Repetitive Loss Area Revisit
City of Liberty – Oak Forest Neighborhood

February 1, 2011
The University of New Orleans
Center for Hazards Assessment, Response and Technology
(UNO-CHART)

www.floodhelp.uno.edu

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**Terminology**

**100-year flood**: The flood that has a one percent (1%) chance of being equaled or exceeded each year.

**Area Analysis**: An approach to identify repeatedly flooded areas, evaluate mitigation approaches, and determine the most appropriate alternatives to reduce future repeated flood losses.

**BFE**: Base Flood Elevation: The elevation of the crest of the base flood or 100-year flood.

**UNO-CHART**: Center for Hazards Assessment, Response and Technology at The University of New Orleans

**FEMA**: Federal Emergency Management Agency

**FIRM**: Flood Insurance Rate Map

**Floodway**: The channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent annual chance flood can be carried without substantial increases in flood heights.

**Freeboard**: A factor of safety usually expressed in feet above the Base Flood Elevation (BFE) for purposes of floodplain management.

**GIS**: Geographic Information Systems; integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information in the form of maps, globes, reports, and charts.

**Hazard Mitigation**: Any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.

**ICC**: Increased Cost of Compliance, a $30,000 rider on flood insurance policies for policy holders located in the special flood hazard area that can be used to bring the structure into compliance in the event that it is substantially damaged by a flood.

**NFIP**: National Flood Insurance Program

**Repetitive Loss property (RL)**: An NFIP-insured property where two or more claim payments of more than $1,000 have been paid within a 10-year period since 1978.

**Severe Repetitive Loss Property (SRL)**: A 1-4 family residence that is a repetitive loss property that has had four or more claims of more than $5,000 or two claims that cumulatively exceed the reported building’s value.

**Substantial Improvement**: The repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure either, (1) before the improvement or repair is started, or (2) if the structure has been damaged and is being restored, before the damage occurred.
Acknowledgements:

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City of Liberty – Oak Forest Neighborhood Executive Summary

Background:
The National Flood Insurance Program (NFIP) is continually faced with the task of paying claims while trying to keep the price of flood insurance at an affordable level. It has a particular problem with repetitive flood loss properties, which are estimated to cost $200 million per year in flood insurance claim payments. Repetitive flood loss properties represent only 1.4% of all flood insurance policies, yet historically they have accounted for nearly one-third of the claim payments (over $9 billion to date). Mitigating these repeatedly flooded properties will reduce the overall costs to the NFIP, the communities in which they are located, and the individual property owners. Ultimately, mitigating repeatedly flooded properties benefits everyone.

Study Area:
The Oak Forest study area is located in the city of Liberty, Texas and is bounded to the north by the commercial properties along Highway 227 or North Main Street, to the south by Hollywood Avenue, to the west by Oak Drive, and the East by Lynwood Drive. There are forty homes in the area. Twelve homes (30%) are on FEMA’s repetitive loss list, and one (2.5%) of those is considered to be a severe repetitive loss property.

Problem Statement:
● Oak Forest is a low lying area and the structures in the study area all fall within the 500-year floodplain mapped by FEMA.
● Flooding is caused by heavy rain events that overload the drainage system
  ○ Recent improvements to the drainage pipes that convey water out of the study area appear to have reduced flooding somewhat
● The twelve repetitive loss properties have made 39 flood insurance claims for a total of $1,560,431.88.
  ○ The average claim for the study area of $40,011.07 is substantial
  ○ Only 3 of the 6 claims dates correspond to disaster declarations, meaning for the other 3 claims dates, flood insurance was the only means of compensation for homeowners

Recommendations for the City of Liberty:
● Complete the application process to join the Community Rating System.
  ○ Have the ditch maintenance procedures put into writing for CRS credit.
● Encourage the residents of Oak Forest to pursue a mitigation measure.
  ○ Residents in the area have taken on mitigation projects that have positively impacted their experience with flooding. Those residents can be used as model examples.
● Keep the City’s website up to date with the latest information on changes that would affect flooding in the area.
● Encourage the purchase of flood insurance policies.
● Assist residents interested in constructing barriers to floodwaters with soils testing.
● Revise the City of Liberty’s Flood Damage Prevention Ordinance to extend its jurisdiction to Oak Forest in order to protect future buildings from flooding and to make the current flood insurance policy holders eligible for special mitigation funding.

Recommendations for the residents of Oak Forest:
● Stay updated about issues that would affect the flooding in the area.
  ○ Flooding complaints can be given online (www.cityofliberty.org) or over the phone.
● Purchase and maintain a flood insurance policy on the home and its contents.
● Review the alternative mitigation measures discussed in this analysis and implement those that are most appropriate for their situation.
● Contact the City of Liberty for more information on possible funding opportunities.
Introduction

Flooding is a problem far too familiar to many neighborhoods across the United States. Enduring the consequences of flooding over and over again can be quite frustrating. When the water rises, life is disrupted, belongings are ruined, and hard-earned money is spent.

This report has been created in collaboration with the City of Liberty and the owners of homes in Oak Forest, a repetitively flooded area, who have continually suffered the personal losses and stresses associated with living in a flood-prone house. The goal is to help homeowners reduce their flood risk by providing a broader understanding of the flooding problems in their neighborhood, and the potential solutions to the continual suffering that results from repetitive flooding. The availability of possible funding sources for certain mitigation options is also discussed.

Here, flooding issues and potential mitigation measures are discussed for homes located in the Oak Forest study area in Liberty, Texas. While the homes in this study are representative of other homes throughout the neighborhood, not all the mitigation measures reviewed in this report are appropriate for all homes in the study area.

It is understood that there are many stresses associated with repetitive flooding including worry about how high the water may rise, the loss of personal belongings, the possibility of mold, and whether or not neighbors will return after the next event. Adding to this worry is the uncertainty related to the potential solutions. Should I elevate and if so, how high? How much will a mitigation project cost? What will my neighborhood look like if I am the only one to mitigate, or the only one not to mitigate? Is there a solution that might work for the entire neighborhood?

These questions are common, and this report attempts to answer them according to the specific situation faced by homeowners in the Oak Forest study area. Informed homeowners can become even stronger advocates for policy change at the neighborhood, city, county, state and even federal levels. Overall, it is hoped that by gaining a better understanding of the flooding issues, neighborhoods can become safer and homeowners better able to confront the hazard of flooding.
Background

The National Flood Insurance Program (NFIP) is continually faced with the task of paying claims while trying to keep the price of flood insurance at an affordable level. It has a particular problem with repetitive flood loss properties, which are estimated to cost $200 million per year in flood insurance claim payments. Repetitive flood loss properties represent only 1.4% of all flood insurance policies, yet historically they have accounted for nearly one-third of the claim payments (over $9 billion to date). Mitigating these repeatedly flooded properties will reduce the overall costs to the NFIP, the communities in which they are located, and the individual homeowners. Ultimately, mitigating repeatedly flooded properties benefits everyone.

The University of New Orleans’ Center for Hazards Assessment, Response and Technology (UNO-CHART) receives funding from FEMA to collate data and analyze the repetitive flood loss areas in Louisiana and Texas in conjunction with local governments, elected officials, residents, and neighborhood associations. Using a geographic information system (GIS) and geo-coded flood insurance claims data, repeatedly flooded areas and properties are being prioritized for attention and analysis. In selected locations where repetitive flooding is a problem, UNO-CHART works with local officials and residents to conduct in-depth analyses of the causes and possible solutions to the flooding problem. These efforts are called “Area Analyses.”

UNO-CHART conducted an “area analysis” case study in the Oak Forest study area. An area analysis follows FEMA guidelines to determine why an area has repeated flood losses and what alternative flood protection measures would help break the cycle of repetitive flooding.

