GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT (GCCDD)

DRAINAGE CRITERIA MANUAL

Approved: February 11, 2026
Effective: February 11, 2026

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I. INTRODUCTION

A. Purpose

This DRAINAGE CRITERIA MANUAL provides a guide for use by Developers and Engineers to follow for the preparation of drainage plans for development within the GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT (the District). It establishes rules and regulations that must be consistently followed and will be enforced throughout the District's jurisdiction. These are minimum requirements and additional requirements may be imposed and/or additional data may be required by the District.

B. Policy

Due to the nature of the watersheds within the District's boundaries and the existence of flood plains that exceed the banks of the creeks in most cases, it is the policy of the District to maintain zero net increase in runoff due to development. Although the District's long-term goal are to construct and maintain facilities (channels and regional detention facilities) that will contain 100-year storm flows within drainage rights-of-way, it is recognized that further impacts cannot be tolerated in the interim period. It is further recognized that impacts outside of the District's boundaries are also unacceptable and the District is dependent and supportive of the action of others to construct upstream and downstream facilities to accommodate 100-year flows.

It is the goal of the District to complete channelization and improvements to the major creeks within its jurisdiction in general conformance with the "Clear Creek Regional Flood Control Plan", dated December 1992, the "Clear Creek Regional Flooding Control Project – Harris County and Brazoria County, Texas" prepared by the Army Corps of Engineers dated June 23, 2008, the "Regional Drainage Study, Mary's, Cowards and Chiggers Watershed" dated August 21, 2001, the "Coward Creek Modeling Update" prepared by Dannenbaum Engineering dated January 2009, and the "Dickinson Bayou Watershed Regional Drainage Plan" dated December 1994. The District further intends to be an active participant in the Clear Creek Regional Flood Plan, the Army Corps of Engineer's Clear Creek Project, the Clear Creek Watershed Steering Committee, the Dickinson Bayou Watershed Steering Committee, and the Dickinson Bayou Watershed Regional Drainage Plan. The District will also support and cooperate with the City of Friendswood, the City of League City, Galveston County, and other governmental entities to improve local drainage.

C. Jurisdiction

The area within the District is drained entirely by five (5) major drainage arteries: Clear Creek, Mary's Creek, Coward's Creek, Chigger Creek, and Dickinson Bayou. Subdivisions and other developments in the area, which are not located directly on one of these major drainage arteries, are generally drained by man-improved or man-made ditches and storm sewers, which convey the rainfall runoff to the major drainage artery.

Responsibility for provision and maintenance of drainage facilities is uniquely

divided between the City of Friendswood, City of League City, Galveston County, the Texas Department of Transportation, and the District in the following manner:

The District has jurisdictions for all creeks, streams, ditches, and outfalls into such drainage arteries within the District's boundaries.

The District is responsible for the maintenance of those creeks, streams, ditches, and outfalls, which drain 100 acres, or more within the District's boundaries.

The City of Friendswood, the City of League City, and Galveston County are responsible for the maintenance of those drainage ways that drain less than 100 acres (such as storm sewers or roadside ditches) at the time of development.

The Texas Department of Transportation is responsible for all drainage systems within the rights-of-way of any State controlled facility.

The District's Master Drainage Plan for the area within its jurisdiction has been approved by the State of Texas (the Texas Water Development Board, formerly the Texas Department of Water Resources) and identifies guidelines for the Right-of-Way and Easement requirements along all creeks, bayous, streams, gullies, and ditches; drainage areas and channel design and size for each major drainage artery as it is improved.

D. In the event that any one or more of the provisions contained in the DRAINAGE CRITERIA MANUAL shall, for any reason, be held to be invalid, illegal or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provisions of this MANUAL, but this MANUAL shall be construed as if such invalid, illegal or unenforceable provisions had never been contained herein, unless the deletion of such provision or provisions would result in such a material change so as to cause application of the criteria contemplated herein to be unreasonable.

E. When this DRAINAGE CRITERIA MANUAL requires the District to provide written notice, such notice shall be sent by certified mail, return receipt requested to the person receiving such notice or an attorney or agent authorized to accept notice.

F. In computing any period of time prescribed or allowed by the procedures in this DRAINAGE CRITERIA MANUAL, the day of the act or event after which the designated period of time begins to run is not to be included. The last day of designated time shall be included unless it falls on a weekend or legal holiday, should the final day fall upon either of the noted previously then the final day shall be extended to include the next available business day.

G. The DRAINAGE CRITERIA MANUAL is effective on the third (3rd) day after the publication of the MANUAL, following adoption or amendment and shall continue to be in effect until otherwise amended or repealed.

II. ADMINISTRATION

A. Predevelopment Review

Each person or entity planning to construct any improvements within the District shall meet with the District's staff to determine whether that person or entity shall submit a Drainage Plan to the District for approval. Any improvements that are included in a previously approved plan or master plan that meet the requirements of that plan or master plan and that meets the requirements of this Criteria Manual may not require the submittal of a plan to the District. If the proposed improvements are not part of a previously approved plan, which was considered at a board meeting, a new plan must be submitted to the District for approval. In addition, any improvement located within the limits of the existing channel or the designated Flood Plain or Flood Way of any channel or stream must be approved by the District.

The District and the City of Friendswood, City of League City, Galveston County, and other governmental entities may from time to time enter into Interlocal Governmental Contracts and pass Joint Resolutions agreeing to share certain review responsibilities. The Developer should make himself aware of these agreements prior to commencing design. In any case where the requirements contained herein conflict with another agency having jurisdiction over the project, the most stringent requirement shall prevail.

B. Submittal

One (1) PDF copy of plans, plats, reports, and calculations shall be submitted to the District's Engineer for review at least two (2) weeks prior to the District meeting at which the item will be considered. After all plans, plats, reports, and calculations have been reviewed and have been found to meet the District's requirements, the District's Engineer will notify the developer, their agent, or their engineer that all final documents shall be provided to the District one week prior to the scheduled meeting. If item is approved by the Board, a signed PDF copy of the item will be provided once available.

Preliminary and final plats and plans, to be considered separately, shall be submitted for each development. For instances where the applicant seeks approval for revisions made to plans or plats prior to the expiration of District approvals, the applicant can proceed directly to final plan / plat approval without the need to receive preliminary approval from the Board. For projects of 50 acres or more or out of tracts of 50 acres or more, approval of a preliminary engineering report and conceptual master plan shall be required, detailing design methodology and concepts for drainage of the project prior to preliminary plat approval. All Final plans and reports must be prepared and sealed by a Licensed Professional Engineer and must contain the Firm's registration number.

C. Fees

Plats and plans submitted to the District for approval must be accompanied by a

check made payable to the District as follows: GCCDD or Galveston County Consolidated Drainage District for an amount specified in the Schedule of Fees as determined by the Board of Directors and on file at the District's Office or see the District's website. Contact the District office at (281) 482-0404 to verify the fee amount. Review of submittals will not commence until the District has received the requisite fees.

D. Site Visit

A representative of the property owner or developer shall meet with District personnel at the project site prior to preliminary approval.

E. Datum

All plats and plans must be related to a National Geodetic Survey (NGS) benchmark with the same elevation datum as the effective Federal Emergency Management Association (FEMA) Firm Map. No exceptions will be made to this policy. Additionally, the applicant must provide an adjustment as required to convert the project elevation data to the datum of the current Flood Insurance Rate Map. The District is not a Floodplain Administrator (FPA). The Applicant should consult with the Floodplain Administrator to determine any additional requirements that the FPA will impose.

F. Preliminary Plat Review

NOTE – All plans and plats typically go before the Board at a District meeting for approval on two separate occasions. After the Board grants preliminary plat or plan approval, the applicant will then begin the process of final review and approval. Only after the Engineer has determined that the final plat or plan submittal meets all of the District's requirements will the District Engineer recommend that the Board grant final approval at a future District meeting. The applicant is encouraged to factor this two-step process into their project schedule.

The preliminary plat shall depict the applicant's overall layout for the proposed development. The preliminary plat shall at a minimum contain the following:

1) Company name (as applicable), address, phone number and contact person for the Owner / Developer of the project.

2) Company name, address, phone number and contact person of surveyor who prepared the plat.

3) Scale of Drawing with a minimum scale of 1 inch (") = 100 feet (').

4) Benchmark and reference benchmark with year of adjustment. Adjustment as required to convert the project elevation data to the datum of the current Flood Insurance Rate Map (FIRM).

5) A detailed location or vicinity map drawn to scale. The project site shall be accurately located on the map.

6) Date on all submittals with date of all revisions including month, day, and year.

7) Preliminary Signature Block for District Directors in accordance with APPENDIX A. Additionally, provide the GCCDD Ref ID# directly beneath this signature block. The District Engineer will provide this reference number after receiving the first submittal.

8) District notes in accordance with APPENDIX B.

9) Ownership of adjacent tracts if unplatted or lot and block numbers, if platted.

10) Contour lines at 0.5-foot (.5') where slopes do not exceed 1.0% and 1.0-foot (1') intervals for slopes exceeding 1.0% intervals covering the entire development and extended beyond the development boundaries at least 200 feet (200') on all sides for developments over 5 acres and 50 feet (50') on development under 5 acres. The contour lines shall at a minimum provide an indication of whether adjacent off-site areas drain toward or away from the subject tract.

11) Points at which structures or pipelines will cross drainage ditches, streams etc., within the development. Include existing easements as applicable.

12) Location of all existing drainage structures, utility lines, pipelines, and other underground features on the property and adjacent rights-of-way.

13) Location and dimensions of all proposed drainage easements and rights-of-way. Guidelines for rights-of-way and easements are listed in APPENDIX C. Any required drainage easement dedications must be secured by the District before the Board will give final plat approval.

14) Public detention facilities shall be placed in "Restricted Reserves-Restricted to Detention Use Only". These Reserves shall include an allowance for the requisite maintenance berm per GCCDD requirements and shall have a minimum of twenty feet (20') of free and clear unobstructed access to a public street or right-of-way.

14) Location of major drainage arteries adjacent to or crossing the development as determined through actual ground survey by the developer's surveyor. The survey shall have been completed within the past year and shall show stream alignment 200 feet (200') upstream and downstream of development. Show the centerline of the ditch, toe of slope, top of bank, and static water edge.

G. Preliminary Plat Approval

1) The District shall provide comments to the applicant as soon as

possible after submittal. Revised plats addressing all comments of the District must be submitted by noon to the District's Office and the District's Engineer at least two Thursdays prior to the District's regularly scheduled meeting. It is the Applicant's responsibility to make timely submittals to the District and allow the District and its Engineer adequate time for review. Submittal prior to the deadline is not a guarantee of being placed on the meeting agenda for the next District meeting.

2) At the District's Board of Director's meeting at which preliminary approval is being considered, the applicant shall bring any additional plats that the Applicant needs signed for their records.

H. Final Plat Review

NOTE – All plans and plats typically go before the Board at a District meeting for approval on two separate occasions. After the Board grants preliminary plat or plan approval, the applicant will then begin the process of final review and approval. Only after the Engineer has determined that the final plat or plan submittal meets all the District's requirements will the District Engineer recommend the Board grant final approval at a future District meeting. The applicant is encouraged to factor this two-step process into their project schedule.

