DRAFT
REPETITIVE LOSS AREA ANALYSIS

City of Savannah, Georgia
Development Services Department

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1 Repetitive Loss Area Analysis

Background

Flooding is the most common natural hazard in the United States. More than 20,000 communities experience floods and this hazard accounts for more than 70 percent of all Presidential Disaster Declarations. In the United States, over 8 million residential and commercial structures are currently built in areas at risk to flooding. The cost of recovery is spread over local, state and federal governments and the victims themselves, who are directly affected by these disasters.

Figure 1: Street flooding at E. Lathrop Avenue and Louisville Road on July 21, 2014. Photo by WSAV3 Staff.

The National Flood Insurance Program (NFIP) is continually faced with the challenge of balancing the financial soundness of the program with the competing expectation of keeping premiums affordable. Repetitive loss properties are one of the two largest obstacles to achieving financial soundness of the NFIP. Since the inception of the NFIP, almost $9 billion have been paid to repetitive loss properties, about one-fourth of all NFIP payments. While the NFIP has resulted in forty years of successful floodplain management, and many of these structures are no longer insured, repetitive loss properties are still a drain on the NFIP. Currently, repetitive loss properties represent 1.3% of all policies, but are expected to account for 15% to 20% of future losses.

Private insurance companies faced with high losses have several options to keep turning a profit. They can raise income through premium rate increases, decrease payments to insurers or reduce the exposure to the hazard. Unfortunately, the NFIP can only do what is allowed by statute. If losses increase, the Federal Emergency Management Agency (FEMA) is authorized by Congress to make incremental adjustments to increase the premium rates and reduce overall coverage. FEMA is not permitted to eliminate coverage for any policy holder including high-risk properties. Actuarial rates cannot be charged to buildings built before State and local floodplain management regulations went into effect. Since repetitive flood claims must be paid, FEMA has no choice but to spread these costs among all policyholders.

Sometimes floodplain management regulations mitigate repetitive flood losses when a building is substantially damaged. A structure where the cost to repair is equal to or exceeds 50 percent of the building's value is considered substantially damaged. A substantially damaged building must be brought up to the same flood protection level as a new building under a community's floodplain management ordinance. Many repetitive loss buildings are not in a regulated floodplain or they do not get substantially damaged and remain at risk to future damage.

Many owners of properties that experience repetitive flooding are not aware of the magnitude of damage they are exposed to because they either purchased the property after the last flood or the seller or lender did not disclose the flood hazard. Disclosure of repetitive flooding is a problem due to the fact that repetitive loss areas are not show on Flood Insurance Rate Maps (FIRMs).

Terminology

Repetitive Loss: Any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. Two of the claims paid must be more than 10 days apart but, within 10 years of each other. A repetitive loss property may or may not be currently insured by the NFIP.

Severe Repetitive Loss: As defined by the Flood Insurance Reform Act of 2004, SRLs are 1-4 family residences that have had four or more claims of more than $5,000 or at least two claims that cumulatively exceed the building's value. The Act creates new funding mechanisms to help mitigate flood damage for

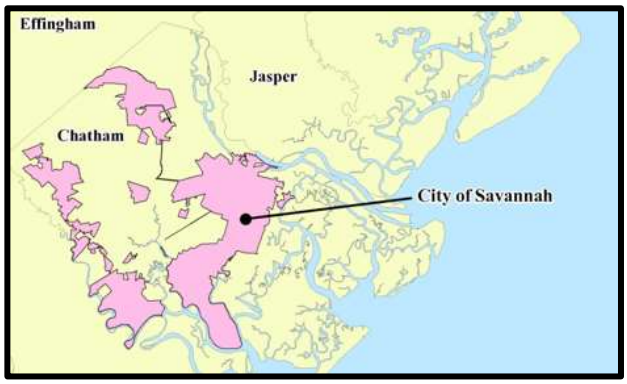
The City of Savannah, Georgia (CID-135163) has been participating in the regular phase of the NFIP since May 21, 1971. In addition to meeting the basic requirements of the NFIP, Savannah has completed additional components to participate in the Community Rating System (CRS) program. Savannah is currently a CRS Class 6 which rewards all policyholders in the SFHA with a 20 percent reduction in their flood insurance premiums. Non-SFHA policies (Standard X Zone policies) receive a 10% discount, and preferred risk policies receive no discount. Savannah has been participating in the CRS program since October 1, 2010.

As of November 30, 2014, there are currently 7,239 NFIP Polices in force in Savannah with annual premiums of $4,581,341 and insurance coverage of almost $2 billion. The City has 1,611 historical paid losses against the NFIP totaling more than $26 million with 92 of those losses being substantial damage claims since May 1970. A repetitive loss property does not have to currently be carrying a flood insurance policy to be considered a repetitive loss property or a severe repetitive loss property. In some cases a community will find that properties on its repetitive loss list are not currently insured. An insured property and claims on that property will make it a repetitive loss property. Once it is designated as a repetitive loss property, that property remains as a repetitive loss property from owner to owner; insured policy to no policy; and even after that property has been mitigated. Fifty percent of repetitive loss buildings in Savannah are currently insured (see the Repetitive Loss Requirement Section).

According to repetitive loss data received from the Georgia Emergency Management Agency

(GEMA) in 2013, there are a total of 185 unmitigated and 142 mitigated repetitive loss properties within the City of Savannah. Fifteen properties are classified as severe repetitive loss. Of the fifteen severe repetitive loss properties, five remain unmitigated. An updated Activity 510 Floodplain Mitigation Plan (FMP) is currently under development for the City. Since the FMP examines flooding issues as a whole within the City and does not assess individual properties, the City of Savannah has opted to complete a Repetitive Loss Area Analysis (RLAA) using the 2013 *CRS Coordinator's Manual*. The RLAA will benefit the City by examining potential mitigation measures for specific repetitive loss areas and increasing its credit in the CRS Program.

Setting



The City of Savannah is located in Chatham County in southeastern Georgia, with a population of 136,286 as of the 2010 U.S. Census. Nestled in close proximity to the Savannah River and the Atlantic Ocean, the City has a total land area of approximately 103 square miles and is situated on a low coastal plain with much of its surrounding area consisting of tidal marshes. Elevations range from sea level along the coast to approximately 40 feet in downtown Savannah. The Savannah River (north of City) and the Ogeechee River (south of City) have drainage areas extending far beyond the limits of Savannah and Chatham County. Main openings to the Atlantic Ocean are Ossabaw Sound and Wassaw Sound.

Flooding within the City of Savannah can be attributed to three sources: 1) tidal flooding resulting from hurricanes and tropical storms; 2) flash flooding resulting from heavy rainfall that overburdens the drainage system within the community; and 3) riverine flooding resulting from heavy and prolonged rainfall over a given watershed which causes the capacity of the main channel to be exceeded. Figure 1 illustrates drainage basins within the City of Savannah along with the main canals.

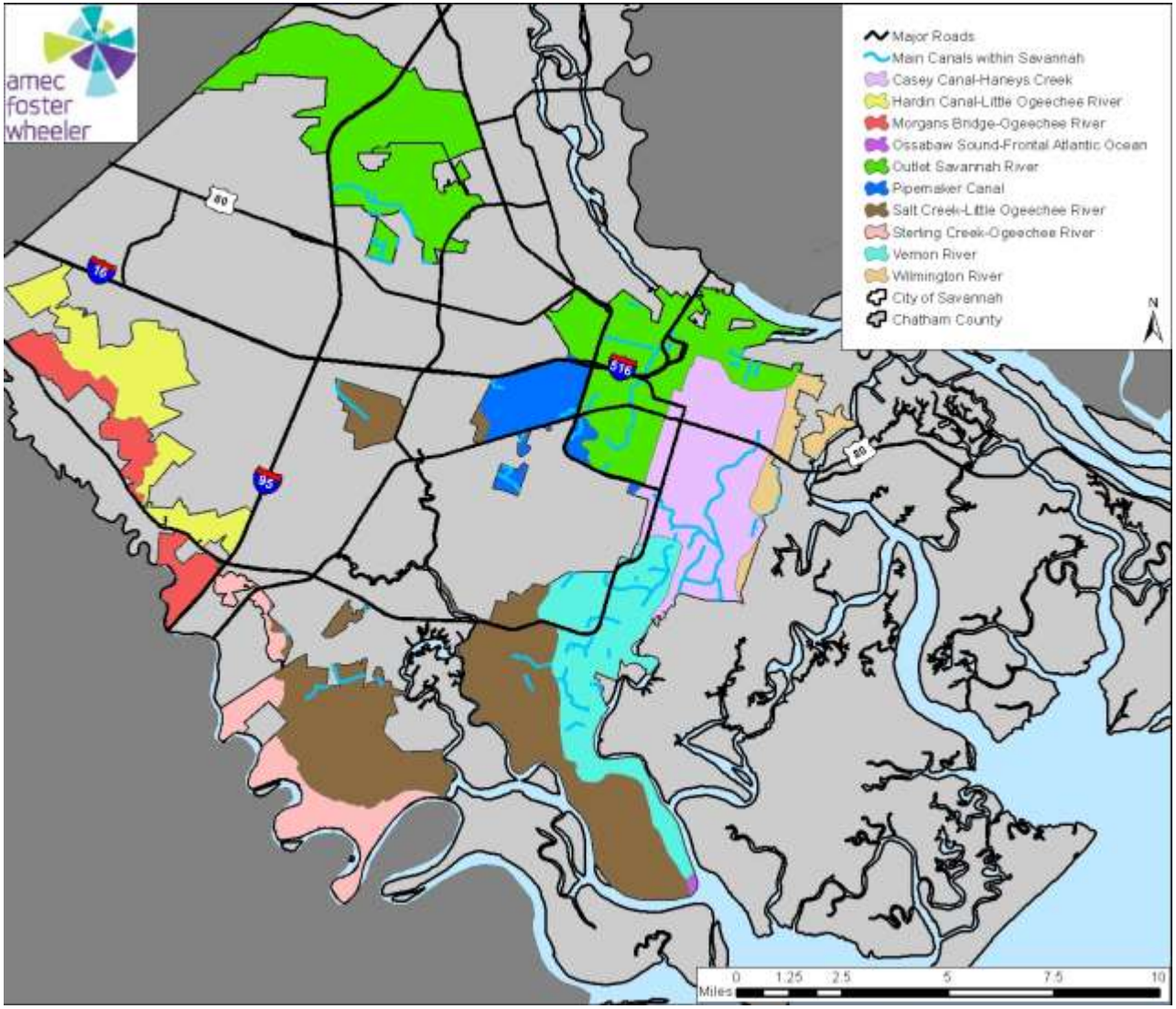


Figure 1- Savannah Drainage Basins and Main Canals

Repetitive Loss Requirement

Repetitive loss data must be maintained and updated annually in order to participate in the CRS. Since many of the losses under the NFIP come from repetitively flooded properties, addressing these properties is a priority for participating in the CRS Program. Depending on the severity of the repetitive loss problem, a CRS community has different responsibilities.

- **Category A**: A community with no unmitigated repetitive loss properties. No special requirements from the CRS.
- **Category B**: A community with at least one, but fewer than 10, unmitigated repetitive loss properties. Category B communities are required by the CRS to research and describe their repetitive loss problem, create a map showing the showing the location of all repetitive loss properties (areas) and complete an annual outreach activity directed to repetitive loss properties.
- **Category C**: A community with 10 or more unmitigated repetitive loss properties. Category C communities are required to do everything in Category B and prepare either a floodplain management plan that covers all repetitive loss properties (areas) or prepare a RLAA for all repetitive loss areas.

Since the latest repetitive loss data obtained from GEMA for the City of Savannah contained a total of 185 unmitigated repetitive loss properties, the City is designated as a Category C repetitive loss community.

Mapping Repetitive Loss Areas

In accordance with the principles outlined in the CRS guidance titled *Mapping Repetitive Loss Areas* dated August 15, 2008, 87 Repetitive Loss Areas were identified within the City of Savannah. The 87 Repetitive Loss Areas included the 185 unmitigated repetitive loss properties, 83 historic repetitive loss properties (those with one paid claim against the NFIP), plus an additional 585 properties that have the same or similar flood conditions but have not had any claims paid against the NFIP. Therefore, a total of 851 properties were included within the RLAA.

For reporting purposes, the 87 Repetitive Loss Areas were grouped into 16 subareas, then divided by 3 General Areas based on predominant building type and flooding source. The 3 General Areas are as follows:

Area 1: Downtown/Historic/Midtown
Area 2: Southcentral
Area 3: South City/Sound

A detailed map of each subarea is provided in Section 2. An overview map of the City of Savannah Repetitive Loss Areas is shown in Figure 2 on the following page.

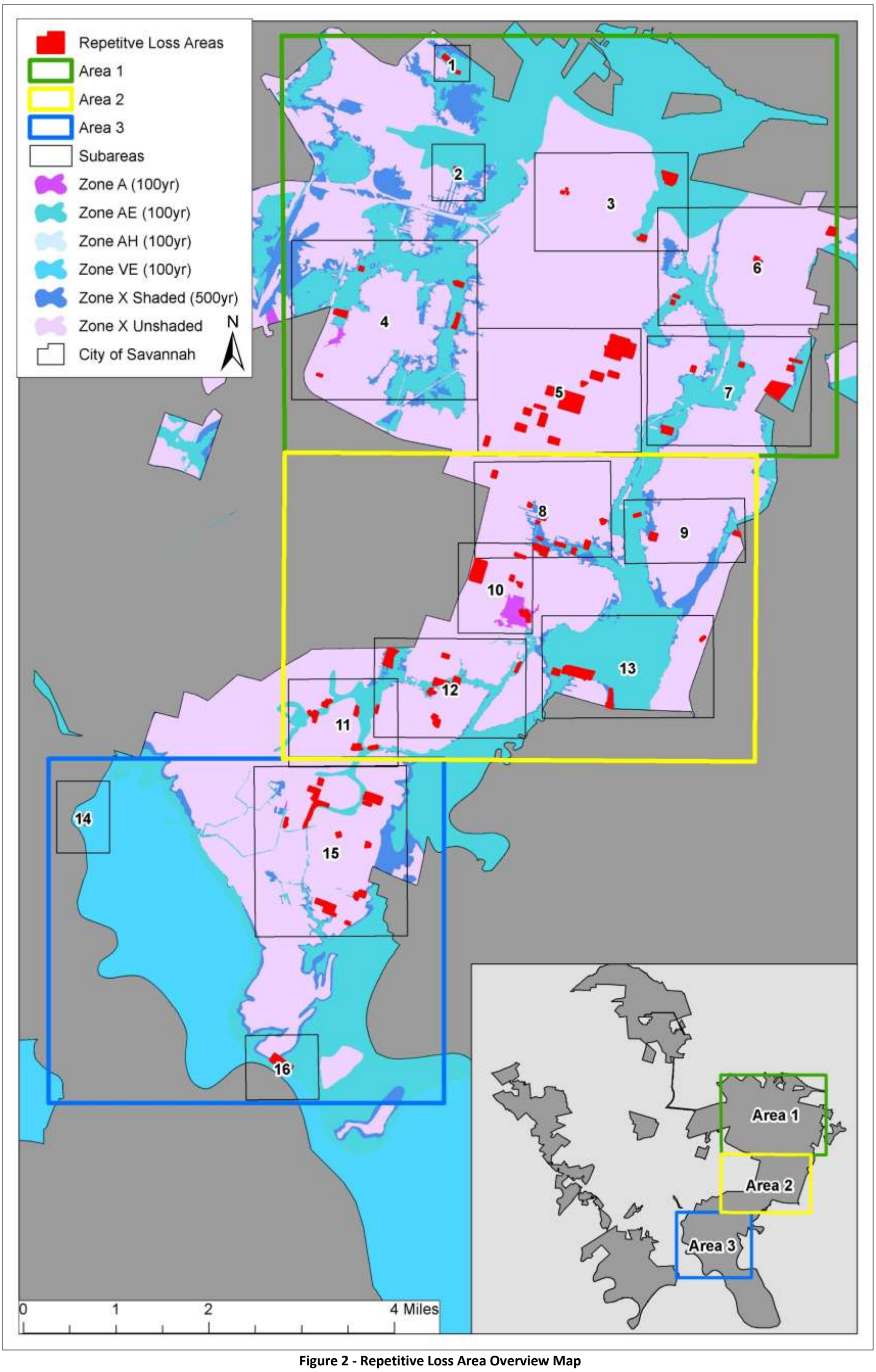


Figure 2 - Repetitive Loss Area Overview Map

2 The RLAA Process

The RLAA planning process incorporated requirements from Section 510 of the 2013 *CRS Coordinator's Manual*. The planning process also incorporated requirements from the following guidance documents: 1) FEMA publication *Reducing Damage from Localized Flooding: A Guide for Communities,* Part III Chapter 7; 2) CRS publication *Mapping Repetitive Loss Areas* dated August 15, 2008; and 3) Center for Hazards Assessment Response and Technology, University of New Orleans draft publication *The Guidebook to Conducting Repetitive Loss Area Analyses*. Most specifically, this RLAA included all five planning steps included in the 2013 *CRS Coordinator's Manual*:

Step 1: Advise all the properties in the repetitive loss areas that the analysis will be conducted and request their input on the hazard and recommended actions.

