Unincorporated Harris County

Floodplain Management Plan

Prepared by the Harris County Permit Office

2008
I. Executive Summary........................................................................................................... 3
II. Introduction.......................................................................................................................... 3
III. Purpose .............................................................................................................................. 4
IV. Plan Organization (CRS Activity 511.1)........................................................................... 4
V. Public Involvement (CRS Activity 511.2)........................................................................... 5
VI. Coordinate with Other Agencies (CRS Activity 511.3).................................................. 5
VII. Assess the Hazard (CRS Activity 511.4)........................................................................ 5
VIII. Assess the Problem (CRS Activity 511.5)...................................................................... 9
IX. Community Goals (CRS Activity 511.6)......................................................................... 10
X. Review Possible Activities (CRS Activities 511.7).......................................................... 11
XI. Action Plan (CRS Activities 511.8)................................................................................ 14
XII. Plan Adoption (CRS Activities 511.9).......................................................................... 16
XIII. Implement, Evaluate, and Revise the Plan (CRS Activity 511.10)................................. 16

Attachment A – List of Acronyms
Attachment B – Map of Known Flood Hazards
Attachment C – Regulations of Harris County, Texas for Flood Plain Management
Attachment D – Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure
Attachment E – Regulations of Harris County, Texas for Storm Water Quality Management
Attachment F – HCFCID Capital Improvement Five-Year Program FY 2008-09 - FY 2012-13
Attachment G - HCFCD Federal Briefing March 2008

Attachment H – HCFCD Property Acquisition Update May 2008

Attachment I – Commissioners Court Letter Approving the *Floodplain Management Plan*
I. Executive Summary

The costliest natural disaster to hit Harris County has been flooding. Tropical Storm Allison caused damages that exceeded $5 billion in June 2001. To help reduce future damages to property and life, Harris County began participating in the Community Rating System (CRS) program through the Federal Emergency Management Agency (FEMA) in 2002. The CRS program encourages and rewards communities for floodplain management activities that exceed the minimum National Flood Insurance Program standards.

As part of this credit, several activities will continue to be implemented, and new activities have been defined to help reduce future flood damage. Additionally, Office of Homeland Security and Emergency Management (OHSEM) is currently working on revising the All Hazards Mitigation Plan. Harris County has achieved an 8 in CRS and will continue to apply for additional points once eligible.

Elevation Reference Marks (ERM) and maps have been updated as part of the Tropical Storm Allison Recovery Project (TSARP). This update has rendered Harris County with a premier benchmark system of over 1,300 benchmarks. Harris County and Harris County Flood Control District (HCFCD) are recovering and maintaining benchmarks located in Unincorporated Harris County. Harris County’s Permits Intranet GIS system provides maps of the county containing the following layers to our staff: Key Map Grid, Firm Panel, Precinct 1 Road Log, Precinct 2 Road Log, Precinct 3 Road Log, Precinct 4 Road Log, Road Network, Base Flood Elevation, FEMA Effective Floodplain 07’, Fire Marshal Sector, Commercial Plans, County Boundary, Watershed and Aerials 2006.

Harris County and HCFCD are continuing to work together to purchase substantially damaged and repetitive loss properties. HCFCD maintains Harris County drainage facilities throughout the county. These actions will reduce flood damages.

HCFCD has scheduled over $335 million in Capital Improvement Projects from 2009 thru 2013. HCFCD’s Property Acquisition Services Section has twelve active grant projects; ten Pre-Disaster Mitigation (PDM), one Hazard Mitigation Grant Program (HMGP), and one Flood Mitigation Assistance (FMA) totaling $42.9 million. There are 5 additional grant projects in the planning stage for the upcoming year totaling $26.1 million.

II. Introduction

Harris County is the third largest county in the United States with a population greater than three million. It covers 1,788 square miles with 1,500 channels totaling about 2,500 miles in length within twenty-two watersheds. The land use consists of urban, residential, commercial, and heavy industrial areas. In the last century, over 30 thunderstorms, tropical storms, and hurricanes have caused flooding in Harris County. Whenever disaster strikes, agencies and communities join together to help citizens repair and recover from the devastation. These agencies consist of federal, state, and local government agencies, as well as volunteer organizations.
Harris County has some unique situations. After devastating flooding in 1935, the state legislature created the Harris County Flood Control District (HCFCD). As stated in the Flood Insurance Study, the HCFCD governs drainage and flood control, while the County Engineer governs floodplain management and permit programs with technical assistance from the HCFCD. Although both agencies are under the jurisdiction of Commissioners’ Court, they are separate agencies.

III. Purpose

The purpose of this floodplain management plan is to review and implement all possible activities that will prevent future damages from flooding and assist in post-disaster recovery; coordinate with other agencies to decrease duplication of effort and increase productivity; educate citizens on disaster preparedness and avoidance; and build a constituency between the public and government bodies to implement the plan.

This plan will review all possible flood damage reduction activities. Examples include preventive activities, property protection activities, activities that protect the natural and beneficial functions of the floodplain, structural projects, and public information activities. Once all options have been evaluated, the implementation of all feasible action items will be defined. These activities will be coordinated with other agencies to ensure that the plan meets the community’s goals and objectives. This coordination will also help reduce the costs of implementing individual activities by identifying possible partnerships and funding sources. Several projects currently underway in Harris County are funded through partnerships with various entities.

Citizens of Harris County will receive information and give recommendations by participating in the preparation and review of the plan. The benefits of the floodplain will be explained. Flood hazards will be identified, and various mitigation activities will be discussed. Residents will learn how to prepare for and respond to flooding situations. Through this education, a constituency of government officials and citizens can help the plan’s recommendations get implemented.

IV. Plan Organization (CRS Activity 511.1)

The planning process for this document was supervised by a professional planner who meets the requirements set forth in the 2007 National Flood Insurance Program CRS Coordinators Manual. The plan was prepared by researching and documenting the community’s current regulatory standards, by identifying projects or programs being implemented by other departments within Harris County, by evaluating possible flood damage reduction mitigation activities, and by gaining valuable input from those who will be implementing the proposed plan.

The plan was revised under the direction of the Assistant Deputy Director, with close coordination from the County’s Deputy Director of Permits. Once this document was
revised, the planning process required the proofing and editing of the document by various local officials and departments, including, but not limited to:

- Raymond J. Anderson, PE, CFM, Deputy Director of Harris County Permits
- Shannon C. Watson, PE, CFM, Asst. Deputy Director of Harris County Permits
- Jorge Cedillo, Harris County Planner
- Michael Talbott, PE, Director of Harris County Flood Control District

V. Public Involvement (CRS Activity 511.2)

A copy is posted on the Harris County Permits website under News. The planning process, the Community Rating System, and the Floodplain Mitigation Plan were explained at the public meeting. Questions were answered throughout the presentation.

VI. Coordinate with Other Agencies (CRS Activity 511.3)

The HCFCD, OHSEM, Texas Division of Emergency Management (TxDHM), Texas NFIP Coordinator, Texas Commission on Environmental Quality (TCEQ), FEMA Region VI, and the CRS ISO officer were notified about the revision to the Unincorporated Harris County Floodplain Management Plan. Once the revised Floodplain Management Plan was prepared, the same people and organizations were asked to review the document for common problems; inconsistencies and conflicts with established policies, plans, programs, and regulations; development policies, and mitigation services. The Permit Office requested such comments by July 29, 2008. The comments or recommendations received were incorporated into the document.

VII. Assess the Hazard (CRS Activity 511.4)

Flooding is the costliest disaster Harris County has faced to date. The Harris County flood hazards are shown in the Harris County Flood Insurance Study (FIS) and the Flood Insurance Rate Maps (FIRMs) that were published on the following dates: September 28, 1990; September 30, 1992; November 6, 1996; April 20, 2000; and June 18, 2007. A map of the known flood hazard areas is in Attachment B. The known flood hazard areas include the adopted FIRM floodplain and locations of structures that flooded as a result of Tropical Storm Allison. The properties that flooded in June 2001 represent repetitive loss areas and areas that are not mapped on the FIRM but have flooded in the past.

Due to the devastation resulting from Tropical Storm Allison, FEMA and HCFCD initiated an extensive countywide restudy project. The project was called the “Tropical Storm Allison Recovery Project” or “TSARP.” New flood hazard information for the primary flooding sources in Harris County was produced using advanced technology. Major benefits expected from this study include “development of flood recovery data allowing state and community officials and property owners to make informed decisions about repairing, rebuilding, and/or relocating damaged structures, infrastructure and public facilities.” New products such as a
digital elevation model, topographic mapping for all of Harris County, revised Flood Insurance Study information and new Digital Flood Insurance Rate Maps (DFIRMs) are available.

Flooding is exacerbated due to the area’s flat terrain, impervious soils, heavy rainfall and annual threats of hurricanes and tropical storms. Major flooding has taken place on all streams including Buffalo, White Oak, Brays, Greens, and Halls Bayous; Cypress, Spring, and Clear Creeks; and the San Jacinto River. Depth of flooding varies from a few inches to above the houses’ rooftops. Velocities can sometimes be treacherous. “Off the Charts,” a Tropical Storm Allison Public Report, contained chronological information on storms that have occurred in Harris County from 1900-2001. Additionally we have included chronological information on storms from 2001 thru 2008. Also included is a brief description of the storm that caused flooding.

**September 1900** – Major hurricane hit Galveston. The “Great Galveston Storm” was the worst natural disaster of the time in U.S. history. Loss of life was reported to be 6,000 to 8,000 citizens. Harris County experienced widespread flooding with property damage between $30 and $40 million.

1907 – Major storm flooded much of Houston and Harris County.

**December 1913** – Major Brazos River storm spread to Harris County. Entire area was hard hit. Buffalo, White Oak, Brays, and Greens Bayous were all out of their banks. Many citizens evacuated.

**August 1915** – Another Galveston hurricane caused major damage throughout Harris County. Buffalo Bayou and widespread areas of Houston experienced heavy flooding. Damages were estimated at $56 million.

**April 1929** – Enormous gulf storm descended on Houston and Harris County and lasted 14 hours. Many areas of the county reported rainfall close to 10 inches. Extensive damage was sustained by businesses and residences in almost all areas of Harris County. All bayous were reported to be out of their banks.

**May 1929** – One month later another major storm hit Harris County. Structural damage, heavy street flooding, and widespread crop damage was reported. The San Jacinto River was 30 feet above normal.

**May 1930** – Large rainstorm cell remained stationary over Harris County for 3 days. Rainfall amounts were reported as high as 12.5 inches. The entire area averaged 8 inches.

**August 1932** – Hurricane hit Freeport and took 40 lives. Harris County suffered widespread flooding on all bayous.
December 1935 – Massive storm inundated Houston and Harris County. Buffalo Bayou was 52 feet above normal. Overwhelming devastation led to the creation of Harris County Flood Control District in 1937.

November 1940 – Heavy rains lasted for 5 days in Northeast Harris County, and 10,000 head of cattle were lost.

July 1943 – Hurricane near Galveston created extensive flooding for Harris County. There was approximately $16.5 million in damage.

October 1943 – A hurricane came in near Freeport. Over 11,000 residences flooded in Harris County.

August 1945 – Area hurricane produced the heaviest rainfall previously recorded in Harris County – over 15 inches in 24 hours. Flooding was reported on all bayous and streams.

February 1950 – A thunderstorm preceded a cold front and resulted in Greens Bayou running out of its banks. Area residents were evacuated. Baytown reported flooding as well.

May 1955 – Major thunderstorm hit the northern portion of Harris County. House flooding was reported in the area.

June 1957 – Hurricane Audrey crossed the Louisiana/Texas coast. Flooding was reported in Harris County.

October 1959 – A thunderstorm flooded over 100 residences in the Houston area.

June 1960 – A thunderstorm inundated many areas throughout Harris County. Cypress Creek, Spring Creek, and San Jacinto River experienced flooding. Over 200 families were evacuated.

September 1961 – Hurricane Carla pounded the Gulf Coast, taking 34 lives. It was the largest hurricane previously recorded with property damages that exceeded $300 million. Heavy flooding was reported in southern Harris County.

February 1969 – Another thunderstorm preceded a cold front and flooded over 250 area residences and businesses. Damages exceeded $3.3 million.

March 1972 – A thunderstorm preceded a cold front and flooded much of northern Harris County. Over 700 families were evacuated.

June 1973 – Major storm hit Harris County and brought 10-15 inches of rain. Sims and Greens Bayous were reported out of their banks. Ten lives were lost and damages exceeded $50 million.
**July 1979** – Tropical Storm Claudette brought record rainfall amounts to the area. Forty-three (43) inches of rain in 24 hours fell in Alvin – a U.S. record that still stands today. Total damages exceeded $700 million.

**May 1983** – Large thunderstorm flooded areas along several creeks and bayous. Damages exceeded $14 million.

**August 1983** – Hurricane Alicia struck Galveston and Harris County. Damages approached $1 billion, mostly due to wind.

**September 1983** – Nine inches of rain fell south of downtown. Over 1,000 residences flooded along Brays Bayou. Damages topped $38 million.

**May 1989** – A major storm delivered 7 to 14 inches of rain over much of Harris County, and 1,400 residences flooded.

**June 1989** – A tropical storm named “Allison” delivered 6-12 inches of rain over portions of Harris County. Nearly 1,100 residences flooded.

**March 1992** – A major storm flooded over 1,500 residences and businesses, and many bayou were out of their banks. Much of I-10 was under water.

**October 1994** – Major storm inundated Southeast Texas, dumping 4 to 29 inches of rain in three days over Harris County alone. Countywide, nearly 3,400 residences in 90 subdivisions were flooded.

**September 1998** – Tropical Storm Frances caused extensive flooding along White Oak Bayou and other bayous. Over 1,300 residences were flooded.

**October & November 1998** – Two more major storms flooded hundreds of more residences, mainly in north Harris County.

**June 2001** – Referred to as “The Great Flood of 2001,” this storm hit Harris County and Houston with a “one-two” punch, beginning June 5th, and dealt the final blow three days later as the storm returned to the gulf. The second pass through the area produced extraordinary rainfall amounts northeast of downtown Houston. The Texas Medical Center was essentially “shut down.” The north portion of downtown Houston was decimated. Two million people were simultaneously impacted. Over 70,000 residences flooded, and 22 lives were lost. Damages exceeded $5 billion.

**October 2002** – Another 1,108 structures flooded in Halls Bayou, Greens Bayou, White Oak Bayou, and Lake Houston watersheds. Another federal disaster was declared.

**November 2003** – Two days of moderate to heavy rainfall with thunderstorms crossing Harris County from East to West flooded over 300 residences.
June 2006 – The combination of a stationary mid level low pressure system over Southeast Texas, combined with deep tropical moisture produced heavy rainfall. Countywide 3,370 residences were flooded.

October 2006 – Two flood events occurred. On October 16th the combination of very deep tropical moisture with levels over 200% above normal combined with a slow moving warm front and the approach of a strong upper level trough resulted in excessive rainfall. Over 115 residences were flooded, and on October 26th and 27th, the combination of an upper level storm system and deep tropical moisture from the Gulf of Mexico, and the remains of Eastern Pacific Hurricane Paul produced heavy rains on top of saturated grounds. Rains developed in Southwest to Northeast bands and trained across Harris County.

August 2007 – Tropical Storm Erin made landfall along the middle Texas coast, just North of Corpus Christi, as a minimal tropical storm with widespread heavy rains developed in strong feeder bands across Harris County.

VIII. Assess the Problem (CRS Activity 511.5)

Harris County has a long history of severe flooding and expects to suffer from flooding in the future. Flooding is a major problem for Harris County and surrounding communities due to the area’s flat terrain, impervious soils, and heavy rainfall. Several storm types can result in flooding, including thunderstorms, hurricanes, and tropical storms.

Severe thunderstorms occur frequently in Harris County. While they may occur throughout the year, springtime is the peak time of the year for storms. Thunderstorms are associated with flash flooding conditions and kill more people in the United States than any other natural phenomenon. Flash flooding can cause streets to become impassable and may cause waters to rise and flood businesses and homes.

Hurricanes can be deadly in this region. Hurricane season lasts from June 1 to November 30 every year; however, most hurricanes occur from August through October. Hurricanes have winds that reach a minimum constant speed of 74 miles per hour and blow in a large tightening spiral around a relatively calm center, commonly referred to as the “eye.” Winds may gust to more than 200 miles per hour near the eye.

Tropical storms also have proved to be fatal in Harris County. These storms have sustained winds between 39 and 73 miles per hour. Tropical storms may drop large amounts of rain over a sustained period of time. Flash flooding and sustained flooding are often the most deadly aspects of tropical storms.

Flooding causes dramatic impacts to life, safety, and health. People may lose everything they own, including their lives. Fatalities often occur during or after a flood due to drowning. As power lines are often down, the possibility of electrocution is present. Emergency response teams have trouble answering calls. Some critical facilities, such as the Texas Medical Center, have been shut down for extended periods of time. Patients, including those in critical
condition, have been evacuated during past events. There always seems to be a shortage of temporary housing during large disasters.

Safety is always at the top of the list for emergency management and law enforcement personnel. Roads become impassable, leaving commuters stranded. Patrols and roadblocks have to be in place to prevent looting. Rodents, snakes, and other dangerous animals invade homes or strike unsuspecting victims floating in floodwaters.

Sometimes public and private water sources become contaminated. Contaminants and pollutants also enter the streams and can cause illness in people who are exposed to them. Increases in stress and depression are also documented. During large disasters, some organizations such as the Red Cross offer counseling services to victims and their families.

Due to all of the effects of flood-related impacts, procedures for warning and evacuation have been prepared and implemented by OHSEM. Copies of these documents are available online at www.hcoem.org. OHSEM is a separate agency in Harris County that also is governed by Harris County Commissioners Court.

Based on FEMA Community Information System records, unincorporated Harris County has 83,978 flood insurance policies in effect with $21,075,836,800 in coverage. The total written premium for this coverage is $27,568,357. Also according to FEMA records, there have been 6,436 losses that paid a total of $183,100,564. The average claim amount is over $28,000. Harris County has 2,513 repetitive loss properties as of January 31, 2008 according to FEMA. A repetitive loss property is defined as a property (or structure) located in the 100-year floodplain that has received two or more paid flood insurance claims that exceed $1,000 each. These numbers represent the numbers generated according to Flood Insurance Claims. There are additional structures that may flood and are not included in the accounting.

According to community records, over 27,900 structures are in areas of the known flood hazards (including floodplains, repetitive loss areas, and areas not mapped that have flooded in the past).

IX. Community Goals (CRS Activity 511.6)

Harris County wishes to reduce the threat to its citizens’ health and safety and to reduce property damage caused by flooding. Floodplain Management Planning and participation in the CRS Program will help reduce flood damages through successful execution of the following activities:

CRS Activities
- Annually update FEMA’s Repetitive Loss List and submit data to FEMA.
- Improve Harris County’s CRS Classification annually with a goal of achieving the best classification for which the community qualifies.
Drainage Projects
- Provide HCFCD with information it requests to prioritize drainage maintenance and future projects.

Floodplain Management
- Encourage citizens to purchase flood insurance for their residences and businesses.
- Revise the County’s floodplain regulations if necessary to minimize flood damage to new construction.

Property Protection
- Continue supporting HCFCD’s Voluntary Buyout Program by providing the District with updated repetitive loss lists.

X. Review Possible Activities (CRS Activities 511.7)

Preventative Activities

Open Space Preservation
Harris County currently has over 33,795 acres in the form of parkland that is located in the FEMA designated Special Flood Hazard Areas (SFHA). These parks have natural areas, open space, recreation facilities, floodplain preservation/conservation, flooding easement, wetlands, detention basins, buyout properties, and greenbelts for its citizens and visitors.

Floodplain Regulation
Unincorporated Harris County has adopted floodplain management regulations that meet or exceed the minimum requirements for participation in the National Flood Insurance Program (NFIP). Detailed information on the Floodplain Regulations may be found in Attachment C, Regulations for Harris County, Texas for Flood Plain Management, effective June 18, 2007.

Stormwater Management
Drainage criteria administered by Harris County is complemented by the City of Houston and HCFCD criteria for newly designed areas that provide protection from structural flooding from a 100-year base flood storm event. Regulations require that an analysis be submitted for all new development or significant redevelopment. The analysis must include plan and profiles of the proposed drainage system, all supporting calculations, hydrology and hydraulic modeling when necessary, a summary of impacts to the existing system, if any, and mitigation for the impacts from storm events up to and including the 100-year frequency. More detailed information is provided in Attachment D, Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure, effective November 15, 2005.

Drainage System Management
HCFCD works out maintenance agreements or maintains County owned drainage systems throughout Harris County.
Subsidence
Differential subsidence and coastal subsidence is a significant problem in Harris County. Harris-Galveston Coastal Subsidence District (HGCSD) monitors subsidence and informs Harris County of changes on a regular basis.

Property Protection

Relocation/Acquisition
The Harris County Permit Office and HCFCD have acquired substantially damaged and repetitive loss properties from volunteers since 1989. The departments received funding through the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Assistance Program (FMAP). The County Permit Office assists HCFCD by providing repetitive loss and substantial damage information immediately following a disaster or upon request. More detailed information is provided in Attachment H, HCFCD Property Acquisition Update containing tables and maps.

Building Elevation
Current Harris County Regulations require the following:

The top of slab of the lowest habitable floor must be elevated to eighteen (18) or more inches above the base flood elevation or to the level of the crown of the nearest public street, whichever is higher, except in a floodway where the bottom of the lowest supporting member of the structure shall be elevated eighteen (18) or more inches above the base flood elevation. However, if the land is located in an “A” Zone and no depth number is shown on the FIRM, the slab or floor (including basement) shall be elevated at least three (3) feet above the highest adjacent grade.

Flood Proofing
Harris County regulations allow for flood proofing of commercial, industrial, or other nonresidential structures. FEMA Bulletin 2-93 or subsequent revisions serve as the guideline. Copies of the Bulletin are available at the County Permit office. The structure must be flood resistant to 18 inches above the base flood elevation as shown on the adopted FIRM. In addition, a registered professional engineer or architect must develop and/or review the structural design, specifications, and plans for the construction, and must certify that the design and methods of construction are in accordance with accepted standards of practice. Records of all certificates are maintained at the County Permit Office.

Insurance
Harris County is actively pursuing the application for the Community Rating System so that citizens receive a discount on flood insurance policies, excluding preferred risk policies. Harris County and HCFCD recommend that all homeowners and business owners have flood insurance.
Natural Resource Protection

Stormwater Quality Practices
All new development and significant redevelopment within unincorporated areas of Harris County, Texas, requires a Stormwater Quality (SWQ) Permit or an Industrial Activity Certification. SWQ is covered thoroughly in Attachment E, Regulations of Harris County, Texas for Storm Water Quality Management, amended April 13, 2004.

Emergency Services

Flood Warning
OHSEM, Harris County Sheriff’s Department, and Harris County Fire and Emergency Services Director coordinate flood warning information to the public. A warning procedures manual is available online at www.hcoem.org. Please contact OHSEM at (713) 881-3100 for specific questions.

Flood Response
Harris County’s Emergency Management Plan outlines specific response procedures in the event of a disaster. Disaster response activities are addressed in both the basic plan and numerous functional annexes. Currently, Mark Sloan is the designated coordinator for Harris County. Copies of the Emergency Management Plan are available online at www.hcoem.org or are available at the Houston Transtar Building. For specific questions, please contact OHSEM at (713) 881-3100. The Emergency Management Plan is updated on a routine basis per state requirements.

Structural Projects

Flood Protection Projects
HCFCD is completing flood protection projects throughout Harris County. These structural projects include channel improvements, channel diversions, and reservoirs. The District participates in federally funded projects, as well as projects funded strictly with Capital Improvement Project (CIP) funding. Attachment F contains HCFCD’s Capital Improvement Five-Year Program FY 2008-09 – FY 2012-13 that summarizes current and proposed projects, including joint projects with the United States Army Corps of Engineers (USACE). Attachment G is a copy of HCFCD Federal Briefing March 2008. This document summarizes in more detail the ongoing projects that HCFCD is participating in with the USACE.

Public Information

Map Information/Technical Assistance
The Harris County Permit Office allows the public to view the most current FIRM maps available. This office also provides information to the public so that maps may be purchased from FEMA and/or maps may be viewed on FEMA website using a computer. Technical assistance is provided for citizens who need help reading the maps or for citizens who have difficulty coming to the office. Employees routinely provide this service by reading FIRM
maps in response to telephone calls, by helping a citizen read the FIRM maps, and by providing the information in response to written requests.

Outreach Projects
Various county departments attend public meetings or participate in public awareness campaigns. The Permit Office also sends employees to attend neighborhood association meetings when invited. One of the goals of attending these meetings is to increase public awareness and stress the importance of purchasing flood insurance.

Real Estate Disclosure
In accordance with state law, potential buyers must be notified if a home has flooded or is in the floodplain. The Permit Office assists by researching and providing available information to people inquiring about a home’s history or unofficial floodplain status. If an official floodplain determination is needed, one may contact a Floodplain Determination Consultant for official floodplain status. A list of these consultants can be found on the FEMA website at http://www.fema.gov/business/nfip/fzone1.shtm. Lending institutions often call requesting official floodplain determinations to determine the requirements for a mortgage.

Library
Publications from FEMA have been placed in Harris County libraries for the purpose of establishing a Flood Protection Reference. Flood Protection References will also be made available on-line at the Harris County Official Website, www.co.harris.tx.us or via links to FEMA websites that post such information.

XI. Action Plan (CRS Activities 511.8)

Harris County’s Flood Mitigation Plan is maintained by the manager and staff of the County Permit Office. The manager is responsible for seeing that copies of the plan are retained, that reviews of the plan are completed, and that necessary updates are completed. The items described below are the items that were chosen to maximize the reduction in flood damages.

Action Item #1: All Hazards Mitigation Plan

OHSEM has received grant funding through the TxDEM to create an All Hazards Mitigation Plan. This draft plan may be used for the basis of the flood mitigation portion. The All Hazards Mitigation Plan will be used in the future for CRS credit as well as Hazard Mitigation Grant Program (HMGP) funding. Various agencies within the county will be participating in the All Hazards Mitigation Plan and will benefit from the final document. HMGP funds may be used toward projects involving design and construction of flood protection measures, drainage improvements, acquisition, elevation, and relocation.

Responsibility: OHSEM

Budget: TxDEM funding (75%); staff time (operating funds)
Action Item #2: Improve CRS Rating

Harris County will conduct an annual review of CRS activities. As new activities are implemented, Harris County will apply for additional points to increase its rating.

Responsibility: Harris County Permit Office

Budget: Staff time (operating funds)

Action Item #3: Update Elevation Reference Marks

The Harris County Permit Office will continue to recover all monuments in Unincorporated Harris County. Our office is also updating the website when additional monuments are set according to the adopted criteria. This office utilizes the ERMs for issuing permits for new construction within unincorporated Harris County. The County currently keeps a list of destroyed and newly issued ERMs on the Harris County Permits website at http://www.eng.hctx.net/permits/benchmark.htm.

Responsibility: Harris County Permits Office

Budget: Staff time (operating funds)

Action Item #4: Update Repetitive Loss List

The Harris County Permit Office will conduct annual evaluations of and update FEMA’s Repetitive Loss List to assist HCFCD with its voluntary buyout program. HCFCD has been applying for grants and completing acquisition projects for many years.

Responsibility: Harris County Permit Office

Budget: Staff time (operating funds)

Action Item #5: Acquisition Projects

HCFCD continues to acquire flood-prone homes in an effort to remove citizens from harm’s way and to reduce repetitive loss homes throughout the community. In post-disaster situations, the Harris County Permit Office helps HCFCD by providing them with substantial damage information as it becomes available. This assists the District with “fast track” acquisition projects. In areas along Halls Bayou where almost entire neighborhoods became substantially damaged, HCFCD has acquired homes for future detention pond sites.

Responsibility: HCFCD

Budget: Staff time (operating funds); TxDEM HMGP funds; TWDB FMA funds; NFIP Increased Cost of Compliance funds for demolition of structures
Action Item #6: Drainage System Maintenance

HCFCD is continuing the maintenance of streams and bayous in Harris County. The District is continuing to implement selective clearing projects, selective herbicide projects, wildflower seeding projects, tree plantings, cyclical mowing schedules, and introduction of native grasses.

Responsibility: HCFCD

Budget: HCFCD funding

XII. Plan Adoption (CRS Activity 511.9)

To meet CRS requirements, Harris County Commissioners Court formally adopted the Draft Floodplain Management Plan on May 6, 2003. For credit to continue, Commissioners Court will need to adopt later amendments to the plan. Harris County Commissioners Court formally adopted the revised Floodplain Management Plan on August 19, 2008.

XIII. Implement, Evaluate, and Revise the Plan (CRS Activities 511.10)

Harris County Permits Group will monitor the implementation of the Plan and conduct periodic reviews to evaluate the effectiveness of the Plan in accordance with CRS requirements. Many of the items presented in this document are already occurring. Those items that have been identified to begin will be implemented upon formal adoption of the amended plan by Commissioners Court.

Raymond J. Anderson, P.E., CFM Deputy Director of the Harris County Permit Office, is responsible for ensuring that the Floodplain Management Plan is reviewed in a timely manner. Once a review is completed, the staff will prepare a Plan Review Report resulting in a revision of the Plan based on input from the public, other agencies, and staff. The Floodplain Management Plan will be resubmitted to Commissioners Court for approval only as required by FEMA to meet CRS Requirements.

Harris County Commissioners Court adopted the revised and updated Floodplain Management Plan on August 19, 2008. Attachment I is a copy of the approved court letter for certification.


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<td>Community Rating System</td>
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<td>Pre-Disaster Mitigation</td>
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<td>Texas Division of Emergency Management</td>
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<td>USACE</td>
<td>United States Army Corps of Engineers</td>
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Attachment B

Map of Known Flood Hazards
Attachment C

Regulations of Harris County, Texas Flood Plain Management
SECTION 1.01 - AUTHORITY

These Regulations are adopted by the Commissioners' Court of Harris County, Texas, acting in its capacity as the governing body of Harris County and the Harris County Flood Control District. The authority of Harris County to adopt these Regulations and for the contents hereof is derived from the following statutes: Texas Local Government Code Section 240.901, as amended; Texas Transportation Code Sections 251.001 - 251.059 and Sections 254.001 - 254.019, as amended; the Harris County Road Law, as amended; and the Flood Control and Insurance Act, Subchapter I of Chapter 16 of the Texas Water Code, as amended. These Regulations may be amended at any time by a majority of Commissioners' Court as approved by the appropriate federal authorities.

SECTION 1.02 - AREA COVERED BY REGULATIONS

These Regulations apply in all unincorporated areas of Harris County, Texas.

SECTION 1.03 - PURPOSE

The purpose of these Regulations is to provide land use controls necessary to qualify unincorporated areas of Harris County for flood insurance under requirements of the National Flood Insurance Act of 1968, as amended, to protect human life and health; to avoid increasing flood levels or flood hazards or creating new flood hazard areas; to minimize public and private losses due to flooding; to reduce the need for expenditures of public money for flood control projects; to reduce the need for rescue and relief efforts associated with flooding; to prevent or minimize damage to public facilities and utilities and to aid the public in determining if a property is in a potential flood area.

SECTION 1.04 - CONSTRUCTION OF REGULATIONS

These Regulations are to be construed liberally to accomplish their purpose and to assure that Harris County complies with all State and Federal Laws.
SECTION 1.05 - ABROGATION AND GREATER RESTRICTIONS

The Regulations of Harris County, Texas for Flood Plain Management heretofore existing are repealed. However, such prior Regulations shall continue to apply to construction pursuant to permits issued prior to the effective date of the Regulations. Except as herein above expressly provided, these Regulations are not intended to repeal, abrogate, or impair any existing laws, regulations, easements, covenants, or deed restrictions. Where these Regulations and other legal requirements conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

SECTION 1.06 - WARNING AND DISCLAIMER OF LIABILITY

The degree of flood protection required by these Regulations is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. On occasion greater floods might occur, and flood heights could be increased by man-made or natural causes. These Regulations do not imply that any area or the uses permitted within any area will be free from flooding and flood damage. These Regulations shall not create liability on the part of Harris County or any officer or employee thereof for any flood damages that result from reliance on these Regulations or any administrative decision lawfully made thereunder. The granting of a permit does not imply that the development can be insured by Federal Flood Insurance.

SECTION 1.07 - FINDINGS OF FACT

It is hereby found by the Commissioners’ Court of Harris County that severe flooding has occurred in the past within its jurisdiction and is likely to occur in the future, and that damage to property occurs for many reasons including flooding from the tidal waters of the Gulf of Mexico and that the entire area within its jurisdiction is a rising-water prone area.

SECTION 1.08 - BASIS FOR REGULATION

Harris County hereby adopts as the basis for Regulation the Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) adopted on June 18, 2007, by the Federal Emergency Management Agency (FEMA) and any subsequent amendments or revisions thereto. Harris County hereby adopts as its regulatory floodways the floodways shown on the said FIRM.
PART 2 - USE OF TERMS

SECTION 2.01 - ACCESSORY BUILDING

“Accessory building” means a structure which is subordinate to, and the use of which is incidental to, that of the principal structure or use on the same property.

SECTION 2.02 - ADMINISTRATOR

“Administrator” means the Federal Emergency Management Agency Director.

SECTION 2.03 - BASE FLOOD

“Base flood” means a flood having a one percent chance of being equaled or exceeded in any one year. This flood is sometimes called a “1%” flood or “100-year flood”.

SECTION 2.04 - BASE FLOOD ELEVATION

“Base flood elevation” means the elevation or level above mean sea level that flood waters shall reach during the base flood.

SECTION 2.05 - BREAKAWAY WALL

“Breakaway wall” means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation systems.

SECTION 2.06 - CERTIFICATE OF COMPLIANCE

“Certificate of Compliance” means a document issued by the County Engineer indicating a site is in compliance with the Regulations of Harris County, Texas for Flood Plain Management as of a specific date. The certificate may be filed in the Real Property Records as outlined in Section 7.01 of these Regulations.
SECTION 2.07 - CERTIFICATE OF NON-COMPLIANCE

“Certificate of Non-Compliance” means a document issued by the County Engineer indicating a site is not in compliance with the Regulations of Harris County, Texas for Flood Plain Management as of a specific date. The certificate also advises that legal action may be taken against the property owner and that a request for denial of flood insurance may be processed with the Federal Emergency Management Agency (FEMA). This certificate may be filed in the Real Property Records as outlined in Section 7.01 of these Regulations.

SECTION 2.08 - COASTAL AREAS

“Coastal Areas” mean areas which border on bays or estuaries or other waterways subject to tidal action which are subject to possible flooding or increased flood levels because of tidal action, hurricane surge or rising water due to storms, hurricanes or tsunamis. A “coastal area” is not necessarily in a “V” Zone. In cases where there is a question as to whether an area is a coastal area the County Engineer shall refer to the Flood Insurance Study.

SECTION 2.09 - CONVEYANCE

“Conveyance” means the flow of water during the base flood with a velocity that is greater than one foot per second or a depth that is greater than one foot.

SECTION 2.10 - COUNTY ENGINEER

“County Engineer” means the holder of the statutory office of County Engineer for Harris County or the employee designated by the County Engineer to perform a task required by these Regulations.

SECTION 2.11 - CRITICAL FACILITIES

“Critical Facilities” means those facilities essential to the preservation of life and property, including, but not limited to schools, nursing homes, hospitals, police, fire and emergency response installations, facilities used for the storage of critical records, and commercial installations which produce, use or store hazardous materials or
hazardous waste as referenced in the Harris County Fire Code’s High-Hazard Group (Group H) of the 2006 International Fire Code.

SECTION 2.12 - DEVELOPMENT

“Development” means any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials. Fences or fence-type walls located within the flood plain are included within this definition.

“Development” shall not include (1) routine maintenance and repairs to existing structures; (2) residential accessory buildings or structures not located in A or V Zones with floor areas of less than one hundred fifty (150) square feet; and (3) other insignificant activities including the temporary storage of equipment or materials in the “X” Zones.

SECTION 2.13 – DFIRM

“DFIRM” means a digital version of the Flood Insurance Rate Map. DFIRMs may contain additional information not normally available on the paper map.

SECTION 2.14 - DRAINAGE

“Drainage” means runoff which flows over land as a result of precipitation. This shall include sheet flow, flow in streets and flows which may concentrate in local drainage systems with or without defined channels.

SECTION 2.15 - ELEVATION

“Elevation” means height above mean sea level. The North American Vertical Datum (NAVD) of 1988 (2001 Adjusted) shall be used. Any future studies changing the FIRM which is referenced to a later re-leveling of the vertical control system shall be used whenever a revised FIRM becomes effective.

SECTION 2.16 - ELEVATION CERTIFICATE
“Elevation Certificate” means FEMA Form 81-31, February 13, 2006 or subsequent revisions used to show elevations of real property in relation to base flood elevations.

SECTION 2.17 - EXISTING MANUFACTURED HOME PARK OR SUBDIVISION

“Existing manufactured home park or subdivision” means a manufactured home park for which the construction of facilities for servicing the lot on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, either final site grading or the pouring of concrete pads, and the construction of streets) are completed before the effective date of flood plain management regulations adopted by Harris County on September 16, 1976.

SECTION 2.18 - EXPANSION

“Expansion” means an addition to an existing development. Different types of “expansions” are treated differently by these Regulations.

(a) “Expansion of a structure” means an addition attached to, but outside of, either the vertical or horizontal confines of the existing structure or below the first floor level of a building elevated on posts or piers, but which is not a “substantial improvement” as defined by these Regulations.

(b) “Expansion of a manufactured home park or subdivision” means the making of any additional manufactured home lots or spaces within an existing manufactured home park, or on land adjoining an existing manufactured home park.

(c) “Expansion to an existing manufactured home park or subdivision” means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, either final site grading or pouring of concrete pads, and the construction of streets).

SECTION 2.19 - FILLING
“Filling” means the placement of natural sands, dirt, soil or rock above the natural grade to raise the elevation of the ground. Fill may also include concrete, cement, soil cement, brick or similar material as approved on a case-by-case basis.

SECTION 2.20 - FLOOD INSURANCE RATE MAP

“Flood Insurance Rate Map” or “FIRM” means an official map of a community on which the Federal Emergency Management Agency has delineated the appropriate areas of flood hazards, the base flood elevations, and the risk premium zones applicable to the County. In these regulations this map shall be called “FIRM”. The map is divided into zones which are used for setting rates for flood insurance. Insurance rates, the type of permit, and the requirements of the permit will vary depending on the zone in which a property is located.

SECTION 2.21 - FLOOD INSURANCE STUDY

"Flood Insurance Study” means the official report provided by the Federal Emergency Management Agency. The report contains flood profiles and the water surface elevation of the base flood.

SECTION 2.22 – FLOODPLAIN MITIGATION

“Floodplain Mitigation” means a hydraulically equivalent volume of floodplain storage sufficient to offset a reduction in floodplain storage or conveyance capacity.

SECTION 2.23 - FLOODPROOFING

“Floodproofing” means any structural and non-structural additions, changes, or adjustments to properties and structures which reduces or eliminates flood damages to lands, water and sanitary facilities, other utilities, structures, and contents of buildings.

SECTION 2.24 - FLOODWAY

“Floodway” means the channel of a river or other watercourse and the adjacent land areas that must be reserved to carry and discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
SECTION 2.25 - HABITABLE FLOOR

“Habitable Floor” means any floor of a building or structure usable for sleeping, living, cooking, working, recreation or any combination thereof. Bathrooms and utility rooms are included in this definition, as are storage areas greater than one hundred fifty (150) square feet in size.

SECTION 2.26 - HIGHEST ADJACENT GRADE

“Highest Adjacent Grade”, as it applies to an elevation certificate, means the highest natural elevation of the ground prior to construction next to the proposed walls of a structure.

SECTION 2.27 - LANDSCAPING

“Landscaping” means the placement of trees, shrubs, or plants for the purpose of beautification.

SECTION 2.28 - LEVEE

“Levee” means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

SECTION 2.29 - LOWEST ADJACENT GRADE

“Lowest Adjacent Grade”, as it applies to an elevation certificate, means the lowest elevation of the finished grade immediately next to the structure.

SECTION 2.30 - MANUFACTURED HOME

“Manufactured home” means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent
foundation when connected to the required utilities. For flood plain management purposes the term “manufactured home” also includes recreational vehicles and other similar vehicles placed on a site for greater than 180 consecutive days.

SECTION 2.31 - MANUFACTURED HOME PARK OR SUBDIVISION

“Manufactured home park or subdivision” means the entire parcel (or contiguous parcels) of land, including the appurtenant improvements, which has been improved so that it contains two or more manufactured home lots available for the placement thereon of manufactured homes for occupancy, whether the sites are sold (subdivision) or rented (park).

SECTION 2.32 - MEAN SEA LEVEL

“Mean Sea Level” means the average height of the surface of the sea for all states of the tide as was established by the United States Coastal and Geodetic Survey in 1929.

SECTION 2.33 - NATURAL GROUND

“Natural Ground” means the grade unaffected by construction techniques such as fill, landscaping, or berms.

SECTION 2.34 - NORTH AMERICAN VERTICAL DATUM (NAVD)

"North American Vertical Datum (NAVD)", as corrected in 1988 (2001 adjusted), is a vertical control used as a reference for establishing varying elevations within the floodplain. If a datum other than NAVD 88 is used then the datum must be listed as the reference datum on the applicable FIRM panel. If a datum other than NAVD 88 is used, a conversion to NAVD 88 must be provided on the Elevation Certificate.

SECTION 2.35 - PERMITS

“Permits” shall mean a permit as required by these Regulations. A Class “I” Permit is issued for any development that is located on a property where the elevation of the ground is above the base flood elevation. A Class “II” Permit is issued for any
development that is located on a property where the ground elevation is below the base flood elevation or subject to flooding as determined by these Regulations.

All County projects shall have a signature block on the drawing, which verifies compliance with these regulations. The executed signature block acts as a permit for County projects for the purpose of these regulations.

SECTION 2.36 - PERSON

“Person” includes any individual or group of individuals, corporation, partnership, association, or any other organized group of persons, including State and Local governments and agencies thereof.

SECTION 2.37 - RECREATIONAL VEHICLE

Recreational vehicle” means a vehicle that is: (1) Built on a single chassis; (2) Four hundred square feet or less when measured at the largest horizontal projections; (3) Designed to be self propelled or permanently towable and (4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

SECTION 2.38 - START OF DEVELOPMENT

“Start of Development” means either the first placement of permanent construction of a structure on a site, such as the pouring of a slab or footings, the installation of piles, or the placement of a manufactured home on a foundation. Included within this definition is grading and filling, installation of streets or underground utilities and other such development. A permit is required prior to the start of any development.

SECTION 2.39 - STRUCTURE

“Structure” means a walled and/or roofed building or a gas or liquid storage tank which is principally above ground. A manufactured home on a permanent foundation is a structure. The term includes a building which is in the course of construction, alteration or repair.
SECTION 2.40 - SUBDIVISION

“Subdivision” means a division of any tract of land into two (2) or more parts for the purpose of laying out any subdivision or any tract of land or any addition to the city, or for laying out suburban lots or building lots, or any lots, and streets, alleys or parts of other portions intended for public use or the use of the purchasers or owners of lots fronting thereon or adjacent thereto. A subdivision includes re-subdivision (replat), but it does not include the division of land for agricultural purposes in parcels or tracts of five (5) acres or more and not involving any new streets, alleys or easements of access. This definition is based on current state statutes and should the statutes be changed its new definition would govern.

SECTION 2.41 - SUBSTANTIAL IMPROVEMENT AND SUBSTANTIAL DAMAGE

A “Substantial Improvement” is the repair, reconstruction, or improvement of a structure, where the cost of the said improvement equals or exceeds 50% of the value of the structure either before the improvement is started or, if the structure has been damaged and is being restored, before the damage occurred. An improvement is started when the first alteration of any wall, ceiling, floor or other structural part of the building commences, whether or not the alteration affects the external dimensions of the structure. For purposes of determining if an improvement is a substantial improvement, the applicant for a permit must submit data reflecting the value of the structure prior to being damaged, improved or modified and the cost of the restoration, improvement or modification. Costs shall include the value of all labor and materials.

For the purpose of determining the value of the structure before being repaired, reconstructed or improved, the Harris County Appraisal District’s assessed value for the structure will be used. If the applicant wishes to contest this value an independent certified appraisal may be submitted. Upon review and concurrence by the Harris County Appraisal District, this appraised value for the structure will be used for determining if the improvement is substantial.

The County Engineer may require the submittal of an independent certified damage assessment in cases where the structure has suffered other than minor damage. In cases where the structure is covered by insurance and the insured losses for damage to the structure (excluding contents) amount to over 95% of the value of the structure, the structure shall be deemed substantially damaged regardless of any other data submitted.

SECTION 2.42 - TEN-YEAR FLOODPLAIN
“Ten-year floodplain” or 10% floodplain means the floodplain that is at or below the ten-year flood elevation, that is, the area which has a minimum statistical probability of one in ten of being flooded in any given year. The ten-year floodplain will be regulated as reflected by the ten-year inundation data and maps as promulgated by the County Engineer.

SECTION 2.43 - UNINCORPORATED AREA

“Unincorporated area” means the area in Harris County, Texas, that is not within an incorporated area of a city, town, village or within the jurisdiction of the Port of Houston Navigation District.

SECTION 2.44 - ZONES

Zones on the Flood Insurance Rate Map have the following meanings:

ZONE A: Areas of the base (1% or 100-year) flood where base flood elevations have not been determined.

ZONE AE: Areas of the base (1% or 100-year) flood where base flood elevations have been determined.

ZONE AH: Areas of the base (1% or 100-year) flood where depths are between 1.0 and 3.0 feet; and base flood elevations are shown.

ZONE AO: Areas of the base (1% or 100-year) flood where depths are between 1.0 and 3.0 feet; average depths of inundation are determined.

ZONE A99: Areas inundated by the base (1% or 100-year) flood to be protected by a Federal flood protection system under construction; no base flood elevations are determined.

ZONE V: Areas of coastal flooding with velocity (wave action); base (1% or 100-year) flood elevations not determined.

ZONE VE: Areas of coastal flooding with velocity (wave action); base (1% or 100-year) flood elevations determined.
ZONE X:  **(Shaded):** Areas of the 0.2% flood or 500-year flood, areas of the base (1% or 100-year) flood with average depths of less than 1.0 foot or with drainage areas less than one (1) square mile, and areas protected by levees from the 1% or 100-year flood.

ZONE X:  **(Unshaded):** Areas determined to be outside both the 1% (100-year) and 0.2% (500-year) floodplains.

For purposes of these Regulations, the term “Any V Zone” includes Zone V and Zones VE and the term “Any A Zone” includes Zone A, AE, AH, AO and A99, but not the floodway within these zones.

**PART 3 - GENERAL PROVISIONS**

**SECTION 3.01 - ADMINISTRATION BY THE COUNTY ENGINEER**

The County Engineer or his designee is responsible for the administration of these Regulations, issuance of permits required by these Regulations, and enforcement of these Regulations and maintaining proper records.

**SECTION 3.02 - USE OF MAPS**

The County Engineer shall use the base flood elevations and floodway shown on the FIRM referred to in Section 1.08 of these Regulations to determine which class of permit may be issued. If the ground elevation of a specific piece of land is lower than the base flood elevation, the ground elevation shall serve as the basis for regulation even if the map indicates that the property is in a Zone which does not require regulation. The County Engineer shall forward any discrepancy he finds in the FIRM to the Administrator via the process described in Section 3.05.

**SECTION 3.03 - MAPS TO BE AVAILABLE**

Copies of the Flood Insurance Rate Map (FIRM) will be maintained in the offices of the County Engineer.
SECTION 3.04 - NOTIFICATION OF ADJACENT COMMUNITIES AND THE STATE WHEN ALTERING A WATER COURSE

Prior to any alteration or relocation of a water course, the County Engineer or the Harris County Flood Control District, whichever is altering or allowing said alteration or relocation, shall notify adjacent communities when such alteration or relocation affects base flood elevations within the adjacent community. A copy of such notification shall be submitted to the Texas Commission on Environmental Quality (TCEQ) and the Federal Emergency Management Agency (FEMA).

SECTION 3.05 - CHANGES IN MAPS

All requests for letters of map amendment (LOMA), letters of map revision (LOMR) and conditional letters of map revision (CLOMR) initiated by any person must first be reviewed by the County Engineer. The County Engineer may require the submission of any data he deems relevant to determining if such approval shall be granted. If the topographic data was prepared using a digital format it is requested that a copy of the data be included with the submittal. The Harris County Flood Control District shall be consulted for its review and approval of any hydrologic or hydraulic studies accompanying the said request. The County Engineer shall delay the submittal of the requests to the Federal Emergency Management Agency until after he is in receipt of the aforementioned approvals from the Harris County Flood Control District. The Commissioners' Court may set a fee to cover the cost of reviewing and processing the said requests.

SECTION 3.06 - USE OF NEW BASE FLOOD ELEVATIONS ON THE BASIS OF CONDITIONAL LETTER OF MAP REVISION

In the administration of these Regulations the County Engineer may use new base flood elevations that are based on pending channel modifications or other structural projects, such as retention ponds, that would decrease base flood levels only after the following steps are followed:

(a) The flood study is forwarded to the Federal Emergency Management Agency (FEMA) and a conditional letter of Map Revision of the study is obtained from FEMA.

(b) Documentation is presented to the County Engineer indicating the channel modifications will be completed within two (2) years of the issuance of permits.
Prospective buyers will be advised of the transitional aspects of the base flood elevations and prevailing flood insurance rates.

(c) The developer and/or builder in his written statement to the prospective buyer will recite the base flood elevations prior to and after the completion of said channel or other structural modifications. A copy of this statement will accompany the submittal of each building permit application.

SECTION 3.07 - RESPONSIBILITY OF OTHER OFFICIALS

Under these regulations the County Engineer is responsible for all administrative decisions, determinations and duties. The County Engineer may seek and secure the assistance of other officials of Harris County and of the Harris County Flood Control District in making his decisions, determinations and in performing his duties but is not required to conform to the recommendations of others, provided however, any decision by the County Engineer may be appealed by the process in Section 6.01 et seq. of these Regulations.

PART 4 - PERMITS

SECTION 4.01 - PERMITS REQUIRED

All development within the unincorporated areas of Harris County without first securing a permit is prohibited.

SECTION 4.02 - APPLICATION FOR PERMIT

The application for a permit will be on a form prescribed by the County Engineer and must be supported by the following:

(a) Two copies of a site plan detailing the dimensions of the property to be developed and showing the position of the development on the property along with a sufficient description to locate the property. The site plan shall be to scale or have sufficient dimensioning to clearly detail the location of the development. The County Engineer may require submittal of a survey map and metes and bounds description of the property to be developed.
(b) One copy of a drawing generally detailing the shape and size of the development proposed.

(c) Proof in the form of drawing approval or other written notification that all requirements of the Harris County Flood Control District and Harris County have been met. (The construction of a single family dwelling and accessory structures on an existing pre-developed tract of land is exempted).

(d) On developments where a Class “II” permit is to be issued the following must be submitted:

1. Three (3) sets of detailed drawings for the proposed development. Drawings must clearly indicate that all provisions of these regulations will be met. On developments other than residential accessory buildings less than one hundred fifty (150) square feet or other insignificant developments, (i.e. – carports, well houses, gazebos, etc.) drawings must be sealed by a registered professional engineer or registered architect certifying that all provisions of these regulations will be met if the development is completed in accordance with the sealed drawings.

2. A topography survey of the property to be developed. The survey must be on one-foot contour intervals and based on the same datum as the flood study of the adjacent stream. On single-family, residential, one-lot developments, an elevation certificate will satisfy this requirement. This requirement may be waived for fences or other insignificant types of development.

3. In cases where a determination must be made as to whether the construction is a substantial improvement, the information in Section 2.41 is required.

The County Engineer may require the submission of additional information, drawings, specifications or documents if he is unable to determine whether a permit should be issued from the information submitted. Approved applications will be held for one hundred eighty (180) days. If the approved applications remain unpaid after one hundred eighty (180) days, the application and submitted documents will be destroyed.
Developments may require permits from other Local, State and Federal agencies. The applicant is responsible for compliance with all applicable regulations and permit requirements.

SECTION 4.03 - DETERMINATION OF PERMIT ELIGIBILITY

After the application is filed, the County Engineer shall:

(a) Determine the Zone on the FIRM in which the land on which the development is to be made is located, the base flood elevation where the development is located and whether the development is located within the floodway.

1. If the County Engineer determines that the development is within any “X” Zone and all other necessary reviews and approvals have been issued, he may issue a Class “I” Permit.

2. If a conditional letter of map amendment (CLOMA) or a conditional letter of map revision (CLOMR) has been issued which will place the development in an “X” Zone and all other necessary reviews and approvals have been issued, he may issue a Class “I” permit. Elevation certificates must be submitted to verify the development is above the required elevation.

3. If the development is in, or partially in, any “A” Zone, below the base flood elevation in any Zone, any floodway, or any “V” Zone, the County Engineer shall determine if a Class “II” Permit should be issued.

(b) Review the proposed construction or development to assure that all reviews or approvals required by other County regulations are obtained. This includes all requirements of the Harris County Flood Control District’s “Policy Criteria and Procedure Manual”.

