Chapter 4. Flood Control

Flood control projects have traditionally been used by communities to control or manage floodwaters. They are also known as "structural" projects that keep floodwaters away from an area as opposed to "non-structural" projects, like retrofitting, that do not rely on structures to control flows. Flood control projects are usually designed by engineers and managed or maintained by public works staff.

As Gretna is faced by two overall types of flooding, levee failure and drainage problems, there are two major orientations for control projects. This chapter covers these issues under the following sections:

4.1 Levees
4.2 Drainage channels
4.3 Storage basins
4.4 System maintenance

Flood control projects have some advantages and disadvantages that make them unique among flood mitigation measures. These are summarized in Table 4-1 and need to be kept in mind when reviewing the effectiveness, cost, and external impacts of flood control as a mitigation measure.

Table 4-1. Pros and Cons of Flood Control Projects

Advantages	Shortcomings
Can protect large areas at less cost than acquiring every property or retrofitting every building.	They disturb the land and disrupt natural water flows, often destroying wildlife habitat.
Can stop most flooding, protecting transportation routes and landscaping, in addition to buildings.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Because of land limitations, may be the only practical solution in some circumstances.	Although it may be unintended, they may promote more intensive land use and development in the floodplain.
Many projects can be built without disrupting homes and businesses.	They can create an illusory sense of security as people protected by a project often believe that no flood can ever reach them.
They are constructed and maintained by a government agency, a more dependable long-term management arrangement than depending on many individual private property owners.	They require regular maintenance, which if neglected, can have disastrous consequences.

CRS credit: One measure of the effectiveness of these activities is their scoring under the Community Rating System (CRS). While the CRS score may not account for special local conditions, it does provide a good measuring stick to compare local programs with national models. At the end of the discussion on each measure is a "CRS credit" section that explains the current and possible scores for the City.

4.1. Levees

Background: Probably the best known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

Key considerations when evaluating use of a levee include:

- Internal drainage of surface flows from the area inside the levee,
- Cost of construction,
- Cost of maintenance,
- River access and views, and
- Creating a false sense of security (while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee).

Levees placed along the river or stream edge degrade the aquatic habitat and water quality of the stream. They also are more likely to push floodwater onto other properties upstream or downstream.

Floodwalls perform like levees except they are vertical-sided structures that require less surface area for construction. Floodwalls are usually constructed of reinforced concrete, which makes the expense of installation cost prohibitive in many circumstances. Floodwalls also degrade adjacent habitat and can displace erosive energy to unprotected areas of shoreline downstream.

Implementation in Gretna: As noted in Chapter 2, Gretna is surrounded by levees. The West Jefferson Levee District is responsible for 21.5 miles of levees along the Mississippi River (in 2007, the District is being supplanted by the Louisiana Flood Protection Authority − West).

These levees are large enough to be considered "standard project levees," i.e., expected to protect against up to the 500-year flood. Except for the Celotex failure in 1985, the levees are considered in good shape and dependable (although it should be remembered that any levee can be overtopped by a flood higher than the design level).

The hurricane protection levees to the west and south are not in as good a shape. They were not built to protect to as high a level and they have been found to have settled and subsided over time. Accordingly, the Corps and the West Jefferson Levee District began several projects to bring the levees back up to their original protection level.

The Mississippi River levee is high, wide, and has floodwalls with moveable gates where roadways cross it (as in this photo at the Gretna Ferry Terminal).