The Final Plat shall be in accordance with the approved preliminary plat. The submittal shall include the following:

1) Company name, address, phone number and contact person for the Owner / Developer of the project.

2) Company name, address, phone number and contact person of surveyor who prepared the plat.

3) Scale of drawing with a minimum scale of 1 inch (1") = 100 feet (100').

4) Benchmark and reference benchmark with year of adjustment. Adjustment as required to convert elevation data to the datum of the current Flood Insurance Rate Map.

5) A detailed location or vicinity map drawn to scale. The project site shall be accurately located on the map.

6) Date on all submittals with date of all revisions, including month, day, and year.

7) Final Signature Block for District Directors in accordance with APPENDIX A. Additionally, provide the GCCDD Ref ID# directly beneath this signature block. The District Engineer will provide this reference number after receiving the first submittal.

8) District notes in accordance with APPENDIX B.

9) Ownership of adjacent tracts if unplatted, or lot and block numbers- if platted.

10) Drainage easements and dedicated Fee Simple Rights-of-Way along all creeks, bayous, streams, gullies, and ditches. (SEE APPENDIX C). Any required drainage easement dedications must be secured by the District before the Board will give final plat approval.

11) Public detention facilities shall be placed in "Restricted Reserves-Restricted to Detention Use Only". These Reserves shall include an allowance for the requisite maintenance berm per GCCDD requirements and shall have a minimum of twenty feet (20') of free and clear unobstructed access to a public street or right-of-way.

12) Location of major drainage arteries adjacent to or crossing the development as determined through actual ground survey by the developer's surveyor. Survey shall have been completed within the past year and shall show stream alignment 200 feet (200') upstream and downstream of development. Show the centerline of the ditch, toe of slope, top of bank, and static water edge.

I. Final Plat Approval

1) The District shall provide comments to the applicant as soon as possible after submittal. At least two Thursdays by noon prior to the District's Board of Directors' regularly scheduled meeting, revised plats addressing all comments from the District must be submitted to the District's Office and the District's Engineer. It is the Applicant's responsibility to make timely submittals to the District and allow the District and its Engineer adequate time for review. Submittal prior to the deadline is not a guarantee that the Applicant's plat will be placed on the agenda for the next District meeting.

2) When a plat is required for a project, the final plat must be approved at the same meeting or before a final drainage plan is considered or approved by the board.

3) At the District's Board of Directors meeting at which final approval is being considered, the Applicant shall be present with any paper or mylar copies of the plat that they need signed by the Board.

J. Short Form Plat Submittal

A development consisting of no more than two residential lots can be submitted under the District's Short Form Procedure allowing the applicant to bypass the preliminary review and approval steps. A final plat containing all applicable requirements of the Final Plat Submittal Section of this Manual can be submitted to the District for approval. The plat will be reviewed consistent with the District's review process and items needing to be

addressed must be completed prior to the District's Board meeting. No conditional approvals will be granted. This short form process addresses plats only and is not to be used for grading and drainage plans.

K. 1. PRE-APPLICATION MEETING REQUIRED

A pre-application meeting with the District's Operations Manager and the District Engineer is required before a submittal can be made to the District. The pre-application meeting will provide the applicant with an opportunity to discuss the proposed construction with District personnel for the purpose of establishing what hydrologic modeling will be necessary. During the meeting, District personnel will also provide the applicant with information regarding the availability of existing hydrologic models, which might be used. The District will decide during this meeting as to whether or not any existing models may need to be updated. Failure to request and attend this meeting could result in studies which are improperly coordinated or prepared. Improperly coordinated or prepared studies will be rejected by the District.

A Drainage Impact Analysis shall be required when one or more of the following applies:

- A tract or any part thereof consisting of 25 acres or more.
- The proposed construction includes realignment or modification of a public drainage way within the District. This shall also include projects which propose inline detention.
- A bridge or culvert crossing of a public drainage way within the District is proposed.
- The proposed work will redirect flows from one watershed to another.
- The proposed construction has the potential to modify or impact the 100-year floodplain and/or floodway.
- The proposed development will outfall into a public facility that cannot accommodate these flows.
- The proposed development will utilize inline or offsite detention.
- The Flood Plain Administrator or District personnel require a study.

2. General Requirements for Drainage Impact Analysis Reports

a) Company name, individual name, address, and phone number of the engineer who prepared the drainage impact analysis. The name, address, phone number, and contact name for the Developer / Owner shall also be provided. The engineer shall also sign and seal the report and the Firm's registration number must be contained on the report.

b) All drawings and exhibits shall include a standard Engineer's scale.

Whenever possible, a minimum scale of 1 inch (1") = 100 feet (100') shall be used.

c) Exhibits shall include contour lines at 0.5-foot (.5') intervals where slopes do not exceed 1.0% and 1.0-foot (1') intervals for slopes exceeding 1.0% for the entire subject area whenever possible. This shall include offsite areas for the purpose of determining how much offsite runoff is directed toward the subject tract.

d) Exhibits shall include the true location of all existing creeks, bayous, streams, gullies, and ditches, as determined by actual on-the-ground survey information which is less than one year old and at a minimum, show top of bank, toe of slope, centerline, and any existing or proposed drainage easements.

e) All elevations on drawings or hydrologic models shall be tied to a benchmark, datum, and year of adjustment as required in Section II. E. If a District benchmark is not used, an adjustment must be provided to get to the District datum and year of adjustment. Additionally, provide an adjustment as needed to compare the project's elevation datum to the current Flood Insurance Rate Map.

f) All submittals must be dated with the month, day, and year. Any revisions must be dated in the same manner.

g) All submittals must be in U.S. Customary units.

h) Bind the District's Signature Block inside the cover of the report. Include the project name, date of issue, and the District's Reference ID number on this page as well. This sheet is meant to be stand-alone evidence of approval should it become separated from the bound report.

3. Content of the Drainage Impact Analysis Report

a) A location or vicinity map drawn to scale must be provided to show the subject area for the drainage impact analysis in an approximate manner. For projects that are not entirely within the District boundary, the exhibit shall show the District boundary in an approximate manner in relation to the area of study.

b) Discuss which additional agencies have jurisdictional authority over the proposed project and the status of coordination, submittals, and approvals from those agencies.

c) Include copies of the current (FIRM) panel(s) in the area of proposed work with project limits drawn to scale on each map.. Discuss how the current 100-year floodplain and/or floodway might be impacted by the proposed improvements and how these impacts will be mitigated. Alternatively, include a statement that the floodplain and floodway will not be adversely affected by the proposed improvements. Finally, include discussion about any preliminary FIRM panels which have not yet been adopted.

d) Confirm in writing that all proposed ponds and ditches modeled in the hydrologic analysis conform to the District's geometric requirements. Alternatively, briefly discuss any non-conforming drainage structures and the variances which the applicant intends to pursue.

e) Discuss the need for drainage easements for any existing or proposed drainage features pursuant to the District's criteria and how the required easements will be obtained.

f) An extreme event sheet flow analysis that describes how the developed flows will be conveyed to the detention facility and ultimately to the point of outfall. The analysis shall also include discussion of adjacent properties and how offsite runoff will be directed around or through the development as applicable.

g) Discussion of potential conflicts (e.g., pipelines) identified during the preliminary engineering analysis including a proposed conceptual approach to resolving the conflict. Proposed encroachments onto easements or fee strips held by others shall be discussed in a similar manner. The applicant is advised that final approval of any plan or plat will not be granted by the Board until the required encroachment agreement(s) are secured by the applicant.

h) Provide a summary of findings in the report, which demonstrates that no increase in the 5-year, 25-year, or 100-year flows will occur as a result of the proposed improvements. The findings shall also demonstrate that no increase in the water surface elevation of the receiving system will occur for the 5-year, 25-year or 100-year events.

i) Submit an electronic copy of all hydrologic models discussed in the report. This submittal shall include the base (pre-development) model. Include the name and version number for the required modeling software required to run each model.

L. Preliminary Drainage Plan Review

NOTE – All plans and plats typically go before the Board at a District meeting for approval on two separate occasions. After the Board grants preliminary plat or plan approval, the applicant will then begin the process of final review and approval. Only after the Engineer has determined that the final plat or plan submittal meets all the District's requirements will the District Engineer recommend the Board grant final approval at a future District meeting. The applicant is encouraged to factor this two-step process into their project schedule.

The preliminary plan shall present the applicant's overall approach to moving rainfall runoff to the appropriate drainage artery. It is recommended that prior to the preparation of the plan a meeting be arranged between the applicant and District Staff to discuss the proposed concept for drainage of the project. The preliminary submittal shall contain the following items.

1) Company name, individual's name, address, and phone number of the

engineer that prepared the plan including contact person and the Firm's registration number.

2) Scale of drawing with a minimum scale of 1 inch (1") = 100 feet (100').

3) Benchmark and reference benchmark with datum and year of adjustment.

4) A detailed location or vicinity map drawn to scale. The project site shall be accurately located on the map.

5) Date on all submittals, with date of all revisions in the format of month, day, and year.

6) Signature lines for District Directors in accordance with APPENDIX A.

7) District notes in accordance with APPENDIX B.

8) Contour lines at 0.5-foot (0.5') where slopes do not exceed 1.0% and 1.0-foot (1') intervals for slopes exceeding 1.0% intervals covering the entire development and extended beyond the development boundaries at least 200 feet (200') on all sides for developments over 5 acres and 50 feet (50') on developments under 5 acres. At least two contours are required for each project.

9) Preliminary scheme for the passage of sheet flow from adjacent properties. The Engineer at a minimum must demonstrate or certify that no adjacent property is adversely impacted by the proposed development.

10) Drainage area divides for project area, with peak run-off rates for each drainage area.

11) Locations of all planned drainage improvements proposed for moving run-off water from the development to the principal drainage artery, i.e., creek, stream, bayou, ditch etc., and their point(s) of entry into the drainage artery.

12) Points at which structures or pipelines will cross drainage ditches, streams etc., within the development require the District approval.

13) Locations of structures or other physical features on the development area to provide orientation as required during field inspection of the site.

14) Location of all existing drainage structures, utility lines, pipelines, and other underground features on the property and adjacent street rights-of-way.

15) Location and dimensions of all proposed drainage easements and rights-of-way. Guidelines for rights-of-way and easements are listed in APPENDIX C.

16) Public detention facilities shall be placed in "Restricted Reserves-Restricted to Detention Use Only". These Reserves shall have a minimum width of twenty feet (20') and shall have a minimum twenty feet (20') of free and clear unobstructed access to a public street or right-of-way.

17) Location of major drainage arteries adjacent to or crossing the development as determined through actual ground survey by the developer's engineer. The survey shall have been completed within the past year and shall show stream alignment 200 feet (200') upstream and downstream of development. Include the top of bank, toe of slope, centerline, and static water level as applicable.

18) Cross-section of detention facility (Must be on plan). Include maintenance berm, minimum top of bank elevation, freeboard, 100-year design water surface elevation, toe of slope, proposed side slopes, and average storage depth.

19) Detention calculations in accordance with SECTION VII including volumetric calculations of detention provided. Please take note of the de facto minimum detention rates in this criteria manual.

20) If the project is in the Flood Plain, preliminary Flood Plain mitigation calculations shall be provided. Differentiate between floodplain and detention mitigation in the calculations. The District is not a Floodplain Administrator. Seek approval from the Floodplain Administrator.