Step 2: Contact agencies and organizations that may have plans or studies that could affect the cause or impacts of the flooding. The agencies and organizations must be identified in the analysis report.

Step 3: Visit each building and collect basic data.

Step 4: Review alternative approaches and determine whether any property protection measures or drainage improvements are feasible.

Step 5 Document the findings. A separate analysis report must be prepared for each area.

Beyond the 5 planning steps, additional credit criteria must be met:

1. The community must have at least one repetitive loss area delineated in accordance with the criteria in Section 503.
2. The repetitive loss area must be mapped as described in Section 503.b. A Category "C" community must prepare analyses for all of its repetitive loss areas if it wants to use RLAA to meet its repetitive loss planning prerequisite.
3. The repetitive loss area analysis report(s) must be submitted to the community's governing body and made available to the media and the public. The complete repetitive loss area analysis report(s) must be adopted by the community's governing body or by an office that has been delegated approval authority by the community's governing body.
4. The community must prepare an annual progress report for its area analysis.
5. The community must update its repetitive loss area analyses in time for each CRS cycle verification visit.

STEP 1. Advise All Property Owners

Before field work began on the RLAA, individual letters were mailed to property owners within the 87 identified Repetitive Loss Areas. Figure 3 on the following page shows an example of the property owner notification letter. A total of 801 letters were mailed to repetitive loss properties, historical repetitive loss properties (those with one paid claim against the NFIP), and additional properties added to the repetitive loss areas which have no claims paid against the NFIP. Notification letters were not mailed to 48 mitigated properties owned by the City that were originally included within the RLAA boundaries. The letters were mailed to property owners on September 3, 2014. Copies of the letters are provided in Appendix A (Appendix A will not be shared with the general public).

Mailed Questionnaire

A property owner questionnaire was included with each letter mailed to building owners in each of the 87 Repetitive Loss Areas. The questionnaire asks about the type of foundation and if the building has a basement, if the building has experienced any flooding and the type of flooding, cause of flooding, flood protection measures and whether the owner has flood insurance. The Flood Protection Questionnaire is shown in Figures 4 and 5 on the following pages.

CITY OF Savannah
DEVELOPMENT SERVICES

September 3, 2014

APS COASTAL LLC
PO BOX 15566
SAVANNAH,GA 31416

Property Address: 12205 DEERFIELD RD SAVANNAH PIN: 2-0096 -14-003

Dear Property Owner:

As part of the City of Savannah's participation in the National Flood Insurance Program's (NFIP) Community Rating System (CRS), the Development Services Department is evaluating properties that have experienced repetitive flood damage. This analysis will include the review of all previous flood data and studies conducted in these locations.

The repetitive loss analysis involves the collection of the following property level data elements:

- Building permit records (including application and associated records)
- Structure and site elevation information (elevation certificate if available)
- Tax ID and lot and parcel number
- Building property value on record (assessed value, replacement value or both)
- Land property value on record
- Building codes/floodplain development regulations exceeding minimum standards
- Historical flood event information (when events occurred, amount of damage to property, etc.)

In addition, the City of Savannah and its contractor will visit each property to survey the flood risk and to take photographs. Property owners are encouraged to provide any relevant flooding information. The survey crews will be looking at the type and condition of the foundation, drainage patterns on the lot and whether outside mechanical equipment is elevated.

The results of the repetitive loss area analysis will include a review of alternative approaches for property protection measures or drainage improvements where feasible. Once the analysis is complete, a copy of the report can be obtained from the Development Services Department or by calling (912) 651-6530 Ext. 1895.

You can help us perform this analysis by **completing and returning this questionnaire by September 30, 2014 to me at 5515 Abercorn Street, Savannah, GA 31405.** If you have any questions, please call me at (912) 651-6530 Ext. 1895.

Sincerely,

Tom McDonald, CFM
Permitting/Floodplain Administrator

P.O. BOX 1027, SAVANNAH, GA 31402
PHONE 912-651-6530 TDD 912-651-6702 FAX 912-651-6543 SAVANNAHGA.GOV

Figure 3 - Example Property Owner Notification Letter

CITY OF Savannah
DEVELOPMENT SERVICES

Flood Protection Questionnaire

Name:_____

Property Address:_____

1. When did you move into this home/building at this address? _____

2. What type of foundation does your home/building have?

☐ Slab ☐ Crawl space ☐ Basement ☐ Other_____

3. Has your home/building or property ever been flooded or had a water problem?

☐ Yes ☐ No (If "no" please complete only items 8-11)

4. In what year(s) did it flood? _____

5. Where did you get water and how deep did it get?

☐ In basement: _____Deep ☐ crawl space: _____Deep

☐ Over first floor: _____Deep ☐ yard only: _____Deep

☐ Water kept out of house by sandbagging, sewer valve, or other protective measure

6. What was the longest time that water stayed in the house/building? _____hours or days_____

7. What do you feel was the cause of your flooding? Check all that affect your home/building.

☐ Storm sewer backup ☐ Sanitary sewer backup ☐ Standing water next to house/building

☐ Drainage from nearby properties ☐ Saturated ground/leaks in basement walls

☐ Overbank flooding from:_____ ☐ Other: _____

8. Have you installed any flood protection measures on your property?

☐ Sump pump ☐ Waterproofed the outside walls ☐ Re-graded yard to keep water away

☐ Moved things out of basement ☐ backup power system/generator ☐ Sandbagged

☐ Other: _____

P.O. BOX 1027, SAVANNAH, GA 31402
PHONE 912-651-6530 TDD 912-651-6702 FAX 912-651-6543 SAVANNAHGA.GOV

Figure 4 - Flood Protection Questionnaire – Page 1

Flood Protection Questionnaire Continued

9. Did any of the measures checked in item 8 work? If so, which ones? If not, do you know why they did not work?

_____

_____

10. Do you have FEMA Flood Insurance?

☐ Yes ☐ No ☐ Not sure

11. Do you want information on protecting your home/building from flooding?

☐ Yes ☐ No

12. Please include any additional information and comments you may have about flooding in your area:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Please return by September 30, 2014 to:
Tom McDonald, 5515 Abercorn Street, Savannah, GA 31405

P.O. BOX 1027, SAVANNAH, GA 31402
PHONE 912-651-6530 TDD 912-651-6702 FAX 912-651-6543 SAVANNAHGA.GOV

Figure 5 - Flood Protection Questionnaire – Page 2

Out of the 801 mailed questionnaires, the City of Savannah received 171 responses which corresponds to a response rate of approximately 21 percent. Copies of the completed questionnaires are located in Appendix B (Appendix B will not be shared with the general public). Questionnaire responses are summarized below. Note: Respondents may have skipped questions and/or provided more than one response to a question.

Q1: When did you move into this home/building at this address?

Responses Received	Percentage	Number Responding
<10 years ago	29	46
10-20 years ago	30	47
20-30 years ago	22	34
30-40 years ago	9	15
40-50 years ago	5	8
> 50 years ago	5	8
Total	**100**	**158**

Q2: What type of foundation does your home/building have?

Answer Choices	Percentage	Number Responding
Slab	53	94
Crawl space	43	75
Basement	1	1
Other	3	6
Total	**100**	**176**

Q3: Has your home/building or property ever been flooded or had a water problem?

Answer Choices	Percentage	Number Responding
Yes	41	68
No	59	98
Total	**100**	**166**

Q4: In what year(s) did it flood?

Responses Received	Percentage	Number Responding
1976	1	1
1985	1	1
1989	1	1
1990	2	2
1994	13	13
1996	18	18
1998	7	7
1999	25	26

Responses Received	Percentage	Number Responding
2000	1	1
2001	1	1
2002	1	1
2003	1	1
2004	2	2
2005	2	2
2006	4	4
2007	2	2
2008	2	2
2010	2	2
2011	3	3
2012	5	5
2013	3	3
2014	4	4
Total	**100**	**102**

Q5: Where did you get water? How deep did the water get?

Answer Choices	Percentage	Number Responding	Depth	
			< 3 ft	> 3 ft
Basement	9	7	7	0
Crawl space	18	14	7	7
Over first floor	35	28	27	1
Yard only	30	24	20	4
Water kept out of house by sandbagging, sewer valve, or other protection measures	8	6	n/a	n/a
Total	**100**	**79**	**61**	**12**

Q6: What was the longest time that water stayed in the house/building?

Responses Received	Percentage	Number Responding
1-2 hours	15	6
3-4 hours	31	12
5-6 hours	8	3
7-8 hours	5	2
9-10 hours	5	2
18 hours	3	1
30 hours	3	1
1-2 days	20	8
3-4 days	10	4
Total	**100**	**39**

Q7: What do you feel was the cause of your flooding?

Answer Choices	Percentage	Number Responding
Storm sewer backup	35	44
Sanitary sewer backup	2	3
Standing water next to house/building	11	14
Drainage from nearby properties	18	23
Saturated ground/leads in basement walls	7	9
Overbank flooding	13	17
Other	13	17
Total	**100**	**127**

Q8: Have you installed any flood protection measures on your property?

Answer Choices	Percentage	Number Responding
Sump pump	21	14
Waterproofed the outside walls	5	3
Re-graded yard to keep water away	29	19
Moved things out of basement	2	1
Backup power system/generator	8	5
Sandbagged	8	5
Other	29	19
Total	**100**	**66**

Q9: Did any of the measures checked in Question 8 work?

Answered "Yes" for the following:	Percentage	Number Responding
Sump pump (when electricity available)	28	7
Waterproofed the outside walls	8	2
Re-graded yard to keep water away	28	7
Moved things out of basement	0	0
Backup power system/generator	4	1
Sandbagged	8	2
Other		
City drainage project	12	3
New gutters	4	1
Raised HVAC	4	1
New plumbing	4	1
Total	**100**	**25**

Q10: Do you have FEMA Flood Insurance?

Answer Choices	Percentage	Number Responding
Yes	55	90
No	39	65
Not sure	6	10
Total	**100**	**165**

Q11: Do you want information on protecting your home/building from flooding?

Answer Choices	Percentage	Number Responding
Yes	48	74
No	52	81
Total	**100**	**154**

The following trends in survey responses should be considered when evaluating mitigation measures for General Areas 1, 2 and 3:

- 52 percent of respondents do not want information from the City of protecting their home/building from flooding. This could indicate a lack of trust in the City or a lack of interest in installing floodproofing measures.
- Over half of the respondents do currently have FEMA flood insurance.
- Of those respondents who have installed flood protection measures, re-grading of property and sump pumps were the most popular methods; furthermore, re-grading of property, sump pumps and city initiated drainage improvement projects appear to be the most effective measures for reducing flooding.
- 35 percent of respondents feel that storm sewer backup is the cause of flooding issues on their property. Drainage from nearby properties and overbank flooding are the next most popular responses.
- Over 50 percent of respondents have a slab foundation. 41 percent have been flooded.
- The majority of flooding has been over the first floor of the home and in crawl spaces. The majority of flooding lasted between one and four hours.
- The years with the largest number of reported flooding incidents are 1994, 1996 and 1999. The following flood events are detailed in NOAA's National Climatic Data Center (NCDC) database:
    - **July 5, 1996 -** Eight to ten (8-10) inches of rain fell in 3-4 hours in and around Savannah. As a result, 50 streets and 100 homes were flooded to various degrees. Numerous businesses had water several inches deep. There were 31,000 residents without power for several hours. This event also occurred close to high

tide. Some streets had water up to headlights on cars while some homes had water almost knee deep.

- **August 7, 1996 –** Four to eight inches of rain fell in two to four hours causing flash flooding of streets and small streams in Savannah.
- **June 29, 1999** - Slow moving showers and thunderstorms developed repeatedly across Chatham County and Effingham County during the day. Twenty-four hour rainfall amounts ranged from about 7 inches to over 13 inches. As a result of the flooding, over 500 homes and businesses were damaged to varying degrees and almost 600 automobiles were damaged. Water was as much as 6 ft deep in some places. Numerous roads were washed out and/or closed during the flooding. Estimated dollar damage for public property was 4.5 million dollars and at least another 2.5 million dollars for private property.

STEP 2. Contact Agencies and Organizations

The City of Savannah contacted external agencies and internal departments that have plans or studies that could affect the cause or impacts of flooding within the identified repetitive loss areas. The data collected was used to analyze the problems further and to help identify potential solutions and mitigation measures for property owners. Those agencies contacted and reports which were analyzed and reviewed included:

- City of Savannah Stormwater Management Department
- City of Savannah Public Works & Water Resources Bureau
- City of Savannah Community Planning & Development Department
- GEMA – Repetitive Loss and Flood Insurance Data
- FEMA – Flood Insurance Study (FIS) & Flood Risk Report for Chatham County, GA
- ISO – Repetitive Flood Insurance Claims Data
- City of Savannah Drainage Improvement Contractors

Summary of Studies and Reports

FEMA Flood Insurance Study

FEMA's FIS for Chatham County, GA is dated July 7, 2014. The FIS revises and updates information on the existence and severity of flood hazards within the County including the City of Savannah. The FIS also includes revised digital Flood Insurance Rate Maps (FIRMs) which reflect updated Special Flood Hazard Areas (SFHAs) and flood zones for the City. SFHA boundaries within the City were updated due to new engineering analysis performed on Pipe Makers Canal and St. Augustine Tributary. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the City's recently developed LiDAR-based topographic data. Areas with the greatest increase of flood zone area are located in the Central part of the City. Areas with the greatest decrease in flood zone area are located in the Northern part of the City.

FEMA Flood Risk Report

FEMA's Draft Flood Risk Report for Chatham County, GA (July 2013) analyzes inland riverine flood risk for the County including the City of Savannah. The report includes flood depth and analysis grids, Hazus estimated loss information and Areas of Mitigation Interest for the City.

Flood Insurance Claims Data

The Privacy Act of 1974 (5 U.S.C. 522a) restricts the release of flood insurance policy and claims data to the public. This information can only be released to state and local governments for the use in floodplain management related activities. Therefore all claims data in this report are only discussed in general terms.

Capital Improvement Plan

The 2013 – 2017 Capital Improvement Program presents the five year capital plan for the City of Savannah. Over two-thirds of expenditures proposed in the 2013-2017 Capital Improvement

Program relate to Health and Environment which is intended to "provide citizens a community that promotes health through good infrastructure while preserving the environment". These expenditures are primarily planned for Water and Sewer infrastructure upgrades and maintenance, as well as the addition of a Sanitation landfill cell.

