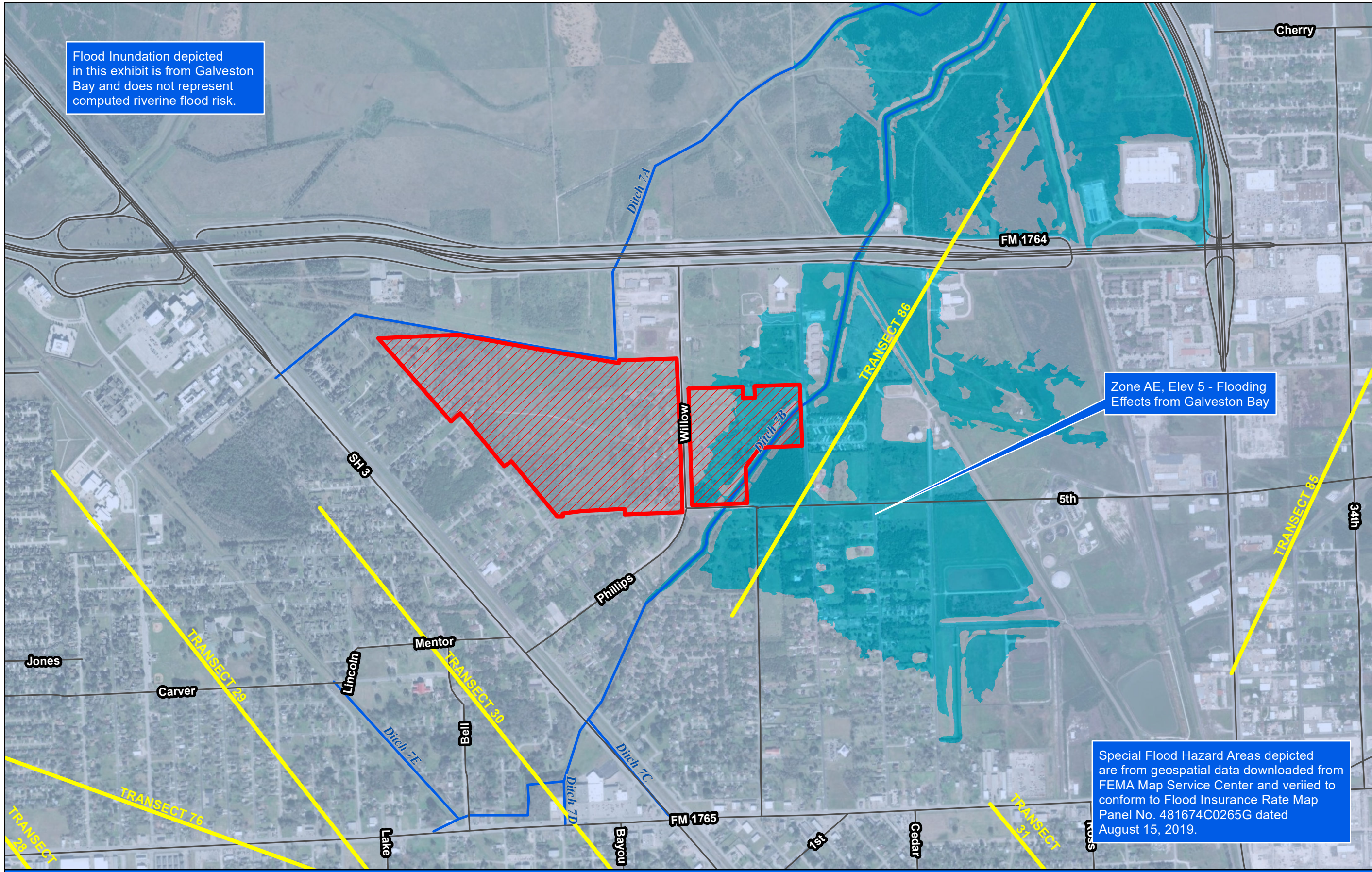
- Transect Line
- Site
- Roads
- Ditch 7 Channels
- Zone AE (1%)
- Shaded Zone X (0.2%)

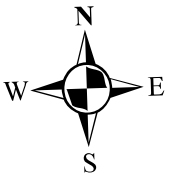
Flood Inundation depicted in this exhibit is from Galveston Bay and does not represent computed riverine flood risk.

Zone AE, Elev 5 - Flooding Effects from Galveston Bay

Special Flood Hazard Areas depicted are from geospatial data downloaded from FEMA Map Service Center and verified to conform to Flood Insurance Rate Map Panel No. 481674C0265G dated August 15, 2019.

# Exhibit 3 - FEMA Speical Flood Hazard Areas





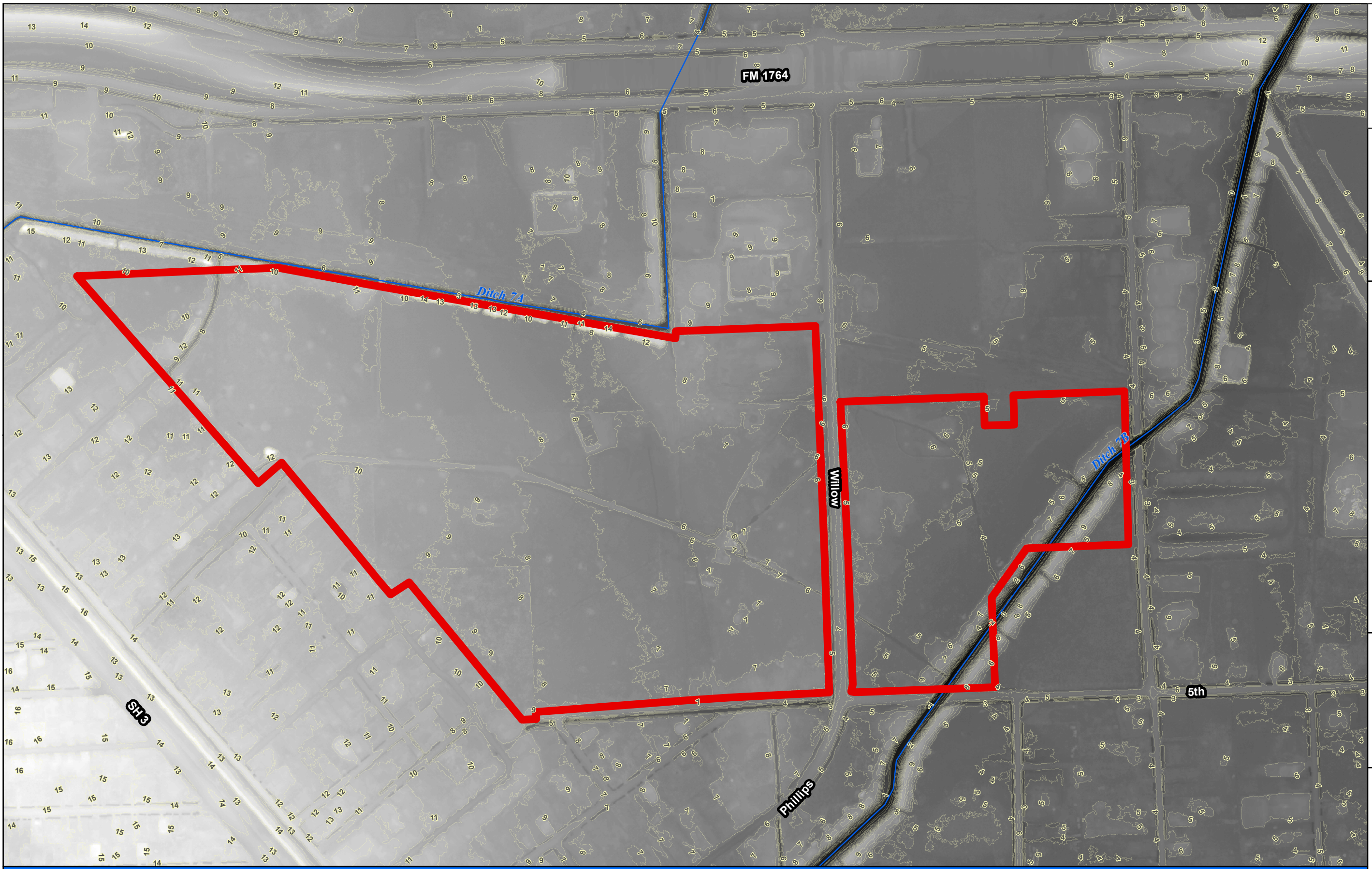
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**WILLOWOOD DEVELOPMENT**  
**Proposed Single Family**  
**Subdivision in Texas City, TX**  
**Galveston County DD No. 2**

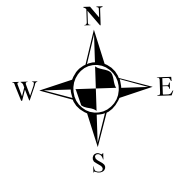
**Drainage**  
**Impact**  
**Analysis**

- Site
- Study Channels
- Elevation Contour
- Roads

**DEM**  
**Elevation**  
High : 40'  
Low : -10'



**Exhibit 4 - Topography and Digital Elevation Model**

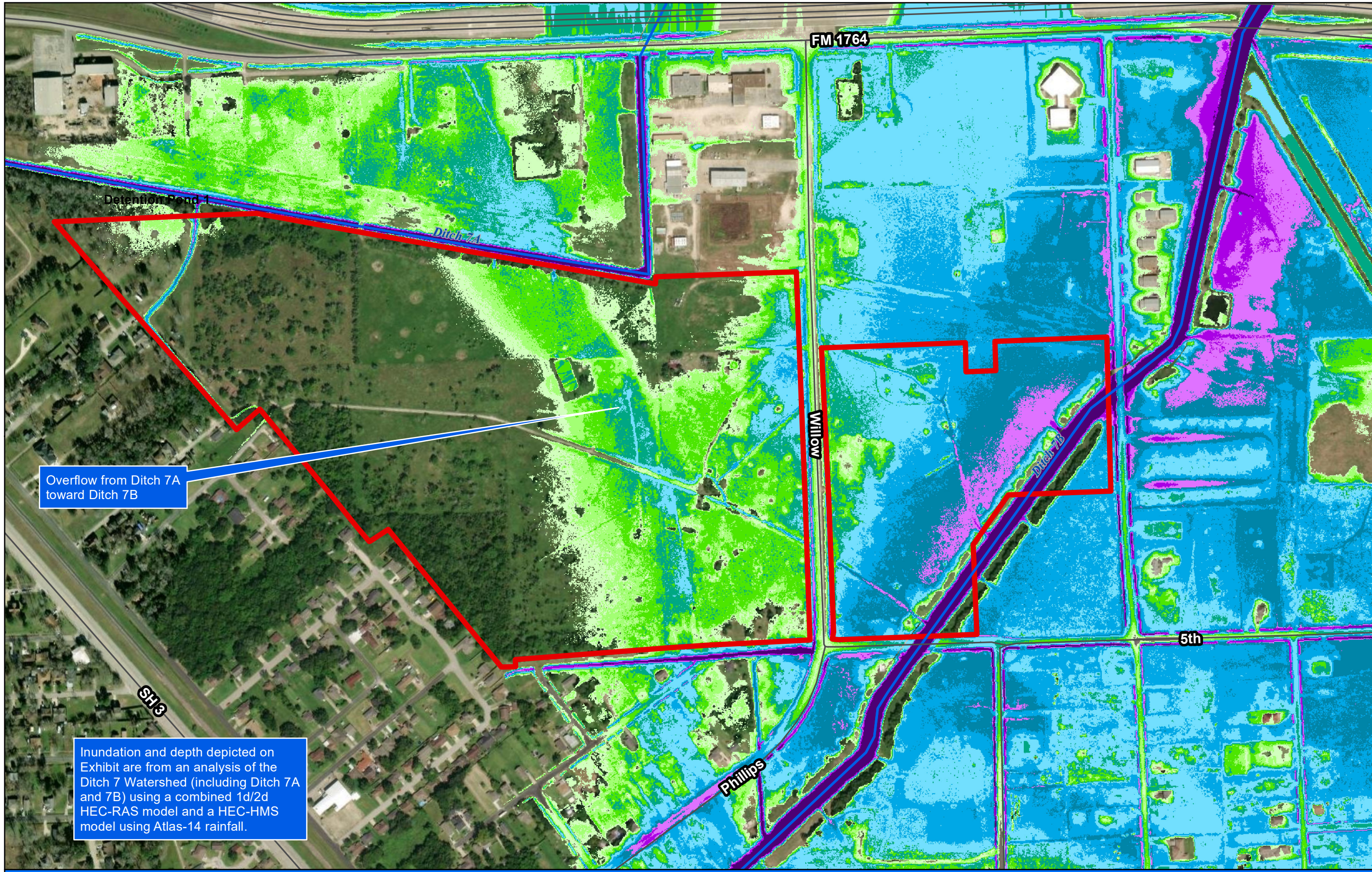
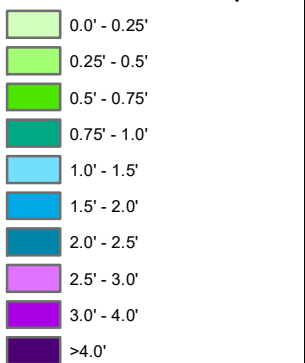


0 200 400 Feet

WILLOWOOD DEVELOPMENT  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

Drainage  
Impact  
Analysis

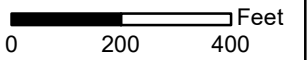
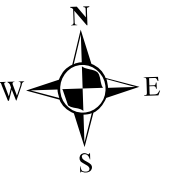
100-Yr Inundation Depth



Overflow from Ditch 7A toward Ditch 7B

Inundation and depth depicted on Exhibit are from an analysis of the Ditch 7 Watershed (including Ditch 7A and 7B) using a combined 1d/2d HEC-RAS model and a HEC-HMS model using Atlas-14 rainfall.

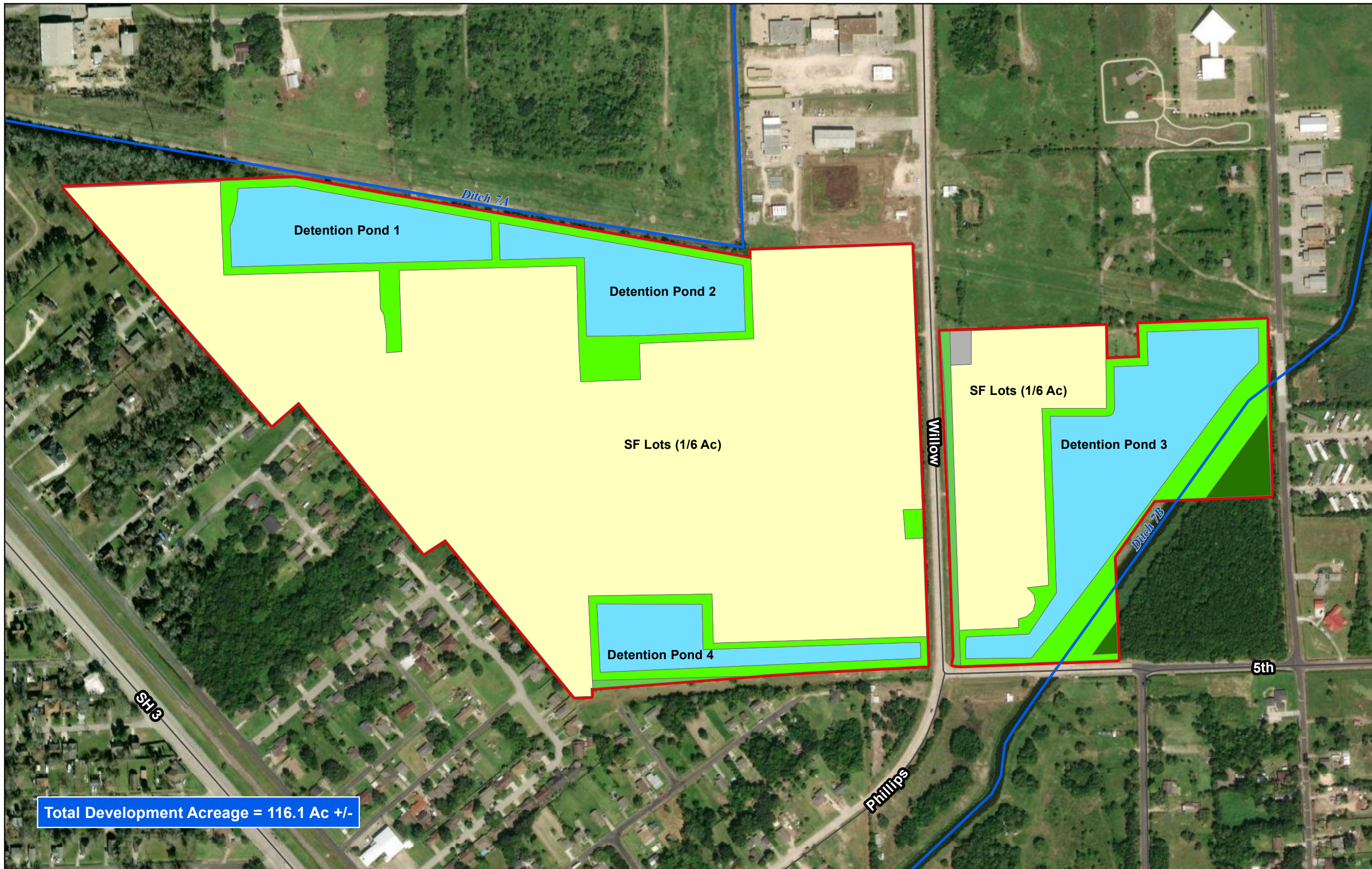
# Exhibit 5 - Computed 100-Yr Inundation



**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

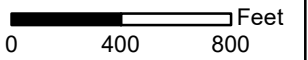
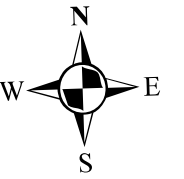
**Drainage  
Impact  
Analysis**