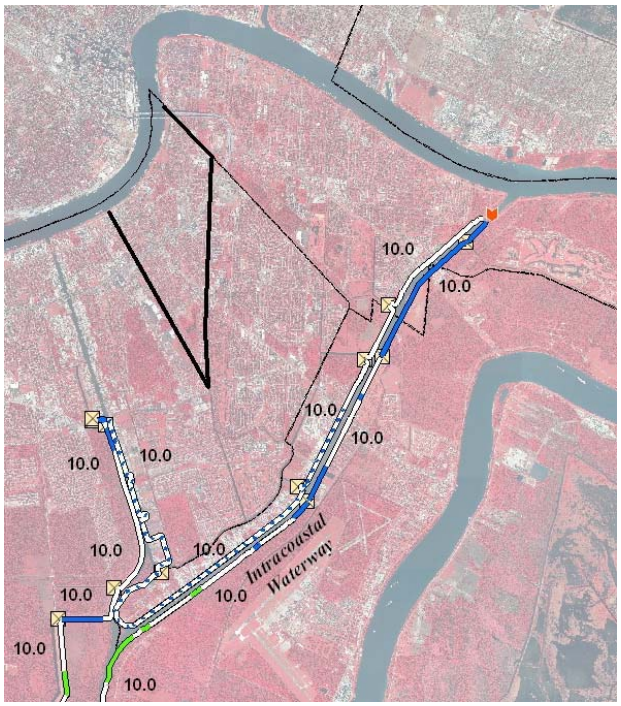
Map 2-2 shows the recently surveyed levels and Map 4-1 shows the levels that the Corps is authorized to bring them up to. In many places, this involves raising the structures more than two feet. The project also includes construction of a floodgate at the south end of the Harvey Canal (there are locks that protect from storm surge on the Harvey and Algiers Canals at the Mississippi River). Most of the projects are underway or being designed.

The original or authorized protection level may or may not provide protection to the 100-year flood. Therefore, in June 2006, Congress authorized the Corps to bring the levees up to at least the 100-year flood level, based on the latest Corps and FEMA studies. The next stage of work will account for:

- wave run-up,
- risk and uncertainty,
- future subsidence,
- sea level rise,
- more conservative geotechnical analysis, and
- realignments to protect from vessel impacts.

One problem with doing this work, though, is that the levees will have to be wider at the bottom to support more height. There are several places where buildings and other development will obstruct such widening (see graphic). A recent study identified 120 homes and businesses that are in the needed right of way. This will increase construction costs and take more time to work out property acquisition arrangements.

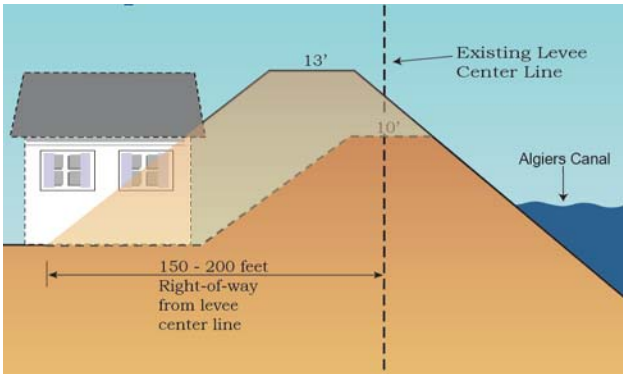
Map 4-1. Authorized Levee Improvements



Legend

- Parish boundary
- City boundary
- Levee needs to be raised less than 2 feet
- Levee needs to be raised more than 2 feet
- Levee needs to be raised more than 2 feet and work has not yet started (as of 9/30/06)
- Pump station
- 10.0 Authorized design grade elevation

Corps of Engineers website



When a levee is raised, more room at the bottom is required, necessitating acquisition of some properties

Corps of Engineers website

The currently authorized work to bring the levees up to their original design levels is expected to be completed in 1 - 2 years. It is hoped that the system will be brought up to the 100-year flood level by 2010.

CRS credit: The CRS does not credit a flood control project that is reflected on the Flood Insurance Rate Map as protecting an area to the 100-year flood level. However, there is a substantial flood insurance rate reduction for those properties that are removed from the mapped A Zone. The resulting reduction in the insurance premium rates from remapping is far greater than CRS credits, so the rate reduction benefit is not duplicated by the CRS rate reduction.

Should the upcoming projects not protect the City to the 100-year flood level and the area is remapped as completely A Zone, then the City and the Parish could apply for Levee Safety credit, in cooperation with the Flood Protection Authority. In short, from a flood insurance rating perspective, the best approach is to get the levee improvements completed so there is no doubt that they are rated as 100-year levees.

