



Interoffice Memorandum

December 10, 2018

TO: Mayor Jerry L. Demings
and Board of County Commissioners

FROM: Mark V. Massaro, P. E., Director, Public Works Department

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SUBJ: **Adoption of Orange County Floodplain Management Plan, Repetitive Loss Area Analysis, and Program for Public Information**

Orange County participates in the Federal Emergency Management Agency National Flood Insurance Program's Community Rating System (CRS) program that provides reductions in flood insurance premiums. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed minimum requirements. Orange County is currently rated a class 5 in the CRS program, which rewards County flood insurance policy holders with a 25% reduction in their flood insurance premiums. CRS program information is attached for your review.

Orange County is striving to improve its CRS standing from its current class 5 to a class 4 by documenting community floodplain management efforts currently being undertaken. There are 10,003 floodplain policies in force within Orange County. Under the class 5 rating (25% premium reduction), policy holders save an estimated \$750,000, annually. A class 4 rating would result in a 30% premium reduction in policy premiums. The 5% reduction in premiums is estimated to result in an additional \$105,000 annual savings to policy holders.

Three plans were prepared to better document, describe, and enhance current activities. Board approval of the three plans is necessary to obtain credit for these activities under the CRS program.

Repetitive Loss Area Analysis (RLAA)

The RLAA is a countywide assessment of flood related repetitive loss areas. The flooding source for each area was identified, documented, and viable mitigation strategies defined.

Program for Public Information (PPI)

The PPI plan assesses and documents current and future outreach activities to better inform Orange County residents of flood related risks. The PPI is an ongoing effort to

prepare, implement, and monitor a range of public information activities designed to meet local needs.

Floodplain Management Plan (FMP)

The purpose of the FMP is to reduce risk to people and property from flood hazards. A comprehensive assessment of countywide factors that contribute to flood risks was completed. The plan helps identify activities that can be undertaken to reduce safety hazards and property damage.

As part of this effort, Orange County created a Floodplain Management Planning Committee (FMPC) made up of County Staff, outside citizens, and stakeholders to conduct a planning process in the development of an FMP and PPI and involved property owners in the development of a RLAA. The FMPC worked for over a year on the planning process to develop the FMP and PPI so that it met all CRS requirements.

These three plans will help Orange County achieve its goal to protect the health, safety and welfare of the citizens and to provide public outreach informing them of flood hazards that impact the County.

The backup documentation for this item has been delivered under separate cover. It may also be accessed online as part of the eAgenda by clicking [here](#).

Action Requested: Adoption of (1) Orange County FL, Floodplain Management Plan April 2018; (2) Repetitive Loss Area Analysis May 2018 County version; and (3) Orange County Program for Public Information July 2018. All Districts.

MD/DN/mh

113 Credit Points and Credited Activities

To be recognized in the insurance rating system, local floodplain management activities must be described, measured, and evaluated by the CRS. The basic document detailing the program is the *CRS Coordinator's Manual*. It sets forth the procedures, creditable activities, and the credit points assigned to each activity, and gives examples of activities and how their credit is calculated.

113.a. Credit Points and Classification

A community receives a CRS classification based upon the total credit for its activities. There are 10 CRS classes. Class 1 requires the most credit points and gives the greatest premium reduction or discount. A community that does not apply for the CRS, or does not obtain the minimum number of credit points, is a Class 10 community and receives no discount on premiums. The qualifying community total points, CRS classes, and flood insurance premium discounts are shown in Table 110-1.

Table 110-1. CRS classes, credit points, and premium discounts.			
CRS Class	Credit Points (cT)	Premium Reduction	
		In SFHA	Outside SFHA
1	4,500+	45%	10%
2	4,000–4,499	40%	10%
3	3,500–3,999	35%	10%
4	3,000–3,499	30%	10%
5	2,500–2,999	25%	10%
6	2,000–2,499	20%	10%
7	1,500–1,999	15%	5%
8	1,000–1,499	10%	5%
9	500–999	5%	5%
10	0–499	0	0

SFHA: Zones A, AE, A1–A30, V, V1–V30, AO, and AH
Outside the SFHA: Zones X, B, C, A99, AR, and D

Preferred Risk Policies are not eligible for CRS premium discounts because they already have premiums lower than other policies. Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage.

Some minus-rated policies may not be eligible for CRS premium discounts.

Premium discounts are subject to change.



Crosswalk of the 2007 CRS Credits to the 2017 CRS Coordinator's Manual

This crosswalk tracks the activities and elements in the 2007 CRS Coordinator's Manual and shows how they were continued, converted, or merged with other elements in the 2017 Coordinator's Manual. If an element is blank in the 2007 Manual column, it means it is a new element that began with the 2013 Coordinator's Manual.

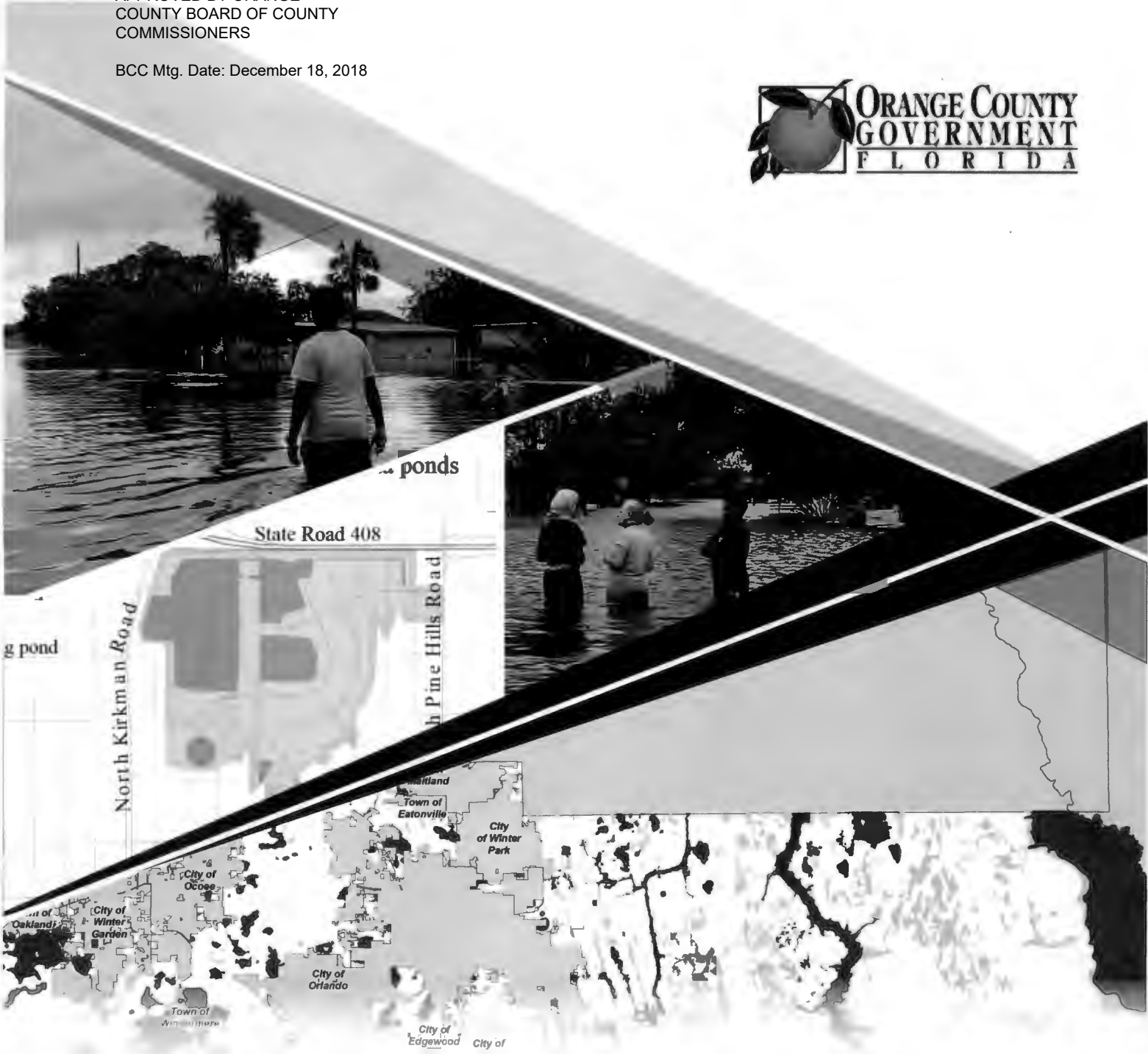
For several activities, the total of the elements listed exceeds the total for that activity (e.g., "c310") as shown in the "Max" column, and in the CRS Coordinator's Manual. This is because some elements are mutually exclusive (e.g., there is not credit for low density zoning (LZ) in areas preserved as open space (OSP)).

Description	2007 Manual			2017 Manual		
	Section	Element	Max	Section	Element	Max
Activity 310 (Elevation Certificates)		c310	162		c310	116
Elevation Certificates (after CRS application date)	311.a	EC	56	→ 312.a	EC	38
Elevation Certificate on post-FIRM buildings	311.b	ECPO	56	→ 312.b	ECPO	48
Elevation Certificate on pre-FIRM buildings	311.c	ECPR	15	→ 312.c	ECPR	30
ECs in a computer format	311.d	ECCF	15	→ 412.a	440-AMD13	14
ECs on the community's website	311.e	ECWS	20	→ 352.c	350-WEB3	20
Off-site record storage	311.f	ORS	10	→ 432.o	430-RA5	5
Activity 320 (Map Information Service)		c320	140		c320	90
1. Basic FIRM information	321	MI	140	→ 322.a	MI1	30
2. LIMWA/floodway info/CBRS area				322.b	MI2	20
3. Other flood problems not shown on FIRM				322.c	MI3	20
4. Flood depth data	351.a	FPA.a	10	→ 322.d	MI4	20
5. Special flood-related hazards				322.e	MI5	20
6. Historical flood information				322.f	MI6	20
7. Natural floodplain functions				322.g	MI7	20
Activity 330 (Outreach Projects)		c330	315		c330	350
Outreach project to the community	331.a	OPC	60		Replaced by OP	
Outreach project to floodplain properties	331.b	OPF	130		Replaced by OP	
Additional outreach projects	331.c(1)	OPA	60		Replaced by OP	
Outreach projects				332.a	OP	200
Flood response preparations				332.b	FRP	50
Public information program strategy	331.c(2)	OPS	125	→ 332.c	PPI	80
Stakeholder delivery				332.d	STK	50
Activity 340 (Hazard Disclosure)		c340	81		c340	80
Real estate agents' disclosure	341.a	DFH	46	→ 342.a	DFH	35
Other disclosure requirements	341.b	ODR	15	→ 342.b	ODR	25
Real estate brochure	341.c	REB	10	→ 342.c	REB	12
Disclosing other hazards	341.d	DOH	10	→ 342.d	DOH	8
Activity 350 (Flood Protection Information)		c350	102		c350	125
Flood protection library	351.a	LIB	25	→ 352.a	LIB	10
Locally pertinent documents	351.b	LPD	5	→ 352.b	LPD	10
Website	351.c	WEB	72	→ 352.c	WEB	105
Cover outreach project topics		WEB(a)	40	→	WEB1	75
Elevation Certificate notice		WEB(b)	2	→	Incorporated into WEB3	
Warning, safety information		WEB(d)	20	→	Incorporated into WEB1	
Real time gage information		WEB(c)	10	→	WEB2	10
Elevation Certificates on website	311.e	310-ECWS	20	→	WEB3	20

Description	2007 Manual			2017 Manual		
	Section	Element	Max	Section	Element	Max
Activity 360 (Flood Protection Assistance)		c360	71		c360	110
Site-specific hazard data, e.g., flood depths	361.a	FPA.a	10	→ 322.d	320-MI4	20
Names of contractors	361.b	FPA.b	4	→ 331.a	330-OP	2
How to deal with contractors	361.c	FPA.c	3	→ 331.a	330-OP	2
Advise after a site visit	361.d	FPA.d	35	→ 362.a	PPV	45
Property protection advice	361.e	FPA.e	14	→ 362.b	PPA	40
Financial assistance advice				362.c	FAA	15
Training	361.f	FPA.f	5	→ 362.d	TNG	10
Activity 370 (Flood Insurance Promotion)					c370	110
Promotion of flood insurance	331.d	330 - PFI	65		Replaced by 370	
Flood insurance assessment				372.a	FIA	15
Coverage plan				372.b	CP	15
Plan implementation				372.c	PI	60
Technical assistance				372.d	TA	20
Activity 410 (Floodplain Mapping)		c410	1,346		c410	850
New study	411.a	NS	410	→ 412.a	NS	350
Extra credit for mapping repetitive loss areas	411.a	NS	50		Dropped	
State review bonus	411.a	NS	120	→ 412.c	SR	60
Leverage for non-FEMA cost sharing (multiplier)	411.b	LEV	%	→ 412.b	LEV	%
Higher study standards	411.c	HSS	160	→ 412.d	HSS	200
Floodway standard	411.d	FWS	200	→ 412.e	FWS	140
Special hazards points to be added in later	411.e	AFDSH	50	→ 412.f	MAPSH	100
Signing the CTP	411.f	CTP1	20		Retired	
CTP bonus for NS credit	411.f	CTP2	121		Retired	
Activity 420 (Open Space Preservation)		c420	900		c420	2,870
Preserved open space	421.a	OS	725	→ 422.a	OSP	1,450
Deed restriction on OSP parcel	421.b	DR	75	→ 422.b	DR	50
Natural functions open space	421.c	NB	100	→ 422.c	NFOS	350
Special hazards open space	421.d	SHOS	50	→ 422.d	SHOS	150
Coastal erosion open space		Supplement to the Manual		→ 422.e	CEOS	750
Land development criteria/open space incentives	430LD.a	430-LDC	100	→ 422.f	OSI	250
Low density zoning	430LD.b	LZ	600	→ 422.g	LZ	600
Natural shoreline protection	431.g	430-NBR	15	→ 422.h	NSP	120
Activity 430 (Higher Regulatory Standards)		c430	2,740		c430	2,462
Freeboard	431.a	FRB	300	→ 432.b	FRB	500
Foundation protection	431.b	FDN	35	→ 432.c	FDN	80
Cumulative substantial improvements	431.c	CSI	110	→ 432.d	CSI	90
Lower substantial improvements	431.d	LSI	90	→ 432.e	LSI	20
Protection of critical facilities	431.e	PCF	100	→ 432.f	PCF	80
Prohibition of fill/compensatory storage	431.f	PSC	80	→ 432.a	DL1	280
Natural/beneficial functions regulations	431.g	NBR	40	→ 422.h	420-NSP	120
Enclosure limitations (* CAZ2 points added)	431.h	ENL	300	→ 432.g	ENL	390*
Other higher standards	431.i	OHS	25	→ 432.o	OHS	100
Other higher standards/prohibition of buildings	431.i	OHS	25	→ 432.a	DL2	1,000
Other higher standards/prohibition of storage	431.i	OHS	25	→ 432.a	DL3	50
Special flood-related hazards regulations	431.k	SHR	100	→ 432.l	SHR	100
State mandated standards	431.l	SMS	45	→ 432.p	SMS	20
Building code	431.m	BC	190	→ 432.h	BC	100
Tsunami hazard regulations		Supplement to the Manual		→ 432.m	TSR	50
Coastal erosion hazard regulations		Supplement to the Manual		→ 432.n	CER	370

Description	2007 Manual			2017 Manual		
	Section	Element	Max	Section	Element	Max
Activity 430 (Higher Regulatory Standards) – continued						
Staff training	431.n	STF	50	→ 432.q	RA1	25
Building department is IAS accredited				432.q	RA2	5
Conducting 3 detailed inspections				432.q	RA3	16
Conducting reinspections				432.q	RA4	16
Off-site record storage	311.f	310 - ORS	10	→ 432.q	RA5	5
Manufacture home park regulations	431.o	MHP	50	→ 432.j	MHP	15
Coastal A Zone regulations	431.p	CAZ1	650	→ 432.k	CAZ	500
Coastal A Zone regulations (* added to ENL)	431.p	CAZ2	150	→ 432.g	ENL	150*
Freeboard in X Zones/Local drainage protection	451.c	450 - FRX	150	→ 432.i	LDP	120
Activity 440 (Flood Data Maintenance)						
Additional map data (GIS)	441.a	AMD	129	→ 442.a	AMD	160
Benchmark maintenance	441.b	BMM	90	→ 442.c	BMM	27
Erosion data maintenance	441.c	EDM	20	→ 442.d	EDM	20
FIRM maintenance	441.d	FM	20	→ 442.b	FM	15
Activity 450 (Stormwater Management)						
Stormwater management regulations	451.a	SMR	225	→ 452.a	SMR	380
Size of development regulated	451.a	SZ	25	→ 452.a	SZ	110
Design storm/managing stormwater volume	451.a	DS	110	→ 452.a	DS	225
Public maintenance regulation	451.a	PUB	20	→ 452.a	PUB	20
Storage basin maintenance	451.a	PUB	70	→ 542.e	SBM	120
Low impact development				452.a	LID	25
Watershed master plan	451.b	WMP	225	→ 452.b	WMP	315
Erosion and sedimentation control	451.d	ESC	45	→ 452.c	ESC	40
Water quality regulations	451.e	WQ	25	→ 452.d	WQ	20
Activity 510 (Floodplain Management Planning)						
Floodplain management plan	511.a	FMP	294	→ 512.a	FMP	382
Repetitive loss area analyses	511.b	RLAA	50	→ 512.b	RLAA	140
Natural floodplain functions plan	511.c	HCP	15	→ 512.c	NFP	100
Activity 520 (Acquisition and Relocation)						
	521	c520	3,200	→ 522	c520	2,250
Activity 530 (Flood Protection)						
	531	c530	2,800	→ 532	c530	1,600
Activity 540 (Drainage System Maintenance)						
Channel debris removal	541.a	CDR1	200	→ 542.a	CDR	200
Problem site maintenance	541.a	CDR2	50	→ 542.b	PSM	50
Capital improvements program	541.a	CDR3	50	→ 542.c	CIP	70
Stream dumping regulations	541.b	SDR	30	→ 542.d	SDR	30
Storage basin maintenance	451.a	450-PUB	70	→ 542.e	SBM	120
Erosion protection maintenance	541.c	EPM	100		Retired	
Activity 610 (Flood Warning and Response)						
Flood threat recognition system	611.a	FTR	40	→ 612.a	FTR	75
Emergency warning dissemination	611.b	EWD	60	→ 612.b	EWD	75
Flood response operations plan	611.c	ORE	50	→ 612.c	FRO	115
Critical facilities planning	611.d	CFP	50	→ 612.d	CFP	75
StormReady community	611.e	SRC	25	→ 612.e	SRC	25
TsunamiReady community	611.f	TRC	30	→ 612.f	TRC	30

Description	2007 Manual			2017 Manual		
	Section	Element	Max	Section	Element	Max
Activity 620 (Levees)		c620	900		c620	235
Levee protection level	621	LPL	900			
Levee maintenance				622.a	LM	95
Levee failure recognition system				622.b	LFR	30
Levee failure warning				622.c	LFW	50
Levee failure operations plan				622.d	LFO	30
Levee failure critical facilities				622.e	LCF	30
Activity 630 (Dams)		c630	175		c630	160
State dam safety program	631.a	SDS	75	→ 632.a	SDS	45
Dam failure recognition system	631.b	DFP1	25	→ 632.b	DFR	30
Dam failure warning	631.c	DFP2	25	→ 632.c	DFW	35
Dam failure operations plan	631.d	DFP3	50	→ 632.d	DFO	30
Dam failure critical facilities				632.e	DCF	20
710 (Community Growth Adjustment)						
US Census growth rate	711.a	USGR	N/A	→ 712.a	CGR	1.5
Community growth rate	711.b	CMGR	N/A		Dropped	
Community/county growth adjustment	712.b	CGA	N/A	→ 712.c	CGA	1.5



Orange County, FL Floodplain Management Plan

April 2018



EXECUTIVE SUMMARY

Background & Methodology

The purpose of this Floodplain Management Plan is to reduce or eliminate risk to people and property from flood hazards. Every community faces different hazards and every community has different resources to draw upon in combating problems along with different interests that influence the solutions to those problems. Because there are many ways to deal with flood hazards and many agencies that can help, there is no one solution for managing or mitigating their effects. Planning is one of the best ways to develop a customized program that will mitigate the impacts of flood hazards while taking into account the unique character of a community. The plan provides a framework for all interested parties to work together and reach consensus on how to move forward. A well-prepared Floodplain Management Plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and activities, preventing conflicts and reducing the costs of implementing each individual activity.

Planning Process

Orange County followed the planning process prescribed by the Federal Emergency Management Agency (FEMA), and this plan was developed under the guidance of a Floodplain Management Planning Committee (FMPC) comprised of representatives of County Departments, citizens and other stakeholders. The FMPC conducted a risk assessment that identified and profiled flood hazards that pose a risk to the County, assessed the County's vulnerability to these hazards, and examined the capabilities in place to mitigate them. The flood hazards profiled in this plan include:

- Climate Change and Sea Level Rise
- Channel Bank Erosion
- Dam/Levee Failure
- Flood: 100-/500-year
- Flood: Stormwater/Localized Flooding
- Hurricane and Tropical Storm

Risk Assessment Findings

After conducting a hazard risk and vulnerability assessment, the FMPC concluded that climate change and sea level rise pose a high risk to the County; dam/levee failure, 100-/500-year flooding, stormwater/localized flooding, and hurricane and tropical storm each pose a moderate risk to the County; and channel bank erosion does not constitute a priority hazard for the purpose of flood mitigation planning.

Goals, Mitigation Strategy & Action Plan

This plan identifies activities that can be undertaken to reduce safety hazards, health hazards, and property damage caused by floods. Based on the risk assessment developed for each of the flood hazards identified above, the FMPC identified goals and objectives for reducing the County's vulnerability to the hazards. The goals and objectives are summarized as follows:

EXECUTIVE SUMMARY

Goal 1 – Reduce vulnerability and exposure to flood hazards in order to protect the health, safety and welfare of both residents and visitors.

Objective 1.1: Maintain a database of flood problems and hazards.

Objective 1.2: Maintain a database of repetitive loss claim history and mitigation activities.

Objective 1.3: Review the Growth Management Plan, Land Development Code, and Ordinances for compatibility with these goals and objectives, and revise where appropriate and financially feasible.

Objective 1.4: Enforce the minimum code requirements of the National Flood Insurance Program as adopted by the Board of County Commissioners.

Objective 1.5: Conduct site investigations, research exposure and hazard data, and evaluate proposed modifications to repair and mitigate stormwater management problems.

Objective 1.6: Develop projects to reduce deficiencies within the stormwater management system as part of the annual budget development process.

Goal 2 – Encourage property owners through an expanded flood hazard communication and outreach program to protect their homes and businesses from flood damage.

Objective 2.1: Educate property owners, including repetitive loss properties, on FEMA grant programs and other methods in order to mitigate possible flood damage.

Objective 2.2: Provide the current floodproofing and retrofitting information to property owners.

Objective 2.3: Effectively communicate flood risk to residents, businesses, contractors, realtors and prospective buyers.

Objective 2.4: Enhance community websites to provide comprehensive flood protection and flood preparedness information.

Goal 3 – Protect critical and essential facilities and infrastructure from the effects of flood hazards.

Objective 3.1: Ensure protection standards for critical facilities meet Florida Building Code standards as adopted by the Board of County Commissioners.

Objective 3.2: Work with appropriate personnel to prioritize critical and essential facilities in need of protection from potential flood damage.

Objective 3.3: Take measures to ensure the continuity of service of all critical facilities in the event of a flood or major storm.

EXECUTIVE SUMMARY

Goal 4 – Encourage protection of natural resources by employing watershed-based approaches that balance environmental, economic, and engineering considerations.

Objective 4.1: Maintain and enforce regulations to protect and restore wetlands and ecological functions for long-term environmental, economic and recreational values.

Objective 4.2: Pursue water management approaches and techniques that improve water quality and protect public health.

Objective 4.3: Preserve and maintain open space in flood prone areas to reduce flood damage to buildings and to provide recreational benefits.

Objective 4.4: Continue to protect aquifers and environmentally sensitive lands from encroachment of development by acquiring lands or requiring buffers and other setbacks mechanisms.

Goal 5 – Reduce damage to all development including repetitively flooded buildings through flood resilient strategies and measures.

Objective 5.1: Reduce stormwater runoff through adequate stormwater management, flood control, on-site retention and best management practices to mitigate impacts associated with incremental construction and redevelopment projects.

Objective 5.2: Evaluate funding mechanisms to increase stormwater capital improvement projects.

Objective 5.3: Minimize adverse impacts to the floodplain.

To meet the identified goals, this plan recommends 23 mitigation actions, which are summarized in the table that follows. Note: Item number does not indicate an order of priority.

EXECUTIVE SUMMARY

Action #	Mitigation Action	Related to Goal	Addresses Current Development	Addresses Future Development	Continued Compliance with NFIP	Mitigation Category
1	Continue to hold the Orange County Hurricane Expo to provide preparedness information to County residents.	2	✓		✓	Public Information & Outreach
2	Speak to Homeowners Associations about flood hazard preparedness and mitigation options.	2	✓		✓	Public Information & Outreach
3	Send outreach brochure to residents of the SFHA, Repetitive Loss Areas, and to HOAs.	2	✓		✓	Public Information & Outreach
4	Encourage residents in repetitive loss areas and high-risk flood zones to consider the option of acquisition or elevation.	1, 2, 5	✓		✓	Property Protection
5	Continue to inspect and maintain waterways, including natural channels, to ensure they are clear of debris.	1, 3, 5	✓		✓	Natural Resource Protection
6	Perform engineering studies of the areas surrounding Lake Venus, including the Orlo Vista neighborhood.	1	✓		✓	Prevention
7	Protect critical facilities and infrastructure from potential flood damage.	1, 3	✓			Emergency Services
8	Ensure back up power systems and generators are in place for all critical facilities and emergency shelters.	1, 3				Emergency Services
9	Install high water level outfalls in lieu of current drainwells or retrofit existing drainwells, including at Lake Price, Lake Pleasant, Mustang Way, and Lake Florence.	1, 3, 5	✓		✓	Structural Projects
10	Retrofit culverts along Apopka Boulevard.	1	✓		✓	Structural Projects
11	Add flood gauges to improve calibration of current flood modeling system and enable better flood warning.	1	✓		✓	Emergency Services
12	Evaluate options for higher regulatory standards to reduce the vulnerability of new development to flooding.	1, 3, 5	✓	✓	✓	Prevention
13	Consider options for public/private partnership with home improvement stores to encourage homeowners to take mitigation and preparedness actions.	2	✓		✓	Property Protection
14	Establish an annual Flood Awareness Week.	2			✓	Public Information & Outreach

EXECUTIVE SUMMARY

Action #	Mitigation Action	Related to Goal	Addresses Current Development	Addresses Future Development	Continued Compliance with NFIP	Mitigation Category
15	Acquire repetitive loss and other properties and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts.	1, 4, 5	✓	✓	✓	Prevention, Natural Resource Protection
16	Acquire properties for a regional stormwater detention basin.	1, 4	✓	✓	✓	Structural Projects
17	Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.	1, 4	✓		✓	Prevention, Natural Resource Protection
18	Prepare watershed master plans for all HUC-12 river basins in the County.	1, 4, 5	✓			Prevention
19	Improve/Upgrade pump stations at Bonnie Brook, Long Lake, Verona Park, and Woodsmere.	1, 3, 5	✓		✓	Structural Projects
20	Complete restoration of the Little Wekiva River at Edgewater Drive.	1, 4, 5	✓		✓	Natural Resource Protection
21	Complete stormwater retrofits on Boggy Creek Pipeline, Control Structure for Pond 6612, and Lake George Outfall.	1, 3, 5	✓		✓	Structural Projects
22	Complete canal bank stabilization projects for Wheatberry Ct B-14 and Winter Park Pines Outfall.	1, 3, 5	✓		✓	Structural Projects
23	Continue to implement emergency hurricane preparedness procedures as needed and update regularly.	1	✓		✓	Emergency Services



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This plan fulfills the requirements of Section 104 of the Disaster Mitigation Act of 2000 and qualifies for CRS credit. The following table provides the 10-step CRS planning credit activity checklist and the section/page number within this plan that describes the completion of each planning step in more detail.

CRS Planning Credit Activity Checklist

CRS Step	Section
1. Organize to prepare the plan.	
a. Involvement of office responsible for community planning	Section 2.1
b. Planning committee of department staff	Section 2.1 / Table 2.1
c. Process formally created by the community's governing board	---
2. Involve the public.	
a. Planning process conducted through a planning committee	Section 2.1 / Table 2.1 / Appendix A
b. Public meetings held at the beginning of the planning process	Section 2.2.1 / Table 2.5 / Appendix A
c. Public meeting held on draft plan	Section 2.2.1 / Table 2.5 / Appendix A
d. Other public information activities to encourage input	Section 2.2.1 / Table 2.6 / Appendix A
3. Coordinate with other agencies.	
a. Review of existing studies and plans	Section 2.2.1
b. Coordinating with communities and other agencies	Section 2.2.1 / Appendix A
4. Assess the hazard.	
a. Plan includes an assessment of the flood hazard with:	Sections 4.1 – 4.6 / Section 5.3
(1) A map of known flood hazards	Figures 4.8, 4.10, 5.2 – 5.7
(2) A description of known flood hazard	Sections 4.1 – 4.6 / Section 5.3
(3) A discussion of past floods	Sections 4.1 – 4.6
b. Plan includes assessment of less frequent floods	Section 4.3 & 5.3.2
c. Plan includes assessment of areas likely to flood	Section 4.7
d. The plan describes other natural hazards	Section 4.2
5. Assess the problem.	
a. Summary of each hazard identified in the hazard assessment and their community impact	Section 5.3
b. Description of the impact of the hazards on:	
(1) Life, safety, health, procedures for warning and evacuation	Section 5.3.1
(2) Public health including health hazards to floodwaters/mold	Section 5.3.2
(3) Critical facilities and infrastructure	Section 5.2.2
(4) The community's economy and tax base	Section 1.3.5
(5) Number and type of affected buildings	Section 5.2.1
c. Review of all damaged buildings/flood insurance claims	Section 5.3.3
d. Areas that provide natural floodplain functions	Section 1.3.3
e. Development/redevelopment/Population Trends	Sections 1.3.7 – 1.3.8
f. Impact of future flooding conditions outlined in Step 4, item c	Section 4.7
6. Set goals.	
7. Review possible activities.	
a. Preventive activities	Section 7.3 / Appendix B
b. Floodplain Management Regulatory/current & future conditions	Section 7.3 / Appendix B
c. Property protection activities	Section 7.3 / Appendix B

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CRS Step	Section
d. Natural resource protection activities	Section 7.3 / Appendix B
e. Emergency services activities	Section 7.3 / Appendix B
f. Structural projects	Section 7.3 / Appendix B
g. Public information activities	Section 7.3 / Appendix B
8. Draft an action plan.	
a. Actions must be prioritized	Section 7.3.1
(1) Recommendations for activities from two of the six categories	
(2) Recommendations for activities from three of the six categories	
(3) Recommendations for activities from four of the six categories	
(4) Recommendations for activities from five of the six categories	Section 7.4
b. Post-disaster mitigation policies and procedures	Section 7.1.2
c. Action items for mitigation of other hazards	Section 7.4
9. Adopt the plan.	
	Section 8
10. Implement, evaluate and revise.	
a. Procedures to monitor and recommend revisions	Sections 9.1 – 9.2
b. Same planning committee or successor committee that qualifies under Section 511.a.2 (a) does the evaluation	Section 9.1.2

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1 INTRODUCTION

1.1 Purpose

As defined by FEMA, “hazard mitigation” means any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event. Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. The purpose of this plan is to identify, assess and mitigate flood risk in order to better protect the people and property of Orange County from the effects of flood hazards. This plan documents Orange County’s flood hazard mitigation planning process and identifies relevant flood hazards and strategies the County will use to decrease vulnerability and increase resiliency and sustainability.

This Plan was developed in a joint and cooperative venture by members of a Floodplain Management Planning Committee (FMPC) which included representatives of Orange County, citizens, and other stakeholders.

This Plan will ensure Orange County’s continued eligibility for federal disaster assistance including the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). This Plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S. C. 5165, enacted under Section 104 of the Disaster Mitigation Act of 2000, (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented at 44 CFR 201.6 and 201.7 dated October 2011.

1.2 Background and Scope

Orange County has participated in the National Flood Insurance Program’s (NFIP) Community Rating System (CRS) since 2008, and currently qualifies for a Class 5 Rating. The CRS recognizes and encourages community floodplain management activities that exceed the minimum standards. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that (1) reduce flood losses, (2) facilitate accurate insurance ratings, and (3) promote the awareness of flood insurance. Through participation in the NFIP and a Class 5 rating with the CRS, owners of properties within Special Flood Hazard Areas (SFHAs) in Orange County are entitled to a 25% discount on their flood insurance premiums. In addition, property owners in non-SFHAs (Zone X and X-500) receive a 10% discount on flood insurance premiums.

As part of the qualification for a Class 5 Rating and having 10 or more repetitive loss properties, Orange County is required to prepare and maintain a Floodplain Management Plan (FMP). It is the goal of the FMPC to continue to work to make improvements to this plan and to strive to maintain and/or improve the Class Rating for the County so that the highest reduction in flood insurance premium rates can be available to property owners.

1.3 Community Profile

1.3.1 Overview of the Community

Orange County is an inland county in central Florida, home to 22 unincorporated communities in addition to Orlando and 12 other incorporated municipalities. The unincorporated communities include:

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- Lake Avalon
- Gotha
- Tildenville
- West Windermere
- Bridle Path
- Clarcona
- North Apopka / Wekiva
- Otter Lake
- Paradise Heights
- Rainbow Ridge
- Tangerine
- Zellwood
- Zellwood Station
- Lake Hart / Lake Whippoorwill
- Lake Mary Jane
- Sunflower Trail / Seaward Plantation
- Bithlo
- Christmas
- Corner Lake
- Lake Pickett
- North Christmas
- Wedgefield

This Plan covers the unincorporated areas of Orange County only.

The County is bordered to the north and northwest by Seminole and Volusia Counties; south and southwest by Osceola and Polk Counties; east by Brevard County, and west by Lake County. According to the U.S. Census Bureau, Orange County (including all incorporated areas) has a total area of 1,003 square miles, of which 903 square miles is land and 100 square miles (9.9% of total area) is water.

An overview map of Orange County is shown in Figure 1.1 on the following page.

1.3.2 Topography and Climate

The topography of Orange County is relatively flat with an average elevation of 78 feet but slightly higher elevation to the west and lower elevation east toward the coast. Tangerine, in northwest Orange County, sits at 151 feet above sea level, while unincorporated Christmas, near the county's eastern boundary, is at 43 feet above sea level.

Orange County lies within the St. Johns River System and the Kissimmee River System, which together are composed of 12 smaller drainage basins. As defined by the United States Geological Survey (USGS), the United States is divided and sub-divided into successively smaller hydrologic units. Each hydrologic unit is identified by a unique hydrologic unit code (HUC). As of 2010 there are six levels of hierarchy, represented by hydrologic unit codes from 2 to 12 digits long. Figure 1.2 illustrates the HUC-12 drainage basins in Orange County. HUC-12 drainage basins are delineated to be between 10,000 and 40,000 acres.