- Land Use**
- Grass
  - Greenspace
  - ROW
  - Subdivision
  - Water
  - Woods



Total Development Acreage = 116.1 Ac +/-

# Exhibit 6 - Proposed Development

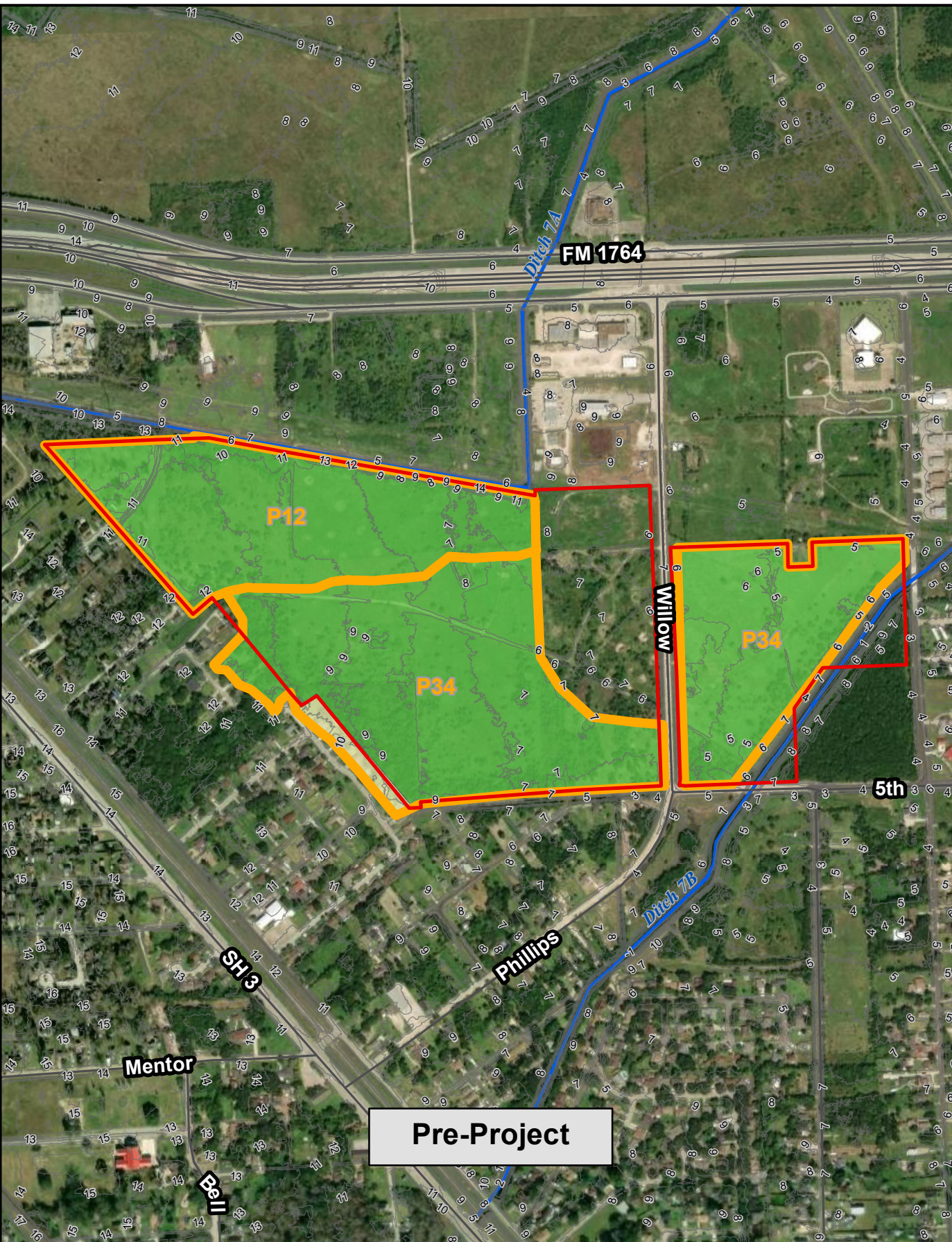


**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

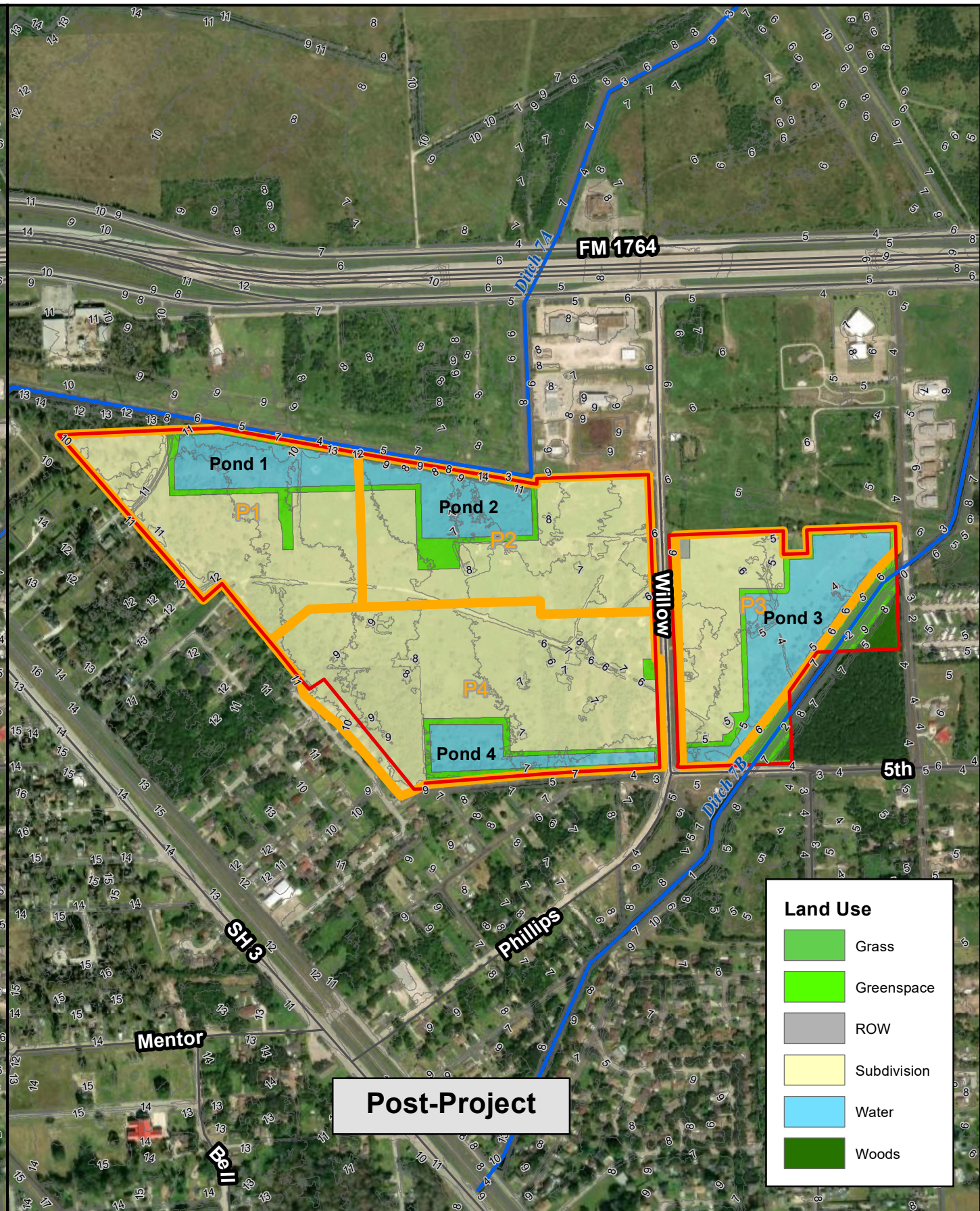
**Drainage  
Impact  
Analysis**

Land Use	
	Grass
	Greenspace
	ROW
	Subdivision
	Water
	Woods

- Drainage Subarea
- Elev Contour
- Road
- Channels
- Site

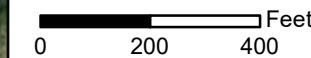
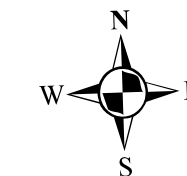


**Pre-Project**



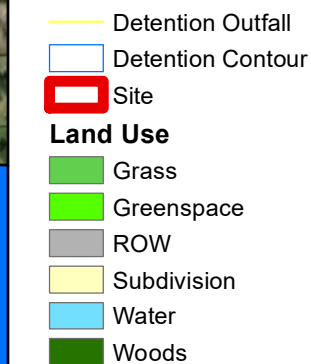
**Post-Project**

**Exhibit 7 - Drainage Subarea Map**



**WILLOWOOD DEVELOPMENT**  
**Proposed Single Family**  
**Subdivision in Texas City, TX**  
**Galveston County DD No. 2**

**Drainage**  
**Impact**  
**Analysis**



**Pond 1 Outfall Restrictor:**  
 15" Orifice Restrictor Plate  
 Inv Elev = 2.0  
**Outfall Pipe**  
 1-24" Pipe, 90 LF +/-  
 US Inv. Elev = 2.0  
 DS Inv Elev = 1.9  
**Earthen Weir (Overflow)**  
 Crest Elev = 9.0  
 Crest Length = 10'

**Pond 2 Outfall Restrictor:**  
 21" Orifice Restrictor Plate  
 Inv Elev = 0.5  
**Outfall Pipe**  
 1-30" Pipe, 90 LF +/-  
 US Inv. Elev = 0.5  
 DS Inv Elev = 0.4  
**Earthen Weir (Overflow)**  
 Crest Elev = 8.0  
 Crest Length = 10'

**Combined Pond 1 & 2**  
 Allowable Flowrate (10/25/100yr) =  
 37.2 cfs / 49.5 cfs / 71.3 cfs  
 Actual Flowrate (10/25/100yr) =  
 24.5 cfs / 32.2 cfs / 42.0 cfs

**Combined Pond 3 & 4**  
 Allowable Flowrate (10/25/100yr) =  
 66.1 cfs / 87.6 cfs / 125.7 cfs  
 Actual Flowrate (10/25/100yr) =  
 44.9 cfs / 71.4 cfs / 105.2 cfs

**Pond 3**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 5.8  
 Stage Elev (10/25/100yr) =  
 3.25/3.78/4.80  
 Storage Volume (10/25/100yr) =  
 22.2 AF/26.8 AF/35.9 AF  
 Peak Outflow (10/25/100yr) =  
 44.9 cfs/71.4 cfs/105.2 cfs

**Pond 1**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 2.0  
 Top Elev = 10.0  
 Stage Elev (10/25/100yr) =  
 5.47/6.60/8.62  
 Storage Volume (10/25/100yr) =  
 13.9 AF/18.9 AF/28.6 AF  
 Peak Outflow (10/25/100yr) =  
 8.8 cfs/11.6 cfs/14.8 cfs

**Pond 2**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 9.0  
 Stage Elev (10/25/100yr) =  
 3.92/4.96/6.82  
 Storage Volume (10/25/100yr) =  
 12.1 AF/16.3 AF/24.3 AF  
 Peak Outflow (10/25/100yr) =  
 15.8 cfs/20.8 cfs/27.4 cfs

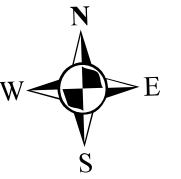
**Pond 4**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 6.0  
 Stage Elev (10/25/100yr) =  
 3.29/3.88/5.05  
 Storage Volume (10/25/100yr) =  
 6.6 AF/8.2 AF/27.2 AF  
 Peak Outflow (10/25/100yr) =  
 57.4 cfs/77.3 cfs/111.6 cfs

**Pond 3 Outfall Restrictor:**  
 None  
**Outfall Pipe**  
 3-30" Pipe, 90 LF +/-  
 US Inv. Elev = 0.5  
 DS Inv Elev = 0.4  
**Earthen Weir (Overflow)**  
 Crest Elev = 4.8  
 Crest Length = 10'

**Pond 4 Outfall Restrictor:**  
 None  
**Outfall Pipe**  
 2-54" Pipes, 215 LF +/-  
 US Inv. Elev = -4.0  
 DS Inv Elev = -4.0  
**Overflow**  
 Willow Rd to Pond 3  
 Min Elev (Ex) = 7.18

**Total Site Acreage = 116.1 Ac +/-**  
**Total Development Acreage = 110.5 Ac**

**Exhibit 8 - Proposed Detention**



0 200 400 Feet

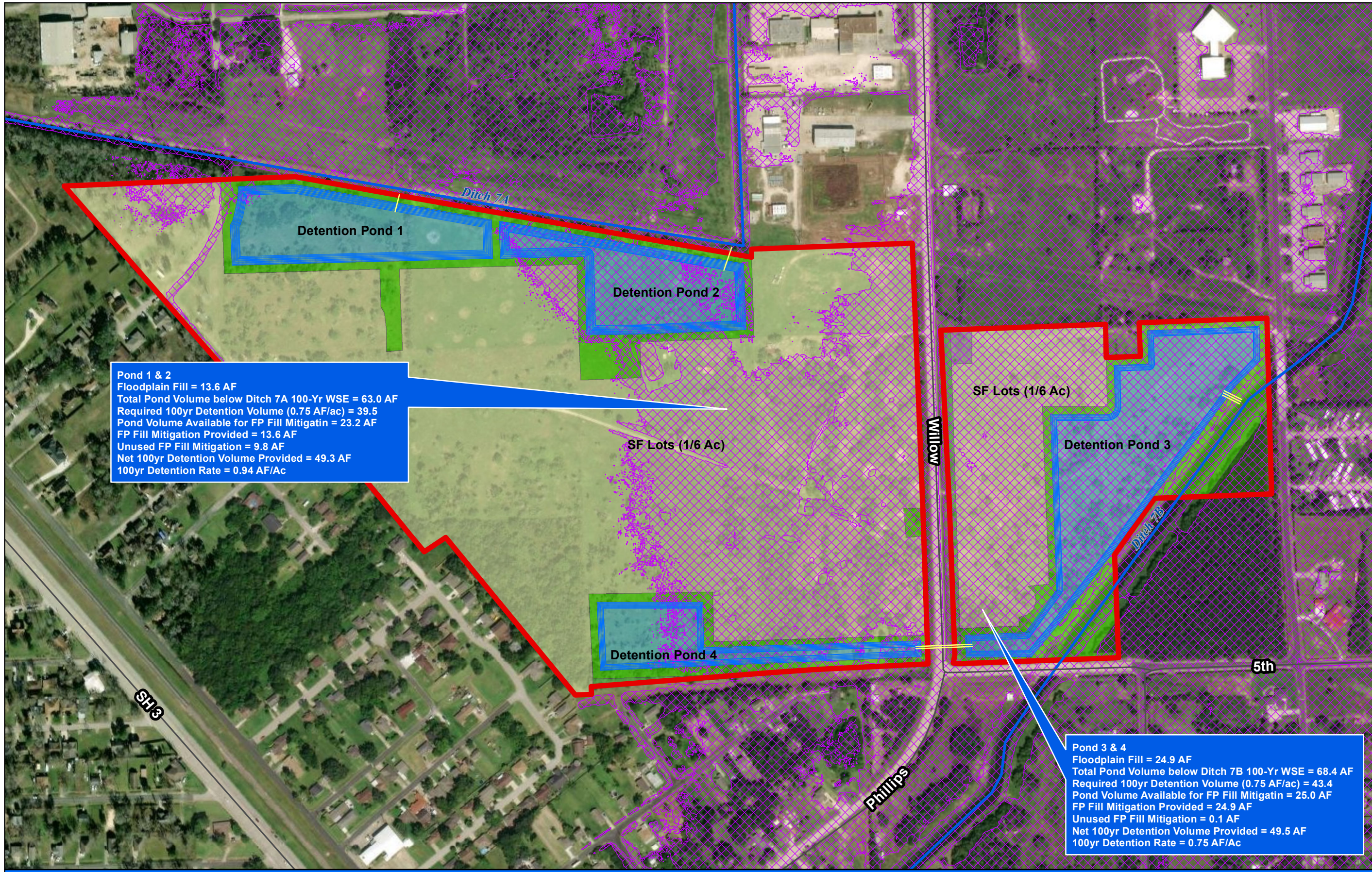
**WILLOWOOD DEVELOPMENT**  
**Proposed Single Family**  
**Subdivision in Texas City, TX**  
**Galveston County DD No. 2**

**Drainage Impact Analysis**

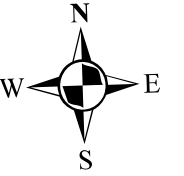
- Detention Outfall
- Detention Contour
- Site
- Computed 100-Yr FP
- Land Use**
- Grass
- Greenspace
- ROW
- Subdivision
- Water
- Woods

**Pond 1 & 2**  
 Floodplain Fill = 13.6 AF  
 Total Pond Volume below Ditch 7A 100-Yr WSE = 63.0 AF  
 Required 100yr Detention Volume (0.75 AF/ac) = 39.5  
 Pond Volume Available for FP Fill Mitigation = 23.2 AF  
 FP Fill Mitigation Provided = 13.6 AF  
 Unused FP Fill Mitigation = 9.8 AF  
 Net 100yr Detention Volume Provided = 49.3 AF  
 100yr Detention Rate = 0.94 AF/Ac

**Pond 3 & 4**  
 Floodplain Fill = 24.9 AF  
 Total Pond Volume below Ditch 7B 100-Yr WSE = 68.4 AF  
 Required 100yr Detention Volume (0.75 AF/ac) = 43.4  
 Pond Volume Available for FP Fill Mitigation = 25.0 AF  
 FP Fill Mitigation Provided = 24.9 AF  
 Unused FP Fill Mitigation = 0.1 AF  
 Net 100yr Detention Volume Provided = 49.5 AF  
 100yr Detention Rate = 0.75 AF/Ac



**Exhibit 9 - FP Fill Mitigation & Detention Rate**

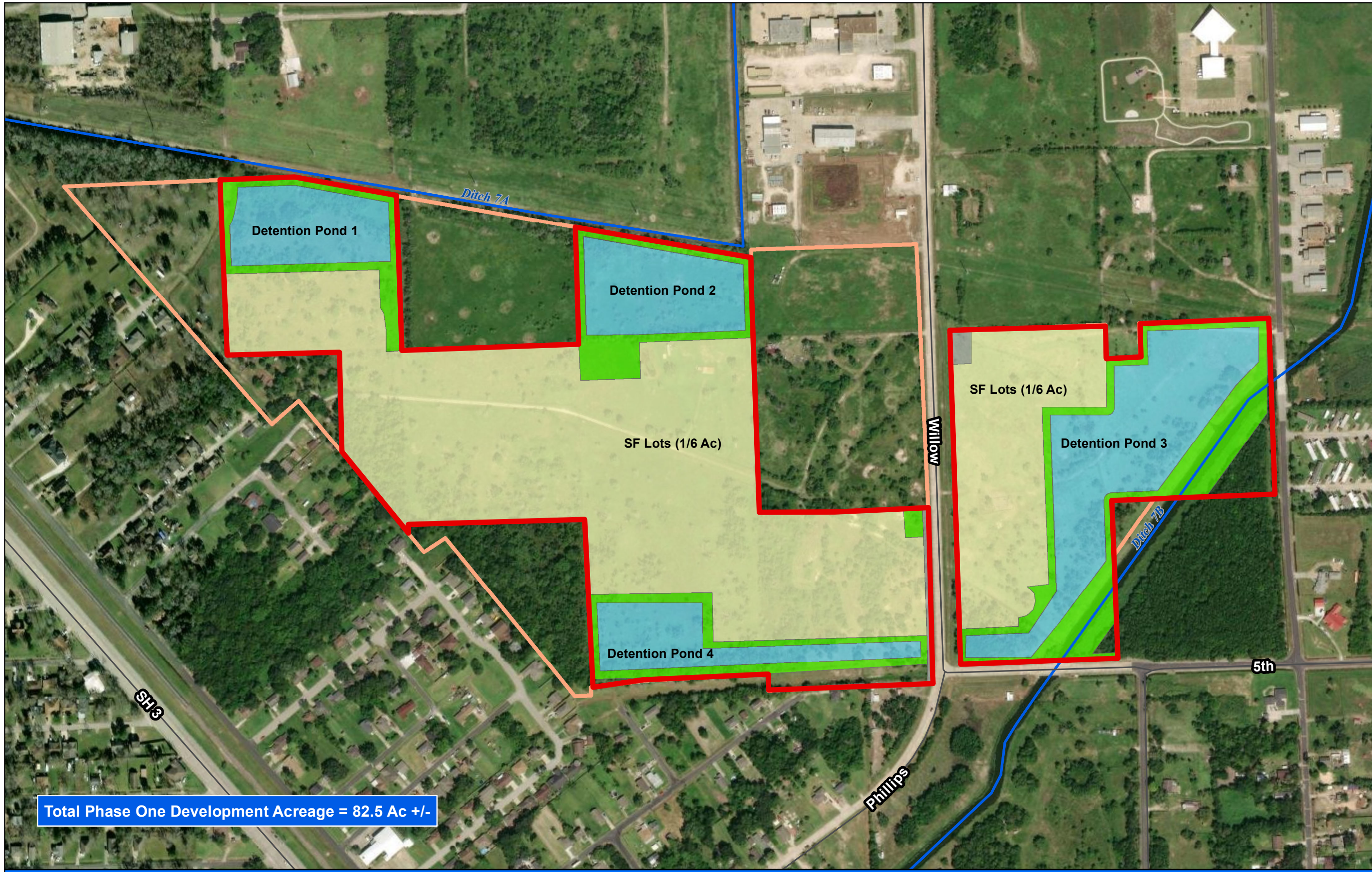


0 200 400 Feet

**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

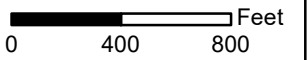
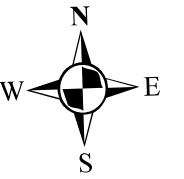
**Drainage  
Impact  
Analysis**