The Area

The Oak Forest study area is located in the city of Liberty and is bounded to the north by the commercial properties along Highway 227 or North Main Street, to the south by Hollywood Avenue, to the west by Oak Drive, and the East by Lynwood Drive. There are forty lots in the area, all with existing structures on them. The area is low lying and 100% residential, but has commercial properties to the north along North Main Street. Of the forty residential properties, twelve (30%) are on FEMA’s repetitive loss list, and one (2.5%) of those is considered to be a severe repetitive loss property. For definitions of repetitive and severe repetitive loss properties, refer to the terminology list on page 3. See the map on page 8 for the location of the Oak Forest study area.

The area was selected for this analysis due to the clustering of repetitive loss properties in the area. Local officials also expressed their interest in addressing the repetitive flooding issues in the area. The clustering of repetitive loss properties in the study area indicates a flooding problem. The study area has flooded several times since 1978, which is when FEMA began tracking flood claims.
Process: In May 2010, after a careful review of the locations of repetitive flood loss properties throughout the State of Texas, a team from UNO-CHART visited the city of Liberty and met with several local officials, and representatives from the Texas Water and Development Board and FEMA Region VI. The local officials were concerned for the flooding issues in the area. During this meeting, the study area was decided upon, and a better understanding of the issues in the area was gained.

This report follows a FEMA-recommended five step process for conducting an area analysis:

Step 1: Advise all the property owners in the repetitive flood loss area that the analysis will be conducted.

Step 2: Collect data on the analysis area and each building in the identified study area within the neighborhood to determine the cause(s) of the repetitive damage.

Step 3: Review alternative mitigation approaches and determine whether any property protection measures or drainage improvements are feasible.

Step 4: Contact agencies or organizations that may have plans that could affect the cause or impacts of the flooding.
Step 5: Document the findings, including information gathered from agencies and organizations, and relevant maps of the analysis area.

Step 1: Neighborhood Notification

The first step in FEMA’s five-step process is to notify the residents in the area about the project. On June 4th, 2010 the city of Liberty sent out a letter to the homeowners introducing them to UNO-CHART and the project. The letter also alerted residents to a special informative meeting that was held on June 12th, 2010, at the City Council Chambers. The purpose of this meeting was to formally introduce the residents to the project and UNO-CHART and gain knowledge from the residents on their flooding history. The meeting is discussed under “On-site Data Collection” later on page 16.

Accompanying the letter was a data sheet that asked residents basic questions about their building and their flooding history. On the back of the data sheet was UNO-CHART’s mailing address and a stamp, so that residents could fold the data sheet, tape it, and mail it back to UNO-CHART.

Copies of the letter and data sheet can be found in Appendices A and B of this report.

Step 2: Data Collection

The second step in the process is the collection of data that pertains to the area; both as a whole and specifically about the causes of the repetitive flooding. The data were collected from several agencies and departments. Step 4 in this report reviews the stakeholders who contributed to the project. There are five primary sources of data and information:

I. Community Plans and Studies
II. Flood Insurance Data
III. Drainage Information
IV. On-Site Data Collection
V. Data Sheets

I. Community Plans and Studies

The UNO-CHART team collected and reviewed the following reports:

A. City of Liberty, Flood Damage Prevention Ordinance, May 1, 2008
B. Houston-Galveston Area Council (HGAC) Regional Hazard Mitigation Plan, April 2006

A. City of Liberty, Flood Damage Prevention Ordinance, May 1, 2008: In order to reduce flood losses, the City of Liberty Flood Damage Prevention Ordinance uses the following methods in all areas of special flood hazards:

- All new construction or substantial improvements shall be designed (or modified and adequately anchored) to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;

1 The HGAC Hazard Mitigation Plan can be found online at: http://www.h-gac.com/community/community/hazard/hazard_mitigation_plan.aspx
All new construction or substantial improvements shall be constructed out of materials resistant to flood damage;

All new construction or substantial improvements shall be constructed by methods and practices that minimize damage;

All new construction or substantial improvements shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from the systems into flood waters; and,

On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

All new construction and substantial improvements of any residential structure shall have the lowest floor (including basement) elevated to or above the base flood elevation.

All new construction or substantial improvements with fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.

The ordinance also notes that encroachments are prohibited so that there is not an increase in flood heights on other properties. This includes fill, new construction, substantial improvements and other development within the adopted regulatory floodway. If it can be demonstrated that the proposed encroachment would not result in any increase in flood levels within the city during the occurrence of the base flood discharge, an encroachment may be permitted. This means there are restrictions on the construction of new buildings, additions, levees, floodwalls or filling on properties in the floodway.

The NFIP minimum requirement is that flood damage prevention ordinances must be enforced in special flood hazard areas (SFHA) such as A, AE, V, and VE Zones. The NFIP does not require that any flood damage prevention or other floodplain ordinances be enforced in the X or X500 Zones as these are areas of “moderate” to “low” risk. The City of Liberty is currently considering the benefits of expanding the ordinance to extend enforcement to the X and X500 Zones. By doing so, future construction will be built protected to the known flood hazard. Further, the residents in X and X500 zones would become eligible for the Increased Cost of Compliance (ICC) benefit to help them recover from flood related damages. ICC is discussed in more detail on page 28 of this report.

The City of Liberty would have to submit a request for a Flood Insurance Rate Map (FIRM) revision to FEMA that would seek to place the study area into the SFHA. Adopting such an ordinance would mandate that all residents living in the Oak Forest study area purchase and maintain flood insurance as a condition of a mortgage on the property. If the home does not have a mortgage, residents may opt not to purchase flood insurance, but this would make them ineligible for any ICC benefits. As the situation currently stands, there are no flood insurance purchase requirements in the Oak Forest neighborhood.
B. Houston-Galveston Area Council (HGAC) Regional Hazard Mitigation Plan, April 2006:

The City of Liberty is part of the seventy-four municipalities and eight counties that participated in the Houston-Galveston Area Council’s Regional Hazard Mitigation Plan (hereafter “the Plan”). The Plan serves the needs of the region, and also focuses on local policies that account for and cover population shifts, growth, hazards education and outreach related activities, and the benefits of protecting and restoring natural resources.

Texas leads the country in Federal disaster declarations with a total of eighty-four disasters, the first recorded being disaster declaration #2 in May of 1953\(^2\). Of those eighty-four declared disasters, only three were for something other than a hurricane, tropical storm, or other rain/flood event. This high frequency of rain/flood related declared disasters illustrates that there is a considerable flooding threat in the state.

The Plan notes as much, as Liberty County is listed under sixteen Federal disaster declarations since 1980, only one of which was for something other than a rain/flood event.

The City of Liberty has a ‘large’ extent of flooding and a ‘moderate’ extent of threat from hurricanes, coastal storms, and severe thunderstorms. The Plan also lists riverine and coastal floods as the number one threat to the counties and various jurisdictions participating in the HGAC’s Regional Hazard Mitigation Plan, with hurricanes, tropical storms, and severe thunderstorms being listed directly after.

In Section 4, Vulnerability Assessment, The Plan covers Liberty County’s exposure to risk from coastal flooding and storm surges. Table 1 below shows the number of people and buildings at risk from categories 1-5 hurricanes and storm surges.

<table>
<thead>
<tr>
<th>At Risk</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
<th>Category 4</th>
<th>Category 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td>773</td>
<td>1,274</td>
<td>2,4650</td>
<td>3,457</td>
<td>3,141</td>
</tr>
<tr>
<td>Buildings(^3)</td>
<td>115</td>
<td>267</td>
<td>461</td>
<td>764</td>
<td>726</td>
</tr>
</tbody>
</table>

The plan covers the floodplain management capability of each participating county and jurisdiction in section 5, Capability Assessment. Liberty County is noted as having 1,477 flood insurance policies worth $191,723 in coverage (building and contents). The Plan also notes that there have been 1,792 flood claims worth $22,868,393 in claims payments.