4.2. Drainage Channels

Background: Gretna's drainage system depends on storm drains, man-made ditches, and canals to convey rainfall runoff away from developed areas. Particularly appropriate for a flat area like the leveed Mississippi River floodplain that will not drain naturally, drainage and storm drain improvements are designed to carry the runoff from smaller, more frequent storms.

There are four types of drainage improvements that are usually pursued to reduce stormwater flooding in the New Orleans area: putting drainageways in underground pipes, channelization, removing obstructions caused by stream crossings (such as culverts with small openings), and increasing pump capacity. Because these improvements convey water faster to other locations, they are only recommended where the receiving channel has sufficient capacity to handle the additional volume and flow of water.

Storm drains: Storm drain improvements include installing new drains, enlarging small pipes, and preventing back flows. The advantage of converting an open channel to a storm drain is that it creates more useable ground surface. It also reduces maintenance problems, because it is harder for debris to get in the pipes and clog the flow of water.

While piping a ditch makes more room for surface use, where will the excess water go?

From a flood protection perspective, piping ditches and installing storm drains has some problems:

- The biggest problem is that a pipe is only so large. What happens to the 10-year storm when a pipe is only designed to carry the 5-year flow?

- Pipe openings and storm drain inlets need to be kept cleaned in order for the water to get into the pipes.
- It's an expensive approach, although it can save maintenance costs in the long run and reduce the potential for accidents or injuries if someone is hurt in an open channel.

Converting an open channel to a storm drain should only be done if there are arrangements for handling the overflow, either through a swale over the pipe or through streets.

Channelization: "Channelization" means straightening, deepening and/or widening a ditch or drainageway to remedy local drainage or flooding problems. It must be kept in mind that channelized streams can create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate.

Some channel improvements can be very damaging to the environment and may pass a flooding problem on to downstream properties.

Channelized waterways also tend to be unstable and experience more streambank erosion. The need for periodic reconstruction and silt removal becomes cyclic, making channel maintenance very expensive. On the other hand, properly sloped and planted channel banks are more aesthetically and environmentally appealing, and can prove cheaper to maintain than concrete ditches.

Drainage improvements do not have to be concrete channels.
They can include measures to improve infiltration and water quality

Crossings and roadways: Drainage problems can be aggravated when a small culvert or bridge opening constricts flows and causes localized backwater flooding. One way to identify such places is to check the flood profiles, graphic portrayals of flood elevations. Obstructions that back up water appear as stair steps on the profile (see illustration on page 4-7).

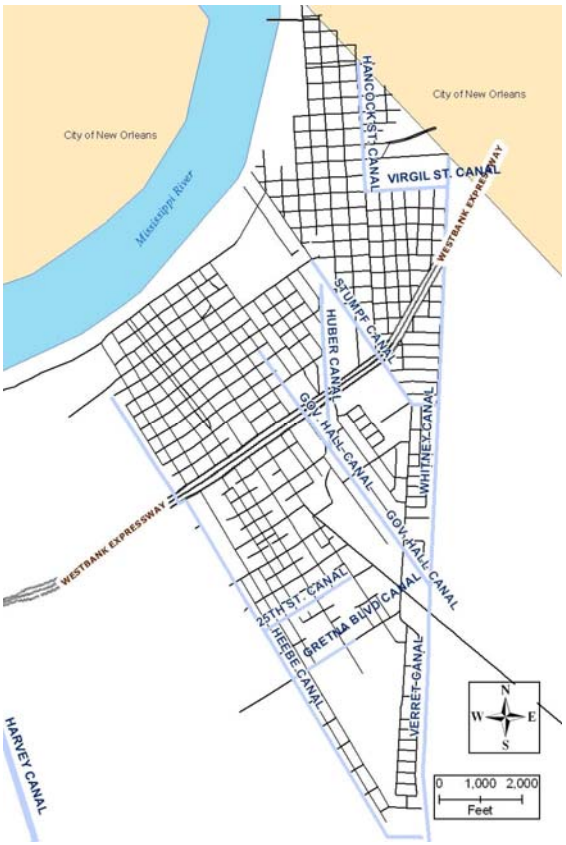
The common solution is to raise the roadbed and enlarge the culvert or bridge opening. However, designers need to consider the potential for a raised road acting as a dam, flooding people upstream and larger openings allowing more water downstream. Plans need to ensure that the projects do not worsen flooding on someone else.