- Land Use**
- Greenspace
  - ROW
  - Subdivision
  - Water
  - Site



Total Phase One Development Acreage = 82.5 Ac +/-

# Exhibit 10 - Phase 1 Development

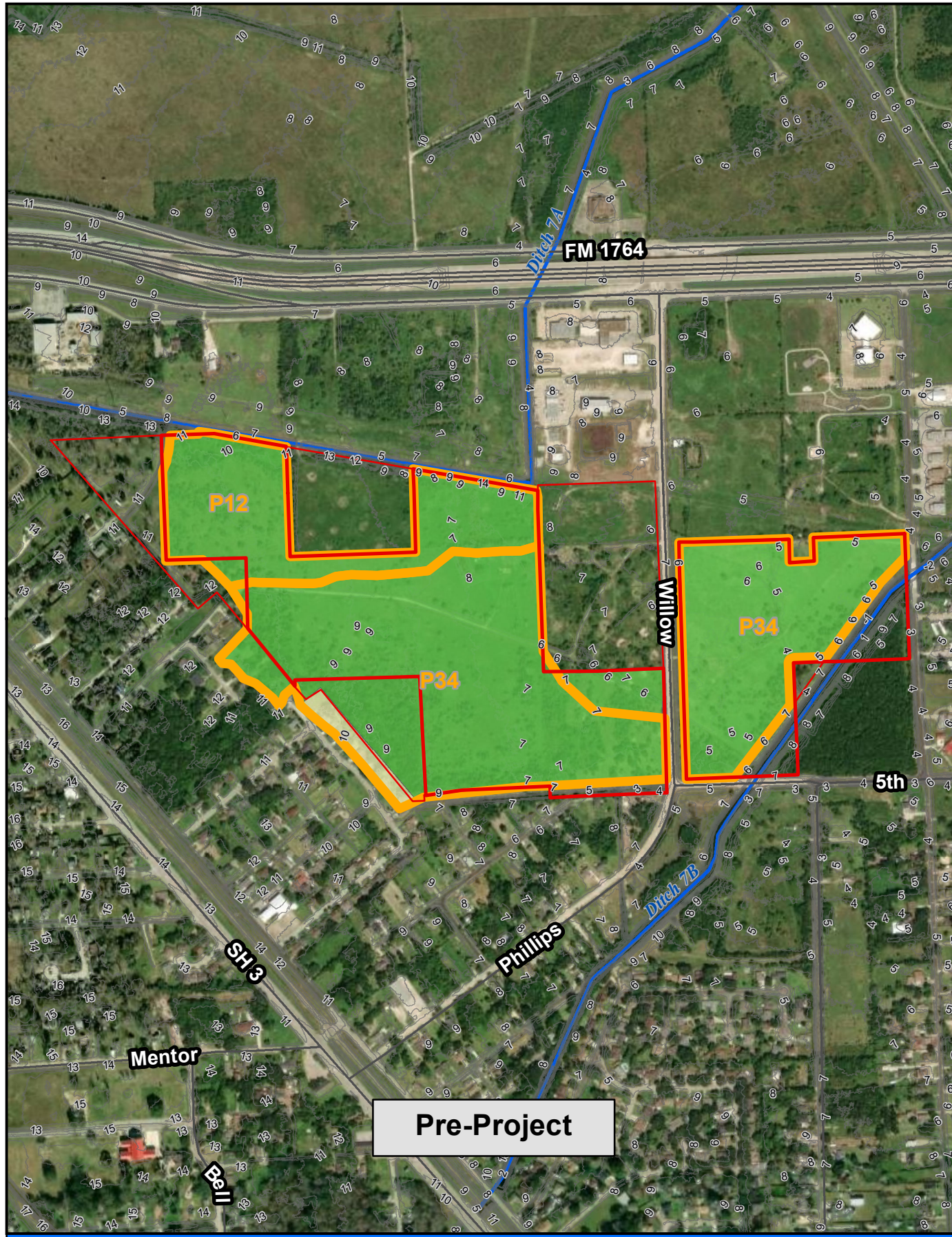


**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

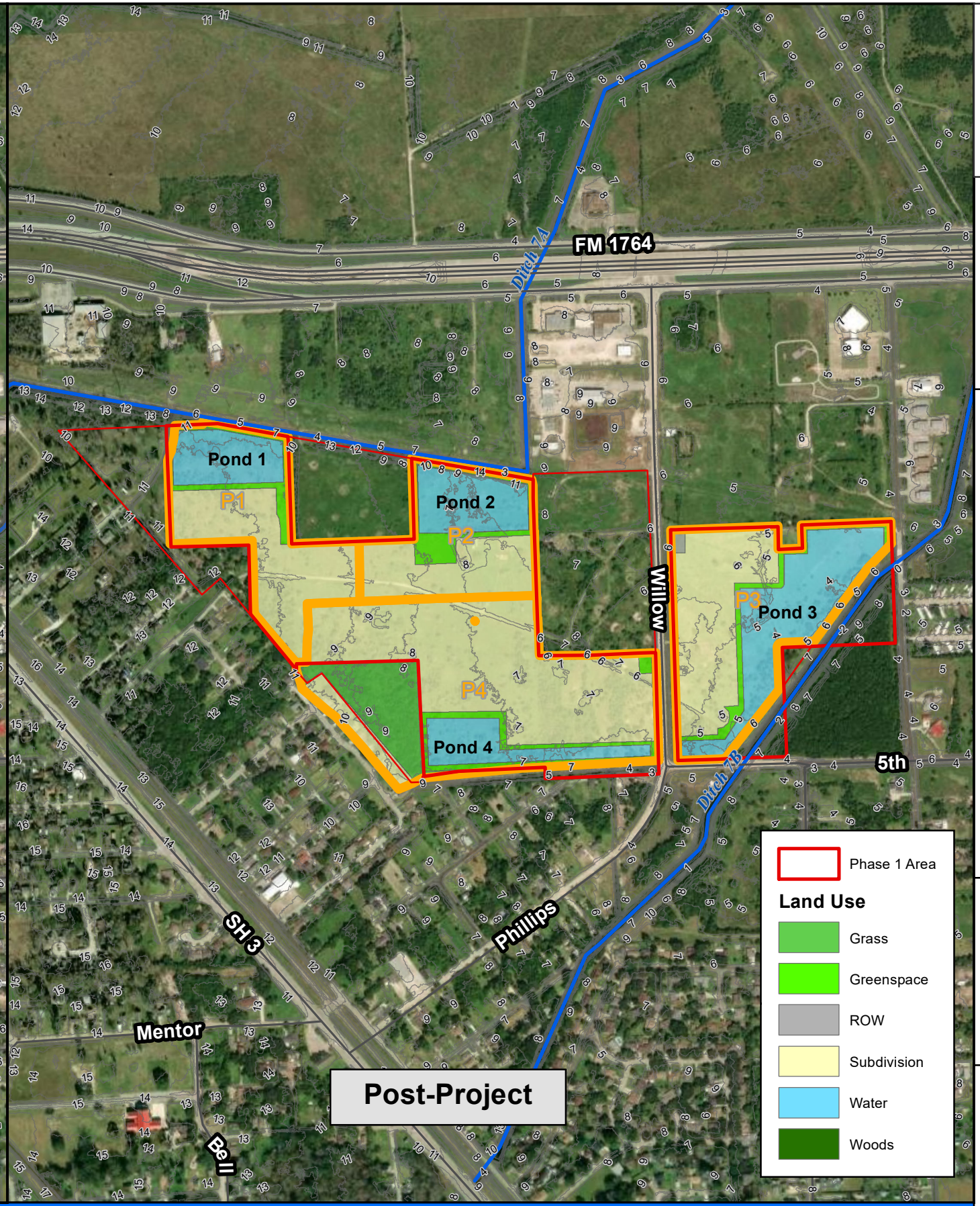
**Drainage  
Impact  
Analysis**

- Phase 1 Area
- Land Use**
  - Grass
  - Greenspace
  - ROW
  - Subdivision
  - Water
  - Woods

- Drainage Subarea
- Elev Contour
- Phase 1 Area
- Road
- Channels
- Site

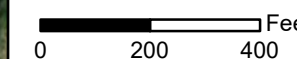
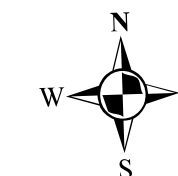


**Pre-Project**



**Post-Project**

**Exhibit 11 - Phase 1 Drainage Subarea Map**



**WILLOWOOD DEVELOPMENT**  
**Proposed Single Family**  
**Subdivision in Texas City, TX**  
**Galveston County DD No. 2**

**Drainage**  
**Impact**  
**Analysis**

- Detention Outfall
- Phase 1 Area
- Full Development
- Land Use**
- Grass
- Greenspace
- ROW
- Subdivision
- Water
- Woods
- Detention Contour

**Pond 1 Outfall Restrictor:**  
 15" Orifice Restrictor Plate  
 Inv Elev = 2.0  
**Outfall Pipe**  
 1-24" Pipe, 90 LF +/-  
 US Inv. Elev = 2.0  
 DS Inv Elev = 1.9  
**Earthen Weir (Overflow)**  
 Crest Elev = 9.0  
 Crest Length = 10'

**Pond 2 Outfall Restrictor:**  
 21" Orifice Restrictor Plate  
 Inv Elev = 0.5  
**Outfall Pipe**  
 1-30" Pipe, 90 LF +/-  
 US Inv. Elev = 0.5  
 DS Inv Elev = 0.4  
**Earthen Weir (Overflow)**  
 Crest Elev = 8.0  
 Crest Length = 10'

**Combined Pond 1 & 2**  
 Allowable Flowrate (10/25/100yr) =  
 24.0 cfs / 31.9 cfs / 45.9 cfs  
 Actual Flowrate (10/25/100yr) =  
 15.9 cfs / 23.5 cfs / 33.2 cfs

**Combined Pond 3 & 4**  
 Allowable Flowrate (10/25/100yr) =  
 65.7 cfs / 87.0 cfs / 125.0 cfs  
 Actual Flowrate (10/25/100yr) =  
 42.0 cfs / 67.4 cfs / 100.8 cfs

**Pond 3**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 5.8  
 Stage Elev (10/25/100yr) =  
 3.20/3.68/4.65  
 Storage Volume (10/25/100yr) =  
 20.1 AF/23.9 AF/32.0 AF  
 Peak Outflow (10/25/100yr) =  
 42.0 cfs/67.4 cfs/100.8 cfs

**Pond 1**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 2.0  
 Top Elev = 10.0  
 Stage Elev (10/25/100yr) =  
 5.09/6.07/7.85  
 Storage Volume (10/25/100yr) =  
 8.5 AF/11.5 AF/17.2 AF  
 Peak Outflow (10/25/100yr) =  
 7.6 cfs/10.4 cfs/13.8 cfs

**Pond 2**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 9.0  
 Stage Elev (10/25/100yr) =  
 2.83/3.46/4.67  
 Storage Volume (10/25/100yr) =  
 2.8 AF/9.4 AF/13.5 AF  
 Peak Outflow (10/25/100yr) =  
 8.3 cfs/13.1 cfs/19.5 cfs

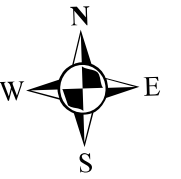
**Pond 4**  
 4:1 Side Slope  
 Wet Bottom w Perm WSE = 0.5  
 Top Elev = 6.0  
 Stage Elev (10/25/100yr) =  
 3.24/3.77/4.85  
 Storage Volume (10/25/100yr) =  
 6.2 AF/7.9 AF/11.1 AF  
 Peak Outflow (10/25/100yr) =  
 47.6 cfs/66.1 cfs/97.3 cfs

**Pond 4 Outfall Restrictor:**  
 None  
**Outfall Pipe**  
 2-54" Pipes, 215 LF +/-  
 US Inv. Elev = -4.0  
 DS Inv Elev = -4.0  
**Overflow**  
 Willow Rd to Pond 3  
 Min Elev (Ex) = 7.18

**Pond 3 Outfall Restrictor:**  
 None  
**Outfall Pipe**  
 3-30" Pipe, 90 LF +/-  
 US Inv. Elev = 0.5  
 DS Inv Elev = 0.4  
**Earthen Weir (Overflow)**  
 Crest Elev = 4.8  
 Crest Length = 10'

**Total Site Acreage = 116.1 Ac +/-**  
**Total Development Acreage = 110.5 Ac**

**Exhibit 12- Phase 1 Detention**



0 195 390 Feet

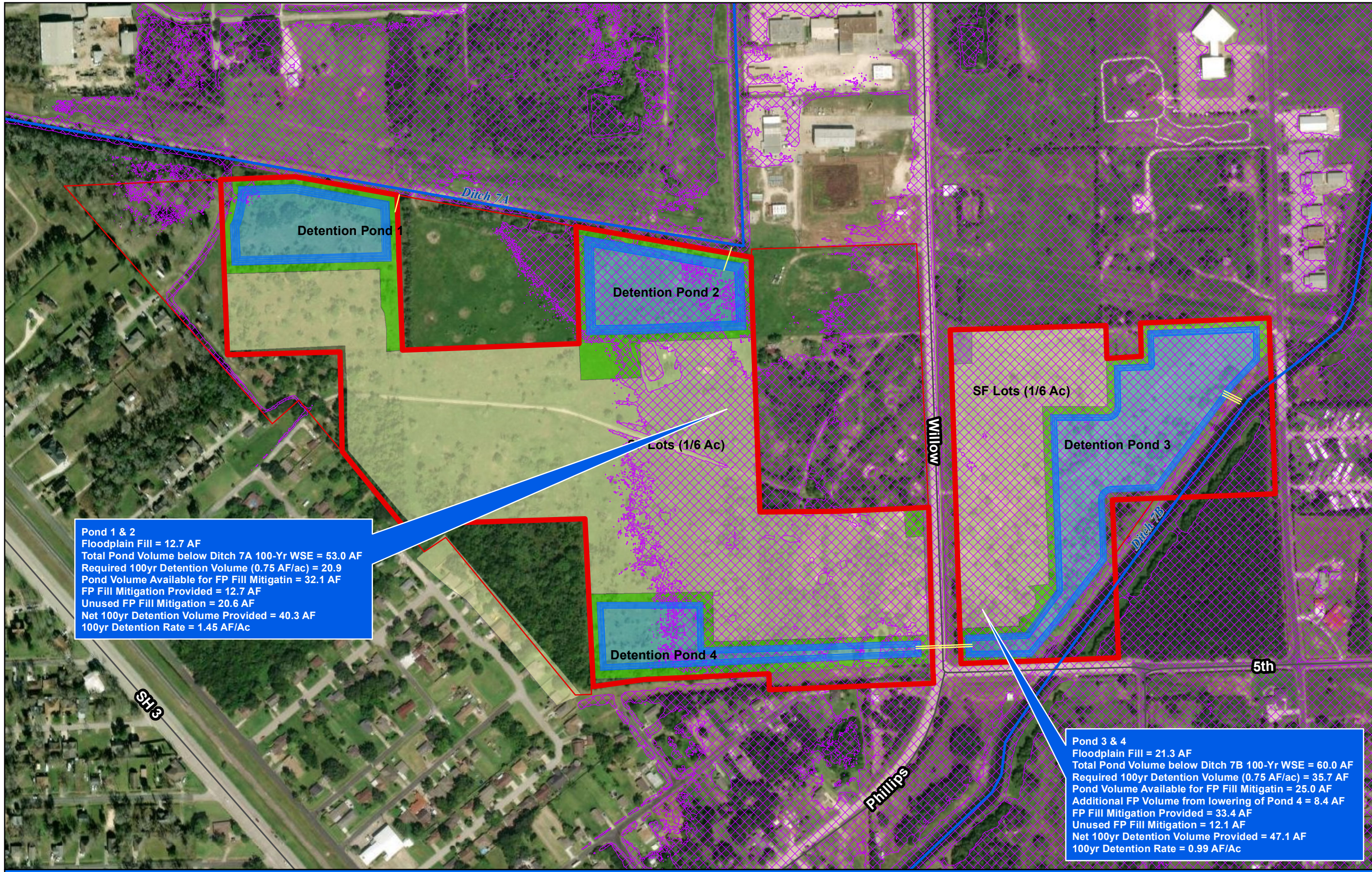
**WILLOWOOD DEVELOPMENT**  
**Proposed Single Family**  
**Subdivision in Texas City, TX**  
**Galveston County DD No. 2**

**Drainage**  
**Impact**  
**Analysis**

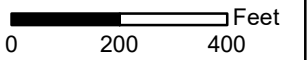
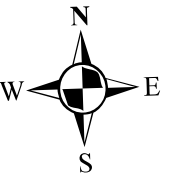
- Detention Outfall
- Detention Contour
- Phase 1 Area
- Site
- Computed 100-Yr FP
- Land Use**
- Greenspace
- ROW
- Subdivision
- Water

**Pond 1 & 2**  
 Floodplain Fill = 12.7 AF  
 Total Pond Volume below Ditch 7A 100-Yr WSE = 53.0 AF  
 Required 100yr Detention Volume (0.75 AF/ac) = 20.9  
 Pond Volume Available for FP Fill Mitigation = 32.1 AF  
 FP Fill Mitigation Provided = 12.7 AF  
 Unused FP Fill Mitigation = 20.6 AF  
 Net 100yr Detention Volume Provided = 40.3 AF  
 100yr Detention Rate = 1.45 AF/Ac

**Pond 3 & 4**  
 Floodplain Fill = 21.3 AF  
 Total Pond Volume below Ditch 7B 100-Yr WSE = 60.0 AF  
 Required 100yr Detention Volume (0.75 AF/ac) = 35.7 AF  
 Pond Volume Available for FP Fill Mitigation = 25.0 AF  
 Additional FP Volume from lowering of Pond 4 = 8.4 AF  
 FP Fill Mitigation Provided = 33.4 AF  
 Unused FP Fill Mitigation = 12.1 AF  
 Net 100yr Detention Volume Provided = 47.1 AF  
 100yr Detention Rate = 0.99 AF/Ac