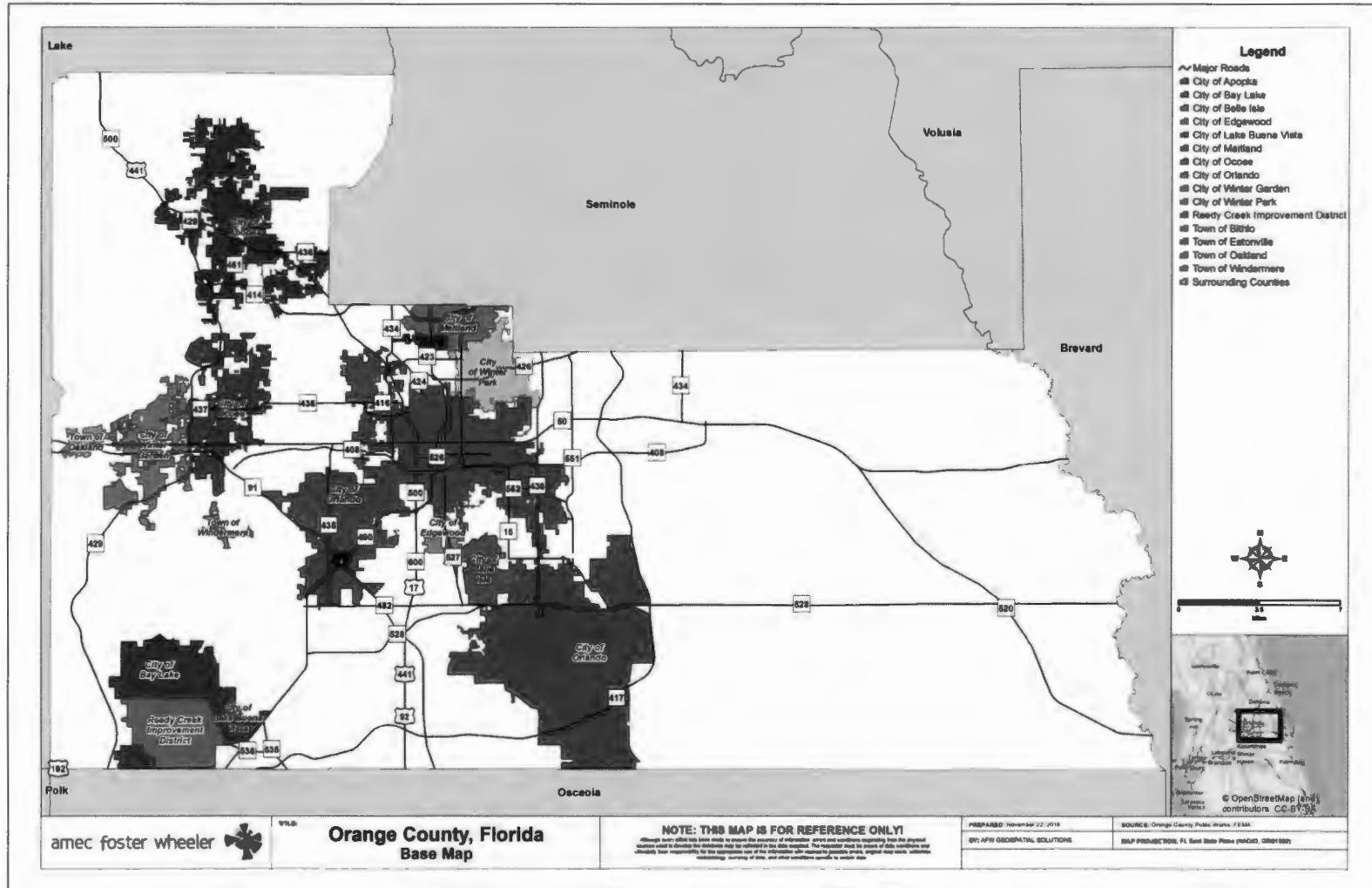


Figure 1.1 – Overview Map of Orange County

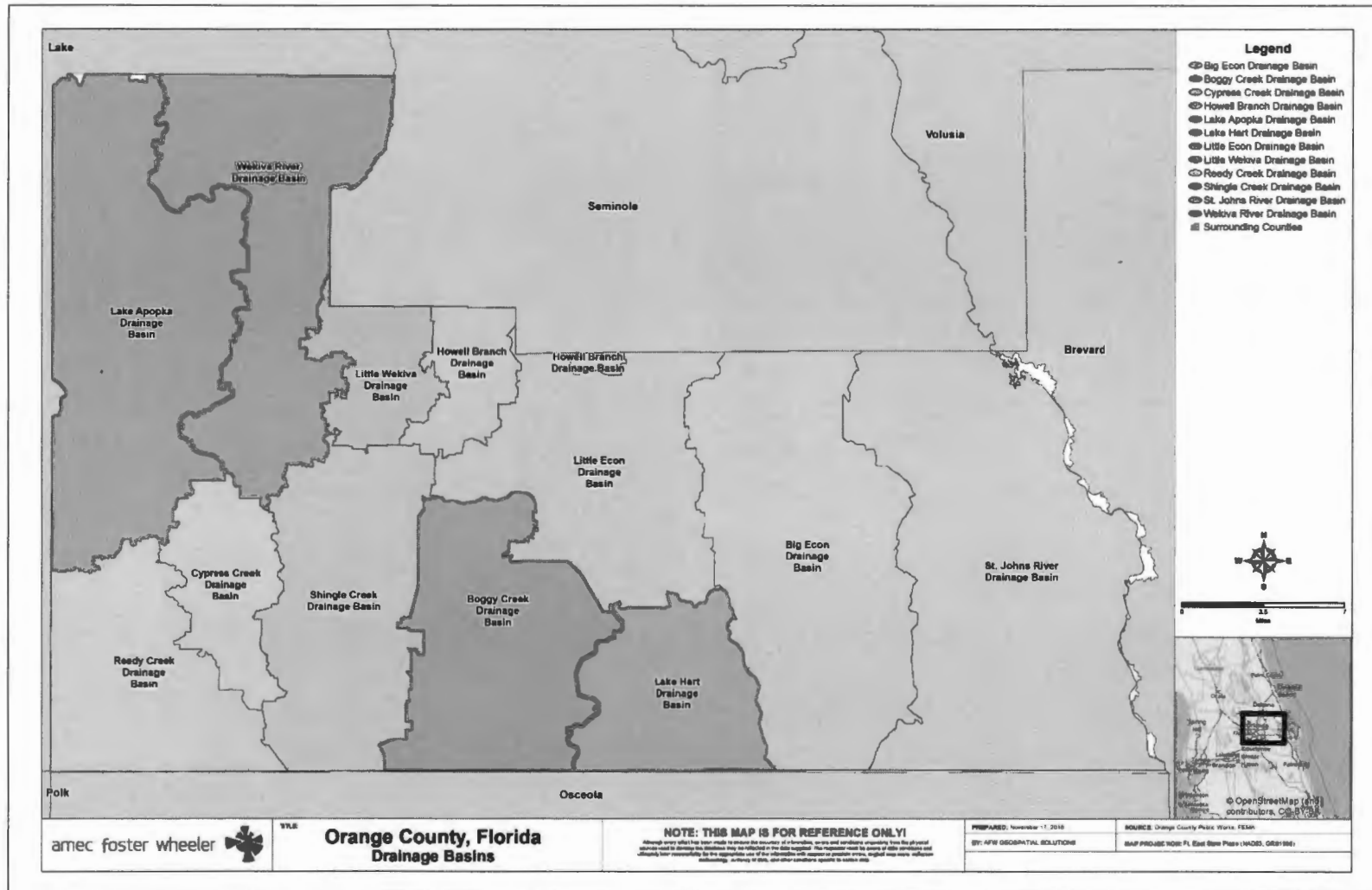


Figure 1.2 – Orange County Drainage Basins

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Temperatures in Orange County range between a peak average high of 92°F in July and August and a peak average low of 50°F in January. Orange County receives about 53.2 inches of rain per year. About 29.7 inches of that 53.2 inches fall during a 4-month “wet season” during June, July, August, and September. Rainfalls of a couple of inches in an hour are not uncommon. Floods can occur at any time of year but are most common during this rainy season. On average the county gets 104 days of rain each year.

1.3.3 Cultural, Historic and Natural Resources

Historic and Archaeological Resources

All sites and structures listed on the National Register of Historic Places for Orange County lie within incorporated municipalities.

Parks, Preserve and Conservation

Orange County has been acquiring and preserving environmentally sensitive land since the early 1990s. In 2002, Orange County formed the Green PLACE (Park Land Acquisition for Conservation and Environmental Protection) Program to formalize the land acquisition process. Though the Green PLACE Program, Orange County has purchased and preserved 22,600 acres of undeveloped, environmentally sensitive land, and has created a land management plan for each Green PLACE property.

Among Green PLACE Program lands and other Parks Department properties are natural and conservation lands, which are environmentally sensitive lands acquired and preserved primarily for environmental protection and may also afford recreational opportunities such as hiking and wildlife viewing. Orange County distinguishes conservation lands from other natural areas by defining them specifically as, at minimum, wetland areas and their adjacent uplands and/or rare habitat areas that support any threatened, endangered species, or species of concern. Table 1.1 details all natural and conservation lands in Orange County.

Table 1.1 – Natural and Conservation Lands in Orange County, FL

Park Name	Acreage	Location	Description
Natural Lands			
Charles H. Bronson State Forest	10,941	Northeast Orange County	This park is bordered on the east by the St. John’s River, a designated American Heritage River. The park allows camping, hiking, horseback riding, and fishing
Eagles Roost	232	South Orange County	A Green PLACE property that offers hiking and horseback riding trails and an observation pier at Lake Hart
Hal Scott Preserve	9,515	East Orange County	This preserve was partially acquired as mitigation for beltway construction and to protect the Econlockhatchee River. The preserve includes miles of trails for hiking, horseback riding, and bicycling, and allows fishing.
Isle of Pine Preserve	464	Southeast Orange County	Green PLACE property next to Lake Mary Jane
John’s Lake Conservation Area	138	West Orange County	Green PLACE property on Johns Lake, allowing boating, fishing, and hiking.
Long Branch	163	East Orange County	Trail system connecting the Hal Scott Preserve and the Pine Lily Preserve
Pine Lily Preserve	431	East Orange County	Green PLACE property connected to Hal Scott Preserve and Long Branch
Sandhill Preserve	83	Northwest Orange County	Small Green PLACE preserve of rare Sandhill habitat
Savage/Christmas Creek Preserve	1,126	Northeast Orange County	Green PLACE preserve with hiking trails through unique habitats

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Park Name	Acreage	Location	Description
Split Oak Preserve	1,800	South Orange County	Offers hiking and wildlife views
Conservation Lands			
Crosby Island Marsh Preserve	243	Southeast Orange County	Purchased in 2004 through the Green PLACE Program, adding to a 3000 acre wildlife corridor. This property contains Pine Flatwoods, Freshwater Marsh, and Oak Hammock habitats, as well as the littoral zone of Lake Mary Jane
Ken Bosserman Econlockhatchee River Preserve	132	Northeast Orange County	Purchased in the 1990s, this property contains Pine Flatwoods, Cypress Domes, Cypress Sloughs, and Freshwater Marsh habitats, and has the Econlockhatchee River running through it
Lake Lucie Conservation Area	166	Northwest Orange County	Purchased in 2005 through the Green PLACE Program, this property includes Oak Hammock, improved pasture, and Freshwater Marsh habitats and has high recharge value for the Floridian Aquifer
Neighborhood Lakes	1,550	Northwest Orange County	Managed by Florida DEP's Park Service and located within the Wekiva Springshed Protection Area, this property includes Freshwater March, improved pasture, Xeric Hammock, and Pine Flatwoods habitats, and it has a high recharge value for the Floridian Aquifer
Nunnally and Evans Property	18.5	East Orange County	Purchased in 2005 through the Green PLACE Program and located in the Econlockhatchee River floodplain
Sunflower and Vienna Properties	59	East Orange County	Acquired in the 1990s and located in the floodplain of the Econlockhatchee River
Pine Plantation	40	Northwest Orange County	Located in the Wekiva Springshed Protection Area, this property includes Pine Plantation habitat and has a high recharge value for the Floridian Aquifer
TM / Econ Mitigation Bank Phase IV	1336	Southeast Orange County	This property includes Oak hammock, Pine Flatwoods, Cypress Domes, Cypress Sloughs, and Freshwater Marsh habitats. It was permitted as a mitigation bank in 2003, used to offset impacts of County development projects
Ranger Parcel	80	East Orange County	This property added to the Ecological Corridor created by the Hal Scott Preserve

In total, the County Parks and Recreation Department accounts for 106 parks. In addition to the natural and conservation lands, these parks also include neighborhood parks, community parks, greenways, recreation centers, sports complexes, and boat ramps. Aside from the natural lands, these parks are located primarily in the urbanized areas of the County and provide open space and recreational uses.

Water Bodies and Floodplains

Floodplains in Orange County are generally found in lowlands along streams and lakes. The County also has a system of channelized streams and manmade canals that serve as minor flood protection but are not designed to contain the 1% annual chance flood. As can be seen in Figure 1.3, most of the County is located within the 100-year floodplain.

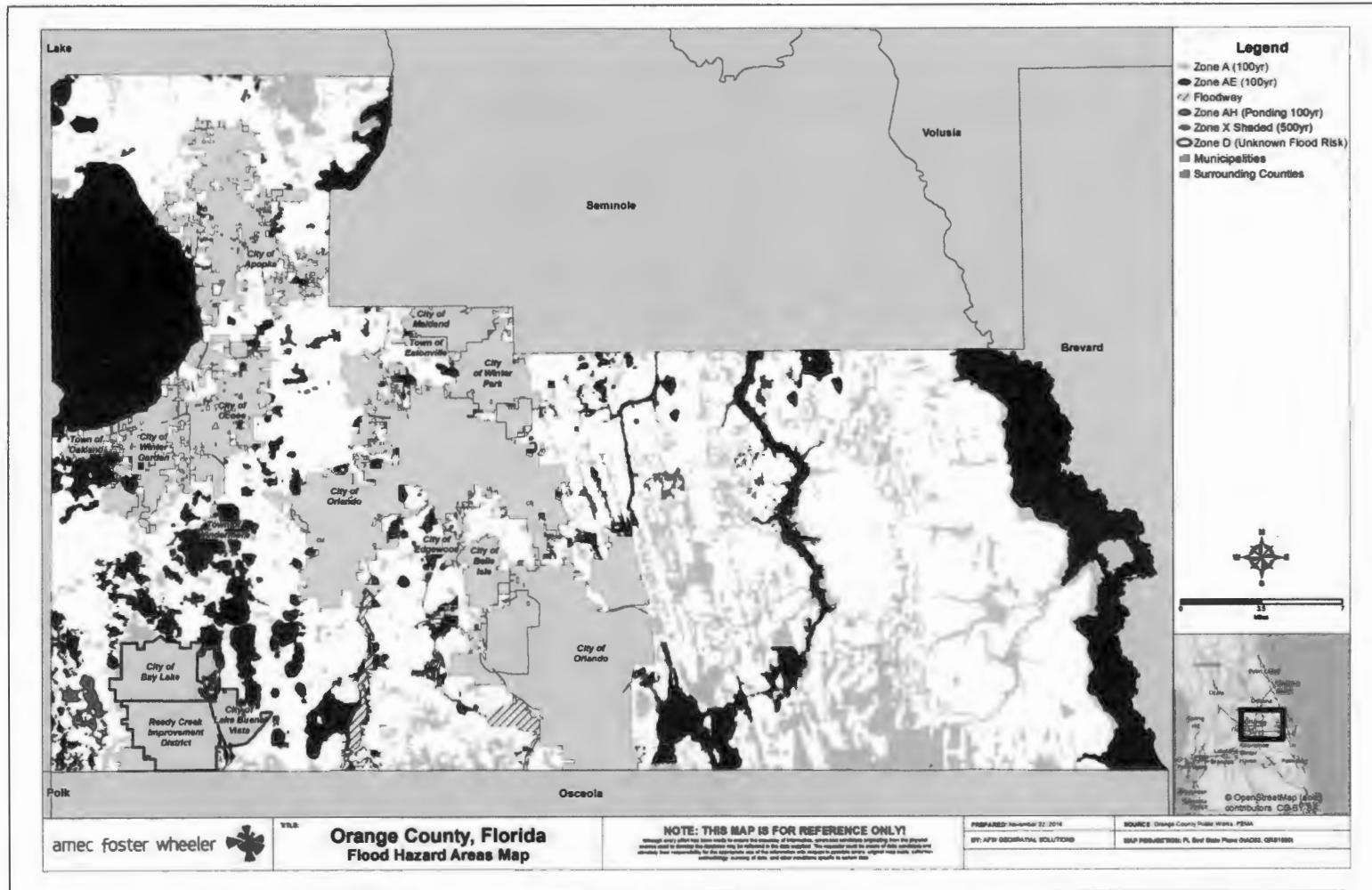


Figure 1.3 – Orange County Flood Hazard Area

Natural and Beneficial Floodplain Functions

Floodplains in riverine areas perform natural functions that cannot be replicated elsewhere. When kept open and free of development, floodplains provide the necessary flood water conveyance and flood water storage needed by a stream or river. When the floodplain is allowed to perform its natural function, flood velocities and peak flows are reduced downstream. Natural floodplains reduce wind and wave impacts and their vegetation stabilizes soils during flooding.

Floodplains in their natural state provide many beneficial functions beyond flood reduction. Water quality is improved in areas where natural cover acts as a filter for runoff and overbank flows; sediment loads and impurities are also minimized. Natural floodplains moderate water temperature, reducing the possibility of adverse impacts on aquatic plants and animals. Floodplains can act as recharge areas for groundwater and reduce the frequency and duration of low flows of surface water. They provide habitat for diverse species of flora and fauna, some of which cannot live anywhere else. They are particularly important as breeding and feeding areas.

Wetlands

As detailed in Table 1.1 above, Orange County includes large areas of environmentally sensitive lands that are wetlands. Because of the unique setting, large portions of these areas were purchased by state, federal, and private conservation groups. Approximately 92% of the conservation lands are wetlands. Naturally managed conservation lands contribute flood storage capacity, conveyance, and wind buffering protection to nearby and inland developments. Preservation of these wetlands and conservation lands are essential for maintenance of existing quality of life. The large parks and preserves were never developed and the only buildings are for conservation related purposes, e.g. park administration, land management, research, education, and staff housing. There are also deed restricted parcels that have not been developed or have been restored to natural conditions. Many of these are preserved as compensation for permitted wetland impacts.

1.3.4 History

Central Florida was initially settled after the Seminole wars, but remained sparsely inhabited until after the Civil War when handfuls of farmers and squatters began making their way south from Georgia and the Carolinas. Early pioneers farmed and ranched, eventually specializing in citrus farming by the 1870s. Central Florida became the citrus capital of the world until several years of blight and freeze in the late 1890s forced many small growers out of business leaving mainly conglomerates.

Cattle ranching is another of Orange County's oldest industries, dating back to pre-colonial time. Between the 1840s and the Civil War, the number of cattle grew rapidly after ranchers from Georgia, Alabama, and the Carolinas homesteaded over 200,000 acres in Florida. By the early 1900's, ranchers were grazing large herds of scrub cattle on the open prairies of Central Florida. Wars provided stimulus to the Florida cattle industry through increased demand for hides and meat. In the following decades, Florida became the nation's leading cattle exporter.

Citrus and cattle ranching remained the base of the Central Florida economy into the 1900s. However, after World War I, land speculation became ubiquitous, and many ranches and orange groves turned over to urbanization. Orange County weathered local economic troubles coupled with the Great Depression, and benefitted from Roosevelt's New Deal Works Progress Administration. Local WPA projects included an expansion and improvement of the airport, which served as a future economic engine to support a wartime and aviation economy and later, a growing tourism industry.

Orange County experienced a resurgence of growth after World War II, spurred by Martin Marietta's establishment of a defense plant in Orlando in 1957, the activation of the Canaveral Air Station in 1948

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and the Kennedy Space Center in 1962 in neighboring Brevard County, and the opening of Walt Disney's Disney World in 1971. These institutions stimulated a growing science, defense, and tourism economy in Orange County. The theme park industry grew particularly quickly with the subsequent establishment of SeaWorld in 1973, Disney's Epcot in 1982 and Hollywood Studios in 1989, Universal Orlando's Universal Studios in 1990, CityWalk in 1998, and Islands of Adventure in 1999 as well as SeaWorld's second park, Discovery Cove, in 2000.

1.3.5 Economy

According to the U.S. Census Bureau, the median household income for Orange County from 2010-2014 was \$47,556. 17.8% of the population is considered to be living below the poverty level. Table 1.2 shows employment and unemployment rates along with industry employment by major classification for the County. Major employers for Orange County are listed in Table 1.3.

Table 1.2 – Employment and Occupation Statistics for Orange County

Employment Status	Percentage
In Labor Force	68.2
Employed	61.1
Unemployed	7.1
Not in Labor Force	31.8
Occupation	
Management, business, science and arts	34.8
Service	21.8
Sales and office	27.6
Natural resources, construction and maintenance	6.9
Production, transportation and material moving	8.8

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Table 1.3 – Major Employers in Orange County, FL

Corporation/Organization	# of Employees
Walt Disney World Resort	74,000
Universal Orlando	20,000
Orlando Health	15,174
Lockheed Martin	7,000
Westgate Resorts	6,500

Source: Orlando Economic Development Commission, Orlando Business Journal, July 2015.

1.3.6 Population

Table 1.4 – Population Estimates for Orange County

Permanent Population (2015*)	
County Total	1,252,396
Unincorporated Orange County	799,985
Apopka	46,571
Belle Isle	6,464
Eatonville	2,246
Edgewood	2,635
Maitland	17,007
Oakland	2,624

Permanent Population (2015*)	
County Total	1,252,396
Ocoee	40,171
Orlando	262,949
Windermere	2,869
Winter Garden	39,871
Winter Park	28,967
Number of Dwelling Units (2010)**	487,839
Number of Hotel Rooms (2012)***	117,396

*Source: BEBR, University of Florida, Florida Estimates of Population 2015

**Source: U.S. Census 2010

***Source: Orange County, Metro Orlando Economic Development Commission

Table 1.5 – Orange County Demographic and Social Characteristics, 2010-2014

Demographic	
Gender/Age	
Male	49.2%
Female	50.8%
Median Age	34.2 years
Under 5 Years	6.3%
65 Years and Over	10.2%
Race/Ethnicity¹	
White	65.1%
Asian	5.0%
Black or African American	20.8%
Some other race	6.0%
Hispanic or Latino	28.2%
Education*	
High School Graduate or Higher	87.3%
Bachelor’s Degree or Higher	30.6%

Source: U.S. Census Bureau, 2010

*2010-2014 American Community Survey, 5-Year Estimates

¹Hispanics may be of any race, so also are included in applicable race categories.

Non-English Speaking Population

Over 34% of the population speaks a language other than English, and in 8% of all Orange County households, no one age 14 and older speaks English only or speaks English “very well”. The most prominent language spoken other than English is Spanish, with 24.2% of the population speaking Spanish.

Special Needs Population

Orange County provides assistance during disasters to residents with special needs, and in coordination with the Florida Division of Emergency Management (FDEM), developed a registry for residents with special needs to register for special assistance in the event of a disaster. As of 2009, according to the Orange County Local Mitigation Strategy, there were 3,726 people on this special needs registry. According to the American Community Survey, 9.9% of the Orange County population identifies as having some form of disability including hearing, vision, cognitive, ambulatory, self-care, and/or independent living difficulties.

Homeless Population

The Orange County homeless population is monitored and supported by the Homeless Services Network of Central Florida (HSNCF), which conducts an annual Point in Time (PIT) count to estimate the number of

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homeless individuals in Orange, Osceola, and Seminole Counties. As of 2015, the homeless population in these counties was estimated at 2,112 individuals, 14% of whom were unsheltered. Children make up 22% of this homeless population. The 2015 Council on Homelessness Report estimated the population in Orange County alone to be 1,396 individuals.

Inmates

Of the 799,985 people estimated in unincorporated Orange County in 2015, 2,597 are inmates, who could require special planning during a flood event depending on the location of jail facilities in the county.

Poverty

According to 2010-2014 American Community Survey Estimates, the number of people whose income was below the poverty level was 17.8% of the total County population.

1.3.7 Growth and Development Trends

The County's permanent population projections are shown in Table 1.6. According to the Orange County Comprehensive Plan, the population in the County is estimated to have increased since 2010, likely due to an increase in baby boomers looking for second homes, retirees moving to Florida, people taking advantage of lower housing prices and a slightly stronger job outlook. The population of Orange County is projected to increase by 60% between 2010 and 2045 (medium range projection).

Table 1.6 – Permanent Population Projections for Orange County, Florida

Countywide Projection	2015	2020	2025	2030	2035	2040	2045
Medium Range	1,252,396	1,407,600	1,551,400	1,679,700	1,799,100	1,908,000	2,004,000

Source: University of Florida Bureau of Economic and Business Research, January 2016

1.3.8 Land Use

As stated in the Orange County Comprehensive Plan Future Land Use Element, Orange County intends to use an Urban Service Area and Smart Growth strategies to encourage planned development within growing urban areas while discouraging sprawl in order to preserve open space and agricultural land outside the Urban Service Area. Throughout this plan, Orange County recognizes the need to balance growth and development with protection and management of natural resources and environmentally sensitive areas. In particular, the plan notes the need to protect the natural and built environment using "greenbelts, transfer of development rights, storm water management, water-wise development standards, and preservation of ecosystems through open space linkages." The County's Infill Master Plan also supports protection and management of open space by identifying opportunities for infill.

Figures 1.4 and 1.5 reflect existing and future land use within Orange County. The future land use map provides a number of additional land use classifications, such as preservation, conservation, planned development and traditional neighborhood, which will assist in growth management and the prevention of sprawl into sensitive areas.

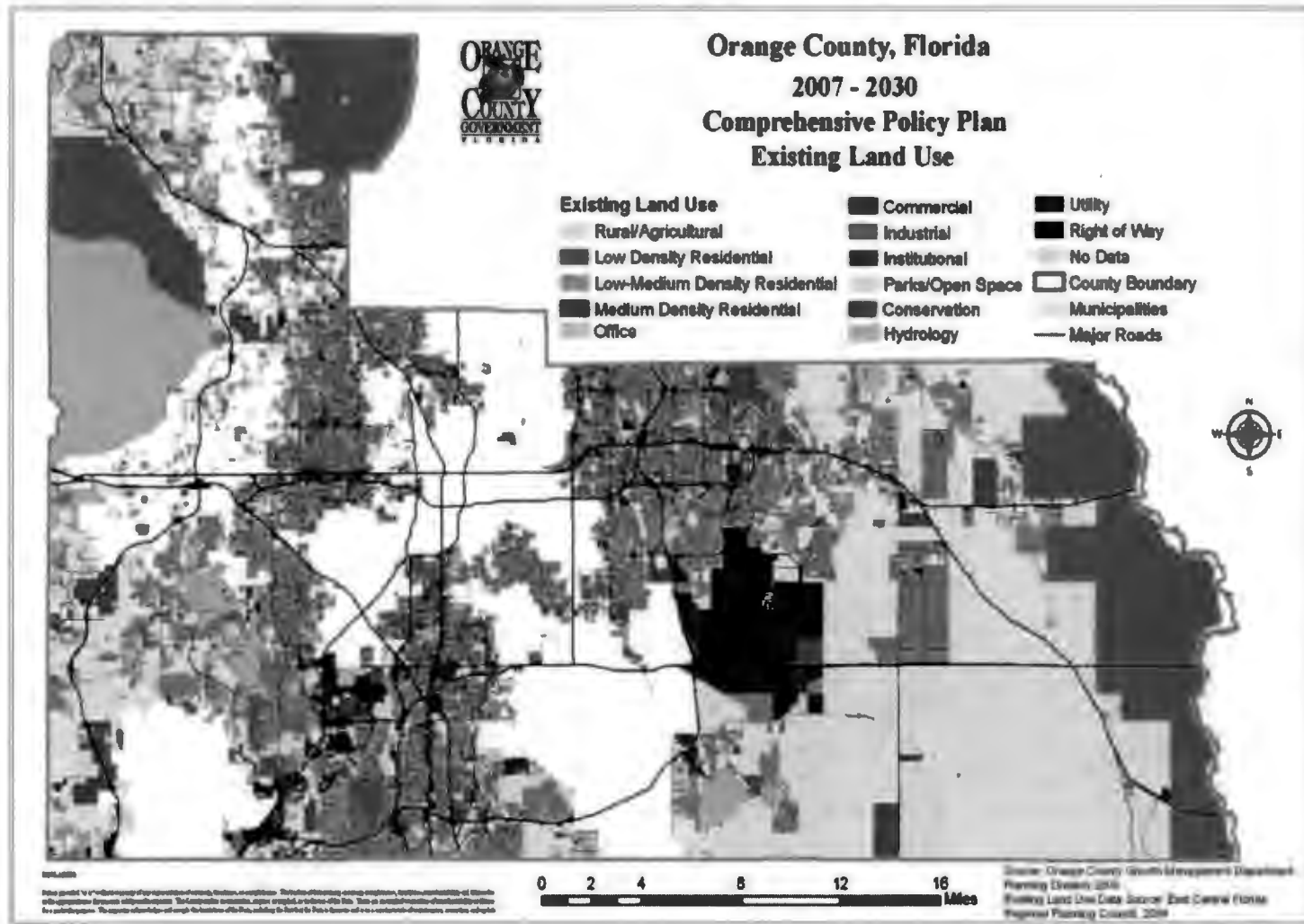


Figure 1.4 – Orange County Existing Land Use Map

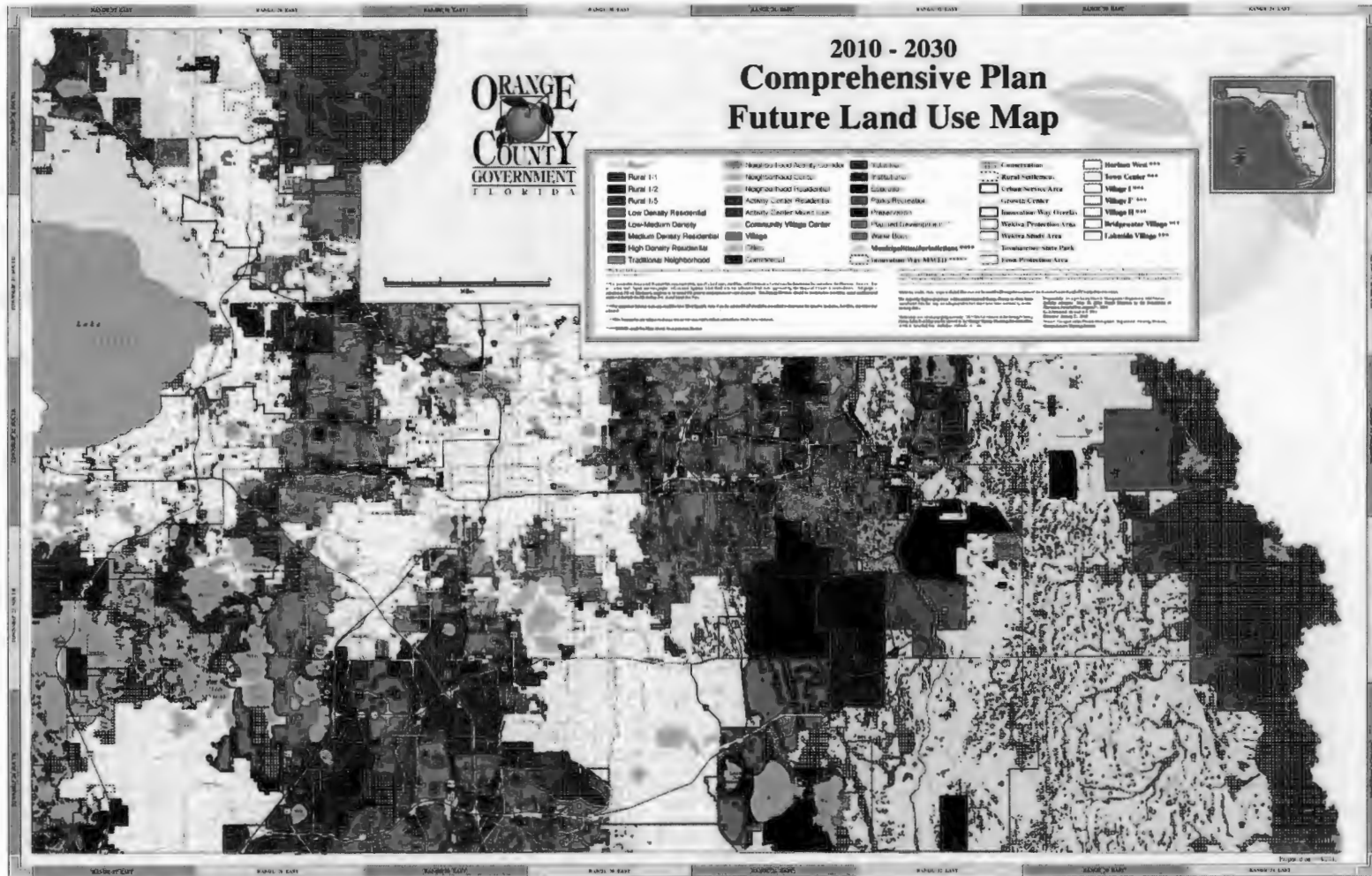


Figure 1.5 – Orange County Future Land Use Map

1.4 Plan Organization

The Orange County Floodplain Management Plan is organized as follows:

- ▶ Chapter 2: Planning Process
- ▶ Chapter 3: Hazard Identification
- ▶ Chapter 4: Hazard Profiles
- ▶ Chapter 5: Vulnerability Assessment
- ▶ Chapter 6: Capability Assessment
- ▶ Chapter 7: Mitigation Strategy
- ▶ Chapter 8: Plan Adoption
- ▶ Chapter 9: Plan Implementation and Maintenance
- ▶ Appendix A: Planning Process
- ▶ Appendix B: Mitigation Strategy
- ▶ Appendix C: References

2 PLANNING PROCESS

44 CFR Subsection D §201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- 1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- 2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
- 3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

44 CFR Subsection D §201.6(c)(1): The plan shall include the following:

- 1) Documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

This Floodplain Management Plan was developed under the guidance of a Floodplain Management Planning Committee (FMPC). The Committee's representatives included representatives of Orange County, state agencies, stakeholder organizations, citizens and other community members.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by floods.

2.1 Local Government Participation

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- ▶ Participate in the process as part of the FMPC;
- ▶ Detail where within the planning area the risk differs from that facing the entire area;
- ▶ Identify potential mitigation actions; and
- ▶ Formally adopt the plan.

For the Orange County FMPC, "participation" meant the following:

- ▶ Providing facilities for meetings;
- ▶ Attending and participating in the FMPC meetings;
- ▶ Completing and returning the Amec Foster Wheeler Data Collection Guide;
- ▶ Collecting and providing other requested data (as available);
- ▶ Managing administrative details;
- ▶ Making decisions on plan process and content;
- ▶ Identifying mitigation actions for the plan;
- ▶ Reviewing and providing comments on plan drafts;
- ▶ Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan;
- ▶ Coordinating, and participating in the public input process; and
- ▶ Coordinating the formal adoption of the plan by the County Commission.

CHAPTER 2: PLANNING PROCESS

The FMPC met all of the above stated participation requirements. The FMPC included key representatives from County Departments/Divisions including the Planning Division, which is responsible for community planning, as well as external organizations and citizen volunteers. The participants comprising the Orange County FMPC included the following:

- Jason Taylor – Orange County Emergency Management
- Daniel Negron – Orange County Stormwater
- Amy Bradbury – Orange County Planning Division
- Gregory Golgowski – Orange County Planning Division
- Nadia Vanderhoof – Orange County Communications
- Kelsie Davis – Red Cross
- Bill Graf – South Florida Water Management District (SFWMD)
- Michelle Cechowski – East Central Florida Regional Planning Council (ECFRPC)
- Eric Alberts – Orlando Health, Inc

In addition to these committee members, another representative of the Orange County Stormwater Division, Mike Drozek, served in an advisory capacity to the committee.

Table 2.1 details the FMPC meeting dates and the FMPC members in attendance. A more detailed summary of FMPC meeting dates including topics discussed and meeting locations follows in Table 2.4. During the planning process, the FMPC members communicated through face-to-face meetings, email and telephone conversations. Draft documents were posted on the County website so that the FMPC members could easily access and review them. Although all FMPC members could not be present at every meeting, coordination was ongoing throughout the entire planning process through emails and phone conversations and by direct contact with the Orange County Stormwater Division. Meeting minutes and sign-in sheets are included in Appendix A.

Table 2.1 – FMPC Meeting Attendance Record

Member Name	Affiliation	Meeting Date					
		10/24/16	11/30/16	1/19/17	3/23/17	8/7/17	12/18/17
Jason Taylor	Orange County	✓	✓	✓			✓
Daniel Negron	Orange County	✓	✓	✓	✓	✓	✓
Amy Bradbury	Orange County	✓	✓	✓	✓	✓	
Gregory Golgowski ¹	Orange County						✓
Nadia Vanderhoof ²	Orange County						
Kelsie Davis	Red Cross	✓	✓	✓			
Bill Graf	SFWMD	✓	✓		✓		
Michelle Cechowski	ECFRPC	✓					✓
Eric Alberts	Orlando Health, Inc.	✓	✓	✓		✓	✓

¹Filled in at final meeting for Amy Bradbury and is not counted as a County representative

²Communicated via phone and email throughout planning process

Based on the area of expertise of each County representative participating on the FMPC, Table 2.2 demonstrates each member's expertise in the six mitigation categories (Prevention, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects and Public Information).