Pumping: No matter how improved the channels are, a leveed area's drainage system requires pumps to convey the water to the rivers outside the levees. When the main canals cannot drain, the other drainageways that feed to the canals cannot drain. Drainage of the area is therefore dependent on the capacity of the pumping stations and a continuous source of power to run the pumps.

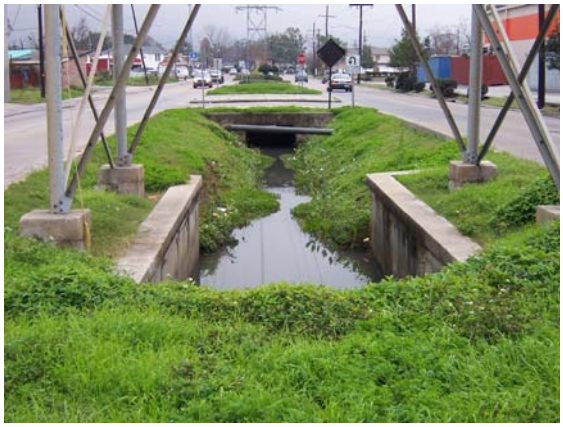
Implementation in Gretna: Gretna's drainage system is a collection of storm drains, open roadside ditches, "WPA ditches," and collector canals. "WPA ditches" are open concrete channels along the streets that were originally built in the 1930's. An example is shown on the left, below. A typical collector canal is shown on the right, below.

There are several collector canals in Gretna, as shown on Map 4-2. They all drain into the Verret Canal. The Verret Canal can drain into several other canals and bayous, depending on how much capacity each has. These canals and bayous are drained by pump stations along the Algiers Canal, as shown on Map 4-3.

Map 4-2. Collector Canals



WPA Ditch



Stumpf Canal

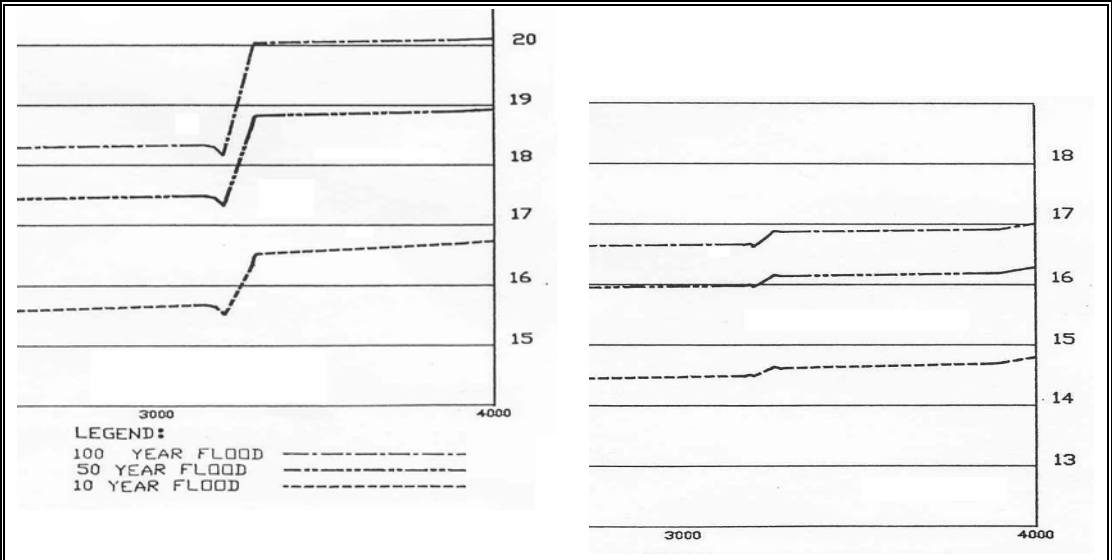
Over the last 25 years, the City has conducted studies of the drainage system to identify the most appropriate and cost-effective projects. Most of these have been in the form of enclosing open ditches, channel improvements, and removing crossing obstructions.