STEP 3. Building Data Collection

The on-site field survey for this analysis was conducted over multiple days between the months of September and November 2014. The National Tool Limited View was not utilized in this effort, but most of the information required by the National Tool was incorporated into the mobile application survey. The mobile application generated data collection forms are included in Appendix C (Appendix C will not be shared with the general public).

In addition, multiple site photos were taken of each structure on the property. Photos were also taken of current drainage features and mitigation and floodproofing measures if evident from street or parking lot views. The following information was recorded for each property:

- Existing mitigation observed
- Type and condition of the structure and foundation
- Number of stories
- Height above street grade and height above site grade
- Presence and type of appurtenant structures
- Flood zone and type of flooding source
- Likely areas and severity of damage on property
- Presence of any HVAC units that would be vulnerable

During the on-site field survey, it was discovered that two of the 185 unmitigated repetitive loss properties received from GEMA are now owned by the City of Savannah and have been mitigated through acquisition and demolition. Therefore, the total number of unmitigated repetitive loss properties was reduced from 185 to 183. The mitigated, City owned properties are as follows:

- 31 E 64th Street
- 1815 E 56th Street

GEMA identified repetitive loss properties which have been mitigated by the City through acquisition and demolition.

1815 E 56th Street, Savannah, GA

31 E 64th Street, Savannah, GA

This page redact from public viewing due to confidential material protected by law.

Problem Statement

General Area 1 – Downtown/Historic/Midtown

General Area 1 is located in northeastern Savannah adjacent to the Savannah River. There are nine identified historic neighborhoods within General Area 1; six of these are listed on the National Register of Historic Places. Historic properties and cultural resources are of high community value in Savannah, in terms of: national recognition (heritage); tourism and convention traffic (business, entertainment); restoration and habitation of residential properties (real estate); appropriate and beneficial business use (local economy); and other such factors.

General Area 1 contains a total of 7 Subareas and 37 Repetitive Loss Areas. Portions of General Area 1 are located within the 100-year floodplain and are subject to periodic flooding from poor drainage proximity to the tidally-influenced Savannah River and a number of historic structures built prior to the NFIP. The effort to reduce repetitive flooding becomes somewhat more complex with the structure type and historic nature of some buildings. In accordance with FEMA publication *551 Selecting Appropriate Mitigation Measures for Floodprone Structures*, mitigation options are limited for historic structures. The approach to reducing repetitive flooding in General Area 1 will require a combination of floodproofing techniques, education, and drainage improvement projects.

Flooding in General Area 1: Downtown/Historic/Midtown

Subarea 1

Repetitive Loss Areas 1 and 2 are located entirely within the 100-year floodplain (Zone AE). Subarea 1 is located in an older, established neighborhood with structures built circa 1950-1960.

Table 1 - Repetitive Loss Area Overview for Subarea 1

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
1	1	1	4	6	Fox Street Cleland Street Tuten Avenue
2	1	0	4	5	Damon Street

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

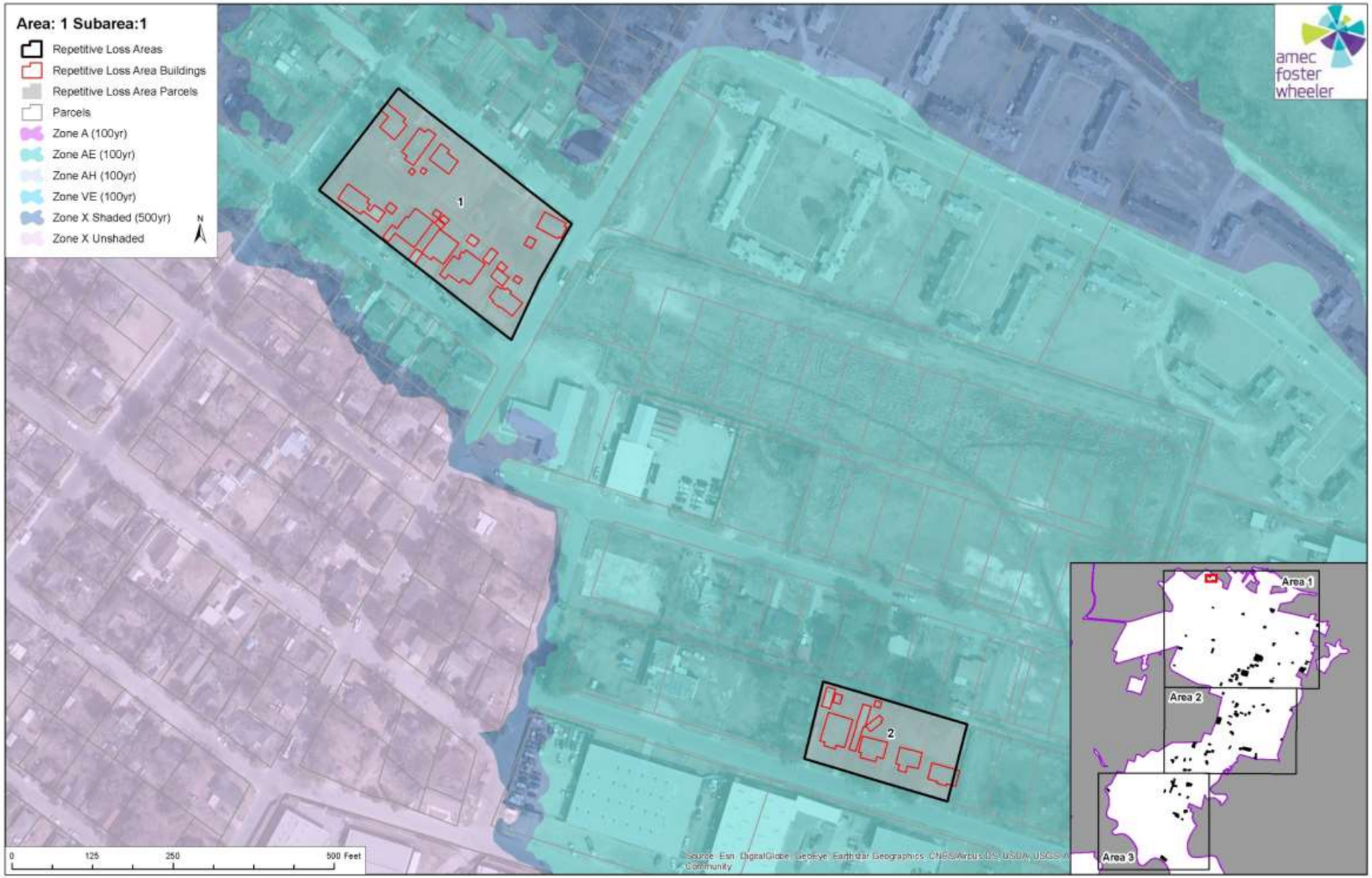


Figure 6 - Repetitive Loss Subarea 1

Example Properties in Subarea 1

Subarea 2

Repetitive Loss Area 3 is located entirely within the 100-year floodplain (Zone AE). Subarea 2 contains several vacant lots and abandoned properties.

Table 2 - Repetitive Loss Area Overview for Subarea 2

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
3	1	0	6	7	Stokes Street Magazine Avenue

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 7 - Repetitive Loss Subarea 2

Example Properties in Subarea 2

Subarea 3

Repetitive Loss Areas 7 and 8 are located entirely within the 100-year floodplain (Zone AE). A portion of Repetitive Loss Area 8 is located within the Eastside Historic District which is predominately residential. Repetitive Loss Areas 4, 5 and 6 are located entirely within the Savannah Historic Landmark District, but are not located within the 100-year floodplain. The Landmark District is known for its outstanding variety of architectural styles, including residential, commercial, and institutional buildings.

Table 3 - Repetitive Loss Area Overview for Subarea 3

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
4	1	0	1	2	Jefferson Street W. Gaston Street
5	1	1	6	8	Tattnall Street W. Wayne Street Jefferson Street
6	1	1	3	5	W. Gaston Street W. Gordon Lane Tattnall Street
7	1	0	0	1	E. President Street
8	2	0	6	8	Paulsen Street E. Gwinnett Street E. Gwinnett Lane Burton Court

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 8 - Repetitive Loss Subarea 3

Example Properties in Subarea 3

Subarea 4

Repetitive Loss Areas 9, 10, 12 and 13 are located entirely within the 100-year floodplain (Zone AE). Repetitive Loss Area 11 is located within the Zone X Unshaded flood zone. Repetitive Loss Area 12 is located within the Cuyler-Brownsville Historic District which is one of the oldest African-American neighborhoods in Savannah. The Cuyler-Brownsville District contains single and multiple family residences, attached row houses, detached commercial buildings and community landmark buildings.

Table 4 - Repetitive Loss Area Overview for Subarea 4

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
9	1	0	3	4	Corvair Avenue
10	1	0	7	8	Mills B Lane Blvd Act Blvd
11	1	0	4	5	Liberty Heights Drive Act Blvd
12	1	0	11	12	W. 42nd Street Ogeechee Road W. Victory Drive
13	2	0	5	7	W. 48th Street W. 49th Street W. 51st Street Stanley Street

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 9 - Repetitive Loss Subarea 4

Example Properties in Subarea 4

Subarea 5

Repetitive Loss Areas 14 through 25 and 86 are located within the Zone X Unshaded flood zone. Repetitive Loss Areas 14 and 15 are located within the Ardsley Park-Chatham Crescent Historic District which is a large, highly intact residential area consisting predominantly of one- and two-story single family homes.

Table 5 - Repetitive Loss Area Overview for Subarea 5

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
14	30	14	59	103	E. Victory Lane E. 44th Street E. 45th Street E. 46th Street E. Chatham Cres Harmon Street Waters Avenue Washington Avenue Paulsen Street Washington Lane
15	3	2	10	15	E. 50st Street E. 51st Street Harmon Street
16	3	7	9	19	E. 52nd Street E. 53rd Street Paulsen Street Atlantic Avenue
17	1	0	4	5	E. 54th Street E. 55th Street Atlantic Avenue
18	3	1	5	9	E. 57th Street E. 58th Street Habersham Street
19	10	7	30	47	E. 57th Street E. 58th Street Columbus Drive Columbus Lane Reynolds Street Battey Street
20	1	1	7	9	E.. 60th Street Habersham Street GA-204 East

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
21	1	0	5	6	E. 61st Street E. 62nd Street GA-204 West
22	1	0	2	3	Habersham Street E. 61st Street E. 62nd Street E. 63rd Street
23	0	1	4	5	E. 64th Street GA-204 West
24	1	0	7	8	Berkeley Place Sylvan Drive Herty Drive
25	1	0	7	8	E. 64th Street Battey Street Reynolds Street
86	1	0	0	1	Medical Arts Ctr E 65th Street E 63rd Street Paulsen Street

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Single apartment building with multiple claims for contents loss. Owner has built a brick wall and placed a barrier against the adjacent fence to keep water out of home.

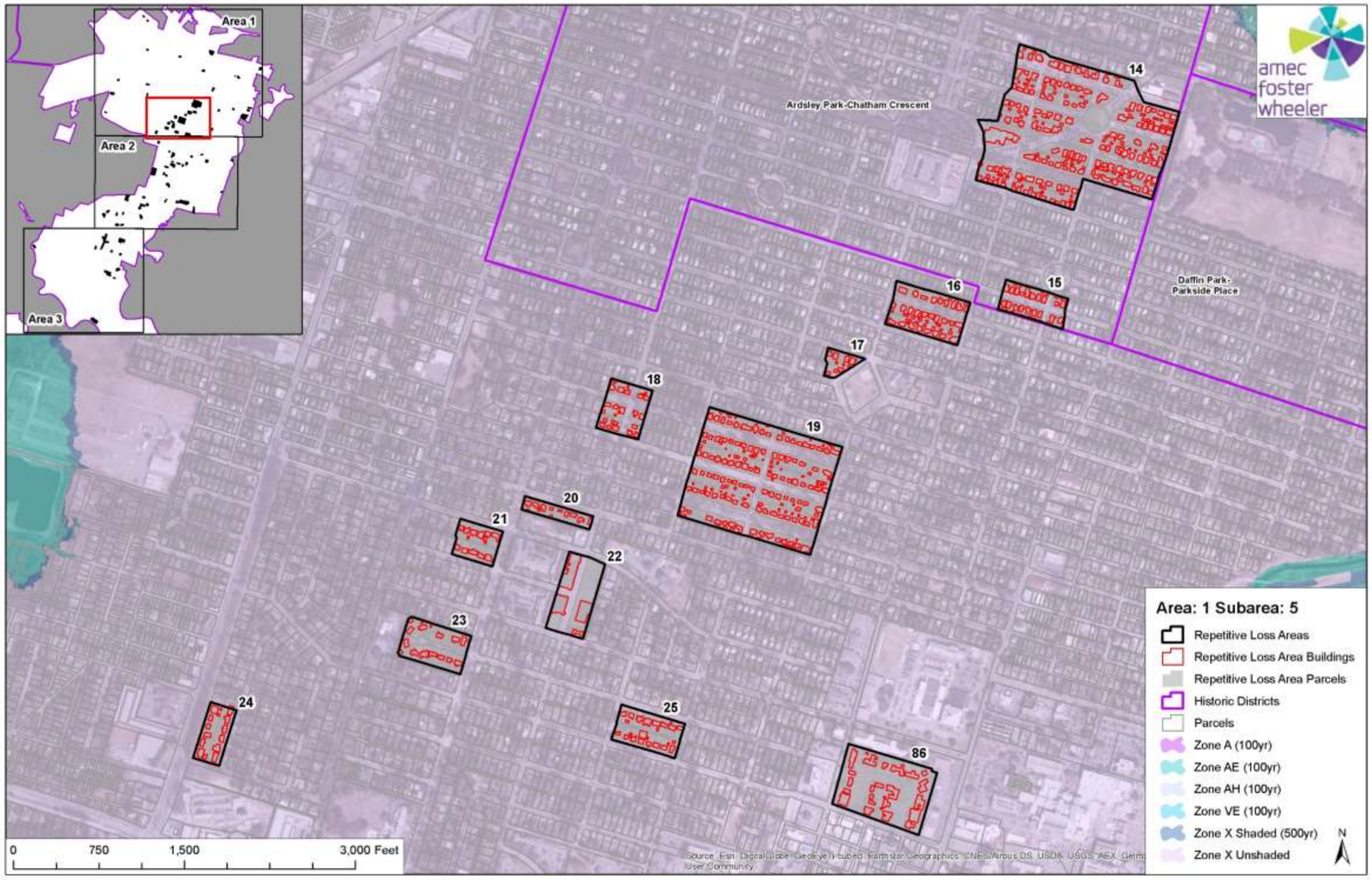


Figure 10 - Repetitive Loss Subarea 5

Example Properties in Subarea 5

Subarea 6

Repetitive Loss Areas 26 and 27 are located within the 100-year floodplain (Zone AE). Repetitive Loss Areas 28, 29 and 87 are located within the Zone X Unshaded flood zone. There is a mixture of newer and older homes within Subarea 6. Some homeowners have taken mitigation action such as elevating HVAC units.