21) Drainage area map of receiving system, if discharging to existing storm sewer system. Drainage area of receiving channel, if discharging to open ditch or stream. Calculations to prove that capacity is available.

22) Copy of application for TxDOT permit if draining to their system. This includes driveway permits, utility in rights-of-way permits, and drainage approvals as applicable.

23) Copies of documents and letters of request for permission to cross privately held easements or rights-of-way.

24) Show limits of 100-year flood plain by a vertically controlled survey and not scaled from the (FIRM) FEDERAL INSURANCE RATE MAP.

25) Ownership of adjacent properties.

26) Copy of request for Army Corps of Engineers permit for construction work within Clear Creek, Chigger Creek, Coward's Creek, Mary's Creek, or Dickinson Bayou.

M. Preliminary Drainage Plan Approval

1) The District shall provide comments to the applicant as soon as

possible after submittal. At least five (5) working days prior to the District's Board of Directors' regularly scheduled meeting, revised plans addressing all comments of the District must be submitted to the District's Office and the District's Engineer. If all comments have been addressed, the plan will be placed on that agenda.

2) The Applicant shall be present at the District meeting with any paper or mylar copies of the plan that he / she needs to be signed by the Board.

3) Preliminary Plan and Plat approval is valid for a period of six months.

N. Final Drainage Plan Review

NOTE – All plans and plats typically go before the Board at a District meeting for approval on two separate occasions. After the Board grants preliminary plat or plan approval, the applicant will then begin the process of final review and approval. Only after the Engineer has determined that the final plat or plan submittal meets all of the District's requirements will the District Engineer recommend the Board grant final approval at a future District meeting. The applicant is encouraged to factor this two-step process into their project schedule.

The final submittal shall consist of detailed construction drawings and final drainage calculations. The overall concept shall be in accordance with the approved preliminary plan with final design details as they will be submitted to the contractor for construction. Design guidelines are given in SECTIONS III, IV, V and APPENDIX E. The submittal shall include the following:

1) Company name, individual name, address, and phone number of the engineer that prepared the plans and the Firm's registration number.

2) Company name, individual name, address, phone number, and contact person of the Owner / Developer.

3) Scale of drawing with a minimum scale of 1 inch (1") = 100 feet (100').

4) Benchmark and reference benchmark with year of adjustment.

5) A detailed location or vicinity map drawn to scale. The project site shall be accurately located on the map.

6) Date of all submittals with date of all revisions, including month, day, and year.

7) Signature lines for District Directors in accordance with APPENDIX A.

8) District notes in accordance with APPENDIX B.

9) Contour lines at 0.5-foot (0.5') intervals where slopes do not exceed 1.0% and 1.0-foot (1') intervals for slopes exceeding 1.0% intervals covering the entire development and extended beyond the development

boundaries at least 200 feet (200') on all sides for developments over 5 acres and 50 feet (50') on developments under 5 acres. At least two contours are required for each project.

10) Lot grading plan which provides for the passage of sheet flow from adjacent property. The Engineer must demonstrate or certify that no adjacent property is adversely impacted by the proposed development.

11) A 100-year sheet flow analysis that provides direct access to the detention facility and/or the receiving stream.

12) Drainage area divides for project area, with peak run-off rates for each inlet, structure, or drainage area.

13) Locations of pipelines, utility lines, drainage structures, buildings, or other physical features on the property and adjacent rights-of-way.

14) Drainage easement and dedicated Fee Simple Rights-of-Way along all creeks, bayous, streams, gullies, and ditches. (SEE APPENDIX C.)

14) Public detention facilities shall be placed in "Restricted Reserves-Restricted to Detention Use Only". These Reserves shall have a minimum width of twenty feet (20') and shall have a minimum twenty feet (20') of free and clear unobstructed access to a public street or right-of-way.

15) True locations of existing creeks, bayous, streams, gullies, and ditches, as determined by actual ground survey, current within one (1) year of approval of the Preliminary Plan. Show stream alignment 200 feet (200') upstream and 200 feet (200') downstream of development.

16) Cross-section of existing and proposed detention facility or ditch. Calculations to verify capacity must be furnished.

17) Details of all ditches, which are to convey rainfall runoff from a subdivision and/or through a subdivision to the appropriate major drainage artery and location of that major drainage artery. All ditches must comply with specifications in APPENDIX C. Include the top of bank, toe of slope, centerline, and static water level as applicable.

18) Complete construction plans for the development with plan and profile drawings of all lines to be dedicated to the public. Plans shall include details of all storm sewer structures. Storm sewers shall comply with specifications in of the City of Friendswood, City of League City or Galveston County as applicable. Outfalls to be constructed within the District's rights-of-way or easements shall be constructed according to the District's standard details.

19) Final detention calculations in accordance with SECTION VII with volumetric calculations of detention provided and Flood Plan mitigation. Please take note of the de facto minimum detention rates in this criteria

manual.

20) Cross-section section of detention facility. (Must be on plan). Include maintenance berm, minimum top of bank elevation, freeboard, 100-year design water surface elevation, toe of slope, proposed side slopes, and average storage depth.

21) Calculations for sizing all storm sewers, culverts, ditches, and structures.

22) Copy of TxDOT permit if applicable. This includes driveway permits, utility in right-of-way permits, and drainage approvals as applicable.

23) Copies of letters of approval from entities holding easements or rights-of-way to be crossed.

24) All construction activities resulting in a land disturbance of equal to or greater than one acre or part of a larger common plan of development or sale shall comply with Texas Commission on Environmental Quality (TCEQ) Construction General Permit No. TXR15000. A Storm Water Pollution Prevention Plan (SWP3) including adequate sediment and erosion control shall be submitted. The SWP3 shall also contain measures to control discarded building material, concrete truck washout water, chemicals, litter, and sanitary waste generated at each construction site. A copy of the Notice of Intent (NOI) and Notice of Termination must be filed with the District.

25) All sheet flow from the subdivision or project shall be directed to the detention facility. The inlets and storm sewer prior to discharges into the facility shall be sized to accept and convey the 100-year discharge including all sheet flow. A lined emergency overflow swale shall also be provided over the storm sewer to the pond.

26) Copy of the Corps of Engineers permit for any construction within Clear Creek, Chigger Creek, Coward's Creek, Mary's Creek, or Dickinson Bayou.

27) Plans shall also be submitted to the District providing for the installation of structural and/or non-structural controls to address stormwater runoff from new developments and redevelopment projects that disturb an area equal to or greater than one acre, including projects less than one acre that are part of a larger common plan of development or sale. The selected controls must prevent or minimize water quality impacts. A report shall be presented that describes the control measures and defines the entity or persons that will ensure long-term operation and maintenance. A copy of the Notice of Intent must be filed with the District.

O. Final Drainage Plan Approval

1) The District shall provide comments to the applicant as soon as possible after submittal. At least two Thursdays by noon prior to the

District's Board of Directors' regularly scheduled meeting, revised plans addressing all comments from the District must be submitted to the District's Office and the District's Engineer. It is the Applicant's responsibility to make timely submittals to the District and allow the District and its Engineer adequate time for review. Submittal prior to the deadline is not a guarantee that the Applicant's plan will be placed on the agenda for the next District meeting.

2) The Applicant shall be present with any paper or mylar copies of the plan that they need to have signed by the Board.

3) Final approval is valid for one (1) year. If construction does not commence within one (1) year of approval, the drainage plan must be resubmitted for review and approval.

P. Project Acceptance

1) Upon completion of all construction the applicant shall notify the District in writing, requesting an inspection of the project. The applicant shall submit one (1) hard copy and one (1) electronic file in AutoCAD format of the as-built plans. The applicant shall also provide the District a one (1) year maintenance bond in the full amount of construction cost.

2) The District shall inspect the construction and notify the applicant of any deficiencies. The applicant shall correct all the deficiencies and request a subsequent re-inspection.

3) Once all deficiencies are corrected, the Board will accept the facility and the District will issue the applicant a letter of acceptance subject to the one (1) year maintenance period. For those facilities to be maintained by the District, the acceptance of the facility shall be placed on the next available Board agenda for approval and acceptance subject to the one (1) year maintenance period.

4) It is the responsibility of the individual or entity to ensure that all improvements (infrastructure) are completed in accordance with the approved Drainage Plan, that all fees are paid, and that all conditions of the District are satisfied prior to application for a municipal building permit. The applicant agrees no municipal building permit will be sought for the proposed construction until all drainage and detention facilities are constructed, inspected, and approved by the District.

5) Prior to the end of one (1) year maintenance period, the District will re-inspect the facility. The applicant will be notified in writing of any deficiencies and these deficiencies shall be corrected prior to the release of the maintenance bond.

Q. Maintenance of Storm Water Detention Facilities

In each case where an on-site stormwater storage facility is provided pursuant

to this CRITERIA MANUAL, the developer shall furnish evidence of acceptance for maintenance of such storage facility to the District.

The District will agree to assume such responsibility provided:

1) The developer must first petition the Board of Directors with a formal request to maintain their storm water detention facility. The Board of Directors must consider and approve the petition.

2) The developer dedicates to the District in fee the area of such facility, including maintenance berms.

3) The developer dedicates an access easement of at least twenty-foot (20') width to such facility from a public street or right-of-way as required.

4) The developer pays the District the required fee for detention pond maintenance as noted on the District's effective fee schedule. A copy of the effective fee schedule may be found on the District's website or at the District's office.

5) The on-site stormwater detention system facility is designed to be a "dry" facility and not an amenity or a private recreational facility. Amenity ponds, including wet or dry ponds, shall be defined as any pond whose land area has been deeded to the Homeowner/Landowners for the benefit of the Homeowner / Landowners Association.

6) For the purpose of this section, a stormwater storage facility shall mean a storage facility serving primarily as a collection device and not as a transmission system, and which is designed and constructed for the purpose of providing on-site detention for the benefit of a multi-parcel development, and not for a single lot or single parcel development.

7) This responsibility does not include District personnel in performance of District work. Liability for all sites maintained by the District shall remain with the grantor of custody and control of the site. The District shall be an additional insured on a policy of liability insurance throughout the term of the maintenance agreement.

R. Time Limits of Approvals

1) Preliminary approvals shall expire within six (6) months if a final approval has not been obtained. In cases where a preliminary approval is given for the entire development and only sections are given final approval, the preliminary approval will be valid for two (2) years.

2) Final approval of plans and plats is valid for one (1) year from the date of Board approval.

3) Board approval of a Drainage Impact Analysis shall be valid for a period of one (1) year. The one-year time period shall be based upon the date of the most recent submittal or Board approval for plats or plans within

the development described in the report. Drainage Impact Analysis for projects which become dormant for one year shall expire.

4) Upon written request, the Board may grant extensions of approval for up to six months. All requests for extensions must be approved prior to the expiration of the original approval. No more than one (1) extension will be granted.

S. Revisions to Drainage Plans and Plats

1) The District must approve all revisions to either the approved plat or drainage plan.

2) The District may require a re-submittal of a preliminary drainage plan or plat dependent upon the changes made.

T. Utility, Pipeline, and Cable Crossing

1) All utilities, pipelines, and cable crossings, either publicly or privately owned, shall obtain a permit from the District prior to any construction to cross any drainage facility within the District boundaries.