SECTION 4.04 - CONDITIONS OF A CLASS “I” PERMIT

A Class “I” Permit will be issued when the County Engineer determines that the development will be made on land that is located entirely outside the mapped 1% floodplain or 100-year regulatory floodplain and that all other necessary reviews and approvals required by County regulations have been obtained.
(a) Location above base flood elevation.

1. In the absence of evidence to the contrary, the County Engineer shall presume that the property shown in any “X” Zone on the FIRM is above the base flood elevation.

2. In the “Shaded X” Zone it must be determined that the ground level is above the base flood elevation before a Class “I” Permit may be issued. The County Engineer may rely on data in his possession to make such a determination or require the submittal of topographical information by the applicant.

(b) Where a conditional letter of map change has been obtained from the Federal Emergency Management Agency for property which has been elevated by the use of fill above the elevation of the base flood, the inspections required in Sections 5.02 (a) (1 & 2) must be made. The lowest floor of any structure shall be at least eighteen (18) inches above the base flood elevation.

SECTION 4.05 - CONDITIONS OF A CLASS “II” PERMIT

A Class “II” Permit will be issued when the County Engineer determines that the development will be made on land that is located in any “A” Zone, below the base flood elevation in any Zone, in a floodway, or in a “V” Zone and that all other necessary reviews and approvals required by County regulations have been obtained. The following conditions must be met:

(a) Notwithstanding anything below to the contrary, no development or other encroachment, including fill, is allowed in a floodway which will result in any increase in the base flood elevations within the floodway during discharge of water of a base flood.

(b) The following conditions must be met for new construction or substantial improvement of a structure:

1. The top of the slab of the lowest habitable floor must be elevated to eighteen (18) or more inches above the base flood elevation or to the level of the crown of the nearest public street, whichever is higher, except in a floodway where the bottom of the lowest supporting member of the structure shall be elevated eighteen (18) or more inches above base flood elevation.
If the land is located in an “AO” Zone, the top of the slab of the lowest habitable floor (including basement) shall be elevated to eighteen (18) or more inches above the depth number in feet specified on the FIRM.

If the land is located in an “A” Zone or “AO” Zone, and no depth number is specified, the top of the slab of the lowest habitable floor (including basement) shall be elevated to at least three (3) feet above highest adjacent grade (natural ground).

2. All structures will be constructed and anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effect of buoyancy.

3. Construction shall use methods and practices that will minimize flood damage and construction materials and utility equipment that are resistant to flood damage. FEMA Bulletins 1-93, 2-93 and 3-93 or subsequent revisions will serve as the guideline for this requirement.

4. Unless dry-floodproofed, enclosed areas below the base flood elevation must be equipped with flood openings or vents capable of equalizing water levels and hydrostatic loads. Covers for these openings must not interfere with the equalization of water levels in the event of a flood and should minimize potential blockage by debris. FEMA Bulletin 1-93 or subsequent revisions shall serve as the guideline for this requirement. A licensed architect or registered professional engineer shall certify the flood openings.

5. Thermal insulation used below the base flood elevation shall be of a type that does not absorb water.

6. Water heaters, furnaces, air conditioning systems, electrical distribution panels and any other mechanical or electrical equipment must be elevated to at least eighteen (18) inches above the base flood elevation. Separate electrical circuits shall serve any level below the base flood elevation and shall be dropped from above.

7. Basements may be constructed only in nonresidential structures, and only on land which is not in a floodway or “V” Zone, and must, together with attendant utility and sanitary facilities, be designed so that below the base flood elevation the structure is watertight with walls substantially
impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A licensed architect or registered professional engineer shall certify that the floodproofing methods used in the construction of the basement are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and other factors associated with the base flood. A record of such certification indicating the specific elevation to which such structures are floodproofed shall be maintained with the County Engineer.

8. All air ducts, loose pipes, propane tanks and storage tanks located at or below the base flood level shall be firmly anchored to prevent flotation. Tanks and ducts shall be vented to at least eighteen (18) inches above the base flood elevation.

9. If the structure will be built on fill, the land must not be within a floodway or “V” Zone and the application must contain a fill plan, accurate existing ground elevations, and a grading plan that provides proper surface drainage. The fill must be inspected according to the provisions of Section 5.01 and 5.02 to determine that the fill has been constructed in accordance with drawings and that the soil density of the fill will support a structure before any construction begins. A maximum of three (3) feet of fill may be used to elevate a residential structure proposed for construction in a subdivision developed prior to September 16, 1976. Any fill material proposed to elevate the structure shall not be greater than is necessary to achieve the purpose for which it is intended. Any excess fill material shall be properly mitigated on a one-for-one basis and shall not interfere with existing drainage patterns.

(c) The lowest floor of recreational buildings proposed for construction with public funds on publicly owned recreational property may be exempted from the requirement to elevate the lowest floor to the base flood elevation provided floodproofing measures are incorporated, and after applicable requirements of this section are met.

(d) Construction of critical facilities shall be, to the extent possible, located outside the limits of the 0.2% floodplain or 500-year floodplain (Shaded Zone X) and any “A” Zone. Construction of new critical facilities shall be permissible within the base floodplain if no feasible alternative site is available.
1. Construction of critical facilities on land located below the base flood elevation in the 0.2% (500-year) floodplain or within the base floodplain shall have the lowest floor elevated to three feet or more above the base flood elevation at the site.

2. Floodproofing and sealing measures must be taken to ensure that toxic substances will not be displaced by or released into floodwaters.

3. Access routes elevated to or above the level of the base flood shall be provided to all critical facilities to the extent possible.

(e) Any reduction in floodplain storage or conveyance capacity must be offset with a hydraulically equivalent (one-to-one) volume of mitigation sufficient to offset the reduction. The reduction may result from development or the placement of fill within the 1% floodplain or 100-year floodplain. Such mitigation shall be within the same watershed and shall be provided on the same property or within the same hydrologic sub-watershed or at an alternate site meeting the approval of the County Engineer. A full hydrological and hydraulic analysis must be submitted to support a request for mitigation outside the boundaries of the property being developed.

(f) Levees may not be used to reclaim a property from any floodplain.

(g) In addition to the requirements of Section 4.05 (i) the following conditions must be met by a manufactured home park or manufactured home subdivision that seeks a Class “II” Permit:

1. Stands or lots must be elevated on a maximum of eighteen (18) inches of compacted fill or on pilings so that the lowest floor of the manufactured homes will be at least eighteen (18) inches above the base flood elevation;

2. Adequate surface drainage and access for a hauler must be provided;

3. If the homes will be elevated on pilings, lots must be large enough to permit steps. Piling foundations must be placed in stable soil no more than ten feet apart, and reinforcement must be provided for piers more than six feet above the ground level;

4. Each manufactured home within the park shall be placed on a permanent foundation and anchored to resist flotation, collapse or lateral movement by providing an anchoring system installed in accordance with the Texas...
Department of Housing and Community Affairs and the Housing and Urban Development (HUD) standards for manufactured housing. Any additions to the manufactured home must be similarly anchored. (This paragraph applies to manufactured homes to be placed or substantially improved in an expansion to an existing manufactured home park or subdivision. This paragraph does not apply to manufactured homes to be placed or substantially improved in an existing manufactured home park or subdivision except where the repair, reconstruction, or improvement of the streets, utilities and pads equals or exceeds fifty (50) percent of the value of the streets, utilities and pads before the repair, reconstruction or improvement has commenced).

5. All utilities and common facilities including gas, electrical systems, sewage systems and water supply systems, must be located and elevated or constructed to avoid or minimize flood damage.

6. The fact that the manufactured home park or subdivision is located below the base flood elevation must be disclosed on a form furnished by the County Engineer and completed by the owner of the manufactured home park or subdivision and provided to the manufactured home lot purchaser or lessee.

7. The owner of the manufactured home park or subdivision shall forward a copy of each notice to the County Engineer. The manufactured home park or subdivision may not be in a floodway or a “V” Zone.

8. An evacuation plan must be developed for evacuation of all residents of all new, substantially improved or substantially damaged manufactured home parks or manufactured home subdivisions located within the area of special flood hazard. This plan shall be filed with and approved by the County Engineer and the Emergency Management Coordinator prior to permit issuance.

Note: Manufactured Home Parks or Subdivisions which received a permit and were constructed prior to September 16, 1976 are governed by the Regulations in effect when their permit was issued except that all manufactured homes placed or substantially improved in said park or subdivision after April 1, 1987 must comply with this section. Any manufactured home park or subdivision that did not hold a permit before September 16, 1976 and expansions or substantial improvements of
existing and permitted manufactured home parks or subdivisions must comply with this section.

(h) The following conditions must be met if the proposed development for which a Class “II” Permit is sought includes a water or sanitary sewer system:

1. The proposed system must be designed and constructed to minimize or eliminate infiltration of flood water into the system and to eliminate discharge of untreated waste from the system into the flood waters.

2. All joints must be watertight.

3. On-site sewage disposal systems, if they meet the Revised Rules of Harris County for On-Site Sewerage Facilities, are allowed.

4. Individual water wells or wastewater disposal systems must be located to avoid impairment to them or contamination from them during flooding.

(i) The following conditions must be met if the proposed development for which a Class “II” Permit is sought is a subdivision, including a manufactured home park or subdivision.

1. The subdivision must be planned to provide adequate drainage so as to reduce flood hazards.

2. If water and sanitary sewer systems are planned, the drawings must be reviewed to determine if they meet the requirements of these regulations.

3. The drawings for development of the subdivision must be adequate to assure that all public utilities and facilities (including gas, electrical systems, sewage systems and water supply systems) are located and elevated or constructed to avoid or minimize flood damage.

4. If a subdivision proposal includes 50 or more lots or is on an area larger than 5 acres the proposal (plat and/or plans) must include base flood elevations for each lot.

(j) The following conditions must be met if the proposed development for which a Class “II” Permit is sought is an expansion of a structure, as the term is defined by
these Regulations, located in any “A” Zone but not within a floodway or below the base flood level in any Zone:

1. The expansion must be constructed of materials resistant to water damage below the base flood elevation and the expansion must be designed to minimize flood damage in accordance with the FEMA approved flood-resistant materials list (Technical Bulletin 2-93).

2. The expansion shall be inspected to determine that the drawings and specifications for the construction have been followed before the roof and the outer wall coverings are in place and again when the expansion is complete. Inspections will be performed in the same manner as the inspection required by Section 5.02 of these Regulations.

(k) Notwithstanding any other provision of these regulations, no permit will be issued if the County Engineer determines that the development will increase flood hazards.

(l) The following additional requirements for development in the 10% floodplain or ten-year floodplain must be met:

1. All construction within the 10% floodplain or ten-year floodplain up to twenty-four (24) inches above the base flood elevation must use masonry, concrete or steel. These materials must be used for piers, columns and foundation walls.

2. The finished floor of the structure must be twenty-four (24) inches above the base flood elevation.

3. Structures may be constructed on an open foundation or on continuous foundation walls below the base flood elevation. If continuous walls are used below the base flood elevation, they must be equipped with openings that allow flood waters to flow into or out of the area enclosed by the walls.

4. For elevation certificates, the lowest adjacent grade is finished grade.

(m) The following additional requirements must be met for development in the floodway:
1. The bottom of the lowest horizontal sill, beam or member supporting the structure in the floodway shall be at least eighteen (18) inches above the base flood elevation.

2. An engineering report sealed by a Texas registered professional engineer containing as a minimum the following information:
   
a. A soils report which includes the results of a soil boring(s) to a depth of five (5) feet below the depth of any proposed piles and the geotechnical engineer’s recommendations for the proposed structure signed and sealed by a Texas registered professional engineer; and
   
b. A hydraulic analysis of pre- and proposed development conditions showing that no increase in the elevation of the base flood will occur as a result of the development.

3. Structures shall be elevated on posts or pilings so that the entire structure, exclusive of the posts or pilings, is eighteen (18) inches above the base flood elevation. Fill may not be used to elevate the structure. The drawings and specifications for said posts or pilings shall be prepared by a Texas registered professional engineer qualified in structural design and he or she shall certify thereon that the posts or pilings have been designed to prevent undermining and structural damage resulting from erosive velocities of the base flood. Minimum pile depth shall be established using historical scour depth, stream velocity and soil conditions. As a minimum piles shall be embedded ten (10) feet below the historical scour depth. Pile design must take into account hydraulic and debris loading imposed by the base flood. If no historical data is available a Texas registered professional engineer shall perform a scour analysis using the “Texas Secondary Evaluation and Analysis for Scour” methodology. After the placement or installation of the posts or pilings, or during or prior to the final inspection or approval of the structure, the permittee shall furnish to the County Engineer a certificate from the said engineer that the posts or pilings have been constructed in the manner set forth in the drawings and specifications attached to the application for a permit. All other requirements must be met, but must not increase the base flood elevation.

4. The following are additional design requirements for construction of structures within the San Jacinto River floodway.
Foundations of structures within the San Jacinto River Floodway have been determined to be prone to scour. The foundation design requirements presented herein assume that potential scour around a foundation system could extend to a depth as great as ten (10) feet below natural grade. The foundation system must extend to a depth below the maximum potential scour that is adequate to prevent excessive vertical and horizontal movement of the foundation system due to design axial and lateral loads imposed during base flood conditions.

These foundation design requirements present minimum foundation design requirements. Foundations must meet or exceed these minimum design requirements, regardless of the type of scour protection provided for the foundation.

a. Design Loads: The structural system of the building shall be designed, connected and anchored to the foundation system to prevent flotation, collapse and permanent lateral movement resulting from wind loads, impact loads, hydrodynamic loads and hydrostatic loads, including the effects of buoyancy from flooding equal to the base flood elevation.

b. Foundation Type: The foundation system shall consist of a driven pile or a drilled pier foundation system.

1. Driven Piles: Driven piles may extend above natural grade and act as the columns supporting the elevated portion of the building above the base flood elevation, or the piles may be terminated near natural grade and a reinforced concrete cap shall be cast on top of the pile.

2. Drilled Piers: Drilled piers shall be terminated below natural grade, and a reinforced concrete cap shall be cast on top of each pier. Columns for the building may consist of cast-in-place concrete connected by dowels to the pier cap.

c. Type and Size of Driven Pile: Driven piles shall consist of either twelve (12) inch (minimum) square pre-stressed concrete piles or fourteen (14) inch (minimum) diameter steel pipe piles with a closed end.
1. Closure Plate: The tip of pipe piles shall be closed prior to driving by welding a circular steel plate over the tip of the pile. The closure plate shall be flush with the outside of the pile, i.e. the diameter of the closure plate shall not be greater than the outside dimensions of the pipe pile. The minimum thickness of the closure plate shall be 3/8 inch. The weld shall be continuous, and the closure shall be waterproof.

2. Minimum Wall Thickness: The minimum wall thickness of the pipe pile shall be 1/4 inch.

d. Type and Size of Drilled Pier: Drilled piers shall be eighteen (18) inch diameter (minimum) and straight-sided (no belled or underreamed base) and shall be installed using the slurry displacement technique in accordance with the ACI Standard Specification for the Construction of Drilled Piers (ACI 336.1-94).

e. Minimum Pile and Drilled Pier Embedment: The minimum embedment below natural grade for driven piles and drilled piers shall be twenty-five (25) feet if a geotechnical investigation is not performed at the building site. If a site specific geotechnical investigation is performed for the building, the minimum embedment may be reduced to twenty (20) feet if the computed allowable axial capacity of the driven pile or drilled pier (factor of safety of at least 2.0 with respect to ultimate axial capacity) is equal to or greater than the design axial load transmitted to the pile.

f. Lateral Restraint of Foundations at Groundline: The individual piles or piers shall be braced horizontally with reinforced concrete tie beams connecting the pier/pile caps each way (not diagonally). For piles that extend above natural grade and act as column supports for the structure, a reinforced concrete collar shall be cast around each pile at the groundline, and the collars shall be connected each way with reinforced concrete tie beams. The purpose of the horizontal bracing at the groundline is to enhance the lateral restraint of the individual piles or piers when scour around a pile or pier reduces the lateral stiffness of the pile or pier.
g. Anchorage of Timber Building Columns to Concrete Pile/Pier Cap: The timber column to concrete pile/pier cap connection should develop the full moment capacity of the timber column. The timber column shall be bolted into a steel sleeve with a welded steel base plate that is bolted to the concrete pile/pier cap using anchor bolts cast into the cap. The steel sleeve shall be oversized with the inside sleeve dimension at least 1 1/2 inch greater than the column dimension. The gap between the sleeve and column should be filled with a high strength non-shrink grout. The bolt(s) connecting the column to the sleeve should be designed for uplift forces and shall be 3/4 inch diameter minimum. The sleeve assembly and bolts shall be galvanized.

h. Driven Pile Installation Techniques: Driven piles shall be installed by driving alone. Jetting with water or air to create a pilot hole or to loosen the foundation soils before or during driving to aid driving will not be permitted. Piles may be driven with a vibratory hammer, a drop hammer, or a diesel or compressed air-operated pile driving hammer. To aid in stabbing and aligning piles, pilot holes may be drilled with a dry auger to a maximum depth of ten (10) feet. The pilot hole diameter shall not exceed the pile diameter or width.

i. Drilled Pier Reinforcement and Concrete: Reinforcement and concrete for drilled piers shall be in accordance with ACI Standard Specification for the Construction of Drilled Piers (ACI 336.1-94).

1. Minimum Reinforcement: The minimum steel area shall be one (1) percent which is equivalent to six (6) No. 6 reinforcing bars for an eighteen (18) inch diameter pier.

2. Concrete: The minimum twenty-eight (28) day compressive strength of the concrete shall be 3000 psi. The maximum nominal course aggregate size shall be 3/4 inch and the minimum concrete slump shall be seven (7) inch.

3. Inspection and Testing: The Texas registered professional engineer who designed the foundation shall observe the installation of each pier or pile foundation element and shall furnish the Permit Division of the Harris County Engineering
Department a certificate that the piers or piles have been constructed per the design plans and specifications submitted with the permit application. Testing in connection with drilled pier installation shall be in accordance with ACI 336.1-94.

5. The area below the base flood elevation shall not be enclosed. A storage area less than 150 square feet may be allowed, provided the walls perpendicular to the flood flow are constructed of materials allowing the free flow of water and that these walls are no greater than twelve (12) feet wide. All other provisions of these regulations must be met.

6. Fences or fence-type walls may be allowed in the floodway provided it can be demonstrated the flow of the base flood will not be impaired and that base flood elevations will not be increased during the discharge of the base flood.

(n) The following conditions must be met if the proposed development is for the construction of a bridge or the repair or replacement of an existing bridge:

1. The construction of a bridge or the repair or replacement of an existing bridge must be in accordance with the criteria for bridges as found in the Criteria Manual for the Design of Flood Control and Drainage Facilities in Harris County, Texas and the Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure.

2. A conditional letter of map revision (CLOMR) and a letter of map revision (LOMR) must be submitted for all bridge projects that modify the base flood elevation or modify the geometry of the channel or bridge.

(o) The following additional requirements must be met for development in “V” Zones:

1. The bottom of the lowest horizontal structural member of the structure (excluding the pilings or columns) must be elevated to or above a level eighteen (18) inches above the base flood elevation. Fill may not be used.

2. Structures shall be elevated on posts or pilings so that the entire structure, exclusive of posts or pilings, is eighteen (18) inches above the base flood elevation. Fill may not be used to elevate the structure. The drawings and
specifications for said posts or pilings shall be prepared by a Texas registered professional engineer and he or she shall certify thereon that the posts or pilings have been designed to prevent undermining and structural damage resulting from erosive velocities of the base flood. After the placement or installation of the posts or pilings, or during or prior to the final inspection or approval of the structure, the permittee shall furnish to the County Engineer a certificate from the said structural engineer that the posts or pilings have been constructed in a manner set forth in the drawings and specifications attached to the application for a permit. Piling depth shall be as outlined in Section 4.05 (m)(4) above.

3. Development must be located landward of the reach of mean high tides.

4. Sand dunes or mangrove stands may not be altered.

5. The space below base flood elevation must be either free of obstruction or constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system. For purposes of this section, a breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. Use of breakaway walls which exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by local or State codes) may be permitted only if a qualified registered professional engineer or architect certifies that the designs proposed meet the following conditions:

   a. Breakaway wall collapse shall result from a water load less than that which would occur during the base flood; and,

   b. The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). Maximum wind and water loading values to be used in this determination shall each have a one percent chance of being equaled or exceeded in any given year (100-year mean recurrence interval). Such enclosed space shall not be used for habitable purposes.
SECTION 4.06 - ISSUANCE OF PERMITS

When the County Engineer determines which, if any, permit shall be issued, he shall issue the permit after obtaining the signature of the permittee or the permittee's agent or attorney on a Certificate of Compliance.

SECTION 4.07 - TERM OF PERMITS

Construction must be started within 180 days of the date the permit is issued or the permit shall be null and void. Upon written request made prior to the permit becoming null and void, two six-month extensions may be obtained. However, if construction has not started at the time of the issuance of a revised or amended FIRM, LOMA, or LOMR, a new permit must be obtained regardless of time span from the issuance of the latest permit.

PART 5 - PERMITTEE

SECTION 5.01 - RESPONSIBILITIES OF ALL PERMITTEES

All permit holders, regardless of the type of permit held, must:

(a) Remove all soil deposits resulting from runoff and/or from vehicular construction traffic and/or from site operations from the road or drainage facility on a daily or more frequent basis in accordance with the Regulations of Harris County, Texas for Storm Water Quality Management.

(b) Post the permit on the jobsite in a place visible from the nearest road or street.

(c) Allow the County Engineer to inspect the work pursuant to a Permit. The County Engineer may make as many scheduled or unscheduled inspections as he may deem necessary to enforce these Regulations. If no specific inspection standards are set by any part of these Regulations, the inspection shall only be to determine that the drawings and specifications furnished with the permit application are met.

(d) All holders of a Class “II” Permit, or persons holding a Class “I” Permit issued pursuant to a conditional letter of map amendment or revision who wish to make
a change to the development, must submit supplemental drawings and/or specifications to the County Engineer for his review. If the changes do not comply with these Regulations the County Engineer shall not approve the change. If a change complies with these Regulations and is approved, a copy of the supplemental drawings and/or specifications shall be added to the permittee's file, and the permit shall be amended by the County Engineer.

SECTION 5.02 - INSPECTIONS

(a) Class “II” Permit holders or persons holding a Class “I” permit pursuant to a conditional letter of map amendment or a Class “I” permit issued for a stormwater detention or retention system shall have the following inspections conducted by a registered professional engineer, registered public land surveyor or registered architect as applicable and the results of said inspections submitted to the County Engineer.

1. When the slab of a structure with an established minimum elevation is poured or for a structure on posts when the posts are placed and the lowest horizontal supporting member is installed, an elevation certificate must be completed, signed and sealed by a registered surveyor, registered engineer or licensed architect, and submitted indicating the required minimum elevation of these Regulations has been met.

2. When the structure is complete and ready for habitation, a final elevation certificate must be completed, signed and sealed by a registered surveyor, registered engineer or licensed architect, indicating that the finished floor of the structure, pier and beams or posts are placed or the lowest horizontal supporting member installed is eighteen (18) inches above the base flood elevation. All elevations must be referenced to the datum on the applicable FIRM.

3. When the structure is complete and ready for habitation, an as-built certification form supplied by the County Engineer must be completed, signed and sealed by a registered engineer or a registered architect indicating that all the minimum requirements of these Regulations have been met.

4. When the development is other than structural in nature, an as-built certification form supplied by the County Engineer must be completed, signed and sealed by a registered engineer or a registered architect
indicating that the project has been completed in accordance with drawings approved by the County Engineer.

(b) Inspections will not be made if the permit is not posted on site.

(c) The permittee will be responsible for determining whether inspections have been made prior to proceeding with work.

(d) Once all applicable certifications have been submitted to the County Engineer’s office, a final inspection will be conducted. A certificate of compliance will be issued by the County Engineer or his representative if all provisions of the permit have been met. Should the County Engineer determine that the applicable certifications have not been provided and the provisions of Section 5.02 of these regulations were not followed, then enforcement procedures as outlined in Section 7.01 shall commence.

(e) Should the County Engineer have to make additional inspections or conduct survey work due to non-compliance with these Regulations, additional fees may be assessed as outlined in Section 8.04 hereof.

SECTION 5.03 - SUSPENSION OF PERMITS

Permit suspensions are handled in accordance with the following provisions:

(a) A permit is suspended when the County Engineer or his inspector advises the permittee or some responsible person on the job that the permit is suspended and posts a written suspension notice over the Permit at the jobsite.

(b) The following actions by the permittee are grounds for suspension of a permit:

1. Non-compliance with Section 5.02 of these regulations.

2. Deviating from drawings and specifications filed with the County Engineer and refusing to make corrections required by the County Engineer.

3. Any grounds for revocation of a permit as outlined in Section 5.04.

(c) When the suspension notice is posted, the permittee must immediately suspend all work on the job except that work necessary to abate the suspension. The suspension will be abated when the corrective work is performed and has passed
inspection. The abatement will be evidenced by the removal of the suspension notice by the County Engineer or his inspector, and the notation on the Permit Notice by the County Engineer or his inspector that the work has now been re-inspected and passed. The suspension notice may not be removed by any person other than the County Engineer or his inspector and removal by any other person will be ineffective.

SECTION 5.04 - PERMIT REVOCATION

Grounds for permit revocation are as follows:

(a) Material deviation from the drawings and specifications on file with the County Engineer, or a pattern of consistent deviation from such drawings and specifications which would demonstrate an intention to avoid conformity with the requirements of the permit.

(b) Refusal to uncover work for a mandatory inspection.

(c) Removal of a building permit suspension notice.

(d) Proceeding with work while a building permit is suspended, other than such work necessary to abate a suspension.

(e) An act or acts of violence, or threat or threats of violence against the County Engineer or his inspector either on or off the job for the purpose of intimidating the County Engineer or his inspector, so that he will not perform his inspection duties.

(f) Falsifying information in the permit application.

(g) Failing to submit all required certifications as outlined in Section 5.02.

SECTION 5.05 - PERMIT REVOCATION PROCEDURES

Permits shall be revoked in the following manner:

(a) The County Engineer must file a complaint stating the reason for permit revocation with the Hearing Examiner.
1. The Examiner will set a hearing as soon as practicable, but within 15 days of receiving the complaint.

2. The Examiner will deliver the original Complaint, Certificate to Commissioners' Court and Hearing Notice to the Clerk of Commissioners' Court to be filed, give one copy to the County Engineer, and designate an appropriate person as Serving Agent and give two copies to him or her.

3. The Serving Agent will take the two copies of the Complaint and Hearing Notice to the site where he will:
   a. Hand one copy of the Complaint and Hearing Notice to the permittee, or
   b. if the permittee is not an individual or cannot be found on the site, the Serving Agent will hand one copy of the Complaint and Hearing Notice to the person on the site who appears to be in charge, or
   c. if no person can be found on the site, the Serving Agent will post the Complaint and Hearing Notice over the Permit and/or Notice of Suspension posted at the job.
   d. Upon posting of the Complaint and Hearing Notice the permit shall be suspended.

4. The Serving Agent will fill in the return on the remaining copy, noting on it the date, time and manner in which he perfected service, and sign the return and return the remaining copy to the Hearing Examiner.

5. At the time set for hearing, if the return copy of the Complaint has been returned to the Hearing Examiner by the serving agent, and reflects that service has been perfected, the Examiner may proceed with the hearing.

6. Hearings will be conducted in the manner provided for by Section 6.02 of these Regulations before the Hearing Examiner appointed by Commissioners' Court and the Examiner may delegate responsibilities of Hearing Examiner to his Assistant.
PART 6 - APPEALS AND HEARING PROCEDURES

SECTION 6.01 - APPEALS

If a permit applicant is denied a permit, or has his permit suspended he may appeal the denial or suspension as provided in this Section. The term “appellant” is used to refer to the appealing party. An appellant must seek his remedy under this procedure before seeking his remedy in court. Application for a permit is deemed to be a waiver of the right to challenge these Regulations before exhausting remedies herein provided.

(a) Appeals are initiated by the making of complaint with or by requesting an exception to the Regulations from the Hearing Examiner in writing.

(b) The Hearing Examiner will set a time for a hearing, which will be scheduled as soon as practicable but within 15 days of the receipt of the written complaint or request, and shall prepare a Notice of Public Hearing naming the time and date of the Hearing. Copies shall be distributed as follows:

1. The original copy and the Certificate to Commissioners' Court will be filed with the Clerk of Commissioners' Court and the Clerk will prepare a file for the Hearing Notice.

2. The Examiner will set up his own working or hearing file, in which he will keep one copy.

3. The Examiner will give one copy to the Appellant.

4. The Examiner will deliver one copy to the County Engineer. The Hearing will be conducted as provided in Section 6.02, below.

(c) Appeal of a suspension will not abate the suspension pending the decision of the Hearing Examiner.

SECTION 6.02 - HEARING BEFORE THE EXAMINER

At Hearings before the Examiner, the Examiner will hear the testimony of the County Engineer and any witnesses called by the County Engineer. The Examiner will hear the testimony of the appellant and any witnesses called by the appellant. The Examiner will
review all documents and exhibits submitted to him by the parties. The Examiner will not be bound by formal rules of evidence and will control the evidence, reserving to himself the power to exclude testimony or exhibits he does not consider relevant. The Hearing Examiner will maintain an accurate record of the evidence adduced at the Hearing.

SECTION 6.03 - FILING OF EXAMINER'S DECISION

The Examiner will prepare a written decision within three working days of the Hearing. A copy of his decision will be filed with the Clerk of Commissioners' Court, the members of the Commissioners' Court, the Regional Director of the Federal Emergency Management Agency and with the County Engineer. The original will be sent to the appellant's address shown on the permit or permit application. If a variance is granted, the County Engineer shall prepare the appropriate permit with any special requirements that may be required by the conditions of the variance.

SECTION 6.04 - REVIEW BY COMMISSIONERS' COURT

If the County Engineer, or the appellant wishes to appeal the Examiner's decision, a written objection must be filed with the Clerk of Commissioners' Court within ten (10) days of the date the Examiner's decision is filed. The Clerk will notify the Hearing Examiner who will place the matter on the Agenda of Commissioners' Court for review at the next meeting of Commissioners' Court. If the objection is filed by the County Engineer, notice that the matter is on the agenda will be sent to the appellant by mail at the appellant's address shown on the permit or application. Commissioners' Court will review the matter. The Commissioners' Court may either affirm or reverse the decision of the Hearing Examiner. A suspension of a permit upheld by the Hearing Examiner will not be abated pending the review of Commissioner's Court.

SECTION 6.05 - VARIANCES

If any person wishes an exception to any provision of these Regulations, he shall request a variance in the manner prescribed for the filing of an appeal by 6.01 and 6.02 with the Hearing Examiner. The Hearing Examiner shall hold a hearing, and deny or grant the variance. Variances will be granted only if the conditions of Section 60.6 of the Title 44 of C.F.R. are met. Specifically:

(a) The applicant has shown good and sufficient cause.
(b) It has been determined that failure to grant the variance would result in an exceptional hardship to the applicant.

(c) The granting of a variance will not result in an increased flood height, additional threats to public safety, extraordinary public expense, or create nuisances, cause fraud or victimization of the public.

(d) Variances shall only be issued upon a determination that a variance is the minimum necessary considering the flood hazard to afford relief.

Economic hardship shall not constitute the sole basis for granting a variance. A hearing before Commissioners' Court regarding variances shall be requested in the manner provided in Section 6.04 of these Regulations. If a variance is granted a permit shall be issued and the permittee shall conform to all applicable provisions of these Regulations except the Sections for which a variance is granted.

PART 7 - ENFORCEMENT

SECTION 7.01 - ENFORCEMENT

If any person violates any provisions of these Regulations the County Engineer may notify the County Attorney and direct him to take whatever action is necessary to remedy the violation, including but not limited to filing suit to enjoin the violation and submitting a request to FEMA for denial of flood insurance. If a violation continues, Harris County may file a Certificate of Non-Compliance in the Real Property Records of Harris County. Once the violation has been resolved any individual may request a Certificate of Compliance be filed in the Real Property Records of Harris County. A fee for this action will be charged in accordance with Section 8.04 of these Regulations. The violator shall bear this and all other costs of effecting compliance.

SECTION 7.02 - VIOLATION OF CONDITIONS OF REGULATIONS

Any person having knowledge of a violation of these Regulations may file a complaint with Commissioners' Court. If the Complaint is filed by the County Engineer or another county official, the County Attorney will prosecute the Complaint.
SECTION 7.03 - CONTEMPT OF COMMISSIONERS' COURT

Commissioners' Court may punish contempts by fine or imprisonment in accord with the provisions of Section 81.024, Texas Local Government Code, as amended. Any person securing a permit under these Regulations does so on the representation to Commissioners' Court that he will comply with the terms of the permit and with these requirements and other County regulations. Violations of such representations to Commissioners' Court constitutes contempt of Commissioners' Court. Additionally, Commissioners' Court has the power to enforce its Orders by civil contempt. If the Commissioners' Court finds the defendant to be guilty of contempt, it will enter such Orders consistent with general law as it deems appropriate to punish the person guilty of contempt, and will enter such other and further Orders enforceable by civil and criminal contempt, and consistent with its authority under general laws, as Commissioners' Court deems necessary to enforce and protect its jurisdiction over the matter, and to uphold the integrity of these Regulations. Procedures for contempt proceedings before Commissioners' Court will be consistent with procedures in actions before other courts in this State for enforcement of Court Orders, and for the protection of the jurisdiction of Courts by the process of contempt.

PART 8 - FORMS AND RECORDS

SECTION 8.01 - FORMS

Forms to be used in the administration of these Regulations shall be promulgated by the County Engineer.

SECTION 8.02 - MAINTENANCE OF RECORDS

All applications for, and file copies of, permits must be maintained by the County Engineer for a retention period of three (3) years. Drawings and specifications on file with the County Engineer may be destroyed after completion of the structure.

SECTION 8.03 - ELEVATION AND FLOOD PROOFING RECORDS

For the duration of the records’ retention period, the County Engineer shall maintain for public inspection and furnish upon request any certificates of flood-proofing,
information on the elevation of the level of the lowest habitable floor of all new or substantially improved structures, and, for a structure which has been flood-proofed.

**SECTION 8.04 - FEES**

Fees for permits and inspections are to be set by Commissioners' Court. Fees shall be paid by cash, cashiers check, money order, or personal check. Checks shall be made payable to the “Harris County Treasurer.” Should the check be returned for insufficient funds the permit(s) may be suspended. If the returned check is not resolved in ninety (90) days, the permit(s) shall become null and void. Fees shall be paid at the time permit is delivered to the permittee unless other arrangements have been made and approved by the County Auditor. Refer to the fee schedule for the appropriate fee.

All permit fees are to be doubled for all construction starting prior to obtaining a permit including minimum and maximum fees.

Charge per square foot shall also include the floors of attached and detached garages and all building floors of multiple story buildings.

Permit fees are not refundable.

Inspection fees are charged for each visit to the jobsite.

**PART 9 - SEVERABILITY**

The provisions of these Regulations are severable. If any word, phase, clause, sentence, section, provision, or part of these Regulations should be invalid or unconstitutional, it shall not affect the validity of the remaining portions and it is hereby declared to be the intent of the Commissioner's Court that these Regulations would have been adopted as to the remaining portions, regardless of the invalidity of any part.
Attachment D

Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure
REGULATIONS OF HARRIS COUNTY, TEXAS FOR THE APPROVAL AND ACCEPTANCE OF INFRASTRUCTURE

AS
ADOPTED: 27 SEPTEMBER 2005
EFFECTIVE: 15 NOVEMBER 2005
AMENDED: 25 JULY 2006

HARRIS COUNTY
PUBLIC INFRASTRUCTURE DEPARTMENT
ENGINEERING DIVISION

ARTHUR L. STOREY, JR. PE
COUNTY ENGINEER

JACKIE L. FREEMAN, PE
ENGINEERING DIVISION DIRECTOR

PERMIT OFFICE
10,000 NORTHWEST FRWY, STE 102
HOUSTON, TEXAS 77092-8620
(713) 956-3000
THE STATE OF TEXAS §

COUNTY OF HARRIS §

The Commissioners Court of Harris County, Texas, convened at a meeting of said Court at the Harris County Administration Building in the City of Houston, Texas, on the ___ day of

JUL 25 2006___, 2006, with the following members present, to-wit:

Robert Eckels County Judge
El Franco Lee Commissioner, Precinct No. 1
Sylvia R. Garcia Commissioner, Precinct No. 2
Steve Radack Commissioner, Precinct No. 3
Jerry Eversole Commissioner, Precinct No. 4

and the following members absent, to-wit: ____________, constituting a quorum, when among other business, the following was transacted:

ORDER AMENDING APPENDIX C TO REGULATIONS OF HARRIS COUNTY FOR THE APPROVAL AND ACCEPTANCE OF INFRASTRUCTURE TO REMOVE REQUIREMENT FOR COMMISSIONERS COURT SIGNATURES ON PLATS

Commissioner ____________ introduced an order and made a motion that the same be adopted. Commissioner ____________ seconded the motion for adoption of the order. The motion, carrying with it the adoption of the order, prevailed by the following vote:

<table>
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<tr>
<th>Judge Eckels</th>
<th>Yes</th>
<th>No</th>
<th>Abstain</th>
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<td>Comm. Eversole</td>
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The County Judge therupon announced that the motion had duly and lawfully carried and that the order had been duly and lawfully adopted. The order thus adopted follows:

Recitals

An Order Adopting Regulations of Harris County for the Approval and Acceptance of Infrastructure was adopted by Commissioners Court on September 27, 2005.

Such regulations, hereinafter called the “Regulations” became effective November 15, 2005.

Section 4.05 of the Regulations states in part that “Required dedicatory language and plat certificates are included in Appendix C.

Presented to Commissioner's Court

JUL 25 2006

APPROVE ____________

Recorded Vol_____ Page_____

A CERTIFIED COPY

ATTEST: ____________ JUL 26 2006

BEVERLY B. KAUFMAN, County Clerk
Harris County, Texas

FRANCES MARTINEZ Deputy
# TABLE OF CONTENTS

## SECTION 1 - PRELIMINARY PROVISIONS ........................................... 1

- Section 1.01 - Authority ................................................................. 1
- Section 1.02 - Area Covered by Regulations ................................. 1
- Section 1.03 - Purpose ................................................................. 1

## SECTION 2 - USE OF TERMS ......................................................... 2

- Section 2.01 - Accredited Laboratory ............................................ 2
- Section 2.02 - Base Flood ............................................................. 2
- Section 2.03 - Base Flood Elevation ............................................. 2
- Section 2.04 - Coastal Areas ......................................................... 2
- Section 2.05 - Conduit ................................................................. 2
- Section 2.06 - County Engineer ...................................................... 3
- Section 2.07 - Curb and Gutter Sections ....................................... 3
- Section 2.08 - Design Storm Event ............................................... 3
- Section 2.09 - Drainage Area Map ................................................. 3
- Section 2.10 - Elevation ................................................................. 3
- Section 2.11- Extreme Event .......................................................... 4
- Section 2.12 - FEMA ................................................................. 4
- Section 2.13 - Geotechnical Engineer .......................................... 4
Section 4.05 - Review Procedures .................................................. 11
Section 4.06 - Recordation Requirements ...................................... 11
Section 4.07 - Certificates Required on Plats of Property
Located in the Unincorporated Area of Harris County .......................... 15

SECTION 5 - ADMINISTRATIVE PROCEDURES FOR THE... 16
REVIEW OF CONSTRUCTION DRAWINGS

Section 5.01 - Submittal Procedures ............................................. 16
Section 5.02 - Construction Drawings - General ......................... 16
Section 5.03 - Drawing Layout Requirements .............................. 17
Section 5.04 - Standard Detail Sheets ........................................ 18
Section 5.05 - Standard Note Requirements ................................. 18

SECTION 6- DRAINAGE REQUIREMENTS ................................. 19

Section 6.01 - Drainage Policy .................................................. 19
Section 6.02 - Design Requirements ............................................ 20
Section 6.03 - Storm Water Detention ....................................... 33
Section 6.04 - Ownership And Easements ................................ 38
Section 6.05 - Submerged Storm Sewers .................................... 40

SECTION 7 -PAVING ............................................................... 42

Section 7.01 - Paving Design Requirements ............................... 42
Section 7.02 - Design Requirements .......................................... 42
Section 7.03 - Materials Requirements ..............................................48
Section 7.04 - Specification Requirements .................................50
Section 7.05 - Geometric Requirements ........................................52

SECTION 8 - STRUCTURES ..........................................................59

SECTION 9 – TESTING REQUIREMENTS .....................................61
Section 9.01 - General.................................................................61
Section 9.02 - Bedding and Backfill .............................................61
Section 9.03 - Subgrade Testing ..................................................61
Section 9.04 - Flexible Base .........................................................62
Section 9.05 - Surface Course .....................................................62
Section 9.06 - Concrete Pavement ...............................................63
Section 9.07 - Concrete Cores ......................................................63
Section 9.08 - Structures.............................................................64

SECTION 10- INSPECTIONS .........................................................65
Section 10.01 - Construction Inspections .................................65
Section 10.02 - Notice of Start ......................................................65

SECTION 11 – ACCEPTANCE OF IMPROVEMENTS ..............66
WITHIN SUBDIVISIONS
Section 11.01 Acceptance Procedures ........................................66
Section 11.02  Inspection and Re-Inspection Fees

SECTION 12 – TRAFFIC

Section 12.01 - Traffic Definitions
Section 12.02 - Left Turn Lanes

SECTION 13 – LANDSCAPE AND MONUMENTATION

Section 13.01 - Landscape and Monumentation Policy
Section 13.02 - Use of Terms
Section 13.03 - Construction Activity
Section 13.04 - Prohibited Activity
Section 13.05 - Construction Requirements for Signage
Section 13.06 - Location Requirements for Landscaping in the Right-of-Way
Section 13.07 - Vegetation Management
Section 13.08 - Standards for Tree Replacement
Section 13.09 - Treescape and Screening Requirements for Commercial Establishments and Public Buildings
Section 13.10 - Tree Planting Requirements for Single Family Residential Lots
Section 13.11 - Preservation of Existing Trees

SECTION 14 – VARIANCES

SECTION 15 – SEVERABILITY
APPENDICES

Owner’s Ratification of Plats ................................................................. A
Lien holder’s Subordination to Dedication
Notary

Utility Service Plan .............................................................................. B

Certificates Required on Plats of Property Located ......................... C
Unincorporated Area of Harris County

Intensity Duration Curve....................................................................... D

Construction Notes to be On All Projects ........................................... E

Construction Notes to ................................................................. F
be on All Projects Involving Paving
or Storm Sewers Located in a Public Right of Way

Construction Notes for Esplanade Openings ..................................... G
and Left Turn Lanes

Construction Notes for All Projects Located .................................... H
in the 100 Year Flood Plain or Below the
Base Flood Elevation

Graphic Requirements ................................................................. I

Expansion Joints in Cul-De-Sacs and Knuckles ................................. J

Monument/Sign Height and Location.............................................. K
SECTION 1 - PRELIMINARY PROVISIONS

SECTION 1.01 - AUTHORITY

These Regulations are adopted by the Commissioners' Court of Harris County, Texas, acting in its capacity as the governing body of Harris County and the Harris County Flood Control District. The authority of Harris County to adopt these Regulations and for the contents hereof is derived from the following statutes: Chapter 232 of the Texas Local Government Code, Texas Local Government Code Section 240.901, as amended; Texas Transportation Code Section 251.001 – 251.05 and Section 254.001 – 254.019, as amended; the Harris County Road Law, as amended, (Special Laws of the 33rd Texas Legislature, Regular Session, 1913, Chapter 17, as amended), and the Flood Control and Insurance Act, as amended. These Regulations may be amended at any time by a majority of Commissioners' Court.

SECTION 1.02 - AREA COVERED BY REGULATIONS

These Regulations apply in all unincorporated areas of Harris County, Texas, and those areas where Harris County maintains the rights-of-way.

SECTION 1.03 - PURPOSE

The purpose of these Regulations is to ensure that the construction of infrastructure within the County’s rights-of-way perform their intended function with limited maintenance and repair.
SECTION 2 - USE OF TERMS

SECTION 2.01 - ACCREDITED LABORATORY

An “Accredited Laboratory” is a laboratory that is accredited by the American Association for Laboratory Accreditation (A2LA) or American Association of State Highway and Transportation Officials (AASHTO) in the field of construction materials testing.

SECTION 2.02 - BASE FLOOD

A “Base Flood” is the national standard on which the floodplain management and insurance requirements of the National Flood Insurance Program (NFIP) are based. Special Flood Hazard Areas (SFHAs) are depicted on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) and are areas subject to inundation by the base flood having a one-percent or greater probability of being equaled or exceeded during any given year (this is also known as a 100-year flood event).

SECTION 2.03 - BASE FLOOD ELEVATION

“Base Flood Elevation” (BFE) means the calculated elevation or level above mean sea level that flood waters may reach during the base flood.

SECTION 2.04 - COASTAL AREAS

“Coastal Areas” means areas which border on bays or estuaries or other waterways subject to tidal action which are subject to possible flooding or increased flood levels because of tidal action, hurricane surge or rising water due to storms, hurricanes or tsunamis. A “coastal area” is not necessarily in a “V” Zone. In cases where there is a question as to whether an area is a coastal area, the Harris County Public Infrastructure Department shall refer to the FEMA Flood Insurance Study.

SECTION 2.05 - CONDUIT

A “Conduit” is any open or closed device for conveying flowing water.
SECTION 2.06 - COUNTY ENGINEER

“County Engineer” means the holder of the statutory office of the County Engineer for Harris County or the employee designated by the County Engineer to perform a task required by these Regulations. The County Engineer is the director of the Harris County Public Infrastructure Department.

SECTION 2.07 - CURB AND GUTTER SECTIONS

A “Curb and Gutter Section” is a full width concrete pavement with curb, either doweled on six-inch (6”) curbs or monolithic or doweled four-inch (4”) by twelve-inch (12”) curb or monolithic curb and gutter sections for asphalt concrete pavement.

SECTION 2.08 - DESIGN STORM EVENT

“Design Storm Event” means the rainfall intensity upon which the drainage facility will be sized. References to rainfall conditions in these specifications shall apply to “Technical Paper No. 40, U. S. Weather Bureau”, published by the U. S. Department of Agriculture, Soil Conservation Service.

SECTION 2.09 - DRAINAGE AREA MAP

“Drainage Area Map” means the area map of a watershed, which is subdivided to show the area served by each subsystem.

SECTION 2.10 - ELEVATION

“Elevation” means height above mean sea level. The vertical control system (benchmarks) referenced in the most current Flood Insurance Study shall be used except in coastal areas where subsidence has occurred. The most recent re-leveling of the vertical control system by the Harris-Galveston Subsidence District shall be used in the coastal areas. Any future studies changing the Flood Insurance Rate Map (FIRM), which is referenced to a later re-leveling of the vertical control system shall be used whenever a revised FIRM becomes effective.
SECTION 2.11 - EXTREME EVENT

“Extreme Event” means a rainfall event, which exceeds the Design Storm Event up-to and including the 100-year frequency resulting in surcharge of the underground storm sewer system and overland sheet flow.

SECTION 2.12 - FEMA


SECTION 2.13 - GEOTECHNICAL ENGINEER

A “Geotechnical Engineer” is a licensed engineer within the State of Texas who works for a company registered in the State of Texas that has been accredited by the American Association for Laboratory Accreditation (A2LA) in geotechnical testing.

SECTION 2.14 - HCFCD

“HCFCD” means the Harris County Flood Control District.

SECTION 2.15 - HYDRAULIC GRADE LINE

“Hydraulic Grade Line” means the line representing the pressure head available at any given point within the drainage system.

SECTION 2.16 - IN-FILL DEVELOPMENT

“In-fill Development” means the development of open tracts of land in areas where the storm drainage infrastructure is already in place and takes advantage of the existing infrastructure as a drainage outlet.

SECTION 2.17 - MEAN SEA LEVEL

“Mean Sea Level” means the average height of the surface of the sea for all states of the tide as was established by the United States Coastal and Geodetic Survey in 1929.
SECTION 2.18 - PERSON

“Person” includes any individual or group of individuals, corporation, partnership, association, or any other organized group of persons, including State and Local governments and agencies thereof.

SECTION 2.19 - RAINFALL FREQUENCY

“Rainfall Frequency” means the probability of a rainfall event of defined characteristics occurring in any given year. Information on rainfall frequency is published by the National Weather Service. For the purpose of storm drainage design, the following frequencies are applicable:

1. 2-year frequency – a rainfall intensity having a 50% probability of occurrence in any given year, or nominally likely to occur once every two years.
2. 3-year frequency – a rainfall intensity having a 33% probability of occurrence in any given year, or nominally likely to occur once every three years.
3. 5-year frequency – a rainfall intensity having a 20% probability of occurrence in any given year, or nominally likely to occur once every five years.
4. 10-year frequency – a rainfall intensity having a 10% probability of occurrence in any given year, or nominally likely to occur once every ten years.
5. 25-year frequency – a rainfall intensity having a 4% probability of occurrence in any given year, or nominally likely to occur once every twenty-five years.
6. 100-year frequency – a rainfall intensity having a 1% probability of occurrence in any given year, or nominally likely to occur once every one hundred years.
SECTION 2.20 - REDEVELOPMENT

“Redevelopment” means a change in land use that alters the impervious cover from one type of development to either the same type or another type and takes advantage of the existing infrastructure in place as a drainage outlet.

SECTION 2.21 - ROADSIDE DITCH SECTIONS

“Roadside Ditch Sections” are ditch sections adjacent to either full width reinforced concrete pavement or asphaltic concrete pavement.

SECTION 2.22 - SHEET FLOW

“Sheet Flow” means the overland storm runoff that is not conveyed in a defined conduit and is typically in excess of the capacity of the conduit or roadside ditch.

SECTION 2.23 - SUBDIVISION

“Subdivision” means a division of any tract of land into two (2) or more parts for the purpose of laying out any subdivision or any tract of land or any addition to the city, or for laying out suburban lots or buildings lots, or any lots, and streets, alleys or parts of other portions intended for public use or the use of the purchasers or owners of lots fronting thereon or adjacent thereto. A subdivision includes re-subdivision (replat), but it does not include the division of land in parcels or tracts of ten (10) acres or more and not involving any new streets, alleys or easements of access. This definition is based on current state statutes and should the statutes be changed its new definition would govern.

SECTION 2.24 - UNINCORPORATED AREA

“Unincorporated Area” means the area in Harris County, Texas, which is not within an incorporated area of a city, town, and village or within the jurisdiction of the Port of Houston Navigation District.
SECTION 3 - GENERAL PROVISIONS

SECTION 3.01 - ADMINISTRATION BY THE COUNTY ENGINEER

The Harris County Public Infrastructure Department is responsible for the administration of these Regulations, approval of plans required by these Regulations, and enforcement of these Regulations and maintaining proper records.

SECTION 3.02 - RESPONSIBILITY OF OTHER OFFICIALS

Under these regulations the Harris County Public Infrastructure Department is responsible for all administrative decisions, determinations and duties. The Harris County Public Infrastructure Department may seek and secure the assistance of other officials of Harris County and of the Harris County Flood Control District in making its decisions, determinations and in performing duties but is not required to conform to the recommendations of others.
SECTION 4 - ADMINISTRATIVE PROCEDURES
FOR THE REVIEW OF PLATS

SECTION 4.01 - APPROVAL REQUIRED

All development within the unincorporated areas of Harris County is prohibited without first securing approved plans or plat, if required, and a development permit issued under the Regulations of Harris County, Texas, for Flood Plain Management.

SECTION 4.02 - ENFORCEMENT

It shall be unlawful for any person to lay out, subdivide or plat any land into lots, blocks, tracts or streets within the unincorporated area of Harris County if the land has not been laid out, subdivided and platted in accordance with these rules and regulations.

SECTION 4.03 - PLAT CRITERIA

For tracts of land located within the extraterritorial jurisdiction (ETJ) of an incorporated city or town and subject to the jurisdiction of the Planning Commission or other governing body of that city or town, general subdivision and layout requirements as established by the applicable Commission or other governing body shall apply. In the circumstance where any rule, regulation, procedure or policy lawfully or officially adopted by the governing body of any city or town exercising jurisdiction within its extraterritorial jurisdiction is less restrictive than that contained herein, the standards adopted by these rules and regulations and applicable State law shall apply.

For all other tracts not located within a municipality’s extraterritorial jurisdiction or for which the municipality has issued a written certification stating that a plat is not required to be filed for that subdivision of land in accordance with Chapter 212 of the Texas Local Government Code, the following rules and design requirements shall apply:

1. Lots shall be of sufficient acreage to meet minimum requirements for on-site sewage service.

2. Public road rights-of-way shall be a minimum fifty feet (50’) in width and in conformance with the Geometric Design Guidelines as adopted by Harris County Commissioners’ Court.
3. A building setback line of not less than twenty-five feet (25’) from the road right-of-way shall be imposed on tracts intended for construction of a single-family structure or structures. However, twenty-foot (20’) building setback lines will be permitted for single-family residential lots on cul-de-sacs and knuckles. A ten-foot (10’) building setback line will be permitted on side lots of single-family residential lots. A building setback line of no less than ten feet (10’) shall be imposed on all other tracts.