Table 6 - Repetitive Loss Area Overview for Subarea 6

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
26	1	0	3	4	E9. 35th Street C3edar Street
27	1	0	5	6	E.7 32nd Lane E. 33rd Street Cedar Street
28	2	0	9	11	Screven Place Screven Avenue Greenville Street
29	1	0	3	4	Capital Street Causton Bluff Road Gregory Street
87	1	0	0	1	Greenville Street Lawton Lane

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

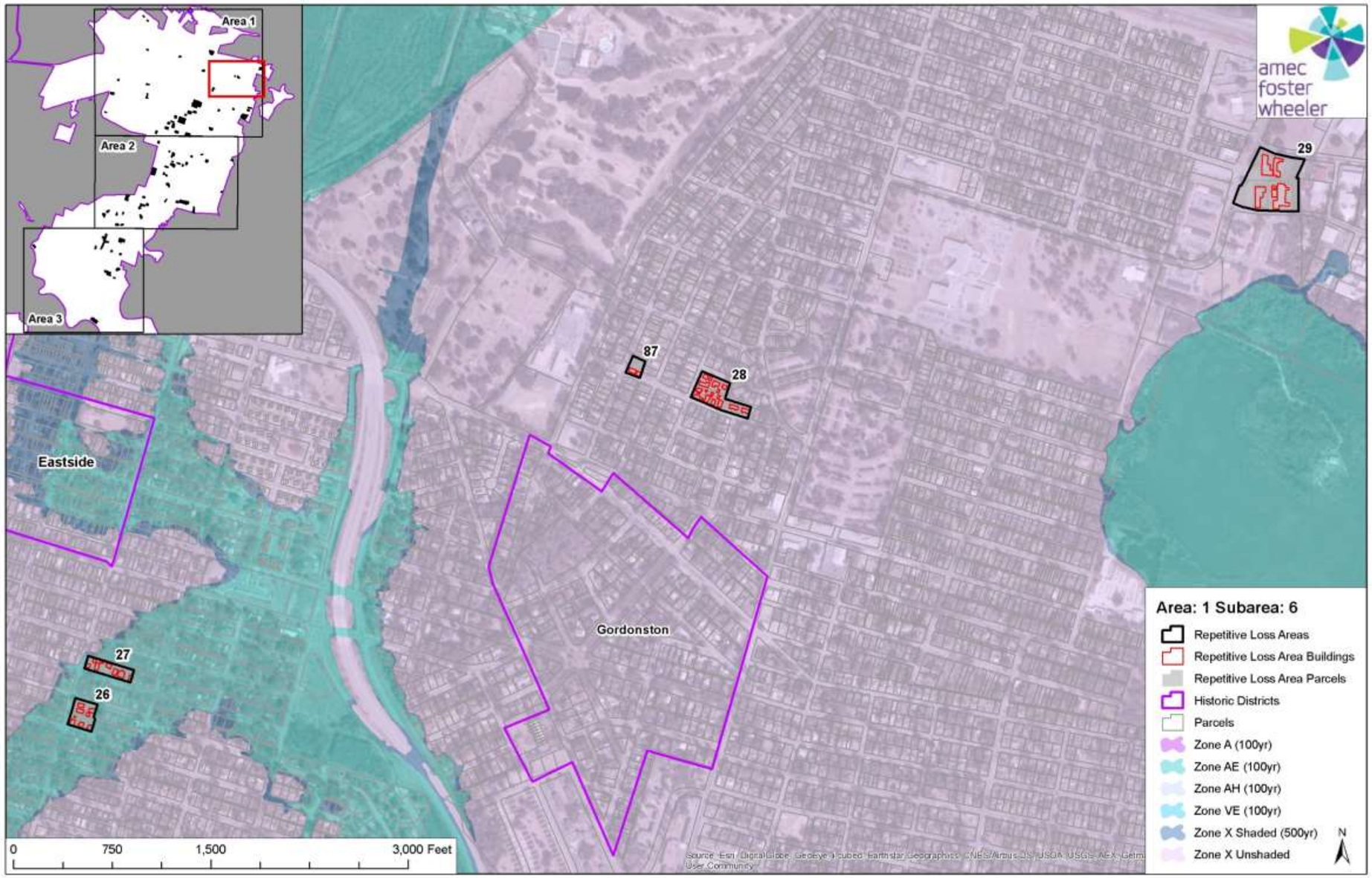


Figure 11 - Repetitive Loss Subarea 6

Example Properties in Subarea 6

Subarea 7

Repetitive Loss Areas 30 and 32 are located entirely within the 100-year floodplain (Zone AE). Repetitive Loss Areas 33 and 34 are partially location within the 100-year floodplain (Zone AE). Repetitive Loss Area 31 is entirely located within the Zone X Unshaded flood zone. Repetitive Loss Area 35 is mostly located within the Zone X Unshaded flood zone with a small portion of the area lying with the 100-year (Zone AE) and 500-year (Zone X Shaded) floodplain. There is a mixture of single-family and multi-family homes in Subarea 7. Some homeowners have taken mitigation actions such as elevating their HVAC units.

Table 7 - Repetitive Loss Area Overview for Subarea 7

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
30	5	4	7	16	E. 58th Street Delesseps Avenue Costa Rica Street Honduras Street
31	1	0	7	8	Grenoble Street Wicklow Street
32	2	0	3	5	E. 41st Street E. 42st Street Wallin Street
33	1	0	5	6	E. 38th Street
34	1	0	6	7	E. 39th Street Herbed Street
35	3	0	25	28	E. 43rd Street Evergreen Avenue US-80 West

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

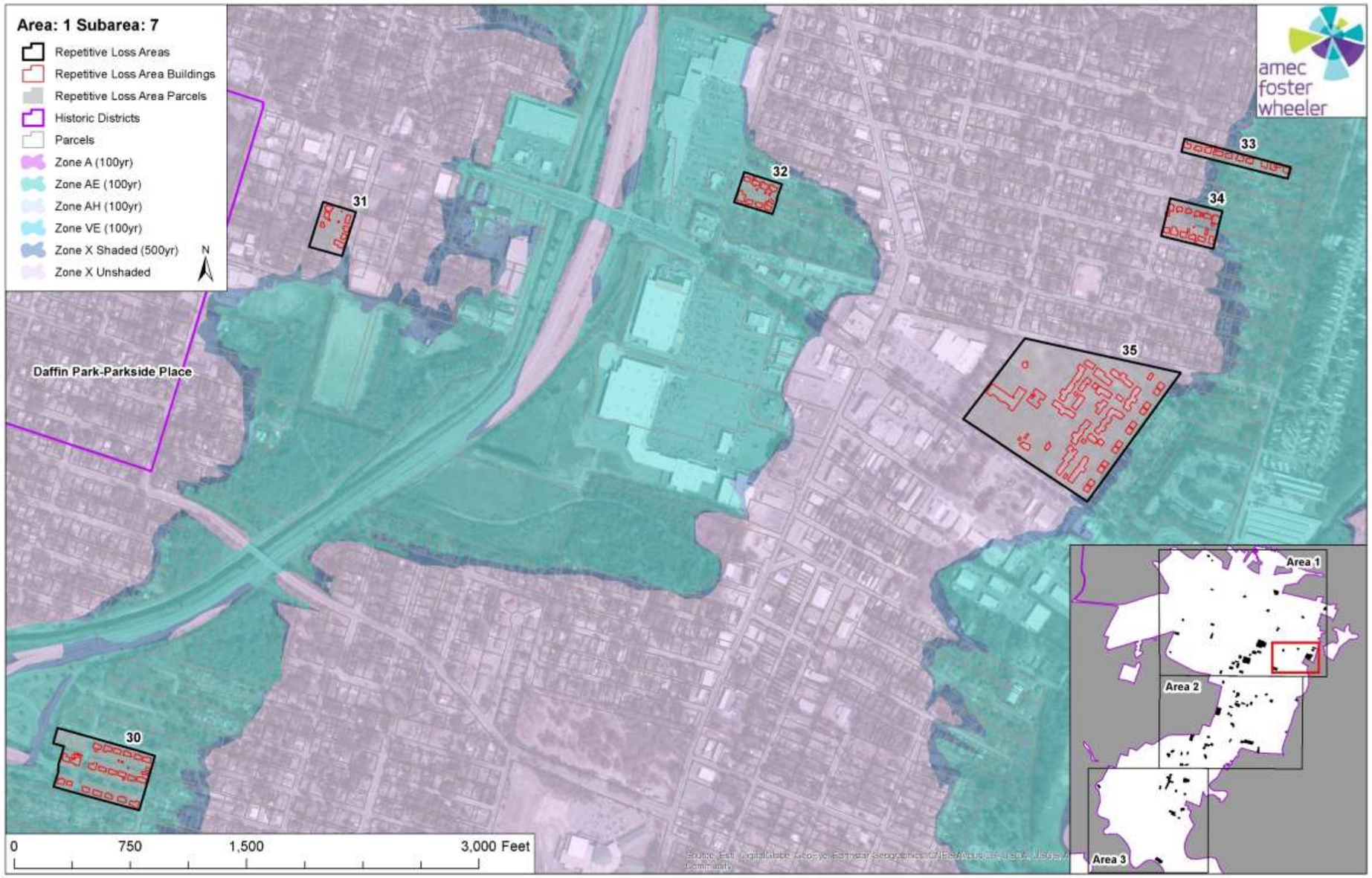


Figure 12 - Repetitive Loss Subarea 7

Example Properties in Subarea 7

STEP 4. Review Alternative Mitigation Approaches - General Area 1

There are many ways to protect a property from flood damage. Different measures are appropriate for different flood hazards, building types and building conditions. Figure 13 below, found in the *2013 CRS Coordinator's Manual*, lists typical property protection measures.

- Demolish the building or relocate it out of harm's way.
- Elevate the building above the flood level.
- Elevate damage-prone components, such as the furnace or air conditioning unit.
- Dry flood proof the building so water cannot get into it.
- Wet flood proof portions of the building so water won't cause damage.
- Construct a berm or redirect drainage away from the building.
- Maintain nearby streams, ditches, and storm drains so debris does not obstruct them.
- Correct sewer backup problems.

Source: 2013 CRS Coordinators Manual.

Figure 13 - Typical Property Protection Measures

Mitigation measures should fall into one of the mitigation categories listed below which are based on the Community Rating System planning process:

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

Mitigation Funding

There are several types of mitigation measures, listed in the table below, which can be considered for each repetitive loss property. Each mitigation measure qualifies for one or more grant programs. Depending on the type of structure, severity of flooding and proximity to additional structures with similar flooding conditions, the most appropriate measure can be determined. In addition to these grant funded projects, several mitigations measures can be taken by the homeowner to protect their home. Please note, the Biggert-Waters 2012 National Flood Insurance Reform Act eliminated the previously available Repetitive Flood Claims grant program.

Table 8 - Mitigation Grant Programs

Types of Projects Funded	HMGP	FMA	PDM	SRL	IIC	SBA
Acquisition of the entire property by a gov't agency	D	D	D	D		
Relocation of the building to a flood free site	D	D	D	D	D	D
Demolition of the structure	D	D	D	D	D	D
Elevation of the structure above flood levels	D	D	D	D	D	D

Types of Projects Funded	HMGP	FMA	PDM	SRL	IIC	SBA
Replacing the old building with a new elevated one	D			D	D	D
Local drainage and small flood control projects	D			D		
Dry floodproofing (non-residential buildings only)		D	D	D	D	D
Percent paid by Federal program	75%	75%	75%	75%	100%	0
Application Notes	1,2	1	1	1	3	2,4

Application notes:

1. Requires a grant application from your local government
2. Only available after a Federal disaster declaration
3. Requires the building to have a flood insurance policy and to have been flooded to such an extent that the local government declares it to be substantially damaged. Pays 100% up to $30,000
4. This is a low interest loan that must be paid back

Mitigation Alternatives

General Area 1 – Downtown/Historic

The Downtown/Historic area is the largest of the 3 General Areas with 412 total properties identified within 7 Subareas and 37 Repetitive Loss Areas. This area is also the historic and tourist section of Savannah where many structures are on the National Historic Register. The majority of the flooding in this area is considered "nuisance" flash flooding that causes minimal damage but does require costly cleanup and numerous street closures due to floodwaters overtopping the roadway.

Flooding in the downtown/historic area can be attributed to its flat topography, aging stormwater infrastructure and proximity to the tidally influenced Savannah River. Flash flooding can occur when the capacity of the stormwater system is exceeded or if conveyance is obstructed by debris, sediment and other materials that limit the volume of drainage. There are several canals located with General Area 1 that may overtop due to heavy rainfall. Furthermore, heavy rains accompanied by high tides do not allow stormwater to quickly drain from this area.

Elevating roadways and improving the stormwater drainage system can eliminate some road closures in this area. These structural methods require large capital expenditures and cooperation from private property owners. Promoting floodproofing techniques and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in this area. The City's websites, e-mail distribution lists, press releases and variable message boards can provide benefit to business owners and residents.

Potential mitigation measures for General Area 1:

Structural Alternatives:

- Dry floodproofing. Commercial structures and even residential structures are eligible for dry floodproofing; however, in many instances this requires human intervention to

complete the measure and ensure success. For example, installing watertight shields over doors or windows requires timely action by the homeowner; especially in a heavy rainfall event.

- Wet floodproofing. Wet floodproofing a structure involves making the uninhabited portions of the structure resistant to flood damage and allowing water to enter during flooding. For example, in a basement or crawl space, mechanical equipment and ductwork would not be damaged.

- For basements, especially with combined storm sewer and sewer systems, backflow preventer valves can prevent storm water and sewer from entering crawlspaces and basements.

- Acquire and/or relocated properties/target abandoned properties (Note: Acquisition of historic structures is not possible and newer structures may not meet FEMA's cost/benefit ratio of 1.0 for mitigation funding).

- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE (Note: Elevation of commercial and historic structures is not politically popular and is cost prohibitive).

- Construct engineered structural barriers, berms, and floodwalls (Note: Assuming lot has required space for a structural addition).

- Construct elevated walkways.

- Increase road elevations above the BFE of the 100-year floodplain.

- Implement drainage improvements such as increasing capacity in the system (up-sizing pipes) and provide additional inlets to receive more stormwater.

- Improve stormwater system maintenance program to ensure inlets and canals are free of clogging debris.

Non Structural Alternatives:

- Relocate internal supplies, products/goods above the flooding depth.

- Improve the City's floodplain and zoning ordinances.

- Consider expanding riparian impervious surface setbacks.

- Provide public education through posting information about local flood hazards on City websites, posting signs at various locations in neighborhoods or discussing flood protection measures at local neighborhood association meetings.

- Promote the purchase of flood insurance.
- Continue coordination with CEMA, the National Weather Service (NWS), and United States Geological Survey (USGS) to enhance flood warning system, including the use of rain/stream gauges, to provide greater warning time for citizens. NWS can use the real-time data collected to issue timely warnings.

Past and Current Capital Improvement Projects Affecting General Area 1:

The Casey South Drainage Project was the most extensive drainage improvement in Savannah's history, relieving chronic flooding in midtown Savannah, including Chatham Crescent, Ardsley Park and Olin Heights. Currently, the City of Savannah has embarked on an ambitious project to relieve flooding along Abercorn and Habersham Streets near 63rd Street. The project includes the construction of approximately 6,000 feet of drainage pipe and 7,500 feet of box culverts extending from Abercorn Street to the Casey Canal. Drainage improvements will occur on Abercorn from 60th to 65th St., 63rd Street from Abercorn to Paulsen Street, Paulsen from 63rd to 60th St., and 60th Street from Paulsen to the Casey Canal. The City is also planning improvements to the Bilbo Box which will improve drainage in a wide area of downtown's eastside.

Cost and Benefits of Mitigation Measures

Three primary mitigation measures are discussed here: acquisition, relocation and barriers. In general the cost of acquisition and relocations will be higher but will completely alleviate any future flood damage. Building small barriers to protect single structures is a lower cost solution, but may not be able to offer complete protection from large flood events.

Acquisition:

Property acquisition and/or relocation are complex processes requiring transferring private property to property owned by the local government for open space purposes. Acquisition is a relatively expensive mitigation measure, but provides the greatest benefit in the lives and property are protected from flood damage. The major cost for the acquisition method is for purchasing the structure and land.

Past property acquisitions in Savannah have been converted to parks and community gardens

The total estimated cost for acquisition should be based on the following:

- Purchase of Structure and land
- Demolition
- Debris removal, including any landfill processing fees
- Grading and stabilizing the property site

- Permits and plan review

Table 9 - Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
• Permanently removes problem since the structure no longer exists. • Allows a substantially damaged or substantially improved structure to be brought into compliance with the community's floodplain management ordinance or law. • Expands open space and enhances natural and beneficial uses. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Resistance may be encountered by local communities due to loss of tax base, maintenance of empty lots, and liability for injuries on empty, community-owned lots.