In the Capability Assessment section The Plan explains the Community Rating System (CRS), and details the basic premise of the CRS and the benefits it provides to the communities that participate in its floodplain management activities. The City of Liberty is currently in the application process for joining the CRS.


\(^3\) Includes residential, commercial, critical facilities (hospitals, police stations, etc.), and hazardous material facilities. For a breakdown by type of building, see HGAC Regional Hazard Mitigation Plan, section 4.3, pages 35-45
Appendix A lists the locally-specific mitigation actions. The City of Liberty has nine mitigation actions listed in section 6, *Mitigation Strategy*. They are as follows (the status of each action is listed in *italics*):

- Implement drainage program in the Whittington Addition – *Complete*
- Elevate FM 2684 to secure secondary evacuation route for South Liberty Oilfield – *Complete*
- Establish hazardous materials (HAZMAT) cargo route – *Ongoing*
- Relocate animal shelter – *Complete*
- Join the Community Rating System – *Currently under advisement*
- Purchase and install generator at north water well – *To be completed by February 2011*
- Construction of pump room at power plant – *The building is no longer standing*
- Trim tree limbs contacting electrical lines – *Ongoing; year round*
- Initiate Building Code Effectiveness Grading Schedule (BCEGS) review – *Complete, updated review in the near future*

II. **Flood Insurance Data**

There are two sources of flood insurance data that the UNO-CHART team has reviewed. Those sources of data are:

a. FIRM
b. Claims data

A. **Liberty County Unincorporated and Incorporated Areas, May 2, 2008**

The Flood Insurance Rate Map (FIRM), published by FEMA, shows potential flood risk according to zones of severity and is used in setting flood insurance rates. The regulatory floodplain used by FEMA for the floodplain management and insurance aspects of the National Flood Insurance Program (NFIP) is based on the elevation of the 100-year flood.

It can be easily misconstrued that the 100-year flood happens only once in 100 years. In actuality, the 100-year flood has a 1% chance of occurring in any given year. For another frame of reference, the 100-year flood has a 26% chance of occurring over the life of a 30-year mortgage. It is becoming more common to refer to the 100-year flood as the 1% annual chance flood. The 100-year storm is not the same as a 100-year flood. A 100-year storm may or may not produce a 100-year flood as flooding is also a factor of ground conditions, amount of water already in the channel, etc.

The FIRM for Liberty County was recently updated in May 2008. The Oak Forest study area falls in the moderate risk X-500 Zone. The X-500 Zone indicates that the area is in between the 1% annual chance and the 0.2% annual chance of flooding. Structures located in the X500 flood zone are located in the 500-year floodplain and are at risk of flooding from a 500-year flood, which has a 0.2% chance of occurring every year. Having an X500 flood zone designation also means that those homeowners are not required by some mortgage lenders to purchase flood insurance and that flood insurance policies are less expensive.

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4 To view the FIRM for Liberty County Unincorporated and Incorporated Areas, please visit [http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1](http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1) and enter your street address.
It should be noted that the FIRM does not illustrate the historical risk of flooding. The houses in the analysis area have flooded many times since they were built. Showing the lots as X500 zones on the FIRM does not accurately explain the true risk of repeated flooding, and could give a new homebuyer a false sense of safety from flooding.

**Figure 2: The FIRM panel for the Oak Forest study area**

**B. Claims Data:** The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of certain types of data to the public. Flood insurance policy and claims data are included in the list of restricted information. FEMA can only release such data to state and local governments, and only if the data are used for floodplain management, mitigation, or research purposes. Therefore, this report does not identify the repetitive loss properties or include claims data for any individual property. Rather, it discusses them only in summary form.

UNO-CHART obtained claims data from FEMA Region VI for all repetitive loss properties in the Oak Forest study area. There are twelve (30%) properties within the 40 property study area that qualify as repetitive loss. Of those twelve repetitive loss properties, one is considered to be a severe repetitive loss property. The homeowners for the twelve repetitive loss properties have made thirty-nine claims, and received $1,560,431.88 in flood insurance payments since 1978. The average repetitive flood loss claim is $40,011.07.

**Major Flood Events:** There have been two major flood events in the study area: May 2000 and October 1994.

In October 1994, all but one of the repetitive loss properties in the Oak Forest study area filed a claim. The total loss amount for this event is the largest for the area, coming in at $865,978.95.
The rainfall in southeast Texas was upward of 28 inches between the 15th and the 19th of October 1994. Residual atmospheric moisture leftover from Hurricane Rosa combined with low-level moisture from the warm Gulf of Mexico, which lead to severe thunderstorms that exceeded record rainfall highs in most areas of the region.

On October 21st, the stream-flow station for the Trinity River located at Liberty recorded the river at 31 feet above the stream gauge (which is itself 2.2 feet above sea level) and 135,000 cfs. The 1% chance annual flood was exceeded by a magnitude of 1.1 times.

In May 2000, all twelve repetitive loss properties filed a flood related claim. The total loss for this event is the second largest at $586,795.32. Between May 19th and 20th there was severe flash flooding recorded in Liberty County. US 90, which runs through the center of the City of Liberty was inundated and shut down for over twelve hours. There were reports of streets within the city being covered with one to two feet of water. At least half the homes in the Oak Forest subdivision were damaged. Over eighteen inches of rain was reported to have fallen within 5 hours on the 19th alone, with the total rainfall for both days being 19.1 inches. Damage was estimated around 10 million dollars.

It is likely that the data in this section understate the flooding problem for the following reasons:

1. NFIP records do not include claims data prior to 1978, so there could have been additional losses not shown here.
2. Policy holders may not have submitted claims for smaller floods for fear of it affecting their coverage or premium rates.
3. Only data for listed repetitive loss properties were reviewed. There could be other properties that have been repeatedly flooded, but did not have insurance at the time of the flood or did not submit claims.
4. The losses account for items covered by the insurance policy. Things not covered include living expenses during evacuation, swimming pools, and automobiles.

Of the six claims dates shown above, three have been declared disasters by the Federal government; Disaster # 595 in July of 1979 for storms and flash flooding, Disaster #828 in May of 1979 for severe storms, tornadoes, and flooding, and Disaster # 1041 in October of 1994 for severe

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5 Cubic feet per second; a common measurement for the rate of flow of water. 1 cfs = 7.48 gallons per second. 135,000 cfs = 1,009,800 gallons per second
6 United States Geological Survey (USGS) *Floods in Southeast Texas, October 1994 Fact Sheet*
storms, thunderstorms, and flooding. The remaining three claims dates correspond with heavy rain events in the area.

III. Drainage Information

The UNO-CHART team collected information on the drainage conditions in the area from the residents of Oak Forest who attended the informative meeting on June 12th, 2010. That meeting is discussed in more detail in the next section, “On-Site Data Collection.” From conversations with the residents and the fieldwork conducted after the meeting, the drainage situation in Oak Forest is summarized below.

Highway 227, also known as North Main Street, is located directly north of the Oak Forest subdivision. Over the years the businesses on Highway 227 have built up on fill, elevating those buildings above the ones in the subdivision. Residents have reported that water flows from the highway south through the subdivision along Oak and Lynnwood Drives.

During the fieldwork, residents on Lynnwood Drive showed the UNO-CHART team the swale that runs between the lots directing the water into the streets. The residents also explained that swales were common throughout the neighborhood.