4. Construction of road and appurtenant drainage facilities shall be in conformance with specifications as set out in these rules and regulations.

5. Financial Surety: A cash deposit, bond, or letter of credit made in accordance with the Texas Local Government Code §232.004 or §232.045 and these regulations.

SECTION 4.04 - EXCEPTIONS

Exceptions to platting requirements are established in Section 232.0015 of the Texas Local Government Code. A brief description follows:

1. A county may not require the owner of a tract of land located outside the limits of a municipality who divides the tract into two or more parts to have a plat of the subdivision prepared if the owner does not lay out a part of the tract as streets, alleys, squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts, and the land is to be used primarily for agricultural use or farm, ranch, wildlife management, or timber production.

2. A county may not require the owner of a tract of land located outside the limits of a municipality who divides the tract of land into four or fewer parts and does not lay out a part of the tract as streets, alleys, squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts to have a plat of the subdivision prepared if each of the lots is to be sold, given, or otherwise transferred to an individual who is related to the owner within the third degree of consanguinity or affinity.

3. A county may not require the owner of a tract of land located outside the limits of a municipality who divides the tract into two or more parts to have a plat of the subdivision prepared if all the lots of the subdivision are more than 10 acres in area and the owner does not lay out a part of the tract as streets, alleys,
squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts.

4. A county may not require the owner of a tract of land located outside a municipality to have a plat of the subdivision prepared if all the lots are sold to veterans through the Veterans’ Land Board program.

5. A county may not require the owner of a tract land to have a plat prepared if the owner is the state or any state agency, board, or commission or owned by the permanent school funds of the state unless the subdivision lays out a part of the tract as streets, alleys, squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts.

6. A county may not require the owner of a tract of land located outside the limits of a municipality who divides the tract into two or more parts to have a plat of the subdivision prepared if the owner of the land is a political subdivision of the state, the land is situated in the floodplain, and the lots are sold to adjoining landowners.

7. A county may not require the owner of a tract of land outside the limits of a municipality who divides the tract into two parts to have a plat the subdivision prepared if the owner does not lay out a part as streets, alleys, squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts and one part is to be retained by the owner, and the other new part is to be transferred to another person who will further subdivide the tract subject to the plat approval requirements.

8. A county may not require the owner of a tract of land locate outside the limits of a municipality who divides the tract into two or more parts to have a plat of the subdivision prepared if the owner does not lay out a part of the tract as streets, alleys, squares, parks, or other parts of the tract to be dedicated to public use or for lots fronting on or adjacent to the streets, alleys, squares, or other parts and all parts are transferred to persons who owned an undivided interest in the original tract and a plat is filed before any further development of any part of the tract.

SECTION 4.05 - REVIEW PROCEDURES
Municipalities in Harris County exercising their extraterritorial jurisdiction in the unincorporated area of Harris County have developed specific and unique procedures in processing plats. Therefore, it shall be the responsibility of the owner of the tract being platted to ensure that the Harris County Flood Control District and the Engineering Division of the Harris County Public Infrastructure Department receive copies of a proposed plat for review and comment. Required dedicatory language and plat certificates are included in Appendix “C”.

The original mylar of the plat fully executed by the owners and approved by the appropriate Planning Commission or governing body accompanied by the required information described in Recordation Requirements is to be submitted to the Harris County Flood Control District. Upon the District’s final review and approval, the plat will be forwarded to the Engineering Division of the Public Infrastructure Department. Upon satisfactory completion of the review, the plat will be forwarded for the signature of the County Engineer. The plat will be processed and placed on the next available Commissioners’ Court agenda for approval. The County Clerk shall calculate the required recording fees and notify the applicant or designee of the same. Upon receipt of those fees, the plat will be filed and recorded in the Official Public Records of Real Property of Harris County, Texas.

SECTION 4.06 - RECORDATION REQUIREMENTS

The following documentation is required to be submitted along with any original plat that is to be reviewed by the Harris County Public Infrastructure Department, submitted to Harris County Commissioners’ Court for approval, and filed with the Harris County Clerk. Harris County will accept for recordation only those plats printed on the front side of the mylar or other reproducible material.

1. A title report, or opinion, title policy or certificate or letter from a title company authorized to do business in the State of Texas must be provided indicating ownership of the property, all liens against same, and any existing easements. The title report shall not have been executed more than sixty (60) days prior to the time the final plat is received by the Harris County Public Infrastructure Department and may require updating at the request of Harris County personnel. Owners of property located within the plat must either sign the plat or execute an Owner’s Ratification of Plat document. Furthermore, liens against the property shall be subordinate to all dedication of streets, rights-of-ways, easements and terms and conditions referred to on the plat. See Appendix “A” for formats for Owner’s Ratification of Plat and Lienholder’s Subordination to Dedication.
An original tax certificate from the tax collector of each political subdivision in which the property is located showing that all taxes owed to the County, School District, Utility District, and/or any other political subdivision have been paid in full. If the plat or replat is filed after September 1 of a year, the plat or replat must also have attached to it a tax receipt issued by the collector for each taxing unit with jurisdiction of the property indicating that the taxes imposed by the taxing unit for the current year have been paid or, if the taxes for the current year have not been calculated, a statement from the collector for the taxing unit indicating that the taxes to be imposed by that taxing unit for the current year have not been calculated. If the tax certificate for a taxing unit does not cover the preceding year, the plat or replat must also have attached to it a tax receipt issued by the collector for the taxing unit indicating that the taxes imposed by the taxing unit for the preceding year have been paid.

This requirement does not apply to the extent of the applicability of exceptions in Texas Property Code § 12.002(e) in regard to certain real property acquired by will or inheritance or to certain property acquired by eminent domain.

A completed Utility Service Plan shall be submitted. In no case shall a plat be recorded prior to assurances being given that all applicable State and County reviews and/or permit(s) have been obtained. See Appendix “B” for this form.

A letter from the County Tax Assessor-Collector certifying that the name of the subdivision to be presented to Commissioners’ Court is not in conflict with any other previously recorded subdivision. This requirement applies only to the first section of multi-section subdivisions and is not applicable to street dedication plats designated by a street name.

A copy of the current Federal Emergency Management Agency’s Flood Insurance Rate Map (FIRM) with the boundaries of the subdivision delineated.

Two (2) sets of approved drawings are to be on file with the Public Infrastructure Department at the time the plat is submitted to Commissioners’ Court. However, if the tract of land is being platted to create reserves for the purpose of sale only and there are no immediate plans for construction of improvements on said reserves, then a note shall be placed on the face of the plat stating:
“Site drainage plans for the future development of this reserve must be submitted to the Harris County Flood Control District and Engineering Division of Harris County Public Infrastructure Department.”

7. A letter, statement or other instrument from the owner of any privately owned easement within the plat boundaries where such easement is to be crossed by streets (either public or private) or public utility or drainage easements, stating that the owner of such easement approves such crossing of the private easement for the purposes intended and depicted on the plat, if such approval is not granted in the original document conveying the easement.

8. A plat review fee as established by Commissioners’ Court is required prior to setting a plat on an agenda.

9. For plats of lots and/or reserves and not dedicating any public rights-of-way, an administrative fee is assessed in the amount of $10.00 per lot and $20.00 per 100 feet of plat boundary adjoining road right-of-way rounded to the next highest increment of $20.00. Fees made payable to the County Treasurer are due upon plan or plat approval as applicable.

10. For plats proposing the dedication of a public street(s) and construction of paving and appurtenant drainage, a Financial Surety is required prior to plan approval and shall be:

   A. Made payable to the County Judge and the Judge’s successor in office, unless cash:
   B. In a total amount based upon the following schedule:
## FINANCIAL SURETY SCHEDULE *

<table>
<thead>
<tr>
<th>RESIDENTIAL SUBDIVISIONS</th>
<th>COMMERCIAL SUBDIVISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50 per lot with average road frontage less than 100 feet.</td>
<td>$75 per 100 feet of proposed pavement. The fee shall be rounded to the next 100 feet.</td>
</tr>
<tr>
<td>$75 per lot with average road frontage 100 feet or greater.</td>
<td></td>
</tr>
</tbody>
</table>

*NOTE:*
The minimum financial surety posted in any case shall be $2,500.00. Included is the non-refundable administrative fee of $10 per lot for residential subdivisions or $20 per 100 ft of pavement in commercial subdivisions.

11. For properties being platted in the unincorporated areas of Harris County, where there is not Extraterritorial Jurisdiction being exercised for water and sewer facilities the following requirements for water and sewage facilities apply:

   a. The drinking water supply shall meet the minimum requirements established by Chapter 341 of the Health and Safety Code and any other minimum requirements established by the Texas Commission on Environmental Quality applicable to drinking water.

   b. Any onsite sewerage disposal systems shall be constructed in accordance with Chapter 366 of the Health and Safety Code and the Revised Rules of Harris County for On-Site Sewerage Facilities.

   c. Any sewerage facility other than a properly permitted onsite sewage facility shall be constructed and operated under a valid permit issued by the Texas Commission on Environmental Quality.

12. Additional information may be required by the Public Infrastructure Department to clarify or support any of the aforementioned recordation requirements.
SECTION 4.07 - CERTIFICATES REQUIRED ON PLATS OF PROPERTY LOCATED IN THE UNINCORPORATED AREA OF HARRIS COUNTY

1. Dedicatory language on the plats must include the following paragraphs:

   A. “FURTHER, Owners do hereby dedicate to the public a strip of land fifteen (15) feet wide on each side of the center line of any and all bayous, creeks, gullies, ravines, draws, sloughs, or other natural drainage courses located in said plat, as easements for drainage purposes, giving the City of (name of city), Harris County, or any other governmental agency, the right to enter upon said easement at any and all times for the purpose of construction and maintenance of drainage facilities and structures.”;

   B. “FURTHER, Owners do hereby covenant and agree that all of the property within the boundaries of this plat and adjacent to any drainage easement, ditch, gully, creek or natural drainage ways shall hereby be restricted to keep such drainage ways and easements clear of fences, buildings, planting and other obstructions to the operations and maintenance of the drainage facility and that such abutting property shall not be permitted to drain directly into this easement except by means of an approved drainage structure.”; and

   C. “FURTHER, Owners certify and covenant that they have complied with or will comply with existing Harris County Road Law, Section 31-C as amended by Chapter 614, Acts of 1973, 63rd Legislature and all other regulations heretofore on file with the Harris County Engineer and adopted by the Commissioners’ Court of Harris County.”

2. Approved Certificate Language may be found in Appendix “C” to these regulations.
SECTION 5 - ADMINISTRATIVE PROCEDURES FOR THE REVIEW OF CONSTRUCTION DRAWINGS

SECTION 5.01 - SUBMITTAL PROCEDURES

1. A preliminary set of drawings shall be submitted to the County Engineer for review along with a County issued Routing Slip. Upon review, the drawings will be returned to the consultant with any necessary comments.

2. Upon addressing all the comments, a final review will be conducted by submitting the marked-up preliminary set, a reproducible set, a blue line set, and the routing slip to the County Engineer. The plans will be approved or additional comments will be made and the sets returned.

SECTION 5.02 - CONSTRUCTION DRAWINGS - GENERAL

For all construction drawings submitted to the Harris County Public Infrastructure Department pursuant to these regulations the following requirements shall apply:

1. A Professional Engineer, licensed in the State of Texas, is required to seal, date and sign each sheet of the drawings in accordance with rules set forth by the Texas State Board for Professional Engineers. The seal must reproduce on all sheets.

2. A cover sheet shall be required for all projects involving three or more plan and profile sheets. All plan sheet numbers should be included on the cover sheet or area map. A vicinity map should always be included to show the project location.

3. Drawings for street and/or public improvements shall be standard twenty-three inch by thirty-six inch (23” x 36”) Federal Aid Sheets or twenty-four inch by thirty-six inch (24” x 36”) overall dimensions for all design in rights-of-way or easements. Site drawings may be submitted on larger sheets when practical.

4. Drawings submitted for Harris County Public Infrastructure Department approval shall be on a reproducible material.

5. A North arrow is required on all sheets and should be generally oriented either upward or to the right.

6. All projects shall be tied to the datum adjustment that matches the FIRMs or the most current datum available in coastal areas. Equations may be used to translate other datum adjustments to the required adjustment.
7. Graphic standards for construction drawings submitted shall be in accordance with those outlined in Appendix “I” to these regulations.

8. If the property lies below the base flood level, the flood plain must be delineated graphically on all plan sheets.

SECTION 5.03 - DRAWING LAYOUT REQUIREMENTS

Drawings submitted to the Harris County Public Infrastructure Department pursuant to these regulations shall have the following items:

1. General construction layouts shall be submitted for all paving and utility projects involving more than three plan and profile sheets. For the purpose of fulfilling this requirement, paving and drainage layouts may be combined and water and sanitary sewer layouts may be combined.

2. A drainage area map shall be submitted and shall include drainage computations with drainage area and storm water flow labeled.

3. A lot grading plan shall be submitted for residential lots on which earthwork is proposed that will change the natural topography.

4. A drawing showing existing natural contours at one-foot (1’) intervals of the land to be developed.

5. A graphical sheet index shall be included on the general construction layout or on a separate index sheet showing the plan and profile sheet location and sheet number.

6. Match lines in appropriate locations and not in the intersections of two streets or cul-de-sac knuckles shall be provided.

7. If a roadway exists where drawings are being prepared to improve the roadway or construct new pavement or to construct a utility, this roadway should be labeled as to its existing width, type of surfacing and base thickness if available without destruction of pavement.

8. All improvements shall be labeled as “Proposed” or “Existing” in both Plan and Profile Views.
SECTION 5.04 - STANDARD DETAIL SHEETS

For all construction drawings submitted to the Harris County Public Infrastructure Department pursuant to these regulations, the following requirements shall apply:

1. The Harris County standard paving and detail sheets shall be incorporated by reference in the project specifications and by construction notes on the drawings.

2. The details of special structures not covered by approved standard drawings, such as stream and gully crossings, special manholes, etc., should be included. The details shall be drawn on the detail sheets with the horizontal and vertical scales equal.

3. The Harris County Public Infrastructure “Express Review Sheet” shall be submitted with each set of drawings and be completed including Harris County Appraisal District account number.

SECTION 5.05 - STANDARD NOTE REQUIREMENTS

The following standard notes shall be included in the drawings, where applicable, as specified below:

All projects shall include the notes in Appendix “E” to these regulations.

All projects involving paving or storm sewers located in a public right-of-way shall include notes in Appendix “F” to these regulations.

All projects involving left turn lanes shall include the notes in Appendix “G” to these regulations.

All projects located within the 100-year flood plain by map or elevation shall include notes in Appendix “H” to these regulations.
SECTION 6 - DRAINAGE REQUIREMENTS

SECTION 6.01 - DRAINAGE POLICY

1. Design Requirements

   A. The drainage criteria administered by Harris County and complemented by the City of Houston and the Harris County Flood Control District Criteria for newly designed areas provides protection from structural flooding from a 100-year base flood storm event. This is accomplished with the application of various drainage enhancements such as storm sewers, roadside ditches, open channels, detention and overland (sheet) run-off. This combined system attempts to prevent structural flooding for extreme events up to a 100-year-storm.

   B. Recognizing that each site has unique characteristics that may enhance the opportunity to provide proper drainage, the intent of these criteria is to specify minimum requirements. These minimums may be modified with prior consent of the Harris County Public Infrastructure Department provided that the objective for the minimum drainage standards is maintained.

2. Street Drainage Design - Street ponding of short duration is anticipated and designed to contribute to the overall drainage capability of the system. Storm sewers and roadside ditch conduits are designed as a balance of capacity and economics. These conduits are designed to convey less intense, more frequent rainfalls while attempting to allow traffic movement during these events. When rainfall events exceed the capacity of the storm sewer system, the additional run-off is intended to be stored or conveyed overland in a manner that reduces the threat of flooding to structures.

3. Flood Control Design – Harris County is a participant in the National Flood Insurance Program. The flood insurance program attempts to make flood insurance available at low cost by providing for measures that reduce the likelihood of structural flooding.

4. Relationship to the Platting Process – The approval of storm drainage systems, detention facilities, and flood channel improvements is a part of the review process for planning and platting of new development.
SECTION 6.02 - DESIGN REQUIREMENTS

All designs of drainage facilities, manholes, inlets, bedding and backfill shall meet the requirements of Standard Specifications, Standard Drawings and Harris County Regulations. The City of Houston design guidelines in effect on September 1, 2005 will apply for all projects located within Harris County and the City of Houston ETJ. The most stringent design details shall apply in the event of any discrepancy.

1. Method of Determining Runoff

   A. Area runoff shall be determined using the Rational Formula which is defined as:

   \[ Q = C_i A \]

   Where

   \[ Q \] = amount of runoff in cubic feet per second (cfs)

   \[ C \] = watershed imperviousness coefficient. See Figure 1: Minimum “C” Values for Land Use Types for suggested typical values.

   \[ i \] = rainfall intensity in inches per hour

   Implicit in the determination of “i” is when the entire watershed under consideration is contributing runoff, a concept known as the Time-of Concentration \( T_c \) ratio, which are expressed in minutes.

   \[ T_c = 10 A^{0.1761} + 15 \text{ (in minutes)} \]

   \[ A \] = acres of subarea under consideration in the watershed area

   \text{Note: See Appendix “D” for intensity duration}

   B. Design Storm Events for typical storm sewer design will consist of a 2-year storm. Design rainfall pattern shall follow the requirements specified in the most current edition of the HCFCR Criteria Manual.
Figure 1: Minimum “C” Values for Land Use Types

<table>
<thead>
<tr>
<th>Land Use Type</th>
<th>Runoff Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential Districts</strong></td>
<td></td>
</tr>
<tr>
<td>Lots more than ¾ acres</td>
<td>0.35</td>
</tr>
<tr>
<td>Lots ¼ - ¾ acre</td>
<td>0.45</td>
</tr>
<tr>
<td>Lot less than ¼ acre</td>
<td>0.55</td>
</tr>
<tr>
<td><strong>Multi-Family Areas</strong></td>
<td></td>
</tr>
<tr>
<td>Less than 20 DU/AC</td>
<td>0.65</td>
</tr>
<tr>
<td>20 DU/AC or Greater</td>
<td>0.80</td>
</tr>
<tr>
<td>Business Districts</td>
<td>0.80</td>
</tr>
<tr>
<td><strong>Industrial Districts</strong></td>
<td></td>
</tr>
<tr>
<td>Light Areas</td>
<td>0.65</td>
</tr>
<tr>
<td>Heavy Areas</td>
<td>0.75</td>
</tr>
<tr>
<td>Railroad Yard Areas</td>
<td>0.30</td>
</tr>
<tr>
<td>Parks / Open Acres</td>
<td>0.18</td>
</tr>
</tbody>
</table>

C. Application of Runoff Calculation Models

(1). The Rational Method shall be used for designs on all areas served by storm sewer up to 600 acres in size.

(2). Rainfall runoff modeling shall be applied to areas greater than 600 acres in size or any areas that are drained by an open channel provided the model takes into account the storage and ponding in streets. Models must be acceptable to FEMA if they are to support a submittal for a map change.

D. Coefficients for the Rational Method.

(1). The runoff coefficient “C” values in the Rational Method formula will vary based on the land use. Minimum to be used is shown in Figure 1: Minimum “C” Values for Land Use Types.

(2). Alternatively, when the area is not outlined in Figure 1, the runoff coefficient “C” in the Rational Method formula can be calculated from the equation:

\[
C = 0.6Ia + 0.2
\]
Where \( C = \) Watershed coefficient
\( I_a = \) percent impervious area

(3). If the alternate form is to be submitted, a calculation of the computation of \( C \) is to be provided as part of the drainage calculations.

2. Design of Storm Sewers

A. Storm sewers shall be designed using the Manning Equation in combination with the Conformity Equation. Proper consideration will be given to the units of measure, whether English or metric.

B. The Manning Equation is defined as:

\[
V = \frac{(K/n)R^{2/3}}{S_{f}^{1/2}}
\]

Where \( K = 1.49 \) for English units; and, \( 1.0 \) for metric units
\( n = 0.013 \) for concrete pipes; and, \( 0.024 \) for CMP pipes
\( V = \) velocity in feet per second
\( R = \) hydraulic radius of the conduit in feet which equals area/wetted perimeter
\( S_{f} = \) friction slope as headloss per length

C. The Conformity Equation is defined as:

\[
Q = VA
\]

Where \( Q = \) Discharge or runoff in cfs
\( V = \) velocity in feet per second
\( A = \) Cross-sectional area of conduit in square feet

D. Design Frequency

(1). Newly Developed Areas – The design storm event for sizing storm sewers in newly developing areas shall be a two (2) year rainfall.

(2). Redevelopment or In-Fill Development with Increased Rate of Runoff – The existing storm drain serving redevelopment or infill development shall be evaluated in accordance with conditions...
outlined below, using a 2-year rainfall, assuming existing development conditions. Afterwards the storm drain shall be re-evaluated with the proposed re-development, or in-fill development, in place.

(a). If the hydraulic gradient is twelve inches (12”) or less above the top of curb with the flow in the receiving channel at the top of the outfall pipe and no structures are threatened by the project, then no improvements to the existing storm drain are required.

(b). If the extreme event analysis indicates that structures are threatened by flooding, the applicant has the option of either making improvements to the existing storm drain or providing detention or improving the receiving stream and not impacting downstream conditions.

E. Velocity Considerations

(1). Storm sewers should be constructed to convey the design flow in sub critical hydraulic conditions if possible.

(2). Minimum 2-year flow velocities should not be less than three feet (3’) per second with the pipe flowing full, under the design conditions.

(3). Maximum 2-year flow velocities should not exceed eight feet (8’) per second.

F. Pipe Sizes and Placement

(1). Soil boring with logs shall be made along the alignment of all storm sewers having a cross section equal to or greater than seventy-two inches (72”) in diameter or equivalent cross sectional area. Each boring shall be taken at intervals not to exceed five hundred (500) linear feet and at a depth of less than three feet (3’) below the flow line of the sewer. The required bedding will be determined from the soil boring.

(2). The storm sewer and inlet lead shall be designed with a minimum of twenty-four inch (24”) inside diameter or equivalent cross sectional
area. Box conduits shall be a minimum of two feet (2’) by two feet (2’). Closed conduits, either circular, elliptical, or box, shall be selected based on hydraulic principles and economy of size and shape.

(3). Larger pipes upstream should not flow into smaller pipes downstream unless construction constraints prohibit the use of a larger pipe downstream, or the improvements are outfalling into an existing system, or the upstream system is intended for use in detention.

(4). Match crowns of trunk storm sewer pipe at any change in pipe size unless severe depth constraints prohibit the matching of crowns. Severe depth constraints include any system in which the outfall system exists and the designed storm system cannot achieve 2 feet or more of cover at the point of lowest cover without additional fill. This includes:

a. Any system that includes a lake or detention pond, and the depth of the storm sewers is constrained by that lake or detention pond, and the designed storm sewer system cannot achieve 2 feet or more cover at the point of lowest cover without additional fill.

b. Any time there is a conflict with the existing utility system which cannot be reasonably relocated. This includes large diameter water lines, underground electrical conduits, underground telecommunication conduits, petrochemical pipelines, or sanitary sewers.

c. Any time there is a conflict with a proposed sanitary sewer system which cannot be avoided due to design criteria constraints. This includes but may not be limited to sanitary sewers and their service leads.

d. The saving of specimen trees which would be harmed by fill on lots with a minimum lot size of 8400 sf. A tree survey must be provided showing location, size and species of trees proposed to be saved.

(5). Locate storm sewers in public street rights-of-way or in approved easements.
(6). All precast, reinforced, concrete conduits must be laid in a straight line. Deflection in accordance with manufacturer’s specifications will be allowed if on approved drawings.

(7). All public side lot or back lot drainage facilities shall be underground storm sewer systems designed in accordance with these Harris County standards. Drainage swales are permitted for off-site sheet flow only. Private, individual lot drainage is exempt from this requirement except when discharging into a public right-of-way.

(8). In all easements restricted to storm sewers, the conduit shall be centered within the limits of the easement. The width of the easement shall be two (2) times the depth plus the diameter of the pipe rounded up to the next highest five foot (5’) increment. The minimum shall never be less than twenty feet (20’).

(9). For storm sewers located in easements adjacent to public street rights-of-way, the minimum width shall be increased for larger pipe or conduit by requiring that a minimum distance of five feet (5’) shall be maintained between the easement line and the outside edge of the sewer, and a minimum distance of two feet (2’) shall be maintained from the right-of-way line to the outside edge of the sewer pipe or conduit.

G. Starting Water Surface and Hydraulic Gradient

(1). The hydraulic gradient shall be calculated using the top of the outfall pipe as the starting water surface elevation.

(2). Should the upstream pipe be higher than the hydraulic grade line at drop in pipes invert, then the hydraulic grade line shall be recalculated assuming the starting water surface to be at the top of the pipe at that point.

(3). For the design storm (a two year frequency), the hydraulic gradient shall at all times be below the gutter line.

H. Manhole Locations

(1). Use manholes for precast conduits at the following locations:
(a). Size or cross section changes.

(b). Inlet lead and conduit intersections.

(c). Changes in pipe grade.

(d). At a maximum space of seven hundred feet (700’) along a conduit run.

(2). Use manholes for monolithic concrete storm sewers at the same locations as precast conduits, except they are not required at the intersection of inlet leads unless needed to provide maintenance access.

I. Inlets

(1). Locate inlets at all low points in gutter or at intermediate points in the profile grade to provide proper drainage.

(2). Inlets should not be placed within driveway locations/limits but should be placed in the center of the lot.

(3). Valley gutters across intersections are not permitted.

(4). Inlet spacing is a function of gutter slope and should be designed to conform with the Pavement Design Requirements and Drainage Design Requirements of these design guidelines.

(a). Local and collector street section: For minimum gutter slopes, the maximum inlet spacing shall be a gutter run of seven hundred feet (700’) at high point in pavement or the adjacent inlet, with a maximum of one thousand four hundred feet (1400’) of pavement draining towards any one inlet location.

(b). On cul-de-sac or partial cul-de-sac sections, gutter runs shall be limited to four hundred feet (400’).

(c). On major thoroughfares, gutter runs shall be limited to three hundred feet (300’).
(5). Use only Harris County and City of Houston Standard Inlets shown in Figure 3, “City of Houston Standard Inlets Acceptable to Harris County.”

(6). Storm sewer leads, twenty-four inches (24”) or larger, must be tied directly into the face or back of “B-B” or “H-2” inlet box and shall not be tied into the short side of “B-B” or “H-2” inlets.

(7). Do not use “Beehive” grate inlets or other “specialty” inlets.

(8). Do not use unprotected grate-top inlets in unlined roadside ditch.

(9). Do not place inlets in circular portion of cul-de-sac streets unless special conditions warrant otherwise and are included on approved plans and are approved prior to placement.

(10). If drainage will enter or leave proposed pavement then inlets must be located at the end of proposed pavement.

(11). Do not locate inlets adjacent to esplanade openings.

(12). Place inlets on side streets intersecting major streets, unless special conditions warrant otherwise and are included on approved plans.

<table>
<thead>
<tr>
<th>FIGURE 3: City of Houston Standard Inlets Acceptable to Harris County</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inlet Type</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B-B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>C-1</td>
</tr>
<tr>
<td>C-2</td>
</tr>
<tr>
<td>C-2A</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>Inlet Type</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>D-1</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>H-2</td>
</tr>
</tbody>
</table>
3. Consideration of Overland Flow

A. Extreme Event Analysis – The design frequency for consideration of overland sheet flow will consider extreme storm events. These events, which exceed the capacity of the underground storm sewer system and result in ponding and overland sheet flow, shall be routed to drain along street rights-of-way or open areas and through the development to a primary outlet.

B. Relationship of Structures to Street

(1). All structures shall be higher than the ponding anticipated in areas immediately adjacent to the structure as anticipated by the extreme event analysis.

(2). In those cases where the design engineer has determined that the sheet flow ponding will encroach within a ten-foot (10’) radius of any point of the structure’s building pad, the engineer shall show the proposed structure’s minimum slab elevation at eighteen inches (18”) above the 100-year flood plain, or, one-foot (1’) above the ponding depth, whichever is greater.

(3). Slab and drainage elevations, conduit locations, and grading for the extreme event shall be shown on a specifically designated page of construction plans.

C. Calculation of Flow

(1). Streets will be designed so that consecutive high points in the street will provide for a gravity flow of drainage to the ultimate outlet.

(2). The maximum depth of ponding at high points will be six inches (6”) above top of curb during an extreme event condition.

(3). The maximum depth of ponding at low points will be eighteen inches (18”) above the top of curb during an extreme event condition.

(4). Along major thoroughfares and principal arterial streets, the depth of water along the median gutter section shall not exceed three inches (3”) in depth under the extreme event condition.
(5). Sheet flow between lots may be provided only in connection with a defined drainage easement.

(6). A map shall be provided which delineates extreme event flow direction through a proposed development and the method of discharge to the primary drainage outlet.

(7). In areas where ponding occurs and where no sheet flow path exists, a calculation must be provided which demonstrates how the runoff from a 100-year event will be conveyed and remain in compliance with the other terms of this Section.

D. Interim off-site sheet flow: Drainage swales may be used for interim offsite sheet flow in lieu of closed conduits in phased projects and for projects adjacent to existing development. This is required any time the proposed development will cause ponding on an adjacent owner’s property.

4. Design of Open Channels

A. Design Frequency

(1). Open channel design and construction standards shall follow the requirements specified in the HCFCD Criteria Manual.

(2). Design standards for outfalls into channels shall conform to those standards delineated in the HCFCD Criteria Manual.

B. Determination of Water Surface Elevation

(1). Water surface elevations shall be calculated using Manning’s Equation and the Continuity Equation.

(2). For the design storm event, the water surface must be calculated to remain within banks.

C. Design of Culverts

(1). Head losses in culverts shall conform to Texas Department of Transportation Hydraulic Manual, Chapter 4 – Culverts.
(2). Corrugated metal pipe will not be approved for permanent culverts in Harris County rights-of-way except at railroad crossings, and if used underneath the railroad crossing, the culvert shall be designed to railroad loadings.

D. Design of Outfalls

(1). All outfall designs shall conform to HCFCD Standards.

5. Design of Roadside Ditches

A. Design Frequency

(1). Roadside ditch design is permissible only for commercial areas equal to or less than one (1) acre or for single-family residential lots. Detention is required in accordance with Section 6.03 for all other conditions.

(2). The design storm event for the roadside ditches shall be a two (2) year rainfall.

(3). Design capacity under the two (2) year storm event for a roadside ditch shall be no less than 0.5 feet below the edge of pavement or the natural ground at the right-of-way line, whichever is lower.

(4). The design shall include an extreme event analysis to indicate that the proposed structures will not be flooded.

(5). Outfall drainage to existing roadside ditches shall be limited to tracts with frontage along the roadside ditch. If no frontage to the roadside ditch exists, but it can be shown with detail topographic surveys that the tract ultimately drains to the roadside ditch, then outfall will only be considered with full retention of the storm water during the design rainfall event.

B. Velocity Considerations

(1). For grass-lined sections, the maximum design velocity shall be four feet (4’) per second during the design event.
(2). A grass-lined or unimproved roadside ditch shall have side slopes no steeper than three (3) horizontal to one (1) vertical (3:1) or as soil conditions will permit. Steeper slopes will be allowed when the existing right-of-way is limited or other construction features dictate the design. The steepest slope shall not exceed two (2) horizontal to one (1) vertical (2:1).

(3). The minimum grade for roadside ditches shall be 0.1 foot per 100 feet.

(4). Calculation of velocity shall use a Manning’s roughness coefficient of 0.04 for earthen sections and 0.025 for ditches for paved inverts.

(5). Erosion control methods shall be used when design velocities are expected to be greater than four feet (4’) per second or where erodable soil conditions are indicated in the geotechnical report.

C. Culverts

(1). Culvert length shall be determined by measuring the width of the crossing and adding a one-foot (1’) shoulder to each edge of radius of the crossing and the intersection length from the edge of the shoulder to the flow line of the ditch. The slope will not be steeper than a three (3) horizontal to one (1) vertical (3:1) at each end.

(2). Culverts shall be placed at all driveway and roadway crossings and other locations where deemed necessary. The size and grade of the culvert(s) shall be provided for each lot.

(3). Pipe culverts shall conform to ASTM Specification C-76, Class III, for reinforced concrete pipe.

(4). The size of roadside culverts is to be based upon drainage area. Notwithstanding this requirement, the minimum culvert size shall be eighteen inches (18”) for residential and commercial driveways.

(5). All proposed and reasonably expected future culverts shall be included in the hydraulic profile. The culvert used shall not create a headloss of more than 0.20 feet greater than the normal water surface profile without the culvert.
(6). Storm water discharging from a ditch into a storm sewer system must be intercepted by use of an appropriate structure (i.e., stubs with ring grates or type “E” manholes).

D. Invert Protection

(1). Ditch invert protection shall be used when velocities exceed four feet (4’) per second.

(2). Ditch invert protection will be used at the upstream and downstream ends of all culverts.

E. Depth and Size Limitations for Roadside Ditches

(1). The maximum depth for a roadside ditch shall not exceed four feet (4’) below the adjacent road centerline top of pavement. There may be instances where extreme conditions may warrant a deeper ditch. In those cases, specific written prior approval must be obtained from the Harris County Public Infrastructure Department.

(2). Roadside ditch bottoms shall be at least two feet (2’) wide, unless design analysis supports a narrower width and prior written approval is obtained from the Harris County Public Infrastructure Department.

(3). A minimum distance of two feet (2’) shall be established and maintained between the right-of-way line and the adjacent edge of the bank of a ditch.

SECTION 6.03 - STORM WATER DETENTION

1. Application of Detention

A. If new development or redevelopment has the opportunity to drain directly into a channel maintained by HCFCDD, then HCFCDD criteria shall prevail.

   (1). If the drainage system for a development project outfalls directly into a channel maintained by the HCFCDD, and the requirements of the HCFCDD include payment of an impact fee, then no further impact fees or detention will be required by Harris County Public Infrastructure Department.
(2). If redevelopment occurs without increasing the overall impervious character of the site, or without increasing the drainage outfall capacity from the site, then no detention will be required.

(3). If the development involves only one single family residence where no major changes in existing drainage are proposed and the tract is not part of a larger development project, then no detention will be required.

(4). If development involves only lots fronting on County roads, no detention is required if the developed area is contained within the 150 foot lot depth fronting the road or the total impervious area does not exceed the area calculated by multiplying the 150 foot lot depth by the lot width adjacent to the County road. This provision is only applicable for single-family residential lots where no changes in existing drainage patterns are proposed for the remainder of the lot.

B. Use of on-site detention is required under these regulations when either.

(1) It is proposed that commercial development outfall into a Harris County roadside ditch, and the depth of the tract or development is greater than one hundred-fifty feet (150’) or the development is for a tract larger than one acre in size; or

(2) It is proposed that the tract or development outfall to a Harris County storm sewer system and the capacity allocated to the tract in the original design calculations is less than projected for the proposed development. This shall be evaluated using either the methodology documented in the original design calculations or that outlined in these regulations.

2. Calculations of Detention Volume

A. Design rainfall shall follow the requirement specified in the current HCFCD Criteria Manual.

B. Detention volume for new development areas is to be calculated based on the gross area of the tract being developed.
C. Detention volume for redevelopment areas is to be calculated on the basis of the amount of area of increased impervious cover.

D. Detention volume for areas proposed for gravity outfall shall be:

1. Roadside ditch outfall - 0.65 acre feet per acre with the discharge rate limited to the capacity of the adjacent storm sewer allocated to the tract or the roadside ditch capacity allotted to the tract as specified in Section 6.03 (4)(A).

2. Storm sewer outfall – 0.65 acre-feet per acre unless a formal hydrologic and hydraulic analysis shows a lower rate and volume is acceptable.

E. For the areas proposed for pumped outfall, the following criteria shall apply:

1. The detention volume shall be the same as D(1) and D(2), **EXCEPT THAT** the volume of pumped flow shall be limited to 75% of total basin capacity.

2. Automatic controls shall be incorporated to shut off all pumping when outfall system capacity is reached. Additionally, a gravity return line to the detention facility must be provided for additional head control in the event of failure of automatic level controls. Pumping cannot be resumed until the outfall has receded to one-half (½) the depth of the roadside ditch.

3. Total storage of 0.75 acre feet per acre shall be provided by detention system outfalling into roadside ditches if no hydrologic analysis is performed.

F. When parking areas are used for detention, the maximum depth of ponding in parking areas shall be nine inches (9”) directly over the inlet grate.

G. Outfall drainage to existing roadside ditches shall be limited to those tracts with frontage along the roadside ditch. In cases where no frontage on roadside ditch exists, but where it can be shown with detail topographic surveys that the tract ultimately drains to the roadside ditch, outfall shall only be considered with full retention of the storm water during the design rainfall event.
3. **Design of Basin**

The following requirements shall apply for basins designed under these Regulations:

A. The side slope ratio shall be 3:1 or flatter depending on local soil conditions.

B. The design must either prevent sheet flow down the basin side slopes or provide for adequate erosion control through the back slope drains, concrete slopes, or other acceptable methods.

C. Dry bottom basins shall be sloped to drain and dry out between storm events in order to accommodate maintenance. The minimum bottom traverse slope shall be three-fourths of one percent (0.75%), and the minimum pilot channel slope shall be one-tenth of one percent (0.1%).

D. Wet bottom basins shall meet the following criteria:

   (1). A minimum of six feet (6’) of permanent water depth is required unless the wet bottom is for purposes of wetlands.

   (2). A six-foot (6’) width minimum shelf, one-foot (1’) above static waters surface elevation is required.

   (3). Side slopes must meet the following criteria:

      (a). A ratio of 3:1 from shelf to bottom of basin; or

      (b). A ratio of 3:1 or flatter depending on local soil conditions from above shelf to natural ground.

   (4). Alternatives to items D(2) and D(3) above may be approved provided the facility design demonstrates that it can be easily maintained with due consideration of public safety.

4. **Detention Outfall Facilities**

A. The maximum discharge rate for detention facilities shall be limited to the capacity allowed to the subject tract of the receiving storm sewer. In the case of a roadside ditch outfall, the rate of runoff from the front one
hundred-fifty feet (150’) of the tract calculated is defined in Section 6.02 (1) of these regulations, assuming a runoff coefficient “C” of 0.6.

B. The outfall orifice shall be designed using the following equation:

\[
Q = \frac{CA \sqrt{2gh}}{D} = \frac{Q^{\frac{1}{2}}}{2.25} \frac{h^{\frac{1}{4}}}{D}
\]

Where

- \( Q \) = outflow discharge in cfs
- \( C \) = 0.8
- \( A \) = orifice area
- \( h \) = head – water surface differential – with a minimum of two feet (2’)
- \( g \) = gravity – 32.2 feet / sec \(^2\)
- \( D \) = diameter of orifice (inches)

C. Restrictor Criteria

(1). The minimum restrictor size shall be six inches (6”).

(2). The outfall pipe containing the restrictor shall be a minimum of eighteen inches (18”) or six inches (6”) greater than the restrictor pipe size, whichever is larger.

(3). The restrictor shall be located in the upstream end of the outfall pipe.

D. Outfall Method

(1). The outfall pipe shall be Class III Reinforced Concrete.

(2). The restrictor shall be PVC or other material acceptable to the Harris County Public Infrastructure Department.

(3). All gravity discharges shall be designed to prevent erosion of the roadside ditch.
(4). Pump systems:

(a). An outfall from a pumped discharged system shall not discharge directly into the roadside ditch but shall provide a stilling manhole or basin for pump system energy dissipation prior to a gravity discharge.

(b). The entrance velocity into the roadside ditch shall **not** exceed three feet (3’) per second.

(c). A maximum level control and return line to the detention basin shall be provided to limit head build up and control outflow into the roadside ditch during a flooding event.

E. A gravity spillway must be provided in addition to the pipe outlet to protect structures from flooding in the event the capacity of the basin is exceeded.

SECTION 6.04 - OWNERSHIP AND EASEMENTS

1. Private Facilities

A. Submission of pump system specifications and a written operating plan that defines how the pump(s) will be controlled to avoid overloading the existing system is required when pump discharge outfalls into a roadside ditch. This information shall be included in the plan detail sheets.

B. A maintenance work area of twenty feet (20’) in width surrounding the extent of the detention area shall be provided. Permanent access easements and necessary utility easements and parking lots may be included as a portion of this twenty-foot (20’) width as determined by the County Engineer.

C. Notice of Detention Requirements Form

(1). Blank forms are available upon request.
(2). The “Notice of Detention Requirements” forms shall indicate the party responsible for maintenance of the detention facility.

(3). A signed and notarized “Notice of Detention Requirements” shall be filed in the Harris County Clerk’s Office, Real Property Records.

(4). Once filed, the form becomes a legal document attached to the property in perpetuity.

(5). If conditions change and the detention system is no longer required, the Harris County Public Infrastructure Department will notify, in writing, the Harris County Clerk’s Office, Real Property Records. Such notice shall unencumber the property from the previously recorded “Notice of Detention Requirements” form.

2. Public Facilities.

A. Detention facilities will be accepted for maintenance by Harris County or the Harris County Flood Control District in cases where public drainage is being provided and the facilities meet minimum requirements for acceptance.

B. A maintenance work area of thirty feet (30’) in width surrounding the detention area must be provided. Up to 10 feet of public right-of-way may be included as a portion of the 30-foot width.

C. A dedication of easement shall be provided by plat or by separate instrument.

D. For wet bottom basins, the minimum wet surface area shall be one (1) acre unless it incorporates storm water quality features such as wetland areas.

E. Any facility draining water from public streets shall be maintained by a governmental body such as a municipal utility district or HCFCID.
SECTION 6.05 – SUBMERGED STORM SEWERS

The use of submerged storm sewers should be avoided unless it is part of a storm water quality feature/amenity lake system. For the purpose of these regulations, storm sewer systems are not considered submerged where only the outlet pipe from the last manhole entering a storm water quality/amenity lake system is below static water surface. In this case, storm sewers shall meet the following conditions:

Permanent Access Easements/Private Streets/Storm Sewers

1. Incorporate methods to drain the system in case of repairs. Methods include specifying locations of cofferdams, specifying portable pump equipment, and providing a sequence that would result in being able to drain any portion of the storm sewer within 3 days with the longest allowable time being 5 days.

2. In order to reduce the possibility of mosquito breeding, a system shall be designed such that sections of storm sewer are dry or hold a minimum of 3 inches of water and are continuously connected to the lake feature.

Public Streets/Storm Sewers

1. Incorporate a sluice gate system into design so that the lake can be drained by gravity. If desired, an additional sluice gate may be added to isolate the storm sewer system from the lake.

2. Design the sluice gate system such that upon opening, the lowest portion of the storm sewer will drain dry by gravity within 3 days with the longest allowable time being 5 days.

3. If equipped with a sluice gate designed to isolate the storm sewer, the manhole adjacent and upstream of the sluice gate must have a sump of sufficient depth to allow for pumping the system dry.

4. Provide an Interlocal Agreement, in a form acceptable to the County Attorney, between the utility district or other political subdivision of the State and the County indicating the following:

   a) The entire system shall be covered by a drainage easement dedicated to the public.
b) The utility district will accept the dedication of the sluice gate system for maintenance.

c) The utility district will make available to the County all complaints regarding the storm sewer system and the utility district’s repair and maintenance records.

d) The utility district agrees not to damage any pavement or storm sewer in its maintenance of the sewer system.

5. In order to reduce the possibility of mosquito breeding, a system shall be designed such that sections of storm sewer are dry or hold a minimum of 3 inches of water and are continuously connected to the lake feature.

The following additional design requirements apply to submerged storm sewer systems.

a) The hydraulic gradient shall be calculated using the static lake level as the starting water surface elevation.

b) All storm sewer pipe shall be reinforced concrete pipe ASTM, C-76, Class III with joint conforming to ASTM C-361 with rubber gaskets conforming to ASTM, C-443.

c) All storm sewers shall be encased in cement stabilized sand in conformity with City of Houston drawings, 02317-03, 02317-05, 02317-06, and 02317-07, as appropriate.
SECTION 7 - PAVING

SECTION 7.01 – PAVING DESIGN REQUIREMENTS

The following design requirements are applicable to all pavement that is designed and constructed under Harris County jurisdiction by the development community.

SECTION 7.02 - DESIGN REQUIREMENTS

The following design requirements are applicable to pavement within the Harris County street right-of-way:

1. PAVEMENT WIDTH – The width shall be in accordance with the following Table 7.1, “Roadway Classifications and Section Requirements” and the “Geometric Design Guidelines for Subdivision Streets, Harris County and City of Houston” as adopted by Harris County Commissioners’ Court on October 1, 1985.
**Table 7.1 Roadway Classifications and Section Requirements**

<table>
<thead>
<tr>
<th>Land Use on Both Sides of Right-of-Way (R.O.W.)</th>
<th>Roadway Classification on Table IV.1</th>
<th>Portland Cement Concrete</th>
<th>Major Thoroughfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single family Residential on both sides of R.O.W.</td>
<td>Local</td>
<td>28’ (B-B)</td>
<td>2/25’</td>
</tr>
<tr>
<td>Single Family Residential Reserve Restricted to Landscape or pocket parks less than one acre</td>
<td>Local</td>
<td>28’ (B-B)</td>
<td>2/25’</td>
</tr>
<tr>
<td>Single Family Residential Detention Pond or Amenity Lake</td>
<td>Collector</td>
<td>28’ (B-B)</td>
<td>2/25’</td>
</tr>
<tr>
<td>Single Family Residential Reserve Restricted to Recreation/Open</td>
<td>Collector</td>
<td>41’ (B-B)*</td>
<td>2/25’</td>
</tr>
<tr>
<td>Single Family Residential Unrestricted or Restricted to Commercial or Industrial</td>
<td>Thoroughfare</td>
<td>41’ (B-B)</td>
<td>2/25’</td>
</tr>
<tr>
<td>Restricted Reserve to Commercial or Industrial on both sides of R.O.W.</td>
<td>Thoroughfare</td>
<td>41’ (B-B)</td>
<td>2/25’</td>
</tr>
</tbody>
</table>

*A waiver to this requirement may be requested if onsite parking is proposed. A site plan for the reserve development indicating the type of facilities and number of parking spaces proposed is required to be submitted with the preliminary infrastructure drawing submittal. Harris County will make a determination if the proposal is satisfactory. If acceptable, a letter of certification from the developer stating that the required number of parking spaces will be provided in connection with the development of the reserve is required as a condition of signature and approval of the infrastructure drawings.

**Notes:**
1. 4x12 curb section shall only be approved on streets where single family structures are taking direct primary access.
2. Alternative paving sections may be considered and approved by the County Engineer for master planned, mixed-use developments.
Table 7.1 Continued below:

<table>
<thead>
<tr>
<th>Land Use on Both Sides of right-of-Way (R.O.W.)</th>
<th>Roadway Classification on Table IV.1</th>
<th>Single Paving Section with Roadside Ditches</th>
<th>Double Paving Section with Roadside Ditches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single family Residential on both sides of R.O.W.</td>
<td>Local</td>
<td>22’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
<tr>
<td>Single Family Residential Reserve Restricted to Landscape or pocket parks less than one acre</td>
<td>Local</td>
<td>22’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
<tr>
<td>Single Family Residential Detention Pond or Amenity Lake</td>
<td>Collector</td>
<td>22’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
<tr>
<td>Single Family Residential Reserve Restricted to Recreation/Open</td>
<td>Collector</td>
<td>41’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
<tr>
<td>Single Family Residential Unrestricted or Restricted to Commercial or Industrial</td>
<td>Thoroughfare</td>
<td>41’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
<tr>
<td>Restricted Reserve to Commercial or Industrial on both sides of R.O.W.</td>
<td>Thoroughfare</td>
<td>41’ (E-E) with 6’ shoulders</td>
<td>2/24’ (E-E) with 6’ shoulders</td>
</tr>
</tbody>
</table>
PAVEMENT THICKNESS

A. Local, Collector, Thoroughfare

(1). Concrete - The requirements presented in Table 7.2, below shall be the minimum allowable local, collector, thoroughfare thicknesses utilizing Portland cement concrete. These thicknesses were developed considering both the Portland Cement Association (PCA) design method ("Design of Concrete Pavement for City Streets", 1974) and the American Association of State Highway and Transportation Officials (AASHTO) method ("AASHTO Guide for Design of Pavement Structures", 1993).

Table 7-2. Concrete Thickness for 30-Year Design Life

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Concrete Pavement Thickness, in.</th>
<th>28-day Compressive Strength, $f_c'$, psi</th>
<th>Minimum Required Depth of Stabilization, in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local$^2$</td>
<td>6</td>
<td>3000</td>
<td>6</td>
</tr>
<tr>
<td>Collector$^2$</td>
<td>6</td>
<td>3000</td>
<td>6</td>
</tr>
<tr>
<td>Thoroughfare$^2$</td>
<td>7</td>
<td>3000</td>
<td>8</td>
</tr>
<tr>
<td>Principal Thoroughfare$^2$</td>
<td>8$^1$</td>
<td>4500</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>10$^1$</td>
<td>3000</td>
<td>8</td>
</tr>
</tbody>
</table>

Notes:

1. For principal thoroughfares in excess of 30,000 VPD (see criteria below).
2. For paving design purposes, see definitions for local, collector, and thoroughfare as described in “Section 12 – Traffic” of these regulations.

(2). Asphalt, Flexible Base – roads shall use a minimum of a six-inch (6") stabilized subgrade, eight inches (8") of base course, one and one-half inches (1½) hot mixed, hot laid asphalt. Alternative
pavement design may be considered provided the equivalent structural number is met or exceeded. Flexible base pavement for all developments, other than low density, single-family, shall be designed in accordance with the design parameters in Section 2, below.

B. Principal Thoroughfares (in excess of 30,000 VPD on year 15 of design life). A licensed engineer shall design the pavement thickness and reinforcement using the AASHTO method and Harris County Public Infrastructure Department specified design parameters. The pavement thickness and reinforcement design shall be based on a current soil analysis, stabilized subgrade, roadway use (including the design lane traffic volume) and life span of the proposed pavement.

Harris County Public Infrastructure Department specified design parameters for reinforced concrete designs for Principal Thoroughfares are:

<table>
<thead>
<tr>
<th>AASHTO Design Parameter</th>
<th>Design Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Coefficient, C_d</td>
<td>1.2</td>
<td>Good to excellent, 1% Excellent, 1% to 5%</td>
</tr>
<tr>
<td>Load Transfer Coefficient, J</td>
<td>3.2</td>
<td>Jointed, reinforced pavement with load transfer such as dowels, specified by detail</td>
</tr>
<tr>
<td>Loss of Support, LS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Modulus of Rupture, S'_c</td>
<td>See comment</td>
<td>Dependent on required concrete compressive strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=570 psi for f'_c =3000 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=620 psi for f'_c =3500 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=660 psi for f'_c =4000 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=710 psi for f'_c =4500 psi</td>
</tr>
<tr>
<td>Reliability, R</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Initial Serviceability Index, p_o</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Terminal Serviceability Index, p_t</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Elastic Modulus, E_c</td>
<td>See comment</td>
<td>Dependent upon required concrete strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E_c=3.6x10^6 psi for f'_c =3000 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=3.8x10^6 psi for f'_c =3500 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M_r=4.0x10^6 psi for f'_c =4000 psi</td>
</tr>
<tr>
<td>AASHTO Design Parameter</td>
<td>Design Value</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td>Friction Factor, $F$</td>
<td>1.8</td>
<td>Lime, lime-fly ash, asphalt or cement stabilized subgrade</td>
</tr>
<tr>
<td>$M_r = 4.2 \times 10^6$ psi for $f'_c = 4500$ psi</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Harris County Public Infrastructure Department specified design parameters for flexible paving designs based on available traffic data are:

<table>
<thead>
<tr>
<th>AASHTO Design Parameter</th>
<th>Design Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability, $R$</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation, $S_o$</td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Soil Resilient Modulus, $M_r$</td>
<td>30,000 psi</td>
<td>$M_r = 1500 \times CBR$; CBR estimated as 20 for stabilized subgrade</td>
</tr>
<tr>
<td>Drainage Coefficient, $m_2 m_3$</td>
<td>1.25</td>
<td>AASHTO Table .24 – good quality drainage (1% - 5%) – drains within 1 day</td>
</tr>
<tr>
<td>Initial serviceability index, $p_o$</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Terminal serviceability index, $p_t$</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

**Structural layer Coefficients**
- Hot-mixed hot-laid asphalt surface material: 0.44
- Black base: 0.34
- Cement-stabilized limestone: 0.23
- Lime-stabilized limestone: 0.17
- Crushed recycled concrete: 0.14
- Raw limestone: 0.14
- Cement-stabilized earth: 0.15
- Lime-stabilized or lime-fly ash stabilized earth: 0.11

**Minimum acceptable recommended thickness**
- Surface course: 2 in.
- Base course: 4 in.
SECTION 7.03 – MATERIALS REQUIREMENTS

The following requirements shall apply to paving subject to the jurisdiction of the Harris County Public Infrastructure Department:

1. The concrete mix design shall be either of the following options:
   
   A. A mix design containing five (5) sacks of cement per cubic yard with no Fly Ash allowed; or
   
   B. A mix design containing Fly Ash and cement that has cementitious content of not less than five and one half (5 ½) sacks per cubic yard. The Fly Ash content shall not exceed twenty-five percent (25%) by weight.