There are 3 criteria that must be met for FEMA to fund an acquisition project:

- The local community must inform the property owners interested in the acquisition program that the community will not use condemnation authority to purchase their property and that the participation in the program is strictly voluntary,
- The subsequent deed to the property to be acquired will be amended such that the landowner will be restricted from receiving any further Federal disaster assistance grants, the property shall remain in open space in perpetuity, and the property will be retained in ownership by a public entity, and
- Any replacement housing or relocated structures will be located outside the 100-year floodplain.

Relocation:

Relocation involves lifting and placing a structure on a wheeled vehicle and transporting that structure to a site outside the 100-year floodplain and placed on a new permanent foundation. Like acquisition, this is one of the most effective mitigation measures.

Table 10 - Advantages and Disadvantages of Relocation

Advantages	Disadvantages

• Removes flood problem since the structure is relocated out of the flood-prone area. • Allows a substantially damaged or substantially improved structure to be brought into compliance with a community's floodplain management ordinance. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Additional costs are likely if the structure must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.

The cost for relocation will vary based on the type of structure and the condition of the structure. It is considerably less expensive to relocate a home that is built on a basement or crawl space as opposed to a structure that is a slab on grade. Additionally, wood sided structures are less expensive to relocate than structures with brick veneer. Items to consider in estimating cost for relocation include the following:

- Site selection and analysis and design of the new location
- Analysis of existing size of structure
- Analysis and preparation of the moving route
- Preparation of the structure prior to the move
- Moving the structure to the new location
- Preparation of the new site
- Construction of the new foundation
- Connection of the structure to the new foundation
- Restoration of the old site

Barriers:

A flood protection barrier is usually an earthen levee/berm or a concrete retaining wall. While levees and retaining walls can be large spanning miles along a river, they can also be constructed on a much smaller scale to protect a single home or group of homes.

Table 11 - Advantages and Disadvantages of Barriers

Advantages	Disadvantages
• Relative cost of mitigation is less expensive than other alternatives. • No alterations to the actual structure or foundation are required. • Home owners can typically construct their own barriers that will complement the style and functionality of their house and yard.	• Property is still located within the floodplain and has potential to be damaged by flood if barrier fails or waters overtop it. • Solution is only practical for flooding depths less than 3 feet. • Barriers cannot be used in areas with soils that have high infiltration rates.

The cost of constructing a barrier will depend on the type of barrier and the size required to provide adequate protection. An earthen berm will generally be less expensive compared to an equivalent concrete barrier primarily due to the cost of the materials. Another consideration is space; an earthen barrier requires a lot of additional width per height of structure compared to a concrete barrier to ensure proper stability.

Key items to consider for barriers:

- There needs to be adequate room on the lot
- A pump is required to remove water that either falls or seeps onto the protected side of the barrier
- Human intervention will be required to sand bag or otherwise close any openings in the barrier during the entire flood event

Floodproofing

Wet floodproofing a structure consists of modifying the uninhabited portions (such as a crawlspace or an unfinished basement) to allow floodwaters to enter and exit. This ensures equal hydrostatic pressure on the interior and exterior of the structure which reduces the likelihood of wall failures and structural damage. Wet floodproofing is practical in only a limited number of situations.

Table 12 - Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
• Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors.	• Extensive cleanup may be necessary if the structure becomes wet inside and possibly contaminated by sewage, chemicals and other materials borne by floodwaters. • Pumping floodwaters out of a basement too soon after a flood may lead to structural damage. • Does not minimize the potential damage from a high-velocity flood flow and wave action.

A dry floodproofed structure is made watertight below the level that needs flood protection to prevent floodwaters from entering. Making the structure watertight involves sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete; installing watertight shields over windows and doors; and installing measures to prevent sewer backup.

Table 13 - Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
• Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program.	• Requires human intervention and adequate warning to install protective measures. • Does not minimize the potential damage from high-velocity flood flow and wave action. • May not be aesthetically pleasing.

Drainage Improvements

Methods of drainage improvements include overflow channels, channel straightening, restrictive crossing replacements, and runoff storage. Modifying the channel attempts to provide a greater carrying capacity for moving floodwaters away from areas where damage occurs. Whenever drainage improvements are considered as a flood mitigation measure, the effects upstream and downstream from the proposed improvements need to be considered.

Table 14 - Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
• Can increase channel carrying capacity through overflow channels, channel straightening, crossing replacements, or runoff volume storage. • Minor projects may be fundable under FEMA mitigation grant programs.	• May help one area but create new problems upstream or downstream. • Channel straightening increases the capacity to accumulate and carry sediment. • May require property owner cooperation and right-of-way acquisition.

Elevation

Elevating a structure to prevent floodwaters from reaching living areas is an effective and one of the most common mitigation methods. Elevation may also apply to roadways and walkways. The goal of the elevation process is to raise the lowest floor of a structure or roadway/walkway bed to or above the required level of protection.

Table 15 - Advantages and Disadvantages of Elevation

Advantages	Disadvantages

• Elevating to or above the BFE allows a substantially damaged or substantially improved house to be brought into compliance. • Often reduces flood insurance premiums. • Reduces or eliminates road closures due to overtopping. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • The appearance of the structure and access to it may be adversely affected. • May require property owner cooperation and right-of-way acquisition. • May require road or walkway closures during construction.

STEP 5. Conclusion and Recommendations - General Area 1

Conclusion

Based on the field survey and collection of data, the analysis of existing studies and reports, and the evaluation of various structural and non-structural mitigation measures, the City of Savannah proposes that mitigation measures be implemented for General Area 1. Table 16 examines past and current mitigation actions in this area.

Table 16 – Past and Current Mitigation Actions in General Area 1

Mitigation Actions	
1	Property owners have documented flooding and identified flooding concerns in returned questionnaires from this analysis.
2	The City has eliminated 21 properties from the repetitive loss list through acquisition and demolition. Many of these areas have been converted to community gardens which have proven to be very popular in the City.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense.
4	City has undertaken numerous, costly capital improvement projects to improve drainage within this Area.

Recommendations

The City will encourage property owners to use floodproofing measures to help protect lower levels of their property. The City will also increase its public education efforts to increase awareness of flood preparedness and flood protection measures including moving valuable items to above the flood elevation and permanently elevating vulnerable HVAC units. At the same time, the City will work with property owners, citizens, neighboring communities, the state and

other regional and federal agencies to implement capital improvement projects which will help to eliminate flooding in the repetitive loss areas.

Mitigation Action 1:

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The City will continue on an **annual basis** to target all properties in the repetitive loss areas reminding them of the advantages to maintaining flood insurance through its annual outreach effort.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas located in General Area 1.

Funding

The cost will be paid for from the City's operating budget through the Development Services Department.

Mitigation Action 2:

Property owners should not store personal property in basements and crawl spaces since personal property is not covered by a flood insurance policy. The City will increase its outreach efforts on an **annual basis** to include information to the outreach materials for the identified repetitive loss areas.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date information to all property owners within the repetitive loss areas located in General Area 1.

Funding

The cost will be paid for from the City's operating budget through the Development Services Department.

Mitigation Action 3:

When appropriate, property owners should consider floodproofing measures such as flood gates or shields, flood walls, and hydraulic pumps.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Mitigation Action 4:

Continue acquisition/demolition mitigation of high-risk flood-prone properties. The highest priorities are properties at the greatest flood risk and where drainage improvements will not provide an adequate level of protection.

Responsibility

The City's Real Property Services in conjunction with the Development Services Department will continue to target properties for acquisition/demolition.

Funding

The acquisition and demolition will be paid for using FEMA mitigation grant funds. Staff time to develop the list of target properties will require funds from the City's operating budget.

Mitigation Action 5:

Prioritize CIP projects to focus on drainage improvement projects in those basins containing repetitive loss areas.

Responsibility

The City's Development Services Department in conjunction with CIP Management.

Funding

Special Purpose Local Option Sales Tax (SPLOST) funds.

Mitigation Action 6:

Encourage property owners to elevate inside and outside mechanical equipment above the BFE and install flood resistant materials in crawl spaces.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Problem Statement

General Area 2 – Southcentral

General Area 2 is located in eastern Savannah, south of General Area 1. There is one historic district within General Area 2, the Fairway Oaks-Greenview District, which is listed on the National Register of Historic Places. General Area 2 contains a total of 6 Subareas and 36 Repetitive Loss Areas. Portions of General Area 2 are located within the 100-year floodplain and are subject to periodic flooding from tidally-influenced rivers and streams. The effort to reduce repetitive flooding depends partly on structure type and the historic nature of the building. The approach to reducing repetitive flooding in General Area 2 will require a combination of floodproofing techniques, education, and drainage improvements.

Source: Savannah Morning News

Flooding in General Area 2: Southcentral

Subarea 8

Portions of Repetitive Loss Areas 37 through 45 are located entirely within the 100-year (Zone AE) or 500-year (Zone X Shaded) floodplain. Repetitive Loss Areas 36 and 46 are entirely located within the Zone X Unshaded flood zone. The entirety of Repetitive Loss Area 46 and a portion of Repetitive Loss Area 45 are located within the Fairway Oaks-Greenview Historic District. The Fairway Oaks – Greenview Historic District consists of two contiguous and historically related suburban residential subdivisions. Many of the homes within this subarea contain a drainage ditch in the yard.

Table 17 - Repetitive Loss Area Overview for Subarea 8

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
36	1	0	3	4	Linden Lane Alpine Drive White Bluff Road
37	1	0	3	4	Groveland Circle
38	2	1	4	7	Althea Court Kensington Court Johnston St
39	1	0	1	2	McLaws Street
40	1	1	1	3	Lee Blvd Andover Drive
41	1	1	4	6	Wheeler Street
42	5	2	9	16	Wheeler Street Jackson Blvd
43	2	1	4	7	Lee Blvd
44	1	0	6	7	Bracken Lane Waters Avenue Meridian Drive Maribob Circle
45	1	0	3	4	Sweet Bay Lane Bracken Lane
46	1	0	4	5	Harlan Drive Brightwood Drive

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 14 - Repetitive Loss Subarea 8

Example Properties in Subarea 8

Subarea 9

Repetitive Loss Area 47 is entirely located within the 100-year floodplain (Zone AE). Portions of Repetitive Loss Areas 48 and 49 are located within the 500-year (Zone X Shaded) flood zone. Many of the homes within this subarea contain a stormwater drainage inlet on or adjacent to the property.

Table 18 - Repetitive Loss Area Overview for Subarea 9

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
47	1	0	2	3	Whitney Road Spalding Road
48	1	0	7	8	Brogdon Street Magnolia Avenue Colonial Drive
49	1	0	2	3	La Roche Court La Roche Avenue

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

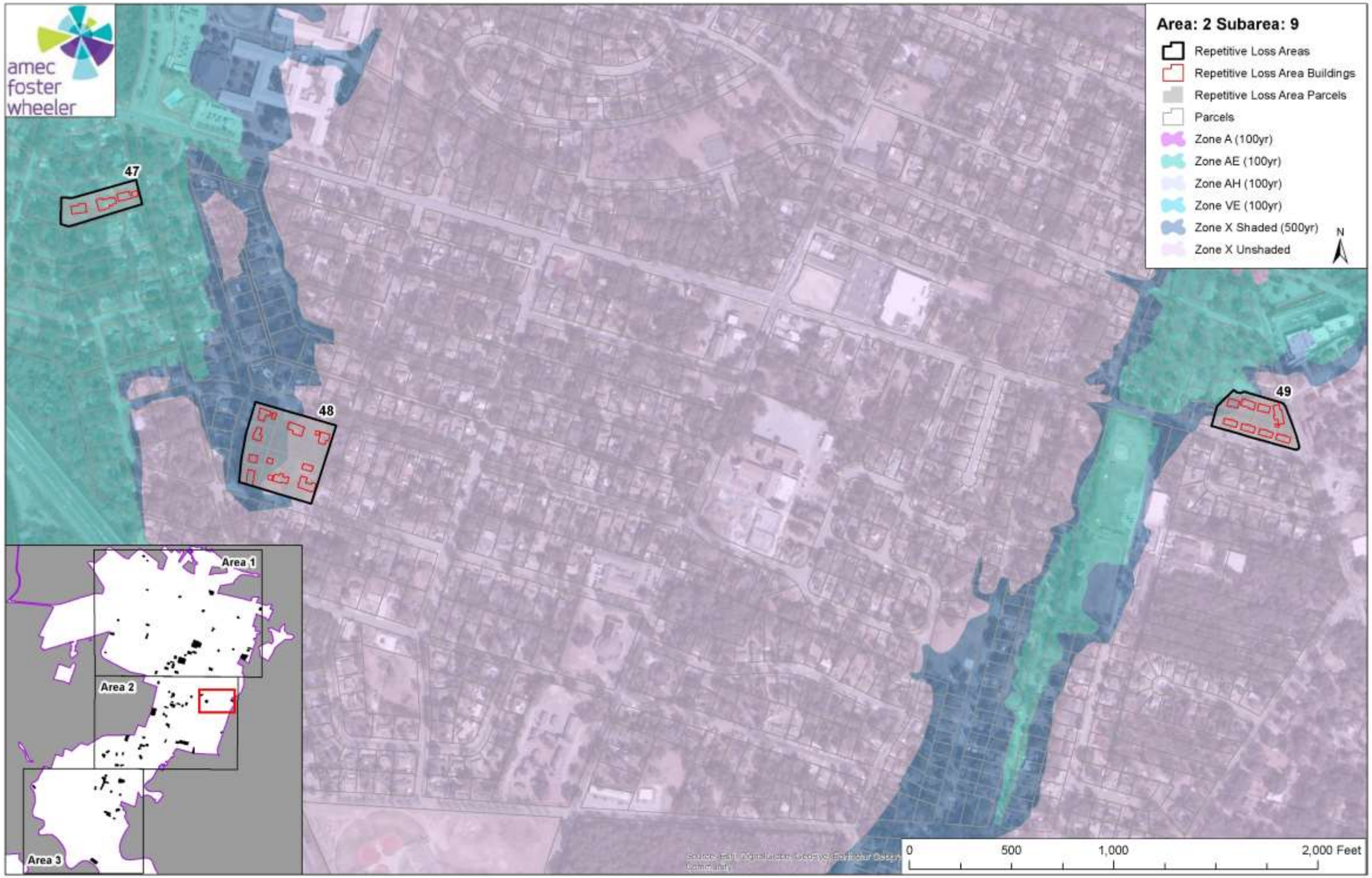


Figure 15 - Repetitive Loss Subarea 9

Example Properties in Subarea 9

Subarea 10

Repetitive Loss Areas 50 through 53 are located entirely within the Zone X Unshaded flood zone. Repetitive Loss Area 54 is located entirely within the 100-year floodplain (Zone A). This subarea contains a mix of commercial properties and newer residential homes.