Where Oak and Hollywood Drives intersect, there is a sixteen-inch drainage pipe that conveys the water into Drainage Ditch Main B that runs parallel to Hollywood Drive along the southern edge of the subdivision. At the intersection of Lynnwood and Hollywood, the City of Liberty replaced the existing twelve-inch pipe with two eighteen-inch pipes that move the water into Drainage Ditch Main B as well (See figure 6 on the next page). The twelve-inch pipe that was in place at the intersection of Lynnwood and Hollywood was at a 90° angle which allowed water to move backwards into the neighborhood when the levels rose in Drainage Ditch Main B. The two eighteen-inch pipes that have since replaced the twelve-inch pipe are now angled at 45° downstream to ensure that water cannot easily move back into the neighborhood. These improvements were made between 2005 and 2006.

Drainage Ditch Main B collects water and moves it to the west before it turns south at Oak Drive. Drainage Ditch Main B flows underneath Highway 227 near Grand Avenue to a pump station that is only used when the Trinity River reaches flood stages. The pump station is also equipped with gates that prevent the Trinity River from backing up into Drainage Ditch Main B.

The Water Control and Improvement District #5 (WCID #5) is responsible for Drainage Ditch Main B. UNO-CHART spoke with the President of the WCID #5 regarding the recent improvements to pipes in the rear of the study area that drain into the Drainage Ditch Main B.
While there are no codified maintenance procedures, the WCID #5 sprays the ditch to kill excess growth 2-3 times per year; weather conditions permitting. The lines are also checked to ensure there are no obstructions to the flow.

IV. On-Site Data Collection

The City of Liberty invited residents to the Council Chambers on June 12th, 2010 for an informative meeting.

At the meeting, UNO-CHART explained the process of the repetitive loss area analysis, and asked residents to share their flooding history with the team. Nine residents turned out at the meeting and offered valuable information to the UNO-CHART team regarding the flooding history of the area.

Many residents voiced their concern over maintenance of the drainage ditch in regards to the flooding. When UNO-CHART conducted the fieldwork, the team found that while there was some overgrowth in the ditch, it did not appear at the time to be enough to block the flow of water.
After the meeting, the UNO-CHART team visited the study area and collected data on each property. The team collected information such as the elevation of each structure above the street and above the grade, the type of foundation, and the type of structure. The residents present at the informative meeting invited the UNO-CHART team to enter their properties and examine their lots in order to gain a better understanding of the flooding issues.

The field work found that:

- All 40 (100%) structures in the area are built on slab
- 32.5% of the homes are elevated one foot above the street on fill
- 35% of the homes are elevated two feet above the street on fill
- 67.5% of the homes are at grade
- 87.5% of the homes are brick structures; the remaining 12.5% are wood frame.

Lake Livingston Dam: Owned and operated by the Trinity River Authority, Lake Livingston dam provides drinking water for the City of Houston. It stores up to 2,045,000 acre feet of water and was completed in 1969. The Trinity River Authority maintains the dam at an elevation between 131 feet and 134 feet in order to mimic natural conditions by allowing for a slow release, even in times of upstream flooding.

Only in pre-hurricane preparations is the lake drained more than the calculated natural flow of the Trinity River downstream. These practices should limit flooding effects downstream except when a hurricane is imminent. Should the dam fail, the U.S. Army Corps of Engineers ranks the dam as High Hazard for loss of life and property downstream.

V. Data Sheets

As discussed in Step 1, the letter that was mailed out to the residents included a data sheet. This data sheet offered residents the opportunity to provide UNO-CHART with details about their flooding experiences and to voice their concerns regarding the flooding in the area. Of the 40 properties to which letters and data sheets were sent, 8 (20%) were either handed in at the residents meeting or mailed back to UNO-CHART offices completed. The residents who completed their data sheet and mailed them back to UNO-CHART offered insight into the flooding issues in the area:

- All of the respondents reported their property being flooded or having a water problem
- The most reported flooding events occurred in 1994 and 2000
- The deepest reported water inside the home was 3 feet
- The longest reported time with water in the house was 3 days
- All of the respondents said that clogged drainage is the reason for their flooding
Problem Statement

Based on the data collected from the five primary and numerous secondary sources of information, the following bullets summarize the repetitive flooding problems in the Oak Forest study area:

- Oak Forest is a low lying area and the structures in the study area all fall within the 500-year floodplain mapped by FEMA.
- Flooding is caused by heavy rain events that overload the drainage system
  - Recent improvements to the drainage pipes that convey water out of the study area appear to have reduced flooding somewhat
- The twelve repetitive loss properties have made 39 flood insurance claims for a total of $1,560,431.88.
  - The average claim for the study area of $40,011.07 is substantial
  - Only 3 of the 6 claims dates correspond to disaster declarations, meaning for the other 3 claims dates, flood insurance was the only means of compensation for homeowners

Step 3: Mitigation Measures

Knowing the flooding history, and types and condition of the buildings in the area leads to the third step in the area analysis procedure – a review of alternative mitigation approaches to protect properties from, or reduce, future flood damage. Property owners should look at these alternatives but understand they are not all guaranteed to provide protection at different levels of flooding. Five approaches were reviewed:

I. Elevating the houses above the 100-year flood level
II. Barriers to floodwaters
III. Dry floodproofing
IV. Yard drainage improvements
V. Maintaining flood insurance coverage on the building

I. Elevation

Raising the structure above the flood level is generally viewed as the best flood protection measure, short of removing the building from the floodplain. All damageable portions of the building and its contents are high and dry during a flood, which flows under the building instead of into the house. Houses can be elevated on fill, posts/piles, or a crawlspace. A house elevated on fill requires adding a specific type of dirt to a lot and building the house on top of the added dirt. A house elevated on posts/piles is either built or raised on a foundation of piers that are driven into the earth and rise high enough above the ground to elevate the house above the flow of flood water.

A house elevated on a crawlspace is built or raised on a continuous wall-like foundation that elevates the house above the flood level. If a crawlspace is used, it is important to include vents or openings in the crawlspace that are appropriately sized: one square inch for each square foot of the building’s footprint.
A. Cost: Most of the cost to elevate a building is in the preparation and foundation construction. The cost to elevate six feet is little more than the cost to go up two feet. Elevation is usually cost-effective for wood frame buildings on posts/piles or crawlspace because it is easiest to get lifting equipment under the floor and disruption to the habitable part of the house is minimal. Elevating a slab house is much more costly and disruptive, and 100 percent of the houses in the Oak Forest study area are on a slab. The actual cost of elevating a particular building depends on factors such as its condition, whether it is masonry or brick faced, and if additions have been added on over time.

While the cost of elevating a home can be high, there are funding programs that can help. The usual arrangement is for a FEMA grant to pay 75% of the cost while the owner pays the other 25%. In the case of elevating a slab foundation, the homeowner’s portion could be as high as $25,000 or more. In some cases, assistance can be provided by Increased Cost of Compliance (ICC) funds, which is discussed on page 28.

B. Feasibility: Federal funding support for an elevation project requires a study that shows that the benefits of the project exceed the cost of the elevation. Project benefits include savings in insurance claims paid on the structure. Elevating a masonry home or a slab can cost up to $100,000, which means that benefit/cost ratios may be low. Looking at each property individually could result in funding for the worst case properties, i.e., those that are lowest, subject to the most frequent flooding, and in good enough condition to elevate.

II. Barriers to Floodwaters
Small floodwalls, levees, or berms could be constructed around one or more properties if flood depths are less than three feet. Small floodwalls are appropriate for some of the homes in the Oak Forest study area. Homes that typically receive three feet of floodwater or less, or where the water does not stay up for a considerable amount of time, can benefit from small floodwalls, levees or berms.