Table 2.2 – Staff Capability with Six Mitigation Categories

Community Department	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Flood Control Projects	Public Information	Other
Orange County Stormwater Management	✓	✓	✓		✓	✓	
Orange County Planning Division	✓	✓	✓		✓	✓	✓
Orange County Communications						✓	
Orange County Emergency Management	✓			✓		✓	

Appendix A provides additional information and documentation of the planning process that was implemented for the development of this FMP.

2.2 The 10-Step Planning Process

The planning process for preparing the Orange County Floodplain Management Plan was based on DMA planning requirements and FEMA’s associated guidance which is structured around a four-phase process. Into this process, Orange County integrated a more detailed 10-step planning process used for FEMA’s CRS and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the requirements of five major programs: FEMA’s Hazard Mitigation Grant Program; Pre-Disaster Mitigation Program; Flood Mitigation Assistance Program; Community Rating System; and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 2.3 shows how the 10-step CRS planning process (CRS Manual Activity 510) aligns with the four phases of hazard mitigation planning pursuant to the Disaster Mitigation Act of 2000.

Table 2.3 – Mitigation Planning and CRS 10-Step Process Reference Table

DMA Process (CFR 44 Subsection D)	CRS Process
Phase I – Planning Process	
§201.6(c)(1)	Step 1. Organize to Prepare the Plan
§201.6(b)(1)	Step 2. Involve the Public
§201.6(b)(2) & (3)	Step 3. Coordinate
Phase II – Risk Assessment	
§201.6(c)(2)(i)	Step 4. Assess the Hazard
§201.6(c)(2)(ii) & (iii)	Step 5. Assess the Problem
Phase III – Mitigation Strategy	
§201.6(c)(3)(i)	Step 6. Set Goals
§201.6(c)(3)(ii)	Step 7. Review Possible Activities
§201.6(c)(3)(iii)	Step 8. Draft an Action Plan
Phase IV – Plan Maintenance	
§201.6(c)(5)	Step 9. Adopt the Plan
§201.6(c)(4)	Step 10. Implement, Evaluate and Revise the Plan

The development of this FMP involved a comprehensive review of all flood hazards specific to Orange County. Also to be noted, this plan provides an analysis of climate change impacts to the County.

2.2.1 Phase I – Planning Process

2.2.1.1 Planning Step 1: Organize to Prepare the Plan

With Orange County’s commitment to participate in the DMA planning process and the CRS, County officials worked to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational aspects of the plan development process.

In addition to County representatives, invitations to participate on the FMPC were extended to City and Town officials, citizens, and federal, state, and local stakeholders that might have an interest in participating in the planning process. The list of initial invitees is included in Appendix A. The following local stakeholders were invited to participate on the FMPC:

Neighboring Communities

City of Winter Park Planning & Community Development
City of Ocoee Engineering
City of Belle Isle City Clerk
City of Orlando Emergency Manager
City of Winter Garden Community Development Director
Town of Windermere Town Manager
Town of Oakland Public Works Director
Reedy Creek Improvement District
City of Maitland, Community Development Director
City of Edgewood City Clerk
City of Apopka Planning Manager
Town of Eatonville
Ranger Drainage District

State and Federal Government

FEMA Region IV CRS Coordinator
FEMA Region IV NFIP Coordinator
FEMA Region IV Floodplain Management and Insurance Branch Chief
Florida Division of Emergency Management - NFIP Program Manager
Florida Forest Service
ISO CRS Specialist
Florida Fish and Wildlife Conservation Commission
Saint Johns River Water Management District
South Florida Water Management District

Educational Institutions

Orange County Public Schools
University of Central Florida
Valencia College
Rollins College

Other Stakeholder Representatives

Wedgfield Homeowners Association
Vista Lakes Community Development District
Greater Orlando Aviation Authority
Universal Orlando
MetroPlan Orlando

Orange County, Florida

Floodplain Management Plan
December 2017

CHAPTER 2: PLANNING PROCESS

Coastal Reconstruction Orange County Neighborhood Preservation & Revitalization

The planning process officially began with a kick-off meeting held on October 24, 2016 at 10:00 am in the Orange County Public Works Administration building, followed by a public kick-off meeting held the same day at 6 pm in the same building. The meetings covered the scope of work and an introduction to the DMA, CRS, and FMA requirements. Public notices were posted in the local newspaper (Orlando Sentinel) and the County website inviting members of the public to attend this kickoff meeting.

During the planning process, the FMPC communicated via face-to-face meetings, email and telephone. Draft documents were posted on the County's website so that the FMPC members could easily access and review them. The formal FMPC meetings followed the CRS Planning Steps. Meeting minutes and sign-in sheets for the FMPC meetings are included in Appendix A. The meeting dates and topics discussed are summarized below in Table 2.4. All FMPC meetings were open to the public.

Table 2.4 – Summary of FMPC Meeting Dates

Meeting Type	Meeting Topic	Meeting Date	Meeting Location
FMPC #1 (Kick-off)	1) Introduction to DMA, CRS and the planning process	10/24/2016 10:00 – 11:00 a.m.	Orange County Public Works Administration Bldg., Room 322
	2) Organize resources: the role of the FMPC, planning for public involvement, and coordinating with other agencies and stakeholders		
	3) Introduction to hazard identification		
FMPC #2	1) Determine critical facilities	11/30/2016 2:00 – 3:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	2) Develop areas of localized flooding concern		
	3) Select PPI target areas and audiences		
FMPC #3	1) Review/discussion of flood hazard profiles	1/19/2017 1:00 – 2:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	2) Review/discussion of vulnerability assessment		
	3) Review of existing Goals from Local Mitigation Strategy and Comprehensive Plan		
FMPC #4	1) Review and develop goals	3/23/2017 1:30 – 2:30 p.m.	Orange County Public Works Administration Bldg., Room 322
	2) Discuss community capability		
	3) Develop PPI projects		
FMPC #5	1) Review HIRA and capability	8/7/2017 3:00 – 4:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	2) Develop mitigation strategies		
FMPC #6	1) Review "Draft" Floodplain Management Plan	12/18/2017 2:00 – 3:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	2) Solicit comments and feedback from the FMPC		

CHAPTER 2: PLANNING PROCESS

2.2.1.2 Planning Step 2: Involve the Public

Early discussions with the FMPC established the initial plan for public involvement. The FMPC agreed to an approach using established public information mechanisms and resources within the community. Public involvement activities for this plan update included press releases, stakeholder and public meetings, public surveys, and the collection of public and stakeholder comments on the draft plan. The formal public meetings for this project are summarized in Table 2.5.

Table 2.5 – Summary of Public Meeting Dates

Meeting Type	Meeting Topic	Meeting Date	Meeting Locations
Public Meeting #1	1) Introduction to DMA, CRS and the planning process	10/24/2016 6:00 – 8:00 p.m.	Orange County Public Works Administration Bldg., Main Conference Room
	2) Introduction to hazard identification		
Public Meeting #2	1) Review complete “Draft” Floodplain Management Plan	12/18/2017 6:15 – 8:15 p.m.	Hunters Creek Middle School Cafeteria 13400 Town Loop Blvd, Orlando, FL 32837
	2) Solicit comments and feedback from the public		

Public outreach for the plan development began during the initial plan development process with an informational press release placed in the local paper and an announcement on the County website calendar inviting the public to the first public meeting held on October 24, 2016. The final public meeting, held on December 18, 2017, was also advertised in the local newspaper and County website. Documentation to support the public outreach efforts can be found in Appendix A.

Involving the Public beyond Holding Public Meetings

The plan development process included additional public outreach activities beyond the formal public meetings as summarized below in Table 2.6. The FMPC found seven different ways to involve the public beyond attending public meetings. Documentation to support the additional public outreach efforts can be found in Appendix A.

Table 2.6 – Public Outreach Efforts

	Location	Event/Message	Date
1	Orlando Sentinel	News article advertising first public meeting and explaining CRS program and the County’s other floodplain management efforts	October 2016
2	Wedgfield HOA website	News announcement posted on website publicizing public meeting and explaining CRS program and the County’s other floodplain management efforts	October 2016
3	Orange County Website	Flood survey posted on website to gather public input	March 2017
4	Hurricane Expo	Distributed copies of draft HIRA and public survey; discussed flood risk and preparedness; discussed floodplain management planning process	June 2017
5	Orange County website	Draft HIRA posted on County website for public review and comment.	July 2017
6	Orange County website	Draft FMP posted on County website for public review and comment	December 2017
7	Homeowners Associations	Conducted outreach to Peppermill, Hunters Creek, Falcon Trace, Whisper Lakes, and Deefield HOAs prior to the final public meeting for the plan.	December 2017

CHAPTER 2: PLANNING PROCESS

The Orange County public survey which requested public input into the floodplain management plan planning process and the identification of mitigation activities that could lessen the risk and impact of future flood hazard events is shown in Figure 2.1. A summary of the completed survey results has been included in Appendix A.

ORANGE COUNTY
FLOODPLAIN MANAGEMENT PLAN QUESTIONNAIRE

We need your help! Orange County is working to become less vulnerable to flooding, and your participation is important to us! The County is preparing a Floodplain Management Plan. This Plan will identify and assess our community's flood hazard risks and determine how to best minimize or manage those risks and what outreach materials may be necessary to better communicate those risks.

This survey is an opportunity for you to share your opinions and participate in the mitigation planning process. The information you provide will help us better understand your flood concerns and can lead to mitigation activities that help lessen the impacts of future hazard events.

BACKGROUND INFORMATION

1. Where do you live?
 Unincorporated Orange County Other: _____

FLOOD INFORMATION

2. Have you ever experienced or been impacted by high water or flooding in Orange County?
 Yes
 No
 a. If "Yes," please explain: _____

3. How concerned are you about the possibility of your community being impacted by flooding?
 Extremely concerned
 Somewhat concerned
 Not concerned

4. Is your home located in a Federal Emergency Management Agency (FEMA) Floodplain?
 Yes
 No
 I don't know

5. Do you have flood insurance for your home/personal property?
 Yes
 No
 I don't know
 a. If "No," why not?
 My home is not located in a floodplain I never really considered it
 I rent I don't need it because my home is elevated or otherwise protected
 It's too expensive I don't need it because it never floods
 Other (please explain): _____

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MITIGATION ACTIONS

6. Have you taken any actions to protect your home from flood damage?
 Yes
 No
 b. If "Yes," please explain: _____

7. Do you know what government agency/office to contact regarding the risks associated with flooding?
 Yes
 No

8. What is the most effective way for you to receive information about how to make your home or neighborhood more resistant to flood damage?
 Newspaper Mail
 Television advertising or programs Email
 Radio advertising or programs Orange County website
 Public workshops/meetings Social media
 School meetings
 Other (please explain): _____

9. What are some steps your local government could take to reduce the risk of flooding in your neighborhood?

THANK YOU FOR YOUR PARTICIPATION:
 This survey may be submitted anonymously; however, if you provide us with your name and contact information before we will have the ability to follow up with you to learn more about your ideas or concerns and inform you of future opportunities to participate (optional):

Name: _____
 Address: _____
 Phone: _____ E-mail: _____

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Figure 2.1 – Orange County Public Survey

2.2.1.3 Planning Step 3: Coordinate

Early in the planning process, the FMPC determined that the risk assessment, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. A list of stakeholders invited to participate on the FMPC is included above under Planning Step 1.

Coordination involved contacting these agencies through a variety of mechanisms and informing them on how to participate in the plan development process. Coordination with these groups included holding face-to-face meetings and sending outreach letters. All of these groups and agencies were solicited asking for their assistance and input and telling them how to become involved in the plan development process. A sample coordination letter can be found in Appendix A along with a summary list of all stakeholders and their mailing addresses.

Coordination with Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. Orange County uses a variety of comprehensive planning mechanisms, such as a Growth Management Plan and land development regulations and ordinances to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans,

CHAPTER 2: PLANNING PROCESS

studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

Table 2.7 – Summary of Existing Studies and Plans Reviewed

Resource Referenced	Use in this Plan
Orange County Florida Comprehensive Plan, 2016	<ul style="list-style-type: none"> • identify growth and development trends and goals • develop community profile • develop HIRA, capability assessment, and mitigation strategy
Orange County Code of Ordinances, including: Zoning Ordinance, Subdivision Regulations, Open Space Ordinance, Floodplain Management Ordinance, Stormwater Management Ordinance	<ul style="list-style-type: none"> • develop capability assessment • develop mitigation strategy
Orange County Local Mitigation Strategy, 2009 and 2016	<ul style="list-style-type: none"> • identify flood hazards and develop hazard profiles • develop capability assessment • develop mitigation strategy
Orange County Stormwater Management Report, 2014	<ul style="list-style-type: none"> • develop HIRA • develop capability assessment • develop mitigation strategy
Orange County Sustainability Plan, 2015	<ul style="list-style-type: none"> • develop mitigation strategy
Orange County Infill Master Plan, 2008	<ul style="list-style-type: none"> • identify growth and development trends
State of Florida Hazard Mitigation Plan, August 2013	<ul style="list-style-type: none"> • identify flood hazards
State of Florida Critical Erosion Report, June 2012	<ul style="list-style-type: none"> • develop HIRA
Emergency Action Plan for Michaels, Banner, and Cheney Dams	<ul style="list-style-type: none"> • develop HIRA • develop mitigation strategy
Orange County Flood Insurance Study, 2009	<ul style="list-style-type: none"> • identify flooding sources and SFHAs – used to prepare the 100-/500-year flooding vulnerability assessment
Orange County Flood Insurance Study, 2015	<ul style="list-style-type: none"> • identify flooding sources
Orange County Capital Improvement Program, FY2016-2020	<ul style="list-style-type: none"> • develop capability assessment • develop mitigation strategy
FEMA/ISO – Repetitive Loss and Flood Insurance Data	<ul style="list-style-type: none"> • develop HIRA • develop mitigation strategy
Orange County Comprehensive Emergency Management Plan, 2013	<ul style="list-style-type: none"> • develop capability assessment • develop mitigation strategy

These and other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Data from these plans and ordinances were incorporated into the risk assessment and hazard vulnerability sections of the plan as appropriate. The data was also used in determining the capability of the community in being able to implement certain mitigation strategies. The Capability Assessment can be found in Section 6.

2.2.2 Phase II – Risk Assessment

Planning Steps 4 and 5: Identify/Assess the Hazard and Assess the Problem

The FMPC completed a comprehensive effort to identify/update, document, and profile all flood hazards that have, or could have, an impact on the planning area including an evaluation of climate change impacts

on flooding. Data collection worksheets were developed and used in this effort to aid in determining hazards and vulnerabilities and where the risk varies across the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. A draft of the risk and vulnerability assessment was posted on the County's website for FMPC and public review and comment.

The FMPC also conducted a capability assessment to review and document the planning area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the FMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Section 4 Hazard Profiles and Section 5 Vulnerability Assessment.

2.2.3 Phase III – Mitigation Strategy

Planning Steps 6 and 7: Set Goals and Review Possible Activities

Amec Foster Wheeler facilitated brainstorming and discussion sessions with the FMPC that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Section 7 Mitigation Strategy. Additional documentation on the process the FMPC used to develop the goals and strategy has been included in Appendix B.

Planning Step 8: Draft an Action Plan

A complete first draft of the plan was prepared based on input from the FMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7. This complete draft was posted for FMPC and public review and comment on the County's website. Other agencies were invited to comment on this draft as well. FMPC, public and agency comments were integrated into the final draft for the FDEM and FEMA Region IV to review and approve, contingent upon final adoption by Orange County.

2.2.4 Phase IV – Plan Maintenance

Planning Step 9: Adopt the Plan

To secure buy-in and officially implement the plan, the plan will be reviewed and adopted by the Board of County Commissioners. An example resolution is shown in Section 8 Plan Adoption.

Planning Step 10: Implement, Evaluate and Revise the Plan

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. Up to this point in the planning process, all of the FMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Section 9 Plan Implementation and Maintenance provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The Section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

3 HAZARD IDENTIFICATION

44 CFR Subsection D §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Chapter 3 identifies the flood hazards that may affect Orange County, FL Unincorporated Areas. This chapter also describes the Risk Assessment process for the development of the Orange County Floodplain Management Plan. It describes how the FMPC met the following requirements from the 10-step planning process:

- ▶ Planning Step 4: Assess the Hazard
- ▶ Planning Step 5: Assess the Problem

As defined by FEMA, risk is a “the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.” Risk is a combination of hazard, vulnerability, and exposure.

The flood risk assessment covers the entire geographical area of the unincorporated areas of Orange County, FL. The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction’s potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events. This risk assessment followed the methodology described in the FEMA publication “Understanding Your Risks—Identifying Hazards and Estimating Losses” (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:



Data collected through this process has been incorporated into the following sections of this chapter:

- ▶ **Chapter 3: Hazard Identification** identifies the natural and man-made hazards that threaten the planning area.
- ▶ **Chapter 4: Hazard Profiles** discusses the threat to the planning area and describes previous occurrences of hazard events and the likelihood of future occurrences.
- ▶ **Chapter 5: Vulnerability Assessment** assesses the planning area’s exposure to the hazards; considering assets at risk, critical facilities, and future development trends.
- ▶ **Chapter 6: Capability Assessment** inventories existing mitigation activities and policies, regulations, and plans that pertain to mitigation and can affect net vulnerability.

Using existing flood hazard data and input gained through planning meetings, the FMPC conducted a hazard identification study to determine and agree upon a list of natural flood hazards that could affect Orange County. Flood hazard data from the Orange County Local Mitigation Strategy (LMS), State of Florida Hazard Mitigation Plan, FEMA, the Florida Division of Emergency Management (FDEM), the National Oceanic and Atmospheric Administration (NOAA), and many other sources were examined to assess the significance of these hazards to the planning area. Significance was measured in general terms

CHAPTER 3: HAZARD IDENTIFICATION

and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries, as well as property and economic damage.

The FMPC also researched past events that resulted in a federal and/or state emergency or disaster declaration in the planning area for Orange County in order to identify and update known flood hazards. Table 3.1 displays flood related major disaster declarations that the state of Florida has received since 1960. This table reflects the vulnerability and historic patterns of flood hazards for Florida.

Table 3.1 – FEMA Major Disaster Declarations for Florida, 1960–2017

Hazard Type	Disaster #	Date
Severe Weather	97	3/23/1960
Hurricane Donna	106	9/12/1960
Abnormally High Tides	141	12/17/1962
Hurricane Cleo	175	9/8/1964
Hurricane Dora	176	9/10/1964
Hurricane Betsy	209	9/14/1965
Hurricane Gladys	252	11/7/1968
Heavy Rains, Flooding	289	7/3/1970
Tropical Storm Agnes	337	6/23/1972
Severe Storms, Flooding	387	5/26/1973
Flooding	479	8/22/1975
High Winds, Heavy Rains, Flooding	484	9/26/1975
Severe Winter Weather	526	1/31/1977
Severe Storms, Tornadoes, Flooding	586	5/15/1979
Hurricane Frederic	600	9/13/1979
Severe storms, flooding	607	9/29/1979
Severe storms, flooding	664	7/7/1982
Hurricane Elena	743	9/12/1985
Hurricane Kate	756	12/3/1985
Flooding, Severe Storm	862	4/3/1990
Flooding, Severe Storm	952	8/14/1992
Hurricane Andrew	955	8/24/1992
Flooding, Severe Storm, Tornadoes	966	10/8/1992
Tornadoes, Flooding, High Winds, Tides, Freezing	982	3/13/1993
Severe Storm, Flooding, Tropical Storm Alberto	1035	7/10/1994
Tropical Storm Gordon, Heavy Rain, Tornadoes, Flooding	1043	11/28/1994
Hurricane Erin	1062	8/10/1995
Hurricane Opal	1069	10/4/1995
Severe Storm, Flooding	1074	10/27/1995
Severe Storms/Flooding	1141	10/15/1996
Severe Thunderstorms, Tornadoes and Flooding	1204	2/12/1998
Hurricane Earl	1241	9/4/1998
Hurricane Georges	1249	9/28/1998
Tropical Storm Mitch	1259	11/6/1998
Hurricane Floyd	1300	9/22/1999

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Hazard Type	Disaster #	Date
Hurricane Irene	1306¹	10/20/1999
Tropical Storm	1344	10/3/2000
Heavy Rains And Flooding	1345	10/4/2000
Tropical Storm Allison	1381	6/17/2001
Tropical Storm Gabrielle	1393	9/28/2001
Severe Storms and Flooding	1481	7/29/2003
Hurricane Charley and Tropical Storm Bonnie	1539¹	8/13/2004
Hurricane Frances	1545¹	9/4/2004
Hurricane Ivan	1551¹	9/16/2004
Hurricane Jeanne	1561¹	9/26/2004
Hurricane Dennis	1595	7/10/2005
Hurricane Katrina	1602	8/28/2005
Hurricane Wilma	1609	10/24/2005
Severe Storms and Tornadoes	1679	2/3/2007
Severe Storms, Tornadoes, and Flooding	1680	2/8/2007
Tropical Storm Fay	1785¹	8/24/2008
Hurricane Gustav	1806	10/27/2008
Severe Storms, Flooding, Tornadoes, and Straight-line Winds	1831	4/21/2009
Severe Storms, Flooding, Tornadoes, and Straight-line Winds	1840	5/27/2009
Tropical Storm Debby	4068	7/3/2012
Hurricane Isaac	4084	10/18/2012
Severe Storms and Flooding	4138	8/2/2013
Severe Storms, Tornadoes, Straight-line Winds, and Flooding	4177	5/6/2014
Hurricane Hermine	4280	9/28/2016
Hurricane Matthew	4283	10/8/2016
Hurricane Irma	4337	09/10/2017

Source: FEMA

¹Disaster Declaration includes Orange County.

A review of the major disaster declaration for Florida indicates that Orange County was included in eight of the flood related federal disaster declarations between 1960 and 2017. Individual Assistance (IA) dollars provide money and services to people in presidentially declared disaster areas. Public Assistance (PA) dollars are made available for communities to quickly respond to and recover from major disasters. Total dollars obligated shown in Table 3.2 below is inclusive of all counties included in the disaster declaration.

Table 3.2 – FEMA Major Disaster Declarations in Florida including Orange County, 1960-2017

Hazard Type	Disaster #	Date	Received Individual Assistance Declaration?	Individual Assistance Dollars Obligated ¹	Received Public Assistance Declaration?	Public Assistance Dollars Obligated ¹
Hurricane Irene	DR-1306	10/20/1999	Yes	N/A	No	\$106,549,390
Counties Included:	IA: Brevard County, Broward County, Collier County, Glades County, Hendry County, Highlands County, Indian River County, Martin County, Monroe County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Polk County, Saint Lucie County, Seminole County and Volusia County.					

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Hazard Type	Disaster #	Date	Received Individual Assistance Declaration?	Individual Assistance Dollars Obligated ¹	Received Public Assistance Declaration?	Public Assistance Dollars Obligated ¹
Hurricane Charley and Tropical Storm Bonnie	DR-1539	08/13/2004	Yes	\$208,970,754	Yes (PA-A & B)	\$612,142,181
Counties Included:	<p>IA: Brevard County, Charlotte County, Collier County, DeSoto County, Dixie County, Duval County, Flagler County, Glades County, Hardee County, Hendry County, Highlands County, Indian River County, Lake County, Lee County, Levy County, Manatee County, Monroe County, Okeechobee County, Orange County, Osceola County, Pasco County, Polk County, Saint Johns County, Sarasota County, Seminole County and Volusia County.</p> <p>PA: Alachua County, Baker County, Bay County, Bradford County, Brevard County, Broward County, Calhoun County, Charlotte County, Citrus County, Clay County, Collier County, Columbia County, DeSoto County, Dixie County, Duval County, Escambia County, Flagler County, Franklin County, Gadsden County, Gilchrist County, Glades County, Gulf County, Hamilton County, Hardee County, Hendry County, Hernando County, Highlands County, Hillsborough County, Holmes County, Indian River County, Jackson County, Jefferson County, Lafayette County, Lake County, Lee County, Leon County, Levy County, Liberty County, Madison County, Manatee County, Marion County, Martin County, Miami-Dade County, Monroe County, Nassau County, Okaloosa County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Pinellas County, Polk County, Putnam County, Saint Johns County, Saint Lucie County, Santa Rosa County, Sarasota County, Seminole County, Sumter County, Suwannee County, Taylor County, Union County, Volusia County, Wakulla County, Walton County and Washington County.</p>					
Hurricane Frances	DR-1545	09/04/2004	Yes	\$411,862,738	Yes (PA-A & B)	\$677,307,267
Counties Included:	<p>IA: Alachua County, Baker County, Bradford County, Brevard County, Broward County, Charlotte County, Citrus County, Clay County, Columbia County, DeSoto County, Dixie County, Duval County, Flagler County, Gilchrist County, Glades County, Hardee County, Hendry County, Hernando County, Highlands County, Hillsborough County, Indian River County, Lake County, Lee County, Levy County, Manatee County, Marion County, Martin County, Miami-Dade County, Nassau County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Pinellas County, Polk County, Putnam County, Saint Johns County, Saint Lucie County, Sarasota County, Seminole County, Sumter County, Suwannee County, Union County and Volusia County.</p> <p>PA: Alachua County, Baker County, Bay County, Bradford County, Brevard County, Broward County, Calhoun County, Charlotte County, Citrus County, Clay County, Collier County, Columbia County, DeSoto County, Dixie County, Duval County, Escambia County, Flagler County, Franklin County, Gadsden County, Gilchrist County, Glades County, Gulf County, Hamilton County, Hardee County, Hendry County, Hernando County, Highlands County, Hillsborough County, Holmes County, Indian River County, Jackson County, Jefferson County, Lafayette County, Lake County, Lee County, Leon County, Levy County, Liberty County, Madison County, Manatee County, Marion County, Martin County, Miami-Dade County, Monroe County, Nassau County, Okaloosa County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Pinellas County, Polk County, Putnam County, Saint Johns County, Saint Lucie County, Santa Rosa County, Sarasota County, Seminole County, Sumter County, Suwannee County, Taylor County, Union County, Volusia County, Wakulla County, Walton County and Washington County.</p>					
Hurricane Ivan	DR-1551	09/16/2004	Yes	\$164,517,308	No	\$695,151,280
Counties Included:	<p>IA: Bay County, Brevard County, Calhoun County, Citrus County, Clay County, Duval County, Escambia County, Flagler County, Franklin County, Gadsden County, Gulf County, Highlands County, Holmes County, Indian River County, Jackson County, Lake County, Lee County,</p>					

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Hazard Type	Disaster #	Date	Received Individual Assistance Declaration?	Individual Assistance Dollars Obligated ¹	Received Public Assistance Declaration?	Public Assistance Dollars Obligated ¹
	Leon County, Liberty County, Manatee County, Marion County, Martin County, Okaloosa County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Polk County, Saint Johns County, Saint Lucie County, Santa Rosa County, Seminole County, Taylor County, Volusia County, Wakulla County, Walton County and Washington County.					
Hurricane Jeanne	DR-1561	09/26/2004	Yes	\$398,624,417	Yes (PA A-G)	\$522,175,653
Counties Included:	IA: Alachua County, Baker County, Bradford County, Brevard County, Charlotte County, Citrus County, Clay County, Columbia County, DeSoto County, Dixie County, Duval County, Flagler County, Gilchrist County, Glades County, Hamilton County, Hardee County, Hendry County, Hernando County, Highlands County, Hillsborough County, Indian River County, Jefferson County, Lafayette County, Lake County, Levy County, Madison County, Manatee County, Marion County, Martin County, Nassau County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Pinellas County, Polk County, Putnam County, Saint Johns County, Saint Lucie County, Sarasota County, Seminole County, Sumter County, Suwannee County, Taylor County, Union County and Volusia County. PA: Alachua County, Baker County, Bradford County, Brevard County, Broward County, Charlotte County, Citrus County, Clay County, Collier County, Columbia County, DeSoto County, Dixie County, Duval County, Flagler County, Gilchrist County, Glades County, Hamilton County, Hardee County, Hendry County, Hernando County, Highlands County, Hillsborough County, Indian River County, Jefferson County, Lafayette County, Lake County, Lee County, Leon County, Levy County, Madison County, Manatee County, Marion County, Martin County, Miami-Dade County, Nassau County, Okeechobee County, Orange County, Osceola County, Palm Beach County, Pasco County, Pinellas County, Polk County, Putnam County, Saint Johns County, Saint Lucie County, Sarasota County, Seminole County, Sumter County, Suwannee County, Taylor County, Union County, Volusia County and Wakulla County.					
Tropical Storm Fay	DR-1785	08/24/2008	Yes	\$19,216,130	No	\$97,207,118
Counties Included:	IA: Alachua County, Baker County, Bradford County, Brevard County, Clay County, Collier County, Duval County, Gadsden County, Glades County, Hendry County, Jefferson County, Lake County, Lee County, Leon County, Liberty County, Madison County, Marion County, Martin County, Nassau County, Okeechobee County, Orange County, Polk County, Saint Lucie County, Seminole County, Taylor County, Volusia County and Wakulla County.					
Hurricane Matthew	DR-4283	10/08/2016	No	--	Yes	\$81,750,537
Counties Included:	PA: Bradford, Brevard, Broward, Clay, Duval, Flagler, Indian River, Lake, Martin, Nassau, Orange, Osceola, Palm Beach, Putnam, Seminole, St. Johns, St. Lucie, Volusia.					
Hurricane Irma	DR-4337	09/10/2017	Yes	\$695,625,385	Yes	unknown
Counties Included:	IA: Alachua, Baker, Bradford, Brevard, Broward, Charlotte, Citrus, Clay, Collier, Columbia, DeSoto, Dixie, Duval, Flagler, Gilchrist, Glades, Hardee, Hendry, Hernando, Highlands, Hillsborough, Indian River, Lafayette, Lake, Lee, Levy, Manatee, Marion, Martin, Miami-Dade, Monroe, Nassau, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Sarasota, Seminole, St. Johns, St. Lucie, Sumter, Suwannee, Union, Volusia.					

Source: FEMA, FDEM

¹Dollar values are for all Counties included in the disaster declaration and are not solely indicative of Orange County assistance.

N/A = no data available

Table 3.3 documents the decisions made by the FMPC as it relates to those hazards that were to be identified, analyzed, and addressed through the development of this plan. This table examines whether or not the hazard was included in the 2013 State of Florida Enhanced Hazard Mitigation Plan as well as

CHAPTER 3: HAZARD IDENTIFICATION

the 2016 Orange County Local Mitigation Strategy. This table summarizes those hazards that were identified for inclusion as well as those that were not identified and the reasoning for the decision.

Table 3.3 – Summary of Flood Hazard Evaluation

Hazard	Included in State 2013 Plan?	Included in Orange Co 2016 Local Mitigation Strategy?	Identified as a significant hazard to be included in the Orange Co FMP?
Climate Change	Yes	No	Yes
Channel Bank Erosion	Yes	No	Yes
Dam/Levee Failure	Yes	No	Yes
Flood: 100-/500-year	Yes	Yes	Yes
Flood: Stormwater/Localized Flooding	Yes	Yes	Yes
Hurricane and Tropical Storms	Yes	Yes	Yes

The following hazard was evaluated by the FMPC and determined to be a non-prevalent hazard that should not be included in the plan:

Tsunamis – Defined as a long-term (generally 15 to 60 minutes) wave caused by a large-scale movement of the sea floor due to volcanic eruption, marine earthquake or landslide. Barely noticeable at sea, the wave velocity may be as high as 400 knots so that it travels great distances and in shoal water reaches heights up to 15 meters. The Atlantic Ocean and the Florida coastline do not contain large fault lines like those found in the Pacific, and as such, the possibility of a tsunami on the East Coast is remote. Underwater landslides pose the greatest potential for causing tsunamis on the East Coast, but these events are extremely rare. Despite a history of earthquakes and subsequent tsunamis in the Caribbean region, the Florida coastline has gone largely unaffected by tsunamis. Moreover, Orange County is far enough inland that it's extremely unlikely a tsunami would affect the County if it did strike the Florida coast.

4 HAZARD PROFILES

44 CFR Subsection D §201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Chapter 3 Hazard Identification, are profiled individually in this section. Information provided by members of the FMPC has been integrated into this section with information from other data sources. Each hazard is profiled in the following format:

Hazard/Problem Description

This section provides a description of the hazard followed by details specific to the Orange County planning area. Where available, this section also includes information on the hazard extent, seasonal patterns, speed of onset/duration, magnitude and any secondary effects.

Past Occurrences

This section contains information on historical events, including the extent or location of the hazard within or near the Orange County planning area.

Frequency/Likelihood of Future Occurrence

This section gauges the likelihood of future occurrences based on past events and existing data. The frequency is determined by dividing the number of events observed by the number of years on record and multiplying by 100. This provides the percent chance of the event happening in any given year (e.g. 10 hurricanes or tropical storms over a 30-year period equates to a 33 percent chance of experiencing a hurricane or tropical storm in any given year). The likelihood of future occurrences is categorized into one of the classifications as follows:

- ▶ **Highly Likely** – Near 100 percent chance of occurrence within the next year
- ▶ **Likely** – Between 11 and 99 percent chance of occurrence within the next year (recurrence interval of 10 years or less)
- ▶ **Possible** – Between 1 and 10 percent chance of occurrence within the next year (recurrence interval of 11 to 100 years)
- ▶ **Unlikely** – Less than 1 percent chance or occurrence within the next 100 years (recurrence interval of greater than every 100 years).

Those hazards determined to have a higher likelihood of future occurrence or likely to result in significant damage were characterized as priority hazards that required further evaluation in Chapter 5 Vulnerability Assessment. These criteria allowed the FMPC to prioritize hazards of greatest significance and focus resources where they are most needed. Significance was determined by frequency of the hazard and resulting damage, including deaths/injuries and property, crop and economic damage.

NOAA's National Centers for Environmental Information (NCEI) [formerly National Climatic Data Center (NCEI)], has been tracking severe weather since 1950. Their Storm Events Database contains an archive of destructive storm or weather data and information which includes local, intense and damaging events. NCEI receives Storm Data from the National Weather Service. The National Weather service receives their information from a variety of sources, which include but are not limited to: county, state and federal emergency management officials, local law enforcement officials, SkyWarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry and the general public, among others. The NCEI database contains 15 flood related severe weather events that occurred in Orange County between January 1950 and July 2016. Table 4.1 on the following page summarizes these events.

CHAPTER 4: HAZARD PROFILES

Table 4.1 – NCEI Severe Weather Reports for Orange County, 1950-2016

Type	# of Events	Property Loss	Deaths	Injuries
Flash Flood	2	\$0	0	0
Flood	2	\$0	0	0
Heavy Rain	9	\$20,000,000	0	0
Hurricane/Typhoon	1	\$500,000	0	0
Tropical Depression	0	\$0	0	0
Tropical Storm	1	\$100,000	0	0
Total:	15	\$20,500,000	0	0

Source: National Climatic Data Center Storm Events Database
 Note: Losses reflect totals for all impacted areas.

The NCEI data on hurricanes and tropical storms is incomplete, given that major disaster declarations and funding have been issued for seven hurricane and tropical storm events in Orange County. We can assume that other hazard types may also be missing data and therefore this information should not be taken as a comprehensive review of impacts on the County. However, the NCEI data does provide an approximation of the severity of individual storm impacts over this time period.

The FMPC supplemented NCEI data with reports from SHELDUS™ (Spatial Hazard Events and Losses Database for the United States), a county-level data set for the U.S. that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities for the period 1960-present. Produced by the Hazards Research Lab at the University of South Carolina, this database combines information from several sources (including the NCEI). Per SHELDUS™ summary reports, Orange County incurred between \$100 million and \$1 billion in losses from natural hazards from 1960-2014. Table 4.2 presents the losses per year from 2004-2014.

Table 4.2 – SHELDUS™ Annual Loss Reports for Orange County, 2004-2014

Year	Total Losses
2014	Less than \$100,000
2013	Less than \$100,000
2012	Less than \$100,000
2011	Between \$100,000 and \$1 Million
2010	Between \$1 Million and \$10 Million
2009	Less than \$100,000
2008	Less than \$100,000
2007	Between \$50,000 and \$500,000
2006	Between \$50,000 and \$500,000
2005	Between \$50,000 and \$250,000
2004	Between \$10 Million and \$37 Million

Source: SHELDUS™ Yearly Summary of U.S. Hazard Losses

Table 4.3 summarizes the flood hazards that the FMPC evaluated as part of this planning process and the risk assessment findings. The following sections provide profiles of these natural flood hazards.