Table 19 - Repetitive Loss Area Overview for Subarea 10

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
50	1	0	4	5	Megan Court Patrick Street King Arthur Lane
51	1	0	4	5	Stephenson Avenue GA-204 West White Bluff Road Eisenhower Drive
52	1	0	2	3	Benfield Drive Forest Park Drive Hodgson Memorial Drive
53	1	0	0	1	Hodgson Court
54	2	0	7	9	Van Buren Avenue Commercial Drive Madison Avenue

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

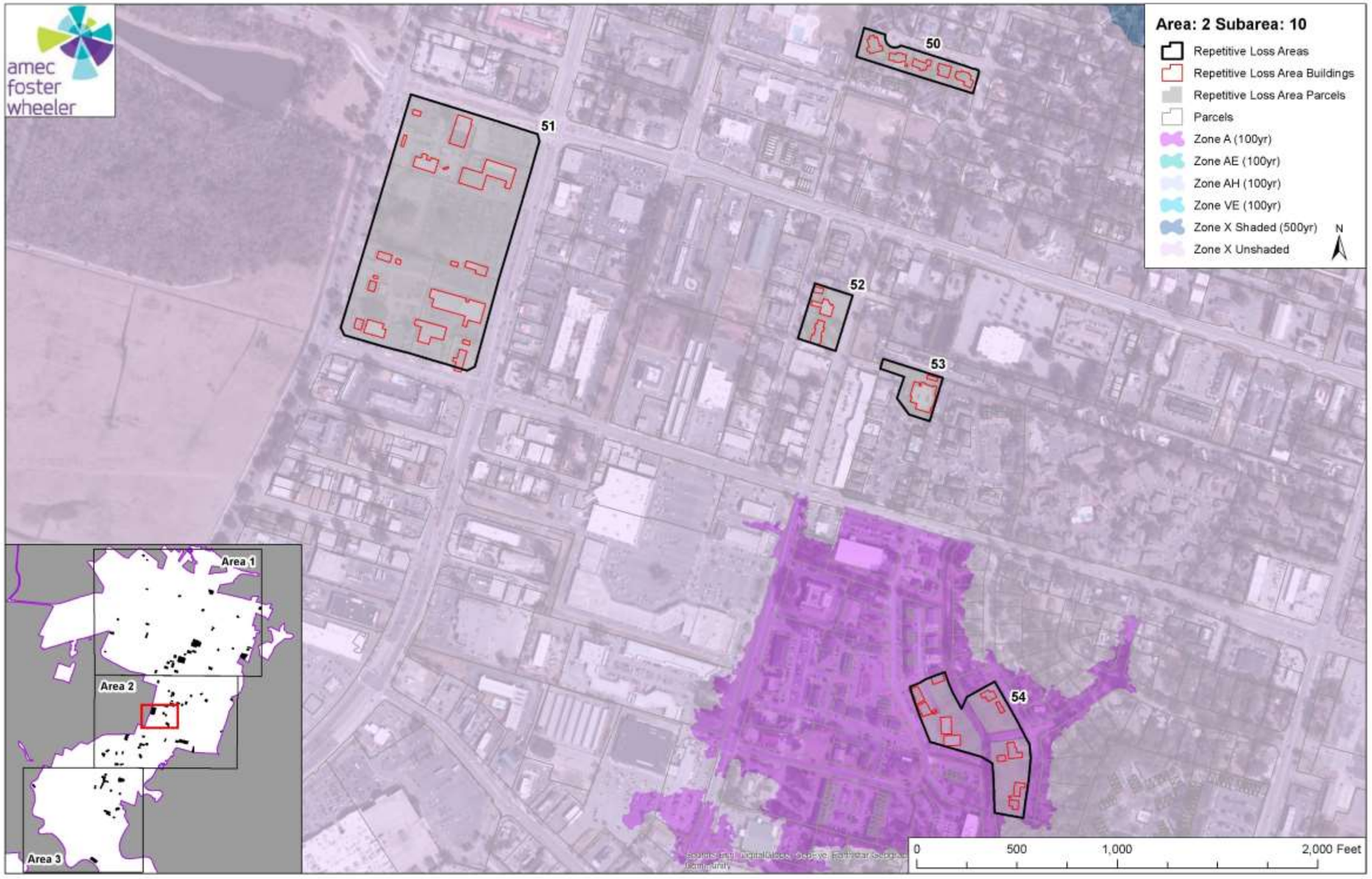


Figure 16 - Repetitive Loss Subarea 10

Example Properties in Subarea 10

Subarea 11

Portions of Repetitive Loss Areas 55 through 60 are located within the 100-year (Zone AE) flood zone. Subarea 11 contains a mix of single-family and multi-family residential properties.

Table 20 - Repetitive Loss Area Overview for Subarea 11

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
55	2	2	7	11	Largo Drive Williamsburg Road
56	3	1	5	9	Coastal Court San Fernando Blvd Largo Drive
57	1	2	3	6	La Brea Blvd Tibet Avenue
58	1	1	2	4	Brandon Lane Tibet Avenue
59	2	0	6	8	Wilshire Blvd Montclair Blvd Balboa Drive
60	1	2	4	7	Vineyard Drive Del Mar Circle Wilshire Blvd

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

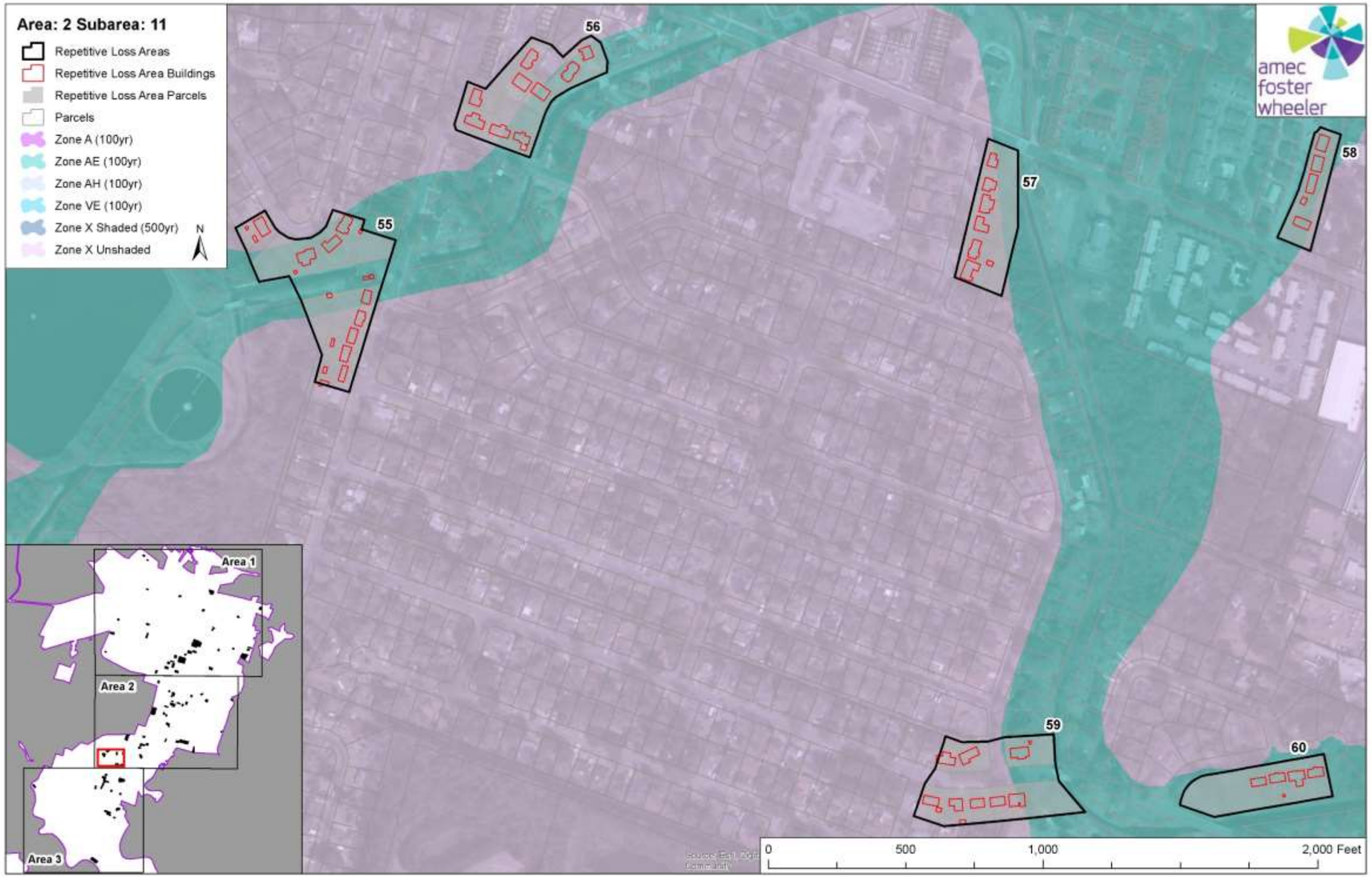


Figure 17 - Repetitive Loss Subarea 11

Example 11

Properties in Subarea

Subarea 12

Repetitive Loss Areas 61, 63, 64, 65 and 67 are located entirely within the 100-year (Zone AE) floodplain. Repetitive Loss Areas 62 and 66 are entirely located within the Zone X Unshaded flood zone. Subarea 12 contains mostly single-family residential properties. Several homes have a drainage ditch directly adjacent to the property, and many homes show signs of recent flooding in the yard.

Table 21 - Repetitive Loss Area Overview for Subarea 12

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
61	3	0	0	3	Montgomery Crossing Road W. Montgomery Cross Road Bass Drive Lands End Circle
62	1	0	7	8	Chippewa Drive Seneca Road White Bluff Road
63	2	1	4	7	Paradise Drive Dyches Drive Inglewood Drive Nina Court
64	3	1	8	12	Croatan Street Cindy Avenue Chatham Street
65	3	0	9	12	Atwood Street Kandlewood Drive Chatham Street
66	2	0	12	14	Sarah Court Paradise Drive Dyches Drive Hillyer Drive
67	1	0	5	6	Catherine Circle Delores Drive Cranman Drive Arthur Circle

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 18 - Repetitive Loss Subarea 12

Example Properties in Subarea 12

Subarea 13

Repetitive Loss Areas 68 and 69 are located within the 100-year (Zone AE) floodplain. Portions of Repetitive Loss Area 70 are located within the 500-year (Zone X Shaded) floodplain. Repetitive Loss Area 71 is located entirely within the Zone X Unshaded flood zone. Subarea 13 contains a mix of newer and older single-family residential properties.

Table 22 - Repetitive Loss Area Overview for Subarea 13

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
68	1	2	2	5	Sherwood Road
69	3	0	20	23	Dale Drive
70	1	0	10	11	Kent Drive Sulgrave Road Queensbury Street Kent Court Marlborough Way E. Montgomery Cross Road Sallie Mood Drive
71	1	0	4	5	Damascus Street Key Street

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

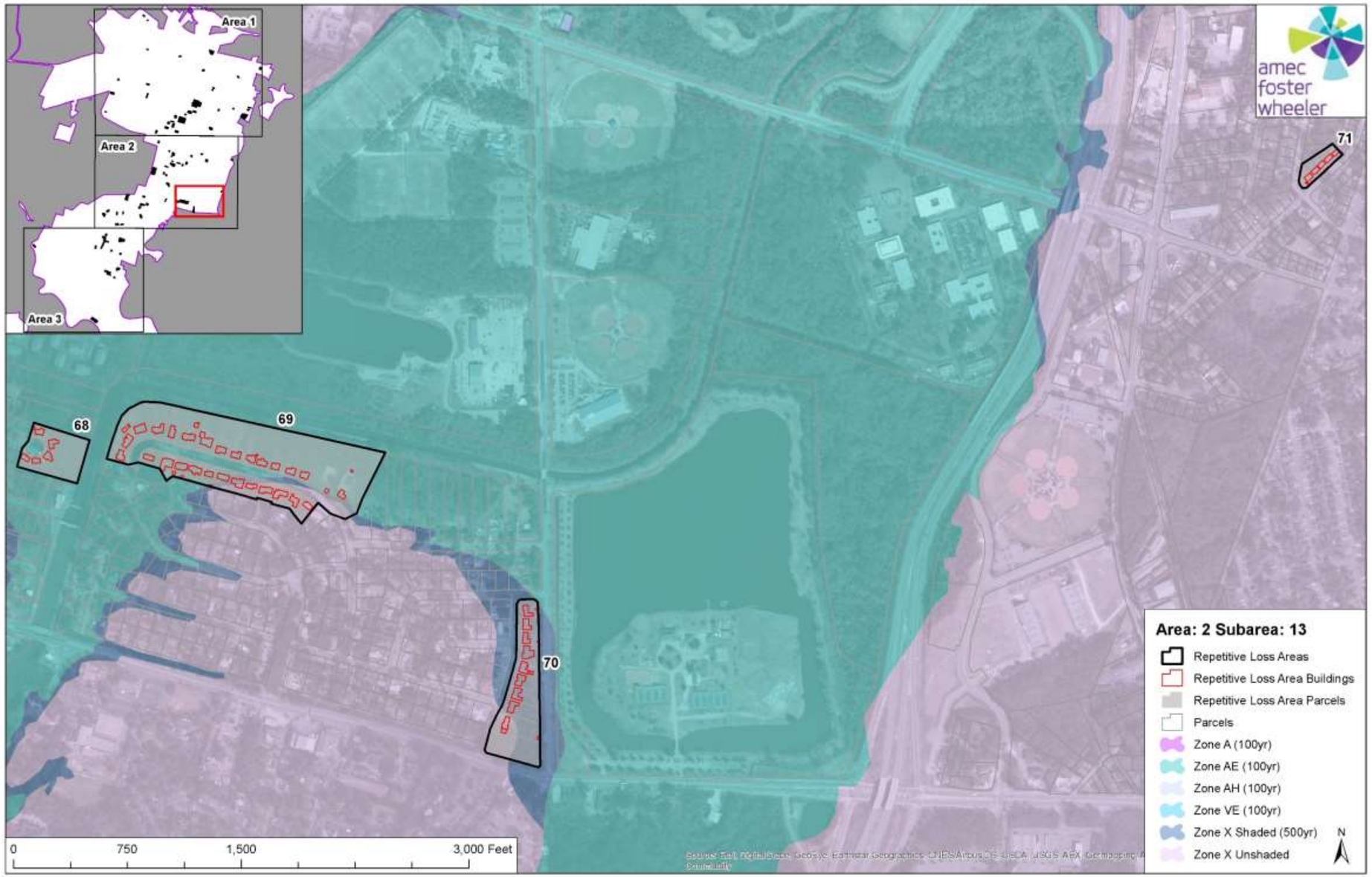


Figure 19 - Repetitive Loss Subarea 13

Example Properties in Subarea 13

STEP 4. Review Alternative Mitigation Approaches - General Area 2

There are many ways to protect a property from flood damage, including, but not limited to, those shown previously in Figure 13. The mitigation measures shown in Table 8 (page 44) can be considered for each repetitive loss property. As shown in the table, each mitigation measure qualifies for one or more grant programs. Depending on the type of structure, severity of flooding and proximity to additional structures with similar flooding conditions, the most appropriate measure can be determined. In addition to these grant funded projects, several mitigations measures can be taken by the homeowner to protect their home. Mitigation measures should fall into one of the mitigation categories listed below which are based on the Community Rating System planning process:

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

Mitigation Alternatives

General Area 2 – Southcentral

General Area 2 contains a total of 253 properties identified within 6 Subareas and 36 Repetitive Loss Areas. The majority of the flooding in this area is considered flash flooding. Flash flooding can occur when the capacity of the stormwater system is exceeded or if conveyance is obstructed by debris, sediment and other materials that limit the volume of drainage. Flooding in the southcentral area can be attributed to its flat topography, aging stormwater infrastructure and proximity to the tidally influenced rivers and streams that flow into the Ossabaw Sound. Heavy rains accompanied by high tides does not allow stormwater to quickly drain from this area.

Improving the stormwater drainage system can eliminate some road closures and flash flooding in this area. Promoting floodproofing techniques and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in this area. The City's websites, e-mail distribution lists, press releases and variable message boards can provide benefit to business owners and residents.

Potential mitigation measures for General Area 2:

Structural Alternatives:

- Dry floodproofing. Commercial structures and even residential structures are eligible for dry floodproofing; however, in many instances this requires human intervention to complete

the measure and ensure success. For example, installing watertight shields over doors or windows requires timely action by the homeowner; especially in a heavy rainfall event.

- Wet floodproofing. Wet floodproofing a structure involves making the uninhabited portions of the structure resistant to flood damage and allowing water to enter during flooding. For example, in a basement or crawl space, mechanical equipment and ductwork would not be damaged.