According to the returned data sheets, 50% of respondents experienced up to three feet of floodwater inside their homes during a flood event. Leves and berms are more suitable for larger lots, and small floodwalls that are located close to the house are appropriate for suburban style neighborhoods with front and side yard space. With the suburban styling of the Liberty study area and neighborhood as a whole, floodwalls are possibly more appropriate than levees and berms in the smaller lots.

Given the flood depths reported by residents on the returned data sheets, barriers could be an appropriate mitigation measure for some homes in the Oak Forest study area. Residents who experience floodwaters that remain for several hours or days should not consider barriers to floodwaters, as seepage can occur and water will end up inside the barrier. The more permeable the soil, the more floodwaters seep under the barrier.

The following map shows the different types of soils in the study area. This map is intended for informational purposes only, and should not be used to determine the soil type at a particular location. It is imperative to test the soils type at any location when considering constructing a
barrier to floodwaters. Residents can contact the City of Liberty for assistance in getting their soils tested.

The lines on the map separate the different types of soils. The letters on the map designate the different soil types, which are:

- **BvB**: Bienville-Kenefick complex – 48.5% of the mapped area
- **Ka**: Kaman clay – 51.5% of the mapped area
- The Bienville-Kenefick complex soil type is considered to be “somewhat excessively drained.” This means that this soil type is permeable, and not ideal for building a barrier to floodwaters. The Kaman clay, on the other hand, is considered to be “poorly drained,” meaning that it is not permeable and could be more favorable for barriers.

Homeowners who are interested in constructing a barrier to protect their house should consider the following requirements:

- A method to close openings, such as the door in the photo in Figure 11 on page 24. Generally, this requires “human intervention,” meaning someone needs to be available and have enough time to take action.

8 The Natural Resources Conservation Service has offices in the area. For more information, go online to: http://www.nrcs.usda.gov/
• Relatively impervious soils to minimize seepage under the floodwall.
• A system to prevent sanitary sewer backup from flowing into the building.
• A system of drain tile (perforated pipes) that collects water that falls or seeps into the protected area and sends it to a collecting basin or “sump.”
• A sump pump to send the collected water outside the barrier (see Figure 9 below).
• Power to operate the sump pump around the clock during a storm.

A. Cost: The cost of a local barrier depends on the depth of flooding and the amount of engineering put into the design. Where flooding is only inches deep and of short duration, almost any barrier of concrete or earth will work. The most conservative cost estimate for a floodwall is based on a two foot high engineered cantilevered concrete floodwall. A cantilevered wall has a footing to provide stability and keep the water pressure from pushing it over. The budget shown in Table 3 is for a 40’x 40’ home with a wall one foot outside the building wall. Labor accounts for about half of the price in the cost estimate.

<table>
<thead>
<tr>
<th>Table 3: Floodwall Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Foot high reinforced concrete cantilever wall, 168 feet @ $200/foot</td>
</tr>
<tr>
<td>Internal drainage and sump pump system</td>
</tr>
<tr>
<td>Sewer backup valve</td>
</tr>
<tr>
<td>Generator for power outages</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

It should be noted that smaller, non-engineered walls such as the ones in Figures 8 and 9 have been built by their owners for less than $10,000. FEMA does not fund individual floodwalls for residential properties; therefore, the homeowner must pay 100% of the cost for a floodwall. However, each person can determine how much of their own labor they want to contribute (which reduces out-of-pocket costs) and whether the cost of the wall is worth the protection from flooding that it provides.
III. Dry Floodproofing
This measure keeps floodwaters out of a building by modifying the structure. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows, and vents) are closed either permanently, or temporarily with removable shields or sandbags. A floodproofing project has three components:

- Make the walls watertight. This is easiest to do for masonry or brick faced walls. The brick or stucco walls can be covered with a waterproof sealant and bricked or stuccoed over with a veneer to camouflage the sealant. Houses with wood, vinyl, or metal siding need to be wrapped with plastic sheeting to make walls watertight, and then covered with a veneer to camouflage and protect the plastic sheeting.
- Provide closures, such as removable shields or sandbags, for the openings; including doors, windows, dryer vents and weep holes;
- Account for sewer backup and other sources of water entering the building. For shallow flood levels, this can be done with a floor drain plug or standpipe; although a valve system is more secure.

As seen in Figure 10 below, dry floodproofing employs the building itself as part of the barrier to the passage of floodwaters, and therefore this technique is only recommended for buildings with slab foundations that are not cracked. The solid slab foundation prevents floodwaters from entering a building from below.

![Figure 10: A Dry Floodproofed house](image)

Also, even if the building is in sound condition, tests by the Corps of Engineers have shown that dry floodproofing should not be used for depths greater than 3 feet over the floor, because water pressure on the structure can collapse the walls and/or buckle the floor. Dry floodproofing is a mitigation technique that is appropriate for some houses in the Oak Forest study area. From the fieldwork it was found that 100% of the houses in the analysis area are on slab foundations, and according to the data sheet responses 50% of the respondents experienced up to three feet of flooding.
Not all parts of the building need to be floodproofed. It is difficult to floodproof a garage door, for example, so some owners let the garage flood and floodproof the walls between the garage and the rest of the house. Appliances, electrical outlets, and other damage-prone materials located in the garage should be elevated above the expected flood levels. Examples of floodproofed houses can be seen in Figures 11 - 14 above.

While conducting the fieldwork, the UNO-CHART team came upon a home that had been constructed in the 1950's and had a concrete apron surrounding the home to protect it from flooding. The resident explained to the UNO-CHART team that her husband had installed the concrete apron after the residence flooded in 1961. The apron is roughly three inches thick and twelve inches high. The house did take on water in October 1994 when floodwaters topped the apron. In May of 2000 the home took on water again due to cracks in the joints of the apron. Photos of the concrete apron and the home are located in Appendix D.

Dry floodproofing has the following shortcomings as a flood protection measure:
• It usually requires human intervention, i.e., someone must be home to close the openings.
• Its success depends on the building’s condition, which may not be readily evident. It is very difficult to tell if there are cracks in the slab under the floor covering.
• Periodic maintenance is required to check for cracks in the walls and to ensure that the waterproofing compounds do not decompose.
• There is no government financial assistance programs available for dry floodproofing, therefore the entire cost of the project must be paid by the homeowner.
• The NFIP will not offer a lower insurance rate for dry floodproofed residences.

A. Cost: The cost for a floodproofing project can vary according to the building’s construction and condition. It can range from $5,000 to $20,000, depending on how secure the owner wants to be. Owners can do some of the work by themselves, although an experienced contractor provides greater security. Each property owner can determine how much of their own labor they can contribute and whether the cost and appearance of a project is worth the protection from flooding that it may provide.

B. Feasibility: As with floodwalls, floodproofing is appropriate where flood depths are shallow and are of relatively short duration. It can be an effective measure for some of the structures and flood conditions found in the Oak Forest study area. It can also be more attractive than a floodwall around a house.

IV. Yard Drainage Improvements
32.5% of the homes in the Oak Forest study area are elevated one foot above the street, while another 35% are elevated two feet above the street. The remaining 32.5% are below or at street level. For those homes at or below street level, living next to an elevated home can mean more water on the lower property. Improvements to yard drainage can assist those homeowners with homes at or below street level living next to an elevated home. Inlets and underground pipes can be added by the homeowners to move the excess water from their yards and into the street before their homes are flooded.

Figure 15: Drainage pipes that move water from the rear of the home to the street
Figure 16: Yard drainage pipes added by a homeowner in the study area
During the fieldwork, the UNO-CHART team observed that some homes had installed drainage pipes that lead from the rear or side of the home to the street, which assists in the drainage of the yard.