Table 4.3 – Hazard Profile Summary

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration
Climate Change	Highly Likely	Minor	Large	> 24 hours	>1 week
Dam Failure	Unlikely	Critical	Moderate	6 to 12 hours	<1 week
100-/500-year Flood	Possible	Limited	Moderate	12 to 24 hours	<1 week
Stormwater/Localized Flooding	Highly Likely	Minor	Small	12 to 24 hours	<24 hours
Hurricane and Tropical Storm	Likely	Limited	Moderate	> 24 hours	<24 hours

4.1 Climate Change

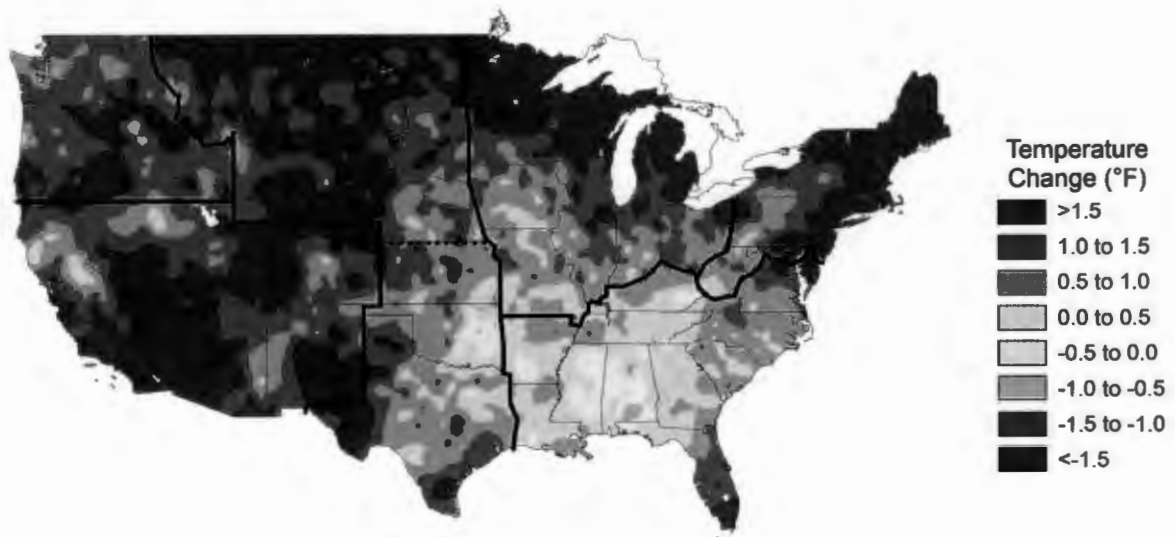
Hazard/Problem Description

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014). Climate change is a natural occurrence in which the earth has warmed and cooled periodically over geologic time. The recent and rapid warming of the earth over the past century has been cause for concern, as this warming is due to the accumulation of human-caused greenhouse gases, such as CO₂, in the atmosphere (IPCC, 2007). This warming is occurring almost everywhere in the world which suggests a global cause rather than changes in localized weather patterns.

Climate change has the potential to alter the nature and frequency of flood-related hazards that the County already experiences such as hurricanes, heavy rainfall, and erosion. The potential for climate change influences on each flood hazard summarized in this plan is noted within each hazard’s “Frequency/Likelihood of Future Occurrence” discussion section.

Past Occurrences

Since 1901, the average surface temperature across the contiguous 48 states has risen at an average rate of 0.14°F per decade (1.4°F per century). Average temperatures have risen more quickly since the late 1970s (0.36 to 0.55°F per decade). According to NOAA’s National Centers for Environmental Information, of the 17 hottest years on record, 16 have occurred since 2000, and 2016, 2015 and 2014 are the three hottest years on record. Figure 4.1 below, prepared by NOAA, shows how annual average air temperatures have changed across the United States since 1901.



Source: National Climate Assessment, 2014

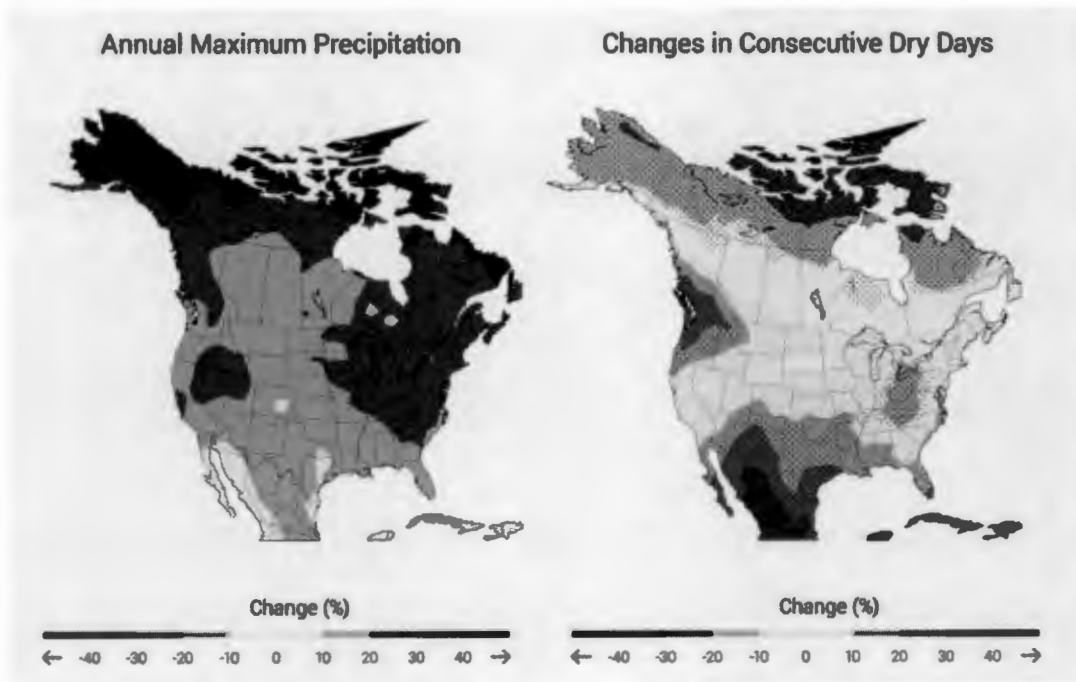
Figure 4.1 – Temperature Change in the United States, 1901-2012

According to the 2014 National Climate Assessment, average annual precipitation in the U.S. has increased by 5% since 1900. However, there is significant regional variability in these changes. The southeastern U.S. has experienced changes in the frequency and intensity of rainfall, with a 27% increase in very heavy

precipitation events. Recent increases in hurricane frequency and intensity have also been recorded as a result of increased sea surface temperature.

Frequency/Likelihood of Future Occurrence

Highly Likely – Under current climate change models, changes in global temperatures, hydrologic cycles, and storm frequency and intensity are expected to continue. Current research projects that the southeastern United States could experience a general increase in average temperatures anywhere from 4.5°F to 9°F in the coming century (Karl et al, 111). With continued high emissions, annual maximum precipitation and consecutive dry days are expected to increase in the southeastern U.S. in 2070-2099 compared to 1971-2000, as shown in Figure 4.2, below. Drought is also expected to increase over most of the southern U.S. due to this increase in the number of days between precipitation events and the concentration of rainfall into fewer, higher intensity events that allow less opportunity for stormwater infiltration. Rainfall may also increase because of increased hurricane activity. The overall number of hurricanes is projected to decline slightly, but the number of strong storms (Category 4 and 5) is expected to increase. Additionally, hurricane precipitation rates are expected to increase by up to 20%. The combination of higher temperatures and increased incidence of drought along with increased heavy precipitation events suggests that the likelihood of flood events may increase because of climate change.



Source: National Climate Assessment, 2014

Figure 4.2 – Precipitation Change Projections for 2070-2099

4.2 Channel Bank Erosion

Hazard/Problem Description

Streams and canals erode by a combination of direct stream processes, such as down cutting and lateral erosion, and indirect processes, such as mass-wasting accompanied by transportation. When the channel bends, water on the outside of the bend (the cut-bank) flows faster and water on the inside of the bend

(the point) flows slower as shown in Figure 4.3. This distribution of velocity results in erosion occurring on the outside of the bend and deposition occurring on the inside of the bend.

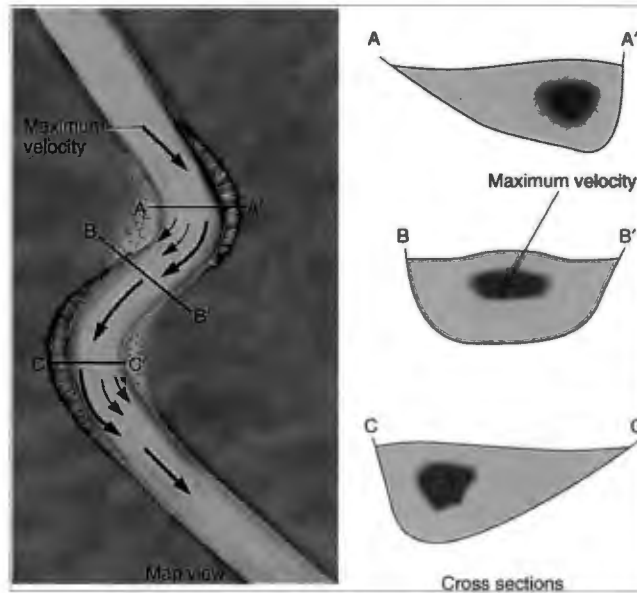


Figure 4.3 – Stream Meanders

Stream bank erosion is a natural process, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Stream bank erosion processes, although complex, are driven by two major components: stream bank characteristics (erodibility) and hydraulic/gravitational forces. Many land use activities can affect both of these components and lead to accelerated bank erosion. The vegetation rooting characteristics can protect banks from fluvial entrainment and collapse, and also provide internal bank strength. When riparian vegetation is changed from woody species to annual grasses and/or flowering plants, the internal strength is weakened, causing acceleration of mass wasting processes. Stream bank aggradation or degradation is often a response to stream channel instability. Since bank erosion is often a symptom of a larger, more complex problem, the long-term solutions often involve much more than just bank stabilization. Numerous studies have demonstrated that stream bank erosion contributes a large portion of the annual sediment yield.

Determining the cause of accelerated streambank erosion is the first step in solving the problem. When a stream is straightened or widened, streambank erosion increases. Accelerated streambank erosion is part of the process as the stream seeks to re-establish a stable size and pattern. Damaging or removing streamside vegetation to the point where it no longer provides for bank stability can cause a dramatic increase in bank erosion. A degrading streambed results in higher and often unstable, eroding banks. When land use changes occur in a watershed, such as clearing land for agriculture or development, runoff increases. With this increase in runoff the stream channel will adjust to accommodate the additional flow, increasing streambank erosion if appropriate erosion protection methods are not installed. Addressing the problem of streambank erosion requires an understanding of both stream dynamics and the management of streamside vegetation.

Past Occurrences

Orange County 2030 Comprehensive Plan notes historic problems with erosion of the banks of the Little Wekiva River, threatening nearby homes, roads, and bridges. No other specific streams or canals are

mentioned as experiencing substantial erosion. However, the plan does indicate extensive urbanization and loss of natural floodplain around many canals and streams, which indicates the possibility for increased flows and thus increased erosion in these channels. The State's Critical Erosion Report (2012) focuses primarily on shoreline erosion and does not identify any areas of critical erosion within Orange County.

Frequency/Likelihood of Future Occurrence

Possible – In addition to normal levels of erosion likely to occur, urbanization is placing an increasing burden on canals to accommodate additional flows. This, in turn, increases the potential volume and speed of flows in these canals. As a result, additional canal and stream bank erosion is likely to occur.

Climate Change and Erosion

Current studies suggest climate change will result in more severe storms and more intense rainfalls. With larger amounts of rainfall in shorter amounts of time, canals and streams will experience greater flows at higher velocities, increasing the likelihood of erosion of their banks.

4.3 Dam/Levee Failure

Hazard/Problem Description

Dam Failure

A dam is a barrier constructed across a watercourse that stores, controls, or diverts water. Dams are usually constructed of earth, rock, or concrete. The water impounded behind a dam is referred to as the reservoir and is measured in acre-feet. One acre-foot is the volume of water that covers one acre of land to a depth of one foot. Dams can benefit farm land, provide recreation areas, generate electrical power, and help control erosion and flooding issues.

A dam failure is the collapse or breach of a dam that causes downstream flooding. Dam failures may be caused by natural events, human-caused events, or a combination. Due to the lack of advance warning, failures resulting from natural events, such as hurricanes, earthquakes, or landslides, may be particularly severe. Prolonged rainfall and subsequent flooding is the most common cause of dam failure.

Dam failures usually occur when the spillway capacity is inadequate and water overtops the dam or when internal erosion in dam foundation occurs (also known as piping). If internal erosion or overtopping cause a full structural breach, a high-velocity, debris-laden wall of water is released and rushes downstream, damaging or destroying anything in its path. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can result from any one or a combination of the following:

- Prolonged periods of rainfall and flooding;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross-section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including use of improper construction materials and construction practices;
- Negligent operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway; and

- High winds, which can cause significant wave action and result in substantial erosion.

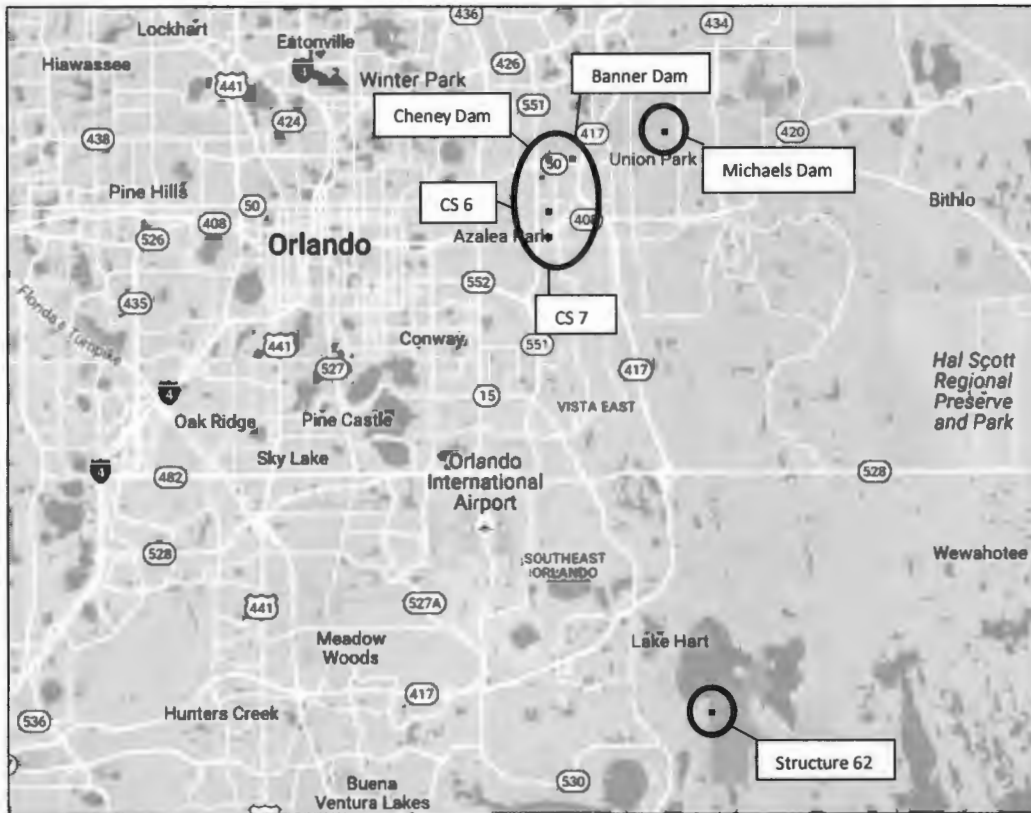
Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major casualties and loss of life could result, as well as water quality and health issues. Potentially catastrophic effects to roads, bridges, and homes are also of major concern. Associated water quality and health concerns could also be issues. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

The National Inventory of Dams (NID) is a database of dams in the United States which was developed and is maintained by the USACE. Congress authorized the USACE to inventory dams as part of the 1972 National Dam Inspection Act. Several subsequent acts have authorized maintenance of the NID and provided funding. The USACE collaborates with FEMA and state regulatory offices to collect data on dams. The goal of the NID is to include all dams in the United States which meet at least one of the following criteria:

1. High hazard classification – loss of at least one human life is likely if the dam fails
2. Significant hazard classification – possible loss of human life and likely significant property or environmental destruction
3. Low hazard or undetermined classification – dams equal or exceed 25 feet in height and exceed 15 acre-feet in storage; OR dams equal or exceed 50 acre-feet storage and exceed 6 feet in height

Low hazard dams that do not meet the criteria specified above are not included in the NID even if they are regulated according to state criteria. In some states, the number of these dams is several times the number of dams included in the NID.

Figure 4.4 reflects all dams included in the NID that are located in and around Orange County. As shown, there are six dams located within the jurisdictional boundaries of Orange County; two of the dams are classified as high hazard. Table 4.3 provides details for the dams as provided in the NID. The 2013 State of Florida Enhanced Hazard Mitigation Plan ranks Orange County as an area of high hazard dams.



Source: U.S. Army Corps of Engineers, National Inventory of Dams

Figure 4.4 – National Inventory of Dams for Orange County

Table 4.4 – National Inventory of Dams, Orange County

Dam Name	NID ID	Owner	Height (Ft.)	NID Storage (acre-feet)	Hazard Classification	River
Michaels Dam	FL00160	Orange County	26	1929	High	Little Econ River
Banner Dam	FL00161	Orange County	17	282	Low	Little Econ River
Cheney Dam	FL00162	Orange County	29	31	High	Little Econ River
Control Structure 6	FL00163	Orange County	28	90	Low	Canal E-6
Control Structure 7	FL00164	Orange County	26	136	Low	Canal E-6
Structure 62	FL00165	SFWMD	19	56,000	Low	Ajay-Hart Canal (C-29A)

Source: U.S. Army Corps of Engineers, National Inventory of Dams; National Performance of Dams Program

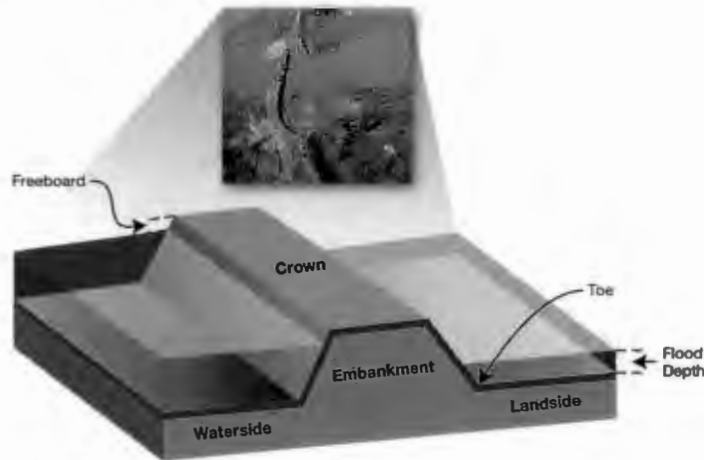
Levee Failure

FEMA defines a levee as “a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water in order to reduce the risk from temporary flooding.” Levee systems consist of levees, floodwalls, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices. Levees often have “interior drainage” systems that work in conjunction with the levees to take water from the landward side to the water side. An interior drainage system may include culverts, canals, ditches, storm sewers, and/or pumps.

Levees and floodwalls are constructed from the earth, compacted soil, or artificial materials, such as concrete or steel. To protect against erosion and scouring, earthen levees can be covered with grass and

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gravel or hard surfaces like stone, asphalt, or concrete. Levees and floodwalls are typically built parallel to a waterway, most often a river, in order to reduce the risk of flooding to the area behind it. Figure 4.5 below shows the components of a typical levee.



Source: FEMA, *What is a Levee Fact Sheet*, August 2011

Figure 4.5 – Components of a Typical Levee

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events. Levees reduce, not eliminate, the risk to individuals and structures behind them. A levee system failure or overtopping can create severe flooding and high water velocities. It is important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Figure 4.6 on the following page reflects all levees included in the U.S. Army Corps of Engineers National Levee Database (NLD) that are located in or around Orange County. Levee centerlines are indicated in purple and circled in red. Table 4.4 below details all levees located in or impacting Orange County as included in the NLD.

Table 4.5 – National Levee Database, Orange County Planning Area

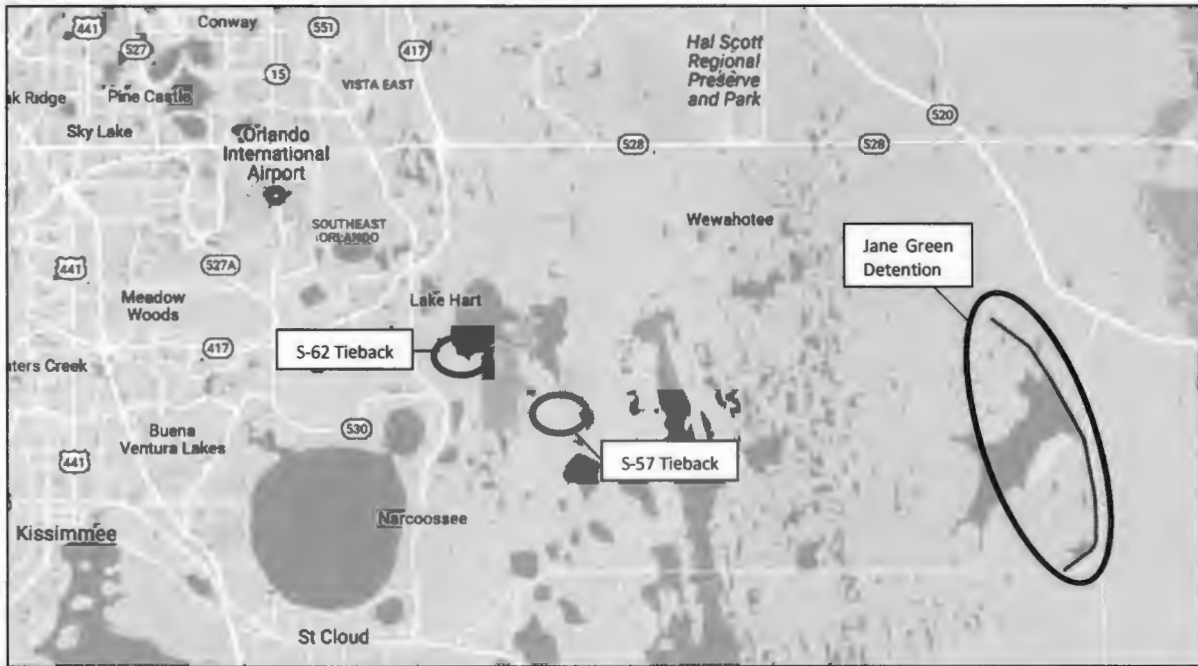
Counties	System Name	Sponsor	Length (mi)	Inspection Rating
Orange, Osceola	S-62 Tieback	SFWMD	0.2	Minimally Acceptable
Orange, Osceola	S-57 Tieback*	SFWMD	0.1	Unacceptable
Brevard, Orange, Osceola, Seminole, Volusia	Jane Green Detention North**	St. John’s River WMD	8.66	Unacceptable

Source: U.S. Army Corps of Engineers National Levee Database

*Note: This levee is located in Osceola County but protects areas of Orange County by regulating flow into Lake Mary Jane

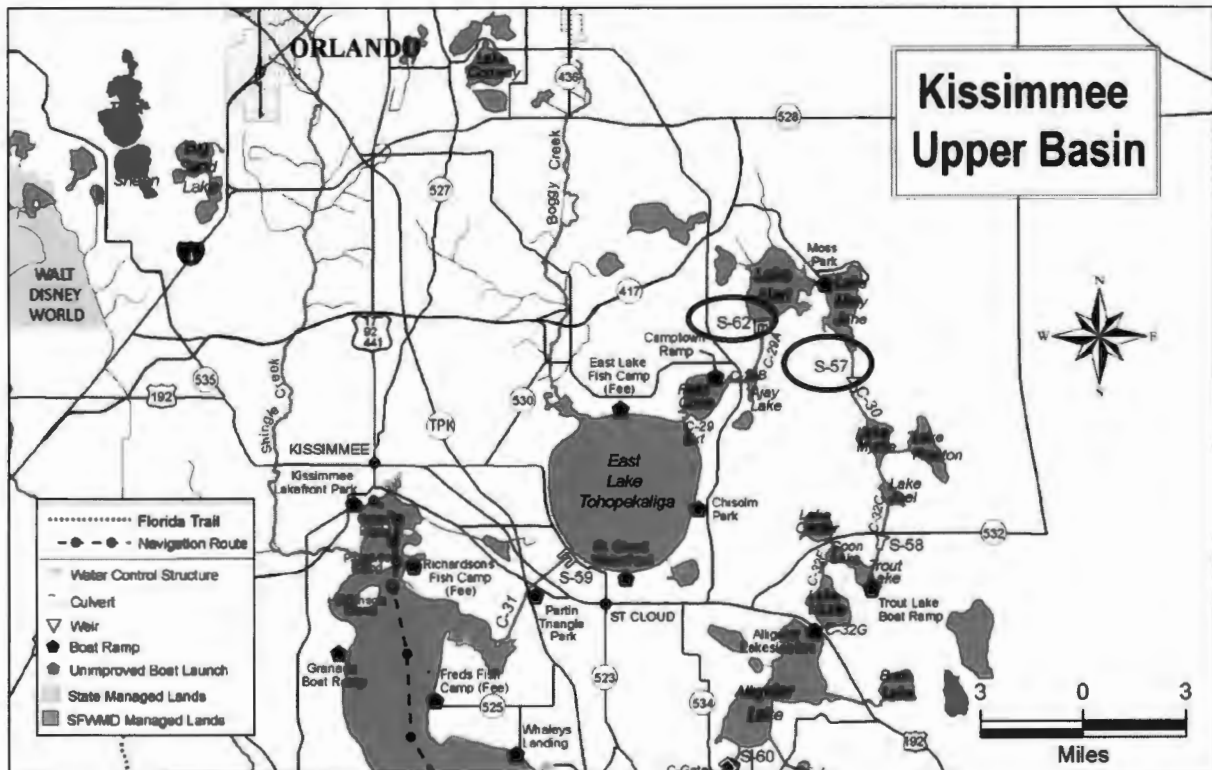
**Note: Part of this levee is located in Osceola County

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Source: U.S. Army Corps of Engineers National Levee Database

Figure 4.6 – National Levee Database for Orange County



Source: South Florida Water Management District

Figure 4.7 – Levee Locations Detail

Past Occurrences

There are no past reported dam breaches or levee failures within Orange County.

Frequency/Likelihood of Future Occurrence

Unlikely – Given there is no precedent of any dam or levee failure at any of the nine structures in the County, we can reasonably conclude that the change of such an occurrence is low. However, it should be noted that the “minimally acceptable” and “unacceptable” ratings of the County’s three levees could indicate an increased likelihood of failure if action is not taken to bring these structures up to acceptable standards. Additionally, there are two high hazard dams in the County, so although dam failure may be unlikely, the effects of a failure could be extremely damaging.

Climate Change and Dam/Levee Failure

Current studies suggest climate change may result in more severe storms and more intense rainfalls. With larger amounts of rainfall in shorter amounts of time, dams’ or levees’ capacities may be surpassed, putting these structures at higher risk of failure.

4.4 Flood: 100-/500-year

Hazard/Problem Description

Flooding is defined by the rising and overflowing of a body of water onto normally dry land. According to the USGS, floods are caused by weather phenomena and events that deliver more precipitation to a drainage basin than can be readily absorbed or stored within the basin. Flooding can result from an overflow of inland or tidal waters or an unusual accumulation or runoff of surface waters from any source. Flooding within Orange County can be attributed to prolonged heavy rainfall over large areas. Flooding is often more severe when rainfall results from hurricanes and tropical storms and when ground conditions are already saturated and/or drainage systems within the community are already overburdened.

Public Health

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where farm animals are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as E.coli and other disease causing agents.

The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned after inundation becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If the county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one’s home damaged and personal belongings destroyed. The cost and labor needed to repair a flood-damaged

home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Sources and Types of Flooding

According to the 2009 Flood Insurance Study (FIS) for Orange County, flooding results from heavy rainfall primarily during thunderstorms in the summer months, with additional rainfall resulting from the passage of hurricanes. The County lies far enough inland that coastal flooding and storm surge pose no threat.

The general topography of Orange County is extremely flat with some gentle hills. The lack of steep slopes limits rapid runoff; therefore, water accumulates in ponded areas and slowly infiltrates the groundwater system or sluggishly drains over the land depending on the soils. The soils in Orange County range from “somewhat excessively drained” to “very poorly drained.” Near Apopka the soil’s high percolation rate reduces surface runoff, near Maitland and Winter Park the soils are well drained and interspersed with many lakes, and around Orlando the soils are poorly drained and mixed with grassy sloughs and swamps.

Current flood protection measures include development regulation as well as stream channelization and manmade canals. These canals are not built to contain the 1% annual chance flood.

Flooding and Floodplains

In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a 1% chance in any given year of being equaled or exceeded. A floodplain is the flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

The 100-year flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Participation in the NFIP requires adoption and enforcement of a local floodplain management ordinance which is intended to prevent unsafe development in the floodplain, thereby reducing future flood damages. Participation in the NFIP allows for the federal government to make flood insurance available within the community as a financial protection against flood losses. Since floods have an annual probability of occurrence, have a known magnitude, depth and velocity for each event, and in most cases, have a map indicating where they will occur, they are in many ways often the most predictable and manageable hazard.

Regulated floodplains are illustrated on inundation maps called Flood Insurance Rate Maps (FIRMs). It is the official map for a community on which FEMA has delineated both the special flood hazard areas (SFHAs) and the risk premium zones applicable to the community. SFHAs represent the areas subject to inundation by the 1-percent-annual chance flood event. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. Flood prone areas within Orange County were identified using the Effective FIS and FIRMs developed by FEMA dated September 25, 2009. Table 4.5 summarizes the flood insurance zones identified by the FIRMs.

Table 4.6 – Mapped Flood Insurance Zones within Orange County

Zone	Description
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone.
A	Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
D	Areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The designation of Zone D is also used when a community incorporates portions of another community's area where no map has been prepared.
AE	AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by hydrologic and hydraulic investigations and have no wave effects.
0.2% Annual Chance (shaded Zone X) or X-500	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.)
Zone X (unshaded)	Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.)

Figure 4.7 on the following page reflects the mapped flood insurance zones for Orange County. A summary of acreage by flood zone is displayed below in Table 4.6:

Table 4.7 – Flood Zone Acreage

	Flood Zone Acreage					Total
	Zone A (100-year)	Zone AE (100-year)	Zone AH (100-year)	Zone X Shaded (500-year)	Zone X Unshaded	
Land Area (% of Total Land Area)	54,850.6 (12.6%)	71,875.1 (16.5%)	1,452.2 (0.3%)	8,230.7 (1.9%)	299,650.7 (68.7%)	436,381.6
Water Area	2,631.43	47,725.50	97.80	30.64	1,350.96	51,900.86

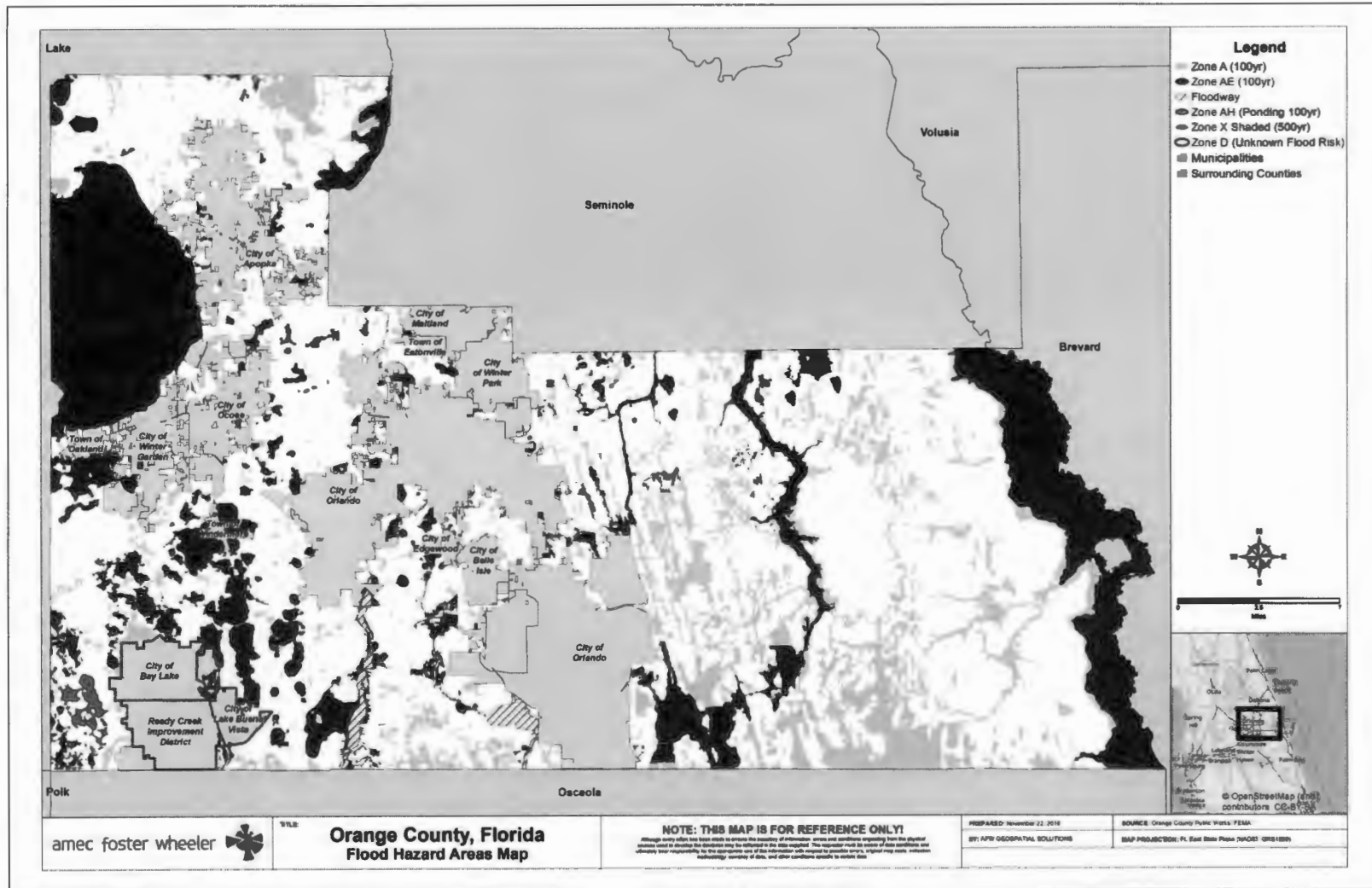
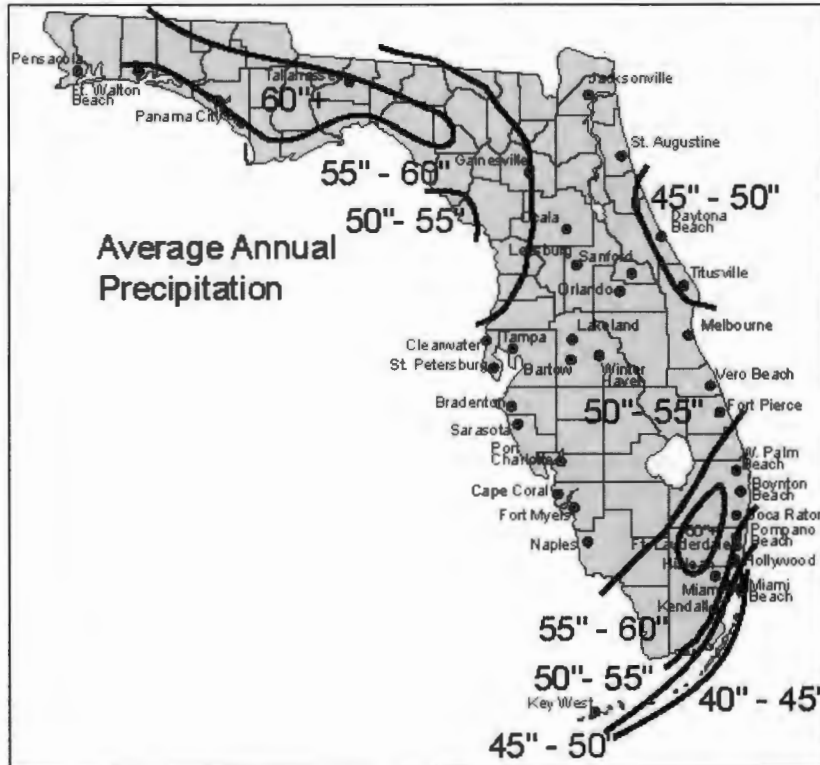


Figure 4.8 – FEMA Flood Zones for Orange County

Past Occurrences

Orange County is located within a semi-tropical environment and is subject to intense thunderstorms and tropical cyclones (hurricanes). Roughly 68% of the 53.2" average annual rainfall occurs during the months of May through October, with approximately 56% of that occurring during the peak rainfall months of June through September. Flooding can occur year-round in Orange County but is most frequent during the summer months, which often bring persistent thunderstorms. In late summer, the heavy rains associated with tropical storms and hurricanes are more prevalent. Past occurrences for tropical storms and hurricanes can be found in Section 4.6.