2) All utilities, pipelines, and cables shall cross District facility within 20 degrees of perpendicular to that facility. No utility, pipeline, or cable shall be located within and parallel to a creek right-of-way.

3) Submittal Procedures shall be the same as required for plats and plans.

4) Application fees are as stated in The Schedule of Fees located on file in the District's office.

5) Review Procedure

(a) All submittals shall meet the requirements of Section II. B. – Submittals.

(b) The District and its Engineer shall review the submitted materials. The Board shall act on the permit at the next regular Board Meeting and either approve, disapprove, or specify changes to be made to comply with this rule for preliminary approval.

(c) The process is the same for final review and approval. No processing fee is required for final approval.

6) Submittal

(a) Top of utility, pipeline, or cable shall be a minimum of five feet (5') below the existing flowline of the channel being crossed, or five feet (5') below the projected flowline of the channel as provided by the most recently adopted version of the District's Master Drainage Plan. Proposed utility, pipeline, or cable must

stay at this depth for the entire width of existing easement and then may be sloped towards the ground surface at a slope not to exceed 4:1.

(b) All pipelines with a working pressure exceeding 200 pounds per square inch shall be constructed with a concrete pad over the line. Pad shall extend one foot (1') on either side of edge of pipeline for the total length of the District's easement and shall be twelve inches (12") thick. Top surface of pad shall be a minimum of five feet (5') below the existing flowline of the channel being crossed or five feet (5') below the projected flowline of the channel as provided by the most recent available information. The District may release requirement for a concrete pad if pipeline is directionally drilled under easement and is at least ten feet (10') below the existing flowline of the channel being crossed, or ten feet (10') below the projected flowline of the channel as provided by the most recently available information.

(c) Benchmark and survey requirements as listed for plats and plans.

(d) Signature block per APPENDIX A.

(e) Applicable APPENDIX B Notes

(f) Copy of Army Corps of Engineers permit if required.

7) Notices

(a) The Applicant shall provide the District with forty-eight (48) hour notice prior to the start of construction.

(b) Upon completion of crossing, the Applicant shall install markers on either end of crossing, at the right-of-way limits of the District's easement. It shall be the Applicant's responsibility to maintain condition of markers.

U. Regional and Sub-Regional Detention Facilities

The District is developing regional and sub-regional detention facilities. Capacity in these facilities may be provided to the developer on condition that:

1) The District determines capacity is available.

2) The development is less than or equal to 8 acres for any single-family residential development or less than or equal to 5 acres for any other type of development.

3) Regional detention capacity may not be used for mitigation of fill in the flood plain without approval of the Board.

4) The Developer provides conveyance to the detention facility without having a detrimental effect on any adjacent properties.

5) The Developer pays the District a fee as determined by the Board of Directors. The effective regional detention fee may be found on the District's effective Fee Schedule and the effective Fee Schedule may be found on the District's website or at the District's office.

6) If conveyance is directed through properties not directly owned by the developer, an executed contract or recorded deed between the parties agreeing to the said conveyance must be presented to the Board.

III. VARIANCES

A. An application for a variance from the criteria in the CRITERIA MANUAL must be submitted in writing in the form set out in APPENDIX D.

B. The variance request must identify the specific criteria sought to be varied; why a variance is necessary and appropriate; how the policy underlying the criteria will be satisfied or alternatively, why the criteria is inapplicable.

C. A request for variance must be supported by appropriate engineering and technical information incorporating generally accepted engineering principles. Drainage plans or reports, plats, or construction drawings as are relevant should accompany the request for variance.

D. The District's Board of Directors will approve or reject the application for a variance at a regularly scheduled meeting upon a majority vote.

E. The District's Board of Directors will not approve a variance if a majority of the Board finds and determines, in the exercise of its discretion, that the variance:

1) If granted would be a detriment to public health, safety, or welfare, or harmful to other property in the District's jurisdiction; or

2) Would not preserve and protect the applicant's substantial property rights.

The financial consequence of complying with the DISTRICT CRITERIA MANUAL is not a basis on which to approve an application for variance unless a majority of the Board finds and determines, in the exercise of its discretion, that compliance would deprive the applicant of all reasonable beneficial use of its property.

F. Approval of the variance will be noted on the written form the applicant has submitted. The Board's designee will provide a written explanation to the applicant of the rejection of an application for variance within five (5) working days of the meeting.

G. The rejection of an application for variance is subject to appeal pursuant to the

procedures set out in SECTION V.

IV. ENFORCEMENT

A. No developer or owner of a tract of land within the District shall begin development of any property in the District or subject to the District's jurisdiction unless that person has complied with the following as required by this MANUAL:

1) Drainage Impact Analysis approval (as applicable).

2) Submission of preliminary and final plats and plans.

3) Preliminary and final plat review.

4) Preliminary and final plat approval.

5) Preliminary drainage plan review and approval.

6) Final drainage plan review and approval.

B. A developer shall strictly comply with final approved plats and plans. The District will have no obligation to accept facilities or approve construction under Section II. O. of the DISTRICT CRITERIA MANUAL that is not completed in strict compliance with the plats and plans that the District has approved.

C. The District's Board of Directors may refer to the District's Attorney any person who has commenced construction on any property in the District or subject to the District's jurisdiction without complying with the requirements of the DISTRICT'S CRITERIA MANUAL.

D. The District's Board of Directors may assess reasonable civil penalties for noncompliance with the requirements of the DISTRICT CRITERIA MANUAL. Any penalty imposed for a violation of the requirements of the DISTRICT CRITERIA MANUAL shall not exceed $1,000.00 per day, exclusive of any award of reasonable and necessary attorney's fees.

E. A civil penalty may be imposed for each individual violation of the DISTRICT CRITERIA MANUAL although more than one violation may arise out of the same event or occurrence.

F. A proceeding to impose a civil penalty is initiated by the District giving written notice to the person against whom penalties are sought ("the respondent"). Such written notice shall inform the respondent.

1) That the District intends to impose civil penalties for violation of one or more requirements of the DISTRICT CRITERIA MANUAL.

2) Of the particular provisions of the DISTRICT CRITERIA MANUAL believed to have been violated.

3) Of the reasons that the District believes the provisions of the DISTRICT

CRITERIA MANUAL have been violated.

4) Of the total amount of penalties that the District may impose.

5) That the respondent may appear before the District at the time and place of the hearing in person, through any attorney or by its officer, director or managing partner to respond to the allegation that provisions of the DISTRICT CRITERIA MANUAL have been violated and to offer witnesses, documents, and other evidence on the subject.

6) Of the date, time, and place of the hearing.

G. At the date, time, and place of the hearing the District's Board of Directors shall present their evidence and take evidence from the respondent on the issue of whether the particular provisions of the DISTRICT CRITERIA MANUAL have been violated. At the close of the evidence, the Board of Directors shall deliberate and vote on whether a violation of the particular provisions of the DISTRICT CRITERIA MANUAL has been proven by a civil preponderance of the evidence. If a majority of the Board of Directors finds that a violation has been proven, a civil penalty may be assessed by a majority vote of the Board.

H. Pursuant to the authority granted in Texas Water Code 49.004, the District may seek, in addition to civil penalties, its reasonable and necessary attorney's fees incurred in connection with the prosecution of proceedings to impose a civil penalty. If fees are sought, then the District shall present its evidence of the amount of reasonable and necessary attorney's fees it has incurred in the prosecution of the subject and in the conduct of the proceeding.

I. If a majority of the Board of Directors finds that a violation has been proven and assesses a civil penalty whether or not accompanied by an award of reasonable and necessary attorney's fees, the District shall give written notice to the respondent of:

1) The particular provisions of the DISTRICT CRITERIA MANUAL found to have been violated.

2) Each penalty assessed.

3) The amount of reasonable and necessary attorney's fees assessed, if any.

4) The date by which payment of the civil penalty and attorney's fees, if any, must be received at the offices of the District, which date shall be thirty (30) days after the day the written notice is mailed to the respondent.

5) The right to file an appeal pursuant to the procedures in SECTION V of the DISTRICT CRITERIA MANUAL.

J. The District may enforce a civil penalty and/or an award of reasonable and

necessary attorney's fees which is unpaid, and which has not been appealed, or in which the respondent's appeal was not successful, by filing a civil action in a court having jurisdiction over the subject matter.

K. The rights and remedies provided by this section of the DISTRICT CRITERIA MANUAL are cumulative of all other rights and remedies the District may have for violations of this MANUAL.

L. The District's assessment of a civil penalty and/or an award of reasonable and necessary attorney's fees are subject to appeal pursuant to the procedures set out in SECTION V.

M. Any civil penalties assessed by the District must be resolved before the District reviews or accepts a submittal for any Final Drainage Plan or Plat. Any future amendments to this subsection M shall require a supermajority vote of the Board of Directors.

V. RIGHTS OF APPEAL

A. An adverse decision on an application for a variance and the assessment of a civil penalty or an award of reasonable and necessary attorney's fees may be appealed pursuant to the provisions of this section.

B. This section does not give rights of appeal from adverse decisions of the District as to:
1) Submission of preliminary and final plats and plans.
2) Preliminary and final plat review.
3) Preliminary and final plat approval.
4) Preliminary drainage plan review and approval.
5) Final drainage plan review and approval.
6) Project acceptance.

C. An applicant under SECTION III or a respondent under SECTION IV may request appellate review by the District's Board of Directors. Such requests must be made in writing and received at the offices of the District within ten (10) days of the date that the applicant or respondent received notice of the adverse decision as shown by the US Postal Form PS 3800.

D. Upon receipt of a written request for appellate review of an adverse decision, the District shall schedule a hearing for appellate review of the adverse decision. The District will schedule such a hearing with thirty (30) days of the receipt of a request for appellate review, if feasible.

E. The District shall give written notice of its action on a written request for appellate review. Such written notice shall inform the appellant:

1) Whether the written request for appellate review was made in a timely manner.

2) If the request for appellate review was made in a timely manner, the respondent may appear before the District at the time and place of the

appellate review hearing in person, through any attorney, or by its officer, director, or managing partner to present additional argument and evidence as to the allegation that provisions of the DISTRICT CRITERIA MANUAL have been violated and to offer additional witnesses, documents, and other evidence on the subject.

3) Of the date, time, and place of the appellate review hearing.

F. At the date, time, and place of the appellate review hearing the District's Board of Directors shall take additional argument and evidence from the appellant on the issue of whether the particular provisions of the DISTRICT CRITERIA MANUAL have been violated. At the close of the appellate review hearing the Board of Directors shall deliberate and vote on whether to affirm, reverse, or vacate and modify the District's prior ruling or rulings. The majority decision of the District's Board of Directors shall constitute the final ruling of the District on the subject of the appellate review.

VI. HYDROLOGY

A. Storm Frequency

All drainage improvements shall be designed for the following storm frequencies.

Type of Facility	
Road Side Ditches & Culverts	5 year
Storm Sewer	5 year
Ditches and Culverts Draining 100 acres or less	25 year
Bridges	100 year
Creeks/Ditches/Culverts Draining More Than 100 Acres	100 year
Detention Facilities	5, 25 and 100 year
Siphons (Must be approved by the Board on a case by case basis)	100 year

** All District-maintained drainage facilities shall be designed for the 100-year storm independent of the amount of acreage served.