VI. Maintaining Flood Insurance

Although not a mitigation measure that reduces property damage from a flood, a National Flood Insurance Program policy has the following advantages for the homeowner or renter:

- A flood insurance policy covers surface flooding from the overflow of inland or tidal waters or from storm water runoff.
- Flood insurance may be the only source of assistance to help owners of damaged property pay for cleanup and repairs.
- Once in effect there is no need for human intervention\(^9\).
- Coverage is available for the contents of a home as well as for the structure.
- Renters can buy contents coverage, even if the building owner does not buy coverage for the structure itself.

A. Cost: Flood insurance rates are based on several factors including what flood zone the building falls in and the age of the structure. Generally, homes in the X Zone have lower flood insurance rates than those in the Special Flood Hazard Area (SFHA), because the X Zone indicates a lower risk from flooding. The homes in the study area fall in the X-500 Zone. Homes in the X-500 Zone are considered to be in moderate to low risk areas and are eligible for a preferred risk policy.

**Preferred Risk Policy (PRP)**\(^10\): There are some eligibility restrictions that homeowners should be aware of. If any of the following circumstances applies to the residence in question, then the structure is not eligible for a preferred risk policy. If in any 10-year period the building has:

- had 2 or more insurance claim payments, each more than $1,000 (if the building is a repetitive loss structure)
- had 3 or more flood insurance claim payments *regardless of amount*\(^11\)
- received 2 Federal flood disaster relief payments (including loans and grants) each more than $1,000

\(^9\) There is a 30-day waiting period for a new flood insurance policy before it goes into effect.

\(^10\) Detailed information can be found online in the *Flood Insurance Manual; October 1, 2010* at: [http://www.fema.gov/pdf/nfip/manual201010/change_pkg_main.pdf](http://www.fema.gov/pdf/nfip/manual201010/change_pkg_main.pdf)

\(^11\) Federal flood disaster relief payments are considered only if the building sustained flood damage.
• received 3 Federal flood disaster relief payments (including loans or grants) regardless of the amount
• received 1 flood insurance claim payment and 1 Federal flood disaster relief payment (including loans and grants) each more than $1,000²

Although these restrictions will keep all twelve repetitive loss properties from qualifying for a PRP, the remaining twenty-seven properties could be eligible for this special flood insurance policy. Table 4 compares the rates for a PRP with a regular X Zone rated policy with $150,000 coverage on the building. It is important to note that any discounts gained from the CRS are not applied to PRP.

Homeowners interested in a PRP should review the criteria above to see if they may qualify and contact their insurance agent. For a list of insurance agents handling NFIP policies, visit www.floodsmart.gov.

B. Community Rating System (CRS): The Community Rating System is a “voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum National Flood Insurance Program (NFIP) requirements” (www.FEMA.gov). Participating communities are rewarded with reduced insurance premiums. Communities that join the CRS complete floodplain management activities that are worth a certain amount of credit. The more credit earned, the better the class ranking of that community. The CRS has 10 classes; a Class ranking of 10 carries the lowest flood insurance premium reduction, whereas a Class 1 carries the maximum discount. The City of Liberty is currently in the application process.

VII. Possible Funding Sources: There are several possible sources of funding for mitigation projects:

A. FEMA grants: HMGP, SRL, FMA, & PDM
B. Flood Insurance
C. Rebates
D. Small Business Administration Mitigation Loans

A. FEMA grants: Most of the FEMA programs provide 75% of the cost of a project. In most communities, the 25% non-FEMA share is paid by the benefitting property owner. Each program has different Congressional authorization and slightly different rules.

I. The Hazard Mitigation Grant Program (HMGP)¹³: The HMGP provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. Projects must provide a long-term solution to a problem (e.g., elevation of a home to reduce the risk of flood damage as opposed to buying sandbags and pumps to fight the flood). Examples of eligible projects include acquisition and elevation, as well as local drainage projects.

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¹² A flood insurance claim payment (on building and/or contents) and a Federal flood disaster relief payment (including loans and grants) for the same loss are considered a single payment.
¹³ For more information please visit http://www.fema.gov/government/grant/hmgp/index.shtm
2. The Severe Repetitive Loss Program (SRL): The Severe Repetitive Loss (SRL) grant program funds mitigation projects for properties on the severe repetitive loss list. Eligible flood mitigation projects include:

- Acquisition and demolition or relocation of structures that are listed on FEMA's severe repetitive loss list and conversion of the property to open space.
- Elevation of existing SRL structures to at least the Base Flood Elevation (BFE).

There is a new SRL ICC Program that can be used to cover the non-FEMA share of the cost. That program is discussed under Flood Insurance on page 29 of this report.

3. The Flood Mitigation Assistance Program (FMA): FMA funds assist States and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP.

- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.

4. Pre-Disaster Mitigation Program (PDM): The Pre-Disaster Mitigation (PDM) program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. There are several requirements that must be met in order to receive PDM funding. For more information please visit [http://www.fema.gov/government/grant/pdm/index.shtm](http://www.fema.gov/government/grant/pdm/index.shtm).

These FEMA grants and the mitigation projects that they cover are summarized below.

**Table 5: Different FEMA grants and the projects covered under each**

<table>
<thead>
<tr>
<th>Types of Projects Funded</th>
<th>HMGP</th>
<th>FMA</th>
<th>PDM</th>
<th>RFC</th>
<th>SRL</th>
<th>ICC</th>
<th>SBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of the entire property by a govt agency</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Relocation of the building to a flood free site</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Demolition of the structure</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Elevation of the structure above flood levels</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Replacing the old building with a new elevated one</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Local drainage and small flood control projects</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Dry floodproofing (nonresidential or historic buildings)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent paid by Federal program</td>
<td>75%</td>
<td>75%</td>
<td>75%</td>
<td>100%</td>
<td>75%</td>
<td>100%</td>
<td>0</td>
</tr>
</tbody>
</table>

14 For more information please visit [http://www.fema.gov/government/grant/srl/index.shtm](http://www.fema.gov/government/grant/srl/index.shtm)
15 For more information please visit: [http://www.fema.gov/government/grant/fma/index.shtm](http://www.fema.gov/government/grant/fma/index.shtm)
B. Flood insurance: There is a special funding provision in the National Flood Insurance Program (NFIP) for insured buildings that have been substantially damaged by a flood, “Increased Cost of Compliance.” ICC coverage pays for the cost to comply with floodplain management regulations after a flood if the building has been declared substantially damaged. ICC will pay up to $30,000 to help cover elevation, relocation, demolition, and (for nonresidential buildings) floodproofing. It can also be used to help pay the 25% owner’s share of a FEMA funded mitigation project.

The building’s flood insurance policy must have been in effect during the flood. This payment is in addition to the damage claim payment that would be made under the regular policy coverage, as long as the total claim does not exceed $250,000. Claims must be accompanied by a substantial or repetitive damage determination made by the local floodplain administrator.

For more information, contact the insurance agent who wrote your flood insurance policy or visit www.fema.gov/plan/prevent/floodplain/ICC.shtm. Coverage under the ICC does have limitations:

- It covers only damage caused by a flood, as opposed to wind or fire damage
- The building’s flood insurance policy must have been in effect during the flood
- A substantial or repetitive damage determination must have been made by the local floodplain administrator
- ICC payments are limited to $30,000 per structure
- Claims must be accompanied by a substantial or repetitive damage determination made by the local floodplain administrator
- The Structure must be located in an Special Flood Hazard Area (SFHA) Zone, such as A, AE, V, and VE Zones. Currently, the Oak Forest neighborhood is not in the SFHA, so an amendment to the City’s floodplain management ordinance would be needed.

The average claims payment in the study area is $40,011.07. With an average claim of that amount, it is possible that some homes in the study area would sustain substantial damage from a flood event.