Source: Florida Climate Center, Florida State University

Figure 4.9 – Average Annual Precipitation for Florida

Table 4.7 shows the flood events from causes other than hurricanes or tropical storms reported by the NCEI since 1950 for Orange County. NCEI receives Storm Data from the National Weather Service (NWS). The NWS receives their information from a variety of sources, which include but are not limited to: county, state and federal emergency management officials, local law enforcement officials, SkyWarn spotters, NWS damage surveys, newspaper clipping services, the insurance industry and the general public, among others. The NWS makes a best guess for damages using all available data at the time of the publication. Property and Crop damage should be considered a broad estimate.

Table 4.8 – NCEI Flooding in Orange County – January 1950 to March 2016

Location	Date	Event Type	Injuries/Deaths	Damages
Winter Park	07/21/2001	Flash Flood	0/0	\$0
West Portion	09/05/2004	Flash Flood	0/0	\$0
Orlando	07/14/1999	Flood	0/0	\$0
Orlando	07/21/2002	Flood	0/0	\$0
Orlando	07/31/2001	Heavy Rain	0/0	\$20,000,000

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Location	Date	Event Type	Injuries/Deaths	Damages
Winter Garden	06/12/2003	Heavy Rain	0/0	\$0
Winter Park	09/27/2005	Heavy Rain	0/0	\$0
Plymouth	06/25/2007	Heavy Rain	0/0	\$0
Union Park	10/08/2011	Heavy Rain	0/0	\$0
Union Park	06/04/2013	Heavy Rain	0/0	\$0
Fairvilla	09/23/2014	Heavy Rain	0/0	\$0
Orlando	11/25/2014	Heavy Rain	0/0	\$0

Source: NCEI, 2016

The following provides additional details on flood events within the NCEI database and additional events reported by South Florida Water Management District.

September 5, 2004 – Hurricane Frances caused 8-10 inches of rain to fall across north and west Orange County, flooding homes and roads.

June 4, 2013 – Tropical Storm Andrea produced heavy rain across Central Florida over a three-day period. Maximum totals in Orange County reached 5-6 inches.

September 23, 2014 – Thunderstorms brought 3-6 inches of rain in less than two hours. Totals for the 24-hour period reached 6-12 inches. Many roads flooded and became impassable, and homes were isolated and damaged from floodwaters.

November 11, 2014 – Two days of heavy rain and thunderstorms caused flooding across Orange County. Rainfall totals reached 3-9 inches, with highest totals across northern parts of the county. Flooding made several roadways impassable.

Maximum Observed 24-hour Rainfall Amounts:

- Bithlo: 12.05"
- Hart Lake: 10.58"
- Isleworth: 10.25"
- Orlando WSO McCoy: 9.41"

Source: St. John's River Water Management District, 1988

Frequency/Likelihood of Future Occurrence

Possible – By definition of the 1-percent-annual-chance flood event, Orange County has a 1 percent chance of a 100-year or significant flood being equaled or exceeded in any given year.

Climate Change and Flood: 100-/500-year

Given that Orange County's largest flood risks stem from heavy rains, climate change-driven increases in the intensity of rain events, hurricanes, and tropical storms will likely affect the County. According to a 2009 report by the SFWMD titled *Climate Change and Water Management in South Florida*, average annual rainfall may increase or decrease slightly in the future but more frequent intense rainfall events are likely to occur with longer dry periods in between. Heavy rainfall poses a threat to homes, businesses, and water control structures. If flooding were to reach new extremes, the water management system already in place may not be adequate to provide the necessary levels of flood protection according to the 2009 SFWMD report. Flooding could also further degrade water quality due to increased runoff, the loss of positive pressure in sewer systems, damage to septic systems, and pollutants washed into water bodies.

4.5 Flood: Stormwater/Localized Flooding

Hazard/Problem Description

Localized stormwater flooding occurs when heavy rainfall and an accumulation of runoff overburden the stormwater drainage system within the community. Orange County has relatively flat terrain and spans 12 drainage basins that comprise the larger the St. Johns River System and the Kissimmee River System watersheds.

Orange County has a natural drainage system of creeks and streams as well as an extensive man-made drainage system. This secondary, man-made system includes grading to control runoff, storm sewers and inlets to intercept stormwater, ditches and canals to transmit large quantities of runoff, and detention ponds to retain runoff at specific sites. According to the 2014 Stormwater Management Report, the drainage system makes up part of Orange County's Primary Water Control System, which also consists of 18 pumping stations, 95 miles of open channels, canals, and closed pipe systems, 52 control structures, and 91 drainage wells. This system is managed by the County, often through special Municipal Service Benefit Units (MSBUs). Flooding can still occur if conditions exceed the system's design capacity or if the flood control systems are not sufficiently maintained.

Localized flooding may be caused by the following maintenance related issues:

- **Clogged Inlets** – debris covering storm drains and catch basin inlets may contribute to an inadequate flow of stormwater into the system which may cause flooding near the structure. Debris and sediment accumulations within the catch basins and stormwater pipes may also reduce the efficiency of the system by reducing the carrying capacity.
- **Blocked Drainage Outfalls** – debris blockage including sediment and vegetation or structural damage at drainage outfalls may prevent the system from discharging runoff which may lead to a back-up of stormwater within the system.
- **Improper Grade** – poor grading around catch basin inlets may prevent stormwater from entering the catch basin as designed.

Past Occurrences

Figure 4.9 on the following page depicts a locator map for the areas of localized flooding within the unincorporated areas of Orange County identified by the FMPC.

Frequency/Likelihood of Future Occurrence

Highly Likely – Due to the low elevations, a flat terrain, and a consistent level of seasonally concentrated annual precipitation resulting from heavy rainstorms, tropical storms, and hurricanes and affecting canal and stormwater system drainage, it is highly likely that unmitigated properties will continue to experience localized flooding.

Climate Change and Flood: Stormwater/Localized Flooding

Climate change does have the potential to affect localized flooding in Orange County. The intensity of individual rainfall events is likely to increase which can overwhelm stormwater drainage systems. It is also possible that average soil moisture and runoff could decline due to increasing temperature, evapotranspiration rates, and spacing between rainfall events.

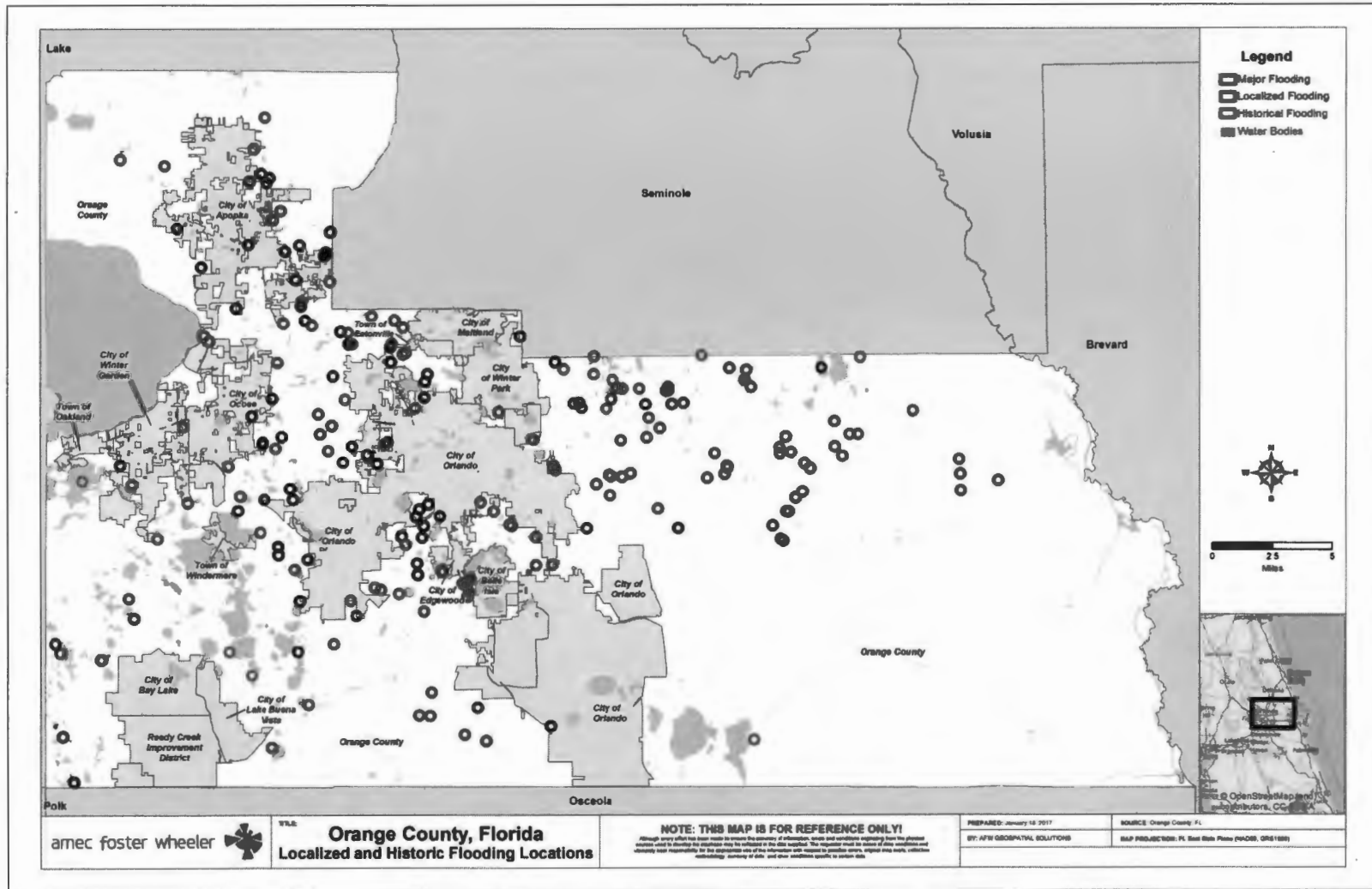


Figure 4.10 – Localized Flooding Locator Map for Orange County

4.6 Hurricane and Tropical Storm

Hazard/Problem Description

A hurricane is a type of tropical cyclone or severe tropical storm that forms in the southern Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the eastern Pacific Ocean. All Atlantic and Gulf of Mexico coastal areas are subject to hurricanes. The Atlantic hurricane season lasts from June to November, with the peak season from mid-August to late October.

While hurricanes pose the greatest threat to life and property, tropical storms and depressions also can be devastating. A tropical disturbance can grow to a more intense stage through an increase in sustained wind speeds. The progression of a tropical disturbance is described below.

- **Tropical Depression:** A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- **Tropical Storm:** A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- **Hurricane:** A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher. In the western North Pacific, hurricanes are called typhoons; similar storms in the Indian Ocean and South Pacific Ocean are called cyclones.
- **Major Hurricane:** A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.

The Saffir-Simpson Hurricane Wind Scale classifies hurricanes by intensity into one of five categories as shown in Table 4.8. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.

Table 4.9 – Saffir-Simpson Hurricane Wind Scale, 2012

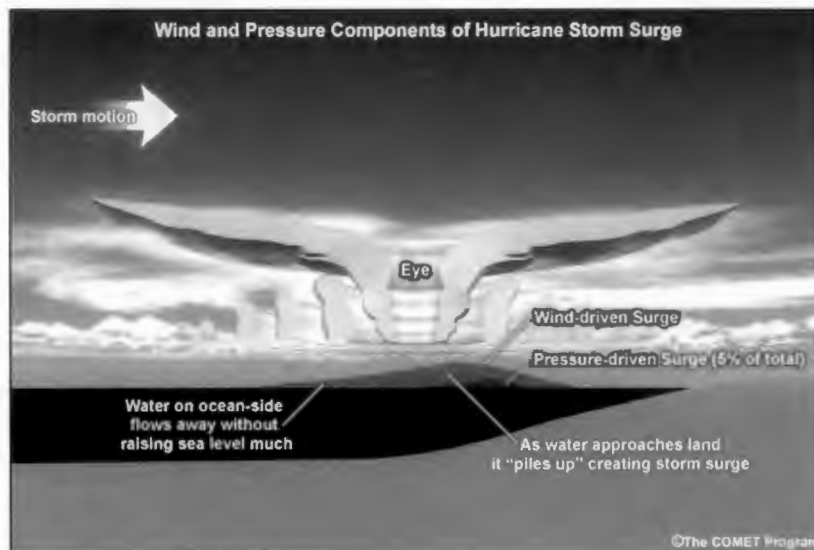
Category	Wind Speed (mph)	Potential Damage
1	74-95	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130-156	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	≥ 157	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center/NOAA

Storm Surge

The greatest potential for loss of life related to a hurricane is from the storm surge. Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm as shown in Figure 4.10. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level to heights impacting roads, homes and other critical infrastructure. In addition, wind driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with the normal high tides.

The maximum potential storm surge for a particular location depends on a number of different factors. Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size (radius of maximum winds-RMW), angle of approach to the coast, central pressure (minimal contribution in comparison to the wind), and the shape and characteristics of coastal features such as bays and estuaries. Other factors which can impact storm surge are the width and slope of the continental shelf. A shallow slope will potentially produce a greater storm surge than a steep shelf.



Source: NOAA/The COMET Program

Figure 4.11 – Components of Hurricane Storm Surge

Storm Surge Mapping

The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model is a computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge. The SLOSH model consists of a set of physics equations which are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads, levees and other physical features. The model creates outputs for all different storm simulations from all points of the compass. Each direction has a MEOW (maximum envelope of water) for each category of storm (1-5), and all directions combined result in a MOMs (maximum of maximums) set of data.



Source: Weather Underground; NOAA SLOSH

Figure 4.12 – Maximum Storm Tide During Category 5 Hurricane at High Tide

Anticipated SLOSH model surge elevations for a Category 5 hurricane are shown for Central Florida in Figure 4.11. Even in this scenario, depicting the maximum possible storm surge scenario for the area, Orange County is far enough inland to remain untouched. FMPC members reviewed the possibility that storm surge could impact the County via the St. John’s River, a tidally influenced river running along the eastern portion of Orange County. However, they found that this does not pose a major flood risk to the County, as tidal influences on the St. John’s River have not been found to have a substantial impact beyond Lake Harney. The greatest risk of flooding along the St. John’s River during and following a hurricane event remains rainfall. Hurricane storm surge will therefore not be considered a flood risk in Orange County.

Past Occurrences

According to the 2016 Orange County LMS, Orange County is vulnerable to hurricane damage from high winds, rain-induced flooding, and hurricane-spawned tornadoes. NOAA’s Historical Hurricane Tracks tool shows that Orange County has been exposed to 75 hurricanes/tropical storms including 32 tropical depressions since 1851. Type and frequency are as follows in Table 4.9. A listing of all hurricanes/tropical storms that came within 60 nautical miles of central Orange County since 1851 is provided on the following page in Table 4.10.

Table 4.10 – Hurricane Type & Frequency

Storm Intensity	Number of Occurrences	Rate of Occurrence
Tropical Depression	8	1 in 20.6 years
Tropical Storm	32	1 in 5.2 years
CAT I Hurricane	16	1 in 10.3 years
CAT II Hurricane	7	1 in 23.6 years
CAT III Hurricane	7	1 in 23.6 years
CAT IV Hurricane	11	1 in 15 years
CAT V Hurricane	2	1 in 82.5 years
TOTAL	83	1 in 2.0 years

Table 4.11 – Orange County Historical Hurricane Tracks

Storm Name	Max Saffir-Simpson	Date
Unnamed 1852*	H1	09/09/1852 – 09/13/1852
Unnamed 1858*	H2	09/14/1858 – 09/17/1858
Unnamed 1859*	H1	10/24/1859 – 10/29/1859
Unnamed 1861	H1	11/01/1861 – 11/03/1861
Unnamed 1871	H3	08/14/1871 – 08/23/1871
Unnamed 1871*	H3	08/17/1871 – 08/30/1871
Unnamed 1872*	H1	10/22/1872 – 10/28/1872
Unnamed 1873	TS	09/22/1873 – 09/24/1873
Unnamed 1880*	H2	08/24/1880 – 09/01/1880
Unnamed 1885	H2	08/21/1885 – 08/28/1885
Unnamed 1887	TS	10/29/1887 – 11/06/1887
Unnamed 1888	TS	09/06/1888 – 09/13/1888
Unnamed 1891	TS	10/07/1891 – 10/16/1881
Unnamed 1892	TS	10/21/1892 – 10/29/1892
Unnamed 1894*	H3	09/18/1894 – 10/01/1884
Unnamed 1897*	TS	09/20/1897 – 09/25/1897
Unnamed 1899	TS	10/02/1899 – 10/08/1899
Unnamed 1906*	TS	10/08/1906 – 10/23/1906
Unnamed 1906	TS	10/14/1906 – 10/17/1906
Unnamed 1909	TS	06/26/1909 – 07/04/1909
Unnamed 1909*	TD	08/23/1909 – 08/31/1909
Unnamed 1910	H4	10/09/1910 – 10/23/1910
Unnamed 1912	H1	10/03/1912 – 10/10/1912
Unnamed 1915	H1	07/31/1915 – 08/05/1915
Unnamed 1916	TS	05/13/1916 – 05/18/1916
Unnamed 1916	H2	08/21/1916 – 08/26/1916
Unnamed 1921*	H1	10/20/1921 – 10/30/1921
Unnamed 1921	TS	10/15/1921 – 10/24/1921
Unnamed 1925	TS	11/27/1925 – 12/05/1925
Unnamed 1926	H4	07/22/1926 – 08/02/1926
Unnamed 1928	H2	08/03/1928 – 08/13/1928
Unnamed 1928	H5	09/06/1928 – 09/21/1928
Unnamed 1930	H4	08/29/1930 – 09/17/1930
Unnamed 1933	H4	08/31/1933 – 09/07/1933
Unnamed 1936	TS	08/20/1936 – 08/23/1933
Unnamed 1937	TS	08/24/1937 – 09/02/1937
Unnamed 1937	TS	07/29/1937 – 08/02/1937
Unnamed 1939	H1	08/07/1939 – 08/19/1939
Unnamed 1941	TS	10/15/1941 – 10/22/1941
Unnamed 1944	H4	10/12/1944 – 10/24/1944
Unnamed 1945	H2	06/20/1945 – 07/04/1945
Unnamed 1945*	H4	09/12/1945 – 09/20/1945
Unnamed 1946	TS	10/31/1946 – 11/03/1946
Unnamed 1949	H4	08/23/1949 – 09/01/1949
Easy 1950	H3	09/01/1950 – 09/09/1950
King 1950*	H4	10/13/1950 – 10/20/1950
Unnamed 1959*	TS	06/18/1959 – 06/21/1959
Donna 1960*	H3	08/29/1960 – 09/14/1960

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Storm Name	Max Saffir-Simpson	Date
Florence 1960	TS	09/17/1960 – 09/27/1960
Cleo 1964*	H4	08/20/1964 – 09/05/1964
Abby 1968	H1	06/01/1968 – 06/13/1968
Brenda 1968*	H1	06/17/1968 – 06/26/1968
Dolly 1968	H1	08/10/1968 – 08/17/1968
Unnamed 1968	TD	08/26/1968 – 09/01/1968
Unnamed 1969	TD	08/29/1969 – 09/01/1969
Jenny 1969	TS	10/01/1969 – 10/06/1969
Gerda 1969	H3	09/06/1969 – 09/10/1969
Unnamed 1970	TD	08/05/1970 – 08/07/1970
Unnamed 1971	TD	08/12/1971 – 08/16/1971
Unnamed 1974*	TS	06/24/1974 – 06/26/1974
Unnamed 1976*	TS	09/13/1976 – 19/17/1976
David 1979	H5	08/25/1979 – 09/08/1979
Unnamed 1980	TD	11/12/1980 – 11/18/1980
Unnamed 1981	TD	07/02/1981 – 07/04/1981
Dennis 1981	H1	08/07/1981 – 08/22/1981
Barry 1983	H1	08/23/1983 – 08/29/1983
Isidore 1984	TS	09/25/1984 – 10/01/1984
Bob 1985	H1	07/21/1985 – 07/26/1985
Unnamed 1987	TD	10/31/1987 – 11/04/1987
Keith 1988	TS	11/17/1988 – 11/26/1988
Gordon 1994	H1	11/08/1994 – 11/21/1994
Erin 1995	H2	07/31/1995 – 08/06/1995
Jerry 1995	TS	08/22/1995 – 08/28/1995
Leslie 2000	TS	10/04/2000 – 10/10/2000
Gabrielle 2001*	H1	09/11/2001 – 09/08/2001
Edouard 2002	TS	09/01/2002 – 09/06/2002
Henri 2003*	TS	09/03/2003 – 09/08/2003
Charley 2004*	H4	08/09/2004 – 08/15/2004
Frances 2004	H4	08/25/2004 – 09/10/2004
Jeanne 2004	H3	09/13/2004 – 09/29/2004
Tammy 2005	TS	10/05/2005 – 10/07/2005
Ernesto 2006	TS	08/24/2006 – 09/04/2006
Fay 2008	TS	08/15/2008 – 08/28/2008

Source: NOAA Historical Hurricane Tracks, 2016; *Storm track passed through Orange County

It should be noted that this is not a comprehensive list of all hurricanes to have impacted Orange County. For example, Hurricane Matthew (2016) is not on this list due to its passing further than 60 nautical miles from the center of Orange County, yet this storm still caused widespread impacts throughout the County.

The following is a description of past occurrences of hurricanes and tropical storms as provided by the 2009 Orange County LMS:

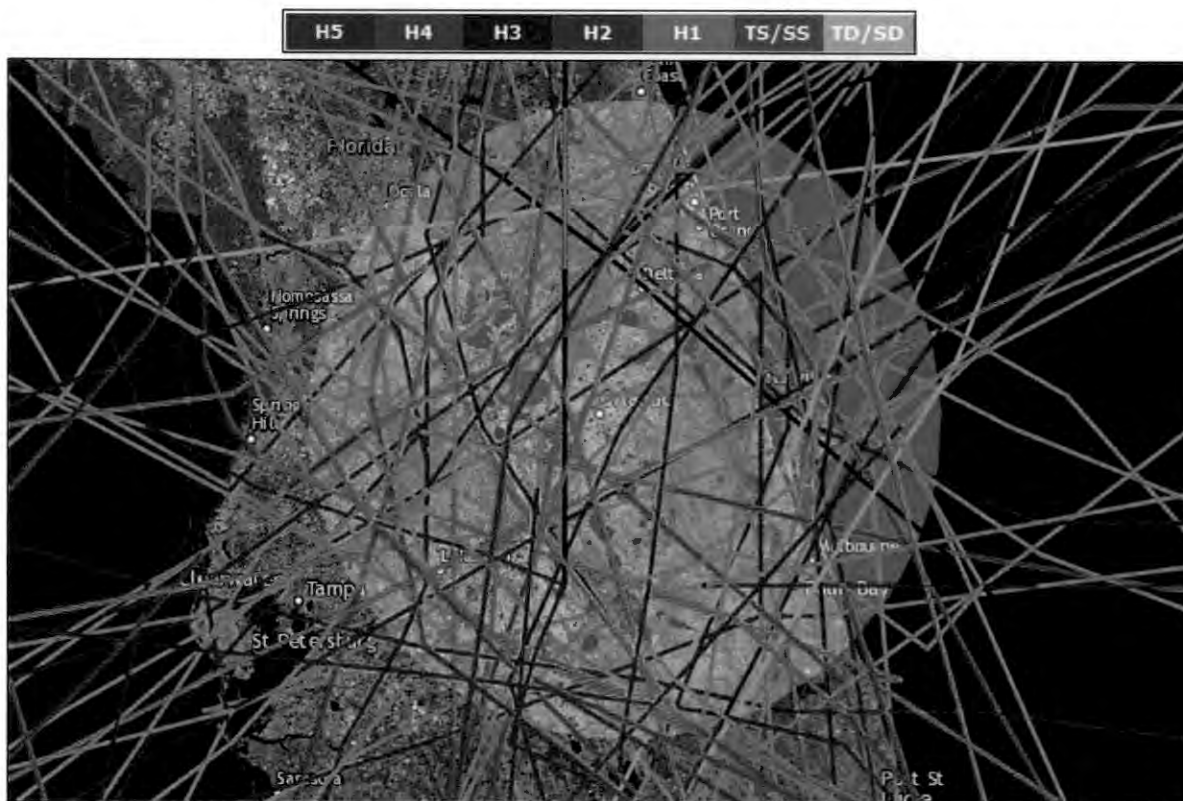
Hurricane Charley: Hurricane Charley was one of three hurricanes during the 2004 season to affect Orange County. Charley had the most significant impact, including leaving 265,000 Progress Energy customers and 150,000 Orlando Utilities Commission (OUC) customers without power. Power losses also affected 400 lift stations, resulting in sewage backups across the county, and 425 traffic signals. The Orange County Property Appraiser's Office estimated \$881.5 million in property damages to 26,700 parcels.

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Tropical Storm Fay: Tropical Storm Fay hit in 2008 and brought 15-20 inches of rain creating areas of flooding and causing property damage to homes and private wells. Total damages were estimated at \$100,000.

Hurricane Irma: During the planning process for the development of this plan, Orange County, along with much of the State of Florida, was hit by Hurricane Irma on September 11, 2017. Irma resulted in severe flooding and a major disaster declaration for the County. Rainfall totals of 10-15 inches were widespread across east-central Florida. During the early morning hours of September 11, flooding breached several hundred homes and resulted in the rescue of 200 residents in Orlo Vista (Orange County) when a lake and adjacent retention ponds overflowed. The total estimated damage cost was \$110 million. Damage occurred primarily to roof shingles, soffits, awnings, and pool enclosures. Numerous trees were uprooted or snapped, some falling onto homes resulting in additional structural damage.

Figure 4.12 illustrates past hurricane strike data for land falling major hurricanes over Orange County, FL as provided by the National Hurricane Center (<http://coast.noaa.gov/hurricanes/#>).



Source: NOAA/National Hurricane Center

Figure 4.13 – Historical Hurricane Tracks within 60 Nautical Miles of Orange County (1851-2016)

Table 4.11 shows hurricane and tropical storm data reported by NCEI since 1998 for Orange County.

Table 4.12 – NCEI Hurricane/Tropical Storm Data for Orange County

Date	Event Type	Deaths/ Injuries	Property Damage	Crop Damage
09/14/1999	Hurricane	0/0	\$500,000	\$0
08/21/2008	Tropical Storm	0/0	\$100,000	\$0
9/10/2017	Tropical Storm	6/0	\$110,000,000	\$0
Total		6/0	\$110,600,000	\$0

Source: NCEI, 2017

NCEI’s available data is not comprehensive, as many of the hurricanes and tropical storms listed in Table 4.10 caused damages in the County.

NCEI does not report any storm surge or tide events in Orange County, which is likely because Orange County is located far enough inland from the coast that any storm surge flooding is highly unlikely. Any hurricane flooding that has occurred has been the result of heavy rains.

Frequency/Likelihood of Future Occurrence

Hurricane and Tropical Storm

Likely – Given the 83 hurricane and tropical storm occurrences recorded by NOAA over a period of 165 years (1851-2016), a hurricane or tropical storm affects Orange County on average once every two years.

Given the lack of historical occurrences and based on the storm surge scenarios estimated by NOAA SLOSH models, coastal storm surge is **unlikely** to affect Orange County.

Climate Change and Hurricane and Tropical Storms

One of the primary factors contributing to the origin and growth of tropical storm and hurricanes systems is water temperature. Sea surface temperature may increase significantly in the main hurricane development region of the North Atlantic during the next century as well as in the Gulf of Mexico.

4.7 Areas Likely to Flood in the Future

Based on the flood hazard profiles, the following areas have been identified by the FMPC as areas likely to flood in the future. Some of these areas are already experiencing flooding but others are not. For example, changes in floodplain development, the watershed, and the population, in combination with climate change, will make these targeted areas more likely to flood in the future.

Identified Area #1: 100-yr and 500-yr SFHAs

According to the Effective FEMA FIRM maps dated September 25, 2009, 35% of the land area within the County is located within a SFHA. Given that the population of Orange County is projected to increase by 60% between 2010 and 2045 (medium range projection), changes in the floodplain and development within the watershed may increase the base flood elevation in SFHAs due to changes in the built environment. SFHA boundaries may also expand as a result of changes in floodplain development and development in the watershed if these changes and development bring an increase in impervious surface or infringe upon natural floodplains and drainage features.

Identified Area #2: Areas of Localized Stormwater Flooding

Due to a relatively flat terrain and a consistent level of annual precipitation, it is likely that unmitigated properties will continue to experience localized flooding. Future population increases will likely lead to new development. An increase in impervious area will exacerbate localizing flooding issues unless measures are taken to reduce the volume of runoff. Furthermore, the intensity of individual rainfall events is likely to increase in the future due to climate change which may further overwhelm stormwater drainage systems.

Identified Area #3: Repetitive Loss Areas

Properties categorized as repetitive loss properties have a greater need for flood protection. Repetitive loss can be attributed to development within the 100-yr floodplain as well as localized stormwater flooding. As mentioned above, both types of flooding are likely to increase in the future due to changes in floodplain development and development in the watershed as well as due to the effects of climate change. Therefore, it is very likely that unmitigated repetitive loss properties will continue to flood in the future and it is possible that properties with similar flood conditions may become repetitive loss properties.

Identified Area #4: Orlo Vista

The heavy rainfall brought by Hurricane Irma on September 11, 2017 revealed serious vulnerability to flooding in Orlo Vista, a neighborhood west of downtown Orlando. Orlo Vista previously experienced major flooding from Hurricane Donna in 1960, but a series of stormwater management projects, including retention ponds, canals, and pumps, were thought to have mitigated flood risk in the area. The neighborhood does not officially fall within the SFHA, but parts of the neighborhood south and east of the lakes are considered vulnerable to the 1%-annual-chance flood according to a report prepared by Geosyntec and reported in the Orlando Sentinel. The flood risk modeled by Geosyntec is shown in Figure 4.14.



Figure 4.14 – Orlo Vista Flood Risk

Heavy rains from Hurricane Irma caused the overtopping of Lake Venus (mapped as “existing pond” in Figure 4.14), which flooded 500 homes and necessitated the evacuation of approximately 200 people from the Orlo Vista neighborhood according to reports in the Orlando Sentinel. Thus, despite the fact that the FIRMs do not reflect this risk, Orlo Vista is considered likely to flood in the future if actions are not taken to mitigate risk.

Impact of Future Flood Conditions

U.S. Census Building Permits Survey data since 2010 shows that Orange County has experienced increasing development over the past seven years. This data is summarized in Table 4.12. According to this data, by far the most common type of new residential construction in the County is single family homes. Compared to multi-unit structures, which typically have a smaller per-unit footprint and house more dwelling units per acre by building up rather than out, single family homes have a large per unit building footprint. Their space requirements also result in increased infrastructure needs such as roads and sidewalks. These large building footprints and infrastructure requirements create impervious surface which contributes to flood hazards by increasing stormwater runoff and reducing the potential for infiltration. Thus, the dominance of single family home construction in the County suggests that future flood increases as a result of population growth and development in the watershed are likely.

The U.S. Census Building Permits Survey data also indicates a substantial annual increase in property value in the County. As development continues, the potential value of losses increases as well. However, the risk to these properties depends upon their location within the County and can be managed with planning and development management to mitigate flood risk.

There are two factors associated with the increase of flood risk to people and property under future flood conditions. First, as development in the watershed continues the amount of runoff sent to drainage features increases. The 1%-annual-chance flood may become more severe as a result, and the floodplain of the 1%-annual-chance flood would expand. Development already in those areas would become exposed to increased flood risk, meaning more people and property would be at risk.

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Second, if development is allowed to occur within the floodplain, this will also increase exposure to future flooding. Additionally, development in the floodplain affects natural floodplain functions by removing needed flood storage capacity and forcing floodwaters elsewhere, thus contributing to expansion of the floodplain and an increase in future flood risk.

These processes can have similar effects on the likelihood and magnitude of stormwater flooding. Stormwater drainage systems can manage limited capacities. As development occurs and increases stormwater runoff, stormwater system capacities can become exceeded more quickly, resulting in more frequent and/or more severe stormwater flooding.

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Table 4.13 – Residential Building Permit Data, 2010-2016

Year	1-unit			2-units			3-4 units			5+ units		
	Bldgs	Units	Value	Bldgs	Units	Value	Bldgs	Units	Value	Bldgs	Units	Value
2010	2,186	2,186	\$ 572,072,925	2	4	\$ 695,111	7	28	\$ 2,788,020	30	662	\$ 60,652,281
2011	2,389	2,389	\$ 681,080,160	5	10	\$ 1,231,722	12	38	\$ 4,820,202	55	1,646	\$ 168,595,132
2012	3,909	3,909	\$ 1,116,486,455	30	60	\$ 6,821,978	6	24	\$ 2,558,274	110	3,239	\$ 349,234,455
2013	4,364	4,364	\$ 1,342,051,064	227	454	\$ 85,840,496	18	66	\$ 7,434,030	112	4,149	\$ 454,567,208
2014	4,483	4,483	\$ 1,495,190,654	39	78	\$ 13,854,251	7	28	\$ 4,279,864	148	4,657	\$ 502,128,198
2015	4,986	4,986	\$ 800,458,029	47	94	\$ 18,683,954	15	46	\$ 5,300,979	146	4,480	\$ 499,729,372
2016	6,156	6,156	\$ 1,659,646,589	105	210	\$ 35,572,892	35	125	\$ 16,442,353	178	5,461	\$ 663,150,021
Total	28,473	28,473	\$ 7,666,985,876	455	910	\$ 162,700,404	100	355	\$ 43,623,722	779	24,294	\$ 2,698,056,667

Source: U.S. Census Building Permits Survey, Annual Totals, 2010-2016

4.8 Flood Hazards Profile Summary

Table 4.13 summarizes the results of the hazard profile for Orange County based on hazard identification data and input from the FMPC. For each hazard profiled within this chapter, this table includes the likelihood of future occurrence and whether or not the hazard is considered a priority for the County. A Vulnerability Assessment is provided in Chapter 5 for priority hazards only.

Table 4.14 – Summary of Flood Hazard Profile Results

Hazard	Likelihood of Future Occurrence	Priority Hazard
Climate Change	Highly Likely	Y
Channel Bank Erosion	Possible	N
Dam/Levee Failure	Unlikely	Y
Flood: 100-/500-year	Possible	Y
Flood: Stormwater/Localized	Highly Likely	Y
Hurricane and Tropical Storms	Likely	N*

*Note: Although the occurrence of a hurricane and/or tropical storm is likely in the future, coastal storm surge is *unlikely* to affect Orange County. A Priority Risk Index rating is calculated for other types of flooding associated with a hurricane or tropical storm, but the vulnerability to that flooding will be covered in greater depth under the vulnerability assessment for Flood.

5 VULNERABILITY ASSESSMENT

44 CFR Subsection D §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. Plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:

A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;

(B): An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; and

(C): Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

This chapter quantifies the vulnerability of Orange County to the priority hazards identified in Table 4.12. It consists of the following subsections:

- ▶ 5.1 Methodology
- ▶ 5.2 Asset Inventory
- ▶ 5.3 Vulnerability Assessment Results
- ▶ 5.4 Priority Index Results

The FMPC conducted a vulnerability assessment of the hazards identified as a priority in order to assess the impact that each hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to natural hazards and estimates potential losses.