B. Rational Method

The Rational Method shall be used for determining peak undeveloped and developed flow rate for detention outfall size determination and hydrograph development if the Simplified Method outlined in SECTION VII. B. 2. is not utilized.

$$Q = C_f (A)(C)(i)$$

Where:

Q = Flow rate in cfs

C = Runoff Coefficient, See EXHIBIT I

C_f = Frequency factor, the product of C_f and C should not exceed 1.0 (see below)

A = Area in acres

i = Rainfall intensity in inches/hour, See EXHIBIT II for a period of time equal to the time of concentration, T_c, at the point of interest.

T_c = Time of Concentration = Time required in minutes for peak runoff from entire upstream contributing area to reach the point of interest.

$T_c = \frac{D}{60V}$ + 10 (ten) minutes initial time

D = Flow Distance, feet

V = Flow Velocity, fps.

Storm Frequency	Frequency Factor (C_f)
≤10	1.00
25	1.10
100	1.25

For purposes of calculating T_c, the following velocities must not be exceeded:

V = 0.5 fps for over land flow (undeveloped)

V = 1 fps for overland flow (developed)

V = 1.5 fps for flow across paved surfaces or along gutter flowlines

V = 2 fps for flow in ditch or channel

V = 3 fps for flow in storm sewer

Time of concentration can be calculated based upon an analysis of the actual travel time from the most remote point in the drainage area. The travel path should be clearly denoted, and a sketch included in the design calculations.

VII. DETENTION STORAGE

Detention Storage will be required for all developments within the District. Calculations must be performed by the applicable method described in the following Sections.

A. General Policy

The following policies will apply to all detention systems within the District:

1) In-stream or “inline” detention facilities on tributaries will be considered on a case-by-case basis only if the drainage channel receives runoff entirely from the property for which the detention capacity is being provided. In all cases a detailed HEC-RAS analysis shall be performed. Excess volume will be required in the amount of two times the required detention volume when in-stream detention is to be utilized. A pre-application meeting is required at a

regular District meeting prior to submittal of preliminary plans when in-stream detention is planned.

2) Off-site compensatory storage will also be allowed on a case-by-case basis. A detailed HEC-RAS analysis shall be performed, and storage provided so that there is no increase in the 25-year or 100-year stormwater surface elevation. Prior to submitting any plans, a pre-application meeting with the Board of Directors must be held.

3) The District has a policy to develop regional and sub-regional detention systems. If the developer opts to participate in this type of system, he must receive approval from the Board of Directors prior to submitting any plats or plans. Requests to participate shall be made in writing and submitted to the District.

4) All detention facilities shall have adequate freeboard to drain the lateral sewers during a 25-year storm.

5) A parking lot may be used as part of the detention system provided that the maximum depth of water over the inlet is nine inches (9") and the maximum depth in the parking stall is six inches (6").

6) Detention facilities may not be located within the 100-year floodplain unless there is no loss in existing floodplain storage volume. Compensatory storage for mitigating floodplain fill will be required in addition to detention storage volume required to insure no loss in floodplain storage. The top of bank for detention and / or floodplain mitigation basins shall not be raised within the mapped 100-year flood zone unless the Engineer can demonstrate that doing so causes no net reduction in the 100-year floodplain volume and no net increase in flood depths along the stream due to the potential obstruction to flood flows.

7) No pumped detention systems will be allowed without prior approval by the Board. Under no circumstances will pump detention be approved for residential developments. A request letter must be submitted and considered by the board prior to using this style of system. If a request to use a pumped detention system is submitted, considered by the board, and approved, the following criteria must be used for the design of the stormwater lift station:

7.1: A combination of pump and gravity outfall must be used.

7.2: No more than 75% of the required detention volume shall be pumped.

7.3: The discharge delivery system for any combination of pumps running shall not have a peak discharge and/or peak stages that exceed the pre-developed 5-year, 25-year, and 100-year design storm events.

7.4: At least two pumps capable of providing the designed discharge

rate must be provided.

7.5: Include an analysis showing that the system will result in the pond being drained from full to empty within 72 hours following a rain event.

7.6: Fencing of the control panel must be provided to prevent unauthorized operation and vandalism. The District must have access to the equipment for periodic inspection by way of a shared key lock box (or similar) on site.

7.7: The pump system shall use a one-way valve or other means of ensuring that the water pumped out of the detention pond will not readily return back to the detention pond by way of the gravity outfall pipe. The one-way valve shall be placed at the appropriate end of the pipe to facilitate inspection and cleaning.

7.8: The Owner of the pump system shall provide the District with a written report at least once per year and upon request by the District showing the dates and times of operation, total hours of operation, and the amount of water pumped. The design on the plans shall demonstrate that the pump system has this data collection capability. An hour meter and flowmeter will be sufficient for meeting these requirements.

7.9: The pump system shall include a water level detection system which cause the system to cease pumping when the water level in the receiving ditch is at 75% of its capacity. This level switch shall be placed away from the force main discharge to avoid misreads due to turbulence and wave action. Show ditch cross section, elevations and calculations to demonstrate compliance.

7.10: The pump system shall include a water level detection system which cause the system to cease pumping when the water level in the detention system reaches the gravity outfall elevation.

7.11: The pump system shall include a water level detection system which cause the system to begin pumping when the water level in the detention system recedes below the gravity outfall elevation.

7.12: The District shall have the right to enter the property and inspect the pump for any reason. Place a statement to this effect on the plan and/or plat.

8) Parties responsible for maintenance of the detention facility must be identified on the plat or plans.

9) Redevelopment and Additions

a. Additional impervious cover may be added to a single-family

residential lot provided that all applicable requirements including purchase of detention have been complied with and subject to all City Ordinances, Interlocal Agreements and County requirements.

All improved lots within an existing subdivision served by a detention facility that is within the platted boundaries of said subdivision and that has been previously accepted and approved by the District, shall be exempt from the regulation to purchase detention for additional impervious cover.

b. All commercial and non-residential new developments, addition or redevelopment will require a new or revised drainage plan for additional impervious cover. The standard minimum rate of detention referenced below will apply to this additional impervious cover.

B. Hydrologic Method for Projects less than 25 Acres

1) Minimum Rate of Detention for Projects less than 25 Acres

When using any of the methods detailed below for calculating the required amount of detention, the minimum amount of detention provided shall never be less than the following standard minimum rates as follows:

For the purpose of determining the standard minimum rate, all the acreage used in the calculation must include proposed or existing development. Raw / undeveloped acreage may not be included in the calculation to lower the standard minimum rate.

a. Commercial Projects – Defined as projects with 90% or more impervious cover or a runoff coefficient of 0.90 or larger – Standard minimum detention rate 0.60 ac-ft / ac.
b. Multi-Family Projects – Defined as projects with 80% or more impervious cover or a runoff coefficient of 0.80 or larger – Standard minimum detention rate 0.55 ac-ft / ac.
c. Residential Projects – Defined as projects with 40% or more impervious cover or a runoff coefficient of 0.55 or larger – Standard minimum detention rate 0.55 ac-ft / ac.
d. Estate Lot Projects – Defined as projects with less than 40% impervious cover and a runoff coefficient less than 0.55 – Standard minimum detention rate 0.55 ac-ft / ac.
e. Mixed Use Projects – The standard minimum rate of detention shall be determined based upon a weighted average of the minimum rates set forth above.

2) Modified Rational Method.

The modified rational method may be used to determine detention storage for all projects less than five (5) acres.

3) Simplified Method.

For projects of less than five (5) acres, a standard minimum rate may be used in lieu of performing a more complex analysis. This coefficient multiplied by the total increase area of impervious cover will yield the total detention volume required.

4) Optional Detention Storage Methodology for Projects less than 25 Acres.

The maximum allowable release rate from the detention facility during the 100-year storm event is the 100-year peak flow rate from the area under pre-development conditions. The undeveloped peak flow rate shall be determined using the Rational Method.

The following methods will be acceptable for determining detention storage volume if the simplified method is not utilized.

(a) TRIANGULAR HYDROGRAPH METHOD

The volume of storage required may be computed as follows:

$$B = \frac{43560V}{0.5\ I}$$

$$S = \frac{0.5\ B\ (I-O)}{43560}$$

Where,

B = Duration of inflow (seconds)

V = Total inflow volume in acre-feet (24 hr. duration event use SCS Curve Number)

S = Required Storage Volume (acre-feet)

I = Peak inflow rate (cfs)

O = Peak outflow rate (cfs)

(b) UNIT HYDROGRAPH METHOD

For projects with drainage areas less than 25 acres, a technique developed by Dr. H.R. Malcom may be utilized in determining the inflow hydrograph. For this method, often referred to as “The Small Watershed Method,” the maximum inflow rate for detention facilities in the District shall be determined by use of the rational formula. (See SECTION VI. B.) With the peak flow and volume of runoff, the equations presented below may be used to determine the inflow hydrograph for the proposed detention facility.

The maximum allowable outflow rate from the detention facility

shall be restricted to the existing flow rate from the undeveloped tract. Outflow control shall be designed for 5-year, 25-year and 100-year storm frequencies in accordance with SECTION VI. In cases where the outfall for the detention facility is to be an existing roadside ditch, storm sewer, etc., the allowable outflow rate may need to be restricted to less than the maximum allowable so as to not overload the outfall.

EQUATIONS

1. $Tp = \frac{V}{1.39\ Qp}$

Where,

$Tp =$ Time to peak in seconds

$V =$ Total volume of runoff for the design storm (cubic feet)

$Qp =$ Peak runoff for the design storm (CFS)

$$V = Dr \bullet A * \left(\frac{43{,}560}{(12)} \right)$$

Where,

Dr = Runoff Depth (IN)

A = Runoff area (acres)

2. $$Qi = \left(\frac{Qp}{2} \right) \left[1 - \cos\left(\frac{\pi \bullet ti}{tp} \right) \right] \bullet \left[\text{For : ti} \le 1.25 \cdot \text{Tp} \right]$$

* Note: The argument of the cosine function shown above must be expressed in radians.

Where:

$ti =$ Time of Interest (SEC)

$qi =$ Runoff at Time of Interest (CFS)

3. $$qi = 4.34 Qp Ve^{(-1.3ti\ /\ Tp)} \quad \left[tiV \rangle V\ 1.25 \right]$$

4. $t =$ Time Interval = $Tp\ /\ 10$

ti and qi are the respective time and flow rates which determine the shape of the inflow hydrograph.

Utilizing these equations to produce the inflow hydrograph and the calculated value for allowable outflow, the required detention volume is determined. (See attached EXHIBIT III.)

C. Detention Storage Methodology for Projects equal to or greater than 25 acres.

For drainage areas equal to or larger than 25 acres, a detailed hydrologic analysis utilizing as a minimum HEC-HMS v 4.10 (or more current version) for windows will be required. This methodology also applies to properties out of tracts of 100 acres or more. A preliminary engineering report conforming to the requirements of SECTION II. K. will be required to detail all design assumptions and parameters.