**Exhibit 13 - Ph 1 FP Fill Mitigation & Detention Rate**



**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

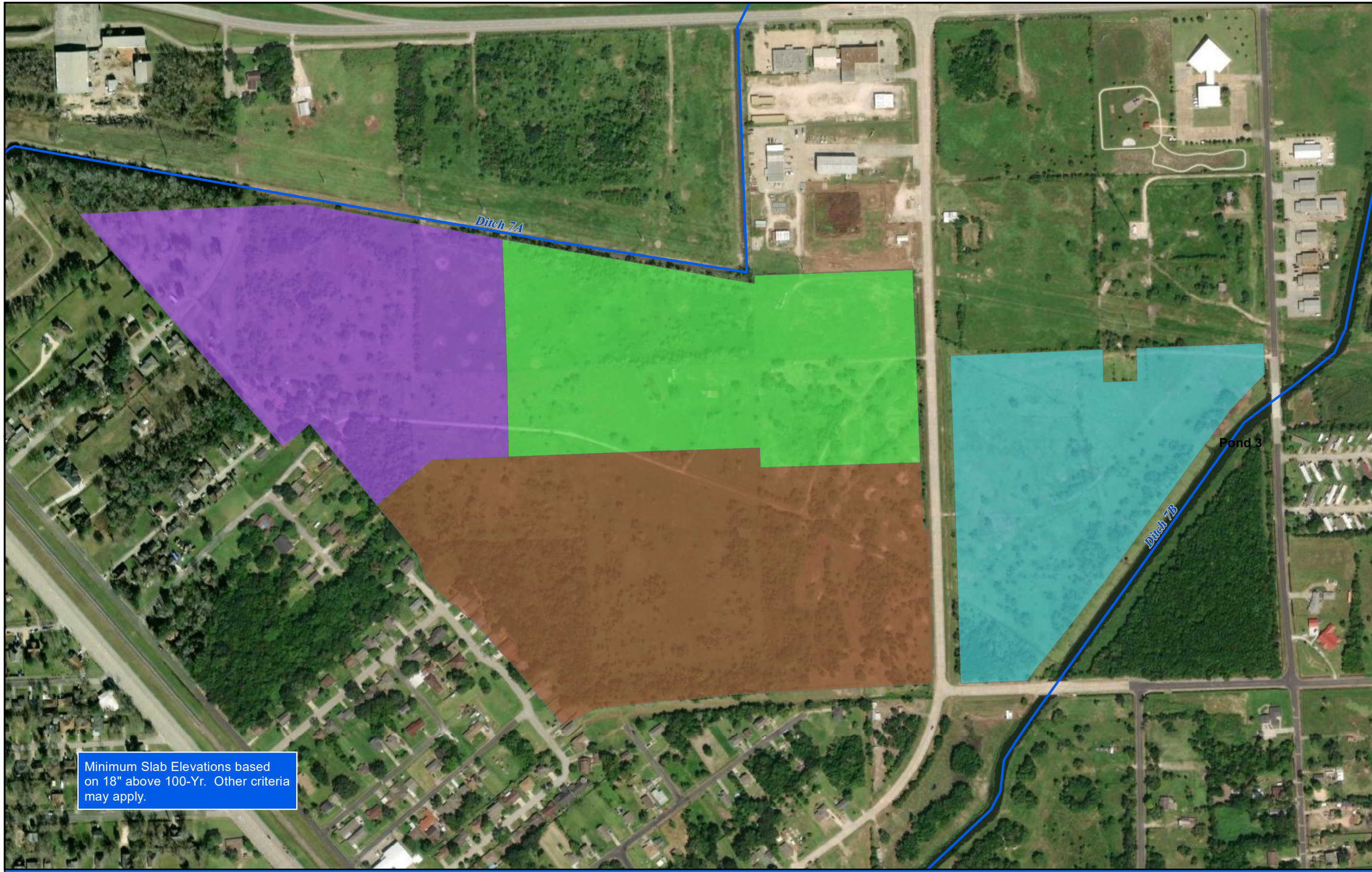
**Drainage  
Impact  
Analysis**

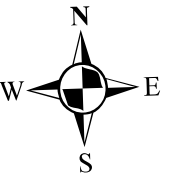
**Minimum Slab Elev**

- 10.5
- 11.5
- 8.7
- 9.0

Minimum Slab Elevations based on 18" above 100-Yr. Other criteria may apply.

# Exhibit 14 - Minimum Slab Elevations





0 200 400 Feet

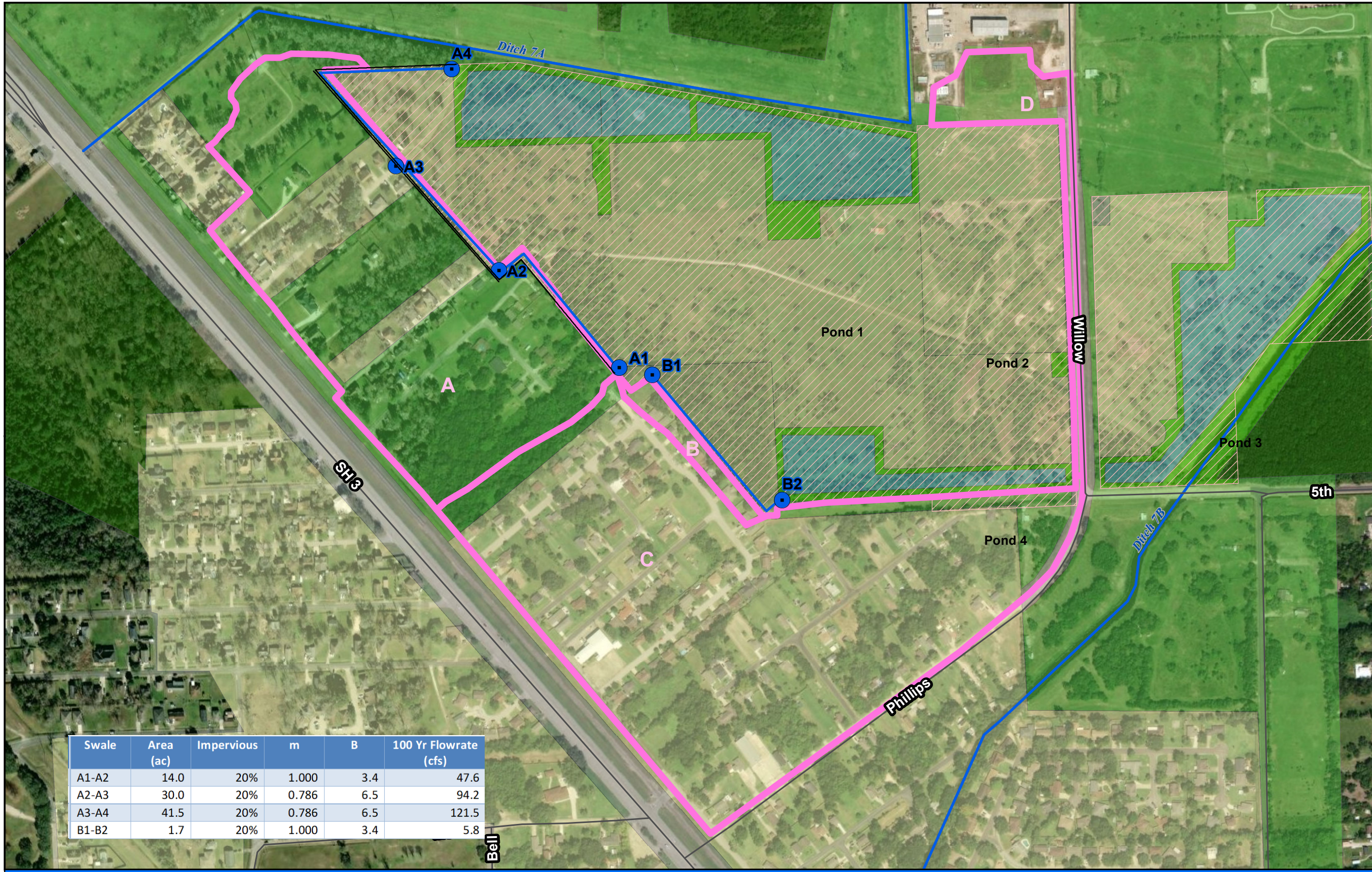
**WILLOWOOD DEVELOPMENT**  
Proposed Single Family  
Subdivision in Texas City, TX  
Galveston County DD No. 2

**Drainage  
Impact  
Analysis**

- Reference Nodes
- Perimeter Swale
- Offsite Areas
- Road
- Channels
- ▨ Site

Swale	Area (ac)	Impervious	m	B	100 Yr Flowrate (cfs)
A1-A2	14.0	20%	1.000	3.4	47.6
A2-A3	30.0	20%	0.786	6.5	94.2
A3-A4	41.5	20%	0.786	6.5	121.5
B1-B2	1.7	20%	1.000	3.4	5.8

# Exhibit 15 - Offsite Flow Management





## STAFF REPORT

To: Zoning Commission - Regular Meeting -- November 19, 2024

From: Kim Golden, P.E., City Engineer 

CC: Doug Kneupper, P.E.

Date: November 15, 2024

RE: Willow Wood Subdivision - Master Plan and request to rezone from District A-1 Single Family Residential to District I – Planned Unit Development

---

**Background: Willow Wood Subdivision** - Applicant, Castlerock Communities, Inc, proposes to develop **80-acre tract of land**, comprising nine individual parcels, located southeast of State Highway 3 and south of FM 1764 as a single-family residential community, complete with stormwater detention facilities, parks and open space. The subdivision will develop **213 single family detached lots at various dimensions ranging from 6,000sft to 13,000sft**, with homes expected to range in price from \$275,000 to \$375,000. There are no proposed non-residential uses. The community will incorporate walking/jogging trails as well as an approximate 7.1 acre park/green space with a playground, seating areas, and landscaped entry reserves.

The subject tract is included GCMUD 66 and subject to a Development Agreement approved by the City Commission in 2007 which requires development of the subject properties as a Planned Unit Development. The application is presented to satisfy the requirements of the Development Agreement.

Planning Board recommended approval of the master plan and PUD at its regular meeting on October 7, 2024.

**Existing Conditions:** The subject tract is mostly flat with elevations ranging from 11 feet above sea level on the northern side of the tract to 14 feet above sea level on the southern side of the tract. The eastern portion of the site falls within the 100-year flood plain. Land uses near the tract include single family residential tracts, public use property and undeveloped property.

The adjacent properties to the north of this area are mostly undeveloped. Southwest of the site parcels consist of residential properties along State Highway 3, with a creek along the southeast boundary.

**Staff analysis:** The total lot yield of 213 lots is a proposed density of 2.7 units per acre.

An important component of a viable residential development is providing parks and meaningful open spaces. The PUD Application and Exhibit B Conceptual Master Plan incorporates walking/jogging trails as well as 7.1 acres in parks in greenspace. Four dual amenity/detention ponds located to the north, south and east exceeds the requirements of the Subdivision Ordinance of one-half acre per 100 homes. Exhibit

D-1 illustrates the Park and Trail Plan with Exhibit D-2 providing examples of the representative amenities.

The PUD Application and Development Agreement require the creation of a Homeowner's Association that will be responsible for maintenance of parks and common areas. The HOA document should include strong language regarding the HOA's ability to keep the subdivision clean, attractive, and sustainable by abating nuisance and property maintenance type issues.

Willow Street, identified as N. Pine St. on Google Maps, is an existing local street which runs through the site providing connections to FM 1764 to the north and Phillips Street to the south. Willow Street will be the access for both east and west sections of the project, but developer intends to add additional property for a future second entrance to the west.

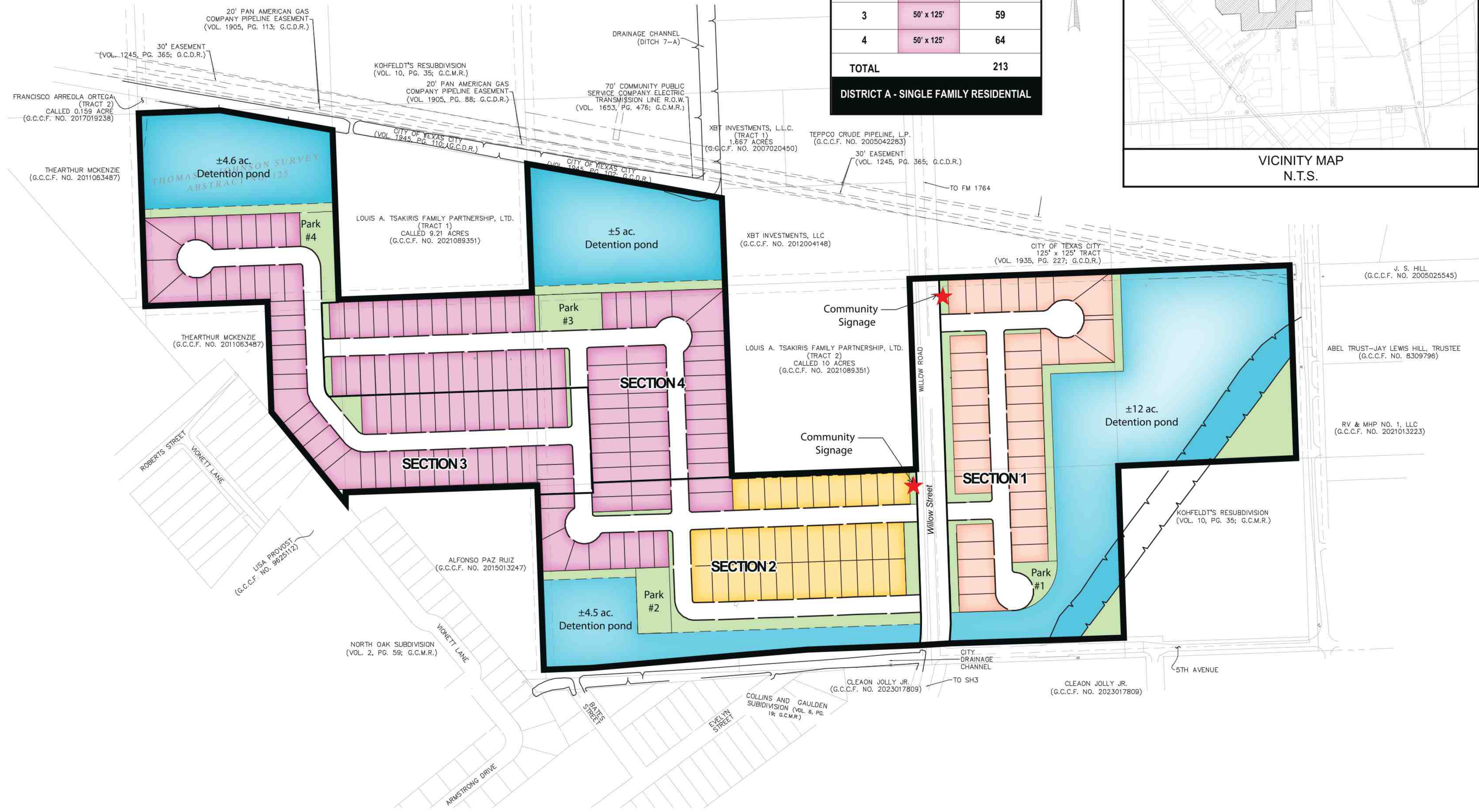
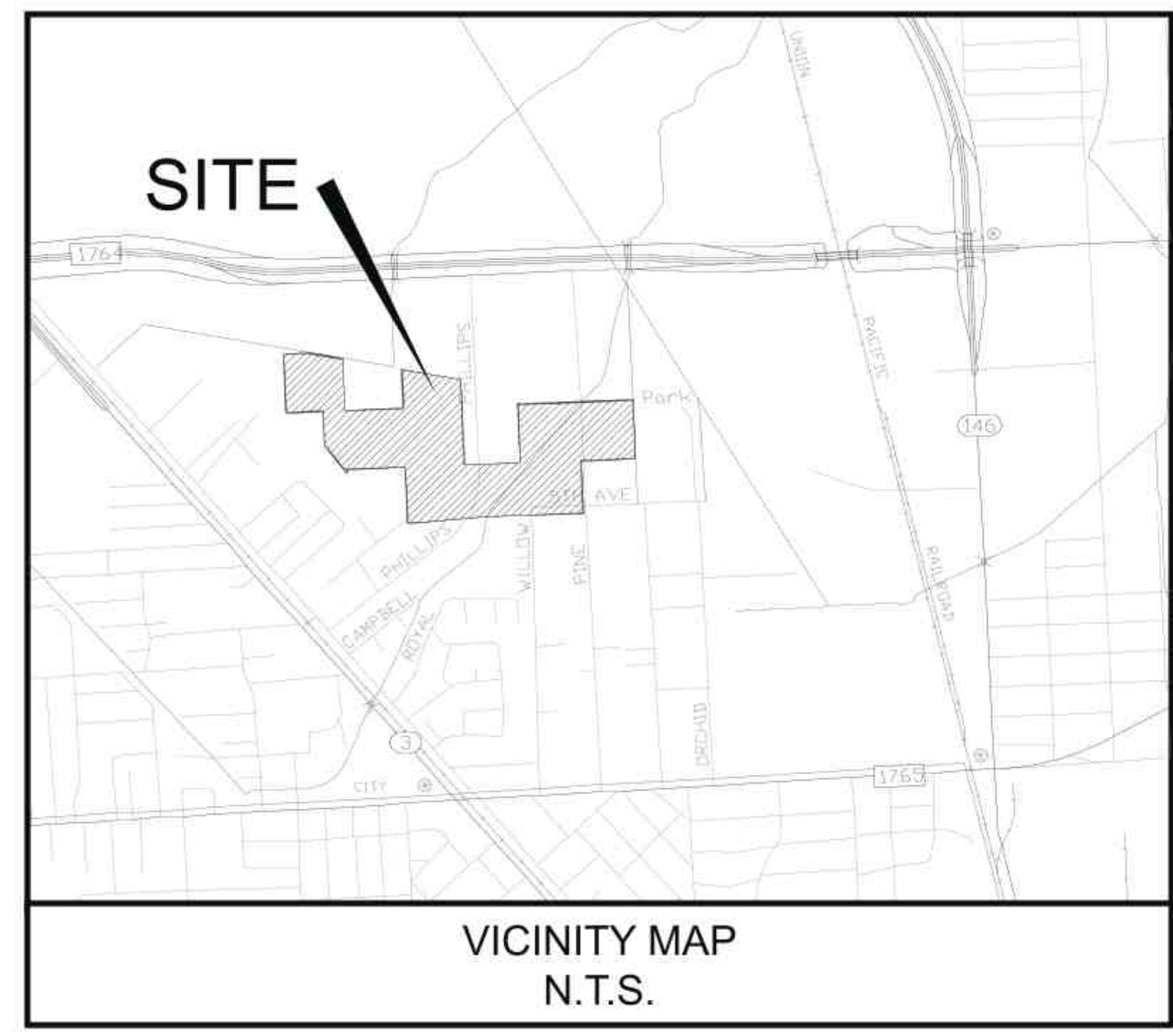
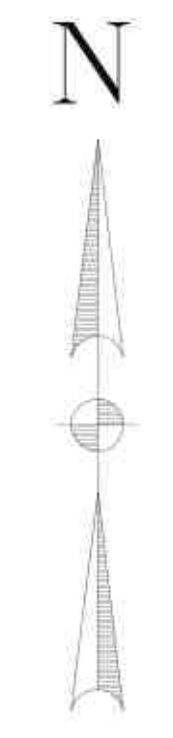
Water and sewer facilities are readily available to this project and can be extended from existing mains.

As noted, some of the site is located in the 100-year flood plain and much of the site provided additional natural detention storage capacity. A thorough drainage impact analysis was provided with review and approval from the GCDD # 2.

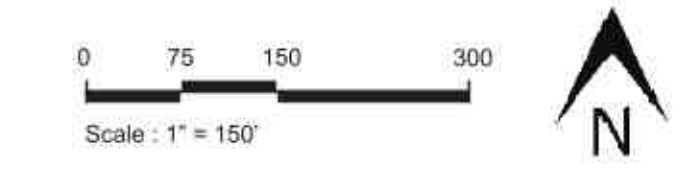
Developer indicates a willingness to adhere to the 60% masonry content reflected in the Development Agreement when approved in 2007. Developer also indicates it does not allow copper clad aluminum wire in the construction of homes and has no objection to such requirement in the Development Agreement.