Vulnerability assessments followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (August 2001). The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

Data used to support this assessment included the following:

- ▶ County GIS data (hazards, base layers, and assessor’s data)
- ▶ Hazard layer GIS datasets from federal agencies
- ▶ Written descriptions of inventory and risks provided by the State Hazard Mitigation Plan
- ▶ Other Existing plans and studies provided by the County

5.1 Methodology

Two distinct risk assessment methodologies were used in the formation of this vulnerability assessment. The first consists of a quantitative analysis that relies upon best available data and technology, while the second approach consists of a somewhat qualitative analysis that relies on local knowledge and rational decision making. The quantitative analysis involved the use of the most recent version of Hazards U.S. Multi-Hazard (Hazu) software, a nationally applicable standardized set of models available from FEMA for estimating potential losses from earthquakes, floods, and hurricanes.

Hazu uses a statistical approach and mathematical modeling of risk to predict a hazard’s frequency of occurrence and estimated impacts based on recorded or historic damage information. The Hazu risk assessment methodology is parametric, in that distinct hazard and inventory parameters—such as wind speed and building type—were modeled using the Hazu software to determine the impact on the built environment.

5.2 Asset Inventory

Based on Orange County’s 2016 parcel layer, an inventory of assets was compiled in order to identify those structures potentially at risk to the identified hazards. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed.

5.2.1 Properties at Risk

Building exposure counts by FEMA flood zone were determined using a spatial intersection of the parcel layer provided by Orange County and the effective FEMA flood zones provided in the Orange County DFIRM database effective September 25, 2009. The building values are based on 2016 Orange County tax assessor data. Table 5.1 details the various property types in Orange County and their estimated value.

Table 5.1 – Properties at Risk by Occupancy Type – Orange County Unincorporated Areas

Occupancy Type	Total Number of Buildings in Floodplain	Total Building Value	Estimated Content Value	Total Value
Zone AH				
Agricultural	1	\$11,628	\$11,628	\$23,256
Commercial	0	\$0	\$0	\$0
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	0	\$0	\$0	\$0
Total	1	\$11,628	\$11,628	\$23,256
Zone A				
Agricultural	71	\$10,115,149	\$10,115,149	\$20,230,298
Commercial	20	\$11,464,554	\$11,464,554	\$22,929,108
Education	2	\$85,888	\$42,944	\$0
Government	0	\$0	\$0	\$0
Industrial	13	\$37,569,954	\$56,354,931	\$93,924,885
Religious	0	\$0	\$0	\$0
Residential	2677	\$853,691,473	\$426,845,737	\$1,280,537,210
Total	2783	\$912,927,018	\$504,823,315	\$1,417,750,333
Zone D				
Agricultural	0	\$0	\$0	\$0
Commercial	0	\$0	\$0	\$0
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	1	\$440,302,320	\$220,151,160	\$660,453,480
Total	1	\$440,302,320	\$220,151,160	\$660,453,480
Zone AE				
Agricultural	85	\$22,282,908	\$22,282,908	\$44,565,816

Occupancy Type	Total Number of Buildings in Floodplain	Total Building Value	Estimated Content Value	Total Value
Commercial	59	\$23,894,943	\$23,894,943	\$47,789,886
Education	5	\$20,448,226	\$11,849,819	\$0
Government	0	\$0	\$0	\$0
Industrial	113	\$106,591,474	\$159,887,211	\$266,478,685
Religious	0	\$0	\$0	\$0
Residential	4070	\$1,181,370,355	\$590,685,178	\$1,772,055,533
Total	4332	\$1,354,587,906	\$808,600,059	\$2,163,187,965
Zone X (500-yr)				
Agricultural	9	\$918,675	\$918,675	\$1,837,350
Commercial	6	\$3,196,707	\$3,196,707	\$6,393,414
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	1,382	\$322,864,461	\$161,432,231	\$484,296,692
Total	1,397	\$326,979,843	\$165,547,613	\$492,527,456
Zone X (Unshaded)				
Agricultural	905	\$406,607,249	\$406,607,249	\$813,214,498
Commercial	4,757	\$2,906,656,996	\$2,906,656,996	\$5,813,313,992
Education	114	\$670,789,217	\$423,670,715	\$1,094,459,932
Government	2	\$816,550	\$816,550	\$1,633,100
Industrial	2275	\$2,182,605,602	\$3,273,908,403	\$5,456,514,005
Religious	0	\$0	\$0	\$0
Residential	226,912	\$45,995,988,624	\$22,997,994,312	\$68,993,982,936
Total	234,965	\$52,163,464,238	\$30,009,654,225	\$82,173,118,463

Source: Orange County 2016 Tax Assessor's Data, FEMA 2009 DFIRM, Hazus v3.1

Note: Content value estimations are generally based on the FEMA Hazus methodology of estimating value as a percent of improved structure values by property type. The residential property type assumes a content replacement value equal to 50% of the building value. Agricultural, commercial, education, government, and religious property types assume a content replacement value equal to 100% of the building value. The industrial property type assumes a content replacement value equal to 150% of the building value.

5.2.2 Critical Facilities Inventory

Of significant concern with respect to any disaster event is the location of critical facilities in the planning area. Critical facilities are often defined as those essential services and facilities in a major emergency which, if damaged, would result in severe consequences to public health and safety or a facility which, if unusable or unreachable because of a major emergency, would seriously and adversely affect the health, safety, and welfare of the public. Critical facility locations are shown in relation to the 1%-annual-chance and 0.2%-annual-chance floodplains in Figure 5.1 and listed by type in Table 5.2 on the following page.

Table 5.7 in Section 5.4.3 lists critical facilities that are currently in the floodplain.

Table 5.2 – Critical Facilities in Orange County by Flood Zone

Facility Type	Count
Zone AE	
School	1
Zone A	
Hospital	1
School	1
Zone X (Unshaded)	
College	8
EOC	2
Fire Station	40
Hospital	3
Law Enforcement	8
National Guard	4
Public School	111
School & Shelter	16

Planning for Critical Facility and Infrastructure Protection

Orange County has several options to reduce the vulnerability of critical facilities. Facilities in the floodplain are the top priority for protection, but all facilities may be at risk because areas outside the 1%-annual-chance and 0.2%-annual-chance floodplain are still at low risk to flooding. Properties outside of high-risk flood areas account for over 20 percent of NFIP claims and one-third of disaster assistance for flooding.

Per FEMA guidance, of primary concern is the protection of essential systems and equipment to maintain the function of critical facilities for community resilience during and after hazard events. One way to protect critical facilities is to ensure that electrical systems, mechanical systems, and other essential equipment are elevated above the base flood elevation. Another option is to install dry floodproofing to protect critical components from floodwaters, flood forces, and leakage. Among the components that should be considered for protection are electrical service and distribution systems; data systems; heating, ventilation, and air conditioning systems; water and wastewater systems; emergency power systems, and elevators. Alternately, Orange County can consider relocating vulnerable critical facilities to new locations outside the floodplain, though additional protection may still be required.

Deciding on protection for critical facilities depends on each facility type and its use before, during, and after a hazard event. Neither school in the 100-year floodplain serves as an emergency shelter. However, flood protection for these facilities is still important, so that after a flood event the school can continue or resume operation without interruption. Maintaining school operation helps flood-affected residents with children to recover and return to normalcy more quickly.

Typically, schools can close if they need time to recover after a flood, but hospitals must remain operational, if possible, through the duration of a flood. Officials of the hospital located in Zone A should ensure that its electrical equipment is elevated and that multiple backup power systems are in place to ensure resilience to flooding. Though evacuation is not ideal, the hospital should also have emergency procedures, including evacuation plans, to be prepared for the worst-case scenario.

The Orange County FMPC has considered these concerns and protection options in developing their mitigation strategies.

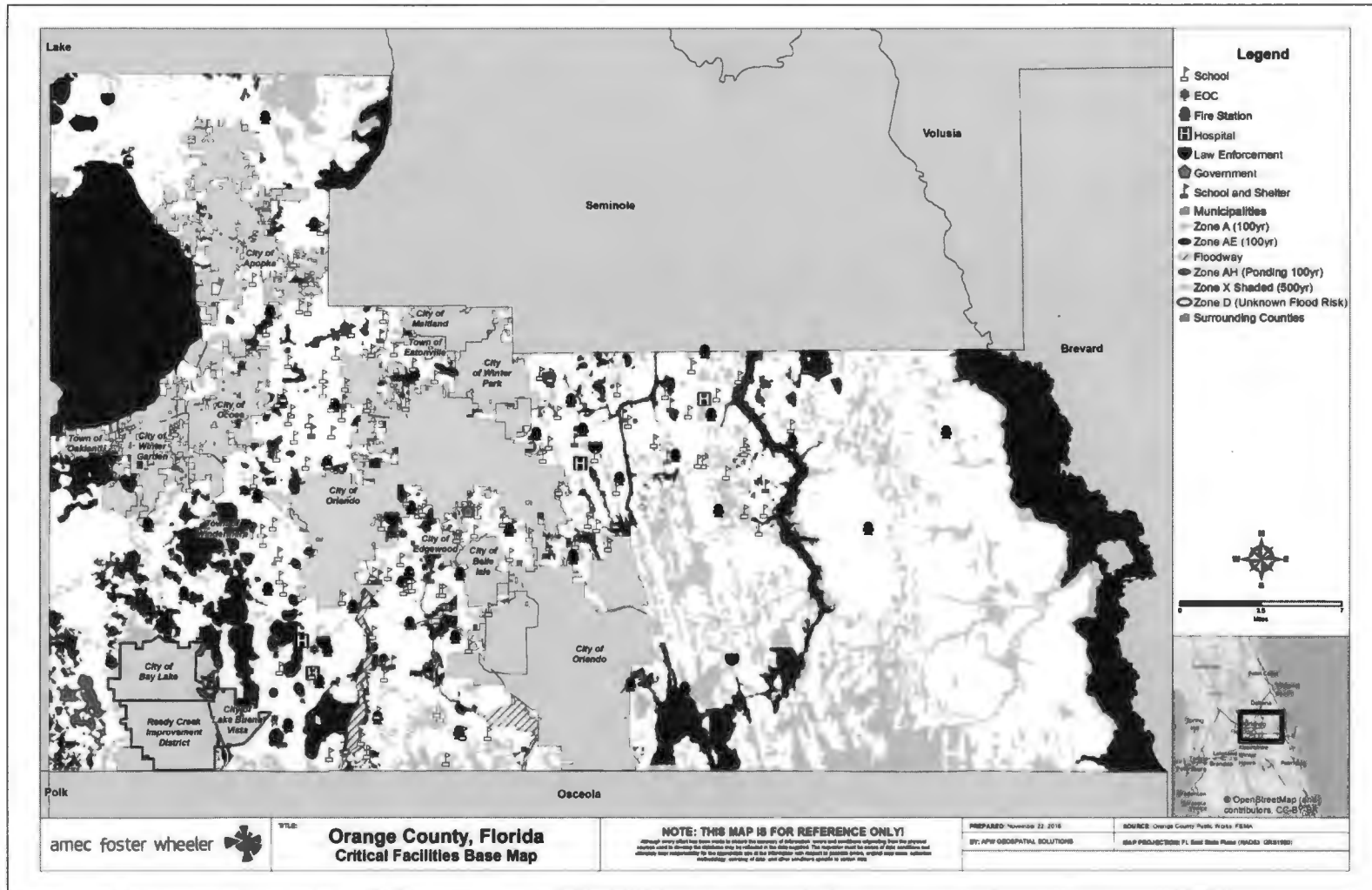


Figure 5.1 – Orange County Critical Facilities

5.3 Health & Safety

5.3.1 Life, Safety, Warning, and Evacuation

All of the flood hazards evaluated in Section 5 Vulnerability Assessment have the potential to impact life, safety and the need for warning and evacuation of residents and visitors. Just six inches of flood-water can knock over an adult, and two feet of water is enough to carry away most vehicles. This risk to life and safety necessitates establishing warning and evacuation procedures to ensure that both residents and visitors are aware of flood events and able to move to safety.

Orange County has multiple public warning systems established to ensure that residents and visitors are notified of flood events. These systems include the following:

- ▶ NOAA Weather Radio
- ▶ OCAAlert.net
- ▶ OCFL Alert Smartphone Apps
- ▶ Media Coordination
- ▶ Orange County Government Website
- ▶ Partners such as 2-1-1
- ▶ Door-to-door Notification by First Responders
- ▶ Code Red (Reverse Dialing)
- ▶ Emergency Alert System
- ▶ Orange County 3-1-1
- ▶ FEMA Smartphone App
- ▶ Orange TV
- ▶ Facebook
- ▶ Twitter

The County’s warning systems are coordinated by the Office of Emergency Management through the Orange County Fire Rescue Communications Center and the Orange County Emergency Operations Center. Information shared on these systems includes emergency actions to be taken, shelter locations and status, evacuation zones, and evacuation routes.

The County does not have any storm surge evacuation zones, but does serve as a sheltering location for evacuees from coastal locations. Evacuation routes intended to funnel evacuees to shelters within the County are shown on the following page. Major routes in this plan include:

- ▶ Interstate 4
- ▶ State Route 50
- ▶ U.S. 441
- ▶ State Route 528
- ▶ John Young Parkway
- ▶ Florida Turnpike
- ▶ State Route 417

The County Stormwater Management Division also has a list of hurricane preparedness procedures that are enacted in the event that a storm event seems likely. These procedures include the following:

- All drainwells are checked to ensure readiness to receive runoff at maximum capacity. Any needing cleaning are cleaned immediately. All drainwells on the hot spot list are checked daily.
- All pump stations are checked to ensure they and their generators are fully operational. Several pump stations are lowered.
- All control structures are checked to be in good condition. Several weirs are lowered.
- All canals are checked for blockages, and any blockages are immediately removed.
- All retention ponds and outfall structures are checked and cleared to ensure proper outflow if needed.
- All mobile pumps are tested and readied for mobilization.
- All chainsaws are readied for mobilization.
- All vehicles and equipment are fueled and readied for mobilization.
- All personnel must update contact information and ready equipment to prepare for mobilization.

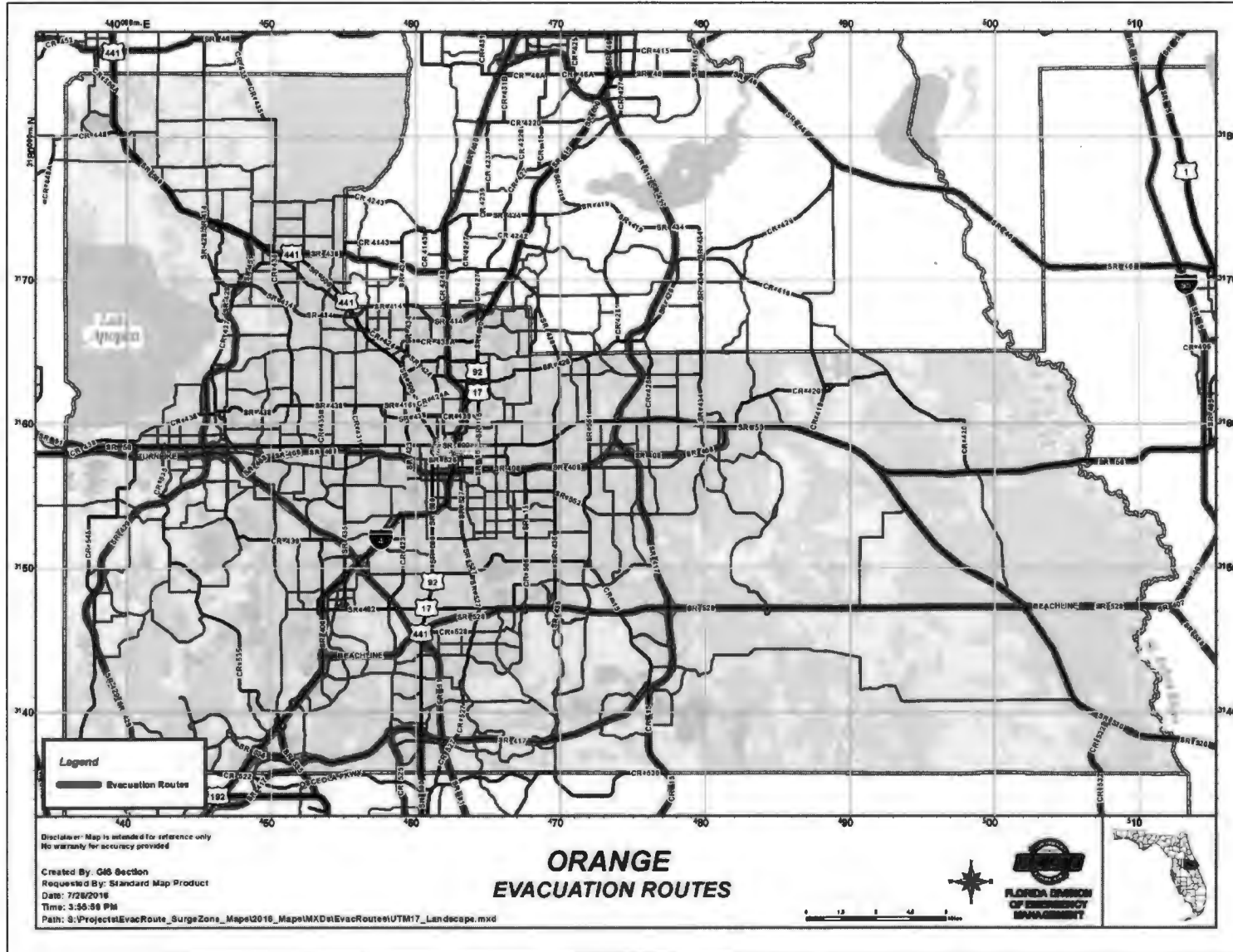


Figure 5.2 – Orange County Evacuation Routes

5.3.2 Public Health

Certain health hazards are common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where farm animals are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e.coli and other disease causing agents.

The second type of health problem arises after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If the County's water systems lose pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and personal belongings destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

5.4 Vulnerability Assessment Results

The Disaster Mitigation Act regulations require that the FMPC evaluate the risks associated with each of the hazards identified in the planning process. This section summarizes the possible impacts and quantifies the County's vulnerability to each of the hazards identified as a priority hazard in Table 4.12.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical facilities, historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat). Together, this information conveys the impact, or vulnerability, of that area to that hazard.

The conclusions drawn from the hazard profiling and vulnerability assessment process can be used to prioritize all potential hazards to the planning area. The Priority Risk Index (PRI) is a good practice to use when prioritizing hazards because it provides a standardized numerical value so that hazards can be compared against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and a weighting factor as summarized below in Table 5.3.

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Table 5.3 – Priority Risk Index

RISK ASSESSMENT CATEGORY	LEVEL	DEGREE OF RISK CRITERIA	INDEX	WEIGHT
PROBABILITY What is the likelihood of a hazard event occurring in a given year?	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 10 & 100% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	100% ANNUAL PROBABILITY	4	
IMPACT In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR > 1 DAY	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR > 1 WEEK.	3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES > 30 DAYS.	4	
SPATIAL EXTENT How large of an area could be impacted by a hazard event? Are impacts localized or regional?	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED	3	
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED	4	
WARNING TIME Is there usually some lead time associated with the hazard event? Have warning measures been implemented?	MORE THAN 24 HRS	SELF DEFINED	1	10%
	12 TO 24 HRS	SELF DEFINED	2	
	6 TO 12 HRS	SELF DEFINED	3	
	LESS THAN 6 HRS	SELF DEFINED	4	
DURATION How long does the hazard event usually last?	LESS THAN 6 HRS	SELF DEFINED	1	10%
	LESS THAN 24 HRS	SELF DEFINED	2	
	LESS THAN 1 WEEK	SELF DEFINED	3	
	MORE THAN 1 WEEK	SELF DEFINED	4	

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). The sum of all five risk assessment categories equals the final PRI value, demonstrated in the equation below (the highest possible PRI value is 4.0).

$$\text{PRI VALUE} = [(\text{PROBABILITY} \times .30) + (\text{IMPACT} \times .30) + (\text{SPATIAL EXTENT} \times .20) + (\text{WARNING TIME} \times .10) + (\text{DURATION} \times .10)]$$

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The purpose of the PRI is to categorize and prioritize all potential hazards for planning area as high, moderate, or low risk. The summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes.

5.4.1 Climate Change

Probability	Impact	Spatial Extent	Warning Time	Duration
Highly Likely	Minor	Large	> 24 hours	> 1 week

Orange County is vulnerable to the potential impacts of climate change, though due to its location inland, is safe from the impacts of sea level rise. The climate change hazard profile in Section 4.1 discusses how climate-driven hazards such as hurricanes and flooding are likely to increase in intensity, and possibly frequency, in the future. Thus the 25-year flood of today may become the 10-year event in the future. The reader should refer to the vulnerability assessment discussions on Flood and Hurricane for the current exposure and risk to these hazards with the perspective that climate change has the potential to exacerbate the existing risk and vulnerabilities. The potential impacts of climate change include increased flooding frequency, potential damage to critical infrastructure, and increasing public costs associated with flood insurance claims, infrastructure repair and maintenance, environmental impacts and increased costs associated with emergency management efforts. Hazard mitigation efforts to address climate change should include property protection strategies to reduce exposure to flooding and public outreach strategies to increase awareness of the likelihood of increased future risk.

5.4.2 Dam/Levee Failure

Probability	Impact	Spatial Extent	Warning Time	Duration
Unlikely	Critical	Moderate	6 to 12 hours	< 1 week

Given the current dam inventory and historic data, a dam breach of a high hazard dam is unlikely (<1 percent annual probability) in the future. However, regular monitoring can help mitigate or prevent failures if appropriate actions are taken when it is determined a failure may be likely.

As noted in Section 4.3, there are six dams located within the jurisdictional boundaries of Orange County; two of the dams are classified as high hazard: Michaels Dam and Cheney Dam. The flood risk associated with the Michaels, Cheney and Banner (low hazard) dams has been determined based on a dam breach analysis performed by Geosyntec. The dam breach analysis consists of modeling a dam failure, a piping failure in this case, and evaluating the resulting downstream hydraulics. The failure scenario was modeled to occur during the 100-year storm, i.e. the boundary conditions related to flow hydrographs and water surface elevations were consistent with those during the 100-year storm. Once the failure scenario was modeled, flood inundation maps were generated to show the extent of the flooding resulting from dam failure. This analysis was performed by a consulting group called CSI in 2014 for Banner and Michaels Dam and 2015 for Cheney Dam.

To create the flood inundation maps, Geosyntec recreated the CSI generated flood inundation extents and then utilized ArcGIS to evaluate what structures and roads would be impacted in the event of a dam failure. Both maximum water surface elevations and water depth rasters were generated and then overlay on the 2016 Orange County aerials. Based on visual inspection, structures and roads were identified as being impacted and to what extent (i.e. expected depth of flooding). Figure 5.3 on the following page depicts an overview map for the Banner and Michael's dam inundation. Figure 5.4 depicts an overview map for Cheney dam inundation.

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For additional inundation details including inundation depth and peak flood elevation of several structures and streets that experience flooding during dam failure, refer to the Emergency Action Plan prepared by Geosyntec Consultants for Orange County in December 2016.

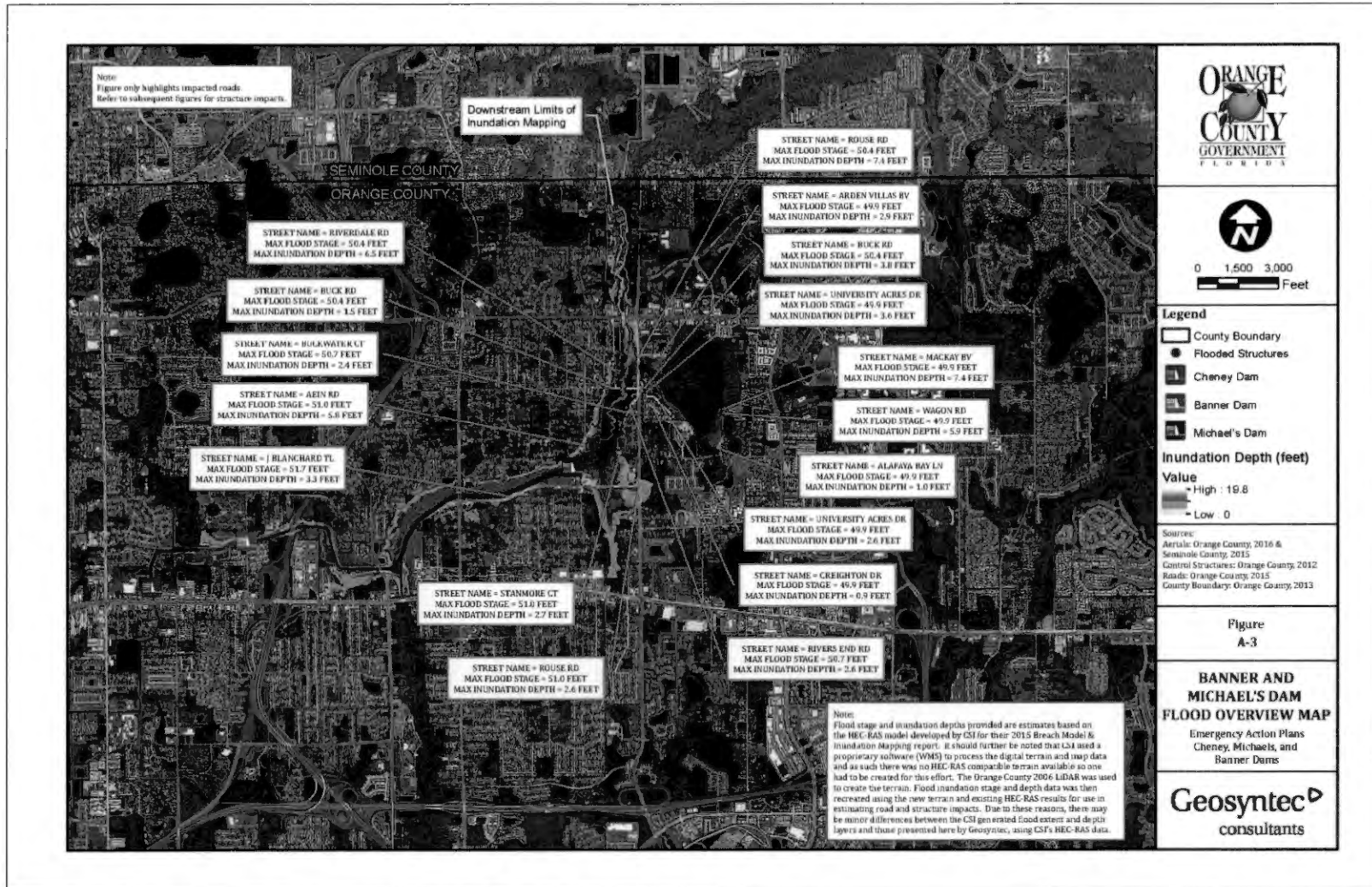


Figure 5.3 – Banner and Michael's Dam Flood Overview Map

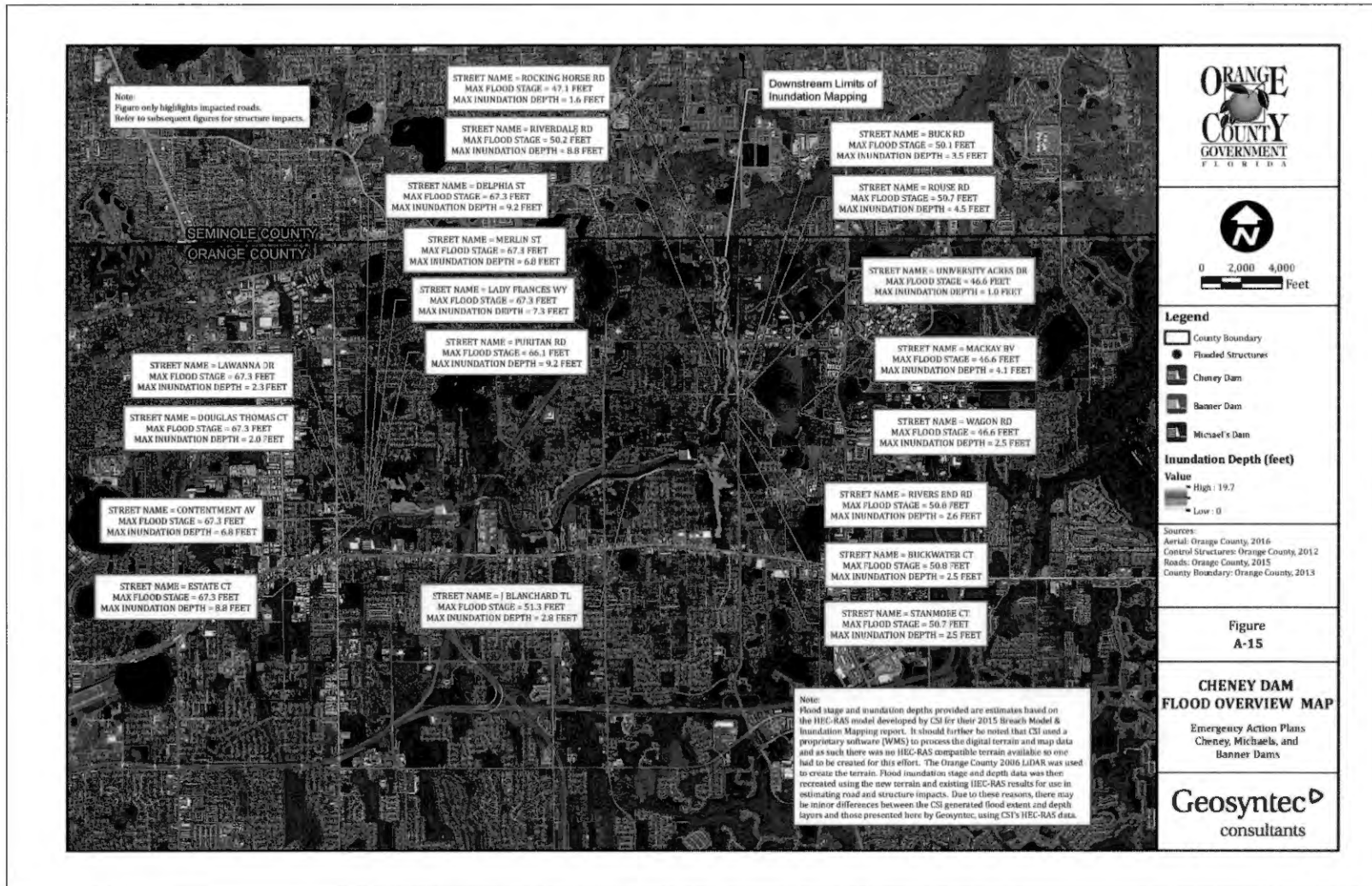


Figure 5.4 – Cheney Dam Flood Overview Map

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5.4.3 Flood: 100-/500-year

Probability	Impact	Spatial Extent	Warning Time	Duration
Possible	Limited	Moderate	12 to 24 hours	< 1 week

Flood damage is directly related to the depth of flooding by the application of a depth damage curve. In applying the curve, a specific depth of water translates to a specific percentage of damage to the structure, which translates to the same percentage of the structure’s replacement value. Table 5.4 provides the depth damage factors that were used to calculate flood losses for Orange County. These depth damage factors are based on the default depth damage curve in Hazus.

Table 5.4 – Depth Damage Percentages

Depth(ft)	Percent Damaged (%)						
	Agricultural	Commercial	Education	Government	Industrial	Religious	Residential
0	0	1	0	0	1	0	13
1	6	9	5	5	10	10	23
2	11	14	7	8	12	11	32
3	15	16	9	13	15	11	40
4	19	18	9	14	19	12	47
5	25	20	10	14	22	12	53
6	30	23	11	15	26	13	59
7	35	26	13	17	30	14	63
8	41	30	15	19	35	14	67
9	46	34	17	22	39	15	71
10	51	38	20	26	42	17	73
11	57	42	24	31	48	19	75
12	63	47	28	37	50	24	77
13	70	51	33	44	51	30	79
14	75	55	39	51	53	38	80
15	79	58	45	59	54	45	81
16	82	61	52	65	55	52	81
17	84	64	59	70	55	58	82
18	87	67	64	74	56	64	82
19	89	69	69	79	56	69	83
20	90	71	74	83	57	74	83
21	92	74	79	87	57	78	83
22	93	76	84	91	57	82	84
23	95	78	89	95	58	85	84
24	96	80	94	98	58	88	84

Content value estimations are based on FEMA Hazus methodologies of estimating value as a percent of improved structure values by property type. Table 5.5 shows the breakdown of the various property types and their estimated content replacement value percentages.

Table 5.5 – Content Replacement Factors

Property Type	Content Replacement Values
Residential	50%
Commercial	100%
Educational	100%
Government	100%
Religious	100%
Industrial	150%

Table 5.6 details the estimated losses for the 100-year flood event, calculated using Hazus methodologies for value of contents based on occupancy type. The loss value is based on the total of improved building value and contents value. Land value is not included in any of the loss estimates as generally land is not subject to loss from floods.

Table 5.6 – Estimated Building Damage and Content Loss for 100-Year Flood

Occupancy Type	Total Number of Buildings with Loss	Total Value (Building & Contents)	Estimated Building Damage	Estimated Content Loss	Estimated Total Damage	Loss Ratio
Agricultural	85	\$19,017,017	\$4,881,544	\$11,711,216	\$16,592,760	87.3%
Commercial	57	\$22,896,586	\$1,835,559	\$6,955,092	\$8,790,652	38.4%
Education	5	\$32,298,045	\$3,227,119	\$3,689,534	\$6,916,653	21.4%
Government	0	\$0	\$0	\$0	\$0	0.0
Industrial	107	\$105,487,250	\$6,610,020	\$21,096,108	\$27,706,129	26.3%
Religious	0	\$0	\$0	\$0	\$0	0.0
Residential	3,997	\$1,147,882,464	\$301,459,268	\$175,841,420	\$477,300,688	41.6%
Total	4,251	\$1,327,581,362	\$318,013,511	\$219,293,371	\$537,306,881	40.5%

Table 5.7 details the critical facilities within the County that are at risk to the 100-year and 500-year flood events.

Table 5.7 – Critical Facilities at Risk to 100-/500-year Flood

Facility Name	Address	Facility Type	Estimated 100-yr Flood Depth (Ft)
Zone AE (100-yr)			
ORLANDO MARINE INSTITUTE	1461 S LAKE PLEASANT RD, APOPKA	School	1.69
Zone A (100-yr)			
UNIVERSITY BEHAVIORAL CENTER	2500 DISCOVERY DR, ORLANDO	Hospital	Data not available
PRINCETON HOUSE CHARTER SCHOOL	4832 FAIRVIEW AVE, ORLANDO	School	Data not available
Zone X Shaded (500-yr)			
No facilities at risk to 500-year flood			

Figure 5.5 on the following page depicts the depth of flooding that can be expected within the Orange County planning area during the 100-year flood event. Figure 5.6 depicts critical facilities in relation to the 100-year flood depth.