Storm drains: The City has enclosed several ditches and canals. Currently, a part of Stumpf Canal is being enclosed (see photo). This work has improved the efficiency of the drainageway by making the "channel" smoother and it has reduced the cost of maintenance.

Enclosing a portion of Stumpf Canal

Channelization: The man-made drainage ditches are already "channelized." However, their efficiency degrades over time with slumping and other natural changes to the channels. Accordingly, the City has lined some of them with concrete. Hurricanes Katrina and Rita caused bank failures on the Verret and Heebe Canals. The US Natural Resources Conservation Service is restoring these canals to their pre-storm condition under the authority of the Emergency Watershed Protection Program. It should be noted that this is maintenance work that will not improve the channels' capacities. It will just restore it to its original condition.

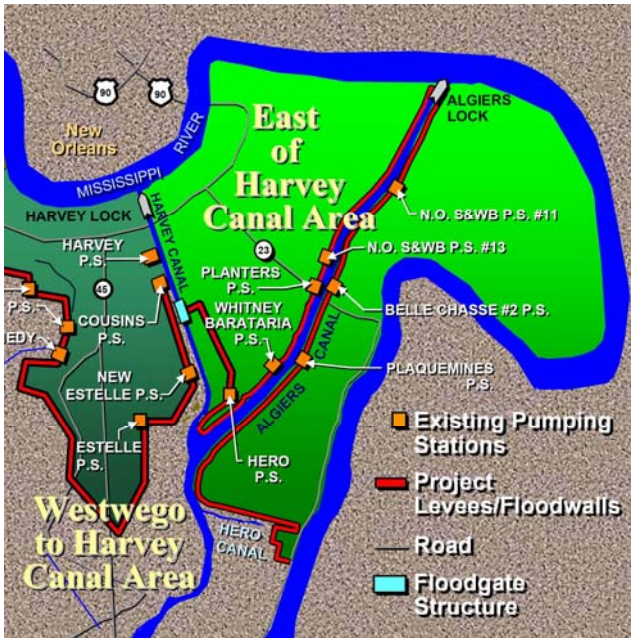
Crossings and roadways: The City's engineering studies have identified several obstructions to flows at street crossings, such as the one illustrated in the profiles below. These have been removed or enlarged where such work will not adversely affect downstream properties. It can be seen that a "dam" of up to two feet has been reduced to a bump of a few inches.



This profile of the Governor Hall Canal at Smith Way shows how a small culvert can back up floodwaters by nearly two feet. After the City's project was constructed, the flood levels were reduced by up to one to two feet and the obstruction was reduced from nearly two feet to a few inches. Elevations on the Y axis are based on the Cairo datum, which is approximately 20 feet below sea level, so a value of 15 on these profiles = roughly 5 feet below sea level.

SELA: The Southeast Louisiana Urban Flood Control Project, or SELA, was authorized by Congress after the May 1995 flood in Orleans, Jefferson and St. Tammany Parishes. It is specifically charged with dealing with rainfall flooding. In the area east of the Harvey Canal, SELA projects included improvements to the Whitney and Heebe Canals. Most, but not all, of the projects have been completed.

Map 4-3. Pump Stations Serving Gretna



Corps of Engineers website

SELA also included construction of a new Whitney-Barataria Pumping Station, with a capacity of 2,000 cubic feet per second. This brought up the number of pumping stations serving the area to four. The Corps also has plans to "stormproof" these pump stations, by hardening them and adding generators.