2. All concrete pavement shall have a minimum design and in place compressive strength of 3000 psi at twenty-eight (28) days.

3. Concrete for principal thoroughfares shall meet the design determined by the AASHTO design required in Section 7.02 B, above.

4. Reinforcing

Reinforcing for Local, Collector, and Thoroughfares shall meet the size, strength, and spacing shown in Table 7.3 following:

<table>
<thead>
<tr>
<th>AASHTO Design Parameter</th>
<th>Design Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-base course</td>
<td>4 in.</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 7.3

REINFORCING STEEL BAR SIZES AND SPACING
FOR VARIOUS PAVEMENT THICKNESS (D) AND WIDTH (W)
WITH:
EXPANSION JOINT SPACING = 80 FT (MAXIMUM)
\( f_{c'} = 3,000 \text{ PSI AND } f_y = 60,000 \text{ PSI} \)

<table>
<thead>
<tr>
<th>PAVEMENT THICKNESS D (IN)</th>
<th>PAVEMENT WIDTH (FT)</th>
<th>NUMBER OF BARS</th>
<th>SPACING (IN)</th>
<th>END BAR SPACING (IN)</th>
<th>SPACING (IN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>28</td>
<td>17</td>
<td>20.50</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>25</td>
<td>17</td>
<td>18.25</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>35</td>
<td>24</td>
<td>18.00</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>36</td>
<td>25</td>
<td>17.75</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>37</td>
<td>25</td>
<td>18.25</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>41</td>
<td>28</td>
<td>18.00</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>45</td>
<td>31</td>
<td>17.75</td>
<td>3</td>
<td>36</td>
</tr>
</tbody>
</table>

A. Minimum lap length for #4 reinforcing steel shall be twenty-two inches (22”). For all cold construction joints, use four-foot (4’), Grade 40 L-bars spaced at 24-inch centers through the deformed metal strip.

B. Expansion joints in cul-de-sacs and knuckles shall be placed as shown in Appendix “J”.

5. Asphalt

Hot mix asphalt shall meet the requirements of “Harris County Specifications, Item No. 340”. (Complete Harris County Specifications are available online at www.eng.hctx.net).

6. Base Course Requirements

A. Cement stabilized crushed aggregate base course shall meet the requirements in “Harris County Specifications, Item No. 231” except that
Section 231.3 is modified so that the base course shall be compacted to 95% Standard Proctor Density, ASTM D-698.

B. Hot mix asphaltic concrete base course (black base) shall meet the requirements in “Harris County Specifications, Item No. 250.”

C. Untreated aggregate base shall meet the requirements in Harris County Specifications Item No. 230. Placement requirements shall be included in the construction drawings, maximum eight-inch (8”) lifts, compacted to 95% Standard Proctor Density, ASTM D-698.

7. **Stabilized Subgrade Requirements**

The geotechnical engineer shall provide subgrade treatment recommendations including type of stabilizer and anticipated application rate (lb/yd²) to develop the required subgrade density design requirements.

A. Lime-stabilized subgrade shall meet the requirements outlined in “Harris County Specifications, Item Nos. 220 and 221”.

B. Cement-stabilized subgrade shall meet the requirements outlined in “Harris County Specifications, Item No. 222”.

C. Lime fly ash or fly ash stabilized subgrade shall meet the requirements outlined in “Harris County Specifications, Item No. 223”.

D. Commercially available products shall meet the requirements of the manufacturer and the geotechnical engineer and shall be approved by Harris County Public Infrastructure Department.

**SECTION 7.04 – SPECIFICATION REQUIREMENTS**

1. Pavement shall be constructed in accordance with “Harris County Specifications, Item No. 360”, as modified below, for all privately funded local, collector, or thoroughfare roadway projects.

A. Section 360.2, is hereby modified to provide fly ash shall conform to the requirements of ASTM C618 to allow Type ‘C’ and Type ‘F’ fly ash.

B. Section 360.2(6), is hereby modified to require the use of grade 60 steel.
C. Section 360.2(7), is hereby modified to provide ¾-inch dowels.

D. Section 360.2(7), is hereby modified to allow the use of a metal center strip in lieu of saw cutting the center longitudinal contraction joint.

E. Section 360.3, is hereby modified to provide for the use of concrete cylinders to determine strength in lieu of beams as prescribed in ACI 318, Section 5.6.2. The strength level of the concrete shall be considered acceptable if both of the following conditions are met: 1) Every arithmetic average of any three consecutive strength tests equals or exceeds the specified strength, and 2) No individual strength test (average of two cylinders) falls below the specified strength by more than 500 psi.

F. Sections 360.3(c), is hereby modified to allow a slump range of 2½" - 6".

G. Section 360.4, is hereby modified to allow the use of wood forms for six-inch (6") and seven-inch (7") pavement sections. The bottom flange of steel forms shall be two inches (2") or more. If other commercially available types of forms are used they shall be installed in accordance with the manufacturer’s suggested method and meet the approval of the design engineer and Harris County Public Infrastructure Department.

H. Section 360.7, is hereby modified to allow steel reinforcing to be secured at every other bar intersection on the interior portion of each panel.

I. Section 360.10, is hereby modified to allow placement at contractor’s responsibility based upon equipment sequence utilized in accordance with recommendations and practices of ACI 304.

J. Section 360.10, is hereby modified to provide for finish in accordance with ACI 325.6R.

K. Section 360.14 Deficient Pavement Thickness, is hereby modified as follows:

It is the intent of Harris County to receive and accept streets and roads into the County’s System of Maintained Roads that are constructed in strict conformity with the paving thickness shown on the approved construction drawings.

Pavement that is constructed and cored in accordance with this specification shall be acceptable if the measurement of any core is not deficient by more than 0.30 inches from the thickness shown on approved construction plans.
If a core shows the pavement to be deficient in thickness by more than 0.30 inches but less than 0.5 inches, the following procedure may be followed:

1. Additional cores for deficient pavement thickness will be taken at ten-foot (10’) longitudinal intervals and at random locations transversely on each side of the deficient core until a core is taken that is acceptable. If the new cores on either side of the deficient core are acceptable and the average of the three cores is not more than 0.30 inches less than the original plan thickness, the pavement is acceptable.

2. If the average of the cores in (1), above, is not acceptable, then additional cores shall be taken until an acceptable core is found on each side of the original deficient core. All concrete between the two acceptable cores shall be removed and replaced to the centerline joint.

3. All cores shall be from the same pavement pour.

Any core that is deficient by more than 0.5 inches is unacceptable. If a core is unacceptable then take additional cores out of the same pour on each side of the deficient core at ten-foot (10’) intervals until the pavement thickness is found to be acceptable as stated above. All concrete between the two acceptable cores shall be removed and replaced to the centerline joint.

L. All references to Harris County Specification requirements contained in this document pertain to the technical provisions of the specifications and not to the measurement and payment provisions therein.

M. Section 360.8 is hereby modified to allow use of fly ash in lieu of retarder up to a temperature of 97° if approved.

N. Section 360.12 is hereby modified to use 2700 psi compressive strength in lieu of flexural strength.

SECTION 7.05 – GEOMETRIC REQUIREMENTS

1. Curb and Gutter Sections

A. The minimum gradient on gutters shall be 0.25 percent.

B. The maximum drop of grade tangents from opposite directions to a common inlet shall be 1.5 feet.
C. The maximum allowable curb run to an inlet shall be seven hundred feet (700′) in one direction for residential streets and three hundred feet (300′) in one direction for major thoroughfares or streets within commercial developments.

D. There shall be a minimum one percent (1%) fall around intersection turnout for a minimum radius of twenty-five feet (25′). The grade for larger radius shall be determined on an individual basis.

E. Vertical curves shall be installed when algebraic difference in grades exceeds one percent (1%). Elevations shall be shown at ten-foot (10′) intervals through vertical curves.

F. The required radius of cul-de-sac pavement is as follows:
   (1). Residential radius shall be a minimum of forty-two feet (42′) to face of curb; and
   (2). Commercial radius shall be a minimum of fifty feet (50′) to face of curb.

G. When a curb and gutter intersects a drainage ditch, the grade of the gutter must be above the designed water surface of the ditch in accordance with requirements of the Harris County Flood Control District.

H. The minimum grade for cul-de-sac shall be 0.60 percent along gutter.

I. All major thoroughfares shall be super elevated in accordance with sound engineering practice whenever the center line radius of lanes or rights-of-way are less than two-thousand feet (2,000′) in accordance with AASHTO’s, “A Policy on Geometric Design.”

J. For boulevard sections, the amount of cross slope over the pavement section shall be shown on the drawings. The usual cross slope is one-fourth inch (1/4″) per foot from curb line to curb line, and one-eighth inch (1/8″) per foot for left turn lanes and esplanade crossovers.

K. For streets with single paving sections, the amount of cross slope over the pavement section shall be in accordance with Harris County Drawing S/D-1, “Subdivision Pavement Standards.”

L. A minimum gradient of 0.40 percent around the longest radius is required on an L-type street intersection.

M. All grades shall be laid to match the top of the curb of an existing inlet.
N. All vertical curves shall be labeled every ten feet (10'). A minimum of 0.03 feet on ten-foot (10') intervals shall be maintained by altering the calculated elevations.

O. When the curb grades are not laid below the natural ground, fill lines shall be shown on the drawings and shall be of a sufficient height to ensure a minimum of three-eighths inch (3/8") per foot transverse slope toward the curb from the property line between a point two feet (2') outside the right-of-way and the top of the curb. If this type fill is required and the pavement is adjacent to a non-participating property owner, fill easements from this property owner must be obtained and filed. A copy of the recorded easement document shall accompany the final drawings.

P. All grades shall be labeled for all top of curbs except at railroad crossings. Centerline grades are only acceptable for approved streets with ditch sections.

Q. Gutter elevations are required for vertical curves where a railroad track is being crossed.

R. The gradient for tangents to vertical curves at railroad crossings shall be a maximum of three and one-half percent (3.5%) and four percent (4%) at bridges, box culverts, and pedestrian tunnels.

S. Where railroad crossings are not at right angles to the pavement slab, vertical curves should be calculated for each curb line and should be posted at ten-foot (10') intervals in the profile.

T. Valley Gutters are not permitted.

2. Roadway Sections with Ditches

A. The minimum grade on ditches shall be one percent (1.0%). If ditches exceed 4 feet in depth, with side slopes steeper than 5 to 1, guard rails shall be required or ditches piped unless an alternative design meeting the intent of this section is submitted and approved.

B. The ditch shall be designed to handle runoff as determined in Section 6.02 “Design Requirements”, above.

C. The side slopes of ditches shall not be steeper than a ratio of 3:1 for unimproved ditches. Steeper slopes may be allowed when existing right-
of-way is limited or other construction features dictate the design. Prior written approval by the Harris County Public Infrastructure Department shall be obtained for steeper slopes.

D. All culverts shall be designed to carry ditch discharge. The minimum culvert size shall be eighteen inches (18”). All driveways shall have culverts or bridges.

3. Curbs

A. The standard curb height for residential streets is either the standard six-inch (6”) curb or a four-inch by twelve-inch (4”x12”) roll-over curb configuration. Islands shall be constructed only with a six-inch (6”) standard curb height in accordance with Harris County Drawing S/D-1, “Subdivision Pavement Standards.”

B. Curbs are to be decreased from six inches (6”) to two inches (2”) in ten feet (10’) when approaching railroad tracks or an existing roadway without curbs.

4. Sidewalks and Driveways

A. All sidewalks and driveways shall conform to the latest revision of the “Regulations of Harris County for the Construction of Driveways and Culverts on County Easements and Rights-of-Way” and in accordance with the requirements of the Texas Department of Licensing and Regulation (TDLR).

B. Paved median noses constructed in esplanades shall be six inches (6”) thick with surface colored black six feet (6’) deep measured from the end of the median nose or until the curbs are four feet (4’) in width face to face, which ever is greater. This requirement is imperative for esplanade noses.

C. Harris County Public Infrastructure Department requires the installation of wheelchair ramps at all intersections unless there are pre-existing conditions, which make installation infeasible or where installation would create an unsafe situation for pedestrians. Wheelchair ramps shall connect to adjacent sidewalks if installed and all ramps shall be designed in accordance with the requirements of the Texas Department of Licensing and Regulation (TDLR).
5. Requirements for Intersections, Turnouts, Transitions, and Thoroughfares

A. At a “T” intersection with a street that has not been improved to its ultimate width, concrete pavement should be stopped either at the right-of-way line or the end of the curb return, whichever would require less concrete removal at a future date.

B. When roadway turnouts are placed where an existing cross street intersects, the turnout should be sized to fit the ultimate pavement width and then transitioned to the existing roadway utilizing the same materials as exist on the existing road/street. The length of transition shall conform to “Geometric Guidelines for Subdivision Streets, Harris County, and City of Houston,” (and any subsequent revisions thereto) as adopted by Commissioners’ Court on October 1, 1985.

C. When paving only one (1) roadway of a proposed two (2) roadway thoroughfare, all left turn lanes and esplanade crossovers in the one-half (1/2) of the right-of-way where the roadway is being paved shall be paved to the center line of the street right-of-way.

D. When meeting an existing concrete street at right angles, the existing street shall be saw cut in a V-shape extending from the curb returns to a point where the center line of the proposed pavement intersects the quarter point of the existing street in order to create a crowned intersection. In the event that this construction would cause an excessively rough riding condition which would make adequate control of the vehicle difficult, a special design will be considered to eliminate this condition.

E. All traffic signs, striping, channelization devices, etc., must comply with the latest edition of the “Texas Manual on Uniform Traffic Control Devices.”

6. Miscellaneous Paving Requirements
A. If driveways are to be constructed with the paving project, show the driveways on the drawings and post a center line for the driveway at the property line with elevation for each drive.

B. Private streets shall be treated as if they were driveways, and the sidewalk area should be honored with no curb extending through this area unless the private street is constructed to public street standards, including wheelchair ramps.

C. Load transfer devices shall be placed at the end of all concrete streets and protected from corrosion.

D. All concrete that must be removed shall be removed either to an existing joint or a sawed joint.

E. A thirty (30) mph minimum sight distance shall be used on all crest vertical curves. A forty (40) mph minimum sight distance shall be used for major thoroughfares.

F. Barricades which meet the City of Houston requirements (Type III) must be placed at the end of all dead-end streets that do not terminate in a cul-de-sac.

G. Prior to final acceptance of the improvements by Harris County, the owner of the development must furnish and install the street name signs for all intersections. The street name signs shall be standard City of Houston type signs.

H. A letter of agreement from the entity approving the construction plan crossing is required when paving is placed over a transmission pipeline.

I. Horizontal dowels are required when meeting concrete pavement that has no exposed steel and further:

   (1). The dowels shall be #6 bars, twenty-four inches (24”) long, twenty-four inches (24”) center to center, embedded twelve inches (12”), and epoxied; and

   (2). As an alternate to (1) above, the existing pavement may be saw cut and removed to expose a minimum of twelve inches (12”) of steel (longitudinal) to the new construction with an equivalent cross section area of steel equal to the proposed pavement steel.
J. All guidelines set forth in the “Texas Manual on Uniform Traffic Control Devices” shall be strictly followed.

K. “Cold” joints in pavement are prohibited.
SECTION 8.0 - STRUCTURES

1. The inclusion of bridges or other ditch type crossings may be required as part of a project in order to maintain a smooth flow of vehicular traffic through any given area. In the event uncertainty exists concerning whether or not a bridge will be required, it is advisable to contact the Harris County Public Infrastructure as soon as possible so that the issue can be resolved while the project is in the planning stage.

For all bridges and similar crossings that are to be constructed within the jurisdiction of Harris County, the following requirements shall apply:

A. All bridges and box culverts to be designed to minimum H20 or HS-20 as applicable load design.

B. Bridge Widths

(1) Where there are no curbs on the approach pavement to the bridge, the width of the bridge (face to face of curbs) shall be out to out distance of the approach road pavement edges plus two feet (2’) each side, plus the walk or walks. The sidewalks shall be four-foot (4’) clear width type.

(2.) Where there are curbs on the approach pavement to the bridge, the width of the bridge (face to face of curbs) shall be the same as the distance between curb faces on the approach road. The sidewalks shall be six-foot (6’) clear-width type.

C. Individual one way traffic bridges on esplanade boulevards shall have one walk on the outside of either side of the bridge and two way traffic bridges shall have a walk on each side of the bridge.

D. All bridges shall be of reinforced concrete design unless specific application require other materials and then only with prior approval of the Harris County Public Infrastructure Department.

E. All bridge railings shall be galvanized or stainless steel on reinforced concrete parapet walls.
F. All galvanized Flex Beam Guard Rails shall be designed and constructed in accordance with the Harris County Public Infrastructure Department drawing titled “Flex Beam Guard Rail Detail”.

G. All design and construction shall be in conformance with “Harris County Specification Item No. 420, Concrete Structures” and all other applicable Harris County specification items.

H. Where culverts are used as a bridge, the headwall shall be of a sufficient height to allow construction of the guardrail and sidewalk at the elevation of the roadway.
SECTION 9.0 - TESTING REQUIREMENTS

SECTION 9.01  GENERAL

1. All construction materials shall be tested and monitored by an A2LA or AASHTO accredited laboratory.

2. All construction materials shall be tested and monitored in accordance with provisions referenced in Section 7.04.

3. Any engineering technician performing testing in accordance with these rules shall be proficient for the type of testing required as deemed by the engineer-in-charge of the accredited laboratory.

4. Upon completion but prior to the acceptance of the work by Harris County Public Infrastructure Department, the accredited materials engineering laboratory shall submit to the Harris County Public Infrastructure Department a written statement of substantial compliance sealed by a professional engineer licensed in the State of Texas. The written statement of substantial compliance must acknowledge that all construction materials and operations used in the project were tested and inspected by accredited laboratory and that they comply with all the specifications applicable to the project.

SECTION 9.02 - BEDDING AND BACKFILL

The testing of materials used for bedding and backfill of storm sewers as well as other utility located underneath or within one-foot (1’) of subgrade shall be conducted to ensure compliance with “Harris County Specification No. 430” and the project specifications.

SECTION 9.03 - SUBGRADE TESTING

1. All paving subgrade shall be proof-rolled after the roadway has been cut to grade. The Design Engineer, Accredited Laboratory, or their designated representative shall monitor proof-rolling operations and shall determine whether remediation of weak areas is required before subgrade treatment. If remediation is required, the Design Engineer or Accredited Laboratory shall provide recommendations for remediation. The Design Engineer shall determine equipment that is suitable for use during proof-rolling.
2. Samples of the paving subgrade shall be taken to verify the applicability of the recommended stabilization type and quantities. The Accredited Laboratory shall determine the frequency of sampling. The Accredited Laboratory shall confirm that the stabilizer type and application rate provided in the plans and specifications is appropriate or shall provide the appropriate stabilizer type and application rate based on laboratory testing of the paving subgrade.

3. Density tests shall be performed every 300 linear feet of chemically treated subgrade. Closer spacing for density testing may be required to verify conformance with project specifications.

4. In the event of rainwater standing on the subgrade after densities are made or other conditions beyond the Contractor’s control, and if the Design Engineer deems that the subgrade condition has been adversely affected, proof rolling of the subgrade will be required if reinforcing steel has not been placed. In the event that reinforcing steel is present, in-place densities will be performed; however, the Design Engineer may request that the steel be removed and the subgrade subjected to proof-rolling.

5. A minimum of three (3) in-place density tests per street are required.

6. The contractor is required to have copies of treated subgrade density test reports in his/her possession at the construction site at the time of placement of base material. The test date shall be clearly marked on the test reports.

SECTION 9.04 - FLEXIBLE BASE

1. All base material shall be from an approved Texas Department of Transportation (TxDOT) supplier or supplier approved by the Design Engineer.

2. A minimum of three (3) density tests per street are required to verify conformance of compaction to the project specifications.

SECTION 9.05 - SURFACE COURSE

1. All surface course material shall be provided from an approved TxDOT supplier or supplier approved by the Design Engineer.
2. Testing shall be performed through asphalt cores to verify compaction criteria outlined in the project specifications is met.

SECTION 9.06 - CONCRETE PAVEMENT

1. All concrete shall be provided from an approved TxDOT supplier or supplier approved by the Design Engineer.

2. The testing Laboratory shall review the submitted concrete mixture proportions to ensure the requirements of the project specifications are met.

3. A minimum of four (4) test cylinders shall be made for each 125 cubic yard, or portion thereof, placed each day. Samples shall be taken in accordance with ASTM C 172 and molded and cured in accordance with ASTM C 31. Field tests including measurement of ambient temperature, concrete temperature, slump, and air content shall be made in accordance with the appropriate ASTM test methods, where applicable.

4. All test specimens shall be prepared in accordance with ASTM C 617 and tested in accordance with ASTM C 39. Two (2) specimens shall be tested at seven (7) days and two specimens shall be tested at twenty-eight (28) days. The acceptance test results shall be the average of the two specimens tested for each age interval. If one specimen in a test age indicates evidence of improper sampling, handling, molding or testing, it shall be discarded and the strength of the remaining specimen shall be considered the test result. Should both specimens in a test interval show any of the aforementioned defects, Harris County may request that cores of the pavement placed in the affected area be re-taken.

5. Additional test specimens may be required due to concrete placing conditions or for adequately determining the strength of concrete when early opening of the paving to traffic is necessary and/or desirable.

SECTION 9.07 - CONCRETE CORES

1. Once the pavement has been in place for a minimum of fourteen (14) days, one core shall be taken for each 1,000 square yards of pavement or portions thereof with a minimum of one core on each street. Cores shall be taken
alternately in each one-half section of the pavement. The Design Engineer or the Testing Laboratory Engineer shall select locations of the cores.

2. All cores shall be broken at twenty-eight (28) days in accordance with ASTM C 42. Each core shall meet the minimum compressive strength requirement outlined in the project specifications. If a core fails to meet the minimum strength requirement, additional cores may require testing to meet the aforementioned testing requirements.

3. See Section 7.04 (1)(K), above for a discussion of pavement thickness verification by concrete cores.

SECTION 9.08 - STRUCTURES

1. Testing for bridges and structures shall be in accordance with the project specifications.
SECTION 10 - INSPECTIONS

SECTION 10.01 - CONSTRUCTION INSPECTION

The construction of improvements shall be conducted under the supervision of a licensed engineer who shall ensure that work is performed in accordance with the approved drawings. Monitoring shall be performed by the following:

1. The Design Engineer shall provide a qualified onsite inspector throughout the construction project for all significant operations.

2. A construction materials technician proficient in the type of testing being performed as deemed by the engineer-in-charge of the accredited laboratory.

3. An inspector from Harris County.

SECTION 10.02 - NOTICE OF START

The contractor shall notify the Harris County Public Infrastructure Department in writing (facsimile acceptable) a minimum of twenty-four (24) hours in advance of the work commencing on the project. The notice shall include the development permit number issued under the “Regulations of Harris County, Texas, for Flood Plain Management.” Failure to follow these requirements may result in the County not accepting the paving and drainage facilities for maintenance upon completion.
SECTION 11 - ACCEPTANCE OF IMPROVEMENTS WITHIN SUBDIVISIONS

SECTION 11.01 – ACCEPTANCE PROCEDURES

A project is eligible for initial acceptance inspection at such time as the pavement and drainage facilities have been completed and the subdivision plat and required right-of-way or easement instruments have been recorded in the Official Public Records of Harris County.

To schedule an initial inspection, the Engineer of Record shall submit the following:

1) A completed “Request for Initial Inspection Form” as promulgated by the County Engineer.

2) A blue line copy of the approved drawings for the project. These drawings shall be stamped record drawings, sealed by a licensed engineer and shall have the following statement. “This project is constructed in general conformance with these plans and elevations on these drawings represent what was constructed within engineering tolerances.”

3) A copy of any performance and payment bonds issued to the developers by the paving and underground contractors.

4) A “Laboratory Acknowledgement Form” as promulgated by the County Engineer demonstrating the project met all testing and performance requirements.

5) Two copies of the recorded plat.

Upon completion of the inspection, the County Engineer shall issue a punch list indicating any items that must be addressed prior to the start of the one-year warranty period. Once all paving and drainage items are corrected as well as any safety related items, the County Engineer shall issue a Letter of Substantial Completion indicating the improvements appear to meet the approved plans and specifications for the project and specifying the date the project will be eligible for final inspection and acceptance for County maintenance. This date will be one calendar year after the date of the Letter of Substantial Completion.

To schedule a final inspection, the engineer shall submit the following:
1) A completed “Request for Final Inspection Form” as promulgated by the County Engineer.

2) A “Directive for Financial Assurance Form” as promulgated by the County Engineer. This form indicates if the developer wishes to forfeit the submitted financial assurance in lieu of completing any necessary repairs found on the inspection.

Upon receipt of the above items, the County Engineer shall schedule an inspection notifying the applicable Precinct representative, developer, engineer, and contractors of the scheduled inspection date.

After completion of the inspection and any subsequent re-inspections, the County Engineer shall do one of the following in regard to any Financial Surety consisting of cash:

1) Recommend acceptance and authorize release of the financial assurance funds minus the administrative portion in their entirety.

2) Recommend retaining the entire submitted financial assurance funds and not accepting the infrastructure due to material defects in the paving and/or drainage improvements constructed by the developer. If this occurs, the County Engineer shall refer the matter to the County Attorney for legal action providing specific evidence. The financial surety funds will be transferred to the County Attorney for litigation expenses.

Failure to complete the inspection process one year after the first date eligible as defined by these regulations shall constitute a violation. Such violation may be referred to the County Attorney for legal enforcement.

SECTION 11.02 - INSPECTION AND RE-INSPECTION FEES

A re-inspection fee in the amount of $1,000.00 shall be charged prior to scheduling the inspection if any of the following events occurs:

1) An inspection is scheduled when the work proposed on the plans is not completed in its entirety unless such partial inspection is specifically approved prior to scheduling.
2) A re-inspection is scheduled and upon inspection it is determined that the deficiencies previously noted have not been addressed.

3) An inspection or re-inspection is cancelled without giving three (3) working days notice unless affected by severe weather.

In order for a project to be considered ready for inspection, all applicable storm sewer manhole lids must be opened and ready for visible inspection and fire plugs in the upper reaches of the storm sewer system must have been flushed to demonstrate proper flow prior to the start of the inspection. If fire plugs are not present or charged, this requirement may be waived. Failure to do so will result in a $1,000.00 re-inspection fee.

In no case will the developer be held responsible for work covered under the “Regulations of Harris County for the Construction of Driveways and/or Culverts” as applicable unless the developer was the permittee. The permittee under those regulations will be held responsible for deficient work.
SECTION 12 - TRAFFIC

SECTION 12.01 – Traffic Definitions:

1. **Principal Thoroughfares** – Long, continuous facilities that are designed to carry high volumes of traffic and generally serve existing or projected heavy commercial or industrial traffic. Typical features are:
   
   A. Five (5) miles or greater in length;
   B. Connects freeways and other principal thoroughfares;
   C. Designed for volumes in excess of 30,000 vpd; and,
   D. Spaced three (3) to five (5) miles apart.

2. **Thoroughfares** – Continuous facilities, not as long as principal thoroughfares, and usually designed to carry lesser volumes of traffic that serve residential or commercial areas. Typical features are:

   A. Three (3) miles or greater in length;
   B. Connects freeways and other thoroughfares;
   C. Designed for volumes of over 20,000 but less than 30,000 vpd; and,
   D. Spaced one-half (1/2) to two (2) miles apart.
   E. Serves commercial development or undesignated acreage tracts.

3. **Collector** – Roadways that carry moderate volumes of traffic. Collectors can be classified as major or minor, depending on the type of facilities to which they are connected, length, type of surrounding land use, and existing and/or projected traffic volume and characteristics. These facilities typically have the primary function of carrying traffic from local roadways or other collectors to intersections with like and/or higher class facilities. Typical features are:

   A. Less than one (1) mile in length;
   B. Connect local roadways and/or other collectors with other collector and/or thoroughfare facilities;
   C. Designed for volumes of over 5,000 but less than 20,000 vpd; and,
   D. Spaced less than one (1) mile apart.

4. **Local** – Roadways that carry low volumes of traffic local to a given area. These facilities are typically very short (less than one (1) mile in length). Their primary function is to provide access to homes and businesses and, where applicable, accommodate on-street parking and pedestrian activities.
SECTION 12.02 – LEFT TURN LANES

Left turn lanes shall be required in the following situations:

1. All signalized intersection approaches along Principal Thoroughfares, Thoroughfares and Collectors, planned or existing.

2. All unsignalized intersections and driveways along divided Principal Thoroughfare, Thoroughfares and Collectors, planned or existing;

3. All unsignalized intersections and driveways along undivided Principal Thoroughfares, Thoroughfares, and Collectors planned or existing.

4. All developments with an overall footprint in excess of five (5) acres located within 500 feet of the intersection of two or more thoroughfare facilities (i.e., Principal Thoroughfares, Thoroughfares, and/or Collectors as defined by the City of Houston Major Thoroughfare and Freeway Plan).

5. New public or private school construction;

6. Shopping centers and other traffic generators with a lease space in excess of one hundred thousand (100,000) square feet;


It should be noted that the preparation of a Traffic Impact Analysis is strongly encouraged for all midsize and large developments. Furthermore, a Traffic Impact Analysis may be required, as a condition for review and/or acceptance, if it is determined by the Harris County Public Infrastructure Department that the development has the potential to impact regional transportation facilities and/or has a regional impact on traffic patterns, such as schools. A traffic impact analysis is required for the evaluation of requests for variances and/or deviations from Harris County Design and Development Guidelines. If the developer or engineer feels a left turn lane is not warranted, he/she shall submit a Traffic Impact Analysis to support any request for a variance of the left turn lane. Turn lanes shall meet the criteria outlined in Section 7 - Paving. The paving design requirements shall be the same as the adjacent main traveled lane requirements.
SECTION 13 - LANDSCAPING AND MONUMENTATION

SECTION 13.01 - LANDSCAPE AND MONUMENTATION POLICY

The purpose of these Rules is to protect the public, to maintain safe and efficient operating regulations, and to preserve and maintain the integrity of Harris County roads and road drainage easements and rights-of-ways, during the construction, maintenance and/or repair of signage or placing of vegetation.

SECTION 13.02 - USE OF TERMS:

A. “Landscaping” means the placement of trees, shrubs, or plants for the purpose of beautification of an esplanade(s) or other portion(s) within a County right-of-way.

B. “Signage” means any sign displaying a subdivision name or other type of name usually placed at the entrance of a subdivision. This definition does not include signs on private property or traffic control signs.

C. “Visibility Triangle” means the triangular area adjacent to the intersection of any street established by measuring a distance of fifteen (15) feet from the point of intersection of two streets along the right-of-way of each of the intersecting streets and connecting the ends of each measure distance to assure adequate visibility sight lines for vehicular traffic approaching the intersection. In these areas, landscaping shall be no greater in height than thirty (30) inches above top of adjacent curb or centerline of pavement when allowed to grow to its maximum height.

D. “Specimen Tree” means an exemplary tree of good health and true to species habit and form, containing a minimum caliper of 1 ½ inches.

E. “Caliper” means the minimum diameter of a tree as measured six (6) inches above the ambient grade for trees up to and including four (4) inches in diameter, twelve (12) inches above the ambient grade for trees having a diameter exceeding four (4) inches but not exceeding eight (8) inches and fifty-four (54) inches above the ambient grade for trees having a diameter greater than eight (8) inches.

SECTION 13.03 - CONSTRUCTION ACTIVITY

No person shall enter upon land acquired, claimed or maintained by Harris County for road and/or road drainage for the purpose of construction of signage or placement or modifications of landscaping until the County Engineer certifies that all requirements have been met.
SECTION 13.04 - PROHIBITED ACTIVITY

No person shall construct signage and/or place landscaping in such a manner as to interfere with the construction, maintenance and/or repair of any County road, ditch or right-of-way. In the event that any such facility interferes in any manner with the construction, maintenance and/or repair of any County road, the person, company, or owner entity in control of the signage or landscaping shall alter it no later than thirty (30) days after notice from the County Engineer and bear the cost and expense of any change or alteration.

No person shall construct signage or place landscaping in such a manner as to interfere with the use of or obstruct vehicular or pedestrian traffic on any County road or drainage on or along such road. No landscaping higher than thirty (30) inches and no signage shall be placed in the visibility triangle.

No person shall construct signage or place landscaping in such a manner as to constitute a danger or hazard of any kind to persons or vehicles using or maintaining such road, or any public property located within the boundaries of the County right-of-way.

The operation of construction equipment on the traveled surface of any improved County road is prohibited unless the construction of signage and/or placement of landscaping cannot be accomplished by any other method. In such instances, the equipment shall use rubber tires on said traveled surfaces unless other methods are approved.

SECTION 13.05 - CONSTRUCTION REQUIREMENTS FOR SIGNAGE

a. Sign Location in Right-of-Way:
Signs may be located at the main entrance to a subdivision and at secondary entrances. They must be within the boundaries of the subdivision/development they identify. Nothing in these regulations shall be construed as restricting such authority as the County may have to remove or require the removal of any sign within the right-of-way, whether or not constructed or maintained in conformance with these regulations.

b. Sign Number:
One sign per allowed location is authorized within the median in subdivisions platted and recorded after January 1, 2005.
c. **Sign Size:**
The maximum sign size is 75 sf. The size is measured by boxing in the subdivision name lettering and any associated symbols.

d. **Sign Height:**
The maximum sign height above top of curb is twelve (12) feet unless restricted by proximity to curb. See Appendix K, Figure 1 for proximity to curb requirements.

e. **Sign Positioning:**
   1) The sign shall be positioned such that it does not interfere with traffic visibility.

   2) Sign positioning shall follow those diagrams provided in Appendix K, Figures 2-4 and shall not be placed in the visibility triangle.

   3) Signage within master-planned communities may vary from these requirements provided they do not exceed the equivalent amount of signage and are approved by the County Engineer.

   4) Signs may be considered on major thoroughfares provided that they meet all the requirements of these regulations and that the requestor dedicated the right-of-way and constructed the road.

**SECTION 13.06 - LOCATION REQUIREMENTS FOR LANDSCAPING IN THE RIGHT-OF-WAY**

If landscape is proposed in the right-of-way, the minimum requirements must be followed. Nothing in these regulations shall be construed as restricting such authority as the County may have to remove or require the removal of any sign within the right-of-way, whether or not constructed or maintained in conformance with these regulations.

a. **At the nose of the esplanade:**
Maintain 350 to 400 feet of sight distance, based on 3 ½-foot height of driver’s eye and 35-40 M.P.H. posted or actual vehicle speed. No plantings or monuments with a height greater than three (3) feet measured from top of curb for:

   1) 35 feet from nose to esplanade and a 10-foot clearance on each side; or
   2) 50 feet from nose of esplanade and a 9-foot clearance on each side; or
3) 100 feet from nose of esplanade and a 7-foot clearance on each side.

Trees or bushes should not be located within twenty-four (24) feet of any existing and/or proposed traffic signal pole or controller, regulatory or warning signs, or other traffic control devices. No tree or shrub plantings exceeding 1 ½ feet in height will be allowed within 150 feet of a school crossing.

b. Along entire esplanade:

1) Centerline of tree trunk or edge of monument must be six (6) feet or greater from the inside edge of curb.
2) Tree branches shall be trimmed and maintained to a minimum of twenty-four (24) inches from inside of curb to a height of fifteen (15) feet from top of curb and in accordance with ANSI standards A-300 (American National Standards for Tree Care Operations.)
3) No trees or plantings allowed within ten (10) feet of a fire hydrant, and the fire hydrant should not be hidden from view from the street by shrubs or structures.
4) Irrigation systems shall be positioned and directed so they do not spray upon the roadway or upon vehicles using the roadway systems.
5) No landscaping shall be placed so as to interfere with the visibility triangle.

SECTION 13.07 - VEGETATION MANAGEMENT

No signage shall be constructed or landscape placed in such a manner as to destroy, damage or remove any landscaping already within the County rights-of-way unless prior approval has been received. To obtain approval, the drawings required in Section 7 must clearly show any existing landscaping and any proposed modifications. Failure to follow this procedure may result in job shut down at the discretion of the County Engineer. Any damaged or removed landscaping must be replaced with an equivalent amount, size and quality at a location designated by the County Engineer. Proper ground cover (turf grass) must be replaced when any significant areas are disturbed and the ground cover removed.

SECTION 13.08 - STANDARDS FOR TREE REPLACEMENT

Specimen Trees Twelve (12) Inch Caliper and Larger:
1. The engineer will provide a tree removal and replacement plan with the construction plans. Auger or tunnel construction methods under selected specimen trees must be used to the extent practicable.
2. Replacement trees should generally have a minimum diameter of three (3) inch caliper as established by the American Association of Nurserymen. Trees twelve (12) inches and larger should be replaced with smaller trees being no less than three (3) inch caliper and totaling the equivalent caliper diameter of the removed tree.

3. Replacement of trees should generally be the same type as the removed tree, unless directed otherwise by the County Engineer or appropriate Precinct designee during the plan review.

4. Specimen trees located in the right-of-way and adjacent to the contractor’s work area are to be fenced with four (4)-foot high orange safety fencing. The limits of the fencing will be coordinated with a landscape professional and the appropriate Precinct designee and approved during plan review.

Specimen Trees Smaller than Twelve (12) Inches:

1. Specimen trees smaller than twelve (12) inches will be transplanted within the County’s right-of-way as directed by the County Engineer or the appropriate Precinct designee during the plan review.

Landscape Professional:

2. The engineer will utilize a Landscape Professional when necessary for the preparation of the tree removal and replacement plan. A Landscape Professional is defined to be an Urban Forester, licensed Landscape Architect, Certified Arborist or similar qualified professional.

SECTION 13.09 - TREESCAPE AND SCREENING REQUIREMENTS FOR COMMERCIAL ESTABLISHMENTS AND PUBLIC BUILDINGS

The following requirements apply to all commercial and public buildings constructed or substantially redeveloped after the effective date of these regulations.

“Public Buildings and Commercial Establishments” include any building where the public may gather or where goods or services are provided for compensation. This definition includes, but is not limited to, auditoriums, classrooms, churches, libraries, restaurants, theaters, schools, daycare facilities, nursing homes, hospitals, correctional facilities, hotels, motels, dormitories, department stores, shopping centers, doctor offices, general offices, laundries, apartment complexes and warehouses. Not included in this definition is an industrial facility having a fire brigade that conforms to requirements of the Occupational Safety and Health Administration or apartment buildings.

Public Buildings and Commercial Establishments (PB&CE) Requirements:
Each PB&CE fronting a public road shall be required to plant trees and shrubs in accordance with the schedule listed below. A landscape design and compliance review sheet as promulgated by the County Engineer shall be submitted for review with each site plan for a proposed PB&CE. Nothing in these regulations shall be construed as restricting such authority as the County may have to remove or require the removal of any sign within the right-of-way, whether or not constructed or maintained in conformance with these regulations.

Street Trees:
The required number of street trees is derived by dividing by thirty (30) the total length of all public street frontage measured in feet. Street trees are required adjacent to all public streets, and the required number of street trees must be planted along said frontage on private property and within ten (10) feet of the property line. Exceptions may be granted in instances where trees would encroach into a visibility triangle. Said trees shall be a minimum of 1.5 caliper inches in size and from the approved list found in Appendix “A” of Chapter 33 of the City of Houston Code of Ordinances in effect at the time of adoption of these regulations. If the development is part of a larger planned development, then its pro rata share of street trees shall be provided. Street trees shall be located on private property within ten feet of the adjacent property line fronting the public right-of-way. This planting area can be increased in cases where encroachment into a visibility triangle would create a safety hazard. The required trees may be placed in the adjacent County right-of-way to fulfill this requirement provided the following conditions are satisfied:

1. Such planting is approved by the respective County Commissioner’s designee.
2. Restrictive covenants exist to provide for the maintenance of said trees with no County involvement.
3. Trees are planted in such a manner that they do not create a traffic hazard or a potential to damage the sidewalk or street pavement.
4. Trees planted beneath a utility line shall not have a mature height of greater than 25 feet.

Parking Lot Trees:
To calculate the number of required parking lot trees: determine the number of parking spaces: divide by 10; and round up or down, unless less than one. A minimum of one tree shall be provided. Said trees shall be a minimum of 1.5 caliper inches in size and located within 120 feet of each parking space. These trees shall be from the approved list found in Appendix “A” of Chapter 33 of the City of Houston Code of Ordinances in effect at the time of adoption of the these regulations.

Parking Lot Shrubs:
Each development fronting a public street shall have a shrub barrier planted along the perimeter of the parking lot to screen the parking area from the public street. The shrubs shall be a minimum of 18 inches in height and shall be selected from the City of Houston’s approved shrub list found in Appendix “D” of Chapter 33 of the City of Houston Code of Ordinance in effect at the time of adoption of these regulations. The number of shrubs required is equal to ten times the number of street trees. No less than 75% of the shrubs required under this section shall be planted along the perimeter of the parking lot adjacent to the public street.

**Buffer Requirement:**
Any new commercial or public building proposed adjacent to existing single family residential property shall provide a landscape buffer. An amenity feature constructed within the subdivision is exempt from this requirement. Acceptable buffers include:

- A minimum of a six (6)-foot tall wood or masonry fence.
- Evergreen plants capable of forming a year round screen of at least six feet in height within three years of installation.

The buffer shall extend the entire distance between the existing single-family residential development and the proposed public building or commercial establishment or its pro rata share if it is a part of a larger development. Pathways may be allowed through the buffer on a case-by-case basis.

**SECTION 13.10 - TREE PLANTING REQUIREMENTS FOR SINGLE FAMILY RESIDENTIAL LOTS**

The following requirements apply to all single-family lots platted and recorded after the effective date of these regulations. Nothing in these regulations shall be construed as restricting such authority as the County may have to remove or require the removal of any sign within the right-of-way, whether or not constructed or maintained in conformance with these regulations. Every lot greater than 5,000 sf in size shall require that a minimum of two 1.5 inch minimum caliper trees are planted in the front yard. Every lot smaller or equal to 5,000 sf in size shall require a minimum of one 1.5 caliper tree be planted in the front yard. These trees shall be planted prior to occupancy of the residence. The trees must be selected from the City of Houston’s approved tree list found in Appendix “A” of Chapter 33 of the City of Houston Code of Ordinances in effect at the time of the adoption of these regulations. These requirements shall appear on the face of the plat and in the restrictive covenants of the subdivision. The required trees may be placed in the County right-of-way to fulfill this requirement provided the following conditions are satisfied.
1. Such planting is approved by the respective County Commissioner’s designee.
2. The restrictive covenants are structured to provide for the maintenance of said trees with no County involvement.
3. The trees are planted in such a manner that they do not create a traffic hazard or a potential to damage the sidewalk or street pavement.

SECTION 13.11 – PRESERVATION OF EXISTING TREES

Existing trees that are preserved and meet all these requirements may be counted towards part or the entire tree requirement on a caliper inch basis for any trees required by these regulations.
SECTION 14 – VARIANCES

The Harris County Public Infrastructure Department may approve a request for variance to these requirements based on sound engineering practice. Individuals requesting a variance shall do so in writing stating the provision(s) they want to vary from and why they need the requested variance. They must also explain how they will provide equivalent measures to the provision from which they wish to vary or why the requirement in the regulations is not applicable to their project.
SECTION 15 - SEVERABILITY

The provisions of these Regulations are severable. If any word, phase, clause, sentence, section, provision, or part of these Regulations should be invalid or unconstitutional, it shall not affect the validity of the remaining portions and it is hereby declared to be the intent of the Commissioners’ Court that these Regulations would have been adopted as to the remaining portions, regardless of the invalidity of any part.
Appendix A

OWNER’S RATIFICATION OF PLAT

THE STATE OF TEXAS                  KNOW ALL MEN BY THESE PRESENTS
COUNTY OF HARRIS

WHEREAS, (names of all owners within plat boundaries) are the owners of that
certain (number of acres) of land out of the (name of the survey and abstract number)
Harris County, Texas, said tract being further described by metes and bounds in Exhibit
“A” attached hereto and made a part hereof for all purposes; and

WHEREAS, (names of all owners who signed plat) has/have platted the
hereinabove described tract of land into a subdivision known as (name of plat), recorded
at Film Code No. (# will be inserted at recording), in the Map Records and Clerk’s File
No. (# will be inserted at recording) of the Official Public Records of Real Property of
Harris County, Texas; and

WHEREAS, the undersigned owner/owners did not join in the platting or sign the
plat of said (name of plat), but is willing to ratify and confirm said subdivision plat and
consent to all its terms and conditions:

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

That (name of owner ratifying plat) is the owner of that certain tract of land
containing (number of square feet or acres) located within the subdivision, as described
by deed dated ________________________, from (name of previous owner), recorded
under Clerk’s File No. _______________ of the Official Public Records of Real Property of
Harris County, Texas, which is Lot _______, Block ________, of the subdivision (or
Reserve _________ of the Subdivision).

That the undersigned by executing the Owner’s Ratification of Plat:

(1) Confirms that he is the owner of the respective tract described in the deed
referred to above, and

(2) Represents that tract owned by him is subject only to the vendor’s lien
described in the deed referred to above, and

(3) Hereby ratifies, confirms, and consents to the subdivision plat of (name of
plat) with the same force and effect as if the undersigned had originally
joined in the plat or signed the plat of (name of plat).

Executed this ________ day of _____________________, 200__.

By:___________________________ Attest:__________________________
(Print owner’s name & title) (Print name & title)
Appendix A

LIENHOLDER’S SUBORDINATION TO DEDICATION

THE STATE OF TEXAS                                      KNOW ALL MEN BY THESE PRESENTS
COUNTY OF HARRIS

          WHEREAS, (owner’s names as on plat) has platted that certain _________ acres
          of land out of the ___________ Survey, Abstract _____________, Harris County, Texas,
          which property was surveyed and platted on (date), by (name of engineer or surveyor)
          and known as (name of subdivision) and recorded at Film Code No. (# will be inserted at
          recording), in the Map Records and Clerk’s File No. (# will be inserted at recording) of
          the Official Public Records of Real Property of Harris County, Texas; and

          WHEREAS, (name of lienholder) is the present owner and holder of a lien against
          the above described property, said lien being evidenced as recorded at File Code No.
          ___________ and Clerk’s File No. _____________________ of the Real Property Records
          of Harris County, Texas, and is the holder of promissory notes secured by said lien,
          desires to subordinate said lien to the dedication of all streets, rights-of-way, and
          easements, as well as, all other terms and conditions referred to on the plat of (name of
          subdivision).

          NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS:

          That for and in consideration of the premises, and the sum of $10.00 and other
          good and valuable consideration this day paid by (owner’s name) to said lienholder, the
          receipt and sufficiency of which is hereby acknowledged and confessed, the said lienholder
          as the present owner and holder of the note and lien given to secure the payment of the
          same, does hereby fully subordinate its lien to the plat of the subdivision of (name of plat)
          and the dedications, terms, and provisions evidenced thereby.

          The said lienholder does hereby WARRANT and REPRESENT that it is the
          present owner and holder of the note and the lien given to secure the payment of the
          same and have not assigned the same nor any part thereof.

          Except as expressly modified hereby, the lien shall remain in full force and effect.

          Executed this the ______ day of __________________________, 200__.

          By:__________________________ Attest:________________________
          (Print owner’s name & title)                                      (Print name & title)
Appendix A

NOTARY FORMATS

a. For a natural person acting in his or her own right.

STATE OF TEXAS
COUNTY OF HARRIS

This instrument was acknowledged before me on _______ (date) by ______________ (name or names of persons acknowledging).

Signature of Notary
NOTARY PUBLIC in and for
The State of Texas

b. For a natural person as principal acting as attorney-in-fact:

STATE OF TEXAS
COUNTY OF HARRIS

This instrument was acknowledged before me on _______ (date) by ______________ (name of the attorney-in-fact) as attorney-in-fact on behalf of (name of the principal for whom the document is signed).

Signature of Notary
NOTARY PUBLIC in and for
The State of Texas

c. For a partnership acting by one or more partners:

This instrument was acknowledged before me on _______ (date) by ______________ (name of the partner or partners signing), partner(s) on behalf of (name of the partnership).

Signature of Notary
NOTARY PUBLIC in and for
The State of Texas
Appendix A

d. For a corporation

This instrument was acknowledged before me on ______ (date) by ______________ (name of officer), (title of officer) of (name of corporation), a (state in which incorporated) corporation, on behalf of said corporation.

Signature of Notary
NOTARY PUBLIC in and for
The State of Texas

e. For a public officer, trustee, executor, administrator, guardian, or other representative.

This instrument was acknowledged before me on (date) by (name of the representative signing), as (title of representative) of (name of the entity or persons represented).

Signature of Notary
NOTARY PUBLIC in and for
The State of Texas
APPENDIX “B”
UTILITY SERVICE PLAN

1. APPLICANT INFORMATION  (Please print or type)

Applicant Name____________________________________________________________________________________________________________________

Applicant Mailing Address ___________________________________________________City __________________ State_________Zip___________________

Office Phone__________________________ Cellular Phone____________________ Fax___________________ Pager____________________

Developer’s Mailing Address ____________________________________________City ____________________State ________Zip____________________

2. LOCATION OF PROPERTY

New Plat ☐ Replat ☐ Subdivision or Proposed Subdivision Name

Adjoining County Road(s) ______________________________________________________________________________________________________ ___

Survey Name___________________________________________________Abstract Number _________________Acreage ________________

3. SERVICE CAPACITY

Proposed Use of Development: ☐ Single Family ☐ Commercial ☐ Mixed Single Family/Commercial

Number of Lots: _____________ Estimated Sewerage Capacity Required: _________________

Number of Reserves: __________________

4. WATER/SEWER SERVICE

☐ Existing Utility District to Extend Service. Provide Proof of Approval from District and Proof of Capacity or Plans to Increase Capacity.

☐ New District Being Formed. Provide Proof of Texas Commission on Environmental Quality (TCEQ) Water Well Plan approval, Harris-Galveston Subsidence District Permit and TCEQ Discharge Permit.

☐ New Water Service and Proposed On-Site Sewerage Facility (Septic System). Provide Copy of TCEQ Water Well Plan approval for wells greater than 4” diameter, Harris-Galveston Subsidence District Permit, if required, and an On-Site Sewerage Facility Subdivision Planning Report approval letter for plats of 2 or more lots.

☐ Other:
________________________________________________________________________________________________________________
________________________________________________________________________________________________________________
________________________________________________________________________________________________________________

I, ___________________________________________________________________, the undersigned have carefully reviewed this form and my answers to all questions. To the best of my knowledge, the answers are all true and correct.

SIGNATURE of Applicant/Agent or Attorney_____________________________________________________ Date________________

Receiving Plans Mapping Date Application Received

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<th>Applicant No.</th>
<th>Planchecker</th>
<th>Sub-ID</th>
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<td>Approved By</td>
<td>Property #</td>
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<tr>
<td>Clerk &amp; Date</td>
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</table>

NO FACSIMILES PLEASE
Harris County Public Infrastructure Department
Architecture & Engineering Division – Permit Group
10000 Northwest Freeway, Suite 102, Houston, TX 77092-8620
Phone 713-956-3000 * Fax 713-956-6276 * Fax 713-956-3050
HCED FPM 99-UTILITY
CERTIFICATES REQUIRED ON PLATS OF PROPERTY LOCATED IN THE UNINCORPORATED AREA OF HARRIS COUNTY

Dedicatory language must include the following paragraphs:

FURTHER, Owners do hereby dedicate to the public a strip of land fifteen (15) feet wide on each side of the center line of any and all bayous, creeks, gullies, ravines, draws, sloughs or other natural drainage courses located in said plat, as easements for drainage purposes, giving the City (name of city), Harris County, or any other governmental agency, the right to enter upon said easement at any and all times for the purpose of construction and maintenance of drainage facilities and structures.

FURTHER, Owners do hereby covenant and agree that all of the property within the boundaries of this plat and adjacent to any drainage easement, ditch, gully, creek or natural drainage way shall hereby be restricted to keep such drainage ways and easements clear of fences, buildings, planting and other obstructions to the operations and maintenance of the drainage facility and that such abutting property shall not be permitted to drain directly into this easement except by means of an approved drainage structure.

FURTHER, Owners certify and covenant that they have complied with or will comply with existing Harris County Road Law, Section 31-C as amended by Chapter 614, Acts of 1973, 63rd Legislature and all other regulations heretofore on file with the Harris County Engineer and adopted by the Commissioners’ Court of Harris County.

Certificate for Harris County Engineer:

I, Arthur L. Storey, Jr., County Engineer of Harris County, hereby certify that the plat of this subdivision complies with all the existing rules and regulations of this office as adopted by the Harris County Commissioners’ Court and that it complies or will comply with all applicable provisions of the Harris County Road Law as amended and all other Court adopted drainage requirements.