1. Watershed Modeling

a) For HEC-HMS analysis, the following parameters shall be used:

Loss Method:	Green and Ampt
Transform Method:	Clark Unit Hydrograph
Initial Loss:	0.1 inches
Moisture Deficit:	0.385
Suction:	12.45 inches
Conductivity:	0.024 inches/hour

Table 1 - % Impervious Cover

Land Use	% Impervious
Water	100
Isolated Transportation	90
High Density	85
Light Industrial	60
Airport	50
Residential Small Lot	40
Residential Large Lot	20
Development Green Areas	15
Residential Rural Lot	5
Undeveloped	0
Unknown	0

Table II - Rainfall Depth (inches)

Duration	100-year	25-year	10-year	5-year	3-year

5 min.	1.40	1.10	0.90	0.80	0.70
15 min.	2.70	2.10	1.80	1.50	1.40
30 min.	3.80	3.00	2.50	2.20	2.00
1 hr.	5.20	4.10	3.40	2.90	2.60
2 hr.	7.50	5.60	4.50	3.50	3.30
3 hr.	9.20	6.60	5.20	4.30	3.70
6 hr.	12.20	8.40	6.50	5.20	4.50
12 hr.	15.00	10.20	7.80	6.20	5.30
24 hr.	17.90	12.10	9.20	7.30	6.20

b) Indicate on a map drawn to scale the existing and proposed watershed areas. All major features such as major roads and drainage entries shall be indicated. Node locations shall be provided in the base model with corresponding nodes at identical points in the model for the proposed system.

c) The model shall include the 5-year, 25-year and 100-year pre-development and post-development runoff analysis. If a proposed development is to be constructed in phases, the analysis should address any intermediate developed conditions.

d) When time series data or paired data are used in the model, briefly discuss the source of the data in the report or show the calculations. Whenever possible, provide an electronic copy of the calculations or the source files..

e) Time of concentration and storage coefficient shall be calculated as referenced in the associated documents related to the source models and studies.

2. Water Surface Profile Modeling

a) Water surface profile models shall be created using as a minimum HEC-RAS v 6.4.1 (or more current version) for Windows. Alternative approaches to modeling shall be discussed with the District prior to commencing the study.

b) The use of steady flow and/or unsteady flow approach may be utilized with proper justification.

c) Provide information and data for the base model which must be included in the report. Base models shall be updated to a minimum of HEC-RAS v 6.4.1.

d) Provide a plan view schematic for the existing and proposed systems. The schematics shall include channel designations, node labels and river stations. The river stations and node labels on the existing model shall match any identical points on the proposed models whenever possible. Physical reference points (e.g., FM

518/Friendswood Drive crossing) shall also be used.

e) All models shall include the 5-year, 25-year and 100-year pre-development and post-development runoff analysis. If a proposed development is to be constructed in phases, the analysis should address any intermediate development conditions. Proposed bridge and/or culvert crossing analyses shall include an extreme event analysis.

f) For any steady flow or unsteady flow data used in the model(s), briefly explain how the data was calculated or the source of the data. Whenever available, these separate data files or calculations shall be included on media acceptable for electronic format with all submittals.

g) All existing bridge or culvert crossing shall be modeled based upon actual on the ground survey data correctly tied to a District approved benchmark, datum and year of adjustment unless authorized otherwise by the District during the pre-application meeting. Vertical data will ideally be on the same datum as the current FIRM. At a minimum, an adjustment shall be provided to relate the vertical data to the FIRM elevations.

h) Bridge and/or culvert crossings shall be analyzed using the highest energy answer obtained using the energy and momentum equations.

i) The model should include a reasonable number of cross-sections based upon current elevation data to ensure that the actual drainage system is properly represented. The spacing of cross-sections may be approximated by using Samuels equation. The use of numerous interpolated sections between two surveyed cross-sections that are too far apart is not an acceptable way of producing additional sections.

j) Some portions of channels within the District are tidally influenced. In those reaches, the models shall account for tidal conditions.

k) For HEC-RAS models, the following methods and parameters will be the District standard modeling requirements:

Contraction Coefficient : 0.1
Expansion Coefficient : 0.3

Table III - Manning's "n" Values

Description	Manning's "n" value
Channel - Conforming to District Criteria & Maintained by the District	
Grass Lined	0.040
Articulated Concrete Block - with grass	0.040

Articulated Concrete Block – bare	0.040
Concrete Lined	0.015
Channel - Conforming to District Criteria & Not Maintained by the District	
Grass Lined	0.045
Articulated Concrete Block - with grass	0.045
Articulated Concrete Block – bare	0.045
Concrete Lined	0.015
Channel - Non-Conforming & Unlikely to be Maintained by the District	
Natural of Overgrown Channels	0.055 - 0.085
Overbanks with Minimal Flow	0.085 - 0.155
Closed Conduits, Boxes & Pipe	
Reinforced Concrete, HDPE, PVC Pipe	0.013
Reinforced Concrete Box Culvert	0.013
Corrugated Metal Pipe	0.028

Submit a justification for deviating from these "n" values.

NOTE: Deviation from the District's standard modeling requirements shall be discussed at the pre-application meeting and will be considered by the District on a case-by-case basis.

VIII. DETENTION POND STRUCTURAL REQUIREMENTS

A. Outfall Design

1) Orifice Outfall

Outfalls, which utilize a pipe restrictor to control outflow, shall use the orifice equation to compute the allowable opening as follows.

$$Q = CA\sqrt{2gH} \qquad \text{(Orifice Equation)}$$

Where:
- Q = Allowable Outflow (cfs)
- C = Pipe Coefficient (use 0.8)
- A = Pipe Cross-Sectional area (ft^2)
- g = Acceleration Due to Gravity (32.2 ft/s^2)
- H = Head Differential

$$A = \frac{Q}{C\sqrt{2gH}}$$

$$A = \pi R^2$$

Where: R = pipe radius (ft)

π = 3.14

For head differential use two feet (2') or 100-year water surface in pond minus the 25-year water surface in the receiving channel, if available. If discharging to roadside ditch or storm sewer use one foot (1').

A restrictor pipe shall be four feet (4') in length and not less than six inches (6") in diameter. Restrictors shall be at the upstream end of the pipe to facilitate cleaning.

2) ALTERNATE OUTFALL

If the Engineer elects to provide an alternate control structure, the Engineer must provide a discussion of the method used to determine outflow along with the calculations for review by the District's Engineer.

3) The outfall structure for ponds discharging into existing storm sewers shall be designed for the five (5) year developed discharge, and roadside ditches discharge shall be designed for the five (5) year undeveloped discharge. In each case, an overflow swale with the outfall grade set at the 100-year flood storage level will be required.

4) For ponds discharging into creeks or ditches under the jurisdiction of the District, the outfall structure shall be designed for the 5, 25, and 100-year storm frequencies. Determine the 5, 25, and 100-year undeveloped discharges and the developed detention volumes. Determine the restrictor sizing to detain the undeveloped flow rates. Use a vertical structure or multiple pipes separated vertically with the flow line of the second opening or pipe set at the 5-year design water surface elevation. The third opening or pipe shall be set at the 25-year design water surface elevation so that the combined total discharge of all pipes or openings shall not exceed the 100-year undeveloped discharge. An overflow weir shall be set at the 100-year design water surface elevation. When using multiple pipes, connect to a common manhole or junction box and connect a single outlet pipe into the receiving drainage system.

B. Pond Details (See Appendix F for Commercial Developments 20 acres or less)

1) Side slopes shall not exceed a slope of 1 vertically to 4 horizontally.

2) Ponds shall have a concrete pilot channel. Side lot detention swales between residential properties are not required to have a concrete pilot channel. Single-user ponds may use the alternative to the concrete pilot channels.

3) Ponds shall have a minimum transverse slope of 1% and a minimum longitudinal slope of 0.20%.

4) Outfalls and overflows shall have erosion protection. Outfall velocity shall not exceed seven feet (7') per second.

5) All flow to the detention facility shall be conveyed through storm sewers or concrete drop structures. Back slope swales around the detention facility will be required if existing or proposed overland flows will enter the pond.

6) Detention ponds less than one (1) acre in size shall have at least four

inches (4”) minimum freeboard. All ponds over one acre in size shall have at least one foot (1') minimum freeboard. Freeboard shall be measured from the maximum 100-year water surface elevation to the minimum top of bank elevation and shall not be used in the calculation of detention storage or mitigation.

7) Public detention facilities shall be placed in “Restricted Reserves - Restricted to Detention Use”. These Reserves shall have a minimum width of twenty feet (20’) and shall have unobstructed frontage to a public street or right-of-way.

8) Public detention facilities to be maintained by the District or Homeowner Association shall have the following minimum maintenance berms:

DEPTH	WIDTH OF BERM
2' - 5'	15'
5' - 10'	20'
10' AND OVER	30'

9) Private detention facilities less than two feet (2') in depth shall have a minimum of ten foot (10') set back from the property line to the top of bank of the detention facility. For facilities over two feet (2') in depth, the maintenance berms shall meet the requirements of Item 8 above.

10) If the detention facility is located adjacent to a District channel a minimum of a twenty-foot (20’) maintenance berm is required on that side. No shared maintenance berms will be allowed without a variance.

11) All pipes entering and/or exiting a District controlled facility shall be reinforced concrete pipe (ASTM C-76, Class III).

12) Appropriate covering (Grass, Slope Paving, etc.) shall be established on side slopes and pond bottom to prevent erosion during periods of maximum water velocity.

13) Standard District details mentioned above are available at the District Office or the Office of the District’s Engineer. They are available in digital format. All construction shall comply with the District’s standard details.

EXHIBIT I

Rational Method Runoff Coefficients

Land Use Type	Run-Off Coefficients, c
Raw Undeveloped Acres	0.20
Improved Undeveloped Acres (i.e., mowed, filled, re-graded, etc.)	0.30
Park Land	0.40
Residential:	
SFR-Estates (>= 1 acre)	0.45
SFR (< 1 acre)	0.55
Multi-Family:	0.85
Commercial/Industrial:	0.95

For large residential lots (2 + acres) with one (1) residential unit the following alternative method may be used:

$C = 0.6\ Ia + 0.2$

Where:

C = Run-Off Coefficient

Ia = Impervious Area/Total Area

EXHIBIT II

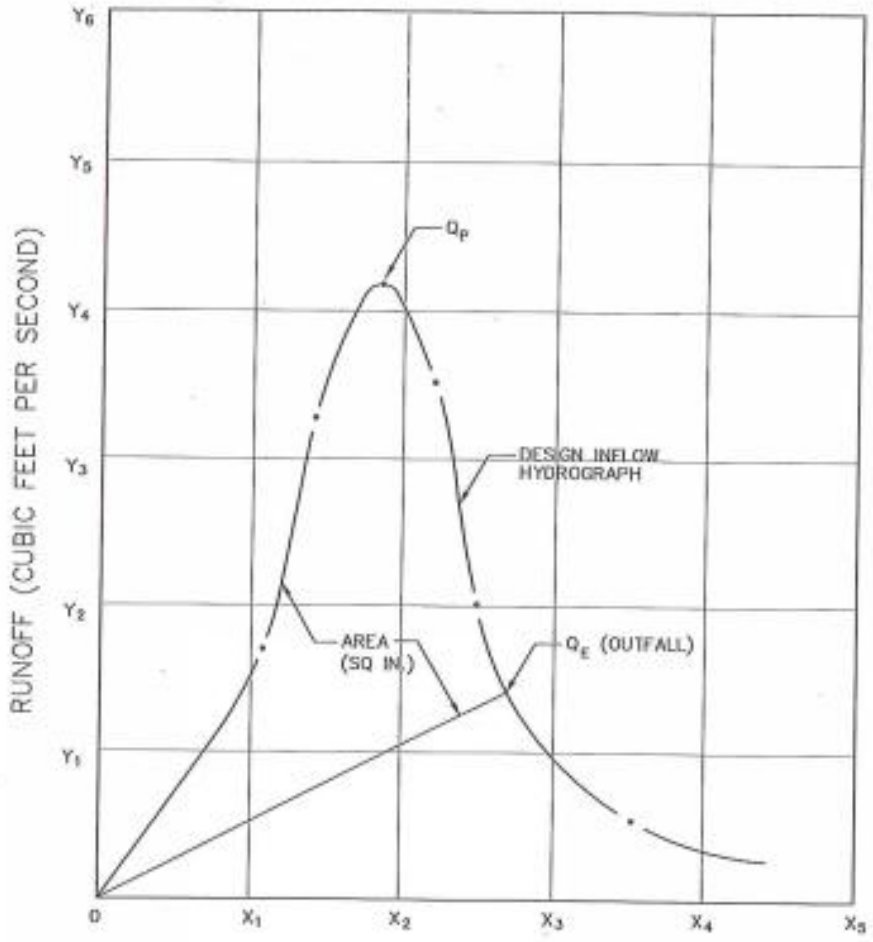
Rainfall Intensity Coefficients

Coefficient	100-Year	50-Year	25-Year	10-Year	5-Year	3-Year
<= 60 Min						
B	76.2	67.9	61.5	51.9	46.6	51.4
D	6.2	6.1	6.4	6.5	7.0	8.1
e	0.641	0.640	0.644	0.647	0.656	0.705
> 60 min						
B	318.6	211.5	154.0	110.3	86.1	69.9
d	96.0	67.7	47.5	30.9	19.4	11.9
e	0.826	0.798	0.783	0.776	0.775	0.768

Intensity Equation: $I = \frac{b}{(t_c + d)^e}$

I = Average rainfall intensity
t_c = Time of concentration
e, b, d = Coefficients based on rainfall IDF data.

EXHIBIT III



$$1 \text{ SQ IN} = Y_1 \ (FT^3/SEC) \ X_1 \ (\text{MINUTES}) \ \frac{60 \ (\text{SECONDS})}{(\text{MINUTE})} \ \frac{\text{ACRE}}{43{,}560 \ FT^2}$$

$$V_S \ (\text{ACRE*FEET}) = A(\text{SQ*IN}) \times \frac{Y_1 X_1}{726} \left(\frac{\text{ACRE*FEET}}{\text{SQ*IN}} \right)$$

APPENDIX A

PRELIMINARY Signature Block

For Drainage Plans

Approved by the GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT

_____	_____
CEO OR COO	Date
_____	_____
District Engineer	Date

The approval granted by these signatures does not constitute the District's approval for the granting of any construction or building permit. This preliminary approval shall expire in (6) months.

APPENDIX A

PRELIMINARY Signature Block

For Plats

Approved by the GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT

_____	_____
CEO OR COO	Date
_____	_____
District Engineer	Date

The approval granted by these signatures does not constitute the District's approval for the granting of any construction or building permit. This preliminary approval shall expire in (6) months.

APPENDIX A

FINAL Signature Block

For Drainage Plans

Approved by the GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT

Director	Date
Director	Date

This is to certify that the above was signed based on the recommendation of the District's Engineer having reviewed all sheets provided and found them to be in general compliance with the District's "Drainage Criteria Manual." This approval is only valid for three hundred sixty-five (365) calendar days. Please note, this does not necessarily mean that all the calculations provided in these plans have been completely checked and verified. The plans submitted have been prepared, signed, and sealed by a Professional Engineer licensed to practice engineering in the State of Texas, which conveys the engineer's responsibility and accountability.

APPENDIX A

FINAL Signature Block

For Plats

Approved by the GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT

Director	Date
Director	Date

This is to certify that the above was signed based on the recommendation of the District's Engineer having reviewed all sheets provided and found them to be in general compliance with the District's "Drainage Criteria Manual." This approval is only valid for three hundred sixty-five (365) calendar days. Please note that this does not necessarily mean that the plat has been completely checked and verified. The plat as submitted, was prepared, signed, and

sealed by a Professional Land Surveyor licensed to practice surveying in the State of Texas, which conveys responsibility and accountability to that Surveyor.

APPENDIX B

Required Plat Notes

1. Buildings, fences, or other permanent improvements shall not be erected in GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT (the District) rights-of-way or drainage easements.

2. The detention and drainage facilities are to be maintained by the property owner unless all requirements mentioned in Note # 3 have been satisfied and the District has accepted the facility for maintenance.

3. The detention facility is to be maintained by the District provided that the District has approved the construction of the facility, the developer has paid the required fee, the site and access have been deeded to the District in fee, and subject to approval by the Board.

4. No building permit shall be issued for any lot within this subdivision until a detention and drainage plan has been approved by the District. Construction of detention improvements shall precede the construction of impervious cover on site.

5. Additional drainage easements may be required at the time a drainage plan is submitted to the District for approval.

6. Plantings, flowerbeds, or other landscaping are not permitted within side lot drainage or detention easements.

7. No building permit shall be applied for until all drainage and detention facilities are constructed, inspected, and approved by the District.

8. No permanent Improvements, including landscaping, paving, trees, utilities, or playground equipment may be constructed within a detention facility (including maintenance berms) on facilities owned or maintained by the District without District approval. If the District does obtain ownership or maintenance responsibilities of such facilities, the District shall not be responsible for any damage, replacement, or reimbursement for any improvements damaged, moved, or removed by the District. The District may also require owner removal of any existing improvements before the District assumes any responsibility in regard to such facilities.

9. Review or approval by the Galveston County Consolidated Drainage District (GCCDD) does not relieve the applicant, developer, or property owner of the obligation to obtain any required review, approval, or permit from other local, state, or federal agencies having jurisdiction. Any revisions, modifications, or conditions required by such agencies, if made subsequent to GCCDD approval, may necessitate resubmittal to GCCDD for further review and approval.

Required Plan Notes

1. Contact the District 48 hours prior to commencing construction and upon completion for the final inspection.

2. Buildings, fences, or other permanent improvements shall not be erected in the District rights-of-way or drainage easements.

3. The detention and drainage facilities are to be maintained by the property owner unless all requirements mentioned in Note # 4 have been satisfied and the District has accepted the facility for maintenance.

4. The detention facility is to be maintained by the District provided that the District has approved the construction of the facility, the developer has paid the required fee, the site and access have been deeded to the District in fee, and subject to approval by the Board.

5. All drainage facilities shall have erosion control established upon completion. Contractor shall provide the District with proposed grass type, application rate, and method for approval prior to commencing. Grass shall be 95% germinated prior to acceptance of the facility.

6. Plantings, flowerbeds, or other landscaping are not permitted within side lot drainage or detention easements.

7. No building permit shall be applied for until all drainage and detention facilities are constructed, inspected, and approved by the District.

8. District Personnel shall have the right to enter upon the property and conduct interim inspections as required.

9. No permanent Improvements, including landscaping, paving, trees, utilities, or playground equipment may be constructed within a detention facility (including maintenance berms) on facilities owned or maintained by the District without District approval. If the District does obtain ownership or maintenance responsibilities of such facilities, the District shall not be responsible for any damage, replacement, or reimbursement for any improvements damaged, moved, or removed by the District. The District may also require owner removal of any existing improvements before the District assumes any responsibility in regard to such facilities.

10. Review or approval by the Galveston County Consolidated Drainage District (GCCDD) does not relieve the applicant, developer, or property owner of the obligation to obtain any required review, approval, or permit from other local, state, or federal agencies having jurisdiction. Any revisions, modifications, or conditions required by such agencies, if made subsequent to GCCDD approval, may necessitate resubmittal to GCCDD for further review and approval.

APPENDIX C

Rights-of-Way and Easements

The GALVESTON COUNTY CONSOLIDATED DRAINAGE DISTRICT (the District) requires the following minimum Right-of-Way in all developments within its boundaries for drainage work. All dimensions given below for minimum Right-of-Way or easements are from the center of the proposed realigned channel. Reference should be made to the District's Master Drainage Plan for detailed information. All required Right-of-Way or easement dedications must be recorded prior to final plan and plat approval by the board.The Attachment 4 process is exempt from this as long as the property owner or applicant enters into an agreement regarding the dedication of the required Right-of-Way or easement at a later time.

1. Clear Creek Fee Simple Right-of-Way

    a. One Hundred Seventy-Five feet (175'). (See latest COE plan.)

2. Chigger Creek Fee Simple Right-of-Way

    a. From Clear Creek to FM 518, One Hundred feet (100').

    b. From FM 518 to Windsong Street: Ninety feet (90').

    c. From Windsong Street to the District boundary: Seventy feet (70').

    d. All gullies or drainage ditches under the District jurisdiction: Fifty feet (50').

3. Cowards Creek Fee Simple Right-of-Way

    a. Clear Creek to Castlewood: One hundred feet (100').

    b. From Castlewood to the District boundary: ninety feet (90').

    c. All gullies or drainage ditch under the District Jurisdiction: Fifty feet (50').

4. Mary's Creek Fee Simple Right-of-Way

    a. Clear Creek to FM 2351: One hundred feet (100').

    b. FM 2351 to the District boundary: Ninety feet (90').

    c. All gullies or drainage ditches under the District jurisdiction: Fifty feet (50').

5. Dickinson Bayou Fee Simple Right-of-Way

a. Upstream District Boundary to American Canal – 250 feet total width, 125 feet per side.

b. American Canal to Downstream District Boundary – 400 feet total width, 200 feet per side.

c. Box Ditch – 250 feet total width, 125 feet per side.

d. Lundy Ditch – 200 feet total width, 100 feet per side.

e. Madera Ditch – 200 feet total width, 100 feet per side

f. Coyote Creek – 200 feet total width. 100 feet per side.

g. Your Ditch – 140 feet total width, 70 feet per side.

h. All gullies or drainage ditches under the District jurisdiction: Fifty feet (50').

6. Dickinson Bayou Bypass Fee Simple Right-of-Way.

a. The District Jurisdiction to Dickinson Bayou: 300 feet total width, 150 feet per side.

b. All gullies or drainage ditches under the District jurisdiction: Fifty feet (50').

7. In those cases where the existing top of bank extends beyond the above stated minimums, the right-of-way shall be increased to provide at least a thirty-foot (30') maintenance berm on each side of the ditch.

8. Unobstructed access at least twenty feet (20') wide shall be provided to all easements and rights-of-way from a road or street at least every 2000 feet (2000'). Additional access easements may be required.