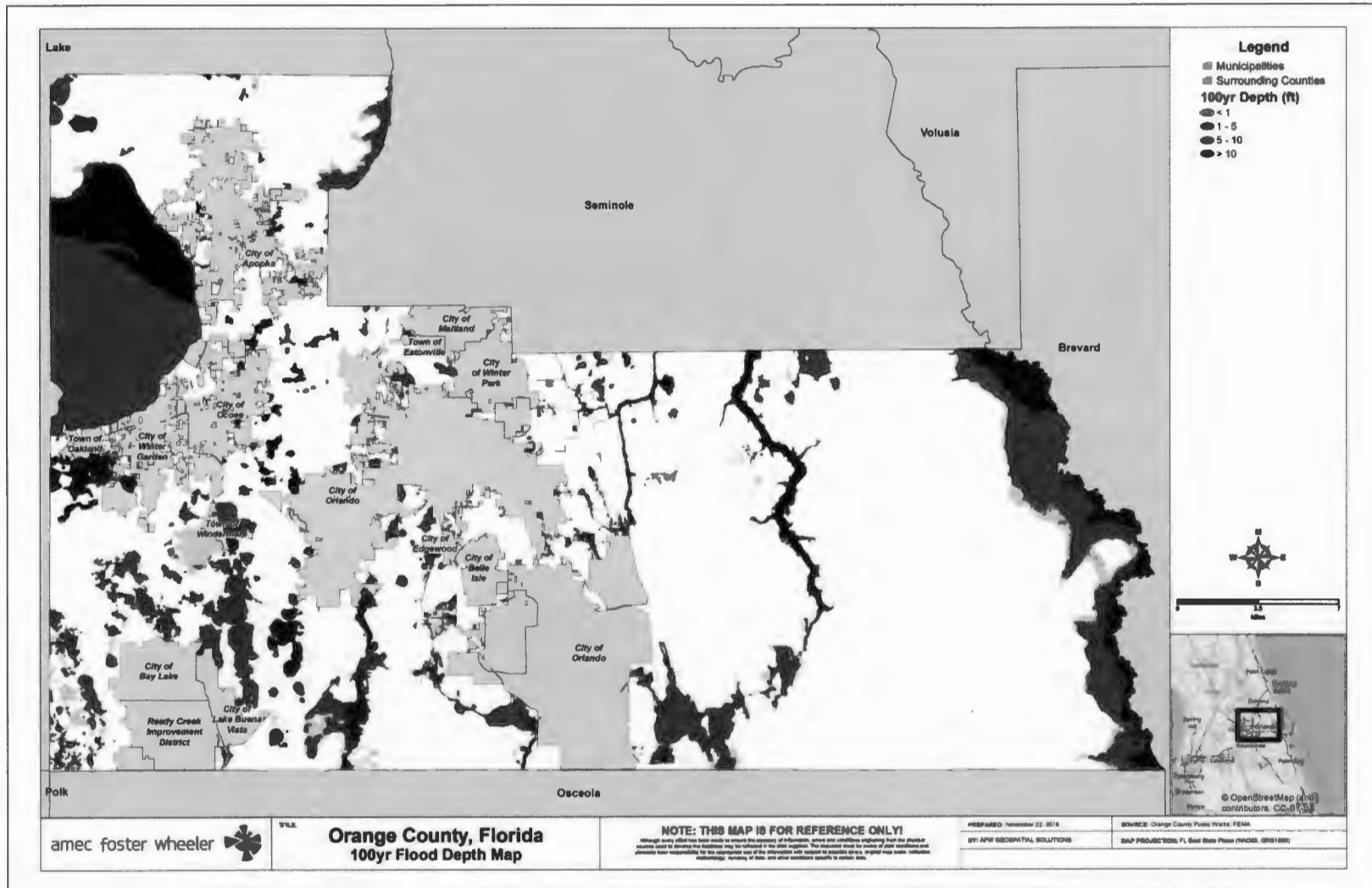


Figure 5.5 – 100-yr Flood Depth for Orange County

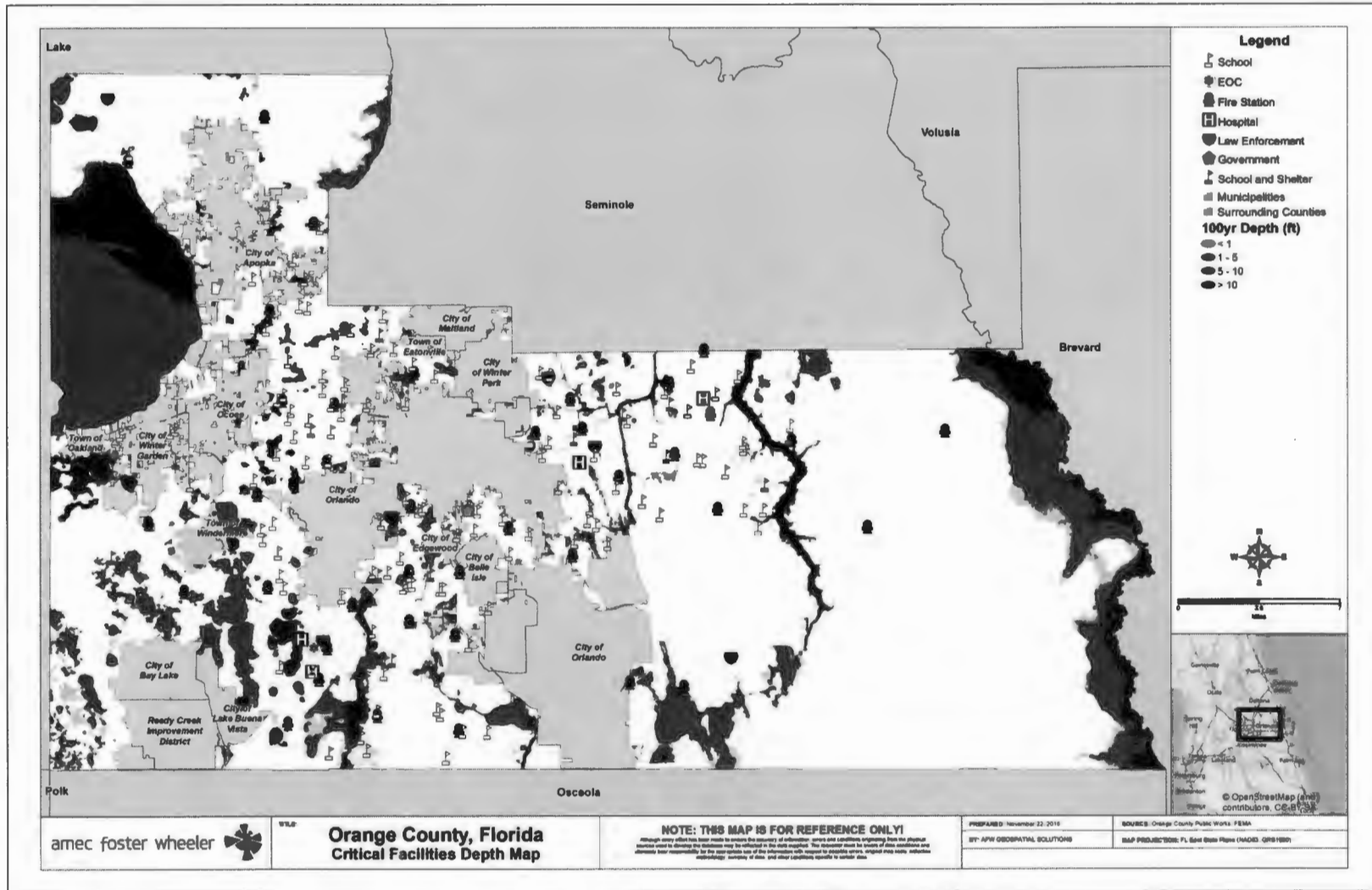


Figure 5.6 – 100-yr Flood Depth and Critical Facilities

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Food Insurance Analysis

One valuable source of information on flood hazards is current flood insurance data for active policies and past claims. Flood insurance is required as a condition of federal aid or a mortgage or loan that is federally insured for a building located in a FEMA flood zone.

Orange County has been a regular participant in the NFIP since December 1981. Orange County has achieved a Class 5 flood insurance rating through participation in the NFIP’s Community Rating System which rewards all policyholders in the SFHA with a 25% reduction in their flood insurance premiums. Non-SFHA policies (Standard X Zone policies) receive a 10% discount, and preferred risk policies receive no discount. The following tables reflect NFIP policy and claims data for the County categorized by occupancy type, flood zone, Pre-FIRM and Post-FIRM.

Table 5.8 – NFIP Policy and Claims Data by Occupancy Type

Structure Type	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	7,938	\$3,441,483	\$2,146,926,700	202	\$2,206,850.36
2-4 Family	88	\$38,729	\$16,664,400	3	\$28,318.99
All Other Residential	1,668	\$437,896	\$207,064,200	12	\$150,790.91
Non-Residential	309	\$476,631	\$148,508,200	16	\$442,190.67
Total	10,003	\$4,394,739	\$2,519,163,500	233	\$2,828,148.00

Source: FEMA Community Information System, February 2017

Table 5.9 – NFIP Policy and Claims Data by Flood Zone

Flood Zone ¹	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2,548	\$1,241,349	\$548,634,300	72	\$831,341.06
A Zones	1,263	\$844,645	\$272,298,700	27	\$344,513.03
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	1	\$540	\$500,000	2	\$26,654.08
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	1,044	\$455,139	\$203,716,500	41	\$764,095.84
Preferred	5,147	\$1,853,066	\$1,494,014,000	82	\$851,821.19
Total	10,003	\$4,394,739	\$2,519,163,500	224	\$2,818,424.00

Source: FEMA Community Information System, February 2017

¹Flood zone is indicative of historic policy zone.

Table 5.10 – NFIP Policy and Claims Data Pre-FIRM

Flood Zone ¹	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	919	\$660,955	\$185,799,800	41	\$312,454.48
A Zones	340	\$284,428	\$58,592,000	11	\$205,311.54
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	0	\$0.00

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Flood Zone ¹	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	523	\$176,970	\$82,183,000	35	\$616,990.45
Preferred	1,033	\$364,671	\$277,918,000	44	\$544,073.79
Total	2,815	\$1,487,024	\$604,492,800	131	\$1,678,829.00

Source: FEMA Community Information System, February 2017

¹Flood zone is indicative of historic policy zone.

Table 5.11 – NFIP Policy and Claims Data Post-FIRM

Flood Zone ¹	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1,629	\$580,394	\$362,834,500	31	\$518,886.58
A Zones	923	\$560,217	\$213,706,700	16	\$139,201.49
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	1	\$540	\$500,000	2	\$26,654.08
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	521	\$278,169	\$121,533,500	6	\$147,105.39
Preferred	4,114	\$1,488,395	\$1,216,096,000	39	\$312,473.85
Total	7,188	\$2,907,715	\$1,914,670,700	94	\$1,144,320.00

Source: FEMA Community Information System, February 2017

¹Flood zone is indicative of historic policy zone.

Repetitive Loss Analysis

A repetitive loss property is a property for which two or more flood insurance claims of more than \$1,000 have been paid by the NFIP within any 10-year period since 1978. An analysis of repetitive loss was completed for Orange County Unincorporated Areas to examine repetitive loss properties against FEMA flood zones.

Methodology

According to 2016 NFIP records, there are a total of 10 unmitigated repetitive loss properties and 4 mitigated repetitive loss properties within Orange County Unincorporated Areas. Table 5.12 details unmitigated repetitive loss building counts by FEMA flood zone, building type and insurance.

Table 5.12 – Unmitigated Repetitive Loss Summary

Flood Zone ¹	Building Type		Building Count		Total Building Payment	Total Content Payment	Total Paid
	Commercial	Residential	Insured	Uninsured			
X		X		X	\$46,135.36	\$0.00	\$46,135.36
X		X	X		\$220,389.95	\$30,688.36	\$251,078.31
AE		X		X	\$20,878.61	\$1,106.73	\$21,985.34
X		X		X	\$24,028.53	\$0.00	\$24,028.53
AE		X		X	\$8,224.20	\$0.00	\$8,224.20
X		X	X		\$43,996.28	\$18,675.82	\$62,672.10
AE		X	X		\$112,804.53	\$43,882.24	\$156,686.77
X		X	X		\$112,481.30	\$30,313.03	\$142,794.33
X		X		X	\$3,402.68	\$0.00	\$3,402.68
X		X	X		\$29,221.90	\$6,261.19	\$35,483.09
Total	0	10	5	5	\$621,156.33	\$130,927.37	\$752,490.71

Source: NFIP Repetitive Loss Data, May 31, 2016

¹Flood Zone is based on 9/25/09 DFIRM.

Figure 5.7 on the following page illustrates repetitive loss areas within Orange County. The repetitive loss areas were created by identifying the unmitigated repetitive loss properties, surrounding historic loss properties and additional properties that are likely to experience the same or similar flood conditions but not have had any claims paid against the NFIP.

Repetitive Loss Area Mapping

The above list of unmitigated repetitive loss properties is not a complete list of properties at risk to repeat flood events. In accordance with the principles outlined in the CRS guidance titled Mapping Repetitive Loss Areas dated August 15, 2008, 9 repetitive loss areas were identified in Orange County. The FMPC and consulting team created the repetitive loss areas by identifying the unmitigated repetitive loss properties, surrounding historic loss properties (those with one claim paid against the NFIP) and additional properties that are likely to experience the same or similar flood conditions but have not yet had any claims paid against the NFIP. The resulting 9 repetitive loss areas are shown together in Figure 5.7 and detailed in Figure 5.8 through Figure 5.16. The structure count within each repetitive loss area is detailed in Table 5.13 below.

Table 5.13 – Structures in Repetitive Loss Areas

Repetitive Loss Area	Number of Structures
1	4
2	1
3	4
4	6
5	3
6	3
7	5
8	4
9	5
Total	35