____________________________________
Arthur L. Storey, Jr., P.E.
County Engineer
Appendix C

Harris County Clerk Certificate of Commissioners’ Court Approval:

I, Beverly B. Kaufman, County Clerk of Harris County and ex officio clerk of the Harris County Commissioners’ Court, do hereby certify that the within instrument was approved at a legally convened meeting of the Harris County Commissioners’ Court held on _________________, 20__ by an order entered into the minutes of the court.

____________________________________
Beverly B. Kaufman
County Clerk
of Harris County, Texas

By: ________________________________
Deputy

Harris County Clerk Certificate of Filing:

I, Beverly B. Kaufman, County Clerk of Harris County, do hereby certify that the within instrument with its certificate of authentication was filed for registration in my office on _________________, 200__, at ________ o’clock ___M., and duly recorded on ________________, 200__, at ________ o’clock ___M., and at Film Code No. ______________________________ of the Map Records of Harris County for said county.

Witness my hand and seal of office, at Houston, the day and date last above written.

____________________________________
Beverly B. Kaufman
County Clerk
of Harris County, Texas

By: ________________________________
Deputy
Intensity Duration Curve (Hydro 35/TP-40)

Intensity, $i = \frac{b}{(d + TC)^e}$

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<th>Rainfall Frequency</th>
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<td>5-year</td>
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<td>10-year</td>
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<td>25-year</td>
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### Appendix E

**CONSTRUCTION NOTES TO BE ON ALL PROJECTS**

<table>
<thead>
<tr>
<th>NO</th>
<th>DESCRIPTION OF ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water lines, wastewater collection systems, and storm drainage systems shall be designed and construction in accordance with the CITY OF HOUSTON'S, DEPARTMENT OF PUBLIC WORKS AND ENGINEERING “DESIGN MANUAL, STANDARD CONSTRUCTION SPECIFICATIONS, AND DETAILS FOR WASTEWATER COLLECTION SYSTEMS, WATER LINES, STORM DRAINAGE AND STREET PAVING”, dated (September 1996 and July 1997).</td>
</tr>
<tr>
<td>2</td>
<td>Reinforced concrete (C76 Class III) storm sewers shall be installed, bedded and backfilled in accordance with the City of Houston’s Drawings 02317-04, 02371-05, 02317-06, 02317-07 and 02371-09 as applicable.</td>
</tr>
<tr>
<td>3</td>
<td>All storm sewers constructed in side lot easements shall be R.C.P., minimum twenty (20) foot wide easements shall be provided.</td>
</tr>
<tr>
<td>4</td>
<td>Alternative to cement stabilized sand backfill for pipes fifty-four (54) inch and larger, from 1-foot above the top of the pipe to the bottom of the subgrade. Contractor may backfill with suitable material, provided the backfill material is placed in eight (8) inch lifts and mechanically compacted to ninety-five (95)% standard proctor density. Tests shall be taken at one hundred (100) foot intervals on each lift. Bedding and backfill to one (1) foot above the top of the pipe shall be cement-stabilized sand.</td>
</tr>
<tr>
<td>5</td>
<td>All proposed pipe stub-outs from manholes or inlets are to be plugged with eight (8) inch brick walls unless otherwise noted.</td>
</tr>
<tr>
<td>6</td>
<td>The contractor(s) shall notify Harris County Public Infrastructure Department – Engineering Division – Permit Office twenty-four (24) hours in advance of commencing utility and/or paving construction at (713) (316-3565) and written notification forty-eight (48) hours in advance of commencing construction at 10000 Northwest Freeway, Suite 102, Houston, TX 77092-8620.</td>
</tr>
<tr>
<td>7</td>
<td>Paving shall be in accordance with the “Regulations of Harris County, Texas for Flood Plain Management” prior to starting construction.</td>
</tr>
<tr>
<td>8</td>
<td>Guidelines set forth in the “Manual on Uniform Traffic Control Devices” shall be observed.</td>
</tr>
</tbody>
</table>
### Appendix E

<table>
<thead>
<tr>
<th>NO</th>
<th>DESCRIPTION OF ITEM</th>
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<tr>
<td>10</td>
<td>Owner to obtain all permits required by Harris County, Texas prior to starting construction of utilities and/or culverts within Harris County Flood Control District and Harris County rights-of-way.</td>
</tr>
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</table>

PLEASE ADD ALL NOTES CIRCLED IN RED TO THE CONSTRUCTION DRAWINGS.
### CONSTRUCTION NOTES TO BE ON ALL PROJECTS INVOLVING PAVING OR STORM SEWERS LOCATED IN A PUBLIC RIGHT-OF-WAY

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<tr>
<th>NO</th>
<th>DESCRIPTION OF ITEM</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>NOTE</strong>: “Authorization notice issued by Harris County Public Infrastructure Department – Engineering Division – Permit Office – required prior to construction of utilities or left turn lanes within Harris County and Harris County Flood Control District Rights-of-Way.” Contact Harris County Permit Office (713) 956-3000.</td>
</tr>
</tbody>
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## CONSTRUCTION NOTES FOR ESPLANADE OPENINGS AND LEFT TURN LANES

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<tr>
<th>NO</th>
<th>DESCRIPTION OF ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Esplanade noses at the crossover are to be bullet type, painted reflectorized yellow, in accordance with the Harris County Pavement Marking Detail and to be six (6) inch reinforced concrete walk colored black on concrete pavement, and six (6) inch H.M.A.C. on asphalt pavement.</td>
</tr>
<tr>
<td>2</td>
<td>The relocation of existing trees, landscaping, sprinkler systems, water meters, fire hydrants, manholes, and pipelines (if applicable) are to be re-installed as recommended by the Harris County Public Infrastructure Department – Engineering Division – Permit Office and/or the Harris County Precinct (If located in Precinct 3, add note: Contractor(s) to contact Walt Peckham with the Parks Administration Office @ (281-531-1592) forty-eight (48) hours prior to construction for tree(s) and landscaping relocation.</td>
</tr>
<tr>
<td>3</td>
<td>Existing reinforced concrete pavement is to be machine saw-cut 1-1/2 inches deep to expose a minimum of twenty-four (24) inches of reinforcing bars and place new reinforcing (1/2 inch diameter deformed bars) twenty-four (24) inches center to center both ways and tie new reinforcing bars ten (10) inch laps to existing reinforcing bars.</td>
</tr>
<tr>
<td>4</td>
<td>Reinforcing concrete pavement is to be a minimum eight (8) inches with a minimum of 5.0 sack cement per cubic yard, [3000 psi in twenty-eight (28) days]. Note: Depth of concrete to meet current requirements of depth of existing pavement whenever it is greater.</td>
</tr>
<tr>
<td>5</td>
<td>Subgrade shall be six (6) inches lime stabilization and compacted to ninety-five (95) percent standard proctor density (+/-) two (2) percent moisture.</td>
</tr>
<tr>
<td>6</td>
<td>Slope on proposed concrete left turn slots is to be a minimum of 1/8 inch per foot with crown at center of esplanade.</td>
</tr>
<tr>
<td>7</td>
<td>All sewers under or within one (1) foot of proposed or future pavement shall be backfilled with 1-1/2 sack cement stabilized sand to within one (1) foot of subgrade.</td>
</tr>
<tr>
<td>8</td>
<td>The contractor shall notify the Harris County Public Infrastructure Department – Engineering Division – Permit Office twenty-four (24) hours in advance of commencing construction at (713) 316-3565 and written notification forty-eight (48) hours in advance of commencing construction for commercial development.</td>
</tr>
<tr>
<td>9</td>
<td>The contractor shall notify the Harris County Public Infrastructure Department – Engineering Division – Permit Office twenty-four (24) hours in advance of commencing construction at (713) 316-3565 and</td>
</tr>
</tbody>
</table>
## Appendix G

### CONSTRUCTION NOTES FOR ESPLANADE OPENINGS AND LEFT TURN LANES

<table>
<thead>
<tr>
<th>NO</th>
<th>DESCRIPTION OF ITEM</th>
</tr>
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<tbody>
<tr>
<td>10</td>
<td>written notification forty-eight (48) hours in advance of commencing construction for residential developments at 10000 Northwest Freeway, Suite 102, Houston, TX 77092-8620.</td>
</tr>
<tr>
<td>11</td>
<td>Paving shall be in accordance with the “Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure” relating to the approval and acceptance of improvements in subdivisions or re-subdivisions and/or amendments of the same.</td>
</tr>
<tr>
<td>12</td>
<td>Guidelines set for in the “Manual on Uniform Traffic Control Devices” shall be observed.</td>
</tr>
<tr>
<td>13</td>
<td>Include Harris County Drawing SD-1 as part of the construction drawings.</td>
</tr>
<tr>
<td>14</td>
<td>Include Harris County Pavement Marking Detail as a part of the construction drawings.</td>
</tr>
<tr>
<td>15</td>
<td>NOTE: “Authorization notice issued by Harris County Public Infrastructure Engineering Department Permit Office required prior to construction of utilities or left turn lanes within Harris County Flood Control District and Harris County rights-of-way.” Contact Harris County Permit Office at (713-956-3000).</td>
</tr>
<tr>
<td>16</td>
<td>OWNER to obtain all permits required by Harris County, Texas prior to starting construction of utilities and/or culverts within Harris County road rights-of-way.</td>
</tr>
</tbody>
</table>

Please add all notes circled in red to the construction drawings.
CONSTRUCTION NOTES FOR ALL PROJECTS LOCATED IN THE 100 YEAR FLOOD PLAIN OR BELOW THE BASE FLOOD ELEVATION

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<tr>
<td>1</td>
<td>No net fill allowed in flood plain. (provide calculations)</td>
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<tr>
<td>2</td>
<td>No fill allowed in Floodway.</td>
</tr>
<tr>
<td>3</td>
<td>All habitable or insurable areas will have finished floor a minimum of eighteen (18) inches above the base (100-year) flood elevation.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Owner</strong> to obtain all permits required by Harris County, Texas prior to starting development within Harris County and Harris County road rights-of-way.</td>
</tr>
</tbody>
</table>

PLEASE ADD ALL NOTES CIRCLED IN RED TO THE CONSTRUCTION DRAWINGS.
Appendix I

CITY OF HOUSTON
Department of Public Works & Engineering

DESIGN MANUAL
Graphic Requirements

Chapter 3

GRAPHIC REQUIREMENTS

3.01  CHAPTER INCLUDES

A. Graphic requirements for engineering drawings.

3.02  REFERENCES

A. City of Houston monument ties in compliance with Article IV, Chapter 33, City Surveys, of the Code of Ordinances.

3.03  DEFINITIONS

A. Computer Aided Drafting Design (CADD) - Preparation of drawings, plans, prints, and other related documents through the use of computer equipment and software programs.

3.04  DESIGN REQUIREMENTS

A. Provide a cover sheet for projects involving three or more design drawings (excluding standard City of Houston detail sheets). Drawing sheet numbers and titles shall be listed on the cover sheet. Include an area key map and vicinity map to identify project location.

B. Drawings shall be prepared on 23" x 36" Federal Aid Sheets, 22" x 34" ANSI standard drawing sheets, or nominal 24" x 36" drawing sheets, as appropriate.

C. Show service area on cover sheet or area map.

D. Final design drawings shall be India ink on mylar, or produced by CADD on mylar. Do not use adhesive-backed material on final drawings. Stick-ons may be allowed with approval of the City Engineer for a minor correction during the final review process.

E. Details of special structures (not covered by approved standard drawings, such as stream or gully crossings, special manholes, or junction boxes) shall be drawn with vertical and horizontal scales equal to each other.

F. Each set of engineering drawings shall contain paving and utility key drawings indexing specific plan and profile sheets. City Standard Details, where applicable, shall be included. All sheets shall have standard title blocks. Where applicable, show HCFCD key drawings and numbers.

G. Draw key overall layouts to a minimum scale of 1" = 200'.

3-1
1099
Appendix I

CITY OF HOUSTON
Department of Public Works & Engineering

DEVELOPMENT MANUAL
Graphic Requirements

H. Plan stationing must run from left to right, except for short streets or lines originating from a major intersection, where the full length can be shown on one sheet.

I. A north arrow is required on all sheets and should be oriented either toward the top or to the right. This requirement is waived under the following conditions:

1. A storm water or sanitary sewer with flow from west to east or from south to north.

2. A primary outfall drainage ditch with flow from west to east or from south to north.

3. Stationing is intended to start from the cardinal points of the compass and proceed in the direction of construction.

J. Standard scales permitted for plans and profiles of paving and utility construction drawings are as follows:

1. Major thoroughfares, streets with esplanades over 400 feet in length, or special intersections/situations.

   \[1'' = 20'\text{ Horizontal}, 1'' = 2'\text{ Vertical}\]

2. Minor or residential single-family streets.

   \[1'' = 20'\text{ Horizontal}, 1'' = 2'\text{ Vertical}\]
   \[1'' = 50'\text{ Horizontal}, 1'' = 5'\text{ Vertical}, or\]
   \[1'' = 40'\text{ Horizontal}, 1'' = 4'\text{ Vertical}\]

3. Scales of paragraph 3.041.2 above are minimum; larger scales may be used to show details of construction.

4. Deviation from specified scales can only be permitted with the special approval of the project manager or section head.

5. Single-banked plan-and-profile drawings are acceptable; double-banked plan-and-profile sheets are allowed in certain situations such as off-site utility lines in undeveloped areas.

K. Show ties on drawings to City monuments when applicable; otherwise, make a statement on the cover sheet referencing control.

L. Each sheet of the plan and profile shall have a benchmark elevation and description defined.

M. The seal, date, and original signature of the Professional Engineer responsible for the drawings is required on each sheet developed by the design engineer. The design engineer may use

3-2
stamped seal or embossed imprint; however, the embossed imprint must be shaded so that it will reproduce on prints.

N. A copy of the final plat for new development shall be included with the final design drawings when submitted for final approval.

O. If a roadway exists where drawings are being prepared to improve or construct new pavement or a utility, label the existing roadway width, surfacing type, and thickness, if available without destruction of pavement. Pavement thickness can be ascertained by coring, with the core hole grout filled to protect pavement prior to construction.

P. Show all street and road alignments on drawings.

Q. Develop drawings to accurate scale showing proposed pavement, typical cross sections, details, lines and grades, and existing topography within street right-of-way, and any easement contiguous with the right-of-way. At the intersection, the cross street details shall be shown at sufficient distance (20-foot minimum distance outside the primary roadway right-of-way) in each direction along cross street for designing adequate street crossings.

R. Match lines between plan and profile sheets shall not be placed or shown within cross street intersections including cross street right-of-way.

S. Show natural ground profiles as follows:

1. For privately-funded projects, centerline profiles are satisfactory except where a difference of 0.50 feet or more exists from one right-of-way or easement line to the other, in which case, dual profiles are required.

2. For City projects, provide natural ground profiles for each right-of-way line. Easement profiles shall conform to paragraph 3.04T.1.

T. Basic plan and profile sheets shall contain the following information:

1. Identify lot lines, property lines, easements, rights-of-way, and HCFCD outfalls.

2. Label each plan sheet as to street/easement widths, pavement widths, pavement thickness where applicable, type of roadway materials, curbs, intersection radii, curve data, stationing, existing utilities (type and location), and any other pertinent feature affecting design.

3. Show utility lines 4 inches in diameter or larger within the right-of-way or construction easement in profile view. Show utility lines, regardless of size, in the plan view, including fiber optic cables.

4. Graphically show flow line elevations and direction of flow for existing ditches.
Appendix I

CITY OF HOUSTON
Department of Public Works & Engineering

DEVELOPMENT MANUAL
Graphic Requirements

5. Label proposed top of curb grades except at railroad crossings. Centerline grades are acceptable only for paving without curb and gutters.

6. Show in profile curb return elevations for turnsouts.

7. Gutter elevations are required for vertical curves, where a railroad track is crossed.

8. Show in profile the centerline elevation at the property line of existing driveways.

9. Show both existing and proposed station esplanade noses or the centerline of esplanade openings, including esplanade width.

10. The design of both roadways is required on paving sections with an esplanade.

11. Show in plan view station PCs, PTs, and radius returns. Show in profile station radius returns and grade change Pls with their respective elevations.

3.05 GRAPHIC STANDARDS

A. The following graphic standards for plan and profile shall apply to drawings of 1" = 20' scale. For smaller scale drawings, use proportionally smaller line sizes.

B. Existing Improvements: The standards shown in Figure 3.1, Existing Improvements, are required for depicting existing improvements on base drawings. Use lower case letters with a No. 0 reprographic pen or equal line weight unless otherwise shown in the pen/line weight table, Figure 3.3, Line Code Definitions. Smaller pen sizes for lettering may be used for clarity.

C. Proposed Improvements: The standards shown in Figure 3.2, Proposed Improvements, are required for depicting proposed improvements on base drawings. Use upper case letters with a No. 3 reprographic pen or equal line weight unless shown otherwise in the pen/line weight table, Figure 3.3, Line Code Definitions. Smaller pen sizes for lettering may be used for clarity.

D. Signature Block: The standard shown in Figure 3.4, Signature Block Detail, are required for approval.

END OF CHAPTER
FIGURE 3.1
EXISTING IMPROVEMENTS
PLAN VIEW

TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEOY

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MISC UNDERGROUND LINES

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3-5

1000
Appendix I

FIGURE 3.1 (CONTINUED)
EXISTING IMPROVEMENTS
PLAN VIEW

PIPELINE OR
WESTERN UNION CONDUIT
SWAT CONDUIT
CABLE TV
MATCH LINE
RAILROAD LINE
WATER LINE
WASTEWATER SEWER LINE
STORM SEWER LINE
IRON PIPE OR IRON
ROD MONUMENTS
POINT OF INTERSECTION (PI)
POINT OF CURVE (PC)
POINT OF TANGENCY (PT)
POWER POLE
POWER POLE W/DOWN GUY
GAS METER
GAS VALVE
MSC UNDERGROUND PIPELINE LABEL

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3-6
1099
**CITY OF HOUSTON**
Department of Public Works & Engineering

**DESIGN MANUAL**
Graphic Requirements

**FIGURE 3.1 (CONTINUED)**
EXISTING IMPROVEMENTS
PROFILE VIEW

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3-8
10/99
FIGURE 3.1 (CONTINUED)
EXISTING IMPROVEMENTS
PROFILE VIEW
TEXT FOR EXISTING IMPROVEMENTS SHALL NOT BE SMALLER THAN 60 LEUCCY

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LC Line Code
**Figure 3.2 (Continued)**

**Proposed Improvements - Sanitary Sewer Lines**

**Plan View**

Text for proposed improvements shall not be smaller than 1/16" ledger.

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**Sanitary Sewer Line**

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**Manhole**

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**Profile View**

Text for proposed improvements shall not be smaller than 1/16" ledger.

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3-11

10/90
FIGURE 3.2 (CONTINUED)
PROPOSED IMPROVEMENTS - STORM SEWER LINES
PLAN VIEW
TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 1/00 LERDY

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STORM SEWER LINES

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FIGURE 3.2 (CONTINUED)
PROPOSED IMPROVEMENTS - STORM SEWER LINES
PROFILE VIEW
TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 1/00 LERDY

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STORM SEWER LINES

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MANHOLE

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INLETS

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<td>1</td>
<td>0.020&quot;</td>
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3-12
10/99
FIGURE 3.2 (CONTINUED)
PROPOSED IMPROVEMENTS - PAVEMENTS
PLAN VIEW
TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LERDY

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TOP OF CURB OR GUTTER LINE ELEVATION
TC=76.56
G=76.06

PROPOSED IMPROVEMENTS - PAVEMENTS
PROFILE VIEW
TEXT FOR PROPOSED IMPROVEMENTS SHALL NOT BE SMALLER THAN 100 LERDY

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TOP OF CURB OR CENTERLINE FOR OPEN DITCH PAVING
TC OR CL @ +0.03%  TC OR CL @ -0.03%

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3-13
1999
FIGURE 3.3
LINE CODE DEFINITIONS
ALL LENGTHS IN INCHES

LINE CODE 0

LINE CODE 1

LINE CODE 2

LINE CODE 3

LINE CODE 4

LINE CODE 5

LINE CODE 6

LINE CODE 7

LINE CODE 8

SOLID LINE

.05" LINE, .05" SPACE, .05" LINE, .05" SPACE, .05" LINE, .05" SPACE, .05" LINE

.125" LINE, .05" SPACE, .125" LINE

.09" LINE, .125" SPACE, .09" LINE

.125" LINE, .125" SPACE, .096" LINE, .125" SPACE, .125" LINE

.09" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" SPACE, .09" LINE

.09" LINE, .1" SPACE, .1" LINE, .1" SPACE, .1" SPACE, .1" SPACE, .1" SPACE, .09" LINE

.09" LINE, .1" SPACE, .1" LINE, .1" SPACE, .09" LINE

.09" LINE, .2" SPACE, .09" LINE

3-14
10/99
## CITY OF HOUSTON

**DEPARTMENT OF PUBLIC WORKS AND ENGINEERING**

### REVIEWED BY

PRIVATELY FUNDED PUBLIC WORKS

CITY FUNDED PUBLIC WORKS

PROJECT MANAGER

CONSTRUCTION

CHIEF ENGINEER

### OTHER APPROVAL

TRAFFIC AND TRANSPORTATION

SPONSOR DEPARTMENT

CITY ENGINEER

DATE

DIRECTOR OF PUBLIC WORKS AND ENGINEERING

DATE

SUBMITTED:

SCALE:

DATE:

SURVEY BY:

F B NO:

DESIGNED BY:

DRAWN BY:

SHEET NO OF SHEETS

CITY DWG NO:

3-15

10999
Appendix J

JOINT DETAIL FOR: KNuckle CONFIGURATION

NOTES:
1. REDWOOD EXPANSION JOINT REQUIRED BETWEEN POINT A AND B.
2. ADDITIONAL EXPANSION JOINTS OR CONTRACTION JOINTS ARE NOT ACCEPTABLE.

---

JOINT DETAIL FOR: TYPICAL CUL-DE-SAC

NOTES:
ADDITIONAL EXPANSION OR CONTRACTION JOINTS ARE NOT ACCEPTABLE.
FIGURE 1
MAXIMUM SIGN HEIGHT

SIGN HEIGHT SHALL NOT EXCEED A PROJECTED 45 DEGREE ANGLE FROM THE EDGE OF CLOSEST CURB OR 12 FEET WHICH EVER IS LESS.

FIGURE 2
SIGN SET BACK IN MEDIAN AT T-INTERSECTION WITH NO FUTURE CROSS-OVER POSSIBLE

"A" OBTAINED FROM "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS." - THE AMERICAN ASSOCIATION OF STATE AND HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
Appendix K

FIGURE 3
SIGN SET BACK IN FOUR WAY INTERSECTION

SIGNALIZED FOURWAY STOP TWOWAY STOP WITH SIGN
A=___ A=___ A=___
AT SIGN LOCATION

TWOWAY STOP WITH SIGN NOT AT SIGN LOCATION
A=___

FIGURE 4
SIGN SET BACK IN DIVIDED THOROUGHFARES

"A" AND "B" ARE OBTAINED IN "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" BY THE AMERICAN ASSOCIATION OF STATE AND HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
Attachment E

Regulations of Harris County, Texas for Storm Water Quality Management
REGULATIONS OF HARRIS COUNTY, TEXAS

FOR

STORM WATER QUALITY MANAGEMENT

AS
ADOPTED AUGUST 21, 2001
AMENDED SEPTEMBER 25, 2001
EFFECTIVE OCTOBER 1, 2001
AMENDED APRIL 13, 2004

HARRIS COUNTY
PUBLIC INFRASTRUCTURE DEPARTMENT
ENGINEERING DIVISION

ARTHUR L. STOREY, JR., PE
COUNTY ENGINEER

JACKIE L. FREEMAN, PE
ENGINEERING DIVISION DIRECTOR
PART A  GENERAL PROVISIONS

Section 1  In General
1.01 Authority
1.02 Area Covered by Regulations
1.03 Purpose
1.04 Construction of Regulations
1.05 Abrogation and Greater Restrictions
1.06 Remedies Not Exclusive
1.07 Access to Facilities
1.08 Severability

Section 2  Definitions
2.01 Accessory Structure
2.02 Applicant
2.03 As-Built Certification
2.04 Best Management Practices (BMP)
2.05 Certificate of Compliance
2.06 Certificate of Non-Compliance
2.07 Certificate of Proper Operation
2.08 CFR
2.09 Clean Water Act
2.10 Commercial Use
2.11 County Engineer
2.12 Development
2.13 Discharge
2.14 Discharger
2.15 Dwelling Unit
2.16 EPA
2.17 Express Plan Review Sheet
2.18 Harris County Pollution Control
2.19 Hearing Examiner
2.20 Impervious Surface
2.21 Industrial Activity Certification
2.22 Industrial Manager
2.23 Multi-Family Residential
2.24 Municipal Separate Storm Sewer System (MS4)
2.25 New Development
2.26 Non-Structural Controls
2.27 Notice of Change (NOC)
2.28 Notice of Intent (NOI)
2.29 Notice of Termination (NOT)
2.30 NPDES
2.31 NPDES Permit
2.32 One-Stop Shop
2.33 Parcel
2.34 Permittee
2.35 Person
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**PART B POST-CONSTRUCTION CONTROLS ON NEW DEVELOPMENT AND SIGNIFICANT REDEVELOPMENT**

**Section 1 Storm Water Quality Permit Process**

1.01 Administration by County Engineer | 13
1.02 Permits Required | 13
1.03 Duration | 14
1.04 Applicability | 14
1.05 Industrial Activity Certification | 15
1.06 Application | 15
1.07 Determination of Permit Eligibility | 16
1.08 Permit Renewal | 17
1.09 Term of Permits | 17

**Section 2 Storm Water Quality Management Plans**

2.01 Plan Approval Required | 17
2.02 Plan Approval Process | 17
2.03 Plan Amendment Process | 19

**Section 3 Ownership and Maintenance of the Storm Water Quality Features**

3.01 Ownership and Maintenance | 19

**Section 4 Permittee Responsibilities**

4.01 Responsibilities of All Permittees | 19
4.02 Certifications and Inspections | 20
4.03 Recordation | 21
4.04 Transfer | 21
Section 5  Suspension and Revocation of Storm Water Quality Permits
   5.01  Suspension of Permits  22
   5.02  Permit Revocation  23
   5.03  Permit Revocation Procedures  23
Section 6  Appeals and Hearing Procedures, Variances, and Review by Commissioners Court
   6.01  Appeals  25
   6.02  Hearing Before the Examiner  25
   6.03  Filing of Examiner’s Decision  26
   6.04  Review by Commissioners Court  26
   6.05  Variances  26
Section 7  Forms and Records
   7.01  Forms and Records  27
Section 8  Fees
   8.01  Fees  27
Section 9  Civil Enforcement
   9.01  Civil Enforcement  28
   9.02  Certificate of Non-Compliance  28

PART C  STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY
Section 1  In General
   1.01  Administration by County Engineer  28
   1.02  Compliance with Permit  29
   1.03  Submission of NOI  29
   1.04  Submission of NOT  29
Section 2  Inspections
   2.01  Inspection Procedures  30
Section 3  Civil Enforcement
   3.01  Civil Enforcement  30
   3.02  Certificate of Non-Compliance  31

PART D  STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY
Section 1  In General
   1.01  Administration  31
   1.02  Unpermitted Discharges Prohibited  31
   1.03  Submission of NOI  32
   1.04  Submission of NOC  32
   1.05  Submission of NOT  32
   1.06  Designation as a Type 1 or Type 2 Facility  32
Section 2  Monitoring
   2.01  Monitoring Required  33
   2.02  No Exposure Certification  35
   2.03  Reporting of Monitoring Results  35
   2.04  Intermittent Discharges  36
REGULATIONS OF HARRIS COUNTY, TEXAS FOR STORM WATER QUALITY MANAGEMENT

PART A – GENERAL PROVISIONS

Section 1 – In General

SECTION 1.01 – AUTHORITY

The Commissioners Court of Harris County, Texas adopts these Regulations in its capacity as the governing body of Harris County and the Harris County Flood Control District. The authority of Harris County to adopt these Regulations and the contents hereof is derived from Texas Local Government Code, Section 422, as amended, and these Regulations may be amended at any time by a majority of Commissioners Court as approved by the appropriate federal authorities.

SECTION 1.02 – AREA COVERED BY REGULATIONS

These Regulations apply in all unincorporated areas of Harris County, Texas.

SECTION 1.03 – PURPOSE

The purpose of these Regulations is to provide land use controls necessary to comply with Harris County’s NPDES or TPDES storm water permit, to protect human life and health and to avoid increasing pollutant levels associated with storm water.

SECTION 1.04 – CONSTRUCTION OF REGULATIONS

(a) The Code Construction Act of Texas (Texas Government Code, Chapter 311) applies for construing these rules unless an alternative instruction, definition, or application is contained herein.

(b) The word “shall” is mandatory and not discretionary as used in these Regulations.

(c) These Regulations are to be liberally construed to give affect to its purpose and intent.
(d) All terms used in the masculine shall refer to the feminine and vice versa.

SECTION 1.05 – ABROGATION AND GREATER RESTRICTIONS

Except as expressly provided, these Regulations are not intended to repeal, abrogate, or impair any existing laws, regulations, easements, covenants, or deed restrictions. Where these Regulations and other legal requirements conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

SECTION 1.06 – REMEDIES NOT EXCLUSIVE

The remedies listed in these Regulations are not exclusive of any other remedies available under any applicable federal, state, or local law, and it is within the discretion of Harris County to seek cumulative remedies. The suspension, revocation, cancellation, or denial of a SWQ Permit issued under these Regulations shall not prohibit the imposition of any civil or criminal penalty. The imposition of a civil or criminal penalty shall not prohibit any other remedy and shall not prohibit the suspension, revocation, or denial of any SWQ Permit issued under these Regulations.

SECTION 1.07 – ACCESS TO FACILITIES

The County Engineer or his designee, or investigators from Harris County Pollution Control, may enter any building or premises at reasonable times to inspect or investigate conditions relating to water quality or to perform their duties under these Regulations.

SECTION 1.08 – SEVERABILITY

The provisions of these Regulations are severable. If any word, phrase, clause, sentence, section, provision, or part of these Regulations should be invalid or unconstitutional, it shall not affect the validity of the remaining portions and it is hereby declared the intent of the Commissioners Court that these Regulations would have been adopted as to the remaining portions, regardless of the invalidity of any part.
Section 2 – Definitions

The following words and terms, when used in these Regulations, shall have the following meanings, unless the context clearly indicates otherwise.

SECTION 2.01 – ACCESSORY STRUCTURE

“Accessory structure” means a non-commercial structure of the type typically associated with a single-family dwelling unit including, but not limited to, a garage, carport or barn.

SECTION 2.02 – APPLICANT

“Applicant” means the person acquiring a Storm Water Quality Permit.

SECTION 2.03 – AS-BUILT CERTIFICATION

“As-Built Certification” means a form supplied and approved by the County Engineer certifying that Storm Water Quality Features are completed and ready to use.

SECTION 2.04 – BEST MANAGEMENT PRACTICES (BMP)

“Best management practices” or “BMP” means the scheduling of activities and maintenance procedures, the creation of non-structural and structural controls, and other management practices to prevent or reduce pollution discharging into the MS4 and the waters of the United States.

SECTION 2.05 – CERTIFICATE OF COMPLIANCE

“Certificate of Compliance” means a certificate issued by the County Engineer indicating a site complies with the Regulations of Harris County, Texas for Storm Water Quality Management as of a specific date.
SECTION 2.06 – CERTIFICATE OF NON-COMPLIANCE

“Certificate of Non-compliance” means a certificate issued by the County Engineer indicating a site does not comply with the Regulations as of a specific date. The Certificate also advises that legal action may be taken against the property owner. The certificate may be filed in the Real Property Records of Harris County, Texas.

SECTION 2.07 – CERTIFICATE OF PROPER OPERATION

“Certificate of Proper Operation” means a form approved and provided by the County Engineer for the purpose of certifying that the owner or operator of the Storm Water Quality Feature is complying with these Regulations and its Storm Water Quality Management Plan.

SECTION 2.08 – CFR

“CFR” means the Code of Federal Regulations, as it may be amended from time to time.

SECTION 2.09 – CLEAN WATER ACT

“Clean Water Act” means the Federal Water Pollution Control Act, as amended (33 U.S.C. § 1251 et. seq.).

SECTION 2.10 – COMMERCIAL USE

“Commercial use” means any profit or not-for-profit activity involving the manufacture, storage, transportation, distribution, exchange or sale of goods or commodities in the provision of professional or nonprofessional services, the sale or lease of real property, or the use of property for multi-family residential purposes.

SECTION 2.11 – COUNTY ENGINEER

“County Engineer” means the holder of the statutory office of County Engineer for Harris County or the employee designated by the County Engineer to perform a task required by these Regulations.
SECTION 2.12 – DEVELOPMENT

“Development” means any man-made change to improved or unimproved real estate including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation, drilling operations, or storage of equipment or materials, and any activity that requires a subdivision plat or that is part of a subdivision plat approved by a municipality.

SECTION 2.13 – DISCHARGE

“Discharge” means the introduction or addition of any pollutant, storm water, or any other substance whatsoever into the MS4 or into the waters of the United States, or to cause, suffer, allow, or permit any such introduction or addition.

SECTION 2.14 – DISCHARGER

“Discharger” means a person that causes or threatens to cause a discharge.

SECTION 2.15 – DWELLING UNIT

“Dwelling unit” means a structure or a portion of a structure that has independent living facilities including provisions for non-transient sleeping, cooking and sanitation.

SECTION 2.16 – EPA

“EPA” means the United States Environmental Protection Agency or any successor agency.

SECTION 2.17 – EXPRESS PLAN REVIEW SHEET

“Express plan review sheet” means a sheet promulgated by the County Engineer for the use of expeditiously reviewing construction drawings.

SECTION 2.18 – HARRIS COUNTY POLLUTION CONTROL

“Harris County Pollution Control” means a division within the Harris County Public Health and Environmental Services Department charged with investigating, monitoring, and reporting the release of pollutants within Harris County, and enforcing environmental regulations.
SECTION 2.19 – HEARING EXAMINER

“Hearing Examiner” means the person appointed by Commissioners Court to hold hearings concerning the appeal of a revocation, suspension, or denial of a SWQ Permit, a challenge to Harris County’s determination that a facility is a Type 1 or Type 2 facility, or that a discharge is contributing a substantial pollutant loading to the MS4.

SECTION 2.20 – IMPERVIOUS SURFACE

“Impervious surface” means any area that does not readily absorb water including, but not limited to, building roofs, parking and driveway areas, compacted or rolled areas that are not revegetated, sidewalks, and paved recreation areas.

SECTION 2.21 – INDUSTRIAL ACTIVITY CERTIFICATION

“Industrial Activity Certification” means a certificate approved by the County Engineer that covers storm water discharges from new development and significant redevelopment at a facility that either has, or will have, permit coverage for Storm Water Discharges Associated with Industrial Activity under a permit issued by the EPA or the TCEQ.

SECTION 2.22 – INDUSTRIAL MANAGER

“Industrial Manager” means the person designated by the County Engineer to oversee the Harris County program dealing with Storm Water Discharges Associated with Industrial Activity.

SECTION 2.23 – MULTI-FAMILY RESIDENTIAL

“Multi-family residential” means the use of property with one or more buildings on a parcel designed for and containing an aggregate of three or more dwelling units. Multi-family residential includes apartments, condominiums, boardinghouses, triplexes and quadraplexes.

SECTION 2.24 – MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)

“Municipal separate storm sewer system” or “MS4” means the system of man-made conveyances owned or operated by a municipality, Harris County, or Harris County Flood
Control District, and designed or used for collecting or conveying storm water and which is not used for collecting or conveying sewage.

SECTION 2.25 – NEW DEVELOPMENT

“New development” means development of an undeveloped parcel of land five (5) acres or larger without regard to the amount of land that will actually be disturbed, except for:

(1) development on an existing undeveloped and undivided parcel of five acres or more of one single-family dwelling unit and one or more accessory structures; however, if the use of the property excluded under the foregoing exception at any time changes to a commercial use, including further subdividing of the property, the owner of the property shall comply with all applicable requirements of these Regulations;

(2) development of a single-family residential subdivision if:
   (a) each lot in the subdivision will have no more than 20% impervious cover;
   (b) no on-site detention for water quantity purposes is required by Harris County or the Harris County Flood Control District; and
   (c) each lot in the subdivision will front on and will take direct access from an existing public road.

(3) projects constructed within waters of the United States and not associated with subdivisions, roads, or other commercial development.

(4) development that results in no impervious surface on the land disturbed.

SECTION 2.26 – NON-STRUCTURAL CONTROLS

“Non-structural controls” means a maintenance or operational practice designed to prevent or reduce the potential of storm water runoff contact with pollution-causing activities.

SECTION 2.27 – NOTICE OF CHANGE (NOC)

“Notice of change” or “NOC” means a written submission that is required by the TCEQ or EPA from a permittee authorized under a general permit who has submitted a Notice of Intent on which information must be corrected or changed.
SECTION 2.28 – NOTICE OF INTENT (NOI)

“Notice of intent” or “NOI” means a notice of intent form that is required by the TCEQ or EPA from an applicant requesting coverage under the terms of a general permit.

SECTION 2.29 – NOTICE OF TERMINATION (NOT)

“Notice of termination” or “NOT” means a notice of termination form that is required by the TCEQ or EPA from a permittee authorized under a general permit who is requesting termination of coverage under the permit.

SECTION 2.30 – NPDES

“NPDES” means the National Pollutant Discharge Elimination System.

SECTION 2.31 – NPDES PERMIT

“NPDES permit” means a permit issued by the EPA (or by the state under authority assumed pursuant to Section 1342(b) of Title 33 of the United States Code) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general basis.

SECTION 2.32 – ONE-STOP SHOP

“One-stop shop” means the Harris County Public Infrastructure Department – Permit Office that is responsible for Storm Water Quality Permit approval.

SECTION 2.33 – PARCEL

“Parcel” means a lot or contiguous piece of land that is under common ownership or control or that is part of a larger common plan of development or sale.

SECTION 2.34 – PERMITTEE

“Permittee” means the holder of the SWQ Permit.
SECTION 2.35 – PERSON

“Person” means an individual, corporation, organization, governmental entity, business trust, partnership, association, an agent or employee thereof, or any other legal entity.

SECTION 2.36 – POLLUTANT(S)

“Pollutant(s)” means dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, filter backwash, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into the MS4 or any waters in the state, or waters of the United States.

SECTION 2.37 – POLLUTION

“Pollution” means the alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

SECTION 2.38 – PROPERTY OWNERS’ ASSOCIATION

“Property owners’ association” means an association composed of owners of the property pursuant to Texas Property Code Chapters 202 through 205, as amended. The property owners’ associations shall be one option in the ownership and maintenance of Storm Water Quality Features.

SECTION 2.39 – REPRESENTATIVE STORM EVENT

“Representative storm event” shall mean a storm event that is greater than one tenth (0.1) of an inch in magnitude and that occurs at least seventy-two (72) hours from the previously measurable (greater than one tenth (0.1) of an inch rainfall) storm event.
SECTION 2.40 – SEWAGE

“Sewage” means waste that is primarily organic and biodegradable or decomposable, and generally originates as human, animal, or plant waste from certain activities, including the use of toilet facilities, washing, bathing, and preparing food.

SECTION 2.41 – SIGNIFICANT REDEVELOPMENT

“Significant redevelopment” means an increase in the total amount of impervious surface on a previously developed five-acre or larger parcel so that the total resulting impervious surface is one acre or larger. Only additions of impervious surface after October 1, 2001 shall be totaled and counted toward the one-acre threshold.

SECTION 2.42 – SINGLE-FAMILY RESIDENTIAL

“Single-family residential” means the use of a lot with one building designed for and containing not more than two dwelling units.

SECTION 2.43 – STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY

“Storm Water Discharges Associated with Construction Activity” means any storm water discharges from construction activity including, clearing, grading, excavation, and demolition activities, except operations that result in the disturbance of less than five acres of total land area that are not part of a larger common plan of development or sale. The term does not include discharges from facilities or activities excluded from the NPDES program under Part 122 of Title 40 of the Code of Federal Regulations.

SECTION 2.44 – STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

“Storm Water Discharges Associated with Industrial Activity” means the same as defined in Section 122.26 (b)(14) of Title 40 of the Code of Federal Regulations, except that it shall not include discharges from the activities enumerated in subsection (x) of that section.
SECTION 2.45 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

“Storm water pollution prevention plan” or “SWPPP” means a plan prepared and required for the purpose of complying with federal, state, or Harris County regulations governing Storm Water Discharges Associated with Construction Activity or Industrial Activity.

SECTION 2.46 – STORM WATER QUALITY ENGINEER

“Storm Water Quality Engineer” means the person designated by the County Engineer to approve Storm Water Quality Management Plans.

SECTION 2.47 – STORM WATER QUALITY FEATURES

“Storm water quality features” means the devices or structures created using Best Management Practices to eliminate or reduce pollution discharged into the MS4.

SECTION 2.48 – STORM WATER QUALITY MANAGEMENT PLAN (SWQMP)

“Storm water quality management plan” or “SWQMP” means a plan prepared by an engineer licensed in the State of Texas in accordance with Part B, Section 2 of these Regulations.

SECTION 2.49 – STORM WATER QUALITY PERMIT (SWQ Permit)

“Storm Water Quality Permit” or “SWQ Permit” means the permit issued by the County Engineer indicating that the operator of a site or facility has submitted and obtained approval of the necessary plans, and given the proper notices, as required by these Regulations.

SECTION 2.50 – STRUCTURAL CONTROL

“Structural control” means a structure or vegetative practice that is generally designed to reduce pollutant levels in storm water runoff.

SECTION 2.51 – TCEQ

“TCEQ” means the Texas Commission on Environmental Quality and any successor agency.
SECTION 2.52 – TPDES

“TPDES” means the Texas Pollutant Discharge Elimination System that was assumed by the state from the EPA pursuant to Section 1342(b) of Title 33 of the United States Code.

SECTION 2.53 – TPDES PERMIT

“TPDES permit” means a permit issued by the TCEQ that authorizes the discharge of pollutants to water in the state, whether the permit is applicable on an individual, group, or general basis.

SECTION 2.54 – TYPE 1 FACILITY

“Type 1 facility” means a municipal landfill, hazardous waste treatment disposal and recovery facility, a facility that is subject to Section 11023 of Title 42 of the United States Code (toxic release inventory program), as it may be amended from time to time, and any other industrial facility that Harris County determines is contributing a substantial pollutant loading to the MS4.

SECTION 2.55 – TYPE 2 FACILITY

“Type 2 facility” means any facility excluding a Type 1 facility, which may include any other municipal waste treatment, storage or disposal facilities (including, but not limited to, publicly owned treatment works, transfer stations, and incinerators) and any other individual industrial or commercial facility, or category of facilities engaging in a particular commercial or industrial activity, Harris County believes is contributing a substantial pollutant loading to the MS4.

SECTION 2.56 – UNINCORPORATED AREA

“Unincorporated area” means the area in Harris County, Texas, which is not within an incorporated area of a city, town or village.

SECTION 2.57 – WATERS OF THE UNITED STATES

“Waters of the United States” means all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; all interstate waters, including interstate wetlands; all other waters the use, degradation or destruction of which would affect or
could affect interstate or foreign commerce; all impoundments of waters otherwise defined as waters of the United States under this definition; all tributaries of water identified in this definition; all wetlands adjacent to the waters identified in this definition; and any other waters within the federal definition of “waters of the United States” in Section 122.2 of Title 40 of the Code of Federal Regulations; but not including any waste treatment systems, treatment ponds, or lagoons designed to meet the requirements of the federal Clean Water Act.

SECTION 2.58 – WETLANDS

“Wetlands” means an area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamp, marshes, bogs, and similar areas.

PART B – POST-CONSTRUCTION CONTROLS ON NEW DEVELOPMENT AND SIGNIFICANT REDEVELOPMENT

Section 1 – Storm Water Quality Permit Process

SECTION 1.01 – ADMINISTRATION BY COUNTY ENGINEER

The County Engineer or his designee is responsible for the administration of these Regulations dealing with post-construction controls on new development and significant redevelopment, the issuance of Storm Water Quality Permits required by these Regulations, the enforcement of these Regulations and maintaining proper records.

SECTION 1.02 – PERMITS REQUIRED

All new development and significant redevelopment within the unincorporated areas of Harris County, Texas without first securing a SWQ Permit, or submitting an Industrial Activity Certification in accordance with Part B, Section 1.05 is prohibited.
If any portion of a project drains directly into a Municipal Separate Storm Sewer System owned by Harris County or the Harris County Flood Control District, that project must have a SWQ Permit issued by Harris County. The granting of a SWQ Permit does not imply that federal or state storm water management criteria have been met and is in addition to any other development permit required in Harris County.

SECTION 1.03 – DURATION

The SWQ Permit shall expire one year from the date the Storm Water Quality Features, created pursuant to a Storm Water Quality Management Plan, receive final approval for operation, but may be renewed. Final approval for operation occurs upon the issuance of a Certificate of Compliance by the County Engineer pursuant to Part B, Section 4.02.

SECTION 1.04 – APPLICABILITY

Except as provided in Part B, Section 1.02, the requirements to obtain a SWQ Permit shall not apply to new development involving any of the following:

(a) Any project that has, prior to October 1, 2001, received a completed and unexpired application for a preliminary or final subdivision plat on file with a municipality provided the project is substantially underway by October 1, 2003;

(b) Any project that has an initial construction plan review from Harris County by October 1, 2001, or in the case of a project not receiving an initial construction plan review, has submitted a valid development permit application to Harris County by October 1, 2001, provided the project is substantially underway by October 1, 2003;

(c) For toll road projects, if there is a preliminary or approved master drainage plan associated with the project prior to October 1, 2001; or

(d) For Harris County or Harris County Flood Control District channel, basin, roadway, or bridge projects, if the date of authorization or notice to proceed with the preliminary engineering report from Harris County or the Harris County Flood Control District to the consultant is prior to October 1, 2001; or
linear projects such as underground pipelines, utilities, or drainage where the resulting impervious surface is limited to less than one acre. For this exemption, plans and drawings showing the total resultant impervious surface must be submitted to the County Engineer. Any future extensions or changes to the impervious surface shall be counted toward the one-acre threshold.

SECTION 1.05 – INDUSTRIAL ACTIVITY CERTIFICATION

If new development or significant redevelopment occurs at a facility that either has or will have permit coverage for Storm Water Discharges Associated with Industrial Activity issued by the TCEQ, the operator shall submit an Industrial Activity Certification on a form prescribed and approved by the County Engineer to the Storm Water Quality Engineer. An Industrial Activity Certification shall also include any of the following:

(a) A copy of the application for an individual permit from the TCEQ or EPA for Storm Water Discharges Associated with Industrial Activity at the facility;
(b) A copy of the permit issued by the TCEQ or EPA for Storm Water Discharges Associated with Industrial Activity at the facility;
(c) A copy of the NOI for coverage under a general permit for Storm Water Discharges Associated with Industrial Activity issued by the TCEQ, or the no-exposure certification referenced in Part D, Section 2.02;
(d) A statement of commitment to file an application for an individual permit from the TCEQ for Storm Water Discharges Associated with Industrial Activity at the facility; or
(e) A statement of commitment to file a NOI for coverage under a general permit for Storm Water Discharges Associated with Industrial Activity issued by the TCEQ.

SECTION 1.06 – APPLICATION

The application for a Storm Water Quality Permit shall be on a form prescribed and approved by the County Engineer and shall be supported by the following:

(a) A complete set of construction plans including a Storm Water Quality Management Plan which must be approved by the Storm Water Quality Engineer under Part B, Section 2 of these Regulations;
(b) A fee in the amount of $300.00 paid in cash, cashiers check, personal check, or money order. Checks shall be made out to “Harris County Treasurer”;

(c) If a bond is required by the Regulations of Harris County, Texas for the Approval and Acceptance of Infrastructure, the amount of the bond shall be increased by an amount equal to the cost of constructing the Storm Water Quality Features. A copy of the bond shall be submitted with the application;

(d) A copy of the NOI to discharge Storm Water Associated with Construction Activity submitted or to be submitted to the EPA or TCEQ; and

(e) One of the following to demonstrate proof or ownership and maintenance responsibility where appropriate:
   1. a copy of a letter from a municipal utility district, a public utility district, a water control and improvement district, a fresh water supply district, or any other utility or water district created pursuant to state law;
   2. a copy of creation documents from a Property Owners’ Association; or
   3. documents from individual owners.

(f) An Affidavit to the Public in a form and containing the statements prescribed by the County Engineer that has been recorded in accordance with Part B, Section 4.03.

The County Engineer may require the submission of additional information, drawings, specifications or documents to determine whether a SWQ Permit shall be issued from the information submitted.

SECTION 1.07 – DETERMINATION OF PERMIT ELIGIBILITY

After the application is filed, the County Engineer shall:

(a) Issue the SWQ Permit if he is satisfied that that applicant has met all the requirements of Part B, Section 1.06; or

(b) Return the application and supporting data to the applicant if any provision of these Regulations is not met. The County Engineer shall notify the applicant in writing of items required for further review of the plans.
SECTION 1.08 – PERMIT RENEWAL

Storm Water Quality Permits shall be renewed annually. The date of renewal shall be the anniversary date the Storm Water Quality Features received final approval for operation pursuant to Part B, Section 4.02. Failure to renew the SWQ Permit before this date means it expires and the person must reapply for a SWQ Permit as required by Part B, Section 1.06 above.

To renew a SWQ Permit the following items must be submitted:

(a) A permit renewal form as prescribed and approved by the County Engineer;
(b) A Certificate of Proper Operation completed by the owner or owner’s agent;
(c) On all projects that involve any structural controls, a certification completed by a professional engineer licensed in the State of Texas that all such controls conform to the plans and technical specifications in the SWQMP; and
(d) A renewal fee in the amount of $150.00, together with any outstanding inspection or other fees, paid in cash, cashiers check, personal check, or money order. Checks shall be made payable to the “Harris County Treasurer.”

All outstanding inspection or other fees owed Harris County shall be paid prior to renewal of the SWQ Permit. Harris County shall not renew a SWQ Permit if such fees are outstanding.

SECTION 1.09 – TERM OF PERMITS

Development activity under the SWQ Permit must start within 180 days from the date of issuance. Failure to initiate development activity shall result in the SWQ Permit becoming invalid. Upon written request, the County Engineer may grant two (2) six-month extensions.

Section 2 – Storm Water Quality Management Plans

SECTION 2.01 – PLAN APPROVAL REQUIRED

Before the County Engineer shall approve a SWQ Permit, a Storm Water Quality Management Plan must be approved by the Storm Water Quality Engineer.

SECTION 2.02 – PLAN APPROVAL PROCESS

The Storm Water Quality Management Plan shall be submitted as follows:

(b) A preliminary set of drawings shall be submitted to the “One-Stop Shop” for initial review. If a site has Storm Water Discharges Associated with Construction Activity then a preliminary set of drawings and a SWPPP shall be submitted. The Express Plan Review Sheet shall be a portion of this submittal. The review will be conducted in conjunction with the review for compliance with the Regulations of Harris County, Texas, for Flood Plain Management; Regulations of Harris County, Texas, for Driveways and Culverts; and the Harris County Flood Control Criteria Manual. Construction control measures including applicable standard drawings shall be included in the submittal. Once reviewed, the drawings shall be returned to the applicant with comments.

(c) Any preliminary drawings or plans altered or marked by the Storm Water Quality Engineer shall be resubmitted along with the corrected original drawings for signature. If further corrections are required, the package shall be returned to the applicant for resubmittal upon completion of revisions.

(d) Drawings shall meet the same standards as far as size, line weight, etc., as outlined in the Rules, Regulations and Requirements Relating to the Approval and Acceptance of Improvements in Subdivisions or Resubdivisions and/or the Harris County Flood Control Criteria Manual.
SECTION 2.03 – PLAN AMENDMENT PROCESS

The Storm Water Quality Management Plan may be amended by resubmitting the plan with the requested changes to the “One Stop Shop” for review in accordance with the procedures for initial plan approval set forth in Part B, Section 2.02. If the plan change involves an amendment to the design of any previously approved structural control, a fee shall be charged in accordance with Part B, Section 8.01 for review and processing of the amendment and issuance of an amended permit.

Section 3 – Ownership and Maintenance of the Storm Water Quality Features

SECTION 3.01 – OWNERSHIP AND MAINTENANCE

Ownership and maintenance of the Storm Water Quality Features designed and built pursuant to Part B, Section 2.02 of these Regulations shall be according to the following:

(a) The Storm Water Quality Feature shall remain with the owner unless there is a transfer pursuant to Part B, Section 4.04.

(b) If Harris County or the Harris County Flood Control District accepts the Storm Water Quality Features for maintenance, the permit holder’s requirements for the SWQ Permit and permit renewal with respect to that feature as set forth in Part B, Sections 1.02 and 1.08 terminate. All other permit requirements continue to apply.