Severe Repetitive Loss ICC Pilot Program: While the conventional ICC only covers buildings that are located in the Special Flood Hazard Areas (SFHA), there is a new pilot program that is aiming to target buildings not in the SFHA. Focusing specifically on Severe Repetitive Loss (SRL) buildings, this pilot program will offer ICC benefits to those SRL properties that are located in X zones and will include those SRL buildings that have grandfathered X zone rates. Under this new pilot program, the ICC benefits could be used to cover the homeowner’s match in a SRL grant. This could be helpful to the one SRL property in the Oak Forest study area.

Alternative language adopted into the local floodplain management ordinance would enable residents with shallower flooding to access ICC funding. Since local ordinances determine the threshold at which substantial damage and/or repetitive claims are reached, adopting language that would lower these thresholds would benefit the homeowners of repetitive loss properties. Adopting alternative language allows for
cumulative damages to reach the threshold for federal mitigation resources more quickly, meaning that some of the properties in Liberty that sustain minor damage regularly would qualify for mitigation assistance through ICC.

C. Rebates: A rebate is a grant in which the costs are shared by the homeowner and another source, such as the local government, usually given to a property owner after a project has been completed. Many communities favor it because the owner handles all the design details, contracting, and payment before the community makes a final commitment. The owner ensures that the project meets all of the program’s criteria, has the project constructed, and then goes to the community for the rebate after the completed project passes inspection.

Rebates are more successful where the cost of the project is relatively small, e.g., under $5,000, because the owner is more likely to be able to afford to finance the bulk of the cost. The rebate acts more as an incentive, rather than as needed financial support. More information on rebates can be found in the Corps of Engineers’ report Local Flood Proofing Programs found at: http://www.nwo.usace.army.mil/nfpc/NFPC_Publications.htm.

D. Small Business Administration Mitigation Loans: The Small Business Administration (SBA) offers mitigation loans to SBA disaster loan applicants who have not yet closed on their disaster loan. Applicants who have already closed must demonstrate that the delay in application was beyond their control.

Measures eligible for SBA mitigation loans may only protect real estate property, not personal items, from the same type of future declared disaster. For example mitigation loans made following a flood can only be used for a measure to protect against future flooding, not a tornado. If the measure existed prior to the declared disaster, an SBA mitigation loan will cover the replacement cost. If the measure did not exist prior to the declared disaster the mitigation loan will only cover the cost of the measure if it is deemed absolutely necessary for repairing the property by a professional third-party, such as an engineer.

Step 4: Coordination
Coordination with relevant agencies, offices, and organizations is an important step in the analysis process. This step helps to open lines of communication among those interested in flood protection in the City of Liberty area and to see what other groups are addressing the flood problems. The following agencies and organizations were contacted by the UNO-CHART team in order to complete this analysis:

- FEMA Region VI, Mitigation Office
- Texas Water Development Board
- City of Liberty, Office of the City Manager
- City of Liberty, Office of Inspections & Permits
- Water Control and Improvement District # 5
Table 5: Summary of the Alternative Mitigation Measures discussed in this report

<table>
<thead>
<tr>
<th>Measure</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>More secure flood protection</td>
<td>High cost</td>
</tr>
<tr>
<td></td>
<td>Flood insurance rate reduction</td>
<td>Need source of non-FEMA cost share</td>
</tr>
<tr>
<td>Barriers to Floodwaters</td>
<td>Effective for shallow flooding</td>
<td>Subject to seepage if water stays up for a long time</td>
</tr>
<tr>
<td>Dry Floodproofing</td>
<td>Low cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effective for shallow flooding on slab foundations</td>
<td></td>
</tr>
<tr>
<td>Yard Drainage Improvements</td>
<td>Homeowners can take on most projects themselves</td>
<td>Not appropriate measure for deep flooding</td>
</tr>
<tr>
<td></td>
<td>Cost effective</td>
<td></td>
</tr>
<tr>
<td>Maintaining Flood Insurance</td>
<td>In effect as long as policy is renewed</td>
<td>Does not prevent flood damage (but does provide funds for repairs)</td>
</tr>
<tr>
<td></td>
<td>Works for all flood levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Under ICC, can be a source of funds for elevation</td>
<td></td>
</tr>
</tbody>
</table>

Step 5: Findings and Recommendations

I. Findings

Properties in the Oak Forest study area are subject to flooding due to heavy rains that overload the drainage system's capacity. When the area experiences a heavy rain event, the water is unable to be moved out of the study area fast enough to keep the properties from flooding. Residents have expressed their concern that the drainage ditch south of the Oak Forest subdivision is overgrown and prohibits water from moving out of the neighborhood fast enough. During the fieldwork, the UNO-CHART team observed the drainage ditch and the growth there. It was determined that there was not enough growth to prohibit or constrict the flow of water.

II. Recommendations

For the City of Liberty:

- Complete the application process to join the Community Rating System.
  - Have the ditch maintenance procedures put into writing for CRS credit.
- Encourage the residents of Oak Forest to pursue a mitigation measure.
  - Residents in the area have taken on mitigation projects that have positively impacted their experience with flooding. Those residents can be used as model examples.
Recommendations For the City of Liberty (continued):

- Keep the City's website up to date with the latest information on changes that would affect flooding in the area.
- Encourage the purchase of flood insurance policies, especially PRPs where applicable.
- Assist residents interested in constructing barriers to floodwaters with soils testing.
- Revise the City of Liberty’s Flood Damage Prevention Ordinance to extend its jurisdiction to Oak Forest in order to protect future buildings from flooding and to make the current flood insurance policy holders eligible for special mitigation funding.
- Adopt this report according to the procedures detailed in the CRS Coordinator’s Manual.

For the residents of Oak Forest:

- Stay updated about issues that would affect the flooding in the area.
  - Flooding complaints can be given online at [www.cityofliberty.org](http://www.cityofliberty.org) or over the phone.
- Contact the City of Liberty for more information on possible funding opportunities.
- Review the alternative mitigation measures discussed in this analysis and implement those that are most appropriate for their situation.
- Purchase and maintain a flood insurance policy on the home and its contents.

Public Meeting – February 1st, 2011

The UNO-CHART team – along with representatives from FEMA Region VI, French & Associates, the Texas Water Development Board, The Water Control and Improvement District #5, and The City of Liberty – held a public meeting to discuss the findings of this report. The following bullet points summarize the discussion after that meeting:

- Residents report that during the October 1994 flood, the pump station did not work. The WCID#5 stated that there have been improvements to the pump station that would keep it from shutting off during a flood event.
- Residents also stated that in the 1994 flood, they were actually flooded twice: once from the rains, then again when the levee broke along the Trinity River.
- The City is planning a road to the east of the Oak Forest neighborhood and believes that it will help with the diversion of water away from the area.
- There was a discussion about the use of High Water Marks in the area. As the Oak Forest area is currently in the X-500 Zone, High Water Marks can be used to publicize the flood threat as well as for future CRS credit if the City decides to join.
Report References

City of Liberty Code of Ordinances

FEMA Region VI Repetitive Flood Loss Data

City of Liberty Flood Insurance Rate Map

Houston-Galveston Area Council (HGAC) Regional Hazard Mitigation Plan, April 2006

Homeowners Guide to Retrofitting: Six ways to protect your house from flooding. FEMA-312, 1998

Reducing Damage from Localized Flooding – A guide for Communities. FEMA-511, 2005

Oak Forest area residents’ homeowner’s data sheets
Appendix A: Letter to the Residents

June 4th, 2010

Oak Forrest Neighborhood Resident
Liberty, TX 77575
RE: Liberty Repetitive Flooding Project

Dear Oak Forrest Resident:

The City of Liberty is reviewing ways to reduce some of our repetitive flooding problems. Your property in the Oak Forrest neighborhood is located in a part of Liberty that has tentatively been designated as an area to study for such possible improvements.