9. Storm sewer easements for outfalls shall be twenty feet (20') minimum and outside of lot lines.

APPENDIX D

Variance Request Information Form

(INLCUDE FINAL DRAINAGE PLAN SIGNATURE BLOCK WITH GCCDD REFERECEN ID)

PROJECT NAME:

APPLICANT:

DATE SUBMITTED:

SPECIFIC VARIANCE IS BEING SOUGHT AND EXTENT OF VARIANCE:

DRAINAGE CRITERIA MANUAL REFERENCE:

STATEMENT OF FACTS:

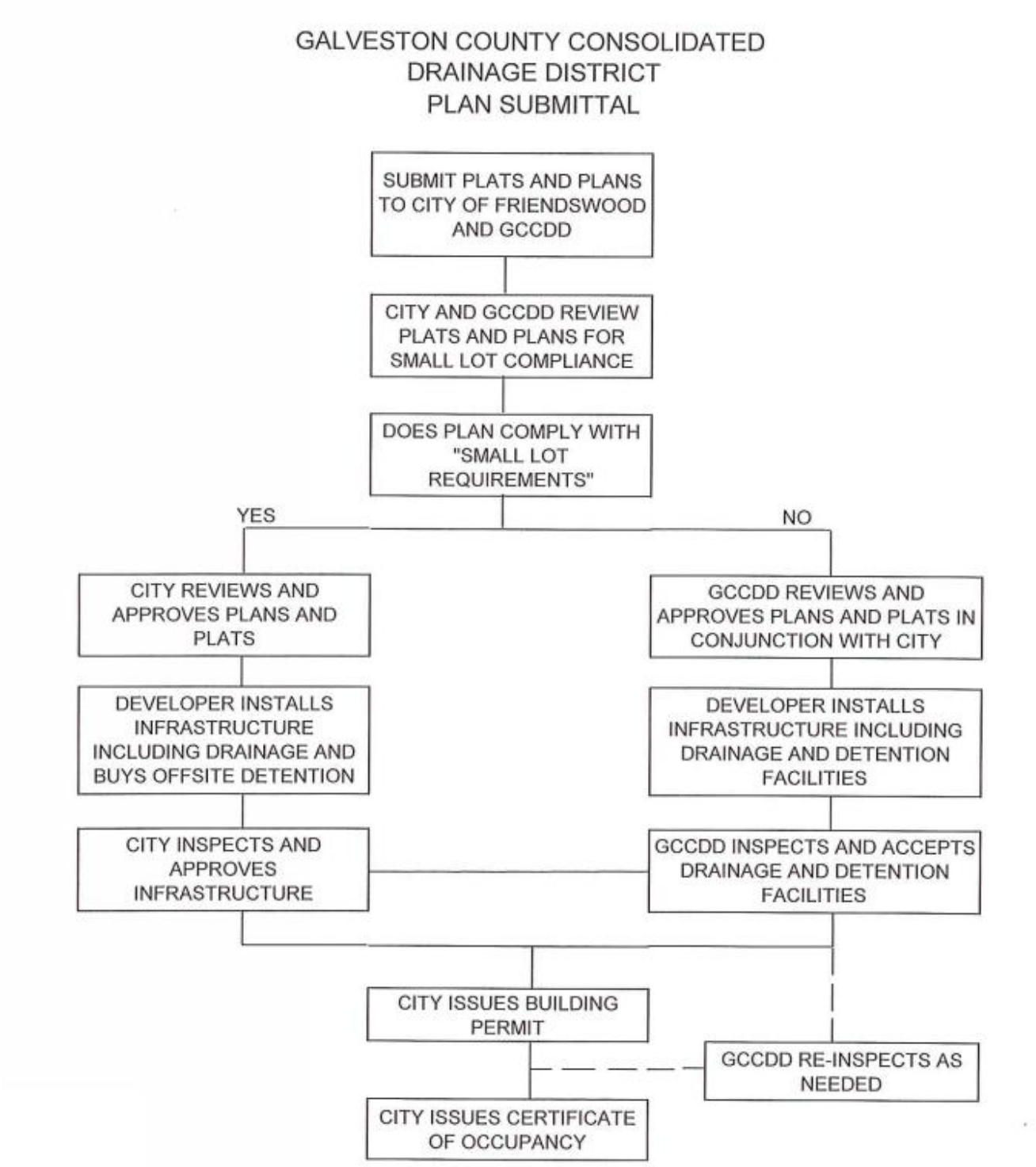
_____

Signature Date

_____

Printed Name

APPENDIX E


GALVESTON COUNTY CONSOLIDATED
DRAINAGE DISTRICT
PLAN SUBMITTAL
SUBMIT PLATS AND PLANS TO CITY OF FRIENDSWOOD AND GCCDD
CITY AND GCCDD REVIEW PLATS AND PLANS FOR SMALL LOT COMPLIANCE
DOES PLAN COMPLY WITH "SMALL LOT REQUIREMENTS"
YES
NO
CITY REVIEWS AND APPROVES PLANS AND PLATS
GCCDD REVIEWS AND APPROVES PLANS AND PLATS IN CONJUNCTION WITH CITY
DEVELOPER INSTALLS INFRASTRUCTURE INCLUDING DRAINAGE AND BUYS OFFSITE DETENTION
DEVELOPER INSTALLS INFRASTRUCTURE INCLUDING DRAINAGE AND DETENTION FACILITIES
CITY INSPECTS AND APPROVES INFRASTRUCTURE
GCCDD INSPECTS AND ACCEPTS DRAINAGE AND DETENTION FACILITIES
CITY ISSUES BUILDING PERMIT
GCCDD RE-INSPECTS AS NEEDED
CITY ISSUES CERTIFICATE OF OCCUPANCY

APPENDIX F

Detention Pond Requirements for Commercial Developments 20 acres or less

1. A 3:1 side slope may be used provided that a slope stability analysis is performed and said analysis supports such slopes with the in-situ soil.
2. A minimum maintenance berm width of 15 feet may be used.
3. Vertical Wall Side Slopes may be used if all of the following criteria is met:
    a. The detention pond is privately maintained.
    b. The Applicant shall submit the detailed design, and construction plans for the retaining wall signed and sealed by a Structural Engineer registered in the State of Texas.
    c. The design of a dry pond must include a 12-foot-wide concrete lined ramp on an 8:1 slope so that maintenance and mowing equipment can access the bottom of the pond. Additionally, concrete landings shall be placed at the bottom and top of the ramp and shall be a minimum of 12 feet in width and length.
    d. The floor of the detention pond must have a concrete pilot channel to ensure quick and adequate drying of the bottom of the pond.
    e. Wet ponds must have at least two sides of earthen side slope meeting the district's criteria.
    f. The required detention volume will be the calculated amount of detention volume required plus 10%.
    g. A letter from the city stating that they will maintain the private pond in the event the development fails to maintain said pond.
    h. Adequate measures must be incorporated into the design and constructed to prevent pedestrians and vehicles falling into the detention facility.
    i. No vertical wall within a detention pond shall be placed within 30-feet of a DISTRICT drainage easement, DISTRICT fee strip, or road right-of-way. In other locations where a vertical wall is not adjacent to a road or DISTRICT facility, a 3-foot safety setback is required. Permanent improvements within this 3-foot safety setback shall be limited to guard-rails, fencing, and other safety measures.

APPENDIX G

Definitions List

1. **Base Flood Elevation (BFE) –** The elevation to which floodwaters are expected to rise during a 100-year storm event, used in floodplain management and building regulations**.**
2. **Construct or Construction –** Activities involved in the planning, design, and execution of projects. These include, but are not limited to, site preparation, clearing and grubbing, excavation, filling and grading, foundation work, structural construction, electrical and plumbing installation, stockpiling of materials, and the import or export of materials. Construction typically involves a combination of manual labor, machinery, materials, and technology to build or modify buildings, infrastructure, or other physical structures.
3. **Datum –** A reference point or system used in surveying to measure elevation, commonly tied to the National Geodetic Survey (NGS) benchmark.
4. **Detention Facility –** A structure designed to temporarily store stormwater runoff and release it at a controlled rate to prevent flooding and erosion.
5. **Drainage Easement –** A legal right granted to the Galveston County Consolidated Drainage District (GCCDD) or other entities to use a portion of private property for stormwater management and drainage purposes.
6. **Encroachment –** Any structure, obstruction, or development within a floodplain or drainage easement that may impact water flow and flood risk.
7. **Floodplain –** The land area adjacent to a stream, river, or bayou that is subject to inundation during heavy rainfall or extreme storm events, usually classified by recurrence intervals such as the 100-year floodplain.
8. **Floodway –** The portion of a floodplain reserved for the conveyance of floodwaters, where obstructions must be limited to prevent raising water surface elevations**.**
9. **Freeboard –** The additional height of a detention pond or drainage structure above the designed water level to provide extra capacity for unexpected inflows.
10. **HEC-HMS (Hydrologic Engineering Center -** Hydrologic Modeling System) – A software application developed by the U.S. Army Corps of Engineers for simulating the hydrologic processes of watersheds. HEC-HMS is used to model rainfall-runoff relationships, streamflow, infiltration, and flood forecasting, aiding in stormwater management, floodplain studies, and water resource planning.
11. **HEC-RAS (Hydrologic Engineering Centers River Analysis System) –** A software program developed by the U.S. Army Corps of Engineers to model water surface profiles in rivers and channels.

12. **Hydrologic Modeling –** A mathematical representation of how water moves across land surfaces and through drainage systems, used to predict flood behavior and stormwater impacts. Commonly used software for hydrologic modeling includes HEC-HMS, HEC-RAS, SWMM, and XPStorm, which assist in analyzing rainfall-runoff relationships, channel flow, and floodplain dynamics.
13. **Improvements –** Any addition or change made to a piece of land that increases its value, usefulness, or appearance.
14. **Impervious Cover –** Any surface that prevents the infiltration of water into the ground, such as rooftops, pavement, and sidewalks, which increases stormwater runoff.
15. **Outfall –** The point where a drainage system, storm sewer, or detention facility discharges runoff into a natural or man-made watercourse.
16. **Rational Method –** A widely used formula for estimating peak runoff rates in small drainage areas based on rainfall intensity, drainage area, and runoff coefficient.
17. **Regional Detention Facility –** A large-scale detention system serving multiple developments to manage stormwater runoff in a coordinated manner.
18. **Retention Facility –** A stormwater management structure that holds water indefinitely, allowing it to infiltrate into the ground rather than being released downstream.
19. **Runoff Coefficient (C) –** A factor in hydrologic calculations representing the fraction of total rainfall that becomes surface runoff, depending on land cover and soil conditions.
20. **Sheet Flow –** The movement of water across the surface of land before it becomes concentrated into defined channels or storm drains.
21. **Short Form Plat –** A simplified approval process for minor developments, such as subdivisions with two residential lots, allowing applicants to bypass preliminary approval steps.
22. **Siphon –** A hydraulic structure designed to move water from one elevation to another using pressure differentials, sometimes used in underground drainage systems.
23. **Storm Frequency –** The statistical probability of a given storm event occurring within a specified time period, such as a 5-year, 25-year, or 100-year storm**.**
24. **Storm Sewer System –** A network of underground pipes designed to convey stormwater runoff to a designated outfall or detention facility.
25. **Stormwater Pollution Prevention Plan (SWP3) –** A plan required by the Texas Commission on Environmental Quality (TCEQ) to minimize erosion, sedimentation, and pollutants in stormwater runoff during construction activities.
26. **Time of Concentration (Tc) –** The time required for runoff from the most remote part of a drainage area to reach a specific point in the system, used in peak flow calculations.
27. **Utility Crossing –** The placement of pipelines, cables, or other infrastructure across a drainage channel, requiring compliance with GCCDD regulations to prevent interference with stormwater flow.
28. **Variance –** A formal request for an exception to GCCDD drainage criteria, requiring justification and approval from the Board of Directors.