Section 4 – Permittee Responsibilities

SECTION 4.01 – RESPONSIBILITIES OF ALL PERMITTEES

All permittees shall:

(a) Comply with the SWQMP;

(b) Remove all soil deposits resulting from runoff or from vehicular construction traffic and/or from site operations from the road adjacent roadside ditch on a daily or more frequent basis, or as specified in the Storm Water Quality Management Plan;
Post the SWQ Permit on the job site in a place visible from the nearest road or street during the construction phase; and

Allow the County Engineer to inspect the work pursuant to a permit. The County Engineer may make as many scheduled or unscheduled inspections as he may deem necessary to enforce these Regulations and shall have access to any building or premise at any reasonable time. If no specific inspection standards are set by any part of these Regulations, the inspection shall only be to determine that the drawings and specifications furnished with the SWQ Permit application are met.

SECTION 4.02 – CERTIFICATIONS AND INSPECTIONS

All Storm Water Quality Features shall be constructed in accordance with the plans approved by the County Engineer. Permittees shall inspect and certify that its Storm Water Quality Features are constructed and operated according to submitted plans as follows:

(a) When the Storm Water Quality Features are complete and ready for use, a professional engineer licensed in the state of Texas must inspect and certify that the Storm Water Quality Features were completed in accordance with the approved plans. The permittee shall then submit an As-Built Certification form supplied by the County Engineer. The form must be completed, signed, and sealed by a professional engineer licensed in the State of Texas indicating that the Storm Water Quality Features were completed in accordance with the approved plans.

(b) Once the As-Built Certification and any certification authorized by the SWQMP are submitted to the County Engineer's office, the County Engineer will issue or deny a Certificate of Compliance. Should the County Engineer determine that the applicable certifications were not provided, or the provisions of Part B, Section 1.06 of these regulations were not followed, then enforcement procedures such as SWQ Permit revocation or civil enforcement may commence. The County Engineer may deny a Certificate of Compliance if he determines that the Storm Water Quality Features were not constructed in accordance with approved plans.

(c) Should the County Engineer have to make additional inspections or conduct survey work due to non-compliance with these Regulations, additional fees may be assessed as outlined in Part B, Section 8.
SECTION 4.03 – RECORDATION

Recordation of the obligation to comply with the Storm Water Quality Permit requirements shall be in the form of an Affidavit to the Public as prescribed by the County Engineer according to the following:

(a) The obligation to comply with the SWQ Permit requirements shall be recorded by the permittee in the Real Property Records of Harris County, Texas for the affected parcel and will apply to all subsequent owners of all or a portion of the parcel. The recordation shall note that no structural or non-structural controls on, or for the parcel, may be changed from the plans and technical specifications in the SWQ Permit for the parcel. If there are substantial changes in the structural or non-structural controls then the procedures as outlined in Part B, Section 1.06 shall be followed. For Storm Water Quality Features that are not accepted by the Harris County Flood Control District for maintenance, the recordation shall reflect that the features are private and must be properly maintained by the owner in accordance with the SWQMP.

(b) For new development that includes the platting of a reserve tract, a notation shall be placed on the subdivision plat that a SWQ Permit must be obtained before the issuance of any development permit for a structure on all or a part of the reserve tract.

(c) Third-party permittees: For subdivisions involving the Property Owners’ Association, the agreement shall be recorded for all parcels in the subdivision. For other new development or significant redevelopment for which there is a third-party permittee, the third-party agreement shall be recorded for all parcels subject to the rights and obligations specified in the agreement at the time of the transfer of the SWQ Permit to the third-party permittee.

(d) The applicant, or if the SWQ Permit has already been issued, the permittee, shall pay all recording fees required by the county clerk’s office.

SECTION 4.04 – TRANSFER

A permittee may transfer its Storm Water Quality Permit in accordance with the following:
(a) The SWQ Permit may be held by an entity or person other than the landowner if the entity or person and the landowner enter into a binding legal agreement that meets the requirements of this section. The entity or person must agree to comply with the requirements of these Regulations and with the terms and conditions of the SWQ Permit, including adherence to the operation and maintenance requirements specified in Part B, Section 3.

(b) The third-party agreement shall grant fee simple title to all structural controls to the entity or person, provide an easement if necessary to allow access by the entity or person across the landowner’s property to maintain structural controls or to implement non-structural controls, and if necessary, to allow storm water from the landowner’s property to drain across any adjacent property to a designated structural control. The legal agreement shall also provide that in the event of its termination for any reason, including either by choice or by default, the obligation to comply with the provisions of this section shall revert to the landowner.

Section 5 – Suspension and Revocation of Storm Water Quality Permits

SECTION 5.01 – SUSPENSION OF PERMITS

SWQ Permit suspensions are handled in accordance with the following provisions:

(a) A SWQ Permit is suspended when the County Engineer, or his inspector, advises the permittee or some responsible person on the job that the SWQ Permit is suspended and posts a written suspension notice over the SWQ Permit at the jobsite.

(b) The following actions by the permittee are grounds for suspension of a SWQ Permit:

1. Non-compliance with Part B, Sections 2 or 4 of these Regulations;
2. Deviating from drawings and specifications filed with the County Engineer and refusing to make corrections required by the County Engineer; or
3. Any grounds for revocation of a SWQ Permit as outlined in Part B, Section 5.02.

(c) When the suspension notice is posted, the permittee must immediately suspend all work on the job except that work necessary to abate the suspension. The suspension will be abated when the corrective work is performed and has passed inspection.
The abatement will be evidenced by the removal of the suspension notice by the County Engineer or his inspector and the notation on the Permit Notice by the County Engineer or his inspector that the work has now been re-inspected and passed. The suspension notice may not be removed by any person other than the County Engineer or his inspector and removal by any other person will be ineffective.

SECTION 5.02 – PERMIT REVOCATION

A Storm Water Quality Permit shall be revoked after notice and opportunity for a hearing pursuant to Part B, Section 5.03 of these regulations if any of the following occur:

(a) Material deviation from the drawings and specifications on file with the County Engineer, including the SWPPP, or a pattern of consistent deviation from such drawings and specifications which would demonstrate an intention to avoid conformity with the requirements of the SWQ Permit;

(b) Refusal to uncover work for a mandatory inspection;

(c) Removal of a permit suspension notice;

(d) Proceeding with work while a permit is suspended, other than such work necessary to abate a suspension;

(e) An act or acts of violence, or threat or threats of violence, against the County Engineer or his inspector either on or off the job for the purpose of intimidating the County Engineer or his inspector, so that he will not perform his inspection duties;

(f) Falsifying information in the SWQ Permit application; or

(g) Failing to submit all required certifications as outlined in Part B, Section 4.02.

(h) Consistent violation of the NPDES or TPDES permit for the project during construction, including failure to correct deficiencies noted during construction-phase inspections.

SECTION 5.03 – PERMIT REVOCATION PROCEDURES

Storm Water Quality Permits shall be revoked in the following manner:
(a) The County Engineer shall file a complaint stating the reason for SWQ Permit revocation with the Hearing Examiner.

1. The Examiner will set a hearing as soon as practicable, but within thirty (30) days.

2. The Examiner will deliver the original Complaint and Hearing Notice to the Clerk of Commissioners Court to be filed, give one copy to the County Engineer, and designate an appropriate person as Serving Agent and give two copies to him or her.

3. The Serving Agent will take the two copies of the Complaint and Hearing Notice to the site where he will:
   a. Hand one copy of the Complaint and Hearing Notice to the permittee, or
   b. If the permittee is not an individual or cannot be found on the site, the Serving Agent will hand one copy of the Complaint and Hearing Notice to the person on the site who appears to be in charge, or
   c. If no person can be found on the site, the Serving Agent will post the Complaint and Hearing Notice over the SWQ Permit and/or Notice of Suspension posted at the job. Upon posting of the Complaint and Hearing Notice the SWQ Permit shall be suspended.

4. The Serving Agent will fill in the return on the remaining copy, noting on it the date, time and manner in which he perfected service, and sign the return and return the remaining copy to the Hearing Examiner.

5. At the time set for hearing, if the return copy of the Complaint has been returned to the Hearing Examiner by the serving agent, and reflects that service has been perfected, the Examiner may proceed with the hearing.

6. Hearings will be conducted in the manner provided for by Part B, Section 6.02 of these Regulations before the Hearing Examiner appointed by Commissioners Court and the Examiner may delegate responsibilities of Hearing Examiner to his Assistant. The Examiner’s decision and review by Commissioners Court are governed by Part B, Sections 6.03 and 6.04.
Section 6 – Appeals and Hearing Procedures, Variances, and Review by Commissioners Court

SECTION 6.01 – APPEALS

If a permit applicant is denied a SWQ Permit or has his SWQ Permit suspended he may appeal the denial or suspension as provided in this Section. The term “appellant” is used to refer to the appealing party. An appellant must seek his remedy under this procedure before seeking his remedy in court. Application for a permit is deemed to be a waiver of the right to challenge these Regulations before exhausting remedies herein provided. The appeals process is as follows:

(a) Appeals are initiated by the making of complaint with or by requesting an exception to the Regulations from the Hearing Examiner in writing.

(b) The Hearing Examiner will set a time for a hearing, which will be scheduled as soon as practicable but within thirty (30) days of the receipt of the written complaint or request, and shall prepare a Notice of Public Hearing naming the time and date of the Hearing. Copies shall be distributed as follows:

1. The original copy and the Certificate to Commissioners Court will be filed with the Clerk of Commissioners Court and the Clerk will prepare a file for the Hearing Notice.
2. The Examiner will set up his own working or hearing file, in which he will keep one copy.
3. The Examiner will give one copy to the Appellant.
4. The Examiner will deliver one copy to the County Engineer. The Hearing will be conducted as provided in Part B, Section 6.02.

(c) Appeal of a suspension will not abate the suspension pending the decision of the Hearing Examiner.

SECTION 6.02 – HEARING BEFORE THE EXAMINER

At Hearings before the Examiner, the Examiner will hear the testimony of the County Engineer and any witnesses called by the County Engineer. The Examiner will hear the testimony of the appellant and any witnesses called by the appellant. The Examiner will review all documents and exhibits submitted to him by the parties. The Examiner will not be bound by formal rules of
evidence and will control the evidence, reserving to himself the power to exclude testimony or exhibits he does not consider relevant. The Hearing Examiner will maintain an accurate record of the evidence adduced at the Hearing.

SECTION 6.03 – FILING OF EXAMINER'S DECISION

The Examiner will prepare a written decision within three (3) working days of the Hearing. A copy of his decision will be filed with the Clerk of Commissioners Court, the members of the Commissioners Court, and with the County Engineer. The original will be sent to the appellant's address shown on the SWQ Permit or application. If a variance is granted, the County Engineer shall prepare the appropriate permit with any special requirements that may be required by the conditions of the variance.

SECTION 6.04 – REVIEW BY COMMISSIONERS COURT

If the County Engineer or the appellant wishes to appeal the Examiner's decision, a written objection must be filed with the Clerk of Commissioners Court within ten (10) days from the date the Examiner's decision is filed. The Clerk will notify the Hearing Examiner who will place the matter on the Agenda of Commissioners Court for review at the next meeting of Commissioners Court. If the County Engineer files the objection, notice that the matter is on the agenda will be sent to the appellant by mail at the appellant's address shown on the SWQ Permit or application. Commissioners Court will review the matter. The Commissioners Court may either affirm or reverse the decision of the Hearing Examiner. A suspension of a permit upheld by the Hearing Examiner will not be abated pending the review of Commissioners Court.

SECTION 6.05 – VARIANCES

If any person wishes an exception to any provision of these Regulations, he or she shall request a variance in the manner prescribed for the filing of an appeal by Part B, Section 6.01 with the Hearing Examiner. The Hearing Examiner shall hold a hearing, and deny or grant the variance. Variances will be granted only if the conditions below are met:

(a) The applicant has shown good and sufficient cause;
(b) It has been determined that failure to grant the variance would result in an exceptional hardship to the applicant; and
(c) The granting of a variance will not result in a pollutant discharge, additional threats to public safety, extraordinary public expense, or create nuisances, cause fraud or victimization of the public.

Economic hardship shall not constitute the sole basis for granting a variance. A hearing before Commissioners Court regarding variances shall be requested in the manner provided in Part B, Section 6.04 of these Regulations. If a variance is granted a SWQ Permit shall be issued and the permittee shall conform to all applicable provisions of these Regulations except the section or sections for which a variance is granted.

Section 7 – Forms and Records

SECTION 7.01 – FORMS AND RECORDS

Forms to be used in the administration of these Regulations shall be provided and approved by the County Engineer. All forms shall be available at the Harris County Public Infrastructure Department and may be amended or supplanted from time to time by the County Engineer.

Section 8 – Fees

SECTION 8.01 – FEES

Fees for SWQ Permits and inspections are to be set by Commissioners Court. Fees shall be paid by cash, cashier’s check, money order, or personal check. Should the check be returned for insufficient funds the SWQ Permit issued becomes invalid. Fees shall be paid at the time the SWQ Permit is delivered to the permittee unless the County Auditor has approved other arrangements. The following fee schedule applies to actions under these Regulations:

<table>
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<tr>
<th>Service</th>
<th>Fee</th>
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<tr>
<td>INITIAL PERMIT</td>
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<tr>
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<tr>
<td>CERTIFICATE OF NON-COMPLIANCE</td>
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</tr>
</tbody>
</table>
PLAN/PERMIT AMENDMENT – STRUCTURAL CONTROL $150.00
TRANSFER OF PERMIT $300.00

Section 9 – Civil Enforcement

SECTION 9.01 – CIVIL ENFORCEMENT

If any person violates any section dealing with Post-Construction Controls on New Development and Significant Redevelopment, the County Attorney may take whatever action is necessary to remedy the violation, including but not limited to filing suit for civil penalties up to $1,000 a day for each violation, and to enjoin the violation. Each day a violation continues is considered a separate violation for purposes of assessing the civil penalty. Nothing in these Regulations precludes Harris County through the County Attorney’s Office from seeking enforcement of state environmental laws pursuant to the Texas Water Code.

SECTION 9.02 – CERTIFICATE OF NON-COMPLIANCE

If the County Engineer determines that a development site or sites does not comply with these Regulations, he may issue a Certificate of Non-Compliance and file the same in the Real Property Records of Harris County, Texas.

PART C – STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY

Section 1 – In General

SECTION 1.01 – ADMINISTRATION BY COUNTY ENGINEER

The County Engineer or his designee is responsible for the administration of these Regulations dealing with the Storm Water Discharges Associated with Construction Activity, and the issuance of SWQ Permits required by these Regulations, and enforcement of these Regulations and maintaining proper records.
SECTION 1.02 – COMPLIANCE WITH PERMIT AND SWPPP

The owner and operator of a facility that is required to have a NPDES or TPDES permit to discharge storm water associated with construction activity shall prepare its SWPPP in accordance with Harris County’s Storm Water Management Handbook for Construction Activities and shall strictly comply with the requirements of its NPDES or TPDES permit, the SWQ Permit issued under these Regulations and its SWPPP. It is a violation of these Regulations to operate a facility that has Storm Water Discharges Associated with Construction Activity without an NPDES or TPDES permit for stormwater discharges or in violation of the NPDES or TPDES permit, the SWQ Permit covering the facility, or the SWPPP.

SECTION 1.03 – SUBMISSION OF NOI

The operator of a facility required to have a NPDES or TPDES permit to discharge storm water associated with construction activity shall not commence construction activity without first submitting an NOI to the EPA or the TCEQ, as appropriate, and shall submit to the Storm Water Quality Engineer:
   (a) a copy of the NOI submitted to the EPA or the TCEQ;
   (b) a certification that the NOI has been submitted to the EPA or the TCEQ as applicable; and
   (c) a copy of a site plan detailing the location of erosion control measures.

The documents required by this section must be submitted to the Storm Water Quality Engineer at the same time the operator submits the NOI to the EPA or TCEQ as applicable.

SECTION 1.04 – SUBMISSION OF NOT

An operator who has filed an NOI with Harris County must submit a certification that he has submitted an NOT to the EPA or TCEQ and a copy of that NOT to the Storm Water Quality Engineer at the same time the operator submits the NOT to the EPA or the TCEQ as applicable.

Section 2 – Inspections
Harris County will make periodic unannounced inspections of the site during construction to insure compliance with the Storm Water Pollution Prevention Plan. Compliance with the provisions of the SWPPP will be checked on every visit, including the following items:

(a) Proper public notice;
(b) Copies of NOI, SWQ Permit, SWPPP, and SWQMP onsite;
(c) Condition and effectiveness of erosion and sediment control devices;
(d) Condition of entrance so as to reduce vehicle tracking;
(e) Inspection and maintenance records;
(f) Proper fueling and/or washout area construction;
(g) Sanitary facilities; and
(h) Proper storage and end of workday containment of trash, construction debris, and work materials.

A Notice of Inspection will be issued to the responsible party. If deficiencies are noted, they must be corrected within 72 hours of receiving a notice. Upon reinspection, if the deficiencies have not been corrected from the first inspection or additional deficiencies are identified, a $50.00 reinspection fee will be assessed in accordance with the fee schedule set forth in Part B, Section 8 of these Regulations. This fee will be assessed on every reinspection conducted where the previous deficiencies were not addressed or new deficiencies are noted and is in addition to any civil penalty that may be imposed under Part C, Section 3.01 of these Regulations. An inspection by Harris County does not insure compliance with any federal or state storm water requirements.

Section 3 – Civil Enforcement

SECTION 3.01 – CIVIL ENFORCEMENT

If any person violates any section dealing with Storm Water Discharges Associated with Construction Activity, the County Attorney may take whatever action is necessary to remedy the violation, including but not limited to filing suit for civil penalties up to $1,000 a day for each violation, and to enjoin the violation. Each day a violation continues is considered a separate violation for purposes of assessing the civil penalty. Nothing in these Regulations precludes Harris
County through the County Attorney’s Office from seeking enforcement of state environmental laws pursuant to the Texas Water Code.

SECTION 3.02 – CERTIFICATE OF NON-COMPLIANCE

If the County Engineer determines that a development site or sites does not comply with these Regulations, he may issue a Certificate of Non-Compliance and file the same in the Real Property Records of Harris County, Texas.

PART D – STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY

Section 1 – In General

SECTION 1.01 – ADMINISTRATION

The Industrial Manager or his designees and Harris County Pollution Control are responsible for the administration of these Regulations dealing with the Storm Water Discharges Associated with Industrial Activity, the enforcement of these Regulations, and maintaining proper records.

SECTION 1.02 – UNPERMITTED DISCHARGES PROHIBITED

The owner or operator of a facility that has Storm Water Discharges Associated with Industrial Activity violates these Regulations if the owner or operator causes, suffers, allows, or permits a discharge into the MS4 without having first obtained authorization under an NPDES permit, TPDES permit, or is otherwise authorized by the TCEQ to discharge storm water. Any violation of any general or individual NPDES or TPDES permit is a violation of these Regulations.

SECTION 1.03 – SUBMISSION OF NOI

If the owner or the operator of a facility that has Storm Water Discharges Associated with Industrial Activity has coverage for those discharges under an NPDES or TPDES general storm
water permit, the owner or operator shall submit to the Industrial Manager a copy of the NOI to obtain coverage for that facility. A copy of the NOI must be submitted to the Industrial Manager no later than fourteen (14) calendar days after filing the NOI with the EPA or TCEQ for such coverage.

SECTION 1.04 – SUBMISSION OF NOC

The owner or the operator of a facility that has Storm Water Discharges Associated with Industrial Activity and who is required by their NPDES or TPDES permit to submit an NOC to the EPA or TCEQ shall submit to the Industrial Manager a copy of the NOC.

SECTION 1.05 – SUBMISSION OF NOT

The owner or the operator of a facility that has Storm Water Discharges Associated with Industrial Activity and who is required by their NPDES or TPDES permit to submit an NOT to the EPA or TCEQ shall submit to the Industrial Manager a copy of their NOT.

If an NOT is submitted because the operator of the facility has changed, a copy of the NOI for the new operator shall be submitted to the Industrial Manager with the NOT.

The copy of the NOT shall be submitted no later than ten (10) calendar days after either all Storm Water Discharges Associated with Industrial Activity are eliminated at the facility or the operator of the facility changes.

SECTION 1.06 – DESIGNATION AS A TYPE 1 OR TYPE 2 FACILITY

Harris County may determine that an individual industrial or commercial facility, or a category of facilities engaging in a particular industrial or commercial activity, are contributing a substantial pollutant loading to the MS4 and are, therefore, Type 1 or Type 2 facilities. Designation as a Type 1 or Type 2 facility shall be based upon such factors as the nature of the activities at the facility and drainage patterns in the area.
Upon designation by Harris County as a Type 1 or Type 2 facility, the Industrial Manager shall send written notification by certified mail, return receipt requested, to any such facility informing the facility of the designation. The facility may then appeal the designation in the manner set forth in Part E, Section 2.01 of these Regulations.

Section 2 – Monitoring

SECTION 2.01 – MONITORING REQUIRED

Operators of facilities that have storm water discharges shall comply with the following monitoring requirements:

(a) All Type 1 and Type 2 facilities required to have authorization to discharge storm water under an NPDES or TPDES permit must undertake all monitoring required by that permit. Upon request, the operator of the facility shall submit the results of this monitoring to the Industrial Manager. The monitoring methods employed by the operators must follow EPA standards for monitoring as set forth in 40 CFR Part 136 as amended, and 30 TAC 319, as amended.

(b) If a Type 1 facility is not required to have authorization to discharge storm water under an NPDES or TPDES permit, the facility must on an annual basis analytically monitor storm water discharges from its facility during a representative storm event on an outfall-by-outfall basis for the following parameters:

1. Any pollutants limited in an existing NPDES or TPDES permit for the facility;
2. Total oil and grease;
3. Chemical oxygen demand;
4. pH;
5. Biochemical oxygen demand, five-day;
6. Total suspended solids;
7. Total phosphorous;
8. Total Kjeldahl nitrogen;
9. Nitrate plus nitrite nitrogen;
10. Total organic carbon;
11. Ammonia (as N);
12. Temperature;
13. Any pollutants for which effluent limitations are imposed in the County’s storm water permit for its MS4; and
14. Any other pollutant that Harris County has determined the facility is discharging which contributes a substantial pollutant loading to the MS4 after written notification by the County sent by certified mail, return receipt requested, informing the facility that the pollutant must be analyzed.

All sampling conducted by a facility shall occur during a representative storm event and shall be completed within the first 30 minutes of discharge using a grab sample. If it is not practicable to complete the sampling within the first 30 minutes, sampling must be completed within the first hour of discharge. For facilities monitoring under this subsection, Harris County has established thresholds which are set forth in Appendix B.

(c) If a Type 2 facility is not required to have authorization to discharge storm water under an NPDES or TPDES permit, the facility must analytically monitor storm water discharges from its facility during a representative storm event on an outfall-by-outfall basis at a frequency to be determined by Harris County for any pollutants Harris County determines the facility may be contributing to the MS4. Harris County will inform each facility of the parameter or parameters for which it must analyze and the applicable threshold for each parameter. Harris County will send written notification of its decision by certified mail, return receipt requested. All sampling conducted by a facility shall occur during a representative storm event and shall be completed within the first 30 minutes of discharge using a grab sample. If it is not practicable to complete the sampling within the first 30 minutes, sampling must be completed with the first hour of discharge. Upon request, the operator of the facility shall submit the results of any monitoring under this section to the Industrial Manager.

SECTION 2.02 – NO EXPOSURE CERTIFICATION

Type 1 and Type 2 Facilities and other Facilities with Storm Water Discharges Associated with Industrial Activity that are subject to the monitoring requirements in Part D, Section 2.01, may be excluded from those requirements if there is no exposure of individual materials or activities to precipitation or runoff. To qualify for a no exposure exclusion, Facilities with Storm Water
Discharges Associated with Industrial Activity shall submit to the Industrial Manager a copy of the no exposure certification required to obtain coverage under the TCEQ Multi-Sector General Permit. Type 1 and Type 2 facilities that do not have Storm Water Discharges Associated with Industrial Activity may qualify for a no exposure exclusion by submitting to the Industrial Manager a no exposure certification on a form provided by the Industrial Manager.

A facility with Storm Water Discharges Associated with Industrial Activities that qualifies for a no exposure certification must obtain a permit to discharge as required in Part D, Section 1.02 before changing operating and management procedures that would result in exposure of storm water to industrial activities. A Type 1 or 2 facility that qualifies for no exposure certification must notify the Industrial Manager in writing before changing operating or management procedures that would result in exposure of storm water to industrial activities.

It is a violation of these Regulations for a facility that has submitted the conditional no-exposure certification to fail to meet the no-exposure certification standards established by the TCEQ or Industrial Manager, as applicable.

SECTION 2.03 – REPORTING OF MONITORING RESULTS

All monitoring results shall be submitted according to the following:

(a) If the results of any monitoring required under Part D, Section 2.01 above, exceed the thresholds established by Harris County pursuant to Part D, Section 2.01 (b or c), or a benchmark or effluent limitation in an NPDES or TPDES storm water permit for a facility, the owner and operator of the facility shall submit the results in writing to Harris County Pollution Control within thirty (30) days after conducting the monitoring.

(b) If the results of any monitoring required by this section exceed the thresholds established by Harris County or a benchmark or effluent limitation in an NPDES or TPDES storm water permit, the owner or operator of the facility shall investigate the cause of the exceedance and take appropriate corrective action to eliminate the exceedance as soon as possible but no later than 30 days from when the exceedance is detected. The operator shall notify Harris County Pollution Control of the corrective measures that will be taken and a schedule for implementation.
(c) Harris County Pollution Control may require additional monitoring at a frequency to be determined by Harris County and may require the submittal of monitoring data not specified in paragraphs (a) or (b) above. Additional monitoring, or the submittal of additional data, will be requested by Harris County Pollution Control in writing. It is a violation of these regulations to refuse to monitor or submit data as required above or as ordered by Harris County Pollution Control.

SECTION 2.04 – INTERMITTENT DISCHARGES

For intermittent discharges to the MS4, the discharger, upon request from Harris County, shall notify Harris County Pollution Control 24 hours prior to discharge, or as soon as is practicable.

Section 3 – Civil Enforcement

SECTION 3.01 – CIVIL ENFORCEMENT

If any person violates any section dealing with Storm Water Discharges Associated with Industrial Activity, the County Attorney may take whatever action is necessary to remedy the violation, including but not limited to filing suit for civil penalties up to $1,000 a day for each violation, and to enjoin the violation. Each day a violation continues is considered a separate violation for purposes of assessing the civil penalty. Nothing in these Regulations precludes Harris County through the County Attorney’s Office from seeking enforcement of state environmental laws pursuant to the Texas Water Code.

PART E – NON-STORM WATER DISCHARGES

Section 1 – In General

SECTION 1.01 – ADMINISTRATION

The Industrial Manager and Harris County Pollution Control are responsible for the administration of these Regulations dealing with non-storm water discharges, enforcement of these Regulations, and maintaining proper records.
SECTION 1.02 – NON-STORM WATER DISCHARGES PROHIBITED

(a) No person shall discharge or cause to be discharged into the Municipal Separate Storm Sewer System (MS4) anything that is not composed entirely of storm water except the following:

1. A discharge authorized by, and in full compliance with, an NPDES or TPDES permit (other than an NPDES permit issued to a governmental entity for discharges from the MS4);

2. A discharge or flow resulting from fire fighting by the fire department if that discharge is not reasonably expected to be a significant source of pollutants to the MS4;

3. A discharge or flow of fire protection water if that discharge is not reasonably expected to be a significant source of pollutants to the MS4;

4. Water line flushing, provided the water contains less than or equal to 5.0 mg/l total chlorine when entering the MS4;

5. Landscape irrigation;

6. Diverted stream flows;

7. Rising Ground Waters;

8. Ground Water infiltration;

9. Infiltration, as defined at 40 CFR 35.2005(20) to separate storm sewers;

10. Pumped ground water;

11. Foundation drains;

12. Discharges from potable water sources, provided the water contains less than or equal to 5.0 mg/l total chlorine when entering the MS4;

13. Irrigation water;

14. Air conditioning condensation;

15. Water from crawl spaces;

16. Springs;

17. Lawn watering provided the water does not contain significant amounts of fertilizers, pesticides, herbicides, or other undesirable lawn care products;

18. Footing drains;
19. Flows from riparian habitats and wetlands;
20. Non-commercial car washing (until such time as the TCEQ issues a general permit for such discharges);
21. Pavement wash waters provided cleaning chemicals are not used or other significant contaminants are not present (until such time as the TCEQ issues a general permit for such discharges);
22. Swimming pool discharges provided the water contains less than or equal to 5.0 mg/l total chlorine when entering the MS4;
23. Materials resulting from a spill where the discharge is necessary to prevent loss of life, personal injury or severe property damage provided that the party responsible for the spill takes all reasonable steps to minimize or prevent any adverse effects to human health or the environment.
24. Uncontaminated compressor condensate; and
25. Traffic control device wash water provided cleaning chemicals or detergents are not used.

(b) Harris County may determine, on a case-by-case basis, that any of the above listed discharges in subsection (a) are contributing a substantial pollutant loading to the MS4, and may prohibit such discharges according to the following:

1. Harris County will provide written notice that the discharge is prohibited;
2. The person affected by this may appeal this decision according to Part E, Section 2 and obtain a variance according to Part E, Section 2.05. To appeal, the person must inform Harris County of its decision to appeal within 30 days after the receipt of notice from Harris County.

(c) It is a violation of these Regulations if a person discharges any storm water that contains a pollutant or any substance which causes, continues to cause, or will cause pollution.

SECTION 1.03 – SPILLS INTO THE MS4

Any discharge into the MS4 subject to the reporting requirements of 30 TAC §319.302 or 30 TAC §327.3 shall be reported to Harris County Pollution Control at 713-920-2831, as soon as possible, and not later than 24 hours after the occurrence.
Section 2 – Appeals and Hearing Procedure, Variances, and Review by Commissioners Court

SECTION 2.01 – APPEALS

If Harris County determines that a facility is a Type 1 or Type 2 facility under Part D, Section 1.05 or that a discharge is contributing a substantial pollutant loading to the MS4 pursuant to Part E, Section 1.02 (b), the discharger may appeal the determination as provided in this Section. The term “appellant” is used to refer to the appealing party. An appellant must seek his remedy under this procedure before seeking his remedy in court. The appeals process is as follows:

(a) Appeals are initiated by submitting a written challenge to Harris County’s determination to the Hearing Examiner.

(b) The Hearing Examiner will set a time for a hearing, which will be scheduled as soon as practicable but within forty-five (45) days of the receipt of the written complaint or request, and shall prepare a Notice of Public Hearing naming the time and date of the Hearing. Copies shall be distributed as follows:

1. The original copy and the Certificate to Commissioners Court will be filed with the Clerk of Commissioners Court and the Clerk will prepare a file for the Hearing Notice.
2. The Examiner will set up his own working or hearing file, in which he will keep one copy.
3. The Examiner will give one copy to the Appellant.
4. The Examiner will deliver one copy to the Industrial Manager. The Hearing will be conducted as provided in Part E, Section 2.02.

(c) Appeal of a determination that a discharge contributes a substantial pollutant loading to the MS4 will not abate the determination pending the decision of the Hearing Examiner.

SECTION 2.02 – HEARING BEFORE THE EXAMINER

At Hearings before the Examiner, the Examiner will hear the testimony of the Industrial Manager or Harris County Pollution Control and any witnesses called by the Industrial Manager or Harris County Pollution Control. The Examiner will hear the testimony of the appellant and any witnesses
called by the appellant. The Examiner will review all documents and exhibits submitted to him by the parties. The Examiner will not be bound by formal rules of evidence and will control the evidence, reserving to himself the power to exclude testimony or exhibits he does not consider relevant. The Hearing Examiner will maintain an accurate record of the evidence adduced at the Hearing.

SECTION 2.03 – FILING OF EXAMINER'S DECISION

The Examiner will prepare a written decision within three (3) working days of the Hearing. A copy of his decision will be filed with the Clerk of Commissioners Court, the members of the Commissioners Court, and with the Industrial Manager. The original will be sent to the appellant's address. If a variance is granted, the Industrial Manager shall prepare the appropriate paperwork requirements that may be required by the conditions of the variance.

SECTION 2.04 – REVIEW BY COMMISSIONERS COURT

If the Industrial Manager, Harris County Pollution Control, or the appellant wishes to appeal the Examiner's decision, a written objection must be filed with the Clerk of Commissioners Court within ten (10) days from the date the Examiner's decision is filed. The Clerk will notify the Hearing Examiner who will place the matter on the Agenda of Commissioners Court for review at the next meeting of Commissioners Court. If the Industrial Manager or Harris County Pollution Control files the objection, notice that the matter is on the agenda will be sent to the appellant by mail. Commissioners Court will review the matter. The Commissioners Court may either affirm or reverse the decision of the Hearing Examiner. The determination that the discharge contributes a substantial pollutant loading to the MS4 will not be abated pending the review of Commissioners Court.

SECTION 2.05 – VARIANCES

If any person wishes an exception to any provision of these Regulations, he or she shall request a variance in the manner prescribed for the filing of an appeal by Part E, Section 2.01, with the Hearing Examiner. The Hearing Examiner shall hold a hearing, and deny or grant the variance. Variances will be granted only if the conditions below are met:
(a) The applicant has shown good and sufficient cause;
(b) It has been determined that failure to grant the variance would result in an exceptional hardship to the applicant; and
(c) The granting of a variance will not result in a substantial pollutant loading into the MS4, additional threats to public safety, extraordinary public expense, or create nuisances, cause fraud or victimization of the public.

Economic hardship shall not constitute the sole basis for granting a variance. A hearing before Commissioners Court regarding variances shall be requested in the manner provided in Part E, Section 2.04 of these Regulations. If a variance is granted the applicant may then discharge and shall conform to all applicable provisions of these Regulations except the section or sections for which a variance is granted.

Section 3 – Compliance Monitoring

SECTION 3.01 – COMPLIANCE MONITORING

Harris County may require the installation and maintenance of monitoring equipment according to the following:

(a) Harris County shall have the right to install at a facility that discharges storm water to the MS4, or to require the installation of, such devices as are necessary to conduct sampling or metering of the facility’s operations.

(b) Harris County may require any facility that it determines has discharged or is discharging a pollutant or any substance which causes, continues to cause, or will cause pollution to conduct specified sampling, testing, analysis and other monitoring of its storm water discharges. Harris County may specify the frequency and parameters of any required monitoring.

(c) Harris County may require any facility that it determines has discharged or is discharging a pollutant or any substance that causes, continues to cause, or will cause pollution to install monitoring equipment as necessary at the facility’s expense. The facility, at its own expense, shall at all times maintain the sampling and monitoring equipment in a safe and proper operating condition. Each device used to measure storm water flow and quality must be calibrated to ensure accuracy.
(d) Any temporary or permanent obstruction to safe and easy access to a facility that is to be inspected or sampled must be promptly removed by the facility at the written or verbal request of the Industrial Manager and may not be replaced. The cost of clearing the access to the facility must be borne by the facility.

**Section 4 – Civil Enforcement**

**SECTION 4.01 – CIVIL ENFORCEMENT**

If any person violates any section dealing with Non-storm Water Discharges, the County Attorney may take whatever action is necessary to remedy the violation, including but not limited to filing suit for civil penalties up to $1,000 a day for each violation, and to enjoin the violation. Each day a violation continues is considered a separate violation for purposes of assessing the civil penalty. Nothing in these Regulations precludes Harris County through the County Attorney’s Office from seeking enforcement of state environmental laws pursuant to the Texas Water Code.
APPENDIX A


2001 Edition
# Table of Contents

**Introduction**
- Background .................................................. 1
- Purpose ......................................................... 1
- Organization ................................................... 1

**Grass Swales**
- Purpose and Definitions ................................... 2
- Applications and Limitations ............................... 2
- Design Criteria ............................................... 2
  - Sizing Procedures .......................................... 3
- Maintenance .................................................... 4
- Sample Calculation for Sizing Grass Swales .......... 8

**Vegetated Filter Strips**
- Purpose and Definitions ................................ 10
- Applications and Limitations ............................. 10
- Design Criteria ............................................... 10
- Maintenance .................................................... 11
- Sample Calculation for Sizing Filter Strips .......... 13

**Wet Pond**
- Purpose and Definitions ................................ 14
- Applications and Limitations ............................. 14
- Design Criteria ............................................... 14
  - Permanent Pool ............................................. 15
  - Hydraulic Residence Time ............................... 15
  - Pond Geometry ............................................. 15
  - Permanent Pool Depth ................................... 15
  - Permanent Pool Surface Area ......................... 16
  - Sediment Forebay .......................................... 16
  - Basin Configuration ....................................... 16
  - Safety Bench ............................................... 16
  - Vegetative Bench ......................................... 16
  - Sizing Procedure .......................................... 17
- Maintenance .................................................... 18
- Sample Calculation for Sizing Wet Ponds ........... 24

**Dry Detention Basins**
- Purpose and Definitions ................................ 26
- Applications and Limitations ............................. 26
- Design Criteria ............................................... 26
  - Sizing Procedure .......................................... 26
- Maintenance .................................................... 27
- Sample Calculation for Sizing Dry Detention Basins 31
Constructed Wetlands for Storm Water Treatment
  Purpose and Definitions 32
  Applications and Limitations 32
  Design Criteria 32
  Maintenance 33

Bibliography 36

APPENDIX (Design Check List)
List of Tables

Table 1.1: Sizing Criteria for Grass Swales 7
Table 1.2: Recommended Plants for Grass Swales 8
Table 1.3: Flow Path and Required Filter Strip Width 11
Table 1.4: Sizing Criteria for Filter Strips 11
Table 1.5: Sizing Criteria for Wet Ponds 19
Table 1.6: Sizing Criteria for Dry Detention Basins 28
Table 1.7: Sizing Criteria for Storm Water Treatment Wetlands 35
List of Figures

Figure 1: Grass Swale Sample Layout 5

Figure 1-A: Level Spreader 6

Figure 2: Filter Strip Example Design Layout 12

Figure 3: Wet Pond Example Design Layout 20

Figure 3-A: Wet Pond Example Cross-Sections 21

Figure 3-B: Wet Pond – Safety and Vegetative Bench Cross-Sections 22

Figure 3-C: Wet Pond – Riser Outlet with Trash Protection 23

Figure 4: Dry Detention Basin Example Design Layout 29

Figure 4-A: Dry Detention Basin Example Cross-Sections 30
INTRODUCTION

Background

As a part of the NPDES storm water permit requirements, the Joint Task Force (JTF), drafted and adopted the *Storm Water Quality Management Guidance Manual (October 2000)*, “Guidance Manual.” The Guidance Manual provides planning-level guidance on several Best Management Practices (BMPs) that may be suitable in Houston and Harris County, and incorporates additional BMPs by reference.

During the public review of the Guidance Manual, several comments were received requesting design-level information for the structural BMPs included in the Guidance Manual. Non-structural BMPs are discussed in Chapter 4.1 of the Guidance Manual. This document, *Minimum Design Criteria for Implementation of Certain Best Management Practices for Storm Water Runoff Treatment Options (2001 Edition)*, was prepared to address the public comments and provide design-level criteria for certain structural BMPs. It is intended to supplement the structural BMP information material provided in the Guidance Manual. The information contained in this document is adapted from several other manuals prepared in other parts of the USA. Sources are listed in the reference section of this document.

Purpose

The purpose of this document is to provide minimum design parameters for certain BMPs for storm water quality features for new development and significant redevelopment. Use of the BMPs presented here does not guarantee acceptance of a particular Storm Water Quality Management Plan or effectiveness of the BMP to reduce pollutants. The BMPs described in the criteria document are intended to facilitate the plan review process for new development and significant redevelopment projects in the City of Houston and unincorporated Harris County.

Organization

This document contains design-level criteria and design detail drawings for five structural BMPs, where each BMP has an identifier code composed of letters and numbers. The document will be revised and updated as necessary to include additional BMPs. Other BMPs may be acceptable on a case-by-case basis. In such cases prior consultation with the reviewing agency is highly recommended. This document provides design-level criteria on the BMPs listed below:

- Grass Swales
- Vegetated Filter Strips
- Wet Pond
- Dry Detention Basins
- Constructed Wetlands for Storm Water Treatment
Grass Swales

BMP HC01.10 Grass Swales

Purpose and Definition
Grass swales are defined as grass-lined, earthen channels, intended to provide water quality enhancements. Grass swales provide effective treatment only when they have low longitudinal slopes, with low velocities and shallow depth of flow in the swale. The main pollutant removal mechanisms in grass swales are filtration as the storm water moves through the vegetation and bacterial decomposition. Careful selections of grass species that allow more contact with microorganisms living on the vegetation enhance pollutant removal of grass swales.

Application and Limitations
Grass swales are applicable best management practices where the peak flow rates and velocities are low. They are recommended as a stand-alone best management practices for areas draining 10 acres or less and where pollutant concentration from the area is low. In developments draining more than 10-acres, grass swales could be used in combination with other best management practices.

Design Criteria
The primary design factors that determine grass swales' effectiveness are peak flow rate, depth of flow, and height of vegetation. The design should promote pollutant removal rather than transporting flow with greater possible hydraulic efficiency. Therefore, it is critical that filtration, sedimentation, and other pollutant removal mechanisms are emphasized.

Grass swales for water quality enhancements should be sized to treat the flow generated by the design rainfall intensity from the drainage area. Table 1.1 summarizes the design criteria for grass swales and Figure 1 depicts a typical layout of a grass swale. Based on the analysis of the 1-hour precipitation data of rainfall gauges in the Harris County area, an intensity of 0.27-inch per hour was computed for 90 percent of the storms. Unless amended by additional rainfall data analysis the design flow shall be calculated using an intensity of 0.27-inch per hour. The rational formula (Q=CIA) shall be used to determine the design flow rate. The flow velocity shall not exceed 1.5 feet per second. The longitudinal slope of the swale shall not exceed 2 percent and the minimum slope shall be 0.1 percent. Because of site condition, if the desired slope could not be attained, check dams shall be used as small drop structures to achieve the desired swale slope. The check dams should be reinforced adequately for erosion protection. The design of grass swales must encourage sheet flow of storm water within the swale. If sheet flow conditions cannot be achieved, a flow spreader (Figure 1-A) must be installed to uniformly...
spread the flow across the width of the swale. The width of the swale shall be sized to achieve a depth of flow, in the grass swale, of 3 inches or half the height of the grass, whichever is less. Table 1.2 summarizes recommended plant list for grass swales. A more comprehensive plant list is provided in the Guidance Manuals Appendix E. The design storm shall travel for at least 50 feet on the grass swale for water quality treatment before its discharge into the receiving stream or municipal storm sewer system. The length of swale should be calculated based on a minimum hydraulic retention time of 5 minutes. Discharges from the grass swale to a receiving stream or roadside ditch shall not promote erosion, and erosion prevention devices shall be constructed. The side slope of the swale shall be 3H:1V or flatter.

**Sizing Procedure**

- Determine the drainage area \( A \) of the site that drains into the grass swales.
- Determine the runoff coefficient \( C \) of the development. Runoff coefficient values from the City of Houston Design Manual, Chapter 9 - Storm Water Design Requirements, shall be used.
- Based on the design storm, calculate design flow rate \( Q_{wq} \) from the drainage area using the rational formula:

\[
Q_{wq} = CIA
\]

Where:
- \( Q_{wq} \) = Water quality design flow rate (ft\(^3\)/sec)
- \( C \) = Runoff coefficient (dimensionless)
- \( I \) = Intensity (in/hr)
- \( A \) = Area in (acres)

- The Manning's roughness coefficient \( n \) for the swale shall be 0.24 for frequently mowed grass with a height of 6 inches.
- Determine the longitudinal swale slope \( S \).
- Determine the depth of flow \( d \). Depth of flow shall be 3 inches or half the grass height, whichever is less.
- Select a channel shape and a side slope \( z \).
- Using Manning’s equation, determine the bottom width \( b \) of the swale by trial and error or use the approximate method given below. Substitute the value of \( Q_{wq} \) calculated above for \( Q \) in the Manning's equation.

\[
Q = \frac{1.49}{n} AR^{2/3} S^{1/2}
\]

Where:
- \( Q \) = Water quality design flow rate ft\(^3\)/sec
- \( n \) = Manning’s roughness coefficient (dimensionless)
- \( A \) = Cross-sectional area (ft\(^3\))
- \( R \) = Hydraulic radius (ft)
- \( S \) = Longitudinal slope (dimensionless)
Basic hydraulic equations and cross sectional formula for a trapezoidal shape:

\[ A = bd + zd^2 \]
\[ P = b + 2d\sqrt{z^2 + 1} \]

\[ R = \frac{A}{P} \]
\[ T = b + 2zd \]

By recognizing that top width \( T \) is much greater than depth of flow \( d \) and the square of the side slope \( z^2 \) is much greater than 1 and certain terms are negligible the approximate solution to determine the bottom width of a trapezoidal shape is:

\[ b \approx \frac{Qn}{1.49d^{1.67}s^{0.5}} - zd \]

- Calculate the cross-sectional flow area.
- Calculate velocity of flow \( V \), and if velocity of flow exceeds the recommended maximum, recalculate the bottom width of the swale.
- Determine the length of the grass swale based on a minimum hydraulic retention time of 5 minutes (300 seconds). The required minimum swale length is 50 feet.

\[ L = V \times t \]

Where:
\[ V = \text{velocity in feet per second} \]
\[ t = \text{hydraulic retention time 300 seconds} \]

**Maintenance**

Maintenance is the most important factor if water quality grass swales are to continue to function as originally designed.
- Until grass is established, grass swales must be inspected within 24 hours after each storm of 0.5 inch or greater or daily during prolonged rainfall events.
- After grass has been established, the swale should be checked at least monthly.
- The grass must be mowed as needed for good growth and to maintain the desired grass height. A maximum grass height of 6 inches shall be maintained.
- Sediment must be removed as needed if growth is inhibited in greater than 10 percent of the swale area or if sediment is blocking the distribution and entry of the storm water runoff.
Figure 1: Grass Swale Sample Layout

BMP HC01.10 - GRASS SWALE
LEVEL SPREADER 1
TYPICAL SECTION

LEVEL SPREADER 2
TYPICAL SECTION

BMP HC01.10 - LEVEL SPREADER

Figure 1-A: Level Spreader
Table 1.1: Sizing Criteria for Grass Swales

<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Grass Swales$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal slope$^2$</td>
<td>Less than 2% with a minimum of 0.1%</td>
</tr>
<tr>
<td>Maximum velocity</td>
<td>1.5 feet per second</td>
</tr>
<tr>
<td>Maximum water depth</td>
<td>3 inches or half the grass height, which ever is less</td>
</tr>
<tr>
<td>Water quality design flow rate</td>
<td>Calculate using rational method using 0.27 in/hr rainfall intensity</td>
</tr>
<tr>
<td>Manning coefficient</td>
<td>0.24</td>
</tr>
<tr>
<td>Bottom width</td>
<td>Size to satisfy depth and flow velocity</td>
</tr>
<tr>
<td>Minimum length</td>
<td>50 feet</td>
</tr>
<tr>
<td>Maximum side slope</td>
<td>3H:1V</td>
</tr>
<tr>
<td>Contributing drainage area</td>
<td>Less than 10 acres</td>
</tr>
<tr>
<td>Hydraulic resident time</td>
<td>5 minutes (300 seconds)</td>
</tr>
</tbody>
</table>

$^1$Easement or restricted reserve dedication must contain wording that references the file number (permit number) and the public entity that holds the plan. The plan must include the maintenance schedule and frequency. Grass swales designed for water quality purposes **CANNOT** be used for drainage conveyance. A separate drainage conveyance should be provided based on the applicable agency criteria.

$^2$If site conditions do not allow a 2% longitudinal slope, check dams must be used as drop structures to achieve the desired slope. The check dams shall be designed with adequate erosion protection.
Table 1.2: Recommended Plants for Grass Swales

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Expected Growth Height</th>
<th>Method of Planting¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carex cherokeensis</td>
<td>Cherokee sedge²</td>
<td>4 to 6 inches</td>
<td>Plug</td>
</tr>
<tr>
<td>Eleocharis macrostachys</td>
<td>Spikerush</td>
<td>2 to 4 inches</td>
<td>Rhizome/plug</td>
</tr>
<tr>
<td>Eleocharis montevidensis</td>
<td>Sand spikerush</td>
<td>2 to 4 inches</td>
<td>Rhizome/plug</td>
</tr>
<tr>
<td>Juncus effusus</td>
<td>Soft rush</td>
<td>18 inches to 4 feet</td>
<td>Rhizome/plug</td>
</tr>
<tr>
<td>Juncus nodatus</td>
<td>Stout rush</td>
<td>2 to 4 feet</td>
<td>Rhizome/plug</td>
</tr>
<tr>
<td>Juncus interior</td>
<td>Inland rush</td>
<td>1 to 3 feet</td>
<td>Plug</td>
</tr>
<tr>
<td>Juncus torreyi</td>
<td>Torrey's rush</td>
<td>1 to 3 feet</td>
<td>Plug</td>
</tr>
<tr>
<td>Sisyrinchium (sp.)</td>
<td>Blue-eye grass</td>
<td>Up to 4 inches</td>
<td>Seed</td>
</tr>
<tr>
<td>Buchloe dactyloides</td>
<td>Buffalograss</td>
<td>2 to 4 inches</td>
<td>Seed</td>
</tr>
</tbody>
</table>

¹Quantities must be determined based on area of planting
²Tolerate shady areas

Sample Calculation for Sizing Grass Swales

**Design Steps**

1. Determine the drainage area of the development. For this example a 5-acre residential development was selected.

2. Determine the runoff coefficient of the development. For this example, a runoff coefficient of 0.45 was selected for single-family medium density residential development based on the City of Houston Design Manual.

3. Based on the design storm, calculate flow rate from the drainage area. For this example, 0.27 in/hr intensity was used to calculate flow rate using the rational formula.

   \[
   Q = CIA
   \]

   \[
   Q = 0.45 \times 0.27 \frac{\text{in}}{\text{hr}} \times 5 \text{ acres} = 0.61 \frac{\text{ft}^3}{\text{sec}}
   \]

4. For a grass lined swale use a Manning’s roughness coefficient of 0.24 as required.

5. Determine the grass height based on frequency of mowing. The maximum recommended height is 6 inches. For this example a height of 6 inches is selected.

6. Determine depth of flow. Depth of flow in the grass swale shall be 3 inches or half the grass height, whichever is less. For this example the depth of flow is 3 inches (0.25 feet).
7. Select the shape of grass swale and side slope. For this example a trapezoidal channel with a side slope of 4H:1V is selected.

8. Select the longitudinal slope of the grass swale. For this example a 1 percent slope is selected.

Basic hydraulic equations and cross sectional formula

\[ A = bd + zd^2 \]
\[ P = b + 2d \sqrt{z^2 + 1} \]
\[ R = \frac{A}{P} \]
\[ T = b + 2zd \]

\[ b \approx \frac{Qn}{1.49d^{1.67}S^{0.5}} - zd \]

- Using the above equation
  \[ b \approx 9 \text{ feet} \]
- Calculate the cross sectional area
  \[ A = bd + zd^2 \]
  \[ A = 9 \times 0.25 + 4 \times 0.25^2 = 2.5 \text{ ft}^2 \]
- Calculate the flow velocity
  \[ V = \frac{Q}{A} = 0.24 \text{ ft/sec} \]

The calculated velocity is less than the recommend maximum velocity of 1.5 feet/second. The design is adequate.

Calculate the length (L)

\[ L = Vt (60 \text{ sec/min}) \]

For t=5 minutes (300 seconds),

\[ L = 0.24 \text{ ft/sec} \times 300 \text{ seconds} = 73 \text{ feet} \]

Based on the above calculation the design parameters for the trapezoidal section grass swales are:

- Bottom width 9 feet
- Length 73 feet
- Depth 0.25 feet
- Side slope 4H:1V
Filter Strips

BMP HC01.20 Vegetated Filter Strips

Purpose and Definition
Filter strips are a vegetative structural control intended to treat sheet flow. Filter strips provide effective treatment only when they have low slopes and where velocities are low. The design of filter strips should promote sheet flow of storm water runoff. The length of filter strip is the treatment media where most of the pollutants are trapped through filtration, sedimentation, sorption, and bacterial decompositions as the storm water sheet flows. Grass species, that allow more contact with the storm water, enhance pollutant removal performance; therefore, selection of grass species must be done carefully.

Application and Limitations
Filter strips are suitable best management practices where the peak flow rates and flow velocities are low, and sheet flow conditions prevail. If sheet flow condition cannot be achieved, a level spreader should be provided to facilitate sheet flow onto the filter strips. They are recommended as a best management practices for areas draining 10 acres or less. In developments draining more than 10 acres, filter strips could be used as a supplement with other best management practices. Filter strips are relatively flat with no side slopes and are typically located adjacent and parallel to paved areas such as parking lots, driveways, and roadways.

Design Criteria
The primary design factor that determines filter strip effectiveness is flow rate, flow velocity, and prevailing flow condition. The design criteria for filter strips are summarized in Table 1.4. The length of the filter strip and the length of the area that generates sheet flow are important design parameters. The filter strip length required is discussed below, and an example of filter strip is found in Figure 2.