As part of this project, a team from the University of New Orleans’ Center for Hazards Assessment, Response and Technology (UNO-CHART) is preparing a “local area analysis” for the target area. The approach that they take includes collecting some data specific to your property such as its flooding experiences.

The City of Liberty and UNO-CHART will hold a special informative meeting on Saturday, June 12th at 11:00 am. The meeting will take place in the City Council Chambers at 1829 Sam Houston, Liberty, Texas 77575 and will consist of a short presentation detailing the project and the process it will follow.

This work would be greatly improved with additional data that you might be able to provide. Attached is a data sheet that we hope you will complete and return by June 18th, 2010. After you fill the form out, please bring it with you to the meeting on Saturday, June 12th. If you are unable to attend, please fold it, tape it, and mail it to the address on the flip side. A stamp has been provided.

Following the meeting at 11:00 am, UNO-CHART staff will be in the area during the day on June 12th, 2010, collecting general information from the street, such as the type of foundation and approximate height of the house above the street. If you would like to speak with staff members about your flooding experiences, this information would greatly enhance the project.

After the analysis is completed, some preliminary recommendations will be developed. You will be invited to a meeting with us and the UNO-CHART team to review the findings. The meeting time and location will be advertised once the analysis is near completion. If you have any questions about this project, please feel free to call Gary Broz at (936) 336-3685, or Erin Patton at UNO-CHART, at (504) 280-1404

Thank you for your assistance in helping us to complete this project.

Sincerely,

Gary Broz, City Manager

1829 Sam Houston Street  Liberty, Texas 77575  936-336-3684  Fax: 936-336-9846  www.cityofliberty.org
Appendix B: Homeowner's Date Sheet

Oak Forest Repetitive Flooding Analysis
Flood Protection Data Sheet

Name: ____________________________________________

Property address: ________________________________, 77575 Liberty, TX

1. In what year did you move into the home at this address? ____________________________

2. What type of foundation does your house have?  □ Slab  □ Crawl space
   □ Posts/piles  □ Other ____________________________

3. If your house has a crawl space or post/piles foundation, please indicate approximately how high from grade your lowest floor of living space is. ____________________________

4. Has the property ever been flooded or had a water problem?
   □ Yes  □ No. (If "no," please skip to question 8)

5. In what year(s) did it flood? ____________________________

6. What was the deepest that the water got?
   □ In yard only: __________________ deep
   □ Over first floor: __________________ deep
   □ Water kept out of house or building by sandbagging or other protective measure:
   ____________________________

7. What was the longest time that the water stayed in the house? ___ hours or ___ days
   a. When was this? ____________________________ (month/year)

8. What do you feel was the cause of your flooding?  Check all that affect your building.
   □ Drainage from nearby properties
   □ Storm surge from nearby waterways
   □ Clogged/under-sized drainage ditch/canal
   □ Overbank flooding from nearby ditch/canal
   □ Sanitary sewer backup
   □ Standing water next to house
   □ Other ____________________________

9. Have you taken any flood protection measures on your property?
   □ Elevated all or parts of the building
   □ Installed drains or pipes to improved drainage
   □ Sandbagged when water threatened
   □ Other ____________________________

10. Did any of the measures checked in item 9 work? If so, which ones? If not, do you know why they didn’t work? ____________________________

11. Do you currently have Flood Insurance?  □ Yes  □ No

12. Are you interested in pursuing measures to protect the property from flooding?
   □ Yes  □ No  If yes, please refer to our website (www.floodhelp.uno.edu)

Please return this data sheet at the Informative Meeting on Saturday June 12th 11:00 am at the City of Liberty Council Chambers; 1829 Sam Houston Street, or mail it back to UNO-CHART by June 18th
### Appendix C: Homeowner’s Data Sheets Results

<table>
<thead>
<tr>
<th>Total Respondents = 8</th>
<th>%</th>
<th>Answer</th>
<th>Number out of 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>In what year did you move into this address?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>1960-1970</td>
<td>2</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>1971-1980</td>
<td>1</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>1981-1990</td>
<td>1</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>1991-2000</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>2001-2010</td>
<td>2</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>No Response</td>
<td>1</td>
</tr>
<tr>
<td>What type of foundation does your home have?</td>
<td>100</td>
<td>Slab</td>
<td>8</td>
</tr>
<tr>
<td>Has the property ever been flooded or have a water problem?</td>
<td>100</td>
<td>Yes</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>In what years did it flood? (multiple answers were allowed)</td>
<td>87.5</td>
<td>1994</td>
<td>7</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>2000</td>
<td>6</td>
</tr>
<tr>
<td>What was the deepest the water ever got? (Multiple answers were allowed)</td>
<td>50</td>
<td>0-2 feet; yard only</td>
<td>4</td>
</tr>
<tr>
<td>37.5</td>
<td></td>
<td>3-6 feet; yard only</td>
<td>3</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>0-2 feet; in house</td>
<td>1</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>3-6 feet; in house</td>
<td>1</td>
</tr>
<tr>
<td>12.5</td>
<td></td>
<td>Over 3 feet; in house</td>
<td>1 (8 feet)</td>
</tr>
</tbody>
</table>
### Appendix C: Homeowner’s Data Sheets Results (continued)

<table>
<thead>
<tr>
<th>Total Respondents</th>
<th>%</th>
<th>Answer</th>
<th>Number out of 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What was the longest time that the water stayed in the house?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Multiple answers were allowed)</td>
<td>12.5</td>
<td>1 day</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>2 days</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>3 days</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>62.5</td>
<td>No Answer/Not sure</td>
<td>5</td>
</tr>
<tr>
<td><strong>What do you feel was the cause of your flooding?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Multiple answers were allowed)</td>
<td>87.5</td>
<td>Drainage from nearby properties</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>37.5</td>
<td>Storm surge</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>Clogged/undersized drainage ditch/canal</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Overbank flooding</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>Storm sewer backup</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Other</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dam break</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extensive rains</td>
<td>1</td>
</tr>
<tr>
<td><strong>Have you taken any flood mitigation protection measures on your property?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Multiple answers were allowed)</td>
<td>25</td>
<td>Installed drains or pipes to improve drainage</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
<td>Moved utilities/contents to a higher level</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>No answer</td>
<td>6</td>
</tr>
<tr>
<td><strong>Do you have flood insurance?</strong></td>
<td>100</td>
<td>Yes</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td><strong>Are you interested in learning more about mitigation?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>62.5</td>
<td>Yes</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>37.5</td>
<td>Not sure/No Answer</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix D: Example of a dry floodproofed house in the Oak Forest study area

<table>
<thead>
<tr>
<th>The front wall, showing the apron.</th>
<th>The wall continues in front of the entranceway.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The entranceway has concrete posts on each side and along the bottom, with bolts sticking out. The bolts are covered with 2X6s and a 2X4 along the bottom. These can be pulled off easily.</td>
<td>When the 2X6 and 2X4 boards are removed, the bolts are exposed.</td>
</tr>
</tbody>
</table>

Continued on next page
This is the back side of the cover for the entrance-way opening. It is stored around the corner in the garage. It has two rows of foam rubber to seal the board to the concrete posts and floor.

The cover is installed over the concrete posts at the entranceway. The bolts are screwed tight with wing nuts. The board must be over 40 years old, but fit like a glove over the bolts.

In the garage, the washing machine and water heater are on an 18” concrete pedestal.

The door from the garage to the house has the same concrete post and wooden shield arrangement as the front entranceway.
Appendix D: Example of a dry floodproofed house in the Oak Forest study area (continued)

| The back patio has a block wall around it. The door to the yard is raised one level of block. | Note that the landscaping conceals the concrete apron. |