**RECOMMENDATION:** The Planning Board considered and unanimously recommended approval of the Master Plan and PUD at its regular meeting on October 7, 2024. City staff have reviewed this Subdivision Masterplan, Development Agreement and PUD Application and has no objections to approval of the masterplan or to the zoning change request. Staff recommends provision be made in the PUD to allow amendment of the PUD to incorporate the additional property when acquired by the developer to provide for the construction of a second entrance. A limit should be determined for the number of permits which will issue until a second entrance is added to the master plan.

LOT TABLE - PROPOSED		
Section	Lot Size	No. of Lots
1	60' x 125'	38
2	55' x 125'	37
2	50' x 125'	15
3	50' x 125'	59
4	50' x 125'	64
<b>TOTAL</b>		<b>213</b>
<b>DISTRICT A - SINGLE FAMILY RESIDENTIAL</b>		



# 80 acre Master Plan - Willow Wood



Texas City, Galveston County, TX | May, 2024

OWNER / DEVELOPER:  
**CASTLEROCK COMMUNITIES**  
 2401 FOUNTAINVIEW DR.  
 STE 215  
 HOUSTON, TX 77057  
 TEL: 713-600-7000

PLANNER:  
**PEA GROUP**  
 16060 DILLARD DRIVE  
 STE 250  
 HOUSTON, TX 77040  
 TEL: 713-688-3530



**Planned Unit District For**  
**Willow Wood Development**

Prepared For  
Castlerock Communities Inc.



**CASTLEROCK**  
COMMUNITIES

Planner:  
PEA Group



August 29, 2024

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- I. INTRODUCTION
  - II. SITE INVENTORY ANALYSIS
    - A. Opportunities and Constraints
    - B. Surrounding Land Use
  - III. PROJECT DESCRIPTION
    - A. Land Use
    - B. Phasing
    - C. Street Circulation Concept
    - D. Open Space Amenities Plan
    - E. School District Zoning
  - IV. ZONING
    - A. Existing Zoning
    - B. Proposed / Future Zoning
  - V. UTILITIES
- 
- EXHIBITS
    - A. Exhibit A-1 – Project Survey
    - B. Exhibit A-2 – Legal Description
    - C. Exhibit B – Conceptual Master Plan
    - D. Exhibit C – Phasing Plan
    - E. Exhibit D-1 – Park and Trail Plan
    - F. Exhibit D-2 – Community Park Image Board
    - G. Exhibit E – Zoning Map
    - H. Exhibit F – Development Timeline
    - I. Exhibit G – Development Agreement

## **I. INTRODUCTION**

The following application is submitted under Section 160.050 "District I (PUD), Planned Unit Development".

This planned development document was created in accordance with City of Texas City (City) ordinances related to the "(PUD) Planned Unit Development". The purpose of this document is to encourage the development of the subject property and to promote the most compatible land use within the community.

The Willow Wood project is an 80-acre tract of land, comprising nine individual parcels, located southeast of State Highway 3 and south of FM 1764. Castlerock Communities Inc. (Developer) is the owner of Subject Tract, and it intends to develop the property as a single-family residential community, complete with stormwater detention facilities, parks, and open space.

The Subject Tract is party to a Development Agreement approved by the City in 2023 (Exhibit G – Development Agreement). This PUD application is presented to satisfy the zoning requirements of the Development Agreement.

## **II. SITE INVENTORY ANALYSIS**

### **A. Opportunities and Constraints**

Similar to surrounding properties, the Subject Tract is mostly flat with elevations ranging from approximately 11 feet above sea level on the northern side of the tract to 14 feet above sea level on the southern side of the tract. Existing physical constraints affecting development of the property include the following:

- The eastern portion of the Subject Tract (Parcel ID.186006) falls within 100-year Flood Zone
- The Subject Tract drains to 55' Galveston County Drainage District No. 2 Easement (G.C.C.F. No. 2000037094)

B. Surrounding Land Use

Land uses in proximity to the Subject Tract include single-family residential tracts, public use property and undeveloped property. Willow Street, an existing local roadway, runs through the Subject Tract, providing connections to state highway FM1764 to the north and Phillips Street to the south. The entrances on Willow Street offer access to both the western and eastern sections of the project. The adjacent parcels to the north of this area predominantly consist of undeveloped land. Southwest of the Subject Tract, neighboring parcels consist of residential family properties situated along State Highway 3. To the southeast lies a creek.

**III. PROJECT DESCRIPTION**

A. Land Use

Exhibit B – “Conceptual Master Plan” depicts the conceptual lotting plan with the proposed land uses for the tract. The 213 single family detached lots are designed at various dimensions, ranging from 6,000 to 13,000 square feet, with homes that are expected to range in sales price from \$275,000 to \$375,000. The community will incorporate walking/jogging trails as well as +/- 7.1 acres of park/greenspace with a playground, seating areas, and landscaped entry reserves as displayed on Exhibit D-1 – “Park and Trail Plan”.

The density of the project will be approximately 2.7 units per acre, and there will be no non-residential uses. Homes in the project will be a mix of one or two stories.

The property drains into four dual amenity/detention ponds located to the north, south, and east of the project. The east portion of this tract lies within the 100-year flood zone.

**Land Use Table**

<b>Land Use Category</b>	<b>Acreage</b>	<b>% of Gross Acreage</b>
Single Family	+/- 46.9	58.1%
Detention Pond	+/- 26	33%
Greenbelt and Parkland	+/- 7.1	8.9%
<b>Total</b>	<b>+/- 80</b>	<b>100%</b>

B. Phasing

The project comprises four distinct sections of single-family lots with varying dimensions. Section 1 and Section 2 constitute Phase 1, while Section 3 and Section 4 comprise Phase 2, as displayed on Exhibit C – “Phasing Plan”.

C. Street Circulation Concept

The main point of access to the project will be known as Willow Street. It is an existing 30’ roadway that connects to state highway FM 1764. The four entrances on Willow Street offer access to both the western and eastern sections of the project.

D. Park and Trail Plan

According to the Texas City code of ordinances, a minimum of one-half acre of land must be dedicated for public neighborhood park use for every 100 proposed dwelling units. Based upon the proposed number of dwelling units illustrated on Exhibit – B “Conceptual Master Plan” the developer is required to dedicate +/- 1.07 acres of parkland. In accordance with the parks and open space requirements, the community will incorporate walking/jogging trails as well as +/- 7.1 acres of parkland/green belt with a playground, seating areas, and landscaped entry reserves as displayed on Exhibit D-1 – “Park and Trail Plan” and Exhibit D-2 – “Community Park Image Board”.

The Developer will create a homeowner’s association (“HOA”) for the community. The HOA will be responsible for all subdivision and common area maintenance including the dual amenity/detention pond maintenance .

E. School District Zoning

The tract is zoned for Texas City ISD.

## II. **ZONING**

A. Existing Zoning

As illustrated on the current Texas City Zoning Map on the City’s website, the project is zoned as “District A Single Family Residential”, permitting a minimum 50’ lot width and a minimum 120’ lot depth with a minimum square footage of 6,000. The existing zoning classifications for the subject property and surrounding properties are further illustrated on Exhibit E – “Zoning Map”.

B. Proposed / Future Zoning

The purpose of this document is to redefine the zoning to comply with the approved Master Plan by the Planning and Zoning Department, refer to Exhibit B “Conceptual Master Plan”. The lot dimensions to be permitted within this PUD shall be a minimum 50’ lot width and a minimum 120’ lot depth with a minimum square footage of 6,000. The minimum lot depth shall not apply to lots that front cul-de-sacs or knuckles, but the minimum lot width and square footage

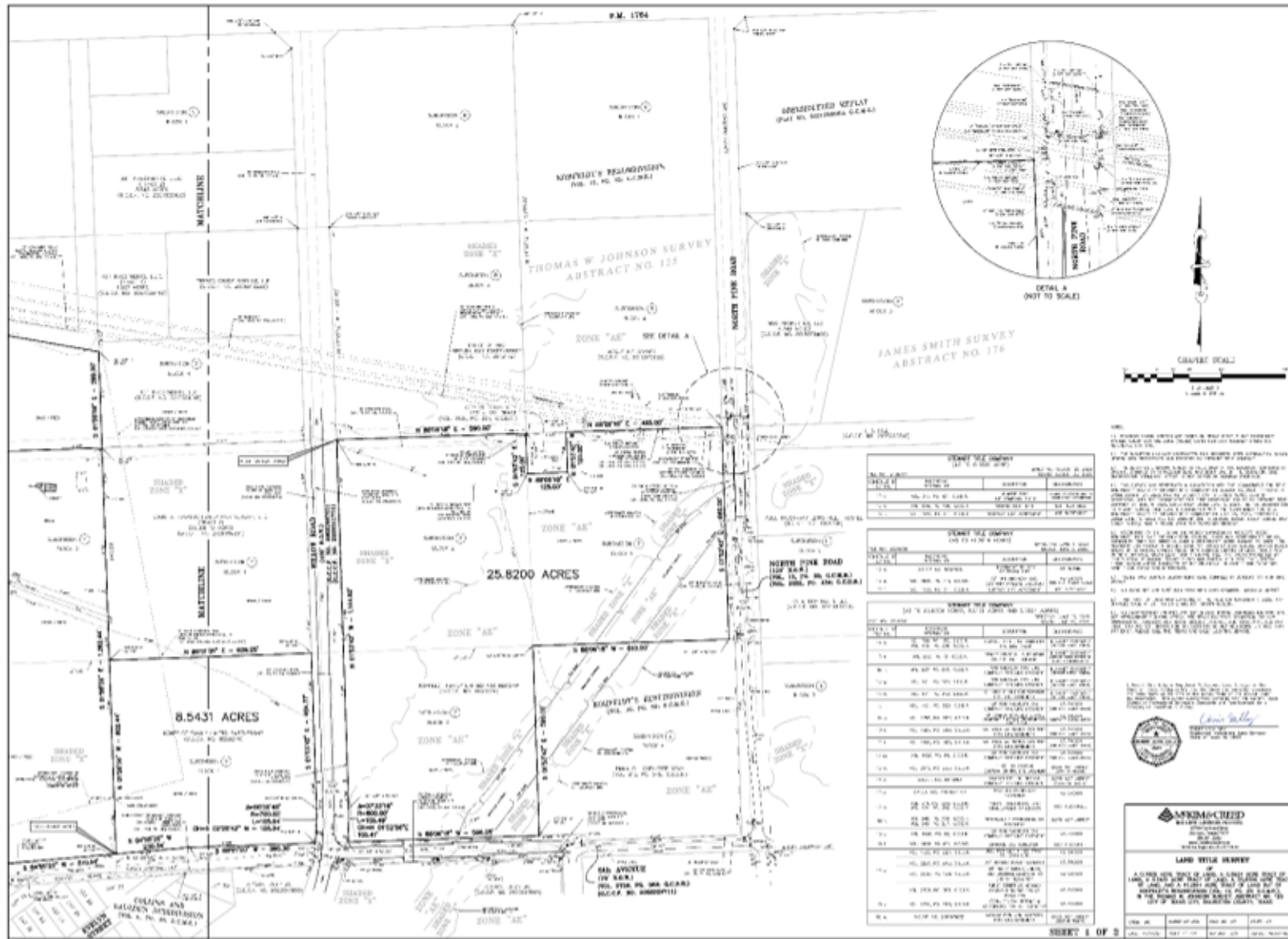
requirements shall still apply. The Developer will abide by rules and regulations of the Texas City Code of Ordinances other than those being modified herein.

### **III. UTILITIES**

All utilities including the water distribution system, sanitary sewer collection system, storm water drainage system, and dual amenity/detention facilities will be financed by the Developer with possible future reimbursement by Galveston County Municipal Utility District No. 66. Ultimately all utilities will be owned and maintained by the City of Texas City except the dual amenity/detention facilities, which will be owned by the MUD and maintained by the HOA.

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**Exhibit 'A-1' Project Survey**



**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
1	10.0000	STATE OF MISSOURI	RESERVED
2	15.8200	STATE OF MISSOURI	RESERVED
3	0.0000	STATE OF MISSOURI	RESERVED
4	0.0000	STATE OF MISSOURI	RESERVED

**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
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**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
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9	0.0000	STATE OF MISSOURI	RESERVED
10	0.0000	STATE OF MISSOURI	RESERVED

**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
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12	0.0000	STATE OF MISSOURI	RESERVED
13	0.0000	STATE OF MISSOURI	RESERVED

**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
14	0.0000	STATE OF MISSOURI	RESERVED
15	0.0000	STATE OF MISSOURI	RESERVED
16	0.0000	STATE OF MISSOURI	RESERVED

**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
17	0.0000	STATE OF MISSOURI	RESERVED
18	0.0000	STATE OF MISSOURI	RESERVED
19	0.0000	STATE OF MISSOURI	RESERVED

**TRACT DATA SUMMARY**  
(SEE DETAIL A)

TRACT NO.	ACRES	OWNER	REMARKS
20	0.0000	STATE OF MISSOURI	RESERVED
21	0.0000	STATE OF MISSOURI	RESERVED
22	0.0000	STATE OF MISSOURI	RESERVED

1. THIS SURVEY WAS MADE IN ACCORDANCE WITH THE MISSOURI SURVEYING ACT OF 1964, AS AMENDED, AND THE RULES AND REGULATIONS THEREUNDER. THE SURVEY WAS MADE BY ME OR UNDER MY CLOSE PERSONAL SUPERVISION AND TO THE BEST OF MY KNOWLEDGE AND BELIEF IT COMES INTO ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS.

2. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

3. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

4. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

5. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

6. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

7. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

8. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

9. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.

10. I HEREBY CERTIFY THAT THE SURVEY WAS MADE IN ACCORDANCE WITH SAID ACT AND RULES AND REGULATIONS AND THAT THE AREA SURVEYED IS THE SAME AS THAT SHOWN ON THE PLAT OF THIS SURVEY.



**LAND TITLE SURVEY**

STATE OF MISSOURI

PLAT NO. 12345

DATE OF SURVEY: 10/15/2023

PROJECT: PROJECT SURVEY

TRACT NO. 1

ACRES: 10.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 2

ACRES: 15.8200

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 3

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 4

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 5

ACRES: 17.8200

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 6

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 7

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 8

ACRES: 25.8200

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 9

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 10

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 11

ACRES: 8.5431

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 12

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 13

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 14

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 15

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 16

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 17

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 18

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 19

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 20

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED

TRACT NO. 21

ACRES: 0.0000

OWNER: STATE OF MISSOURI

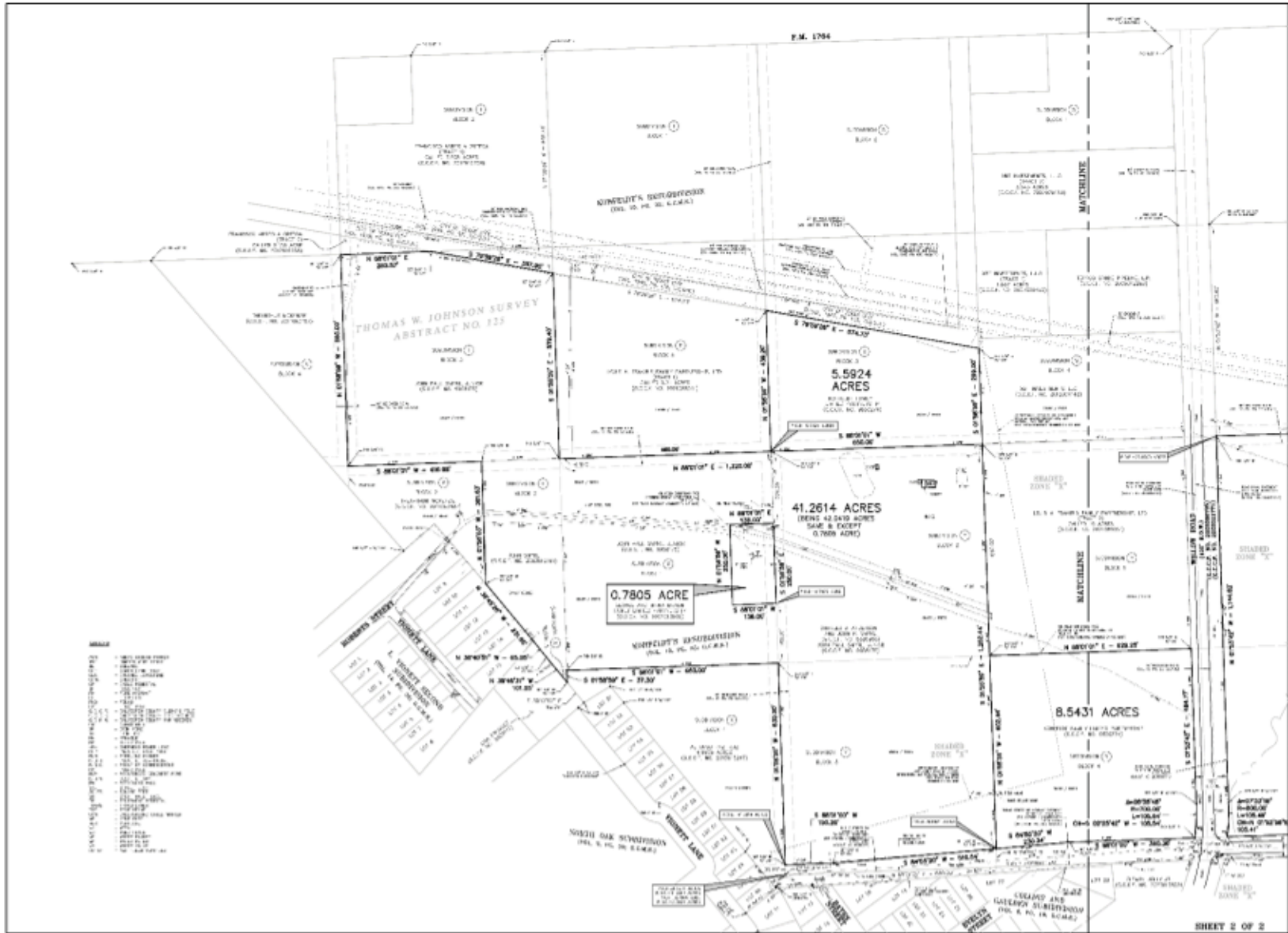
REMARKS: RESERVED

TRACT NO. 22

ACRES: 0.0000

OWNER: STATE OF MISSOURI

REMARKS: RESERVED



## Exhibit 'A-2' Legal Description

November 7, 2023

### *25.8200 acres of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas*

A FIELD NOTE DESCRIPTION of a 25.8200 acre tract of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas; said 25.8200 acre tract being all of Blocks 1, 2 and 3, Subdivision Z, Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records, conveyed to Kohfeldt Family Limited Partnership, as recorded in Galveston County Clerk's File No. 9850274; save and except a 125-foot by 125-foot tract of land conveyed to the City of Texas City, as recorded in Volume 1935, Page 227 of the Galveston County Deed Records; save and except a 2.416 acre road right-of-way easement to the City of Texas City, as recorded in Galveston County Clerk's File No. 2003011771; save and except a 1.0606 acre public street or highway easement to the City of Texas City, as recorded in Volume 2759, Page 363 of the Galveston County Deed Records; save and except a 0.3030 acre public street, utility and drainage easement to the City of Texas City, as recorded in Volume 2335, Page 134 of the Galveston County Deed Records; and save and except a 30-foot wide portion of North Pine Road dedicated by said Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records; said tract being more particularly described by metes-and-bounds as follows with the bearings being based on Texas State Plane Coordinate System, South Central Zone (NAD83) per GPS Observations using National Geodetic Survey Continuously Operating Reference Stations:

BEGINNING at a 5/8-inch iron rod found in the east line of Willow Road (100 feet wide), as recorded in Galveston County Clerk's File Nos. 2002066705 and 2003011771, in the north line of said Block 2 of Subdivision Z and in the south line of Block 3, Subdivision R of said Kofeldt's Resubdivision for a northwest corner of this tract; from which a 5/8-inch iron rod with cap stamped "Walsh Surveying" found bears North 01° 53' 42" East - 660.00 feet;

THENCE, North 88° 06' 18" East - 590.00 feet with the north line of said Block 2 of Subdivision Z and with the south line of said Block 3 of Subdivision R to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Block 1 and 2 of Subdivision Z and Block 3 and 4 of Subdivision R, for the northwest corner of said 125-foot by 125-foot tract conveyed to the City of Texas City, and for a northeast corner of this tract; from which a 1/2-inch iron pipe found in the south right-of-way line of F.M. 1764 bears North 01° 53' 42" West - 1,270.00 feet;

THENCE, South 01° 53' 42" East - 125.00 feet with the east line of said Block 2 of Subdivision Z, with the west line of said Block 1 of Subdivision Z, and with the west line of said 125-foot by 125-foot tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the southwest corner of said 125-foot by 125-foot tract and for an interior corner of this tract;

THENCE, North 88° 06' 18" East - 125.00 feet with the south line of said 125-foot by 125-foot tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the southeast corner of said 125-foot by 125-foot tract and for an interior corner of this tract;

THENCE, North 01° 53' 42" West - 125.00 feet with the east line of said 125-foot by 125-foot tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the north line of said Block 1 of Subdivision Z and in the south line of said Block 4 of Subdivision R for the northeast corner of said 125-foot by 125-foot tract and for a northwest corner of this tract;

THENCE, North 88° 06' 18" East - 485.00 feet with the north line of said Block 1 of Subdivision Z and with the south line of said Block 4 of Subdivision R to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in west right-of-way line of North Pine Road (100 feet wide at this point), according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records and as recorded in Volume 2335, Page 134 of the Galveston County Deed Records for a northeast corner of this tract;

THENCE, South 01° 53' 42" East - 660.00 feet with the west right-of-way line of said North Pine Road to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the south line of said Block 1 of Subdivision Z and in the north line of Block 4 of said Subdivision Z for a southeast corner of this tract;

THENCE, South 88° 06' 18" West - 610.00 feet with the south line of said Block 1 of Subdivision Z and with the north line of said Block 4 of Subdivision Z to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Blocks 1-4 of Subdivision Z and for an interior corner of this tract;

THENCE, South 01° 53' 42" East - 590.00 feet with the east line of said Block 3 of Subdivision Z and with the west line of said Block 4 of Subdivision Z to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the north right-of-way line of 5<sup>th</sup> Avenue (70 feet wide), as recorded in Volume 2759, Page 363 of the Galveston County Deed Records and in Galveston County Clerk's File No. 2002029711 for a southeast corner of this tract;


THENCE, South 88° 06' 18" West - 596.95 feet with the north right-of-way line of said 5<sup>th</sup> Avenue to a 5/8-inch iron rod with cap stamped "McKim & Creed" set at the intersection of the north right-of-way line of said 5<sup>th</sup> Avenue with the east right-of-way line of said Willow Road for the southwest corner of this tract;

THENCE, in a northerly direction with the east right-of-way line of said Willow Road and with a curve to the left having a radius of 800.00 feet, a central angle of 07° 33' 18", a length of 105.49 feet, and a chord bearing North 01° 52' 56" East - 105.41 feet to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for a point-of-tangency;

THENCE, North 01° 53' 42" West - 1,144.82 feet with the east right-of-way line of said Willow Road to the POINT OF BEGINNING and containing 25.8200 acres of land.

Note: This metes-and-bounds description was compiled in conjunction with a survey performed on even date.

COMPILED BY:  
MCKIM & CREED  
Engineers, Surveyors, Planners  
Stafford, Texas  
Firm Registration No. 10177600  
Job No. 08780-0005  
Y:\legals\08780-0005\_tract 1.docx

  
Robert Chris Kelly  
Registered Professional Land Surveyor  
State of Texas No. 6833



November 7, 2023

**8.5431 acres of land in the Thomas W. Johnson Survey, Abstract No. 125,  
City of Texas City, Galveston County, Texas**

A FIELD NOTE DESCRIPTION of an 8.5431 acre tract of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas; said 8.5431 acre tract being all of Block 4, Subdivision Y, Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records, conveyed to Kohfeldt Family Limited Partnership, as recorded in Galveston County Clerk's File No. 9850274; save and except a 2.416 acre road right-of-way easement to the City of Texas City, as recorded in Galveston County Clerk's File No. 2003011771; and save and except a 1.0110 acre public street or highway easement to the City of Texas City, as recorded in Volume 2759, Page 363 of the Galveston County Deed Records; said tract being more particularly described by metes-and-bounds as follows with the bearings being based on Texas State Plane Coordinate System, South Central Zone (NAD83) per GPS Observations using National Geodetic Survey Continuously Operating Reference Stations:

COMMENCING FOR REFERENCE at a 5/8-inch iron rod with cap stamped "Survey 1" found for the southwest corner of Block 3, Subdivision Y of said Kofeldt's Resubdivision, for the southeast corner of Block 4, Subdivision X of said Kofeldt's Resubdivision, for the southeast corner of a 4.9905 acre tract of land conveyed to Alfonso Paz Ruiz, as recorded in Galveston County Clerk's File No. 2015013247, and for the southwest corner of a 0.7772 acre public street or highway easement to the City of Texas City (5<sup>th</sup> Avenue – unimproved right-of-way), as recorded in Galveston County Clerk's File No. 8326967;

THENCE, North 88° 01' 01" East - 660.00 feet with the south line of said Block 3 of Subdivision Y to a point for the southeast corner of said Block 3 of Subdivision Y, for the southwest corner of said Block 4 of Subdivision Y, for the southeast corner of said 0.7772 acre public street or highway easement, and for the southwest corner of said 1.0110 acre public street or highway easement (5<sup>th</sup> Avenue – unimproved right-of-way);

THENCE, North 01° 58' 59" West - 57.56 feet with the east line of said Block 3 of Subdivision Y and with the west line of said Block 4 of Subdivision Y to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the northeast corner of said 0.7772 acre public street or highway easement, for the northwest corner of said 1.0110 acre public street or highway easement, and for the southwest corner and POINT OF BEGINNING of this tract;

THENCE, North 01° 58' 59" West - 602.44 feet with the east line of said Block 3 of Subdivision Y and with the west line of said Block 4 of Subdivision Y to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Blocks 1-4 of said Subdivision Y and for the northwest corner of this tract;

THENCE, North 88° 01' 01" East - 629.25 feet with the north line of said Block 4 of Subdivision Y and with the south line of said Block 1 of Subdivision Y to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the west right-of-way line of Willow Road (100 feet wide), as recorded in Galveston County Clerk's File Nos. 2002066705 and 2003011771 for the northeast corner of this tract;

THENCE, South 01° 53' 42" East - 484.77 feet with the west right-of-way line of said Willow Road to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the point-of-curvature of a curve to the right;

THENCE, in a southerly direction with the west right-of-way line of said Willow Road and with said curve to the right having a radius of 700.00 feet, a central angle of 08° 38' 48", a length of 105.64 feet, and a chord bearing South 02° 25' 42" West - 105.54 feet to a 5/8-inch iron rod found at the intersection of the west right-of-way line of said Willow Road with the north line of said 1.0110 acre public street or highway easement (5<sup>th</sup> Avenue) for the southeast corner of this tract;

THENCE, South 88° 01' 00" West - 390.38 feet with the north line of said 1.0110 acre public street or highway easement to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for an angle point of said 1.0110 acre public street or highway easement and for an angle point of this tract;

THENCE, South 84° 55' 20" West - 230.34 feet with the north line of said 1.0110 acre public street or highway easement to the POINT OF BEGINNING and containing 8.5431 acres of land.

Note: This metes-and-bounds description was compiled in conjunction with a survey performed on even date.

COMPILED BY:  
MCKIM & CREED  
Engineers, Surveyors, Planners  
Stafford, Texas  
Firm Registration No. 10177600  
Job No. 08780-0005  
Y:\legals\08780-0005\_tract 2.docx

  
Robert Chris Kelly  
Registered Professional Land Surveyor  
State of Texas No. 6833



November 7, 2023

***5.5924 acres of land in the Thomas W. Johnson Survey, Abstract No. 125,  
City of Texas City, Galveston County, Texas***

A FIELD NOTE DESCRIPTION of a 5.5924 acre tract of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas; said 5.5924 acre tract being a portion of Block 3, Subdivision S, Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records, conveyed to Kohfeldt Family Limited Partnership, as recorded in Galveston County Clerk's File No. 9850274; said tract being more particularly described by metes-and-bounds as follows with the bearings being based on Texas State Plane Coordinate System, South Central Zone (NAD83) per GPS Observations using National Geodetic Survey Continuously Operating Reference Stations:

COMMENCING FOR REFERENCE at a 5/8-inch iron rod with cap stamped "Survey 1" found for the southwest corner of Block 3, Subdivision Y of said Kofeldt's Resubdivision, for the southeast corner of Block 4, Subdivision X of said Kofeldt's Resubdivision, for the southeast corner of a 4.9905 acre tract of land conveyed to Alfonso Paz Ruiz, as recorded in Galveston County Clerk's File No. 2015013247, and for the southwest corner of a 0.7772 acre public street or highway easement to the City of Texas City (5<sup>th</sup> Avenue – unimproved right-of-way), as recorded in Galveston County Clerk's File No. 8326967;

THENCE, North 01° 58' 59" West with the west line of said Block 3 of Subdivision Y, with the east line of said Block 4 of Subdivision X, and with the east line of said 4.9905 acre tract, at a distance of 660.00 feet pass a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Blocks 1 and 4 of Subdivision X, Blocks 2 and 3 of Subdivision Y of said Kofeldt's Resubdivision, and for the northeast corner of said 4.9905 acre tract and continuing with the west line of said Block 2 of Subdivision Y and with the east line of said Block 1 of Subdivision X for a total distance of 1,320.00 feet to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Block 1 of Subdivision X, said Block 2 of Subdivision Y, Block 3 of said Subdivision S, Block 4 of Subdivision T of said Kofeldt's Resubdivision, and for the southwest corner and POINT OF BEGINNING of this tract; from which a 5/8-inch iron rod found for the common corner of said Blocks 3 and 4 of Subdivision T and Blocks 1 and 2 of Subdivision X of said Kofeldt's Resubdivision bears South 88° 01' 01" West - 660.00 feet;

THENCE, North 01° 58' 59" West - 439.20 feet with the west line of said Block 3 of Subdivision S and with the east line of said Block 4 of Subdivision T to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the southwest corner of a 50-foot wide strip of land conveyed to the City of Texas City, as recorded in Volume 1945, Page 102 of the Galveston County Deed Records, for the southeast corner of a 50-foot wide strip of land conveyed to the City of Texas City, as recorded in Volume 1945, Page 110 of the Galveston County Deed Records and for the northwest corner of this tract;


THENCE, South 79° 59' 26" East - 674.73 feet with the southwest line of said 50-foot wide strip to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the east line of said Block 3 of Subdivision S and in the west line of Block 4 of said Subdivision S for the northeast corner of this tract;

THENCE, South 01° 58' 59" East - 299.00 feet with the east line of said Block 3 of Subdivision S and with the west line of said Block 4 of Subdivision S to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Blocks 3 and 4 of Subdivision S, Blocks 1 and 2 of Subdivision Y and for the southeast corner of this tract;

THENCE, South 88° 01' 01" West - 660.00 feet with the south line of said Block 3 of Subdivision S and with the north line of said Block 2 of Subdivision Y to the POINT OF BEGINNING and containing 5.5924 acres of land.

Note: This metes-and-bounds description was compiled in conjunction with a survey performed on even date.

COMPILED BY:  
MCKIM & CREED  
Engineers, Surveyors, Planners  
Stafford, Texas  
Firm Registration No. 10177600  
Job No. 08780-0005  
Y:\legals\08780-0005\_tract 5.docx

  
Robert Chris Kelly  
Registered Professional Land Surveyor  
State of Texas No. 6833



November 7, 2023

***41.2614 acres of land being a 42.0419 acre tract save and except a 0.7805 acre tract in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas***

A FIELD NOTE DESCRIPTION of a 42.0419 acre tract of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas; said 42.0419 acre tract being a portion of Blocks 2 and 3 of Subdivision X, Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records, conveyed to John Smyrl, as recorded in Galveston County Clerk's File No. 2003012161, being all of Block 1, Subdivision X and a portion of Block 3, Subdivision T of said Kofeldt's Resubdivision, conveyed to John Paul Smyrl, Junior, as recorded in Galveston County Clerk's File No. 9958175, and being all of Blocks 2 and 3, Subdivision Y of said Kofeldt's Resubdivision, conveyed to John Paul Smyrl, Junior, as recorded in Galveston County Clerk's File No. 9958175 and also conveyed to Charles J. Anderson and John P Smyrl, as recorded in Galveston County Clerk's File No. 8326966; save and except a 0.7772 acre public street or highway easement to the City of Texas City, as recorded in Galveston County Clerk's File No. 8326967; said tract being more particularly described by metes-and-bounds as follows with the bearings being based on Texas State Plane Coordinate System, South Central Zone (NAD83) per GPS Observations using National Geodetic Survey Continuously Operating Reference Stations:

COMMENCING FOR REFERENCE at a 5/8-inch iron rod with cap stamped "Survey 1" found for the southwest corner of said Block 3 of Subdivision Y, for the southeast corner of Block 4 of said Subdivision X, for the southeast corner of a 4.9905 acre tract of land conveyed to Alfonso Paz Ruiz, as recorded in Galveston County Clerk's File No. 2015013247, and for the southwest corner of said 0.7772 acre public street or highway easement (5<sup>th</sup> Avenue – unimproved right-of-way);

THENCE, North 01° 58' 59" West - 30.00 feet with the west line of said Block 3 of Subdivision Y, with the east line of said Block 4 of Subdivision X, with the east line of said 4.9905 acre tract, and with the west line of said 0.7772 acre public street or highway easement to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the northwest corner of said 0.7772 acre public street or highway easement and for a southwest corner and POINT OF BEGINNING of this tract;

THENCE, North 01° 58' 59" West - 630.00 feet with the west line of said Block 3 of Subdivision Y, with the east line of said Block 4 of Subdivision X, and with the east line of said 4.9905 acre tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Block 1 and 4 of said Subdivision X and Block 2 and 3 of said Subdivision Y, for the northeast corner of said 4.9905 acre tract, and for an interior corner of this tract;

THENCE, South 88° 01' 01" West - 660.00 feet with the common line of said Blocks 1 and 4 of Subdivision X and with the north line of said 4.9905 acre tract to a 5/8-inch iron rod found for the common corner of Blocks 1-4 of said Subdivision X, for the northwest corner of said 4.9905 acre tract, and for an interior corner of this tract;

THENCE, South 01° 58' 59" East - 37.30 feet with the common line of Blocks 3 and 4 of said Subdivision X and with the west line of said 4.9905 acre tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the northeast line of a tract of land conveyed to Lisa Provost, as recorded in Galveston County Clerk's File No. 9625112 for an angle point of said 4.9905 acre tract and for a south corner of this tract; from which a 1-inch iron pipe found for an angle point of Lot 51, North Oak Subdivision, according to the map or plat recorded in Volume 2, Page 59 of the Galveston County Map Records bears South 39° 12' 52" East - 82.29 feet;

THENCE, North 39° 46' 31" West - 101.55 feet with the northeast line of said Provost tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for an angle point;

THENCE, North 38° 40' 51" West - 65.05 feet with the northeast line of said Provost tract to a point for the east corner of Lot 15, L. Vionett Second Subdivision, according to the map or plat recorded in Volume 14, Page 36 of the Galveston County Map Records, for the north corner of said Provost tract and for an angle point of this tract;

THENCE, North 39° 45' 26" West - 231.85 feet with the northeast line of said L. Vionett Second Subdivision to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the south corner of a tract of land conveyed to Thearthur McKenzie, as recorded in Galveston County Clerk's File No. 2011063487 and for a southwest corner of this tract;

THENCE, North 01° 58' 03" West - 381.63 feet with the east line of said McKenzie tract to a 3/8-inch iron rod found in the north line of said Block 2 of Subdivision X and in the south line of said Block 3 of Subdivision T for a northeast corner of said McKenzie tract and for an interior corner of this tract;

THENCE, South 88° 01' 01" West - 416.98 feet with the north line of said Block 2 of Subdivision X, with the south line of said Block 3 of Subdivision T, and with the north line of said McKenzie tract to a 5/8-inch iron rod found for the common corner of said Block 2 of Subdivision X, Block 3 of Subdivision T, Block 4 of Subdivision U, and Block 1 of Subdivision W of said Kofeldt's Resubdivision, for an interior corner of said McKenzie tract and for an interior corner of this tract;

THENCE, North 01° 58' 59" West - 660.00 feet with the west line of said Block 3 of Subdivision T, with the east line of said Block 4 of Subdivision U, and with the east line of said McKenzie tract to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Blocks 2 and 3 of said Subdivision T and Blocks 1 and 4 of said Subdivision U, for a northeast corner of said McKenzie tract and for a northwest corner of this tract;

THENCE, North 88° 01' 01" East - 280.57 feet with the common line of said Blocks 2 and 3 of Subdivision T to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the west corner of a 50-foot wide strip of land conveyed to the City of Texas City, as recorded in Volume 1945, Page 98 of the Galveston County Deed Records, for the south corner of a 50-foot wide strip of land conveyed to the City of Texas City, as recorded in Volume 1979, Page 47 of the Galveston County Deed Records, and for an angle point of this tract;

THENCE, South 79° 59' 26" East - 387.90 feet with the southwest line of said 50-foot wide strip to a 5/8-inch iron rod with cap stamped "McKim & Creed" set in the common line of Block 3 and 4 of said Subdivision T for the southeast corner of said 50-foot wide strip and for the southwest corner of a 50-foot wide strip of land conveyed to the City of Texas City, as recorded in Volume 1945, Page 110 of the Galveston County Deed Records for a northeast corner of this tract; from which a 5/8-inch iron rod found in the south right-of-way line of F.M. 1764 bears North 01° 58' 59" West - 692.44 feet;

THENCE, South 01° 58' 59" East - 579.40 feet with the common line of said Blocks 3 and 4 of Subdivision T to a 5/8-inch iron rod found for the common corner of said Blocks 3 and 4 of Subdivision T and said Blocks 1 and 2 of Subdivision X for an interior corner of this tract;

THENCE, North 88° 01' 01" East with north line of said Block 1 of Subdivision X and with the south line of said Block 4 of Subdivision T, at a distance of 660.00 feet pass a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Block 1 of Subdivision X, Block 2 of Subdivision Y, Block 3 of Subdivision S, and Block 4 of Subdivision T and continuing with the north line of said Block 2 of Subdivision Y and with the south line of said Block 3 of Subdivision S for a total distance of 1,320.00 feet to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner Blocks 1 and 2 of said Subdivision Y, Blocks 3 and 4 of said Subdivision S, and for a northeast corner of this tract;