- The minimum width of the filter strip shall be 20 feet. For areas that have a flow path of less than 60 feet, the minimum 20 feet filter strip shall be provided.
- For areas that have a flow path greater than 60 feet, an additional 5 feet of vegetation width shall be added for each additional 20 feet or fraction thereof. The maximum flow path of the paved surface shall not be more than 150 feet. Table 1.3 summarizes the required filter strip width for areas that have flow paths from 60 to 150 feet.
Table 1.3: Flow Path and Required Filter Strip Width

<table>
<thead>
<tr>
<th>Flow Path Across the Paved Surface, feet</th>
<th>Filter Strip Width, feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;60</td>
<td>20</td>
</tr>
<tr>
<td>60 to 80</td>
<td>25</td>
</tr>
<tr>
<td>80 to 100</td>
<td>30</td>
</tr>
<tr>
<td>100 to 120</td>
<td>35</td>
</tr>
<tr>
<td>120 to 140</td>
<td>40</td>
</tr>
<tr>
<td>140 to 150</td>
<td>45</td>
</tr>
</tbody>
</table>

- Dense growth vegetation is required, and the filter strip shall be constructed along the entire length of the contributing area.

Maintenance

Maintenance is the most important factor if water quality filter strips are to continue to function as designed. The maintenance requirement of filter strips is similar to grass swales.

Table 1.4: Sizing Criteria for Filter Strips

<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Filter Strips¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal slope</td>
<td>Less than 10% with a minimum of 0.1%</td>
</tr>
<tr>
<td>Maximum velocity</td>
<td>1.0 feet per second</td>
</tr>
<tr>
<td>Maximum water depth</td>
<td>1 inch maximum</td>
</tr>
<tr>
<td>Water quality design flow rate</td>
<td>NA</td>
</tr>
<tr>
<td>Manning coefficient</td>
<td>NA</td>
</tr>
<tr>
<td>Bottom width</td>
<td>NA</td>
</tr>
<tr>
<td>Minimum length</td>
<td>20 feet filter strip width for flow path up to 60 feet; an additional 5 feet of filter strip width shall be added for each additional 20 feet or fraction thereof</td>
</tr>
<tr>
<td>Maximum drainage pathway</td>
<td>150 feet (across paved area)</td>
</tr>
<tr>
<td>Maximum side slope</td>
<td>NA</td>
</tr>
<tr>
<td>Contributing drainage area</td>
<td>Less than 10 acres</td>
</tr>
</tbody>
</table>

¹Easement or restricted reserve dedication must contain wording that references the file number (permit number) and the public entity that holds the plan. The plan must include the maintenance schedule and frequency.
Figure 2: Vegetated Filter Strip Example Design Layout

BMP HC01.20 - VEGETATED FILTER STRIP
Sample Calculation for Sizing Filter Strips

Design Steps

1. Determine the flow path that needs to be serviced. For this example, a 300 feet wide parking lot with varying length is selected.

2. Calculate the required filter strip width. A 45 feet wide filter strip is needed for 150 feet paved area.

3. Select plants appropriate for the project site conditions. For this example Buffalo grass with a mix of Meadow sedge, Cherokee sedge, and Blue eyed grass are selected.
Wet Pond

BMP HC01.30 Wet Pond

Purpose and Definition

A wet pond is a constructed storm water treatment facility that retains a permanent pool of water. The permanent pool area enhances storm water runoff by gravitational settling, and plants in the fringe areas of the wet pond remove nutrients. Bacterial action in the water helps in chemical decomposition of complex substances into simpler forms.

Application and Limitations

Wet ponds are one of the most effective BMPs to enhance the quality of storm water runoff. The wet pond permanent pool is designed to hold and treat the design runoff for water quality enhancements between storm events through quiescent settling and biological uptake. In areas where soil permeability is high, water seepage from unlined ponds could result in a dry pond, particularly in dry seasons. Lining the bottom and the sides of the ponds with low permeable material helps to reduce seepage and maintain the design permanent pool volume. If wet ponds are used in areas with insufficient runoff, a supplemental water source may be necessary.

Wet ponds may be a single purpose facility to provide water quality treatment or they may serve multiple functions by providing flood control storage or recreational facilities. Wet ponds can be designed to have different storage stages, including the bottom stage permanent pool, extended detention, and flood protection storage. When combined with flood control function, the permanent pool is stacked under the extended detention and flood protection storage with potentially little loss of developable area.

Design Criteria

Several design factors determine the effectiveness of wet ponds. These factors include permanent pool volume, hydraulic residence time, pond geometry, pond depth, forebay (pre-settling), and permanent pool surface area. Table 1.5 summaries the design parameter for wet pond design. The presence of aquatic vegetation also may improve storm water quality. Other design considerations include a liner to prevent seepage, overflow and emergency spillways, berm embankments or slope stabilization, and maintenance drains. For a basic wet pond without extended detention, the volume of the permanent pool shall be equal to or greater than the total volume of runoff from the water quality design storm. Figure 3 and 3-A show examples of the layout and cross-sections of a wet pond. Figure 3-C shows details of the riser outlet with trash protection.
Permanent Pool Volume
The permanent pool volume shall be 0.5 inch of runoff from the drainage area. The permanent pool should remain full at all times to provide a source of water for wetland plants at the fringe of the wet pond and minimize turbulence within the pond. During storm events, the pond is designed to flush out the treated water and replace it with the incoming runoff. The permanent pool also minimizes re-suspension of sediments.

Hydraulic Residence Time
The hydraulic residence time (HRT) is the period of time a storm water runoff stays in the treatment system. Nationally, a time of two weeks has been shown to be sufficient to provide desirable storm water quality.

Pond Geometry
A length-to-width ratio of 3:1 or more shall be used to promote “plug flow,” (Plug flow describes the hypothetical condition of storm water storm water moving through the pond as a unit where the incoming storm water displacing the existing storm water) and minimize short-circuiting and dead storage area. Ponds that have good distance separation between the inlet and outlet locations are less prone to short-circuiting. Short-circuiting occurs when incoming runoff passes through the pond without adequate treatment. Short-circuiting can be prevented by maximizing the distance between the pond inlet and outlet locations or by increasing the travel time within the basin. This type of design encourages the incoming storm water to displace the existing water in the permanent pool. An alternative method of achieving plug flow characteristics is to construct baffles within the pond to lengthen the flow path between the inlet and outlet.

Permanent Pool Depth
The permanent pool depth of the open water area shall be 3 to 6 feet deep. Permanent pool depth is an important design parameter, since most of the pollutant removal is accomplished by gradual settling. Extremely shallow basins, those that are less than 2 feet deep and without aquatic vegetation, are prone to re-suspension problems. Depths of more than 8 feet are not recommended because of thermal stratification of the pond. Basins with variable depths that contain both shallow areas of less than 2 feet for aquatic vegetation growth and deeper areas of greater than 3 feet may be most beneficial for water quality improvements. In shallow areas of the ponds, the emergent aquatic vegetation enhances nutrient uptake, whereas the deeper areas provide pollutant removal by gravitational settling. The vegetative bench area, if provided, shall be shallower than 3 feet.
Permanent Pool Surface Area
The permanent pool surface area is usually expressed as a percentage of the drainage area. It is recommended that the permanent pool surface area of a wet pond be at least 1 to 1.5 percent of the drainage area. Pollutant removal by sedimentation is a function of the surface loading rate and the amount of pollutant per unit surface area of the pond. Since sedimentation is the primary pollutant removal mechanism in wet ponds, the surface area of the pond plays an important role in enhancing pollutant removal.

Sediment Forebay
Sediment forebay is a required element of a wet pond design. The sediment forebay volume shall be 20 percent of the permanent pool volume, and the main pool shall contain the remaining water quality design volume. The depth of the sediment forebay shall be 4 to 6 feet. A tear shaped sediment forebay with length to average width ratio of 3:1, with the inlet at the narrow end is recommended. All inlets to the basin must first enter a sediment forebay. If desired, multiple sediment forebays can be used. A maintenance access must be provided. The forebay shall be designed to dissipate the energy and reduce the velocity.

Basin Configuration
Wet ponds can be designed to have different storage stages, including the bottom stage permanent pool, extended detention, and flooding protection storage. These types of basins are referred to as multi-purpose basins, and the permanent pool is stacked under the extended detention and flood protection storage. A multi-use wet pond outlet such as an emergency spillway, and outlet for storm water quantity control should be designed based on the applicable agency's drainage criteria.

Safety Bench
Safety bench area could be dry above the permanent pool or a shallow vegetative bench area below the permanent pool, Figure 3-B. A safety bench 10 feet wide and slope of 1 to 2 percent shall be provided above the permanent pool elevation of the wet pond. If the wet pond is designed with a combined vegetative/safety bench area, the safety bench shall be at least 6 feet wide, to facilitate mowing. The remaining 4 feet shall be vegetative bench area below the permanent pool.

Vegetative Bench
If only a vegetative bench area is included along the perimeter of the wet pond, the width shall be a minimum of 10 feet, Figure 3-B. This width includes the safety bench area with 10 percent slopes or flatter. The maximum depth of the vegetative bench shall be 3 feet. Both the sediment forebay and the main pool could have vegetative benches.
Providing vegetative bench adds aesthetics to the site and enhances pollutant removal. The total surface area of the vegetative bench should be approximately 20 to 30 percent of the permanent pool surface area.

**Sizing Procedure**

- Determine the drainage area \((A)\) that contributes runoff to the pond.
- Determine the permanent pool volume \((V_{pp})\), which is 0.5 inch of runoff from the drainage area.
- Calculate the volume of the pre-settling basin or forebay \((V_f)\) and the main pool \((V_m)\). \(V_f = 0.2 \times V_{wq}\) and \(V_m = 0.8 \times V_{wq}\)
- Design the pond layout to achieve the length to width ratio of at least 3L:1W. The pond layout shall maximize the flow path between the inlet and the outlet, minimize short-circuiting, and avoid dead storage area.
- Select a side slope based on the site condition. A side slope of 3H:1V or flatter is required for earthen ponds.
- Prepare a pond grading plan (establish contours) and capacity-elevation table of the pond.
- Determine the depth \((d)\) and the surface area of the permanent pool \((S)\), and set the water surface elevation of the permanent pool.
- Calculate water quality treatment volume \((V_{wq})\) which is 0.5 inch of runoff from the drainage area.
- Using the capacity-elevation table of the pond, determine the water quality volume elevation assuming that all of the water quality volume will be in the pond at once.
- Determine the average release rate assuming the water quality volume is released within 24 hours i.e., 0.021 cubic feet per second per drained acre.
- Calculate the average head \((\Delta H)\) from the elevation difference between the water quality and permanent pool elevations.
- Size an outlet based on the values calculated from the two procedures listed above, see sample calculation for further detail. Specify equation used.
- Specify overflow device such as emergency spillway and overflow elevation.
- Calculate the area of the permanent pool to be planted with wetland vegetation. This area is 20 to 30 percent of the permanent pool area.
- Consult a wetland specialist for wetland plant selections suitable to the project site.
- Specify floatables control or trash trap devices.
**Maintenance**

Maintenance is an important factor if water quality wet ponds are to continue to function as originally designed. A specific maintenance plan shall be prepared outlining the schedule and scope of maintenance operation. This plan should be included in the Storm Water Quality Management Plan and submitted to the applicable agency. The maintenance plan should include at a minimum:

- Inspection frequency, removal of floating debris and accumulated petroleum products.
- Removal frequency and method of disposal of sediments from the sediment forebay.
- Maintenance and management of the aquatic vegetation and aesthetic appearance of the site.
- Control of invasive plants and mowing.
Table 1.5: Sizing Criteria for Wet Ponds

<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Wet Pond¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent pool volume</td>
<td>0.5 inch of runoff from the drainage area</td>
</tr>
<tr>
<td>Water quality treatment volume</td>
<td>0.5 inch of runoff from the drainage area</td>
</tr>
<tr>
<td>Permanent pool depth</td>
<td>3 feet min. and 6 feet max.</td>
</tr>
<tr>
<td>Pond geometry or length (L) to width (W) ratio²</td>
<td>Length to width ratio of 3L:1W or more; avoid dead storage areas and minimize short-circuiting</td>
</tr>
<tr>
<td>Side slope</td>
<td>3H:1V or flatter for earthen and no minimum for concrete</td>
</tr>
<tr>
<td>Vegetative shelf</td>
<td>20 to 30 percent of the permanent pool with depth less than 3 feet</td>
</tr>
<tr>
<td>Volume of pre-settling basin or forebay ³</td>
<td>20 percent of the permanent pool volume; 4 to 6 feet deep</td>
</tr>
<tr>
<td>Safety bench</td>
<td>Minimum of 10 feet wide without vegetative shelf area or 6 feet wide with vegetative shelf area above the permanent pool elevation.</td>
</tr>
<tr>
<td>Pond configurations (stages)</td>
<td>Multi stages for extended detention and flood control allowed</td>
</tr>
<tr>
<td>Distance between inlet and outlet</td>
<td>Placed to maximize flow path and without causing short-circuiting.</td>
</tr>
<tr>
<td>Outlet</td>
<td>Size to meet extended detention storage</td>
</tr>
</tbody>
</table>

¹Easement or restricted reserve dedication must contain wording that references the file number (permit number) and the public entity that holds the plan. The plan must include the maintenance schedule and frequency.

²For wet ponds, the flowpath length from inlet to outlet should be measured at deepest and the width at deepest can be found as (average top width + average bottom width)/2.

³All inlets that convey storm water runoff shall enter first the forebay or pre-treatment basin.
Figure 3: Wet Pond Example Design Layout
Figure 3-A: Wet Pond Example Cross-Sections
VEGETATIVE BENCH

DRY SAFETY BENCH

COMBINED VEGETATIVE AND DRY SAFETY BENCH

Figure 3-B: Wet Pond - Safety and Vegetative Bench Cross-Sections
PERFORATED RISER

SLOTTED RISER

WIRE MESH TRASH RACK NOTES:
1. WIRE MESH MUST BE FINER THAN PERFORATION DIAMETER OR SLOT WIDTH.
2. DISTANCE BETWEEN SIDES OF WIRE MESH RACK MUST BE 3 TIMES THE PERFORATION DIAMETER OR GREATER.

BMP HC01.30 - RISER OUTLET

Figure 3-C: Wet Pond - Riser Outlet With Trash Protection
Sample Calculation for Sizing Wet Ponds

Design Steps

1. Determine the drainage area that contributes storm runoff. For this example a 20-acre site is selected and all of the area drains into the wet pond. It was assumed that the underling soil is acceptable to support a wet pond without lining and the water table at the site is below the lowest elevation of the wet pond.

2. Compute the permanent pool volume. The permanent pool volume is 0.5" of runoff from the drainage area, which is 0.83 acre-feet.

\[ V_{pp} = 0.5 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} \times 20 \text{ acres} = 0.83 \text{ acre-feet} \]

3. Compute the forebay and the main pool volumes. For this example the forebay volume is 20 percent of the permanent pool volume and the remaining 80 percent is the main pool volume. Forebay volume is 0.17 acre-feet and the main pool volume is 0.66 acre-feet.

\[ \text{Forebay volume } V_f = V_{pp} \times 0.20 \Rightarrow 0.83 \times 0.20 = 0.17 \text{ acre-feet} \]
\[ \text{Main pool } V_m = V_{pp} \times 0.80 \Rightarrow 0.83 \times 0.80 = 0.66 \text{ acre-feet} \]

4. Layout the pond with approximate length to width ratio of at least 3:1. In the main pool at the widest point, the pond depth was set at 6 feet. The slope in both directions was 5:1 for 27 feet then it transitions to a 10-feet wide safety bench and vegetative shelf area with a 10:1 side slope. Based on these dimensions the assumed average depth was calculated to be approximately 3 feet. Length of the forebay is 61 feet and length of the main pool is 154 feet. The surface area of the forebay is 0.07 acres and the surface area of the main pool is 0.21 acres. The average width of the forebay and the main pool is calculated as 55 feet.

5. Compute the water quality treatment volume using 0.5" of runoff from the drainage area (0.83 acre-feet). Based on the layout and grading of the pond this volume creates a head of 2.39 feet above the permanent pool elevation.

6. Calculate the orifice area required to drain the water quality treatment volume within 24-hours. Using the following equation from Guidance Manual Page 4-38:
where: \( A_p \) = perforation area, square inches  
\( V \) = volume cubic feet  
\( \Delta t \) = draw down time in hours  
\( \Delta H \) = maximum head in feet  

\[
A_p = \frac{V_{\text{vol}}}{120.3 \times \Delta t \sqrt[2]{\Delta H}}
\]

The orifice area required is 8.10 in\(^2\) and ten one-inch diameter holes could be used.

7 Calculate the vegetative bench area for planting of wetland vegetation. For this example 20 percent of the pool area (main pool plus forebay area) will be planted with wetland vegetation.

Planting area \( 0.28 \text{ acre} \times 43560 \frac{\text{ft}^2}{\text{acre}} \times 0.2 = 2440 \text{ ft}^2 \)
Dry Detention Basins

BMP HC01.40

**Purpose and Definition**

Dry detention basins temporarily detain a portion of runoff for a specified length of time and release the storm water slowly. These basins are dry except for a period ranging from hours to several days following the storm event. Sedimentation is the primary pollutant removal mechanism in dry detention basins, allowing particulate and suspended solids to settle out of the water, thereby removing pollutants. The two most common types of dry detention basins are conventional and extended detention basins, depending on the design of the outlet structure that controls the release of storm water. Extended detention basins drain more slowly than conventional detention basins.

**Application and Limitations**

Dry detention basins are suitable BMPs where the expected concentrations of soluble pollutants from the area are low. Overall pollutant removal in dry detention basins is low to moderate. Dry detention basins can be used in conjunction with other BMPs.

**Design Criteria**

Several design factors determine the effectiveness of dry detention basins. *Table 1.6* summarizes the design parameter for dry detention basin design. The design of dry detention basins is similar to wet ponds with the exclusion of the permanent pool and aquatic shelf areas. These factors include water quality storage volume, hydraulic residence time, pond geometry, and outlet design. The basin dimensions and basin outlet structure should be designed to detain the design storm water runoff for an average detention time of 24 hours. The desired time may be achieved by using the full basin drain time of at least 48 hours, with no more than 50 percent of the water quality volume draining in the first 24 hours. *Figure 4 and 4-A* show examples of the layout and cross-sections of dry detention basins pond.

**Sizing Procedure**

- Determine the drainage area \( A \) that contributes runoff to the basin.
- Determine the water quality treatment volume \( V_{wq} \), which is 0.5 inch of runoff from the drainage area.
- Design the pond layout to achieve the length to width ratio of at least 3L:1W. The pond layout should maximize the flow path between the inlet and the outlet, minimize short-circuiting, and avoid dead storage area.
• Select a side slope based on the site condition. A side slope of 3H:1V or flatter is required for earthen basins.
• Prepare a pond grading plan (establish contours) and capacity-elevation table of the pond.
• Size an outlet to attain an average hydraulic detention time of 24 hours. This may be achieved by using the full basin drain time of at least 48 hours, with no more than 50 percent of the water quality volume draining in the first 24 hours.
• Specify overflow device such as emergency spillway and overflow elevation.
• Specify floatables control or trash trap devices.

**Maintenance**

Maintenance is the primary important factor if water quality dry detention basins are to continue to function as originally designed. Several studies conducted in the other parts of the USA have evaluated the pollutant removal performance of dry detention basins. The majority of the problems that affect the performance of these basins are associated with maintenance. Many dry basins have partially failed or are not meeting their design performance due to inlet or outlet clogging. Some of major performance-related problems encountered include excessive sediment or debris buildup, inappropriate ponding of water that resulted in uncontrolled vegetative growth, and clogging of the outflow structure.

A specific maintenance plan should be prepared outlining the schedule and scope of maintenance operation. This plan should be included in the Storm Water Quality Management Plan and submitted to the applicable agency. The maintenance plan should include at a minimum:

• Inspection frequency, removal of floating debris and accumulated petroleum products.
• Inspection and maintenance of outlet structures.
• Removal frequency and method of sediment disposal.
• Vegetation control and mowing.
<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Dry Detention Basin¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality treatment volume</td>
<td>0.5 inch of runoff from the drainage area</td>
</tr>
<tr>
<td>Permanent pool volume</td>
<td>NA</td>
</tr>
<tr>
<td>Permanent pool depth</td>
<td>NA</td>
</tr>
<tr>
<td>Pond geometry or length (L) to width (W) ratio²</td>
<td>Length to width ratio of 3L:1W or more; avoid dead storage areas and minimize short-circuiting</td>
</tr>
<tr>
<td>Inlet location</td>
<td>Inlet shall be located 1 foot above the bottom of the basin</td>
</tr>
<tr>
<td>Side slope</td>
<td>3H:1V or flatter for earthen and no minimum for concrete</td>
</tr>
<tr>
<td>Hydraulic resident time</td>
<td>24 to 48 hours³</td>
</tr>
<tr>
<td>Shallow water vegetative shelf</td>
<td>NA</td>
</tr>
<tr>
<td>Pond configurations (stages)</td>
<td>NA</td>
</tr>
<tr>
<td>Distance between inlet and outlet</td>
<td>Placed to maximize flow path and without causing short-circuiting</td>
</tr>
<tr>
<td>Outlet</td>
<td>Design to meet hydraulic resident time</td>
</tr>
</tbody>
</table>

¹Easement or restricted reserve dedication must contain wording that references the file number (permit number) and the public entity that holds the plan. The plan must include the maintenance schedule and frequency.

²All inlets and outlet that convey storm water runoff should be placed to maximize the flow path inside the basin.

³An average detention time of 24 hours is desired and may be achieved by using the full basin drain time of at least 48 hours, with no more than 50 percent of the water quality volume draining in the first 24 hours
BMP HC01.40 - DRY DETENTION BASIN

Figure 4: Dry Detention Basin Example Design Layout
Figure 4-A: Dry Detention Basin Cross-Sections
Sample Calculation for Sizing Dry Detention Basin

Design Steps

1. Determine the drainage area that contributes storm water runoff. For this example a 20-acres site is selected and all of the area drains into the basin.

2. Compute the water quality treatment volume. The water quality treatment volume is 0.5" of runoff from the drainage area, which is 0.83 acre-feet.

\[ V_{wq} = 0.5 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} \times 20 \text{ acres} = 0.83 \text{ acre-feet} \]

3. Design the basin layout with approximate length to width ratio of at least 3:1. The basin depth was set at 3 feet. The bottom width of the basin was 58 and the bottom length of the basin was 174 with the side slopes of 3:1.

4. Calculate the orifice area required to drain 50 percent of the water quality volume within 24-hours. Using the following equation from the Guidance Manual Page 4-38 the orifice area required would be:

\[ A_p = \frac{V_{wq}}{120.3 \times \Delta t \sqrt{\Delta H}} \]

Where:  
- \( A_p \) = perforation area, square inches  
- \( V \) = volume cubic feet  
- \( \Delta t \) = draw down time in hours  
- \( \Delta H \) = maximum head in feet

\[ 0.5 \times 0.83 \text{ acre-feet} \times 43560 \frac{\text{ft}^2}{\text{acre}} = 36 \text{ in}^2 \]

\[ A_p = \frac{36 \text{ in}^2}{120.3 \times 24 \text{ hr} \sqrt{3 \text{ feet}}} = 3.6 \text{ in}^2 \]

The required orifice area would be 3.6 in² and eighteen half-inch diameter holes or equivalent could be used.
Constructed Wetlands for Storm Water Treatment

BMP HC01.50 Storm Water Treatment Wetlands

Purpose and Definition
Storm water treatment wetlands are constructed shallow ponds designed often based on the ecological function of natural wetlands. Natural wetlands are more or less self-maintaining systems; whereas, constructed wetlands for storm water treatment purposes require active management.

Wetlands are constructed in development and redevelopment activity for two main purposes. The first purpose is to mitigate lost, impacted or filled wetlands due to development or construction activity, and the second purpose is to treat storm water runoff (storm water treatment wetlands).

Newly constructed wetlands should be evaluated for exemption listed in 40 CFR 122.2 that provides an exemption to classification as “Waters of the U.S.” for treatment pond systems or lagoons designed to meet the requirements of the Clean Water Act. However, if a constructed wetland is exempted by being defined as a treatment facility, it cannot be used for wetlands mitigation for losses due to construction. Modification of an existing wetland area to serve for storm water treatment function is potentially subject to 404 permitting. The need for section 404 permits should be evaluated on a case-by-case basis.

Application and Limitations
Wetlands have shallower depths than wet ponds and generally requires more surface area to treat an equal amount of storm water runoff from the same size drainage area. Since water depths are shallower than wet ponds, water loss by evaporation is an important concern. Careful planning and water budget analysis is needed to be sure sufficient water will be retained to sustain good wetland plant growth. The most important pollutant removal processes in wetlands treatment systems are the purely physical processes of sedimentation via reduced velocities and filtration by wetland vegetation. Intimately linked with the sediment biota, the wetland vegetation serves as a major storage vector for carbon and nutrients, as an energy source for sediment microbial metabolism, and as a gas exchange vector between sediments and air. Thus, it is important to design for a substantial native emergent vegetative component.

Design Criteria
Wetlands design is site-specific but general design consideration includes a sediment forebay, maximized hydraulic retention time, elimination of dead zone and hydraulic short-circuiting, and selection and establishment of native wetland vegetation. Table 1.7 summaries
the design parameter for storm water treatment wetland design. The sediment forebay should be provided for initial sediment deposition and reduction of storm water inflow velocities. It is very important to drop the initial suspended sediment load and lower the inflow water velocity to maintain system longevity and proper functionality of the wetland system. Most of the design elements discussed in the wet pond section are applicable to wetlands. The exceptions are depth and distribution of aquatic vegetation. These two parameters are discussed below.

The wetland area should consist of various depths and the following distribution of depths in the wetland cell could be used as a guide.

- 50 percent of the area should have 0.5-foot depth. This is the outer most section of the wetland area closer to the berm of the basin.
- 15 percent of the area should have 0.5 to 2-foot depth. This is the next inner section of the wetland area.
- 15 percent of the area should have 3 to 4-feet depth. This is the most inner section of the wetland area and mostly open water section.
- 20 percent of the area should have greater than 3-feet depth with maximum of 6-feet depth. This is the forebay or the pre-treatment section of the wetland.

- Other design considerations should include flow bypass for higher frequency storms.
- A soil study and geotechnical analysis should be conducted, and soil through the wetland area should have an infiltration rate low enough to maintain a permanent pool.
- Careful selection of diversified wetland plant species is one of the most important design aspects to avoid takeover of wetlands system by invasive aquatic nuisance plants.
- *Table 1.5* summarizes the criteria for the design parameters for storm water treatment wetlands.

**Maintenance**

Maintenance is the most important factor if storm water treatment wetlands are to continue to function as originally designed. A specific maintenance plan should be prepared outlining the schedule and scope of maintenance operation. This plan should be included in the Storm Water Quality Management Plan and submitted to the applicable agency. The maintenance plan should include at a minimum:

- Inspection frequency, removal of floating debris and accumulated petroleum products.
- Inspection and maintenance of outlet structures.
- Removal frequency and method of sediment disposal.
• Maintenance and management of the aquatic vegetation and aesthetic appearance of the site.
### Table 1.7: Sizing Criteria for Storm Water Treatment Wetlands

<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Wetlands&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality treatment volume</td>
<td>0.5 inch of runoff from the drainage area</td>
</tr>
<tr>
<td>Permanent pool volume</td>
<td>Same as water quality treatment volume</td>
</tr>
<tr>
<td>Depth of sediment forebay (Pre-treatment)</td>
<td>4 feet minimum and 6 feet maximum</td>
</tr>
<tr>
<td>Volume of pre-settling basin or forebay</td>
<td>20 % of the permanent pool volume</td>
</tr>
<tr>
<td>Pond geometry or length (L) to width (W) ratio&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Length to width ratio of 3L:1W or more; layout the pond to avoid dead storage areas and minimize short-circuiting</td>
</tr>
<tr>
<td>Side slope</td>
<td>3H:1V or flatter</td>
</tr>
</tbody>
</table>
| Surface-area-to-pool-depth relationship  | 50% of the area, 0.5 foot deep  
15% of the area, 0.5 to 2 foot deep  
15% of the area, 3 to 4 feet deep  
20% of the area, greater than 3 feet deep with maximum of 6 feet deep (forebay section) |
| Wetland Vegetation                       | Diverse mixture of floating, emergent and submergent plants; consult a wetland specialist for a specific plant species suitable to the project site |
| Distance between inlet and outlet        | Placed to maximize flow path and without causing short-circuiting.                   |
| Outlet                                   | Size to meet extended detention storage                                              |

<sup>1</sup>Easement or restricted reserve dedication must contain wording that references the file number (permit number) and the public entity that holds the plan. The plan must include the maintenance schedule and frequency.

<sup>2</sup>All inlets that convey storm water runoff should enter first the forebay or pre-treatment basin.

<sup>3</sup>The flowpath length from inlet to outlet should be measured along the deepest section and the width can be found as (average top width + average bottom width)/2.
Bibliography

City of Austin. 1998. City of Austin Environmental Criteria Manual. City of Austin Department of Environmental Protection.


### Vegetated Filter Strips

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area Serviced</td>
<td></td>
<td></td>
<td>10(^1)</td>
<td>Acres</td>
</tr>
<tr>
<td>Width of Buffer Strip</td>
<td></td>
<td>20</td>
<td>45</td>
<td>ft</td>
</tr>
<tr>
<td>Overland Travel Distance (to start of Vegetative Buffer Strip)</td>
<td></td>
<td></td>
<td>150</td>
<td>ft</td>
</tr>
<tr>
<td>Maximum Flow Velocity</td>
<td></td>
<td></td>
<td>1</td>
<td>ft/s</td>
</tr>
<tr>
<td>Easement or Restricted Reserve(^2)</td>
<td></td>
<td></td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Slope</td>
<td>0.1%</td>
<td>10%</td>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

**Flow Spreader**

**Sampling Location (Treated)**

**Type of Vegetation**

**Height of Vegetation** ft or inches

#### Collection System

**Type of System**

**Design Frequency**

**Maximum Flow**

**Maximum Depth**

#### Maintenance Considerations

<table>
<thead>
<tr>
<th>Maintenance Consideration</th>
<th>every</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Owner/Operator Self Inspection (per half inch rainfall event)</td>
<td></td>
</tr>
<tr>
<td>Frequency of Owner/Operator Self Inspection</td>
<td>1</td>
</tr>
<tr>
<td>Clear Out Criteria</td>
<td></td>
</tr>
<tr>
<td>Permit Renewal Frequency</td>
<td>6</td>
</tr>
</tbody>
</table>

**Reporting Frequency, Certification Frequency, Permit Renewal, Operation Permit**

---

\(^1\) In developments draining more than 10 acres, filter strips could be used as a supplement with other best management practices.

\(^2\) The easement or plat dedication must contain wording which references the file number (or permit number) and the public entity that holds the plan. The plan will include the accepted maintenance plan.
### Grass Swales

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Area Serviced</td>
<td></td>
<td>10¹</td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Length of Travel</td>
<td></td>
<td>50</td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Maximum Flow Velocity</td>
<td></td>
<td>1.5</td>
<td></td>
<td>ft/s</td>
</tr>
<tr>
<td>Design Depth</td>
<td></td>
<td>1/2 grass height or 3 inch, whichever is less</td>
<td>ft</td>
<td></td>
</tr>
<tr>
<td>Type of Grass</td>
<td></td>
<td></td>
<td>Specify</td>
<td></td>
</tr>
<tr>
<td>Roughness Coefficient</td>
<td></td>
<td>0.24</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>Longitudinal Slope</td>
<td></td>
<td>0.1</td>
<td>2%</td>
<td>%</td>
</tr>
<tr>
<td>Side Slope</td>
<td></td>
<td>3H:1V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom Width</td>
<td></td>
<td></td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Easement or Restricted Reserve²</td>
<td></td>
<td></td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Design Equation</td>
<td></td>
<td></td>
<td>Specify</td>
<td></td>
</tr>
<tr>
<td>Discharge Conditions</td>
<td></td>
<td></td>
<td>Specify</td>
<td></td>
</tr>
<tr>
<td>Sampling Location (Treated)</td>
<td></td>
<td></td>
<td>Specify</td>
<td></td>
</tr>
</tbody>
</table>

**Overflow Considerations**

| Overflow Elevation               | Specify | ft |
| Overflow Device                  | Specify |
| Design Equation                  | Specify |

**Maintenance Considerations**

| Frequency of Owner/Operator Self Inspection (per half inch rainfall event) | every |
| Frequency of Owner/Operator Self Inspection | 1 | 2 | weeks |
| Permit Renewal Frequency          | 6 | 12 | months |

**Conveyance of the less frequent storm such as a 2-year must be done in a different location or by a different method. For properties larger than 10-acres, this system can be used in conjunction with one of the detention ponds.**

1 In developments draining more than 10 acres, filter strips could be used as a supplement with other best management practices.

2 The easement or plat dedication must contain wording which references the file number (or permit number) and the public entity that holds the plan. The plan will include the accepted maintenance plan.
**Dry Detention Basins**

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area Serviced</td>
<td></td>
<td></td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Easement or Restricted Reserve&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Design Depth</td>
<td></td>
<td></td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Design Volume</td>
<td>0.5</td>
<td></td>
<td></td>
<td>Inch per acre</td>
</tr>
<tr>
<td>Side Slope</td>
<td>earthen channels =&gt; preferred</td>
<td>3H:1V</td>
<td></td>
<td>H:V ft/ft</td>
</tr>
<tr>
<td>(concrete channels)</td>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom Slope</td>
<td>earthen channels =&gt; preferred</td>
<td>0.1</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Design Water Surface Elevation</td>
<td></td>
<td></td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Average Detention Time</td>
<td>24</td>
<td></td>
<td></td>
<td>Hours</td>
</tr>
<tr>
<td>Design Flow Rate</td>
<td></td>
<td></td>
<td></td>
<td>ft³/s</td>
</tr>
<tr>
<td>Outlet Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Equation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling Location (s) (Pre-treatment and Treated)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Dual Use Design Considerations (Optional)**

| Design Storm (2-year, 100-year) | | | | |
| Detention Volume | | | | ft |
| Water Surface Elevation | | | | ft |
| Side Slope | | | | ft H/ft V |
| Outlet Size and Type | | | | ft |
| Design Equation | | | | |
| Allowable and Design Flow Rate | | | | ft³/s |

**Overflow Considerations**

| Overflow Elevation | | | | ft |
| Overflow Device | | | | |
| Design Equation | | | | |
| Floatable Trapping Mechanism | | | | |

**Maintenance Considerations**

| Settling Basin Clean Out Criteria (% volume lost in forebay, if included in the design) | 50% |
| Frequency of Owner/Operator Self Inspection (per half inch rainfall event) | every |
| Frequency of Owner/Operator Self Inspection | 1 | 2 | weeks |
| Permit Renewal Frequency | 6 | 12 | months |

1 In developments draining more than 10 acres, filter strips could be used as a supplement with other best management practices.

2 The easement or plat dedication must contain wording which references the file number (or permit number) and the public entity that holds the plan. The plan will include the accepted maintenance plan.
## Wet Ponds

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Pool Depth at deepest point</td>
<td>4</td>
<td>6</td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Pond Area (includes berms, etc.)</td>
<td></td>
<td></td>
<td></td>
<td>ft² or acres</td>
</tr>
<tr>
<td>Side Slope</td>
<td>3</td>
<td></td>
<td></td>
<td>ft H / ft V</td>
</tr>
<tr>
<td>Bench Elevation Above Permanent Water Surface Elevation</td>
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<td></td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Drainage Area Serviced</td>
<td></td>
<td></td>
<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Easement or Restricted Reserve*</td>
<td>1</td>
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<td></td>
<td>Acres</td>
</tr>
<tr>
<td>Length to Width Ratio</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forebay Volume %</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Volume</td>
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<td></td>
<td></td>
<td>Inches per acre</td>
</tr>
<tr>
<td>Side Slope</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>earthen</td>
<td>3</td>
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<tr>
<td>concrete</td>
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<td></td>
<td></td>
<td></td>
<td>ft</td>
</tr>
<tr>
<td>Outlet Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Equation</td>
<td></td>
<td></td>
<td></td>
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<td>Sampling Location (s) (Pre-treatment and Treatment)</td>
<td></td>
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<td>Vegetation Types</td>
<td></td>
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<td></td>
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<tr>
<td>Vegetated Shelf Area</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Dual Use Design Considerations (Optional)

| Design Storm (2-year, 100-year)                      |         |         |       |                |
| Detention Volume                                    |         |         |       | acre-ft        |
| Water Surface Elevation                             |         |         |       | ft             |
| Side Slope                                          |         |         |       | ft H/ft V      |
| Outlet Size and Type                                |         |         |       | ft             |
| Design Equation                                     |         |         |       |                |
| Design Flow Rate                                    |         |         |       | ft³/s          |

### Overflow Considerations

| Overflow Elevation                                  |         |         |       | ft             |
| Overflow Path                                       |         |         |       |                |
| Overflow Device                                     |         |         |       |                |
| Design Equation                                     |         |         |       |                |
| Floatable Trapping Mechanism                        |         |         |       |                |

### Maintenance Considerations

| Settling Basin Clean Out Criteria (% volume lost in forebay) | 50%     |
| Frequency of Owner/Operator Self Inspection (per half inch rainfall event) | every   |
| Frequency of Owner/Operator Self Inspection            | 1       | 2       | weeks          |
| Permit Renewal Frequency                              | 6       | 12      | months         |
| Reporting Frequency, Certification Frequency, Permit Renewal, Operation Permit |         |         |                |
# Type 1 Facility Monitoring Thresholds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Oil and Grease</td>
<td>15 mg/l</td>
</tr>
<tr>
<td>Chemical Oxygen Demand (COD)</td>
<td>120 mg/l</td>
</tr>
<tr>
<td>pH</td>
<td>6-9 Standard Units</td>
</tr>
<tr>
<td>Biochemical Oxygen Demand (BOD)</td>
<td>30 mg/l</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>100 mg/l</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>2 mg/l</td>
</tr>
<tr>
<td>Nitrate plus Nitrite Nitrogen</td>
<td>0.68 mg/l</td>
</tr>
<tr>
<td>Total Kjeldahl Nitrogen (TKN)</td>
<td>15 mg/l</td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>75 mg/l</td>
</tr>
<tr>
<td>NH3</td>
<td>15 mg/l</td>
</tr>
<tr>
<td>Temp</td>
<td>100 degrees F</td>
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Attachment F

HCFCD Capital Improvement Five-Year Program FY 2008-09 – FY 2012-13
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B - ARMAND BAYOU WATERSHED

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C - SIMS BAYOU WATERSHED

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D - BRAYS BAYOU WATERSHED

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**E. WHITE OAK BAYOU WATERSHED**

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<td>23,948</td>
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<td>U502-02-00-E001</td>
<td>Proposed Stormwater Detention</td>
<td>642,890</td>
<td>957,083</td>
<td>402,794</td>
<td>46,679</td>
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<td>2,049,446</td>
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<td>U506-06-00-E001</td>
<td>E &amp; R Contract - Sprint</td>
<td>10,100</td>
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<td>ADDICKS RESERVOIR TOTALS:</td>
<td>708,868</td>
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<td>402,794</td>
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<td>W - BUFFALO BAYOU WATERSHED</td>
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<td>742,713</td>
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<td>W129-00-00-FP00</td>
<td>Design Stage for Conveyance Imp</td>
<td>52,500</td>
<td>75,000</td>
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<td>W151-00-00-P001</td>
<td>Drainage &amp; Flood Control Study</td>
<td>241,049</td>
<td>97,734</td>
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<td>BUFFALO BAYOU TOTALS:</td>
<td>1,036,262</td>
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<td>Z - HARRIS COUNTY</td>
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<td>Z100-00-00-FP03</td>
<td>Category 2 - Future PDM/Earnar</td>
<td>1,010,008</td>
<td>822,853</td>
<td>167,139</td>
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<td>Z100-00-00-FP04</td>
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<td>1,010,008</td>
<td>1,522,852</td>
<td>677,139</td>
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<td>Z100-00-00-FP05</td>
<td>Category 2 - Future FMA/pilot</td>
<td>505,004</td>
<td>411,426</td>
<td>83,570</td>
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<td>Z100-00-00-FP06</td>
<td>Category 2 - Severe Repetitive loss</td>
<td>505,004</td>
<td>901,426</td>
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<td>Z100-00-00-G100</td>
<td>Elevation Survey</td>
<td>3,213</td>
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<td>Z100-00-00-H014</td>
<td>PDM-03-G-01</td>
<td>1,201,679</td>
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<td>1,716,684</td>
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<td>PDM-05-021</td>
<td>727,086</td>
<td>311,608</td>
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<td>881,575</td>
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<td>Z100-00-00-H017</td>
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<td>1,385,740</td>
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<td>PDM 2005 - 020</td>
<td>1,097,666</td>
<td>453,174</td>
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<td>1,550,839</td>
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<td>Z100-00-00-H019</td>
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<td>1,246,197</td>
<td>534,084</td>
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<td>1,780,281</td>
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<td>878,154</td>
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<td>Z100-00-00-H021</td>
<td>PDM 2005 - 028</td>
<td>305,555</td>
<td>130,952</td>
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<td>436,507</td>
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<td>Z100-00-00-H022</td>
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<td>718,522</td>
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<td>Z100-00-00-H023</td>
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<td>2,579,450</td>
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<td>TSARP Appeal Support Program</td>
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<td>1,246,509</td>
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<td>Z100-00-00-Y055</td>
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<td>Z100-00-00-Contingency &amp; Escalation Funds</td>
<td>12,600,000</td>
<td>17,300,000</td>
<td>17,790,000</td>
<td>6,110,000</td>
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CIP With 09 Spending

5/9/2008
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<th>Name</th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>Totals</th>
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<tr>
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<td>HARRIS COUNTY TOTALS:</td>
<td>$40,009,291</td>
<td>$31,827,037</td>
<td>$19,605,961</td>
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<td>JUNE 2008 CIP GRAND TOTAL:</td>
<td>$139,970,217</td>
<td>$119,426,747</td>
<td>$57,467,958</td>
<td>$16,618,168</td>
<td>$1,525,076</td>
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Harris County Flood Control District
2008 Federal Briefing

March 13, 2008 • Washington, D.C.
Introduction to HCFCFD

Federal Project Summaries

Congressional Districts

WRDA

Appropriations

HCFCF Lead Projects Section 211(f)
  - Brays Bayou
  - Hunting Bayou
  - White Oak Bayou
  - Buffalo Bayou
  - Harris Gully

Corps Lead Projects
  - Sims Bayou
  - Clear Creek
  - Greens Bayou

FEMA Projects
  - FEMA Model & Map Management
  - Buyout
  - Harris Gully

USGS
Jack Peterson, *Washington contact for the Harris County Flood Control District*
2810 North Harrison Street
Arlington, VA  22207
703.536.6964

Harris County Flood Control District
9900 Northwest Freeway
Houston, TX  77092

Mike Talbott, *Director of Harris County Flood Control District*
Steve Fitzgerald, *Chief Engineer*
Fred Garcia, *Director of Communications*
Burton Johnson, *Planning Department Manager*
Wayne Crull, *Section 211(f) Study Manager*
AGENDA

Federal Briefing
Harris County Flood Control District
Thursday, March 13, 2008                           Washington, D.C.

INTRODUCTIONS AND BRIEFING OVERVIEW ......................... Peterson

INTRODUCTION TO HCFCD .................................................. Talbott
  • Mission/Capabilities
  • Flooding Problem
  • Congressional Districts, Watersheds, and Corps Projects

COMMUNITY AND NATURAL VALUES.................................. Talbott
  • Environment, Habitat, and People
  • Non-Federal Flood Damage Reduction Projects
  • Addicks and Barker Reservoirs – Emergency Roles & Responsibilities
  • Hurricane Surge and Wave Damage Reduction Study – Galveston Bay

WRDA ................................................................. Fitzgerald
  • 2007
  • 2008

APPROPRIATION NEEDS .................................................. Fitzgerald
  • FY09 Needs
  • FY98-FY08 Funding Status
  • Funding Limitations for Reimbursement Projects

FEDERAL PROJECT STATUS .............................................. Fitzgerald
  HCFCD Lead Projects – Section 211(f)
  • Brays Bayou
  • Hunting Bayou
  • White Oak Bayou
  • Buffalo Bayou
  • Halls Bayou

  Corps Lead Projects
  • Sims Bayou
  • Clear Creek
  • Greens Bayou

  FEMA Projects
  • FEMA Model and Map Management
  • Home Buyouts
  • City of Houston Harris Gully Project

  USGS
  • Stream Gages
  • Proposed Land and Vegetation Management/Stormwater Runoff Study

WRAP-UP DISCUSSION .................................................. Peterson
Introduction to HCFCD
Provide flood damage reduction projects that work, with appropriate regard for community and natural values.

Reduce the risk of flood damage by:

- Devising the flood damage reduction plans;
- Implementing the plans; and,
- Maintaining the infrastructure.
OUR MISSION

Provide flood damage reduction projects that work, with appropriate regard for community and natural values.

The District accomplishes its mission by:
• Devising flood damage reduction plans
• Implementing the plans
• Maintaining the infrastructure

The Harris County Flood Control District (District) is a special purpose district created by the Texas Legislature in 1937 in response to devastating floods that struck the region in 1929 and 1935. The District’s boundaries are coincident with Harris County, a community of more than 3.9 million that includes the City of Houston. Nature gave us 22 primary watersheds within the county’s 1,756 square miles, each with its own independent flooding problems.

The District’s mission, in simple terms, is to: (1) Devise flood damage reduction plans; (2) Implement the plans; and (3) Maintain the infrastructure. The District’s drainage and flood control infrastructure is extensive, including more than 1,500 channels totaling about 2,500 miles in length (about the distance from Los Angeles to New York). Nature also challenges us with flat terrain, clay soils that do not absorb water well, and annual rainfall of 48 inches. The flooding problems in the community are severe, with several hundred thousand homes and businesses in the identified flood plain (not all flooding areas are mapped yet), and projects to reduce the risk are estimated to cost several billion dollars.

The District’s income is derived primarily from a dedicated ad valorem property tax. The rate is variable depending on operation and maintenance needs, and in 2007 was set at 3.1 cents per $100 valuation (the statutory limit for the District’s tax rate is 30 cents per $100 valuation). Capital projects are funded with District short term borrowing and long term bonds, Harris County long term bonds, impact fees, and cash. By using the combined resources of Harris County and the District, many more projects can be implemented across Harris County. The District's Capital Improvement Program proposed for FY2008-09 calls for about $200 million in projects.

Through aggressive privatization and managed competition, the District has reduced its full time staff to 423, down from nearly 1,000 in 1989. The District is organized into four primary divisions, as shown on the next page. The District obtains virtually all engineering design work for capital projects and maintenance repairs through consulting contracts, and obtains all construction work through the competitive bidding process. All of the District’s routine maintenance (mowing) is performed through contracts with private companies.

The District’s Mission Statement is: “Provide flood damage reduction projects that work, with appropriate regard for community and natural values.” This balancing act is a continual challenge in the third most populous county in the United States, and achieving needed flood risk reduction within financial limitations is the major component of the District’s commitment to make every taxpayer dollar count.
HARRIS COUNTY FLOOD CONTROL DISTRICT
2008 FACT SHEET

BACKGROUND
- Special purpose district created by the Texas State Legislature in 1937.
- HCFCDC boundaries coincident with Harris County, 1,756 square miles.
- Harris County Commissioners Court oversees HCFCDC and appoints Executive Director.
- Harris County population – 3.9 million, 3rd most populous in U.S.
- 32 cities in Harris County, including Houston, 4th most populous city in U.S.
- 22 primary watersheds, 1,500 channels, and 2,500 miles of channel.
- 7 U.S. Congressional Districts.

FUNDING
- 2008 Funding
  - Operations and maintenance – $77 million
  - Capital projects – $200 million
- Operation and maintenance funding source – dedicated ad valorem property tax. In 2007, rate was 3.1 cents per $100 valuation.
- Capital projects funding source – long term bonds, short term borrowing backed by an agreement with Harris County, impact fees, and cash.
- Capital Improvement Program - ± $200 million/year (includes Federal funds leveraged with HCFCDC funds. Does not include Federal funds spent directly by the Corps of Engineers.)

MANPOWER
- 423 full time employees
  - 224 Infrastructure Maintenance and Property Management
  - 128 Engineering and Support
  - 71 Administrative Services
- Almost all planning, design, maintenance, and construction are contracted.

FEDERAL PARTNERS
- U.S. Army Corps of Engineers – Flood Damage Reduction Projects (8 active projects).
- Federal Emergency Management Agency – Floodplain Mapping, Hazard Mitigation Grant Program, Flood Mitigation Assistance, and Pre-Disaster Mitigation (home buyouts).
- National Aeronautics and Space Administration (NASA) – Application of NASA geospatial data, research, and technology to the assessment and management of watershed and land resources.
- U.S. Geological Survey – Streamgage network cooperating partner; and proposed study on the effect of land and vegetation management on stormwater runoff with the Texas Water Resources Institute and the Katy Prairie Conservancy.

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008  WASHINGTON, D.C.
HCFCD Expenditures for FY2007-2008 (millions)

Total - $166.9 million

- **Facility Maintenance**: $28.8M (17%)
- **Bond Debt Service**: $49.0M (29%)
- **Corps of Engineers' Projects**: $33.1M (20%) *(Includes Corps Share)*
- **Non-Federal Projects**: $26.0M (16%)
- **Admin. and Operations**: $23.5M (14%)
- **FEMA Buyout Projects**: $6.5M (4%) *(Includes FEMA Share)*
House Flooding and 1% (100 Year) Floodplains
(Does Not Include Tropical Storm Allison, June 2001)

LEGEND
- 1% (100 YEAR) FLOODPLAIN LIMITS
- CONGRESSIONAL DISTRICT BOUNDARY
- MAJOR CHANNEL

KNOWN HOUSE FLOODING
- 2007 FLOOD: 508 HOUSES
- 2006 FLOOD (3): 3,623 HOUSES
- 2003 FLOOD: 301 HOUSES
- 2002 FLOOD: 2,064 HOUSES
- 1998 FLOODS (3): 1,957 HOUSES
- 1994 FLOOD: 3,248 HOUSES
- 1992 FLOOD: 1,517 HOUSES
- 1989 FLOODS (2): 2,371 HOUSES
- 1987 FLOOD
- 1984 FLOOD
- 1983 FLOOD
- 1981 FLOOD
- 1979 FLOOD

ESTIMATED NUMBER OF HOUSES FLOODED
(ACTUAL NUMBER USUALLY HIGHER)

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008 WASHINGTON, D.C.
Federal Project Summaries
# ACTIVE FEDERAL PROJECTS STATUS SUMMARY

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>DESCRIPTION</th>
<th>CURRENT PROJECT AUTHORIZATION</th>
<th>CURRENT PHASE/STATUS</th>
<th>CURRENT PHASE EST. COMPLETION</th>
<th>TOTAL COST (spent to date)</th>
<th>FEDERAL (spent to date)</th>
<th>NONFED (spent to date)</th>
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<tbody>
<tr>
<td>Sims Bayou</td>
<td>19.3 miles of channelization (flood bench section); environmental mitigation &amp; enhancements; 4% level of protection (full development); B/C=6.5</td>
<td>1986, 1990,1992</td>
<td>Construction (started 1994), 80% complete</td>
<td>2010</td>
<td>$379 million ($310 million)</td>
<td>$254 million ($196 million)</td>
<td>$125 million ($114 million)</td>
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<td>Clear Creek &amp; Tributaries</td>
<td>3 detention basins &amp; in-line detention; 20.4 miles channelization; environmental enhancements; 10% level of protection (partial development); B/C=2.5</td>
<td>1968</td>
<td>General Reevaluation, 90% complete</td>
<td>2009</td>
<td>Current est. $167 million ($49 million)*</td>
<td>$125 million ($30 million)*</td>
<td>$42 million ($19 million)*</td>
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<td>Greens Bayou</td>
<td>1 detention basin; 3.7 miles channelization; environmental enhancements; 10% level of protection (partial development); B/C=4.0</td>
<td>1990</td>
<td>Need Construction designation, 0% complete</td>
<td>2013</td>
<td>$38 million ($10 million)</td>
<td>$29 million ($5 million)</td>
<td>$9 million ($5 million)</td>
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<td>Brays Bayou - Upstream Element; Section 211(f)</td>
<td>3 detention basins; in-channel control structures; 3.7 miles channelization; environmental enhancements; 1% level of protection (full development); B/C=4.6</td>
<td>1990</td>
<td>Construction (started 1994); 75% complete; PCA signed Mar. 2000</td>
<td>2012</td>
<td>$195 million ($88 million)</td>
<td>$120 million ($41 million)</td>
<td>$75 million ($47 million)</td>
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<td>Brays Bayou - Downstream Element; Section 211(f)</td>
<td>1 detention basin; 17.4 miles channelization; environmental enhancements; Near 1% level of protection (full development); B/C=3.0</td>
<td>1990</td>
<td>General Reevaluation, 100% complete; Under final review</td>
<td>2008</td>
<td>Current est. $327 million</td>
<td>$149 million</td>
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<td>Hunting Bayou; Section 211(f)</td>
<td>1 detention basin; 3.8 miles channelization; environmental enhancements; Near 1% level of protection (partial develop.), B/C=2.9</td>
<td>1990</td>
<td>General Reevaluation, 85% complete</td>
<td>2011</td>
<td>Current est. $176 million</td>
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<td>$88 million</td>
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<td>White Oak Bayou; Section 211(f)</td>
<td>5 detention basin complexes; 11.5 miles channelization; environmental enhancements; Near 10% level of protection (full development); B/C=2.6</td>
<td>1986</td>
<td>General Reevaluation, 85% complete; R.A. signed Feb. 2006</td>
<td>2008</td>
<td>Current est. $225 million</td>
<td>$151 million</td>
<td>$74 million</td>
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<td>Halls Bayou; Section 211(f)</td>
<td>Reconnaissance Study Complete; Completing Without Project Conditions in 2008</td>
<td>1990</td>
<td>General Reevaluation (started 2006), 30% complete</td>
<td>2011</td>
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<td>Buffalo Bayou - Main Stem; Section 211(f)</td>
<td>Reconnaissance Study Complete; Completing Without Project Conditions in 2008</td>
<td>1954</td>
<td>General Reevaluation (started 2006), 30% complete</td>
<td>2011</td>
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* Includes costs for both GRR and channelization project currently on hold.
# Federal Flood Control Projects in Harris County, Texas

## Milestone Date Summary

<table>
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<tr>
<th>PROJECT</th>
<th>STUDY AUTHORIZATION</th>
<th>PROJECT AUTHORIZATION</th>
<th>LCA or PCA</th>
<th>PHYSICAL CONSTRUCTION START</th>
<th>PHYSICAL CONSTRUCTION COMPLETE</th>
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<td>Addicks and Barker Reservoirs, Buffalo Bayou</td>
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<td>Cypress Creek</td>
<td>1946</td>
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--- Completed ---

--- Under Construction ---

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<th>PROJECT AUTHORIZATION</th>
<th>LCA or PCA</th>
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<th>PHYSICAL CONSTRUCTION COMPLETE</th>
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<td>Clear Creek</td>
<td>1962</td>
<td>1968</td>
<td>1986</td>
<td>1988</td>
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<td>Brays Bayou*</td>
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<td>1990</td>
<td>2000</td>
<td>1994</td>
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--- Authorized ---

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>STUDY AUTHORIZATION</th>
<th>PROJECT AUTHORIZATION</th>
<th>LCA or PCA</th>
<th>PHYSICAL CONSTRUCTION START</th>
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<tr>
<td>Hunting Bayou*</td>
<td>1948</td>
<td>1990</td>
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<td>1986</td>
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<td>Halls Bayou*</td>
<td>1948</td>
<td>1990</td>
<td>--</td>
<td>--</td>
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</tr>
<tr>
<td>Buffalo Bayou - Main Stem*</td>
<td>1948</td>
<td>--</td>
<td>--</td>
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</tr>
<tr>
<td>Greens Bayou</td>
<td>1948</td>
<td>1990</td>
<td>--</td>
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<tr>
<td>Carpenters Bayou</td>
<td>1948</td>
<td>1990</td>
<td>--</td>
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<td>--</td>
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<tr>
<td>Little White Oak Bayou</td>
<td>1948</td>
<td>1990</td>
<td>--</td>
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</tr>
</tbody>
</table>

* Section 211(f) Projects
Congressional Districts
Watersheds and Congressional Districts

LEGEND
- CONGRESSIONAL DISTRICT BOUNDARY
- WATERSHED BOUNDARY
- CHANNEL NETWORK

U.S. CONGRESSIONAL DISTRICTS
- DISTRICT 2  TED POE
- DISTRICT 7  JOHN CULBerson
- DISTRICT 9  AL GREEN
- DISTRICT 10  MICHAEL MCCaUL
- DISTRICT 18  SHEILA JACKSON LEE
- DISTRICT 22  NICK LAMPSO
- DISTRICT 29  GENE GREEN

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008  WASHINGTON, D.C.
WRDA
WRDA 2007 Authorizations

Buffalo Bayou
Amended WRDA 1996 by adding Buffalo Bayou as a Section 211(f) project.