The product of all these improvements should be reflected in reduced damage. Rainfall data for 1997 – 2004 for a gage on the Huber canal, in the middle of Gretna, were obtained from the Parish. The top storms were investigated to see what happened to flood insurance claims

Table 4-2 summarizes the findings. Because of the damage they caused, all four storms resulted in Presidential Disaster Declarations for Jefferson Parish. While Georges was not equaled or exceeded until Katrina, Isidore came the closest to dropping the same amount of rain. However, Isidore resulted in 1/5 the number of claims in Gretna. Because data are not available to match storms in the 1990's with similar storms after 2000, it cannot be proven that the improvements to date have reduced insurance claims, but the numbers look positive.

Table 4-2. Recent Rainfall and Claims Data

Date	Name	Peak day Rainfall	3 Days' Rainfall	Number of Claims	Average Claim
Sept 1998	Georges	9.94	16.48	116	$8,530
June 2001	Allison	5.06	6.62	38	$3,792
Sept 2002	Isidore	8.39	13.58	21	$4,803
Oct 2002	Lili	4.90	5.41	6	$3,435

NFIP/CRS

CRS credit: The Community Rating System credits capital improvement plans that fund drainage improvements that reduce the need for maintenance or that eliminate bottlenecks and other maintenance problems. Up to 50 points are provided in Activity 540 – Drainage System Maintenance. The City has a master plan, but it is not receiving CRS credit.

4.3. Storage Basins

Background: Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower flood heights by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flood has subsided, then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the drainage system can accommodate downstream.

Storage basins can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected.

Urban detention basin

In urban areas, some reservoirs are simply manmade holes, excavated to store floodwaters (see photo). Reservoirs in urban areas are typically constructed adjacent to streams. When built in the ground, there is no dam for these detention basins and no dam failure hazard. Wet or dry basins can also serve multiple uses by doubling as parks or other open space uses.

Implementation in Gretna: Traditionally, channel and pump improvements have been the flood control projects of choice to handle drainage problems in the New Orleans area. However, their effectiveness is dependent on conditions downstream. This problem was recognized by the City in the 1980's.

In 1989 – 1990, a storage basin was constructed in City Park to relieve overloaded storm drains and ditches in the southern part of the City (see photo). The basin has control structures that allow releases when the receiving canals can take the water. A second basin is located in the northern part of the City on vacant land. It may have already alleviated flooding in the northernmost repetitive loss area (see Map 2-7). A third site is being investigated.

This aerial view shows how the detention basin blends in and adds to City Park.

Google Earth

CRS credit: If it can be demonstrated that the reservoirs lowered the flood level on buildings in the A Zones, the CRS credit can be calculated for Activity 530 − Flood Protection . The City is not receiving this credit at this time.

4.4. System Maintenance

Background: Drainage system maintenance is an ongoing program to clean out blockages caused by overgrowth, bank erosion, or debris. "Debris" refers to a wide range of blockage materials that may include tree limbs and branches that accumulate naturally, or large items of trash or lawn waste accidentally or intentionally dumped into channels and storage basins.

A regular inspection and maintenance program removes debris before it becomes an obstruction to stream flows.

Dr. Warren Campbell

Maintenance activities normally do not alter the shape of the channel or basin, but they do affect how well the drainage system can do its job. Sometimes it is a very fine line that separates debris that should be removed from natural material that helps form habitat.

A model drainage system maintenance program does the following:

- Inspects the entire drainage system at least once each year;
- Checks known problem sites during or immediately after heavy storms;
- Responds to inquiries or complaints from citizens; and
- Removes debris soon after it is found.

Dumping regulations: One approach that can reduce drainage problems and the workload of the maintenance crews is an anti-dumping program. Many communities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Drainageway dumping regulations need to also apply to "nonobjectionable" materials, such as grass clippings or tree branches which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Public information: Many people do not realize the consequences of their actions. They may fill in the ditch in their front yard, not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a drainage system maintenance program and an anti-dumping program should include public information materials that explain the need for maintenance, how individuals can help, the reasons for the dumping rules, and the penalties.