THENCE, South 01° 58' 59" East with the common line of Blocks 1 and 2 of said Subdivision Y, at a distance of 660.00 feet pass a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Blocks 1-4 of Subdivision Y and continuing with the common line of Blocks 3 and 4 of said Subdivision Y for a total distance of 1,262.44 feet to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the northeast corner of said 0.7772 acre public street or highway easement to the City of Texas City, for the northwest corner of a 1.0110 acre public street or highway easement to the City of Texas City, as recorded in Volume 2759, Page 363 of the Galveston County Deed Records, and for a southeast corner of this tract;

THENCE, South 84° 55' 20" West - 510.54 feet with the north line of said 0.7772 acre public street or highway easement to a 5/8-inch iron rod with cap stamped "McKim & Creed" set for an angle point 0.7772 acre public street or highway easement and for an angle point of this tract;

THENCE, South 88° 01' 00" West - 150.20 feet with the north line of said 0.7772 acre public street or highway easement to the POINT OF BEGINNING and containing 42.0419 acres of land, save and except 0.7805 acre of land leaving a net area of 41.2614 acres; said 0.7805 acre tract described as follows:

***0.7805 acre of land in the Thomas W. Johnson Survey, Abstract No. 125,  
City of Texas City, Galveston County, Texas***

A FIELD NOTE DESCRIPTION of a 0.7805 acre tract of land in the Thomas W. Johnson Survey, Abstract No. 125, City of Texas City, Galveston County, Texas; said 0.7805 acre tract being out of Block 1, Subdivision X, Kofeldt's Resubdivision, according to the map or plat recorded in Volume 10, Page 35 of the Galveston County Map Records, conveyed to George and Minna Braun Family Limited Partnership, as recorded in Galveston County Clerk's File No. 2004013806; said tract being more particularly described by metes-and-bounds as follows with the bearings being based on Texas State Plane Coordinate System, South Central Zone (NAD83) per GPS Observations using National Geodetic Survey Continuously Operating Reference Stations:

COMMENCING FOR REFERENCE at a 5/8-inch iron rod with cap stamped "Survey 1" found for the southwest corner of Block 3, Subdivision Y of said Kofeldt's Resubdivision, for the southeast corner of Block 4, Subdivision X of said Kofeldt's Resubdivision, for the southeast corner of a 4.9905 acre tract of land conveyed to Alfonso Paz Ruiz, as recorded in Galveston County Clerk's File No. 2015013247, and for the southwest corner of a 0.7772 acre public street or highway easement to the City of Texas City (5<sup>th</sup> Avenue - unimproved right-of-way), as recorded in Galveston County Clerk's File No. 8326967;

THENCE, North 01° 58' 59" West with the west line of said Block 3 of Subdivision Y, with the east line of said Block 4 of Subdivision X, and with the east line of said 4.9905 acre tract, at a distance of 660.00 feet pass a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of Blocks 1 and 4 of Subdivision X and Blocks 2 and 3 of Subdivision Y and for the northeast corner of said 4.9905 acre tract and continuing with the west line of said Block of Subdivision Y and with the east line of said Block 1 of Subdivision X for a total distance of 846.00 feet to a point for the southeast corner and POINT OF BEGINNING of this tract;

THENCE, South 88° 01' 01" West - 136.00 feet to a point for the southwest corner of this tract;

THENCE, North 01° 58' 59" West - 250.00 feet to a point for the northeast corner of this tract;

THENCE, North 88° 01' 01" East - 136.00 feet to a point in the west line of said Block 2 of Subdivision Y and in the east line of said Block 1 of Subdivision X for the northeast corner of this tract; from which a 5/8-inch iron rod with cap stamped "McKim & Creed" set for the common corner of said Block 1 of Subdivision X and Block 2 of Subdivision Y bears North 01° 58' 59" West - 224.00 feet;

THENCE, South 01° 58' 59" East - 250.00 feet with the west line of said Block 2 of Subdivision Y and with the east line of said Block 1 of Subdivision X to the POINT OF BEGINNING and containing 0.7805 acre of land.

Note: This metes-and-bounds description was compiled in conjunction with a survey performed on even date.

COMPILED BY:  
MCKIM & CREED  
Engineers, Surveyors, Planners  
Stafford, Texas  
Firm Registration No. 10177600  
Job No. 08780-0005  
Y:\legals\08780-0005\_tract 3.docx

  
Robert Chris Kelly  
Registered Professional Land Surveyor  
State of Texas No. 6833



November 7, 2023

**0.7805 acre of land in the Thomas W. Johnson Survey, Abstract No. 125,  
City of Texas City, Galveston County, Texas**

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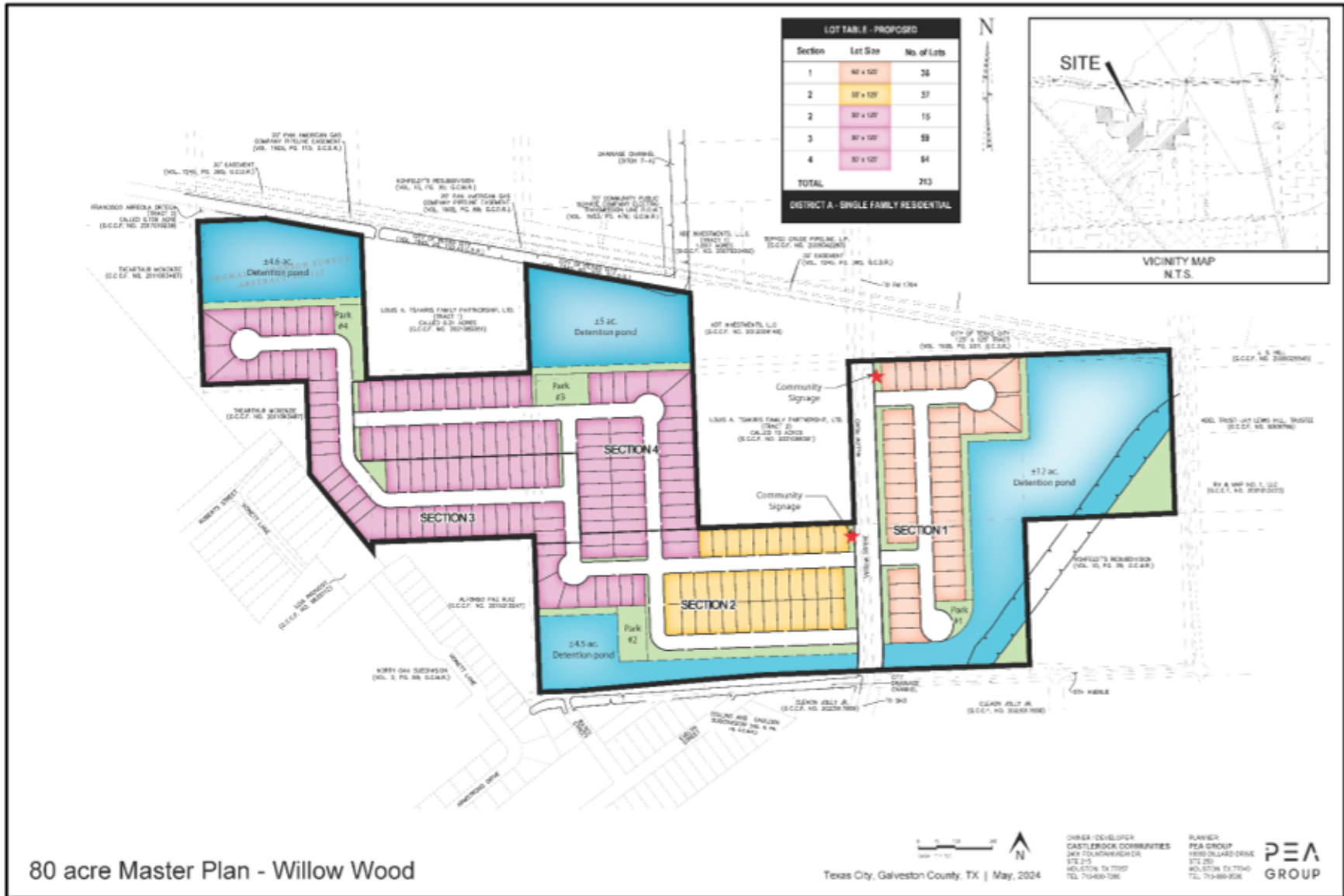
Note: This metes-and-bounds description was compiled in conjunction with a survey performed on even date.

COMPILED BY:  
MCKIM & CREED  
Engineers, Surveyors, Planners  
Stafford, Texas  
Firm Registration No. 10177600  
Job No. 08780-0005  
Y:\legals\08780-0005\_tract 4.docx

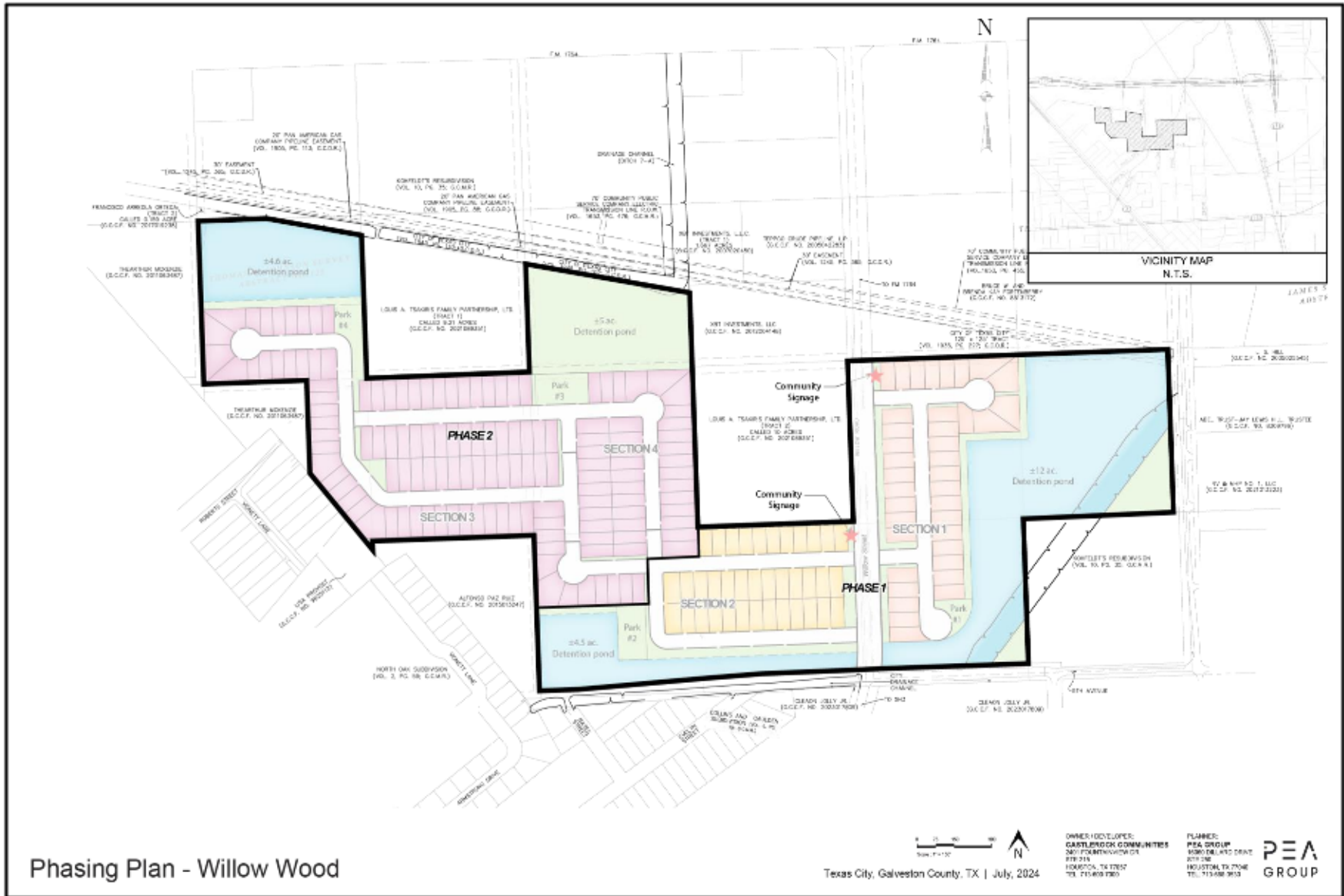


  
Robert Chris Kelly  
Registered Professional Land Surveyor  
State of Texas No. 6833

# Exhibit 'B' Conceptual Master Plan



**Exhibit 'C' Phasing Plan**



Phasing Plan - Willow Wood

Texas City, Galveston County, TX | July, 2024

OWNER / DEVELOPER: **CARLETON COMMUNITIES**  
2601 FORTBERRY AVENUE  
FPO 216  
HOUSTON, TX 77057  
TEL: 713.683.1900

PLANNER: **PEA GROUP**  
6000 FORT LINDSEY DRIVE  
SUITE 200  
HOUSTON, TX 77056  
TEL: 713.686.9103

**PEA GROUP**

# Exhibit 'D-1' Park and Trail Plan



**Exhibit 'D-2' Community Park Image Board**

**Site Furnishing**



Bench



Trash receptacle



Aluminum pet station

**Pavillion**



Open timber truss with column



Square steel pavillion

**Free Standing Play Equipment**



2 Arch



Apollo spinner and tree fort



Swing set



Spring rider

**Playground Equipment**



Playground equipment:  
2 to 5 years



Playground equipment:  
5 to 12 years

Community Park Image Board - Willow Wood

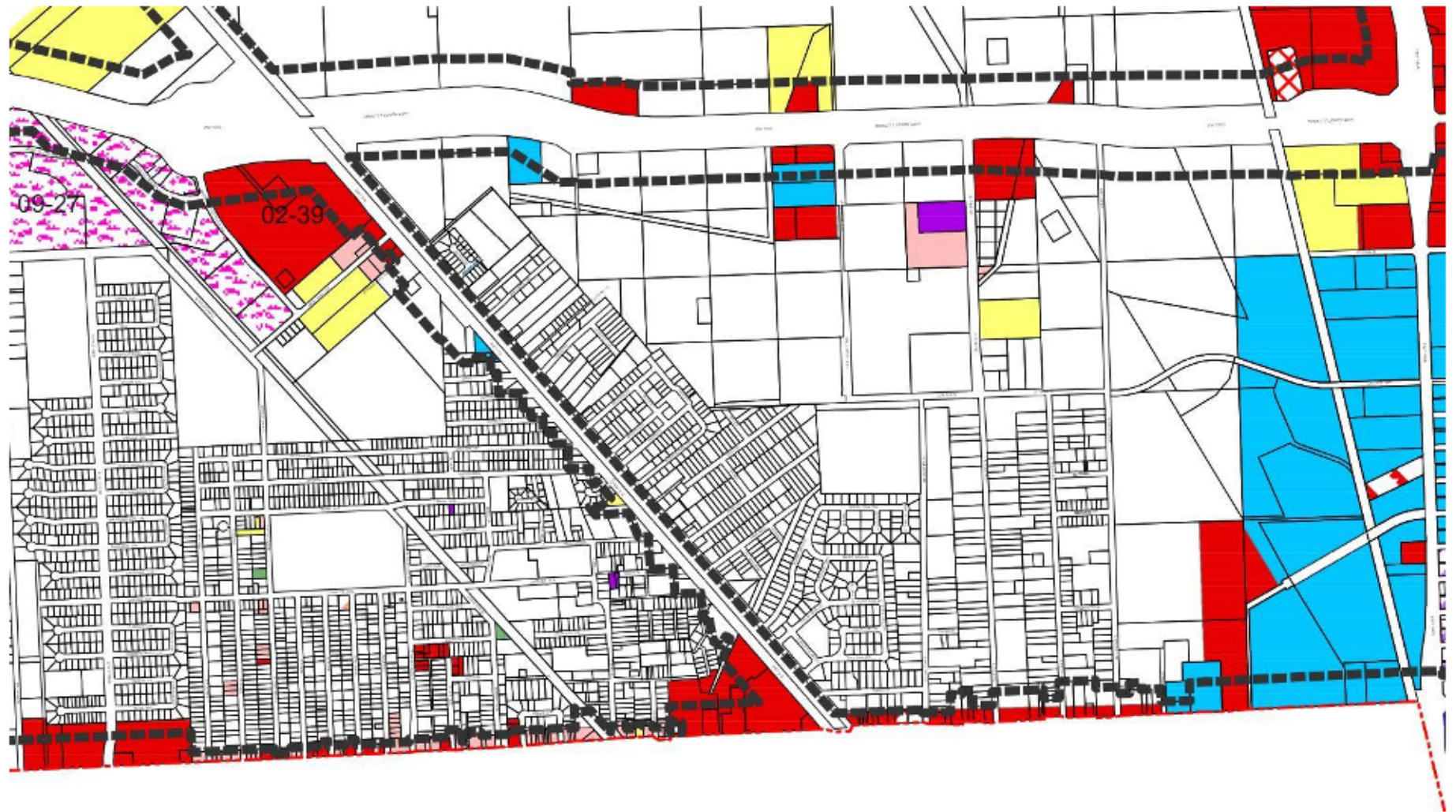
Texas City, Galveston County, TX | May, 2024

OWNER / DEVELOPER:  
GARDENHOCK COMMUNITIES  
3414 POSTWATERWAY  
STE 204  
HOUSTON, TX 77057  
TEL: 713-966-7289


PLAYERS:  
PEA GROUP  
6905 DALLAS DRIVE  
STE 200  
HOUSTON, TX 77049  
TEL: 281-866-8600

**PEA**  
GROUP

**Exhibit 'E' Zoning Exhibit**



<p><b>CITY OF TEXAS CITY</b> <b>ZONING</b></p>		<p><b>Legend</b></p>		<p><b>ZONING DISTRICT</b></p>		<p><b>ENVIRONMENTAL OVERLAY DISTRICT</b></p>	
		<p>ZONING</p> <p>B</p> <p>C</p> <p>A-1</p> <p>A-2</p>	<p>D-1</p> <p>E</p> <p>D</p> <p>E-2</p>	<p>E-3</p> <p>E-4</p> <p>F</p> <p>F-1</p>	<p>G</p> <p>G-2</p> <p>G-3</p> <p>H</p> <p>I</p>	<p>D</p> <p>D-2</p> <p>P-1</p> <p>CMU</p> <p>L&amp;D</p>	<p>PUD</p> <p>S-2</p> <p>I.D.D.</p> <p>L&amp;D</p>



EST. 1911

PUBLIC RECORD  
102  
APR 13, 2017

## **Exhibit F**

### Development Timeline

Plan to begin development improvements during 3rd and 4th quarter of 2025 with homebuilding to start in 2026.

*\*The anticipated dates are subject to change due to fluctuating market conditions*

**Exhibit 'G' Development Agreement**

**RESOLUTION NO. 07-101**

**A RESOLUTION AUTHORIZING THE MAYOR TO EXECUTE A DEVELOPMENT AGREEMENT WITH HIGHWAY 66 PARTNERS, LTD. IN CONNECTION WITH THE DEVELOPMENT OF APPROXIMATELY 310 ACRES OF LAND; PROVIDING THAT THIS RESOLUTION SHALL BECOME EFFECTIVE FROM AND AFTER ITS PASSAGE AND ADOPTION.**

**WHEREAS**, on November 2, 2005, the City Commission adopted Resolution No. 05-130 consenting to the inclusion of 248 acres in a municipal utility district; and

**WHEREAS**, subsequent to the adoption of Resolution No. 05-130, the owners and developers acquired additional land that they wish to be included in the municipal utility district, making the total 310 acres; and

**WHEREAS**, City staff and consultants recommend the Developer (Highway 66 Partners, Ltd.) and City enter into a development agreement to provide the terms and conditions that will govern the development of the Property.