Halls Bayou
Amended WRDA 1996 by adding Halls Bayou as a Section 211(f) project.

Amend Section 575, WRDA 1996
Amended WRDA 1996, Section 575, to include Upper White Oak Bayou.

All federal flood risk reduction projects in Harris County are now covered by Section 575 which says not to consider flood control construction projects or nonstructural actions by the local sponsor in the evaluation of the economic benefits and costs of Corps of Engineers flood damage reduction alternatives. This allows the local sponsor to continue limited flood damage reduction actions during the study without jeopardizing identification of a federal project.
SEC. ____.

CONSTRUCTION OF FLOOD CONTROL PROJECTS BY NON-FEDERAL INTERESTS.

(a) In General- Section 211(e)(6) of the Water Resources Development Act of 1996 (33 U.S.C. 701b-13(e)(6)) is amended by adding at the end following:

(E) BUDGET PRIORITY-

(i) IN GENERAL- Budget priority for projects under this section shall have the same budget priority as those projects being studied, planned, engineered, designed and constructed by the Corps or Engineers.

(ii) COMPLETED PROJECT- A completed project shall have the same priority as a project with a contractor on site.

(iii) REIMBURSEMENTS – For projects under this section, reimbursements may be made from appropriations made from any Federal fiscal year and may pay for projects or projects segments completed in any Federal fiscal year.

The purpose of these recommended changes is to put Section 211(f) projects (local sponsor lead projects) on equal budget footing with Corps lead projects.

Also, OMB guidance for recent Corps budget preparations state that CG funds can only be budgeted for work completed in the fiscal year. For 211(f) projects that require completion of a discrete segment prior to submitting invoices for reimbursement, it is very difficult to satisfy this requirement.
Appropriations
## FEDERAL APPROPRIATIONS ¹

(In Thousands)

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>FUND TYPE</th>
<th>FY98</th>
<th>FY99</th>
<th>FY00</th>
<th>FY01</th>
<th>FY02</th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09 President's Budget</th>
<th>FY09 Could Be Used</th>
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<td>HCFCD LEAD PROJECTS</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Brays Bayou³</td>
<td>CG</td>
<td>$2,000</td>
<td>$4,500</td>
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<td>$6,000</td>
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<td>$11,800</td>
<td>$15,387</td>
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<td>$5,382</td>
<td>$11,000</td>
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<td>Hunting Bayou⁴</td>
<td>GI,CG</td>
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<td>$500</td>
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<tr>
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<tr>
<td>Sims Bayou</td>
<td>CG</td>
<td>$12,000</td>
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<td>Clear Creek</td>
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<td>$750</td>
<td>$1,770</td>
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<td>$1,200</td>
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<td>Greens Bayou⁶</td>
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<td>$1,000</td>
<td>$600</td>
<td>$560</td>
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<td>$377</td>
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<td>$75</td>
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<td><strong>TOTALS</strong></td>
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<td>$16,400</td>
<td>$19,670</td>
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<td>$38,987</td>
<td>$35,717</td>
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</table>

¹- Actual funding through FY05 is less than appropriations. GI typically 15%-35% less. CG typically 15%-25% less.
²- In Act language.
³- Brays Bayou recognized as one project under construction in FY03.
⁴- Construction new start in FY03.
⁵- New Section 211(f) project in WRDA 2007. Funding is for Corps oversight and monitoring.
⁶- Ready for construction new start in FY09.
⁷- Major changes made to Corps budget processes and procedures in FY06.
⁸- Upstream only
**FY98-FY08 FEDERAL FUNDS FOR CORPS PROJECTS IN HARRIS COUNTY**

As of February 2008 (In Thousands)

<table>
<thead>
<tr>
<th>Federal Fiscal Year</th>
<th>Brays Bayou (CG)</th>
<th>Hunting Bayou (CG)</th>
<th>White Oak Bayou (GI)</th>
<th>Buffalo Bayou (GI)</th>
<th>TOTALS</th>
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</thead>
<tbody>
<tr>
<td>FY98$^1$</td>
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<td>$0</td>
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<td>$500</td>
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<tr>
<td>FY99$^1$</td>
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<td>$13,453</td>
<td>$13,453</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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**PROJECT TOTALS**

$87,206 | $81,179 | -$16,017 | $5,578 | $4,291 | -$2,930 | $3,653 | $2,745 | -$1,175 | $300 | $174 | -$162 | $96,737 | $88,389 | -$20,864

1- In Act language for Section 211(f) projects.
2- Amount Corps receives after OMB savings and slippage applied. Corps calls this Initial Work Allowance.
3- Construction new start in FY03.
### FY98-FY08 FEDERAL FUNDS FOR CORPS PROJECTS IN HARRIS COUNTY

As of February 2008 (In Thousands)

<table>
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<tr>
<th>Federal Fiscal Year</th>
<th>Corps Lead Projects</th>
<th>All Projects</th>
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<td>$12,209</td>
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<td>FY07</td>
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1- In Act language for Section 211(f) projects.
2- Amount Corps receives after OMB savings and slippage applied. Corps calls this Initial Work Allowance.

<table>
<thead>
<tr>
<th>FY</th>
<th>GI</th>
<th>CG</th>
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<tbody>
<tr>
<td>FY02</td>
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<td>33%</td>
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<td>FY05</td>
<td>21%</td>
<td>11%</td>
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<tr>
<td>FY06</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>FY07</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
| FY08| 0%  | 0% | (Rescission)
Energy and Water Development Appropriations Act, 2000

Sec. 102. Agreements proposed for execution by the Assistant Secretary of the Army for Civil Works or the U.S. Army Corps of Engineers after the date of enactment of this Act pursuant to

- section 4 of the Rivers and Harbor Act of 1915, Public Law 64–291;
- section 11 of the River and Harbor Act of 1925, Public Law 68–585;
- the Civil Functions Appropriations Act, 1936, Public Law 75–208;
- sections 104, 203, and 204 of the Water Resources Development Act of 1986, as amended (Public Law 99–662);
- and section 211 of the Water Resources Development Act of 1996, Public Law 104–303,

shall be limited to a single agreement per project, credits and reimbursements per project not to exceed $10,000,000 in each fiscal year, and total credits and reimbursements for all applicable projects not to exceed $100,000,000* in each fiscal year.

*Changed from $50,000,000 to $100,000,000 in Energy and Water Development Appropriations Act, 2006

### APPROPRIATION PROJECTIONS FOR SECTION 211(f) PROJECTS IN HARRIS COUNTY

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>FUND TYPE</th>
<th>FY98-FY00</th>
<th>FY00-FY07</th>
<th>FY08</th>
<th>FY09 Could Be Used</th>
<th>FY10-FY12</th>
<th>FY12-FY16</th>
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<td>Hunting Bayou</td>
<td>GI, CG</td>
<td>$1,000,000</td>
<td>$4,578,000</td>
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<td>$100,000</td>
<td>$5–10 M/year</td>
<td>$10–15 M/year</td>
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<tr>
<td>White Oak Bayou</td>
<td>GI</td>
<td>$450,000</td>
<td>$3,105,000</td>
<td>$98,000</td>
<td>$200,000</td>
<td>$5–10 M/year</td>
<td>$10–15 M/year</td>
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<tr>
<td>Buffalo Bayou</td>
<td>GI</td>
<td>$0</td>
<td>$300</td>
<td>$0</td>
<td>$100</td>
<td>$100-500/year</td>
<td>--</td>
</tr>
<tr>
<td>Halls Bayou</td>
<td>GI</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$100</td>
<td>$100-500/year</td>
<td>--</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td></td>
<td><strong>$1,450,000</strong></td>
<td><strong>$7,683,000</strong></td>
<td><strong>$98,000</strong></td>
<td><strong>$300,000</strong></td>
<td><strong>$10–20 M/year</strong></td>
<td><strong>$20–30 M/year</strong></td>
</tr>
</tbody>
</table>

1 - Actual funding is less than appropriations. GI typically 15%-35% less. CG typically 10%-20% less.
2 - In Act language, cannot be reprogrammed.
3 - Most has been reprogrammed.
4 - New budget rules, reprogramming discouraged.
5 - For reimbursement of Federal share for discrete segments.
6 - Construction new start in FY03.
7 - Added as 211(f) Project in WRDA 2007

Note: Brays Bayou is not subject to Section 102 limits per ASA(CW) letter dated 11/18/99.
HQ Provides Budget Guidance (Mar)

OMB Provides Budget Guidance (Jan)

Field Offices Develop Program Requirements (Apr - May)

HQ Review & Approval (May - Jun)

Budget Presented to Sec. Army (Jul - Aug)

Budget Submitted to OMB (Sep)

OMB Passback (Nov)

President’s Budget to Congress (Feb)

Cong. Hearings (Mar - Apr)

Appropriations Bills (Jul - Sep)

President Signs Appropriation Bill (Sep - Oct)

Funding Alloc. To Field Offices (Oct - Dec)

Appropriations Bills

Funding Alloc. To Field Offices

President’s Budget to Congress
HCFCD Lead Projects
Section 211(f)
Section 211 of the Water Resources Development Act (WRDA) -- 1996 allows local sponsors to take the lead role in the planning, design, and construction of flood damage reduction projects as opposed to the Corps taking the lead role. The Corps provides oversight and verifies the work is done in accordance with established regulations, guidance, and requirements for Federal participation. The Federal/local sponsor cost sharing is the same as Corps lead projects. The local sponsor pays all costs in advance of Congressional appropriations and is reimbursed the Federal share provided certain conditions are satisfied.

The benefit of this legislation is in Subsection (f) that designated eight projects in 1996 and an additional six in 2007 to demonstrate the advantages and effectiveness of non-federal implementation. (Five in California, five in Harris County, and one each in Nevada, Illinois, Louisiana, and Wisconsin.) The primary advantage is that, at their own risk, the local sponsor can design and build the project before the plan is approved by the Assistant Secretary of the Army for Civil Works and agreements are in place. Being able to begin implementation sooner rather than later is critical in developing urban areas like Harris County, Texas. Project costs are less and land needed for the project can be acquired before it is developed and the project becomes infeasible.

In establishing the policy guidance for Section 211(f), the Corps recognized the need for periodic reimbursement as opposed to reimbursement once the entire project is complete. The local sponsor can be reimbursed the Federal share as "discrete segments" are completed. Discrete segments are complete and functional parts of the total project.

Section 211 has changed our relationship with the Corps in two ways. First, by taking responsibility for moving the projects forward ourselves, instead of the Corps, we both assumed new roles. It took some time for us to adjust, but we have learned to appreciate each other’s jobs more and our relationship has grown stronger.

Second, we had to learn the Corps’ planning process, conduct analysis, satisfy NEPA, and prepare reports in accordance with Corps regulations and guidance. This has resulted in a stronger partnership on all Corps projects because we better understand the Corps’ planning process and challenges. Our communications and coordination on all projects are significantly more productive.

Section 211(f) of WRDA 1996 has resulted in a stronger partnership that can work on more projects more efficiently than if only one of us was in the lead. Together, we serve our mutual constituents better by building more flood damage reduction projects sooner.
HCFCD Lead Projects
Section 211(f)

Brays Bayou
BRAYS BAYOU SECTION 211(f) FLOOD CONTROL PROJECT -
UPSTREAM WORK INFORMATION

DESCRIPTION
- Brays Bayou watershed - 128 square miles; Upstream Element upstream (west) of Sam Houston Tollway; also referred to as the Detention Element
- Project authorization - 1990
- Project Cooperation Agreement executed March 2000
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- Corps – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- 3 detention basins - 595 surface acres; 8,800 acre-feet of storage (5.5 Astrodomes); and 3 in-channel control structures
- 3.7 miles of channel conveyance improvements from Old Westheimer Rd. to SH 6
- Environmental quality features – wetland creation, and 20,000 trees and shrubs; and aesthetic layouts
- Bid and complete at least one “discrete segment” each year to complete project in timely manner and maintain annual funding stream
- Estimated completion - 2012

BENEFITS/COSTS
- 1% (100-yr.) level of flood protection (under full development)
- Original Corps total cost estimate $195M (est. HCFCD: $75M, Corps: $120M)
- Previous HCFCD total cost estimate $151M (est. HCFCD: $71M, Corps: $80M)
- New HCFCD total cost estimate $160M (est. HCFCD: $45M, Corps: $115M) – update based on work completed and excludes cost of buying land for disposal of excavated material
- Expenditures to date – Total $88M (HCFCD: $41M, Corps: $47M, accounts for reimbursements)
- Benefit-to-Cost ratio = 4.6

PROGRESS
- Detention excavation completed to date – 6,567 acre-feet, 2.1 billion gallons, 4.2 Astrodomes

<table>
<thead>
<tr>
<th>Basin</th>
<th>Segments Complete</th>
<th>% Complete</th>
<th>Est. Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sam Houston Parkway</td>
<td>11 of 12</td>
<td>95%</td>
<td>2008</td>
</tr>
<tr>
<td>Old Westheimer</td>
<td>3 of 3</td>
<td>100%</td>
<td>2007</td>
</tr>
<tr>
<td>Eldridge</td>
<td>4 of 11</td>
<td>40%</td>
<td>2012</td>
</tr>
</tbody>
</table>

- Channel construction completed in 2005
- ROW - 595 acres acquired at all three basins
- Bridges – No replacements or modifications needed
- Discrete Segments – 17 completed
- Nine reimbursements received totaling $46.9 for 15 Discrete Segments
- Tenth reimbursement of $5.6M pending completion of the audit Discrete Segments 21 & 22

FEDERAL FUNDING

<table>
<thead>
<tr>
<th>FY98 - FY08</th>
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<td>D.S. #19 &amp; 23</td>
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* Brays Bayou is not subject to Section 102 limits per ASA(CW) letter dated 11/18/99

CONGRESSIONAL SUPPORT NEEDED
- Continue annual funding for the project
Brays Bayou Federal Flood Damage Reduction Project
Upstream Element Cost Savings Estimate as of January 2008

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<td>$209M</td>
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1 - Federal costs is design and construction costs.
2 - Based on the U.S. Army Corps of Engineers (USACE) Project Design Memorandum for the Detention Element. (Now referred to as the Upstream Element.) Dated September 1997, revised January 1998.
3 - Current storage volume about 10% higher than 1998 estimate due to reallocation between basins. Increase Federal share by 10% and non-Federal share by 3%.
4 - Current storage volume about 10% higher due to reallocation between basins.
Brays Bayou Federal Project
Eldridge Stormwater Detention Basin Under Construction
2006

Brays Bayou Federal Project
Channel Construction Near Dairy Ashford
2005

Brays Bayou Federal Project
Completed Channel Construction and Tree Planting. Near Dairy Ashford, 2007
BRAYES BAYOU SECTION 211(f) FLOOD CONTROL PROJECT -
DOWNSTREAM WORK INFORMATION

DESCRIPTION

- Brays Bayou watershed - 128 square miles; Downstream Element downstream (east) of Sam Houston Tollway; also referred to as the Alternative to the Diversion Element
- Project authorization – 1990
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- Corps – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- HCFCD conducting the General Reevaluation Study, following Corps guidelines to obtain Corps endorsement of recommended project and ASA(CW) approval
- Locally preferred plan
- 17.4 miles earthen channel modifications
- 1 detention basin: 280 surface acres, 1,900 acre-feet of storage
- 31 bridge replacements/extensions
- Aesthetic and environmental quality features are included. Recreational opportunities are being considered

APPARENT BENEFITS/COSTS

- Number of structures subject to 4% (25-year) flood reduced from 3,520 to 50
- Number of structures subject to 1% (100-year) flood reduced from 16,800 to 1,800
- Previous total first cost estimate $288 Million (est. HCFCD: $157M, Corps: $131M)
- New total first cost estimate $327 Million (est. HCFCD: $178M, Corps: $149M) – Higher due to updated cost factors, structure values, and interest rate
- Benefit-to-Cost ratio = 3.0

PROGRESS

- Alternative Formulation Briefing with Galveston District, Southwest Division, Headquarters, and ASA(CW) held in April 2001
- Final policy review conference held December 2004
- Final GRR to Galveston District for final review February 2008
- Goal – Chief’s Report and ASA(CW) approval late summer 2008

FEDERAL FUNDING

- After ASA(CW) approval and PCA amended, will request $10–20 Million per year from 2010 to 2017
- Brays Bayou is not subject to Section 102 limits per ASA(CW) letter dated 11/18/99

CONGRESSIONAL SUPPORT NEEDED

- Continue annual funding for the project

HCFCd FLOOD DAMAGE REDUCTION PROJECT

DESCRIPTION

- Similar to apparent NED plan
- Approved by Harris County Commissioners Court to begin implementation June 2000

PROGRESS

- Completed first bridge (Fannin Street) with Metropolitan Transit Authority in November 2002
- Detention basin property acquisition complete; and channel right-of-way acquisition underway
- Channel reaches from Mouth to Lawndale, Calhoun to S. Braeswood, and inter-tidal marsh complete
- Third channel reach, Calhoun to Ardmore, under construction
- Two detention basin segments complete; Third segment under construction
Brays Bayou Federal Project
Freshwater Tidal Marsh and Channel, Construction Complete
2007

Brays Bayou Federal Project
Walkway Construction, Lower Reach
At Broadway and the Houston Ship Channel
2007

Brays Bayou Federal Project
Proposed Mid-Reach Channel Modification
At Texas Medical Center
Brays Bayou Project Locations

LEGEND
- COMPLETED BRIDGE
- PROPOSED BRIDGE REPLACEMENT
- EXPANDED PROJECT AREA
- WASHED-OUT PROJECT AREA
- INCREASED HARD COMPLETION DATE

FRESH WATER WASH
(Completion 2002)

OLD KEISTEIMER DETENTION BASIN
(Completion 2007)

ARTHUR STOREY PARK DETENTION BASIN
(Completion 2007)

UPSTREAM DETENTION BASIN
(Completion 2007)

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008 WASHINGTON, D.C.

PROJECT BRAYS COMPLETION DATES

ELDRIDGE DETENTION BASIN
(Completion 2013)

WILLIAMS WATERHOLE DETENTION BASIN
(Completion 2017)
HCFCD Lead Projects
Section 211(f)

Hunting Bayou
DESCRIPTION
- Hunting Bayou watershed - 29 square miles
- Project authorization - 1990
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- Corps – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- HCFCD conducting the General Reevaluation Study, following Corps guidelines to obtain Corps endorsement of recommended project and ASA(CW) approval
- Apparent NED plan
  - 3.8 miles channel conveyance improvement – grass-lined
  - 75 surface acres off-line detention basin and 30 surface acres of in-line detention
  - 22 bridge replacements/modifications
- Aesthetic and environmental quality features are included

APPARENT BENEFITS/COSTS
- Number of structures subject to 1% (100-year) flood reduced from 7,000 to 1,400
- Total cost estimate $176 Million (est. HCFCD: $88M, Corps: $88M)
- Benefit-to-Cost ratio = 2.9

PROGRESS
- HCFCD purchased 75 acre detention site; 1st construction contract 2008
- General Reevaluation Report (GRR)
  - Submit 2nd Draft GRR to Galveston District Spring 2009
  - Conduct Alternative Formulation Briefing with Corps in January 2010
  - Submit GRR to Corps Headquarters mid-2010, Obtain ASA(CW) approval 2011

FEDERAL FUNDING

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<td>GRR</td>
<td>Design/Construction</td>
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</tbody>
</table>

CONGRESSIONAL SUPPORT NEEDED
- Continue annual funding for the project
- Adjust reimbursement maximums per Energy and Water Development Appropriations Act of 2000, Section 102, if necessary
Hunting Bayou
Section 211(f) Federal Flood Control Project

LEGEND
RECOMMENDED PLAN
CHANNEL MODIFICATION - 3.8 MILES
STORMWATER DETENTION BASIN
PROPOSED BRIDGE MODIFICATION/REPLACEMENT

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008    WASHINGTON, D.C.
Hunting Bayou Federal Project Reach
Kashmere Gardens, Wayne Street
Existing Channel

Hunting Bayou Federal Project
Proposed Grass-Lined Channel
HCFCD Lead Projects
Section 211(f)

White Oak Bayou
WHITE OAK BAYOU SECTION 211(f) FLOOD CONTROL PROJECT
INFORMATION

DESCRIPTION
• White Oak Bayou watershed - 110 square miles
• Upper White Oak project authorization – 1986; Entire watershed study authorization – 1996
• Harris County Flood Control District (HCFCD) manages the project, performs the study and prepares the planning reports following Corps guidelines to obtain Corps endorsement of recommended project
• Corps monitors the overall project and approves HCFCD work
• Apparent NED plan: 15 miles grass-lined channel conveyance improvement, 5 detention basin complexes (7 basins at 3,500 acre-feet)
• Aesthetic features and environmental quality features, and recreational opportunities are included

PROGRESS
• Expedited reconnaissance report approved by Corps March 1999
• Reimbursement Agreement executed August 2006
• Draft General Reevaluation Report (GRR) reviewed by Galveston District March 2006
• Goal
  • Conduct Alternative Formulation Briefing with Corps August 2008
  • Submit GRR to Corps Headquarters February 2009

APPARENT BENEFITS/COSTS
• Number of structures subject to a 10% (10-year) flood reduced from 1,300 to 50
• Number of structures subject to a 4% (25-year) flood reduced from 2,600 to 750
• Number of structures subject to a 1% (100-year) flood reduced from 6,100 to 4,500
• Total first cost estimate $225 Million (est. HCFCD: $74M, Corps: $151M)
• Benefit-to-Cost ratio = 2.6

FEDERAL FUNDING

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<td>Construction/Reimbursement*</td>
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*Assuming ASA(CW) approval and new start are obtained

CONGRESSIONAL SUPPORT NEEDED
• Continue annual funding for the project
• New start for construction general funding, at appropriate time
• Adjust reimbursement maximums per Energy and Water Development Appropriations Act of 2000, Section 102, if necessary

HCFC DS REGIONAL FLOOD CONTROL PROJECT

GENERAL INFORMATION
• Purchased 10 detention sites totaling 490 acres; excavated 6.2 million cubic yards (1.2 billion gallons, 2.3 Astrodomes) from 10 of the sites
• Completed 7.5 miles of channel conveyance improvement from Tidwell Rd. upstream to the Sam Houston Tollway. Jersey Village diversion channel improvement is scheduled for 2008.
• Two detention basins are currently under construction; Completion estimate fall 2009.
• Expenditures to date - $75M
• Federal Project incorporates many of the regional project components

FEDERAL BRIEFING
HARRIS COUNTY FLOOD CONTROL DISTRICT
MARCH 2008  WASHINGTON, D.C.
White Oak Bayou Regional Stormwater Detention Basin on W. Little York Rd.
2006

White Oak Bayou Regional Detention Basins
Fairbanks-N. Houston Rd.
2007

White Oak Bayou Regional Detention Basins
Fairbanks-N. Houston Rd.
Storing Water During Flood
2002
White Oak Bayou Regional Detention Basin
Jersey Village at W. Sam Houston Tollway
2006

White Oak Bayou Channel and Detention Complete
Near Fairbanks-N. Houston Rd.
2006

White Oak Bayou Regional Detention Basin
Near Jones Rd. Under Construction
2006
HCFCD Lead Projects
Section 211(f)

Buffalo Bayou
BUFFALO BAYOU SECTION 211(f) FLOOD CONTROL PROJECT INFORMATION

DESCRIPTION
- Buffalo Bayou watershed – 360 square miles
- Study authorization - 1948
- Study limits – Main stem from the Turning Basin to Barker Reservoir (32 miles) and lower end of White Oak (about 7 miles)
- Upper watershed runoff into Buffalo Bayou controlled by two Corps of Engineers detention facilities – Addicks and Barker Reservoirs
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- Corps – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- HCFCD conducting the General Reevaluation Study, following Corps guidelines to obtain Corps endorsement of recommended project and ASA(CW) approval
- Study will consider Ecosystem Restoration alternatives
- Recommended plan will include aesthetic and environmental quality features

PROGRESS
- Designated as Section 211(f) project in WRDA 2007
- HCFCD completed the Without Project condition data collection & models. Draft report expected to go to Galveston District for independent technical review by May 2008.
- Memorandum of Agreement signed on Aug. 11, 2005 for the HCFCD to fund Corps involvement until the Corps receives appropriations
- Goal - complete GRR in 2011

FEDERAL FUNDING

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</table>

CONGRESSIONAL SUPPORT NEEDED
- Continue annual funding for the project
Buffalo Bayou
Terry Hershey Park Linear Detention Basin
2004

Buffalo Bayou
Barker Reservoir Outlet
November 2002

Buffalo Bayou
Near Allen Parkway and Shepherd
2007
HCFCD Lead Projects
Section 211(f)

Halls Bayou
HALLS BAYOU SECTION 211(f) FLOOD CONTROL PROJECT

INFORMATION

DESCRIPTION
- Halls Bayou watershed – 42 square miles (major tributary of Greens Bayou)
- Project authorization - 1990
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- Corps – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- HCFCD conducting the General Reevaluation Study, following Corps guidelines to obtain Corps endorsement of recommended project and ASA(CW) approval
- Recommended plan will include aesthetic and environmental quality features

PROGRESS
- Designated as Section 211(f) project in WRDA 2007
- Memorandum of Agreement signed on Dec. 15, 2005 for the HCFCD to fund Corps involvement until the Corps receives authorization to participate
- HCFCD will complete work on the Without Project condition this year
- Public involvement and alternative analysis will begin this year
- Goal - complete GRR in 2011

FEDERAL FUNDING

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CONGRESSIONAL SUPPORT NEEDED
- Annual funding for the project

HCFCD FLOOD DAMAGE REDUCTION PROJECT

DESCRIPTION
- Based on 1986 Greens Bayou Master Plan and 2002 conceptual plan developed by HCFCD
- 100 ± acre regional detention basin within the City of Houston’s 500-acre Keith-Wiess Park
- Two regional detention sites at US 59, each site 70 ± acres

PROGRESS
- Prepared joint detention/park plan with City of Houston for Keith-Wiess Park; 100 acre detention basin construction completed in 2007
- Purchased property at US 59 for two detention sites; western side under construction
Halls Bayou
Keith-Wiess Park/Stormwater Detention Basin
Construction Complete, 2007

Halls Bayou
Typical Channel
2002
Corps Lead Projects
Corps Lead Projects

Sims Bayou
SIMS BAYOU FEDERAL FLOOD CONTROL PROJECT INFORMATION

DESCRIPTION
- Sims Bayou watershed area - 94 square miles
- Project authorizations - 1986, 1990, and 1992
- Harris County Flood Control District (HCFCD) and Corps signed Local Cooperation Agreement 10/19/90
- Corps – manages, designs and builds the project
- HCFCD – buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); and operates and maintains the channel after construction
- 19.3 miles of channel conveyance improvements (flood bench section) from the Houston Ship Channel to Croquet Street (west of S. Post Oak)
- Includes environmental mitigation and environmental quality features
- 12-16 years to build (est. 1994-2010)

BENEFITS/COSTS
- 4% (25-yr.) level of flood protection (under full development)
- 1% (100-yr.) flood plain removed from approx. 35,000 homes and 2,000 commercial structures
- Previous total cost estimate $344 Million (est. HCFCD: $124M, Corps: $220M)
- New total cost estimate $379 Million (est. HCFCD: $125M, Corps: $254M) – Higher due to several repair contracts, construction cost increases, and longer construction time
- Expenditures to date – Total $310 Million (HCFCD: $125M, Corps: $196M)
- Benefit-to-Cost ratio = 6.5

PROGRESS
- Channel Conveyance Improvements

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<td>Complete</td>
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<td>Under Construction</td>
<td>S.H. 288 to Robin Blvd. (1 miles)</td>
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<tr>
<td>Design Underway</td>
<td>Robin Blvd. to Hiram Clarke (3.2 miles)</td>
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</table>
- ROW – Total to be purchased 925 acres: Complete up to Hiram Clarke, ROW surveying underway from Hiram Clarke to end
- Bridges – 21 to be replaced or modified: 15 completed, 1 under construction, 5 currently in design

FEDERAL FUNDING

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<td>Robin Blvd. to Hiram Clarke</td>
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CONGRESSIONAL SUPPORT NEEDED
- Continue funding for the project

HCFCFD REGIONAL FLOOD CONTROL PROJECT

GENERAL INFORMATION
- 3 regional detention basins upstream (west) of Scott St.
- Increases flood protection of Federal Project to 1% (100-yr.) level (under full development)
- Provides some benefit in the upper reach of the watershed now, while the Federal Project continues to move upstream (west)

PROGRESS
- Purchased 3 regional detention sites totaling 700 acres for $6.1M
- Over 3.6 million cubic yards (across 215 surface acres) excavated since January 1995 by Harris County Toll Road Authority contractors, HCFCD contractors and others
Sims Bayou Federal Project
Channel 10 Years After Completion, Near Broadway
2007

Local Supplement to Sims Bayou Federal Project
Hill At Sims Detention Basin
2007
Corps Lead Projects

Clear Creek
CLEAR CREEK FEDERAL FLOOD CONTROL PROJECT INFORMATION

DESCRIPTION

- Clear Creek watershed area - 260 square miles
- Project authorization - 1968
- Harris County Flood Control District (HCFCD) and Galveston County signed Local Cooperation Agreement with Corps 6/30/86
- In June 1999, Corps initiated General Reevaluation Study – local sponsors are Brazoria Drainage District #4, Galveston County, and HCFCD
- Corps – manages, designs and builds the project
- HCFCD, Galveston County, and Brazoria Drainage District #4 – buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); and operates and maintains the channel after construction
- Apparent NED Plan:
  - Clear Creek - 15.1 miles of channel rectification and 500 acre-foot in-line detention from Dixie Farm Road to State Highway 288; and 1,750 acre-foot detention basin
  - Mud Gully - 0.8 miles of channel rectification and 1,550 acre-foot detention basin
  - Turkey Creek - 2.4 miles of channel rectification
  - Mary’s Creek - 2.1 miles of channel rectification and 900 acre-foot detention basin

APPARENT BENEFITS/COSTS

- Number of structures subject to 1% (100-yr.) flood plain reduced from 3,380 to 1,130
- Total first cost estimate $167 Million (est. HCFCD: $42M, Corps: $125M)
- Benefit-to-Cost ratio = 2.5

1986 PROJECT PROGRESS

- Expenditures to date (including General Reevaluation Study) – Total $49 Million (HCFCD and Galveston County: $19M, Corps: $30M)
- Put on hold in 1999
- Channel Rectification
  - Status: Complete
  - Location: Second outlet channel from Clear Lake to Galveston Bay, and gated control structure
  - Plans & ROW started

- Bridges – 8 of 11 bridges replaced or modified
- Utility adjustments - Almost complete up to SH 3
- Soil placement areas - 1 completed

GENERAL REEVALUATION STUDY PROGRESS

- NED alternative being refined
- Submit GRR to Southwest Division and Corps Headquarters Spring 2009

FEDERAL FUNDING

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CONGRESSIONAL SUPPORT NEEDED

- Continue to work with the Corps, local sponsors, and constituents to identify an acceptable project
- Continue annual funding for the project

Note: The request to include tributaries, ecosystem restoration, and recreation in the authorization was addressed on June 23, 2004 with a Committee Resolution by the Committee on Environment and Public Works of the U.S. Senate.
Clear Creek Federal Project
Completed Second Outlet Gates After Modification
2007

Clear Creek Federal Project Reach
West of I-45
1997
Corps Lead Projects

Greens Bayou
GREENS BAYOU FEDERAL FLOOD CONTROL PROJECT INFORMATION

DESCRIPTION
- Greens Bayou watershed - 213 square miles
- Project authorization - 1990
- Corps is conducting a General Reevaluation Study
- Corps – manages, conducts planning study, designs and builds the project
- Harris County Flood Control District (HCFCD) – buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); and operates and maintains the channel after construction
- Recommended plan – 108 acre detention basin and 3.7 miles of channel rectification between Veterans Memorial Drive and Cutten Road
- Environmental and aesthetic features are being incorporated into the channel and detention basin

BENEFITS/COSTS
- Level of protection estimated to be 10% (10-year) for partial development
- Estimated total cost - $38 Million (est. HCFCD: $9M, Corps: $29M)
- Expenditures to date – Total $10 Million (HCFCD: $5M, Corps: $5M)
- Benefit-to-Cost ratio = 4.0

PROGRESS
- General Reevaluation Report (GRR) approved in February 2006
- Corps ready to begin design and prepare construction drawings
- Estimated time to design and build - 5 years
- Recreation plan being prepared; potential recreation sponsor, Harris County Precinct 4
- HCFCD purchased 138 acre detention basin site for project
- HCFCD evaluating option to initiate construction under WRDA 1996, Section 350, if Federal construction funding is delayed

FEDERAL FUNDING

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<td>Design/Construction</td>
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CONGRESSIONAL SUPPORT NEEDED
- FY09 new start for construction general funding
- Continue annual funding for the project

HCFC REGIONAL FLOOD CONTROL PROJECT

GENERAL INFORMATION
- 6 regional detention basins acquired upstream of US 90; Totaling 2,235 acres and costing $21M
- Currently purchasing a 7th basin totaling 160 acres (74 acres acquired for $8.5M so far)
- Federal project may incorporate one of the regional project components

PROGRESS
- 1 regional basin completed, 5 partially excavated
- Purchasing a new regional basin site downstream of I-45
- Excavation to continue at existing sites, as funding is available
Greens Bayou Federal Project Reach
Near Cutten Road
1998

Proposed Greens Bayou Section
FEMA Projects
FEMA Projects

FEMA Model & Map Management
FEMA FLOOD INSURANCE STUDY AND MAPS

DESCRIPTION

- This project was called the Tropical Storm Allison Recovery Project (TSARP) and was accomplished by a partnership between the Harris County Flood Control District (HCFCD) and FEMA Region VI that utilized a Cooperative Technical Partnership Agreement executed in 2000.
- Federal funding for TSARP became available as a result of the devastating flooding of 2001 in Harris County, Texas caused by Tropical Storm Allison.
- Products – New FEMA Flood Insurance Rate Maps for all of Harris County, Texas and associated useful models and technical products
- The largest detailed flood insurance study to date is used by FEMA as a model for similar projects in the Map Modernization Program, including the public outreach and education campaign.
- Total estimated project cost - $32 million; approximately an even split between FEMA and HCFCD

RESULTS

- 144 new Flood Insurance Rate Maps (FIRMs) became effective on June 18th, 2007 for the 35 National Flood Insurance Program (NFIP) communities in Harris County
- Since Tropical Storm Allison in 2001, the number of NFIP flood insurance policies in Harris County has increased from 120,000 to 286,000. Harris County now accounts for 43 percent of all flood insurance policies in the state of Texas
- The study website and interactive mapping tool located at www.tsarp.org continues to be a valuable resource for the citizens of Harris County in addition to the official FEMA website www.fema.gov

MODEL AND MAP MANAGEMENT

DESCRIPTION

- Model and map management (M3) is a program to keep the models developed for the new FIRMs as accurate as possible as watershed and channel conditions change in the highly urbanized and developing Harris County. Two tracks to be performed by HCFCD are:
  - Continuous Updates – Update the maps and models to reflect the latest Letters of Map Revision (LOMR) by working closely with FEMA during the LOMR process
  - Watershed Model Updates – Regular updates on a watershed wide basis to reflect non-LOMR related changes in the watershed, new model versions, and other issues
- Benefit - Local officials and engineers will have access to the up-to-date data and models to plan future flood damage reduction projects and land developments

PROGRESS

- HCFCD and FEMA have worked out an agreement that allows for HCFCD to be the custodian and distributor of the hydrology and hydraulic computer models
- HCFCD and FEMA are working on agreements that outlines the work for the Continuous and Watershed Model Updates

FEDERAL FUNDING

- No federal funding is required at this time
FEMA Projects

Buyout
### Active FEMA Buyout Program Status
#### As of January 2008

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<th>Number of Homes</th>
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<th>FEMA Share (millions)</th>
<th>HCFCD Share (millions)</th>
<th>Homes Purchased</th>
<th>Homes Withdrawn</th>
<th>Total Payments (millions)</th>
<th>FEMA Share (millions)</th>
<th>HCFCD Share (millions)</th>
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<tbody>
<tr>
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<td>22</td>
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<td>$2.1</td>
<td>$0.7</td>
<td>18</td>
<td>4</td>
<td>$2.8</td>
<td>$2.1</td>
<td>$0.7</td>
<td>Closeout in progress</td>
</tr>
<tr>
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<td>$1.1</td>
<td>$0.4</td>
<td>10</td>
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<td>$1.4</td>
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<td>$0.4</td>
<td>Closeout in progress</td>
</tr>
<tr>
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<td>$2.3</td>
<td>$1.7</td>
<td>$0.6</td>
<td>14</td>
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<td>$1.5</td>
<td>$0.5</td>
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</tr>
<tr>
<td>PDM05-021</td>
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<td>$2.1</td>
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<tr>
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<td>$0.3</td>
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<td>15</td>
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<td>HMGGP DR-1606-40</td>
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<td>PDM 2007 (App. 1)</td>
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<td>$0.0</td>
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<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>Initiated Jan. 2008</td>
</tr>
<tr>
<td>FMA 2007</td>
<td>35</td>
<td>$4.3</td>
<td>$3.2</td>
<td>$1.1</td>
<td>0</td>
<td>0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>$0.0</td>
<td>Initiated Jan. 2008</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>274</strong></td>
<td><strong>$41.8</strong></td>
<td><strong>$31.2</strong></td>
<td><strong>$10.6</strong></td>
<td><strong>203</strong></td>
<td><strong>49</strong></td>
<td><strong>$27.1</strong></td>
<td><strong>$20.4</strong></td>
<td><strong>$6.7</strong></td>
<td></td>
</tr>
</tbody>
</table>

PDM: Predisaster Mitigation Program - funding from FY 2005 & FY2007

FMA: Flood Mitigation Assistance Program

HMGP: Hazard Mitigation Grant Program - funding associated with the 2005 Hurricane Rita disaster declaration.

300 candidate homes approved; can substitute until funding exhausted.
Home Purchased Near Greens Bayou
Before Demolition
2007

Same Lot After Demolition
2007
USGS Funding for Streamgages

USGS STREAMGAGE PROGRAM

- USGS operates 479 streamgages in Texas, down from 485 in 2003. USGS does not have sufficient funds to continue to operate that entire network and to partner with Harris County to provide the enhancements needed to protect the lives and property of Harris County citizens and businesses.
- National Streamflow Information Program (NSIP)
  - The streamgage network required to provide a base level of national streamflow information at 100% USGS funding. If fully funded, it would cover the cost of 415 streamgages in Texas. It currently supports about 33 streamgages statewide.
  - Program has recently been reviewed by National Academy of Sciences and received high marks.
- Cooperative Water Program
  - Supports streamgages not funded by NSIP or by other Federal Agencies.
  - Cost shared with 49 state and local agencies in Texas (800 agencies nationwide).
  - Initially 50/50, now it is about 66% local and 34% USGS in Texas because of insufficient matching funds from USGS.

VALUE OF USGS STREAMGAGES

- Quality and consistency in collecting, recording, analyzing, and delivering data.
- Data is free and source is neutral and credible; USGS is non-regulatory and not a resource manager.
- Data is imperative to making water supply and flood control operational decisions on our nation’s waterways and to delineate flood plains for FEMA Flood Insurance Maps.
- Data is needed to plan and design reservoirs, detention basins, flood control channels, navigation channels, highways, aquatic habitats, etc.
- Data is needed by the National Weather Service to issue flood warnings to protect life and property.

USERS OF USGS STREAMFLOW DATA

- Water supply managers, reservoir operators, and flood control and emergency managers.
- Civil and environmental engineers designing water, wastewater, and transportation infrastructure.
- Recreational users.

ISSUES

- Current NSIP funding is less than 15 percent of funding needed for full implementation.
- USGS funds have remained essentially steady or decreased over past 5 years, therefore, local agency costs have increased significantly.
- Many local agencies cannot afford increases, therefore, number of streamgages is going down.
- More data is needed to make better operation and design decisions.

FEDERAL FUNDING (thousands)

<table>
<thead>
<tr>
<th></th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09 USGS Request</th>
<th>FY09 Additional Needed Above Request</th>
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<td>National Streamflow</td>
<td>$13,814</td>
<td>$13,944</td>
<td>$16,610</td>
<td>$20,130</td>
<td>$23,812</td>
<td>$2,700</td>
</tr>
<tr>
<td>Information Program</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program</td>
<td>$76,151</td>
<td>$76,777</td>
<td>$80,950</td>
<td>$82,980</td>
<td>$86,097</td>
<td></td>
</tr>
</tbody>
</table>

CONGRESSIONAL SUPPORT NEEDED

- Restore 50/50 cost share for the USGS Cooperative Water Program. An increase of $2.9 million more for Texas streamgages would restore the 50/50 balance in Texas.
- Increase National Streamflow Information Program funding to fully fund at least the Texas portion which would be about a $2.7 million increase in annual NSIP funding.
Potential USGS Funding for Land and Vegetation Management/Stormwater Runoff Study

BACKGROUND
Much of Harris County, Texas was once a vast natural coastal prairie that was very poorly drained and supported prairie vegetation and habitat. Most of the prairie was initially converted to agricultural use that resulted in loss of the prairie vegetation and land modifications to improve drainage. Like many parts of the U.S., new land development is spreading into rural areas to satisfy a growing population’s need for housing. Current agricultural uses of land in Harris County are economically stressed by the encroaching land development, and are becoming less viable. In almost all cases, there are houses and businesses downstream of these new developments that can be impacted by flooding. One way to possibly reduce potential downstream flooding may be to restore some of the ecological and hydrological value of the natural prairie, or to use vegetation and land development techniques that retain more of the stormwater by natural means. While land and vegetation management techniques have shown to be beneficial in reducing stormwater runoff in some parts of the country, specific information for the native vegetation and physical conditions of this region is not available.

BENEFITS
The research study has direct application to the ongoing Urban Stormwater Management Study (USMS) jointly funded by the District, City of Houston, Harris County, and the Texas Department of Transportation. One information gap that exists for the USMS is detailed and specific data on how rainfall runoff is influenced by land and vegetation management conditions and techniques. The research study would fill the information gap and help evaluate how management of vegetation and agricultural land can complement structural flood management measures. Results from this study could also be used to encourage low impact land development techniques and possibly reduce the costs of flood mitigation. Substantial environmental benefits in terms of improved wildlife habitat and water quality could also be realized. The initial study area will likely be in the Cypress Creek watershed, although the results would be applicable throughout Harris County and the region.

PARTICIPANTS
The Texas Water Resources Institute (TWRI) and the Katy Prairie Conservancy have approached the Harris County Flood Control District (HCFCD) to support this study and be a participant. On February 21, 2006, Harris County Commissioners Court (HCFCD’s governing body) authorized the HCFCD to pursue discussions regarding the study and possible federal financial assistance.

The TWRI brings particular expertise to the study effort that is beneficial. TWRI is located on the main campus of Texas A&M University in College Station, Texas, and is a unit of the Texas Agricultural Experiment Station and Texas Cooperative Extension. The TWRI serves as a focal point for water-related research at Texas universities and links academic expertise with state and federal agencies, strengthening water research and education. As a land trust, the Katy Prairie Conservancy is charged with protection of a portion of the Katy Prairie in perpetuity for the benefit of its wildlife and all Texans. As part of KPC’s mission, it has a goal of protecting between 30,000 and 60,000 acres of the Katy Prairie, and conducts or facilitates research needed for accomplishment of its mission. The HCFCD since 1997 has frequently partnered with the KPC on land ownership projects currently totaling about 3,000 acres.
Attachment H

HCFCD Property Acquisition Update May 2008
May 2008

Active Grant Projects
Currently, the Property Acquisition Services (PAS) Section has 12 active grant projects: ten PDM, one HMGP, and one FMA (see table below and attached map). Note: Information as of May 4, 2008.

<table>
<thead>
<tr>
<th>Project</th>
<th>Number of Candidates</th>
<th>FEMA &amp; District Match (millions)</th>
<th>Number Declined Participation</th>
<th>Homes Purchased</th>
<th>In Settlement</th>
<th>Homes Demolished</th>
<th>FEMA Share (millions)</th>
<th>District Share (millions)</th>
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</thead>
<tbody>
<tr>
<td>PDM 05-017</td>
<td>22</td>
<td>$2.8</td>
<td>4</td>
<td>18</td>
<td>0</td>
<td>18</td>
<td>$2.1</td>
<td>$0.7</td>
</tr>
<tr>
<td>PDM 05-019</td>
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<td>$1.5</td>
<td>1</td>
<td>10</td>
<td>0</td>
<td>10</td>
<td>$1.1</td>
<td>$0.4</td>
</tr>
<tr>
<td>PDM 05-020</td>
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<td>$2.3</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>13</td>
<td>$1.7</td>
<td>$0.6</td>
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<tr>
<td>PDM 05-021</td>
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<td>20</td>
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<td>$3.0</td>
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<td><strong>TOTALS</strong></td>
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<td><strong>201</strong></td>
<td><strong>29</strong></td>
<td><strong>192</strong></td>
<td><strong>$32.2</strong></td>
<td><strong>$10.7</strong></td>
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</table>

*Grey indicates projects near completion; red denotes remaining tasks. Blue indicates ongoing/new projects.

Potential Grant Projects
Five additional grant projects are in the planning stage for the upcoming year (see table below and attached map).

<table>
<thead>
<tr>
<th>Project</th>
<th>Status</th>
<th>Number of Candidates</th>
<th>FEMA &amp; District Match (millions)</th>
<th>FEMA Share (millions)</th>
<th>District Share (millions)</th>
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<tbody>
<tr>
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<td>*$15.6</td>
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<td><strong>$26.1</strong></td>
<td><strong>$22.2</strong></td>
<td><strong>$3.9</strong></td>
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</table>

* 90/10% cost-share

Ongoing District-funded Projects
HCFCD continues to pursue floodplain preservation tracts within the Cypress Creek and Greens Bayou watersheds. In addition, the Hunting Bayou Channel ROW Project currently has three properties in condemnation, four on hold, and one purchased.

HCFCD Property Acquisition Update
May 2008
Attachment I
HARRIS COUNTY PUBLIC INFRASTRUCTURE DEPARTMENT
ARCHITECTURE AND ENGINEERING DIVISION

13 August 2008

Honorable County Judge
& Commissioners’ Court
Building

SUBJECT: Recommendation by the Director of Architecture and Engineering that Commissioners’ Court Approve the Revised Flood Plain Management Plan to Retain Participation in the National Flood Insurance Program’s (NFIP) Community Rating System (CRS)

Dear Court Members:

The Federal Emergency Management Agency (FEMA) requires all communities in the Community Rating System (CRS) to update their flood plain management plan and have it formally adopted by the governing body of the community every five (5) years as part of the community’s re-verification. The CRS was implemented as a program for recognizing and encouraging community flood plain management activities that exceed the minimum National Flood Insurance Program (NFIP) standards.

Harris County has attained a rating of eight (8) in the CRS program. Citizens with non-preferred risk policies will qualify for a minimum 10% reduction in flood insurance premiums.

Sincerely,

Deborah M. Vaughn, P.E.
Director

Presented to Commissioner’s Court
AUG 19 2008
APPROVE [G/C]

Recorded Vol. 0 Page. 1

cc: Arthur L. Storey, Jr., HCPID
Jackie L. Freeman, HCPID
Raymon J. Anderson, HCPID
Shannon C. Watson, HCPID

1001 Preston Avenue • Seventh Floor • Houston • Texas • 77002 • (713) 755-5370

A CERTIFIED COPY

ATTEST: AUG 19 2008
BEVERLY KAUFMAN, County Clerk
Harris County, Texas

Jennifer Antionette Rahimi - Schultz
STATE OF TEXAS

COUNTY OF HARRIS

ORDER

On this the ___ day of AUG 19 2008, at a regular meeting of the Commissioners Court of Harris County, sitting as the governing body of Harris County, with the following members present to wit:

Ed Emmett  
El Franco Lee  
Sylvia R. Garcia  
Steve Radack  
Jerry Eversole  
County Judge  
Commissioner, Precinct One  
Commissioner, Precinct Two  
Commissioner, Precinct Three  
Commissioner, Precinct Four

And the following member(s) absent to wit: ________________

constituting a quorum, when among other business, the following was transacted:

ORDER ADOPTING THE REVISED FLOOD PLAIN MANAGEMENT PLAN TO RETAIN PARTICIPATION IN THE NATIONAL FLOOD INSURANCE PROGRAM COMMUNITY RATING SYSTEM

Commissioner ________________ introduced the order and made a motion that the same be adopted. Commissioner ________________ seconded the motion for the adoption of the order. The motion carrying with it the adoption of the order, prevailed by the following vote:

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<th></th>
<th>Yes</th>
<th>No</th>
<th>Abstain</th>
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</thead>
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<td>___</td>
<td>___</td>
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</tr>
<tr>
<td>Coman. Lee</td>
<td>___</td>
<td>___</td>
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<td>___</td>
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<tr>
<td>Coman. Radack</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Coman. Eversole</td>
<td>___</td>
<td>___</td>
<td>___</td>
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The County Judge thereupon announced that the order had been duly and lawfully adopted. The order thus adopted reads as follows:

ORDER

IT IS ORDERED that, Commissioners' Court has approved the revised Flood Plain Management Plan to Retain Participation in the National Flood Insurance Program's (NFIP) Community Rating System (CRS) for Harris County.

AUG 19 2008

APPROVE

Recorded Vol. __ Page.___

A CERTIFIED COPY

ATTEST:

BEVERLY R. KAUFMAN, County Clerk
Harris County, Texas

[Signature]

Jennifer Antionette Rahimi - Schultz

28