Stream dumping notice

Implementation in Gretna: Maintenance of the drainage system that serves Gretna is divided between the City and Jefferson Parish:

- The City Department of Public Works is responsible for storm drains, roadside ditches, WPA ditches, and the smaller collector canals. The Department has a five person crew that inspects and cleans ditches and catch basins. There are also grass cutting crews that keep an eye out for debris. A vacuum truck helps keep storm drains and their inlets and catch basins clear.
- The Parish Drainage Department inspects and maintains the larger canals and the Department of Pump Stations owns and cares for the 17 Westbank pumping stations. The Parish has a drainage maintenance program that has been held up as a national example in a FEMA Community Rating System publication.

Jefferson Parish drainage inspector
CRS Credit for Drainage System Maintenance

Both programs would be more effective if they were supported by more frequent inspections by residents. An "adopt an inlet" or "stream team" type of program can make an inspector of every resident adjacent to a storm drain inlet or open ditch. If they find leaves, grass clippings, trash or similar debris, they can remove the problem to ensure that the inlet or ditch will work during the next storm. If they find bigger problems, such as broken pipes, they can report them to the Department of Public Works.

Section 46-1 of the City's Code of Ordinances states that "No person shall dump, discharge or permit to be dumped or discharged into any waters or drains of this city specifically drainage ditches, canals and subsurface drains, any trees or other objects, substances or materials which might interfere with the drainage." The City advertises this law in various media, as discussed in Chapter 9.

CRS credit: The CRS provides up to 200 points for a comprehensive drainage system maintenance program. The City is currently receiving the maximum credit for its maintenance program and the maximum (30 points) for its stream dumping regulations. However, since the program was last reviewed the CRS credit criteria have changed. It is doubtful that the current documentation will be approved without changes.

4.5. Conclusions

1. Flood control projects can protect large areas, including streets and other property in addition to buildings, often at a lower cost than other mitigation measures. However, care must be taken to ensure that they are properly maintained and that they do not give people an illusory sense of being completely protected from flooding.

2. The levees on the north and east of the City provide protection from almost all floods from the Mississippi River. The levees to the south and west need to be improved to provide acceptable protection from coastal storms and hurricanes. Improvements are underway.

3. The canals and the pump stations that drain them have been improved and more improvements are planned. The product of this work may already be evident in the form of fewer flood insurance claims.

4. The City has utilized local storage basins to augment the canals and a third one may be constructed.

5. The drainage system is well-maintained, although additional help from residents would make it more effective.

4.6. Recommendations

The following recommendations are made in light of the five goals set for this plan (see page 3-6.)

Mitigation Plan Goals

1. Protect critical facilities and utilities
2. Protect lives and health
3. Protect homes, businesses, and schools
4. Minimize costs to the City and property owners
5. Ensure that new construction supports these goals

4-1. The Corps and Parish should complete the levee improvement projects as soon as possible. The levees should be raised to provide at least 100-year flood protection.

4-2. The Parish and City should complete all planned drainage, canal, and pump station improvements. The master drainage improvements plan should be reviewed and updated to ensure that it qualifies for CRS credit.

4-3. The current drainage system maintenance procedures should be reviewed in light of changes in the Community Rating System credits for the program.

4-4. Steps should be taken to educate residents in:

- The hazard of levee failure, even if levees are improved to higher levels, and
- How they can help maintain their portion of the drainage system.

4.7. References

- *CRS Coordinator's Manual*, FEMA, 2006
- *CRS Credit for Drainage System Maintenance*, FEMA, 2006
- *Flood Insurance Study*, Jefferson Parish, FEMA, 1995
- *Southeast Louisiana Urban Flood Control Project, East of Harvey Canal Basin,* Appendix A, Economics, April 2004, US Army Corps of Engineers, New Orleans District.
- Interview with Mike Chopin, City Engineer
- Interview with Jack Griffin, Director of Public Works
- Interview with Jerry Spohrer, Executive Director, West Jefferson Levee District
- Websites of the US Army Corps of Engineers, Jefferson Parish, City of Gretna, and West Jefferson Levee District