- For basements, especially with combined storm sewer and sewer systems, backflow preventer valves can prevent storm water and sewer from entering crawlspaces and basements.

- Acquire and/or relocated properties/target abandoned properties (Note: Acquisition of historic structures is not possible and newer structures may not meet FEMA's cost/benefit ratio of 1.0 for mitigation funding).

- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE (Note: Elevation of commercial and historic structures is not politically popular and is cost prohibitive).

- Construct engineered structural barriers, berms, and floodwalls (Note: Assuming lot has required space for a structural addition).

- Increase road elevations above the BFE of the 100-year floodplain.

- Implement drainage improvements such as increasing capacity in the system (up-sizing pipes) and provide additional inlets to receive more stormwater.

- Improve stormwater system maintenance program to ensure inlets and canals are free of clogging debris.

Non-Structural Alternatives:

- Relocate internal supplies, products/goods above the flooding depth.

- Improve the City's floodplain and zoning ordinances.

- Consider expanding riparian impervious surface setbacks.

- Provide public education through posting information about local flood hazards on City websites, posting signs at various locations in neighborhoods or discussing flood protection measures at local neighborhood association meetings.

- Promote the purchase of flood insurance.

- Continue coordination with CEMA, the National Weather Service (NWS), and United States Geological Survey (USGS) to enhance flood warning system, including the use of rain/stream gauges, to provide greater warning time for citizens. NWS can use the real-time data collected to issue timely warnings.

Past Capital Improvement Projects Affecting General Area 2:

Recent drainage improvement projects that installed pump stations at Montgomery Crossroads and DeRenne Drive now move stormwater down several major drainage canals while allowing drainage to occur during high tides, which previously was not possible.

Cost and Benefits of Mitigation Measures

Three primary mitigation measures are discussed here: acquisition, relocation and barriers. In general the cost of acquisition and relocations will be higher but will completely alleviate any future flood damage. Building small barriers to protect single structures is a lower cost solution, but may not be able to offer complete protection from large flood events.

Acquisition:

Property acquisition and/or relocation are complex processes requiring transferring private property to property owned by the local government for open space purposes. Acquisition is a relatively expensive mitigation measure, but provides the greatest benefit in the lives and property are protected from flood damage. The major cost for the acquisition method is for purchasing the structure and land. The total estimated cost for acquisition should be based on the following:

- Purchase of Structure and land
- Demolition
- Debris removal, including any landfill processing fees
- Grading and stabilizing the property site
- Permits and plan review

Past property acquisitions in Savannah have been converted to parks and community gardens

Table 23 - Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
• Permanently removes problem since the structure no longer exists. • Allows a substantially damaged or substantially improved structure to be brought into compliance with the community's floodplain management ordinance or law. • Expands open space and enhances natural and beneficial uses. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Resistance may be encountered by local communities due to loss of tax base, maintenance of empty lots, and liability for injuries on empty, community-owned lots.

There are 3 criteria that must be met for FEMA to fund an acquisition project:

- The local community must inform the property owners interested in the acquisition program that the community will not use condemnation authority to purchase their property and that the participation in the program is strictly voluntary,
- The subsequent deed to the property to be acquired will be amended such that the landowner will be restricted from receiving any further Federal disaster assistance grants, the property shall remain in open space in perpetuity, and the property will be retained in ownership by a public entity, and
- Any replacement housing or relocated structures will be located outside the 100-year floodplain.

Relocation:

Relocation involves lifting and placing a structure on a wheeled vehicle and transporting that structure to a site outside the 100-year floodplain and placed on a new permanent foundation. Like acquisition, this is one of the most effective mitigation measures.

Table 24 - Advantages and Disadvantages of Relocation

Advantages	Disadvantages

• Removes flood problem since the structure is relocated out of the flood-prone area. • Allows a substantially damaged or substantially improved structure to be brought into compliance with a community's floodplain management ordinance. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Additional costs are likely if the structure must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.

The cost for relocation will vary based on the type of structure and the condition of the structure. It is considerably less expensive to relocate a home that is built on a basement or crawl space as opposed to a structure that is a slab on grade. Additionally, wood sided structures are less expensive to relocate than structures with brick veneer.

Items to consider in estimating cost for relocation include the following:

- Site selection and analysis and design of the new location
- Analysis of existing size of structure
- Analysis and preparation of the moving route
- Preparation of the structure prior to the move
- Moving the structure to the new location
- Preparation of the new site
- Construction of the new foundation
- Connection of the structure to the new foundation
- Restoration of the old site

Barriers:

A flood protection barrier is usually an earthen levee/berm or a concrete retaining wall. While levees and retaining walls can be large spanning miles along a river, they can also be constructed on a much smaller scale to protect a single home or group of homes.

Table 25 - Advantages and Disadvantages of Barriers

Advantages	Disadvantages

• Relative cost of mitigation is less expensive than other alternatives. • No alterations to the actual structure or foundation are required. • Home owners can typically construct their own barriers that will complement the style and functionality of their house and yard.	• Property is still located within the floodplain and has potential to be damaged by flood if barrier fails or waters overtop it. • Solution is only practical for flooding depths less than 3 feet. • Barriers cannot be used in areas with soils that have high infiltration rates.

The cost of constructing a barrier will depend on the type of barrier and the size required to provide adequate protection. An earthen berm will generally be less expensive compared to an equivalent concrete barrier primarily due to the cost of the materials. Another consideration is space; an earthen barrier requires a lot of additional width per height of structure compared to a concrete barrier to ensure proper stability.

Key items to consider for barriers:

- There needs to be adequate room on the lot
- A pump is required to remove water that either falls or seeps onto the protected side of the barrier
- Human intervention will be required to sand bag or otherwise close any openings in the barrier during the entire flood event

Floodproofing

Wet floodproofing a structure consists of modifying the uninhabited portions (such as a crawlspace or an unfinished basement) to allow floodwaters to enter and exit. This ensures equal hydrostatic pressure on the interior and exterior of the structure which reduces the likelihood of wall failures and structural damage. Wet floodproofing is practical in only a limited number of situations.

Table 26 - Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
• Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors.	• Extensive cleanup may be necessary if the structure becomes wet inside and possibly contaminated by sewage, chemicals and other materials borne by floodwaters. • Pumping floodwaters out of a basement too soon after a flood may lead to structural damage. • Does not minimize the potential damage from a high-velocity flood flow and wave action.

A dry floodproofed structure is made watertight below the level that needs flood protection to prevent floodwaters from entering. Making the structure watertight involves sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete; installing watertight shields over windows and doors; and installing measures to prevent sewer backup.

Table 27 - Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
• Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program.	• Requires human intervention and adequate warning to install protective measures. • Does not minimize the potential damage from high-velocity flood flow and wave action. • May not be aesthetically pleasing.

Drainage Improvements

Methods of drainage improvements include overflow channels, channel straightening, restrictive crossing replacements, and runoff storage. Modifying the channel attempts to provide a greater carrying capacity for moving floodwaters away from areas where damage occurs. Whenever drainage improvements are considered as a flood mitigation measure, the effects upstream and downstream from the proposed improvements need to be considered.

Table 28 - Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
• Can increase channel carrying capacity through overflow channels, channel straightening, crossing replacements, or runoff volume storage. • Minor projects may be fundable under FEMA mitigation grant programs.	• May help one area but create new problems upstream or downstream. • Channel straightening increases the capacity to accumulate and carry sediment. • May require property owner cooperation and right-of-way acquisition.

Elevation

Elevating a structure to prevent floodwaters from reaching living areas is an effective and one of the most common mitigation methods. Elevation may also apply to roadways and walkways. The goal of the elevation process is to raise the lowest floor of a structure or roadway/walkway bed to or above the required level of protection.

Table 29 - Advantages and Disadvantages of Elevation

Advantages	Disadvantages
• Elevating to or above the BFE allows a substantially damaged or substantially improved house to be brought into compliance. • Often reduces flood insurance premiums. • Reduces or eliminates road closures due to overtopping. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • The appearance of the structure and access to it may be adversely affected. • May require property owner cooperation and right-of-way acquisition. • May require road or walkway closures during construction.

STEP 5. Conclusion and Recommendations - General Area 2

Conclusion

Based on the field survey and collection of data, the analysis of existing studies and reports, and the evaluation of various structural and non-structural mitigation measures, the City of Savannah proposes that mitigation measures be implemented for General Area 2. Table 30 examines past and current mitigation actions in this area.

Table 30 – Past and Current Mitigation Actions in General Area 2

Current Actions	
1	Property owners have documented flooding and identified flooding concerns in returned questionnaires from this analysis.
2	The City has eliminated 3 properties from the repetitive loss list through acquisition and demolition. Many of these areas have been converted to community gardens which have proven to be very popular in the City.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense.
4	City has undertaken costly capital improvement projects to improve drainage within this Area.

Recommendations

The City will encourage property owners to use floodproofing measures to help protect lower levels of their property. The City will also increase its public education efforts to increase awareness of flood preparedness and flood protection measures including moving valuable items to above the flood elevation and permanently elevating vulnerable HVAC units. At the same time, the City will work with property owners, citizens, neighboring communities, the state and other regional and federal agencies to implement capital improvement projects which will help to eliminate flooding in the repetitive loss areas.

Mitigation Action 1:

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The City will continue on an **annual basis** to target all properties in the repetitive loss areas reminding them of the advantages to maintaining flood insurance through its annual outreach effort.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas located in General Area 2.

Funding

The cost will be paid for from the City's operating budget through the Development Services Department.

Mitigation Action 2:

Property owners should not store personal property in basements and crawl spaces since personal property is not covered by a flood insurance policy. The City will increase its outreach efforts on an **annual basis** to include information to the outreach materials for the identified repetitive loss areas.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date information to all property owners within the repetitive loss areas located in General Area 2.

Funding

The cost will be paid for from the City's operating budget through the Development Services Department.

Mitigation Action 3:

When appropriate, property owners should consider floodproofing measures such as flood gates or shields, flood walls, hydraulic pumps, and the use of flood resistant materials in crawl spaces.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Mitigation Action 4:

Continue acquisition/demolition mitigation of high-risk flood-prone properties. The highest priorities are properties at the greatest flood risk and where drainage improvements will not provide an adequate level of protection.

Responsibility

The City's Real Property Services in conjunction with the Development Services Department will continue to target properties for acquisition/demolition.

Funding

The acquisition and demolition will be paid for using FEMA mitigation grant funds. Staff time to develop the list of target properties will require funds from the City's operating budget.

Mitigation Action 5:

Prioritize CIP projects to focus on drainage improvement projects in those basins containing repetitive loss areas.

Responsibility

The City's Development Services Department in conjunction with CIP Management.

Funding

Special Purpose Local Option Sales Tax (SPLOST) funds.

Mitigation Action 6:

Encourage property owners to elevate inside and outside mechanical equipment above the BFE and install flood resistant materials in crawl spaces.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Problem Statement

General Area 3 – South City/Sound

General Area 3 is located in southeastern Savannah, south of General Areas 1 and 2. There are no historic districts located within General Area 3. General Area 3 contains a total of 3 Subareas and 14 Repetitive Loss Areas. Portions of General Area 3 are located within the 100-year floodplain and are subject to periodic flooding from tidally-influenced rivers and streams as well as tropical storms and hurricanes. The effort to reduce repetitive flooding depends partly on structure type and elevation of the structure. The approach to reducing repetitive flooding in General Area 3 will require a combination of floodproofing techniques, elevation and education.

Source: Savannah Morning News

Flooding in General Area 3: South City/Sound

Subarea 14

Repetitive Loss Area 72 is located entirely within the 100-year (Zone VE) floodplain. Subarea 14 contains newer, single-family residential properties that are not elevated.

Table 31 - Repetitive Loss Area Overview for Subarea 14

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
72	1	0	6	7	End Street Rio Road

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 20 - Repetitive Loss Subarea 14

Example Properties in Subarea 14

Subarea 15

Repetitive Loss Areas 77 and 83 are located within the 100-year (Zone AE) floodplain. The remaining Repetitive Loss Areas within Subarea 15 are located within the Zone X Unshaded floodplain. Subarea 15 contains a mix of older, single-family and multi-family residential properties that are not elevated.

Table 32 - Repetitive Loss Area Overview for Subarea 15

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
73	1	0	4	5	Northwood Road Windsor Road Largo Drive
74	1	0	7	8	Deerfield Road Ortega Drive Bedford Drive
75	1	1	6	8	Collingwood Road Bedford Drive Woodley Road
76	1	1	3	5	Woodley Road Deerfield Road Linwood Road
77	5	6	11	22	Deerfield Road Linwood Road Briarcliff Circle Windsor Road Winwood Place Mimosa Place Barberry Drive
78	8	13	19	40	Holland Drive Windmill Lane Windmill Court Holland Park Circle Holland Park Court Austin Drive
79	2	0	4	6	Austin Drive
80	1	0	4	5	Willow Road Tanglewood Road
81	1	0	7	8	Merrydell Drive Chateaugay Road W. Welwood Drive
82	8	3	21	32	Old Mill Lane Mill Court Mill Drive

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
					Millstream Court
83	4	1	14	19	White Bluff Road Bordeaux Lane
84	1	0	6	7	Old Coffee Bluff Road Brown Pelican Drive Vernon River Drive

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

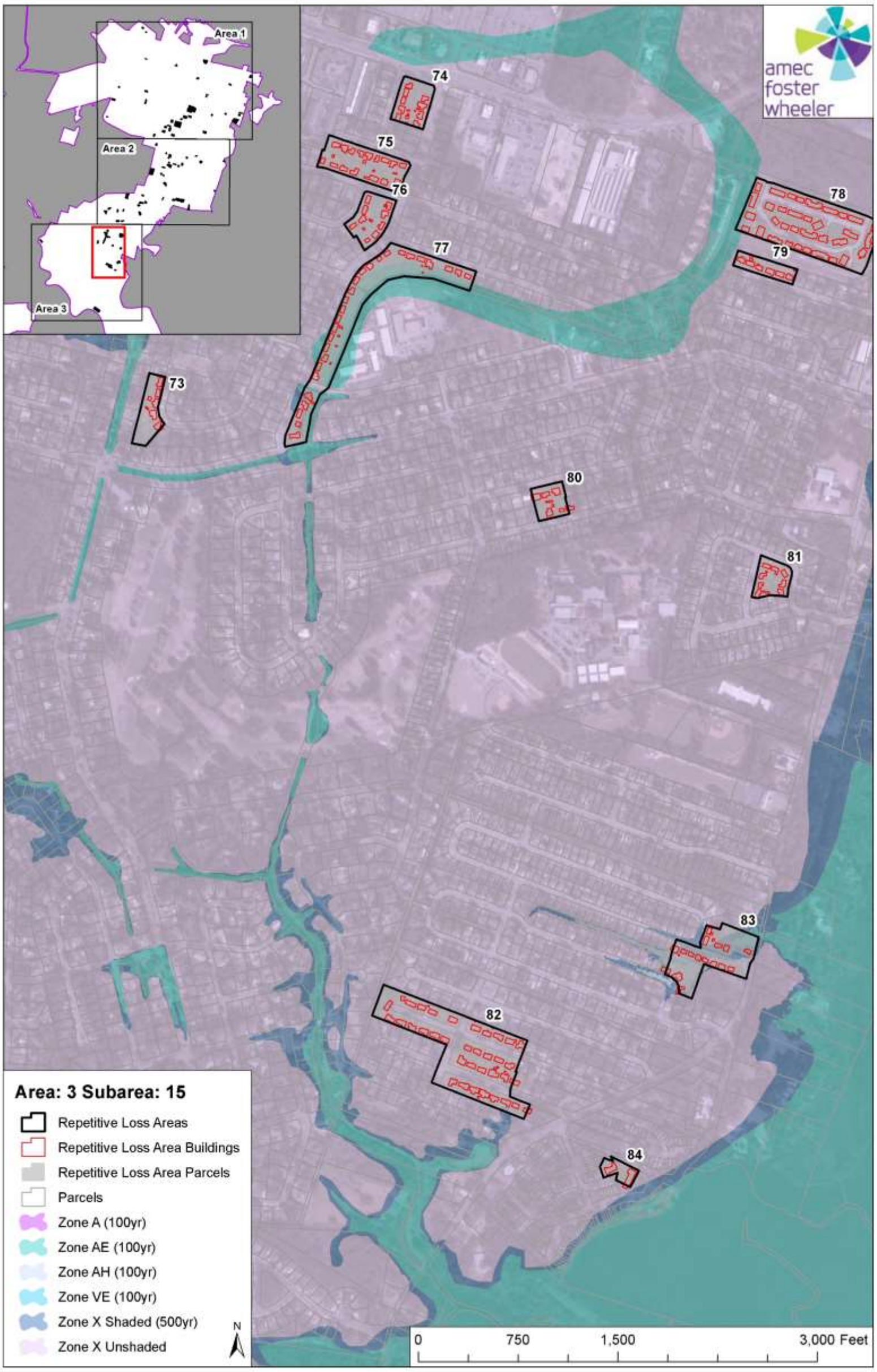


Figure 21 - Repetitive Loss Subarea 15

Example Properties in Subarea 15

Subarea 16

Repetitive Loss Area 85 is located partially within the 100-year (Zone AE) and 500-year (Zone X Shaded) floodplain. Subarea 16 contains newer, single-family properties. Some homes in this subarea have been elevated.