**NOW, THEREFORE, BE IT RESOLVED BY THE CITY COMMISSION OF THE CITY OF TEXAS CITY, TEXAS:**


**SECTION 1:** That the City Commission of the City of Texas City, Texas, authorizes the Mayor to negotiate and execute a Development Agreement with Highway 66 Partners, Ltd. in substantially the same form as Exhibit "A," attached hereto and made a part hereof for all purposes.

**SECTION 2:** That this Resolution shall be in full force and effect from and after its passage and adoption.

PASSED AND ADOPTED this 15th day of August, 2007.

  
Matthew T. Doyle, Mayor  
City of Texas City, Texas

ATTEST:

  
Pamela A. Lawrence  
City Secretary

APPROVED AS TO FORM: 

Robert Geryais  
City Attorney

## DEVELOPMENT AGREEMENT

This DEVELOPMENT AGREEMENT (this "Agreement"), is made and entered into as of \_\_\_\_\_, 2007, by and between the CITY OF TEXAS CITY, TEXAS, a home rule municipality located in Galveston County, Texas (the "City"), and HIGHWAY 66 PARTNERS, LTD., a Texas limited partnership (the "Developer").

### RECITALS

The Developer owns or has under contract approximately 318 acres of land more fully described in Exhibit A, attached hereto (the "Property"). The Property shall also include any additional land annexed into the District (as defined below) with the City's consent. The Developer proposes to develop the Property as a residential community (the "Project"). The Property is currently located within the corporate limits of the City of Texas City, Texas (the "City").

The Developer determined that the creation of Galveston County Municipal Utility District No. 66 (the "District") over the Property was necessary for the provision of water, sewer, and drainage facilities, canals, and certain road and street improvements necessary to develop the Property.

The City has consented to the creation of the District.

The City and the Developer have determined that they are authorized by the Constitution and laws of the State of Texas to enter into this Agreement and have further determined that the terms, provisions, and conditions hereof are mutually fair and advantageous to each.

### AGREEMENT

For and in consideration of these premises and of the mutual promises, obligations, covenants, and benefits contained herein, the City and the Developer contract and agree as follows:

### ARTICLE 1 DEFINITIONS

The terms "City," "Developer," "District," "Project," and "Property" shall have the meanings provided for them in the Recitals, above. Except as may be otherwise defined, or the context clearly requires otherwise, capitalized terms and phrases used in this Agreement shall have the meanings as follows:

*PUD* means the Planned Unit Development for the Property to be adopted pursuant to the City's Zoning Code, Section 40-48 in effect as of the effective date of this Agreement.

*Utility Services Agreement* means the utility services agreement entered into between the City, the Developer, and the District.

*Zoning Code* means the City's Revised Zoning Ordinance in effect as of the date of this Agreement.

## ARTICLE 2 OBLIGATIONS OF THE CITY

2.01. Acquisition of Easements for Off-Site Utilities. The City will acquire all off-site water and wastewater easements and sites needed to serve the Property using capital recovery fees paid by the Developer and other developers. The City will cooperate with the Developer to insure that all such easements and sites are acquired in a timely manner that supports the completion of the off-site water and sewer facilities in a manner that meets the Developers plan for developing the Property, subject to the requirements of section 4.6 and 4.7 of this Agreement and the terms and conditions of the Utility Services Agreement to be entered into between the City, the District, and the Developer.

## ARTICLE 3 OBLIGATIONS OF THE DEVELOPER

3.01. Municipal Use Sites. The Developer agrees to contribute \$500 per lot to the City for the construction of the municipal use facilities (including but not limited to police, fire and EMS, library, satellite office or utility dispatch uses) to be constructed to serve the area of the City in which the Property is located, with such contribution to be paid at the time the final plat for a phase of development on the Property is filed for recordation.

3.02. Property owners' association. The Developer agrees to create one or more property owners' association to serve the Property and to include all of the Property in at least one of such property owners' association. The Developer further agrees to submit to the Mayor of the City or his designee for review and comment prior to recordation all rules of the property owners' association(s) created to serve the Property and all deed restrictions proposed for the Property. The Developer will provide copies of its commercial deed restrictions and commercial development covenants, if any, to the City for review and approval by the Mayor or his designee at least 60 days prior to filing same.

3.03. Maintenance of certain improvements. The Developer agrees to form one or more property owners association, which shall have as one of their stated purposes to permanently maintain through assessments all lakes, ponds, and other detention facilities and open ditches, open drainage channels, canals, and other open stormwater drainage improvements, parks and recreation facilities, landscaping, and monumentation developed as part of the Project (the "Non-City Improvements") to the extent that the District is not responsible for maintaining such Non-City Improvements. The Developer acknowledges and agrees that the Non-City Improvements will be maintained by the District or by the property owners' association or associations serving the Property, as appropriate, and that the City shall never have the responsibility to own, operate or maintain the Non-City Improvements.

3.04. Cost reimbursement. The Developer shall reimburse the City for professional consulting fees, including legal and engineering, reasonably incurred by the City in connection with the creation and organization of the District, including the review and approval of this Agreement, the Utility Services Agreement, Planned Unit Development, and any other agreements between the City, the Developer and the District. To aid in review and evaluation of the proposed development, the City shall engage the services of consultants and legal counsel. The City will enter into engagement letters and/or service agreements with its consultants and legal counsel. The City will be the client for purposes of these consulting and legal engagements. However, the Developer agrees to be responsible, on behalf of the City, for all fees, expenses, and other costs associated with the City's consulting and legal engagements.

The Developer further agrees to counter-sign the engagement letters between the City and its consultants and legal counsel to acknowledge the Developer's financial responsibility thereunder. The City's consultants and legal counsel shall submit invoices for fees, expenses, and other costs incurred on behalf of the City to the Developer (with a copy to the City) on a monthly basis and such invoices will be payable within thirty days of receipt. The Developer agrees that it will provide payment to the City's consultants and legal counsel accordingly on behalf of the City. The Developer's obligation under this section is cumulative with any other cost reimbursement arrangements previously or subsequently entered into between the City and the Developer.

3.06. Dry Utilities. The Developer agrees that all dry utilities, such as electric, gas, telephone and cable, shall be placed underground throughout the Property; provided, however, that "three-phase" power lines may be elevated and may be placed in easements along the perimeter of the Property and within the interior of the Property as may be required by the power provider to serve the Property. Unless otherwise approved by the City and the Developer and unless no reasonable alternative is available to the power provider for the location of said poles, no elevated three-phase power or larger poles may be placed along any major roads or highways. The Developer agrees that public street light poles throughout the Project shall be

galvanized metal or concrete; provided, however, the Developer may use light poles made out of a material that is of a higher quality than concrete, as determined by the Mayor or his designee. Decorative and specialty light poles are acceptable on private property and along private streets; provided, however, that the City shall never be responsible for maintenance of such light poles.

3.06. 25<sup>th</sup> Avenue Improvements. The Developer will pay for the cost of extending the northern two lanes of 25<sup>th</sup> Avenue for approximately 300 feet to the southwest side of Highway 3 and installing related storm drainage facilities (the "25<sup>th</sup> Avenue Paving Project"); provided, however, that (a) the Developer is not responsible for any paving or other road work on the north side of Highway 3, (b) such costs do not include the relocation of any utilities or pipelines, and (c) such costs do not exceed \$150,000.

3.07 Property Values. The Developer recognizes that a significant portion of the City's consideration for entering into this Agreement and consenting to the creation of the District is the Developer's representations that it would achieve an average home value in the District of \$160,000 (the "Target Value"). The Developer agrees to make to the City a payment in lieu of taxes (the "PILOT") to compensate the City for any loss of tax revenue attributable to the Developer's failure to achieve the Target Value on the dwelling units that are used to support the financial feasibility of the District's first bond issue, over the life of the first bond issue. The PILOT shall be calculated by first multiplying the City's then current total tax rate by the difference between the Target Value and the certified appraised value, as determined by the Galveston County Appraisal District, of the average completed home in the District on January 1 of the year in which the District sells its first series of bonds, divided by 100 (the "Estimated Annual Revenue Loss Calculation"). The Estimated Annual Revenue Loss Calculation shall be multiplied by a timing factor (the greater of 20 years or the term of the District's first bond issue) to arrive at the PILOT due from the Developer to the City. A table demonstrating the calculation of the PILOT is shown on Exhibit "B" attached hereto and incorporated herein for all purposes. The PILOT shall be paid within 30 days of the Developer's receipt from the District of its share of proceeds from the District's first bond issue.

#### ARTICLE 4 LAND AND DEVELOPMENT COVENANTS

4.01. Land Use. Developer shall submit to the City, for its review and approval, the plan for the development of the Property (the "General Plan") in accordance with Section 40-48 of the Zoning Code in effect as of the effective date of this Agreement. Developer shall develop or cause any undeveloped Property to be developed in accordance with the latest General Plan approved by the City.

4.02 Planned Unit Development. (a) Developer agrees that development of the Property shall be in accordance with the Zoning Code and the General Plan, as the General Plan may be amended in accordance with the provisions of the Zoning Code and the terms of the PUD.

(b) The Developer and City recognize that it is in the interest of the Developer and the City that part of the Property be used to further the economic development interests of both the Developer and the citizens of the City, including attracting desirable businesses and industry to provide highly skilled jobs and to maintain an appropriate balance between the City's residential and non-residential tax base. Therefore, the Project shall be developed as a PUD in accordance with the Zoning Code. The Developer agrees to comply with all of the procedures provided for a PUD in the Zoning Code. The PUD shall include but not be limited to: (1) proposed land uses; (2) maximum number of housing units; (3) number of lots; (4) sizes of the lots; (5) housing types; (6) prospective commercial uses; (7) street and circulation system/arterial plan; (8) development schedule; (9) request for variance to the development code; (10) typical street cross section with proposed landscape standards; (11) bulk head material; (12) estimated construction value of housing by lot size; (13) proposed amenities plan; (14) utility (water and sewer) plant and sites and trunk line locations; (15) storm water plan; (16) Municipal Utility District boundaries; (17) any likely alternative development scenario; and (18) if a municipal services site is dedicated, it must be shown in the PUD Conceptual Plan.

4.03 Development Covenants. The Developer agrees to adopt deed restrictions and other restrictive covenants, and promulgate the Developer's guidelines regarding development standards, consistent with the PUD, the Zoning Code and any relevant City ordinances and regulations. The Developer will provide copies of its residential deed restrictions and residential development covenants to the City for review and comment by the Mayor or his designee no later than prior to the approval of the first residential development covenants for review and comment no later than prior to the approval of the PUD. The Developer agrees to require Sub-developers to abide by the Developer's development standards and provide for enforcement mechanisms for restrictive covenants.

4.04. Marketing Cooperation. The Developer will share non-confidential marketing information with the City relating to the marketing of the Project, and will solicit recommendations to assist the marketing of the Project from the City. The City will designate a contact person for this purpose.

4.05 Notice. Developer agrees to provide notice to the Mayor or his designee of any material proposed changes, amendments or revisions to the PUD, the Property, or the Project prior to taking any action on such change.

**ARTICLE 5  
TERM AND DEFAULT**

5.01. Term. This Agreement shall be in effect as of the date set forth on the first page hereof, and shall terminate 50 years thereafter, unless terminated earlier as specifically provided herein.

5.02. Default.

a. A party shall be deemed in default under this Agreement (which shall be deemed a breach hereunder) if such party fails to materially perform, observe or comply with any of its covenants, agreements or obligations hereunder or breaches or violates any of its representations contained in this Agreement.

b. Before any failure of any party to perform its obligations under this Agreement shall be deemed to be a breach of this Agreement, the party claiming such failure shall notify, in writing, the party alleged to have failed to perform of the alleged failure and shall demand performance. No breach of this Agreement may be found to have occurred if performance has commenced to the reasonable satisfaction of the complaining party within 30 days of the receipt of such notice. Upon a breach of this Agreement, the non-defaulting Party shall be entitled to specific performance. Regardless of any other provision, neither Party shall be entitled to recover money damages for breach of this Agreement or a tort related to this Agreement. Except as otherwise set forth herein, no action taken by a party pursuant to the provisions of this Section pursuant to the provisions of any other section of this Agreement shall be deemed to constitute an election of remedies and all remedies set forth in this Agreement shall be cumulative and non-exclusive of any other remedy either set forth herein or available to any Party at law or in equity. Each of the parties shall have the affirmative obligation to mitigate its damages in the event of a default by the other party.

**ARTICLE 6  
MISCELLANEOUS PROVISIONS**

6.01. Approvals and consents. Approvals or consents required or permitted to be given under this Agreement shall be evidenced by an ordinance, resolution or order adopted by the governing body of the appropriate party or by a certificate executed by a person, firm or entity previously authorized to give such approval or consent on behalf of the party. Approvals and consents shall be effective without regard to whether given before or after the time required for giving such approvals or consents.

6.02. Address and notice. Any notice to be given under this Agreement shall be given in writing, addressed to the party to be notified as set forth below, and may be

given either by depositing the notice in the United States mail postage prepaid, registered or certified mail, with return receipt requested; by messenger delivery; or by telecopy. Notice deposited by mail shall be effective three days after posting. Notice given in any other manner shall be effective upon receipt by the party to be notified. For purposes of notice, the addresses of the parties shall be as follows:

If to the City, to:  
Mayor  
City of Texas City, Texas  
P.O. Box 2608  
Texas City, Texas 77592

If to Developer, to:  
Hwy 66 Partners, Ltd.  
Attn: Phil Newton  
1514 3<sup>rd</sup> Street  
Seabrook, Texas, 77586

cc to the District to:  
Galveston County Municipal Utility  
District No. 66  
c/o: McDonald & Sechrist LLP  
770 South Post Oak Lane, Suite 410  
Houston, Texas 77056  
Attn: Terrie L. Sechrist

The parties shall have the right from time to time to change their respective addressees by giving written notice of such change to the other party at least 15 days prior to the effective date of the change.

6.03. Assignability; successors and assigns. All covenants and agreements contained by or on behalf of a party in this Agreement shall bind its successors and assigns and shall inure to the benefit of the other parties, their successors and assigns. The parties may assign their rights and obligations under this Agreement or any interest herein, only with the prior written consent of the other party, which consent shall not be unreasonably withheld, and any assignment without such prior written consent, including an assignment by operation of law, is void and of no effect; provided that, the Developer may make a collateral assignment in favor of a lender without consent. This Section shall not be construed to prevent the Developer from selling lots, parcels or other portions of the Land in the normal course of business. If such assignment of the obligations by the Developer hereunder is effective, the Developer shall be deemed released from such obligations. If any assignment of the obligations by the Developer hereunder is deemed ineffective or invalid, the Developer shall remain liable hereunder.

6.04. No additional waiver implied. The failure of either party to insist upon performance of any provision of this Agreement shall not be construed as a waiver of the future performance of such provision by the other party.

6.05. Reservation of rights. All rights, powers, privileges and authority of the parties hereto not restricted or affected by the express terms and provisions hereof are reserved by the parties and, from time to time, may be exercised and enforced by the parties.

6.06. Parties in interest. This Agreement shall be for the sole and exclusive benefit of the parties hereto and shall not be construed to confer any rights upon any third parties.

6.07. Merger. This Agreement embodies the entire understanding between the parties and there are no representations, warranties, or agreements between the parties covering the subject matter of this Agreement.

6.08. Modification; Exhibits. This Agreement shall be subject to change or modification only with the mutual written consent of the City and the Developer. The exhibits attached to this Agreement are incorporated by this reference for all purposes.

6.09. Captions. The captions of each section of this Agreement are inserted solely for convenience and shall never be given effect in construing the duties, obligations or liabilities of the parties hereto or any provisions hereof, or in ascertaining the intent of either party, with respect to the provisions hereof.

6.10. Interpretations. This Agreement and the terms and provisions hereof shall be liberally construed to effectuate the purposes set forth herein and to sustain the validity of this Agreement. This agreement, although drafted by the City, shall be construed fairly and reasonably and not more strictly against the City than the Developer because both parties were represented by legal counsel in the negotiation and review of this Agreement.

6.11. Severability. If any provision of this Agreement or the application thereof to any person or circumstances is ever judicially declared invalid, such provision shall be deemed severed from this Agreement and the remaining portions of this Agreement shall remain in effect.

6.12. Authority within City limits. Regardless of any other provision, nothing herein shall impair or restrict any authority, powers or rights of the City within the incorporated limits of the City.

[EXECUTION PAGES FOLLOW]

AGREED AND ACCEPTED as of the date first above written.

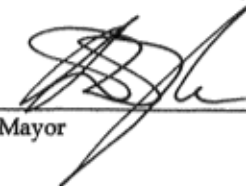
HWY 66 PARTNERS, LTD.,  
a Texas limited partnership

By: Jabaz Development Co., Inc.,  
a Texas corporation,  
its general partner

By: \_\_\_\_\_  
Phil Newton, President

AGREED AND ACCEPTED as of the date first above written.

CITY OF TEXAS CITY, TEXAS



\_\_\_\_\_

Mayor

ATTEST: \_\_\_\_\_

\_\_\_\_\_  
City Secretary

(SEAL)

APPROVED AS TO FORM:

\_\_\_\_\_  
City Attorney

City of Texas City  
 Highway 66 Partners  
 Payment in Lieu of Taxes Calculation

I. Estimated Annual AV Value Loss Calculation		
A.	\$ 160,000	Target Value per Dwelling Unit
B.	\$ [REDACTED]	(-) Average value per dwelling unit (calculated as the total number of A1 properties at the time of the bond sale / total value of all A1 properties as of the time of the bond sale, to be provided by MUD TAC per GCAD records)
C.	\$ 160,000	(=) Variance between target value per dwelling unit and average value per dwelling unit
D.	\$ 160,000	Variance between target value per dwelling unit and average value per dwelling unit
E.	\$ [REDACTED]	(*) Total A1 properties at the time of the bond sale to be provided by MUD TAC per GCAD records
F.	\$ -	(=) Estimated AV Loss
II. Estimated Annual Revenue Loss Calculation		
G.	\$ -	Estimated AV Loss
H.	\$ -	(/) 100
I.	\$ 0.45624	(*) Texas City Tax Rate (at time of bond sale)
J.	\$ -	(=) Estimated Annual Taxes Lost
III. Payment in Lieu of Taxes Calculation		
K.	\$ -	Estimated Annual Taxes Lost
L.	\$ [REDACTED]	(*) Timing factor (20, or the term of the bonds, whichever is greater)
M.	\$ -	(=) Total Payment at time of sale

**I. Estimated Annual AV Value Loss Calculation**

A.	\$160,000	Target Value per Dwelling Unit
B.	\$130,000	(-) Average value per dwelling unit (calculated as the total number of A1 properties at the time of the bond sale/total value of all A1 Properties as of the time of the bond sale, to be provided by MUD TAC per GCAD records)
C.	\$30,000	(=) Variance between target value per dwelling unit and average value per dw
D.	\$30,000	Variance between target value per dwelling unit and average value per dwellir
E.	84	(*) Total A1 properties at the time of the bond sale to be provided by MUD TAC per GCAD records
F.	<u>\$2,520,000</u>	(=) estimated AV loss

**II. Estimated Annual Revenue Loss Calculation**

G.	\$2,520,000	Estimated AV Loss
H.	\$25,200	(/) 100
I.	\$0.4562	(*) Texas city Tax Rate (at time of bond sale)
J.	\$11,497	(=) Estimated Annual Taxes Lost
K.	\$11,497	Estimated Annual Taxes Lost
L.	20	(*) Timing Factor (20 or the term of the bonds, whichever is greater)
M.	\$229,945	(=) Total Payment at time of sale