Table 33 - Repetitive Loss Area Overview for Subarea 16

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
85	1	0	13	14	S Grant Street E. Back Street Lee Street

Note: Additional data on buildings within each repetitive loss area is located on the field survey forms in Appendix C.

Figure 22 - Repetitive Loss Subarea 16

Example Properties in Subarea 16

STEP 4. Review Alternative Mitigation Approaches - General Area 3

There are many ways to protect a property from flood damage, including, but not limited to, those shown previously in Figure 13. The mitigation measures shown in Table 8 (page 44) can be considered for each repetitive loss property. As shown in the table, each mitigation measure qualifies for one or more grant programs. Depending on the type of structure, severity of flooding and proximity to additional structures with similar flooding conditions, the most appropriate measure can be determined. In addition to these grant funded projects, several mitigations measures can be taken by the homeowner to protect their home. Mitigation measures should fall into one of the mitigation categories listed below which are based on the Community Rating System planning process:

- Prevention
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

Mitigation Alternatives

General Area 3 – South City/Sound

General Area 3 contains a total of 186 properties identified within 3 Subareas and 14 Repetitive Loss Areas. Flooding in the South City/Sound area can be attributed to its proximity to the tidally influenced rivers and streams that flow into the Ossabaw Sound as well as the heavy rains associated with tropical storms and hurricanes. Heavy rains accompanied by high tides can overwhelm the stormwater infrastructure in this area.

Promoting floodproofing techniques and structure elevation as well as increasing public education and awareness of the flood hazards are the best alternatives for property owners in this area. The City's websites, e-mail distribution lists, press releases and variable message boards can provide benefit to business owners and residents.

Potential mitigation measures for General Area 3:

Structural Alternatives:

- Dry floodproofing. Commercial structures and even residential structures are eligible for dry floodproofing; however, in many instances this requires human intervention to complete the measure and ensure success. For example, installing watertight shields over doors or windows requires timely action by the homeowner; especially in a heavy rainfall event.

- Wet floodproofing. Wet floodproofing a structure involves making the uninhabited portions of the structure resistant to flood damage and allowing water to enter during flooding. For example, in a basement or crawl space, mechanical equipment and ductwork would not be damaged.

- Acquire and/or relocated properties/target abandoned properties (Note: Newer structures may not meet FEMA's cost/benefit ratio of 1.0 for mitigation funding).

- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE (Note: Elevation of commercial structures is not politically popular and is cost prohibitive).

- Construct engineered structural barriers, berms, and floodwalls (Note: Assuming lot has required space for a structural addition).

- Increase road elevations above the BFE of the 100-year floodplain.

- Implement drainage improvements such as increasing capacity in the system (up-sizing pipes) and provide additional inlets to receive more stormwater.

- Improve stormwater system maintenance program to ensure inlets and canals are free of clogging debris.

Non-Structural Alternatives:

- Relocate internal supplies, products/goods above the flooding depth.

- Improve the City's floodplain and zoning ordinances.

- Consider expanding riparian impervious surface setbacks including a 25' setback on coastal marshland and wetlands.

- Provide public education through posting information about local flood hazards on City websites, posting signs at various locations in neighborhoods or discussing flood protection measures at local neighborhood association meetings.

- Promote the purchase of flood insurance.

- Continue coordination with CEMA, the National Weather Service (NWS), and United States Geological Survey (USGS) to enhance flood warning system, including the use of rain/stream gauges, to provide greater warning time for citizens. NWS can use the real-time data collected to issue timely warnings.

Cost and Benefits of Mitigation Measures

Three primary mitigation measures are discussed here: acquisition, relocation and barriers. In general the cost of acquisition and relocations will be higher but will completely alleviate any future flood damage. Building small barriers to protect single structures is a lower cost solution, but may not be able to offer complete protection from large flood events.

Acquisition:

Property acquisition and/or relocation are complex processes requiring transferring private property to property owned by the local government for open space purposes. Acquisition is a relatively expensive mitigation measure, but provides the greatest benefit in the lives and property are protected from flood damage. The major cost for the acquisition method is for purchasing the structure and land. The total estimated cost for acquisition should be based on the following:

Past property acquisitions in Savannah have been converted to community gardens

- Purchase of Structure and land
- Demolition
- Debris removal, including any landfill processing fees
- Grading and stabilizing the property site
- Permits and plan review

Table 34 - Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
• Permanently removes problem since the structure no longer exists. • Allows a substantially damaged or substantially improved structure to be brought into compliance with the community's floodplain management ordinance or law. • Expands open space and enhances natural and beneficial uses. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Resistance may be encountered by local communities due to loss of tax base, maintenance of empty lots, and liability for injuries on empty, community-owned lots.

There are 3 criteria that must be met for FEMA to fund an acquisition project:

- The local community must inform the property owners interested in the acquisition program that the community will not use condemnation authority to purchase their property and that the participation in the program is strictly voluntary,

- The subsequent deed to the property to be acquired will be amended such that the landowner will be restricted from receiving any further Federal disaster assistance grants, the property shall remain in open space in perpetuity, and the property will be retained in ownership by a public entity, and
- Any replacement housing or relocated structures will be located outside the 100-year floodplain.

Relocation:

Relocation involves lifting and placing a structure on a wheeled vehicle and transporting that structure to a site outside the 100-year floodplain and placed on a new permanent foundation. Like acquisition, this is one of the most effective mitigation measures.

Table 35 - Advantages and Disadvantages of Relocation

Advantages	Disadvantages
• Removes flood problem since the structure is relocated out of the flood-prone area. • Allows a substantially damaged or substantially improved structure to be brought into compliance with a community's floodplain management ordinance. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • Additional costs are likely if the structure must be brought into compliance with current code requirements for plumbing, electrical, and energy systems.

The cost for relocation will vary based on the type of structure and the condition of the structure. It is considerably less expensive to relocate a home that is built on a basement or crawl space as opposed to a structure that is a slab on grade. Additionally, wood sided structures are less expensive to relocate than structures with brick veneer.

Items to consider in estimating cost for relocation include the following:

- Site selection and analysis and design of the new location
- Analysis of existing size of structure
- Analysis and preparation of the moving route
- Preparation of the structure prior to the move
- Moving the structure to the new location
- Preparation of the new site
- Construction of the new foundation
- Connection of the structure to the new foundation
- Restoration of the old site

Barriers:

A flood protection barrier is usually an earthen levee/berm or a concrete retaining wall. While levees and retaining walls can be large spanning miles along a river, they can also be constructed on a much smaller scale to protect a single home or group of homes.

Table 36 - Advantages and Disadvantages of Barriers

Advantages	Disadvantages
• Relative cost of mitigation is less expensive than other alternatives. • No alterations to the actual structure or foundation are required. • Home owners can typically construct their own barriers that will complement the style and functionality of their house and yard.	• Property is still located within the floodplain and has potential to be damaged by flood if barrier fails or waters overtop it. • Solution is only practical for flooding depths less than 3 feet. • Barriers cannot be used in areas with soils that have high infiltration rates.

The cost of constructing a barrier will depend on the type of barrier and the size required to provide adequate protection. An earthen berm will generally be less expensive compared to an equivalent concrete barrier primarily due to the cost of the materials. Another consideration is space; an earthen barrier requires a lot of additional width per height of structure compared to a concrete barrier to ensure proper stability.

Key items to consider for barriers:

- There needs to be adequate room on the lot
- A pump is required to remove water that either falls or seeps onto the protected side of the barrier
- Human intervention will be required to sand bag or otherwise close any openings in the barrier during the entire flood event

Floodproofing

Wet floodproofing a structure consists of modifying the uninhabited portions (such as a crawlspace or an unfinished basement) to allow floodwaters to enter and exit. This ensures equal hydrostatic pressure on the interior and exterior of the structure which reduces the likelihood of wall failures and structural damage. Wet floodproofing is practical in only a limited number of situations.

Table 37 - Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
• Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors.	• Extensive cleanup may be necessary if the structure becomes wet inside and possibly contaminated by sewage, chemicals and other materials borne by floodwaters. • Pumping floodwaters out of a basement too soon after a flood may lead to structural damage. • Does not minimize the potential damage from a high-velocity flood flow and wave action.

A dry floodproofed structure is made watertight below the level that needs flood protection to prevent floodwaters from entering. Making the structure watertight involves sealing the walls with waterproof coatings, impermeable membranes, or a supplemental layer of masonry or concrete; installing watertight shields over windows and doors; and installing measures to prevent sewer backup.

Table 38 - Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
• Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program.	• Requires human intervention and adequate warning to install protective measures. • Does not minimize the potential damage from high-velocity flood flow and wave action. • May not be aesthetically pleasing.

Drainage Improvements

Methods of drainage improvements include overflow channels, channel straightening, restrictive crossing replacements, and runoff storage. Modifying the channel attempts to provide a greater carrying capacity for moving floodwaters away from areas where damage occurs. Whenever drainage improvements are considered as a flood mitigation measure, the effects upstream and downstream from the proposed improvements need to be considered.

Table 39 - Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
• Can increase channel carrying capacity through overflow channels, channel straightening, crossing replacements, or runoff volume storage. • Minor projects may be fundable under FEMA mitigation grant programs.	• May help one area but create new problems upstream or downstream. • Channel straightening increases the capacity to accumulate and carry sediment. • May require property owner cooperation and right-of-way acquisition.

Elevation

Elevating a structure to prevent floodwaters from reaching living areas is an effective and one of the most common mitigation methods. Elevation may also apply to roadways and walkways. The goal of the elevation process is to raise the lowest floor of a structure or roadway/walkway bed to or above the required level of protection.

Table 40 - Advantages and Disadvantages of Elevation

Advantages	Disadvantages
• Elevating to or above the BFE allows a substantially damaged or substantially improved house to be brought into compliance. • Often reduces flood insurance premiums. • Reduces or eliminates road closures due to overtopping. • May be fundable under FEMA mitigation grant programs.	• Cost may be prohibitive. • The appearance of the structure and access to it may be adversely affected. • May require property owner cooperation and right-of-way acquisition. • May require road or walkway closures during construction.

STEP 5. Conclusion and Recommendations - General Area 3

Conclusion

Based on the field survey and collection of data, the analysis of existing studies and reports, and the evaluation of various structural and non-structural mitigation measures, the City of Savannah proposes that mitigation measures be implemented for General Area 3. Table 41 examines past and current mitigation actions in this area.

Table 41 – Past and Current Mitigation Actions in General Area 3

Current Actions	
1	Property owners have documented flooding and identified flooding concerns in returned questionnaires from this analysis.
2	The City has eliminated 24 properties from the repetitive loss list through acquisition and demolition. Many of these areas have been converted to community gardens which have proven to be very popular in the City.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense.

Recommendations

The City will encourage property owners to use floodproofing measures to help protect lower levels of their property. The City will also increase its public education efforts to increase awareness of flood preparedness and flood protection measures including moving valuable items to above the flood elevation and permanently elevating structures and vulnerable HVAC units. At the same time, the City will work with property owners, citizens, neighboring communities, the state and other regional and federal agencies to implement capital improvement projects which will help to eliminate flooding in the repetitive loss areas.

Mitigation Action 1:

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The City will continue on an **annual basis** to target all properties in the repetitive loss areas reminding them of the advantages to maintaining flood insurance through its annual outreach effort.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas located in General Area 3.

Funding

The cost will be paid for from the City's operating budget through the Development Services

Department.

Mitigation Action 2:

Property owners should not store personal property in basements and crawl spaces since personal property is not covered by a flood insurance policy. The City will increase its outreach efforts on an **annual basis** to include information to the outreach materials for the identified repetitive loss areas.

Responsibility

The City's Development Services Department will provide the most relevant up-to-date information to all property owners within the repetitive loss areas located in General Area 3.

Funding

The cost will be paid for from the City's operating budget through the Development Services Department.

Mitigation Action 3:

When appropriate, property owners should consider floodproofing measures such as flood gates or shields, flood walls, and hydraulic pumps.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

Mitigation Action 4:

Continue acquisition/demolition mitigation of high-risk flood-prone properties. The highest priorities are properties at the greatest flood risk and where drainage improvements will not provide an adequate level of protection.

Responsibility

The City's Real Property Services in conjunction with the Development Services Department will continue to target properties for acquisition/demolition.

Funding

The acquisition and demolition will be paid for using FEMA mitigation grant funds. Staff time to develop the list of target properties will require funds from the City's operating budget.

Mitigation Action 5:

Prioritize CIP projects to focus on drainage improvement projects in those basins containing repetitive loss areas.

Responsibility

The City's Development Services Department in conjunction with CIP Management.

Funding

Special Purpose Local Option Sales Tax (SPLOST) funds.

Mitigation Action 6:

Encourage property owners to elevate inside and outside mechanical equipment above the BFE and install flood resistant materials in crawl spaces.

Responsibility

The City's Development Services Department will promote effective flood protection measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost will be paid for by individual property owners. Advice and assistance will require staff time. Promotion of existing floodproofing measures may require some additional funds from the City's operating budget.

3 References

Federal Emergency Management Agency/ISO, City of Savannah, Repetitive Loss Data, December, 2011.

Georgia Emergency Management Agency, City of Savannah, Repetitive Loss Data, 2013.

Federal Emergency Management Agency, National Flood Insurance Program, Community Rating System CRS Coordinator's Manual. FIA-15/2013. Section 510.

Federal Emergency Management Agency, National Flood Mitigation Data Collection Tool and RLP Viewer, User's Guide. FEMA 497/August 2008.

Federal Emergency Management Agency, Reducing Damage from Localized Flooding: A Guide for Communities. FEMA 511/June 2005. Part III Chapter 7.

Federal Emergency Management Agency, Selecting Appropriate Mitigation Measures for Floodprone Structures. FEMA 551/March 2007.

Federal Emergency Management Agency, Flood Insurance Study, Chatham County, Georgia and Incorporated Areas, July 2014.

Federal Emergency Management Agency, Chatham County, GA: Inland Riverine Draft Flood Risk Report, July 2013.

City of Alexandria, Potomac River Waterfront Flood Mitigation Study, Evaluation and Recommendations of Mitigation Measures, July 2012.

University of New Orleans, Center for Hazards Assessment, Response and Technology, Draft Guidebook to Conducting Repetitive Loss Area Analyses, 2012.

Federal Emergency Management Agency, National Flood Insurance Program, Community Rating System, Mapping Repetitive Loss Areas, August 2008.

Appendix A – Property Notification Letters

Appendix B – Questionnaire Responses

Appendix C – Building Survey Data