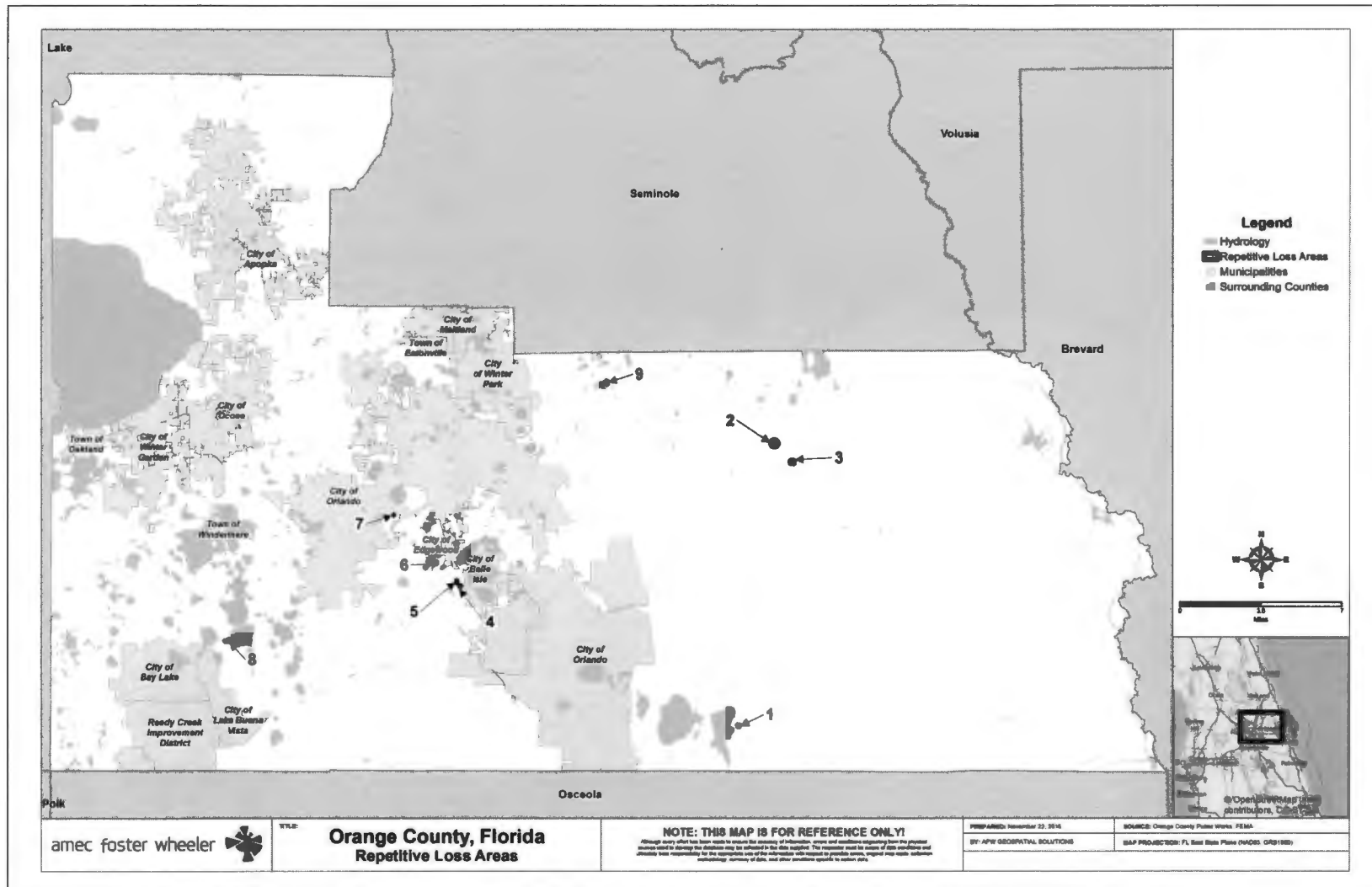


Figure 5.7 – Repetitive Loss Areas

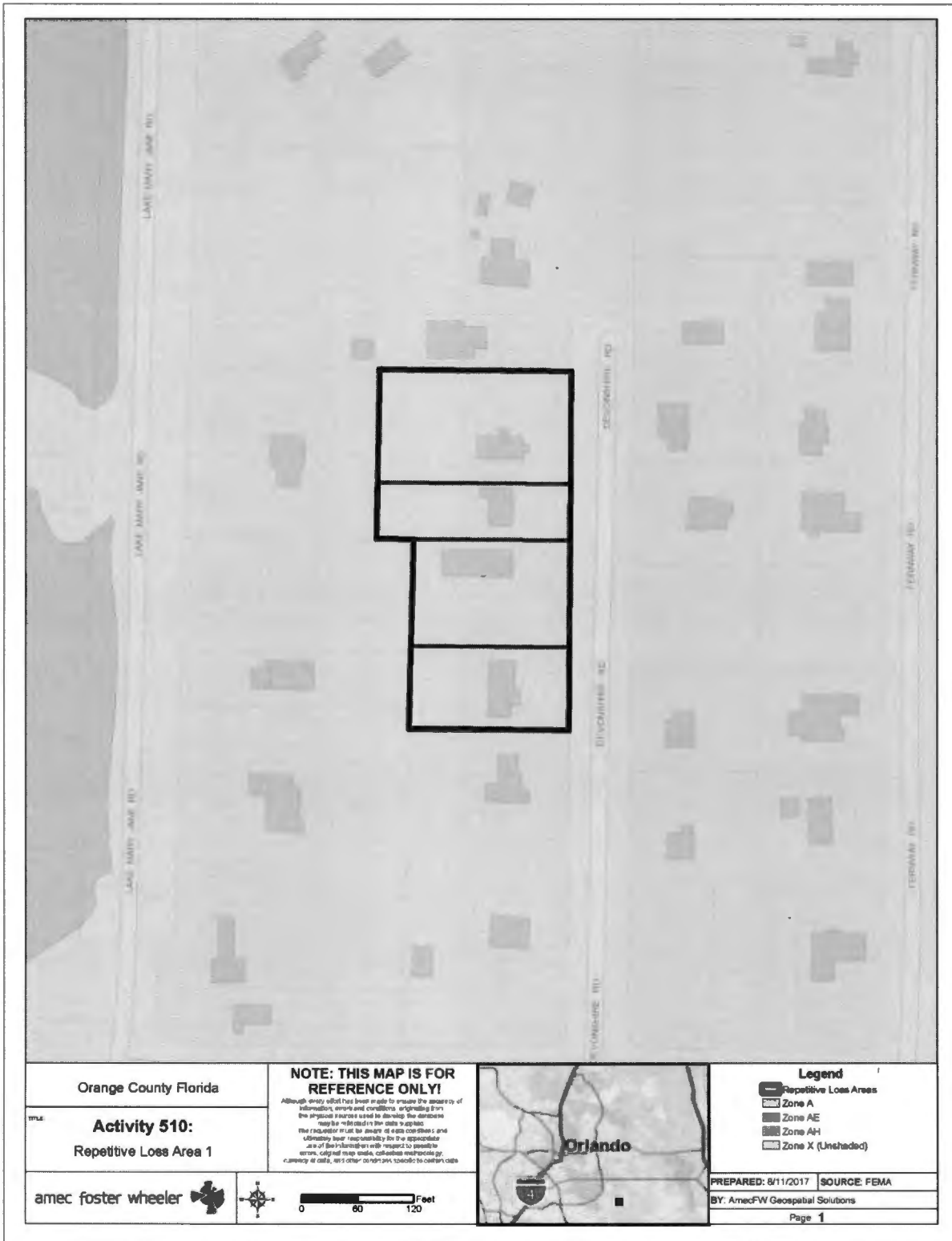


Figure 5.8 – Repetitive Loss Area 1

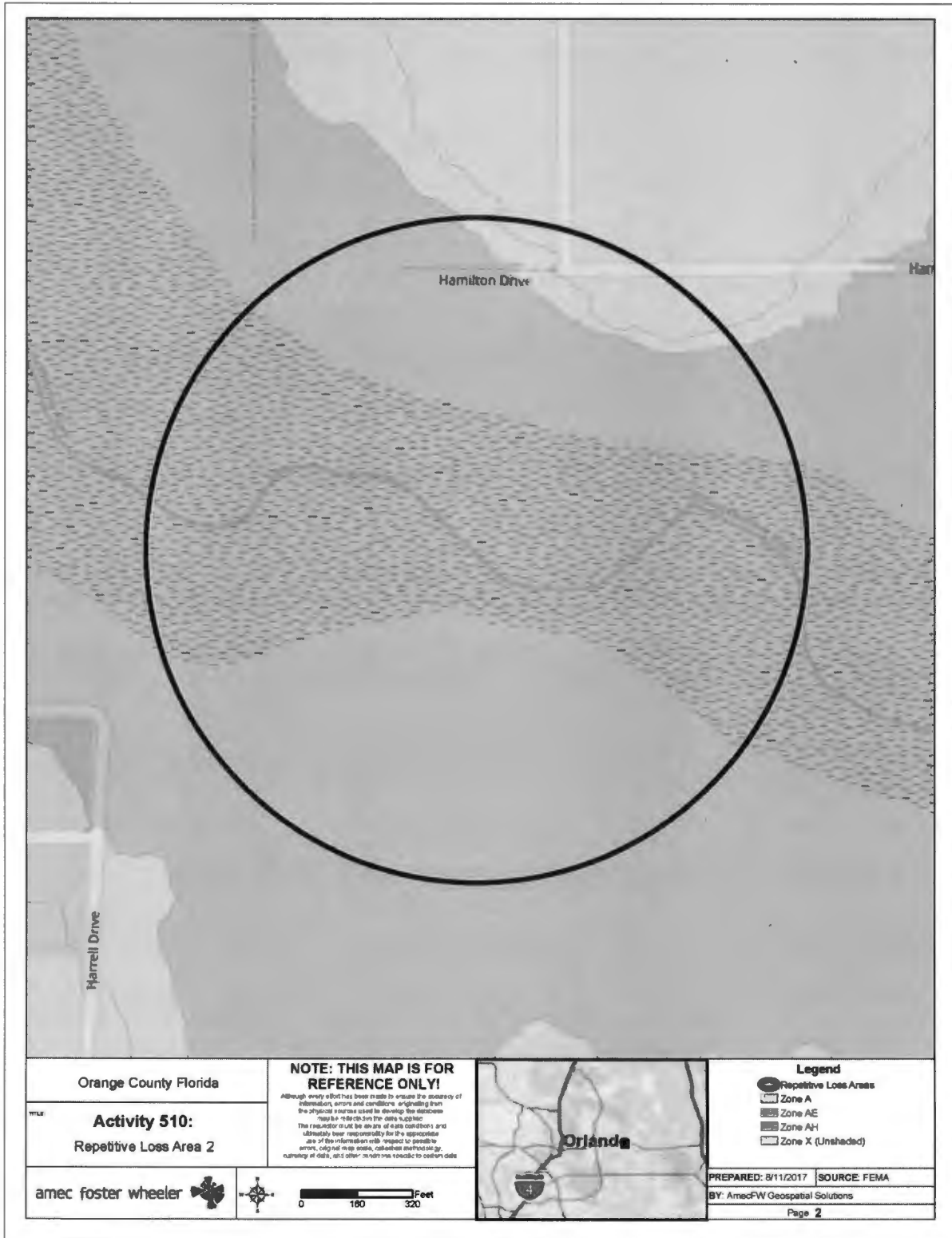


Figure 5.9 – Repetitive Loss Area 2

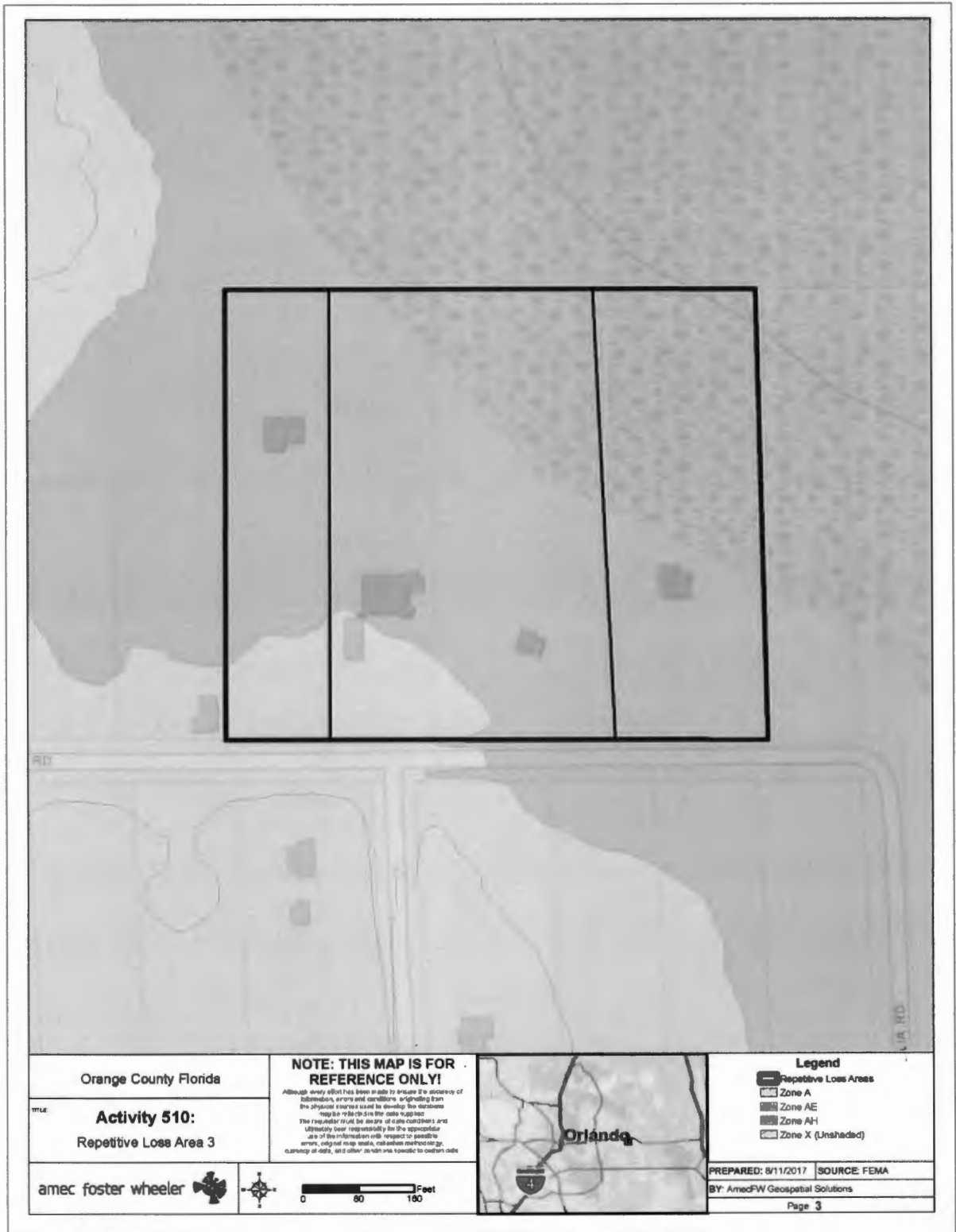


Figure 5.10 – Repetitive Loss Area 3

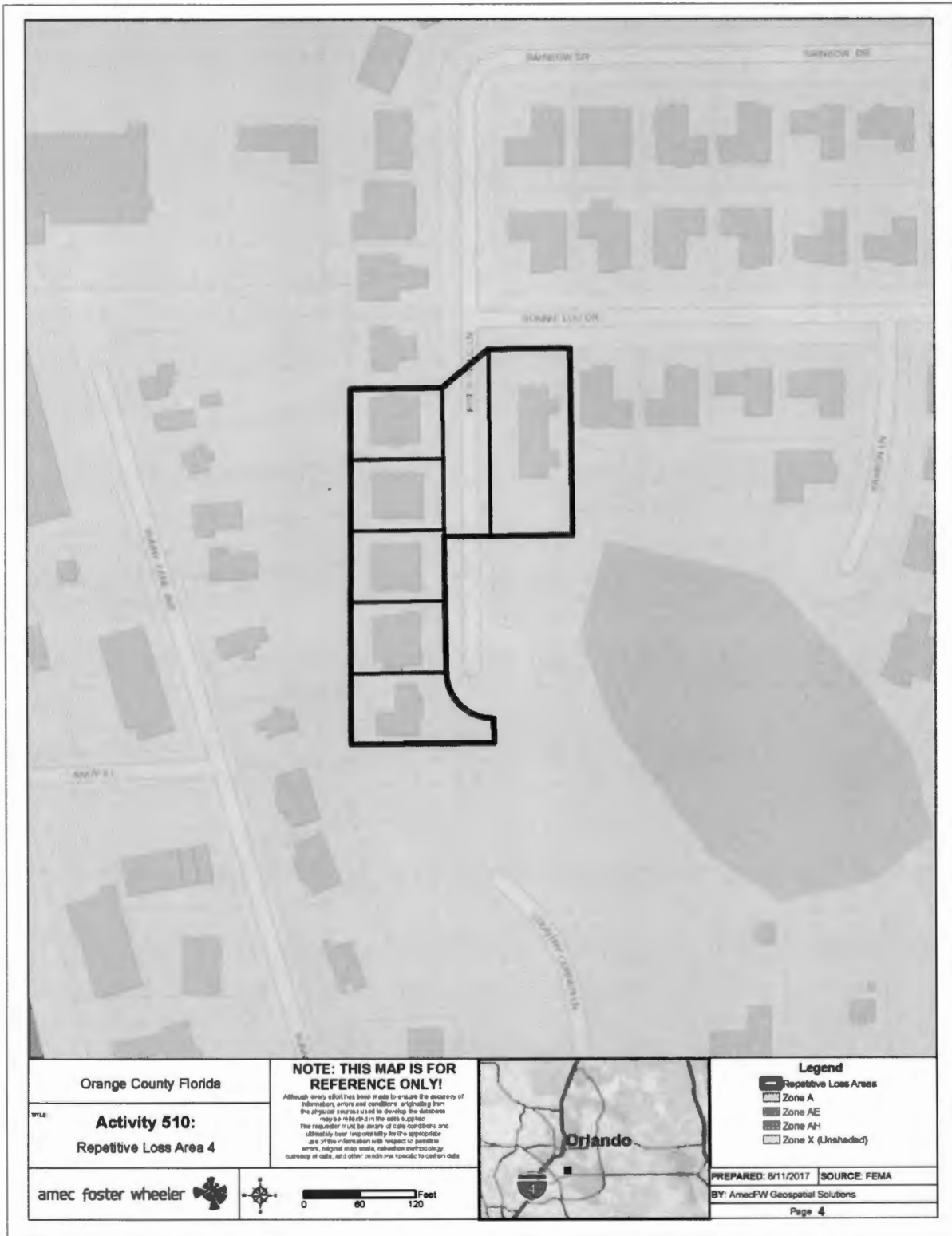


Figure 5.11 – Repetitive Loss Area 4



Figure 5.12 – Repetitive Loss Area 5

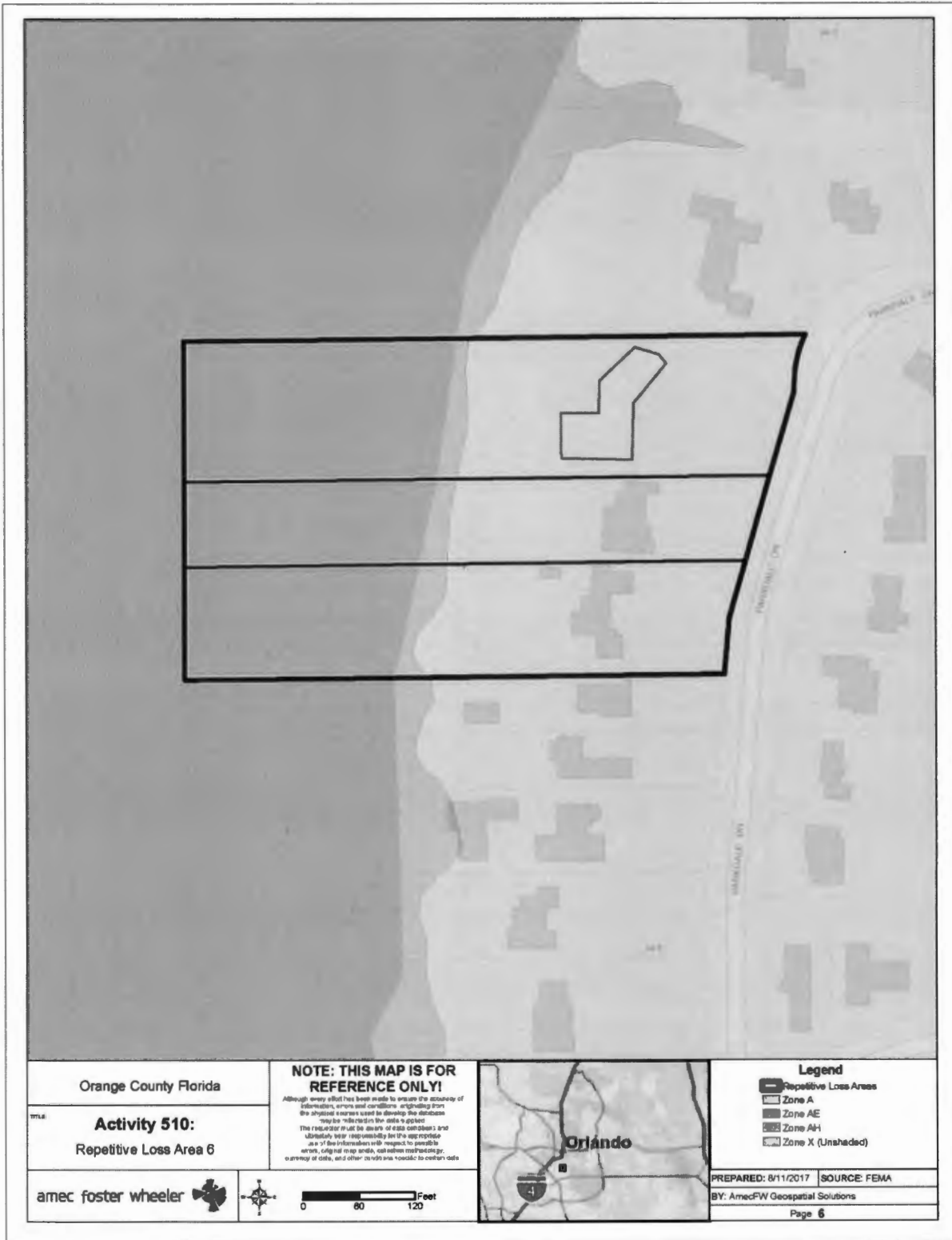


Figure 5.13 – Repetitive Loss Area 6

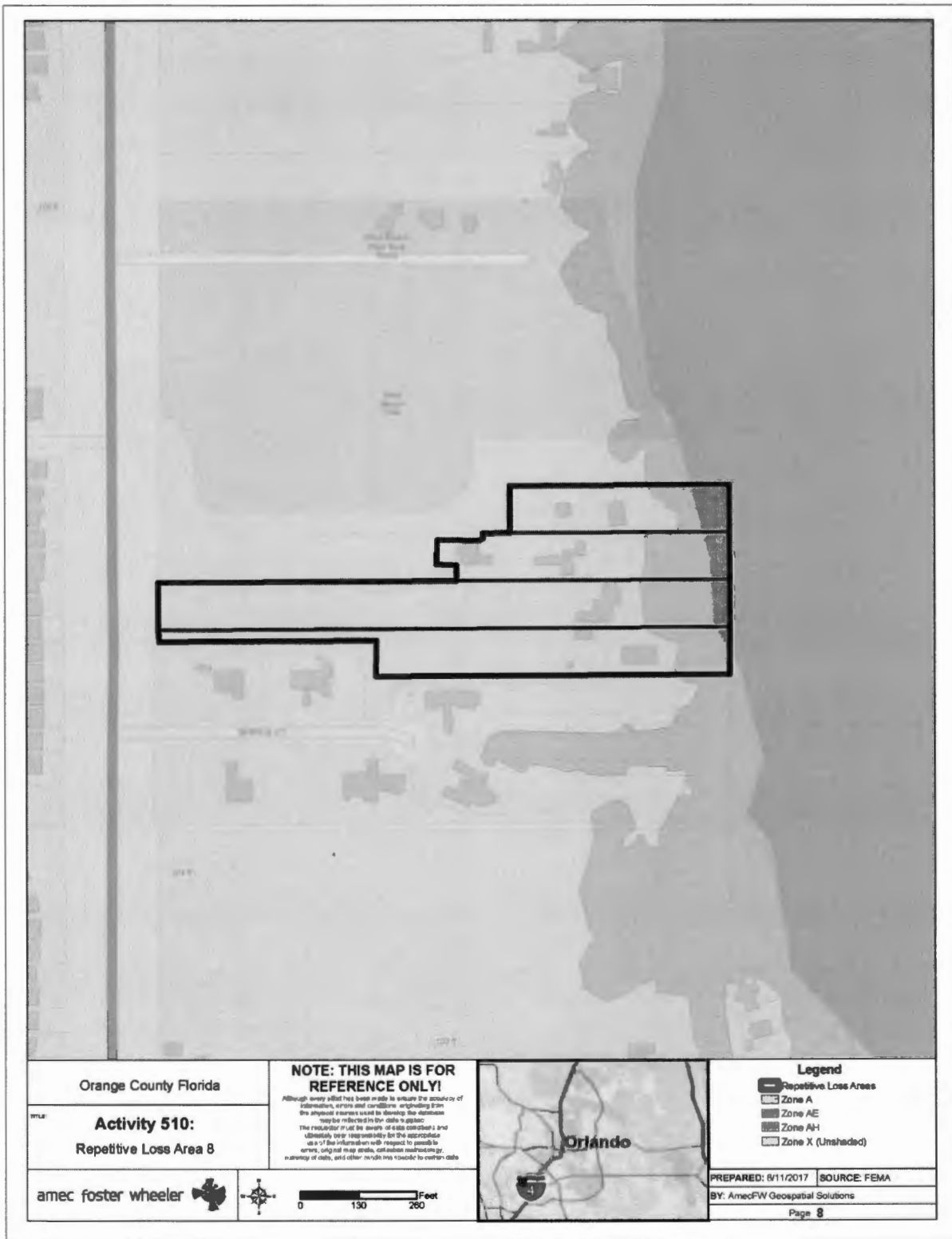


Figure 5.15 – Repetitive Loss Area 8

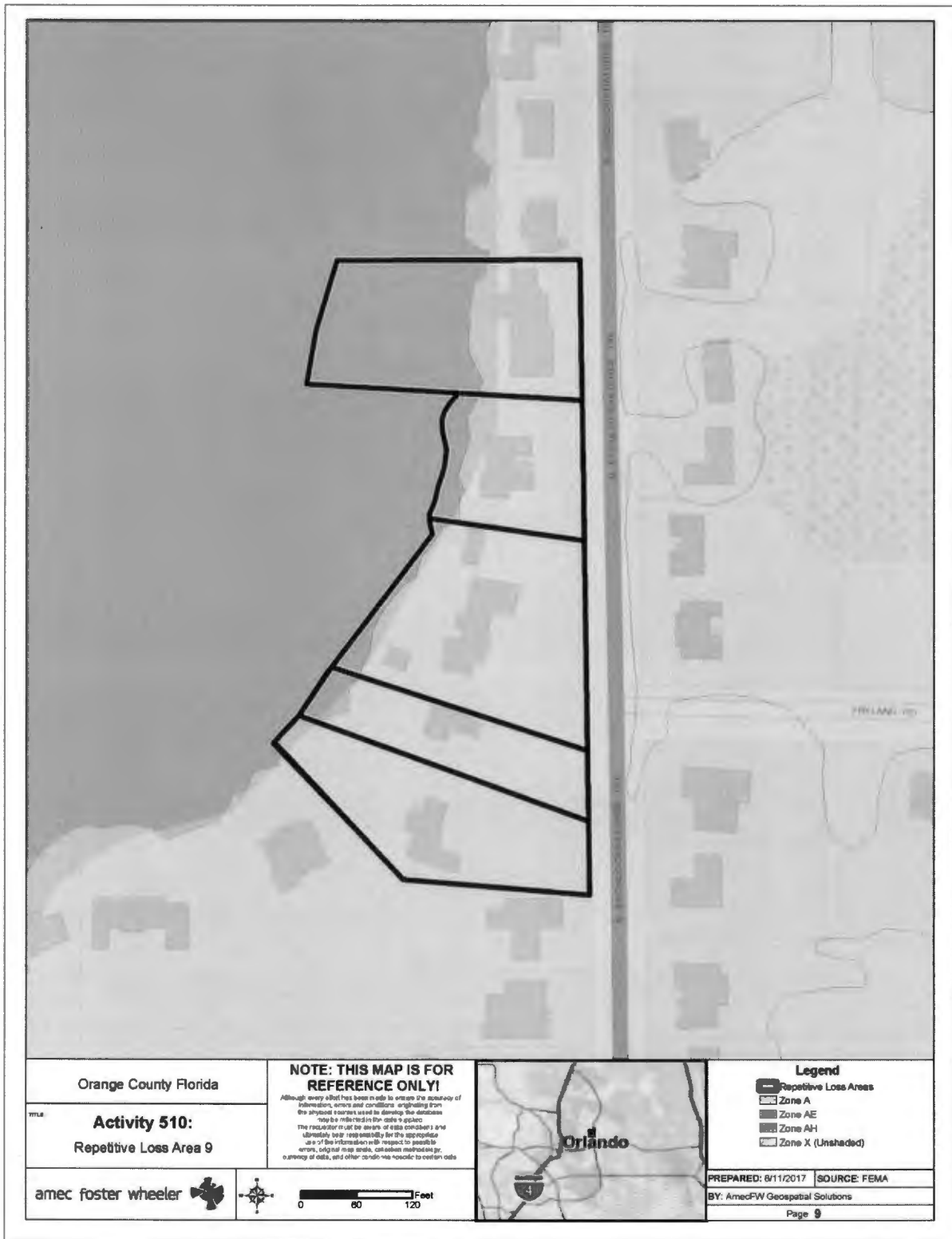


Figure 5.16 – Repetitive Loss Area 9

5.4.4 Flood: Stormwater/Localized Flooding Vulnerability Assessment

Probability	Impact	Spatial Extent	Warning Time	Duration
Highly Likely	Minor	Small	12 to 24 hours	< 24 hours

Localized flooding occurs at various times throughout the year with several areas of primary concern to the County. Localized flooding and ponding affect streets and property. Figure 5.17 shows the possible correlation between localized flooding and repetitive loss properties. The areas of overlap suggest that localized flooding may contribute to NFIP repetitive loss claims. Areas of localized flooding were identified and further defined as “historical” or “major” by the Orange County Public Works’ Roads & Drainage Division. These areas are monitored before and after a storm event.

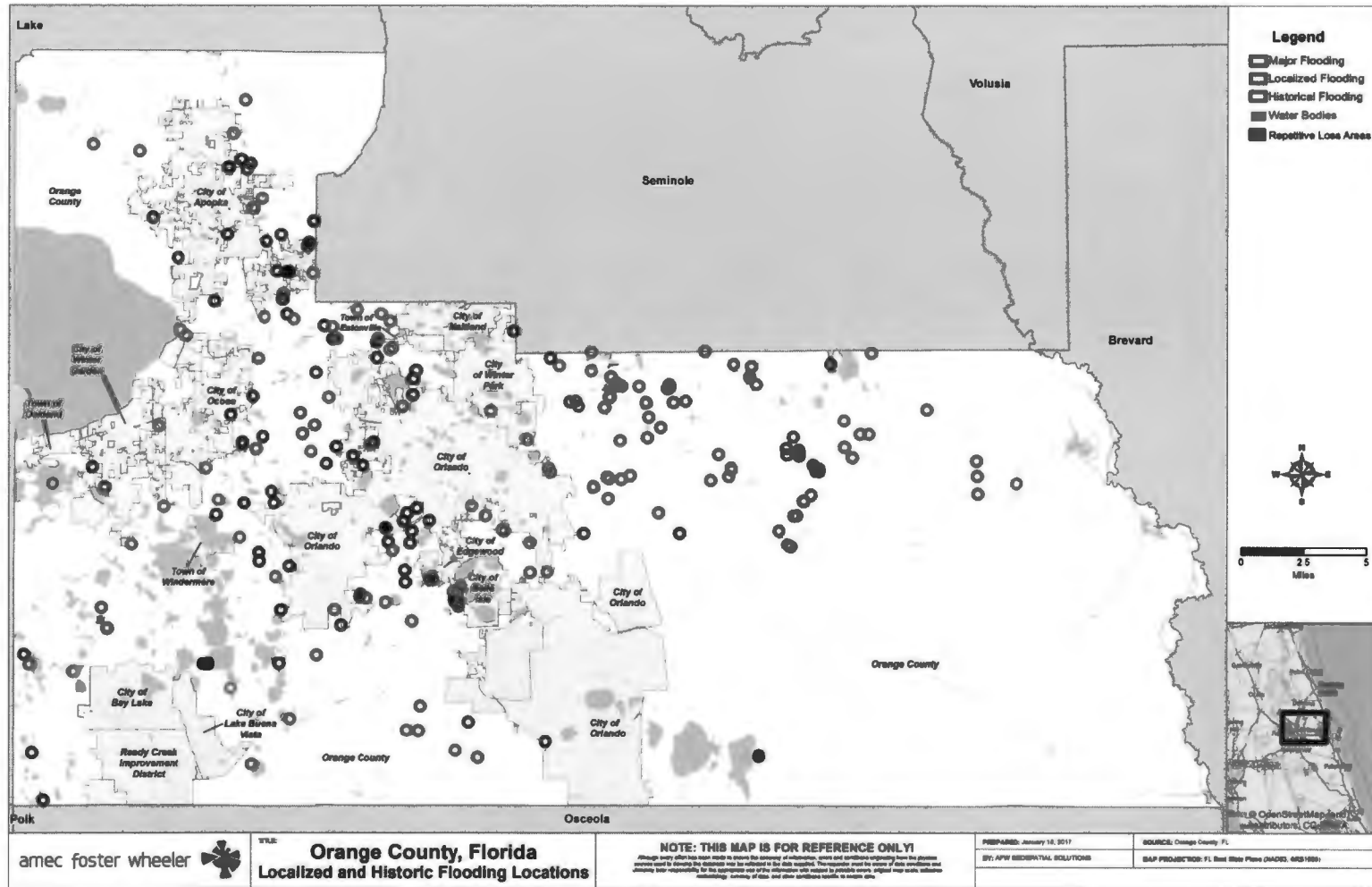


Figure 5.17 – Localized Flooding and Repetitive Loss Areas

5.4.5 Hurricane and Tropical Storm Vulnerability Assessment

Probability	Impact	Spatial Extent	Warning Time	Duration
Likely	Limited	Moderate	> 24 hours	< 24 hours

For the purpose of this plan, this assessment of vulnerability to hurricanes and tropical storms is limited to rainfall from these events. As such, the estimate building damage and content loss as well as critical facilities at risk mirrors what is detailed for 100-year and 500-year flooding in Section 5.3.3.

Hurricanes and tropical storms are expected to pass through Orange County, on average, once every two years. According to research provided by the NOAA Weather Prediction Center, the heaviest rainfall from hurricanes and tropical storms typically occurs in the 12-hr period starting 6 hours prior to a storm’s landfall. Rainfall is not correlated with the intensity of a storm, but is related to the velocity and length of the storm along its axis of movement.

5.5 Priority Risk Index Results

Table 5.14 summarizes the degree of risk assigned to each identified hazard using the PRI method.

Table 5.14 – Summary of PRI Results

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Climate Change	Highly Likely	Minor	Large	> 24 hours	>1 week	2.8
Dam Failure	Unlikely	Critical	Moderate	6 to 12 hours	<1 week	2.4
100-/500-year Flood	Possible	Limited	Moderate	12 to 24 hours	<1 week	2.3
Stormwater/Localized Flooding	Highly Likely	Minor	Small	12 to 24 hours	<24 hours	2.3
Hurricane and Tropical Storm	Likely	Limited	Moderate	> 24 hours	<24 hours	2.2

The results from the PRI have been classified into three categories based on the assigned risk value which are summarized in Table 5.15 below:

- ▶ **Low Risk** – Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- ▶ **Medium Risk** – Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- ▶ **High Risk** – Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread.

Table 5.15 – Summary of Hazard Risk Classification

High Risk (2.5 – 3.0)	Climate Change
Moderate Risk (2.0 – 2.4)	Dam Failure 100-/500-year Flood Stormwater/Localized Flooding Hurricane and Tropical Storm
Low Risk (≤ 2.0)	None

6 CAPABILITY ASSESSMENT

This chapter discusses the County’s existing mitigation capabilities, including planning, programs, policies and land management tools. The purpose of conducting a capability assessment is to determine the community’s ability to implement feasible mitigation actions based on an understanding of the capacity of those agencies or departments tasked with their implementation. The process of conducting a capability assessment includes developing an inventory of relevant plans, ordinances, or programs already in place and assessing the community’s resources and ability to implement existing and/or new policies. Through the capability assessment, a community can identify any gaps or weaknesses in existing programs and policies as well as positive measures already in place which should be supported through additional mitigation efforts.

6.1 Regulatory Capabilities

Table 6.1 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Orange County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities.

Table 6.1 – Regulatory Mitigation Capabilities

Regulatory Tool (ordinances, codes, plans)	Y/N	Date*	Comments
Comprehensive Plan	Y	2016	
Zoning Ordinance	Y	2016	
Subdivision Ordinance	Y	2009	
Floodplain Ordinance	Y	2009	
Stormwater Ordinance	Y	2000	
Building Code	Y	2014	
BCEGS Rating	Y	2013	4/4
Erosion or Sediment Control Program	Y	1991	Addressed in Stormwater Design Standards in County Code of Ordinances
Stormwater Management Program	Y	2016	NPDES Permit #FLS000011, discussed in Stormwater Management Report
Site Plan Review Requirements	Y		
Capital Improvement Plan	Y		
Economic Development Plan	Y	2016	Economic Element of Comprehensive Plan
Local Emergency Operations Plan	Y	2013	Comprehensive Emergency Management Plan
Flood Insurance Study or Other Engineering Study for Streams	Y	2015	Effective FIS 2009; Preliminary FIS 2015
Repetitive Loss Plan	N		Under development
Elevation Certificates	Y		

* Most recent version (includes latest amendments)

Orange County Comprehensive Plan, Adopted 2009, Updated 2016

Florida's Growth Management Act requires the state’s counties and municipalities to adopt Comprehensive Plans that guide future growth and development. A Comprehensive Plan establishes goals, policies and objectives for the implementation of the plan.

Goals, objectives and/or policies in the Plan include:

Stormwater Management Element

- Orange County shall identify and correct existing stormwater/drainage facility deficiencies on a priority basis.
- Orange County shall not approve for construction any road, street, or facility proposed to be constructed within a designated flood hazard area, unless mitigation measures as identified in the applicable regulations have been installed by the developer to overcome the flood hazard.
- Orange County shall require that all new stormwater management systems provide for the safe handling of all stormwater runoff that flows into, across, and is discharged from the site without creating any additional flooding to adjacent property owners.
- Orange County shall continue to ensure that the stormwater management regulations contained in the County Land Development Code protect natural drainage features by requiring compensatory storage, restoration/mitigation of wetlands, nonstructural techniques when feasible, erosion and sediment control, maintenance of natural hydroperiods, and maximization of on-site detention/retention.
- As part of the development review process, an impact assessment will be required that addresses the effects of new development on existing stormwater management systems. This review process, as defined in the Land Development Code, considers how the stormwater management system will operate at build-out.
- Orange County shall manage and coordinate its stormwater review and implementation process to meet future needs and protect the functions of natural drainage features.

Open Space Element

- Orange County shall maintain the Environmentally Sensitive Lands Program (ESL) as a funding mechanism for acquisition and maintenance of environmentally sensitive lands throughout the planning horizon.
- Orange County shall consider acquiring natural undeveloped land areas via public/private ventures to address development impacts on wetlands, protecting wetland buffers and uplands with rare or sensitive habitat.
- The County shall incorporate land use strategies that will optimize open space and protect the health of the Wekiva River System.

Conservation Element

- Orange County shall continue to protect shoreline vegetation by restricting the removal of desirable native vegetation through implementation of the Land Development Code and the Lakeshore Protection Ordinance requirements.
- Orange County shall continue to improve and enforce the Orange County Floodplain Management Ordinance by requiring compensatory storage for encroachment in floodplains, restricting encroachment in floodways, and requiring habitable structures to be flood proofed.
- Orange County shall continue to identify and recommend, to the State and the Water Management Districts, floodplains that would warrant acquisition under the Conservation and Recreation Lands Program, Florida Forever Program, and the Save Our Rivers Program.
- Orange County shall assist the Water Management Districts, Florida Department of Environmental protection and other applicable agencies to improve soil management adjacent to Orange County surface water bodies. This assistance may include, but not be limited to, protection and planting of desirable native species of vegetation and erosion control measures.

Future Land Use Element

- Orange County shall use an Urban Service Area as an effective fiscal and land use technique for managing growth.
- Amendments to the Urban Service Area will be judged based on whether they encourage sprawl. Criteria for denial include if the amendment fails to adequately protect and conserve natural resources, such as wetlands, floodplains, native vegetation, environmentally sensitive areas, natural groundwater aquifer recharge areas, lakes, rivers, shorelines, and other significant natural systems.
- Orange County shall use an Adequate Public Facilities Ordinance (APFO) as a growth management tool for directing the timing and location of future development. Prior to commencing development within any Village, public facilities must be determined to meet standards established by the APFO. These standards include stormwater management.
- Orange County will develop Low Impact Development (LID) strategies in conjunction with the State Water Management Districts to reduce impacts to water quality and manage water quantity concerns.

Orange County Local Mitigation Strategy, Updated 2016

The Orange County Local Mitigation Strategy is a multi-jurisdictional, multi-hazard mitigation plan, developed with input from a wide variety of stakeholders comprising the Local Mitigation Strategy Working Group. The plan includes Orange County, 11 incorporated municipalities, and the University of Central Florida. The LMS addresses diseases and pandemic, extreme temperatures, floods, severe thunderstorms, sinkholes / land subsidence, hazardous materials, terrorism, tropical storms, and wildfire.

Orange County Comprehensive Emergency Management Plan (CEMP), 2013

The Orange County CEMP is an emergency operations framework for the County, which establishes the Orange County Emergency Response Team (OCERT) responsible for incident management and ensures integration of emergency management efforts across the County and its municipalities. The plan is intended to address prevention, preparedness, mitigation, response, and recovery for identified hazards.

Floodplain Management Ordinance

A floodplain management ordinance is perhaps a community's most important flood mitigation tool. Orange County updated and adopted its current floodplain management ordinance in 2009 in conjunction with the adoption of its current effective flood insurance rate maps. The objectives of Orange County's current Flood Damage Prevention Ordinance are to:

- Protect human life, health and to eliminate or minimize property damage;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and public utilities such as water and gas mains, electric, telephone and sewer lines, roadways, and bridges and culverts located in floodplains;
- Maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize flood blight areas; and
- Ensure that potential homebuyers are notified that property is in a special flood hazard area.

Orange County's Floodplain Management Ordinance establishes a requirement that all construction in the regulatory floodplain be elevated with a one foot freeboard above base flood elevation. All critical facilities must be elevated to one foot above the elevation of the 0.2 percent annual chance floodplain.

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Those critical facilities constructed within the special flood hazard area must be elevated three feet above the base flood elevation.

Zoning and Subdivision Regulations

Site Development Ordinance – Ensures compliance with all site development requirements, including establishing consistency with the conservation element of the Comprehensive Plan.

Stormwater Standards – Categorizes development based on size and impervious surface coverage and sets design standards for each category. Design standards include pollution abatement, recharge, rate of discharge, and protection from flooding, as well as additional stipulations for development in SFHAs, which include providing compensatory storage.

Flood Insurance Study (Effective, 2009)

A Flood Insurance Study (FIS) dated September 25, 2009 was prepared by FEMA for Orange County, Florida and Incorporated Areas. The FIS identifies areas within Orange County that are subject to flooding from the 100-year storm event. This information is used by Orange County to implement floodplain regulations as part of participation in the NFIP and to promote sound land use and floodplain development within the community.

This FIS, as well as the Preliminary FIS dated October 30, 2015, was used in the development of this FMP to identify FEMA flood hazard areas and to calculate the associated flood depths for the 100-year storm event. The flood depths were then used to prepare the risk assessment for Orange County. Based on the flood depth, a depth damage factor was applied to each building based on its occupancy class in order to calculate an accurate damage assessment for each building located within the 100-year flood hazard area.

6.2 Administrative/Technical Mitigation Capabilities

Table 6.2 identifies personnel responsible for activities related to mitigation and loss prevention in Orange County.

Table 6.2 – Administrative/Technical Capabilities

Resource	Y/N	Responsible Department
Planner/Engineer with knowledge of land development/land management practices	Y	Planning & Development Department
Engineer/Professional trained in construction practices related to buildings and/or infrastructure	Y	Division of Building Safety
Planner/Engineer/Scientist with an understanding of natural hazards	Y	Stormwater Management Division, Planning & Development Department
Personnel skilled in GIS	Y	Planning & Development Department
Full time building official	Y	Division of Building Safety
Floodplain Manager	Y	Stormwater Management Division
Emergency Manager	Y	Office of Emergency Management
Grant writer	N	
GIS data – Hazard areas	Y	Planning & Development Department
GIS data – Critical facilities	Y	Planning & Development Department
GIS data – Land use	Y	Planning & Development Department
GIS data – Building footprints	N	
GIS data – Links to Assessor's data	Y	www.octaxcol.com
Warning Systems/Services	Y	Systems: Television, radio, cell/smart phones, email, and dedicated radio receivers; Services: Emergency

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Resource	Y/N	Responsible Department
		Alert System (EAS), OTV, OCAlert, OCFL Alert, NOAA Weather Radio, Amateur Radio

6.3 Fiscal Mitigation Capabilities

Table 6.3 identifies financial tools or resources that the County could potentially use to help fund mitigation activities.

Table 6.3 – Fiscal Mitigation Capabilities

Resource	Accessible/Eligible to Use (Y/N)
Community Development Block Grants	Y
Capital improvements project funding	Y
Authority to levy taxes for specific purposes	Y
User fees for water, sewer, gas or electric services	Y
Impact fees for new development	Y
Incur debt through general obligation bonds	Y
Incur debt through special tax bonds	Y
Incur debt through private activity bonds	Y
Withhold spending in hazard prone areas	Y*
SFWMD Cooperative Funding Program	Y

*According to the Comprehensive Plan Future Land Use Element Policy FLU1.3.1, Orange County can refuse expansions of the Urban Service Area on the basis of an amendment failing to meet Comprehensive Plan goals, including if that proposed amendment “fails to adequately protect and conserve natural resources, such as wetlands, floodplains... and other significant natural systems.”

Other funding sources noted in the 2016 Local Mitigation Strategy that may be relevant to projects identified as part of this Floodplain Management Plan include:

- Homeland Security Grants
- Florida’s State Homeland Security Grant Program (SHSGP)
- Emergency Management Preparedness & Assistance (EMPA) Base Grant Program

6.4 Mitigation Partnerships and Outreach

Partnerships

Local

Orange County coordinates with many other government and agencies to plan and carry out emergency preparedness, emergency response, and hazard mitigation activities. To prepare for natural disasters such as flooding, the County and 11 of its incorporated municipalities participate in the Orange County Local Mitigation Strategy Working Group. The group is composed of members drawn from county and municipal governments as well as from interested citizens from around Orange County. The purpose of the LMS Working Group is to identify new mitigation opportunities, techniques and, if necessary, reprioritize existing mitigation projects. This group meets at least annually and after every disaster event that causes significant damages to infrastructure.

The following is a list of partners identified in the 2013 Orange County Comprehensive Emergency Management Plan (CEMP) to help mitigate natural hazards through mutual aid agreements, memoranda of understanding, and other agreements:

- Lake County
- Osceola County

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- Polk County
- Seminole County
- Brevard County
- Greater Orlando Aviation Authority
- Kissimmee Fire Department
- Maitland Fire Department
- Orlando Fire Department
- Oviedo Fire Department
- Reedy Creek Fire Department
- Winter Garden Fire Department
- Apopka Fire Department
- Lynx
- Salvation Army
- American Red Cross
- Progress Energy
- OUC
- TECO Gas

State

The County is a partner with the State of Florida Department of Emergency Management. The County utilizes the State's Hazard Mitigation Plan and State databases to collect information, perform local risk assessments, and develop mitigation strategies. The County also partners with the State on grant funding opportunities.

Federal

The County is a partner with FEMA. The County utilizes FEMA's flood insurance study to perform local risk assessments and to enforce local floodplain management ordinances. The County also utilizes FEMA literature and brochures to promote flood risk awareness.

Outreach

Orange County provides information on a variety of emergency management educational and awareness topics and training opportunities on their website. Information is provided on the following:

- Hurricane Preparedness
- Making a Family Emergency Plan
- Making a Business Emergency Plan
- Pet Information
- Sheltering Information
- Special Needs Registration
- Emergency Medical Services
- Sandbag Pick-Up Locations
- Emergency Communications
- Emergency Debris Removal
- Mobile Apps & Emergency Notifications
- Community Newsletters
- Special Alerts Services & Apps
- Flood Protection Tips
- Water Atlas
- FEMA Floodsmart

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44 CFR Subsection D §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the Orange County Floodplain Management Plan. It describes how the County met the following requirements based on the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

7.1 Mitigation Strategy: Overview

The results of the planning process, the risk assessment, the goal setting, and the identification of mitigation actions led to the mitigation strategy and mitigation action plan for this FMP. Section 7.2 identifies the goals and objectives of this plan and Section 7.4 details the new mitigation action plan. The following umbrella mitigation strategy was developed for this FMP:

Communicate the hazard information collected and analyzed through this planning process as well as FMPC success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.

Implement the action plan recommendations of this plan. The Mitigation Action Plan identifies and overall implementation priority for each action based on timeline and priority. Implementation and Maintenance are discussed further in Section 9.

Use existing rules, regulations, policies, and procedures already in existence. In developing the mitigation strategy, the FMPC referenced the County's Code of Ordinances, the Local Mitigation Strategy, the 2016 Comprehensive Plan, the 2014 Stormwater Management Report, the 2015 County Sustainability Plan, the Emergency Action Plan for Michaels, Banner, and Cheney dams, the County's Capital Improvement Program, FEMA/ISO data of repetitive loss and flood insurance, and the County's 2013 Comprehensive Emergency Management Plan.

Monitor multi-objective management opportunities so that funding opportunities may be shared and packaged and broader constituent support may be garnered.

7.1.1 Continued Compliance with the NFIP

Given the flood hazards in the planning area, an emphasis will be placed on continued compliance with the NFIP and participation in the CRS. The CRS was created in 1990. It is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. Orange County is currently classified as a Class 5 community, which gives a 25% premium discount to individuals in the Special Flood Hazard Area, and a 10% discount to policyholders outside the Special Flood Hazard Area. Preferred Risk Policies receive no discount. All three communities meet or exceed the following minimum requirements as set by the NFIP:

- Issuing or denying floodplain development/building permits

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- Inspecting all development to assure compliance with the local ordinance
- Maintaining records of floodplain development
- Assisting in the preparation and revision of floodplain maps
- Helping residents obtain information on flood hazards, floodplain map data, flood insurance and proper construction measures

The County's Planning & Development Department and Development Review Committee are responsible for the review and approval of all development applications to the County. The application review process includes an analysis for compliance with the County's Land Development Code, the County's Code of Ordinances (which includes the Flood Damage Prevention Ordinance), the Florida Building Code, the South Florida Water Management District permitting rules (when applicable), the County's concurrency requirements, and other related regulations for development approval compliance. Both the development permit and building permit approval processes consist of extensive reviews of the submitted applications to determine compliance before a recommendation for approval is given. Once a development begins actual construction, there are a number of scheduled and required on-site inspections performed by trained inspection staff to ensure compliance before the construction can proceed toward completion.

The Stormwater Management Division maintains the record of all map revisions and changes received from FEMA. As a part of the services offered to the public, the Public Works Department provides FEMA floodplain mapping information, flood insurance program information, flooding hazards information, and proper construction methods within the special flood hazard area.

The following is a summary of the CRS Activities for which Orange County currently receives credit:

Activity 310 – Elevation Certificates: The Public Works Department Roads and Drainage Division maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates, plans, regulations and other records are maintained in a secure location away from the permit office.

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with flood zone information from the community's latest Flood Insurance Rate Map (FIRM), publicizing the service annually and maintaining records.

Activity 330 – Outreach Projects: A community brochure is mailed to all properties in the community on an annual basis. The community also displays flood information at public buildings and community events.

Activity 340 – Hazard Disclosure: Credit is provided for state and community regulations requiring disclosure of flood hazards.

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Orange County Public Library. Credit is also provided for floodplain information displayed on the community's website.

Activity 360 – Flood Protection Assistance: The community provides technical advice and assistance to interested property owners and annually publicizes the service.

Activity 410 – Additional Flood Data: Credit is provided for conducting and adopting flood studies for areas not included on the FIRMs and that exceed minimum mapping standards.

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 87,957 acres in the Special Flood Hazard Area (SFHA) as open space. Credit is also provided for open space land that is deed restricted and preserved in a natural state.

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Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, protection of floodplain storage capacity, protection of natural and beneficial functions, other higher regulatory standards, and land development criteria, and state mandated regulatory standards. Credit is also provided for a BCEGS Classification of 4/4, the adoption and implementation of the Florida Building Codes, and for staff education and certification as a floodplain manager.

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for maintaining copies of all previous FIRMs and Flood Insurance Study Reports.

Activity 450 – Stormwater Management: The community enforces regulations for stormwater management, freeboard in non-SFHA zones, soil and erosion control, and water quality.

Activity 510 – Floodplain Management Planning: Based on the updates made to the NFIP Report of Repetitive Losses as of December 31, 2011, Orange County has 9 repetitive loss properties and is a Category B community for CRS purposes. All requirements for the 2013 cycle have been met. Credit is provided for the adoption and implementation of the Floodplain Management Plan. Since Orange County is a Category B community with an approved Floodplain Management Plan, a progress report must be submitted on an annual basis and an updated plan is due on October 1, 2015.

Activity 540 – Drainage System Maintenance: A portion of the community’s drainage system is inspected regularly throughout the year and maintenance is performed as needed by Orange County Public Works Department. Records are being maintained for both inspections and required maintenance. Credit is also provided for an ongoing Capital Improvements Program. The community also enforces a regulation prohibiting dumping in the drainage system.

Activity 610 – Flood Warning Program: Credit is provided for a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. Credit is also provided for the designation as a Storm Ready Community by the National Weather Service.

Activity 630 – Dam Safety: All Florida communities currently receive CRS credit for the state’s dam safety program.

7.1.2 Post-Disaster Redevelopment and Mitigation

The Orange County Comprehensive Emergency Management Plan (CEMP) outlines procedures for post-disaster redevelopment and mitigation in order to use the recovery process as a means of reducing future flood risk. The plan identifies 20 emergency support functions, which are: transportation, communication, public works and engineering, firefighting, urban search & rescue, hazardous materials, information and planning, mass care, resource support, health and medical, food and water, energy, military support, public information, volunteers and donations management, law enforcement and security, animal care, community and business, damage assessment, and utilities.

Recovery activities are coordinated by the Director of Emergency Management, the State Advanced Recovery Liaison, Emergency Coordination Officers, and Community Relations Partners.

Mitigation is incorporated into the recovery process through coordination with the Orange County Local Mitigation Strategy (LMS) Working Group. The LMS Working Group conducts mitigation assessments in conjunction with damage assessments and identifies opportunities for mitigation based on the goals and objectives outlined in the LMS.

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The CEMP identifies multiple funding sources for post-disaster mitigation, which include: Public Assistance, Hazard Mitigation Grant Program, State Homeland Security Grant Program funds, Urban Area Security Initiative funds, Emergency Management Preparedness and Assistance funds, Emergency Management Performance Grant funds, Hazard Analysis Grant funds, Metropolitan Medical Response System funding, Community Emergency Response Team funding, Citizen Corps Grant funds, Pre-Disaster Mitigation Grant Program funds, Flood Mitigation Assistance Grant Program funding, Repetitive Flood Claims Grant Program funds, and Severe Repetitive Loss Program funds.

Post-disaster mitigation should also involve helping prepare people and property for future hazards. Orange County's disaster recovery procedures include the following actions:

- Public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Identifying other mitigation measures that can lessen the impact of the next disaster
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long-term mitigation activities
- Applying for post-disaster mitigation funds

7.2 Goals and Objectives

44 CFR Subsection D §201.6(c)(3)(i): [The mitigation strategy section shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Section 4 Hazard Profiles documents the flood hazards and associated risks that threaten Orange County. Section 5 Vulnerability Assessment evaluates the vulnerability of structures, infrastructure, and critical facilities to each of these hazards. Section 6 Capability Assessment evaluates the capacity of the County to reduce the impact of those hazards. The intent of Goal Setting is to identify areas where improvements to existing capabilities (policies and programs) can be made so that community vulnerability is reduced. Goals are also necessary to guide the review of possible mitigation measures. This Plan needs to make sure that recommended actions are consistent with what is appropriate for the County. Mitigation goals need to reflect community priorities and should be consistent with other plans in the County.

Goals: are general guidelines that explain what is to be achieved. They are usually broad-based policy type statements, long term and represent Global visions. Goals help define the benefits that the plan is trying to achieve.

Objectives: are short term aims, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

7.2.1 Coordination with Other Planning Efforts

The goals of this Plan need to be consistent with and complement the goals of other planning efforts. The primary planning documents with which the goals of this Plan must complement and be consistent are the County's Local Mitigation Strategy (LMS) and Comprehensive Plan. The comprehensive plan is important as it is developed and designed to guide future growth within the community. Therefore, there should be some consistency in the overall goals and how they relate to each other. Likewise, the goals of the County's LMS play an important role as it also focuses on flood hazards and projects must be prioritized in the LMS in order to receive funding. The FMPC members considered the goals of both of these documents in setting goals for this FMP.

7.2.2 Goal Setting Exercise

On January 19, 2017, the Orange County FMPC conducted an exercise to outline its goals for this floodplain management plan. The first part of the exercise including asking each committee member: "*What should be the goals of the mitigation program?*" in order to get a sense of the FMPC's general priorities for mitigation. Each member was given a handout which appears in Figure 7.1.

Committee members wrote down their top three choices and discussed these choices with the larger committee membership. There was some consistency in the members' topics; the prevailing goals are listed below:

- Protect critical facilities
- Protect wetlands/environmentally sensitive areas
- Protect homes
- Enhanced education/outreach

These priorities were used to focus a discussion on potential goals and arrive at the final plan goals and objectives, listed in Section 7.2.3.

Goals Exercise

What should be the goals of our mitigation program?

Here are possible answers to this question, listed in alphabetical order. Pick three that you think are most important. You may reword them or add new ones if you want.

Circle your top three answers.

- Help people protect themselves
- Make sure future development doesn't make things worse
- Maximize the share paid by benefiting property owners
- Maximize use of state and federal funds
- Minimize property owner's expenditures
- Minimize public expenditures
- New developments should pay the full cost of protection measures
- Protect businesses from damage
- Protect cars and other vehicles
- Protect centers of employment
- Protect critical facilities
- Protect forests
- Protect homes
- Protect new/future buildings
- Protect people's lives
- Protect power stations and power lines
- Protect public health
- Protect public services (fire, police, etc.)
- Protect repetitively flooded areas
- Protect scenic areas, greenways, etc.
- Protect schools
- Protect shopping areas
- Protect streets
- Protect utilities (power, phone, water, sewer, etc.)
- Protect wetlands/environmentally sensitive areas
- Protect a particular area _____
- Protect a particular property _____
- Restrict development in hazardous areas
- Use public/private partnerships
- Other _____

Figure 7.1 – Goals Exercise

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7.2.3 Resulting Goals and Objectives

At the end of the exercises, the FMPC agreed upon five general goals for this planning effort. The FMPC also included objectives in support of the goals. The refined goals and objectives include:

Goal 1 – Reduce vulnerability and exposure to flood hazards in order to protect the health, safety and welfare of both residents and visitors.

Objective 1.1: Maintain a database of flood problems and hazards.

Objective 1.2: Maintain a database of repetitive loss claim history and mitigation activities.

Objective 1.3: Review the Growth Management Plan, Land Development Code, and Ordinances for compatibility with these goals and objectives, and revise where appropriate and financially feasible.

Objective 1.4: Enforce the minimum code requirements of the National Flood Insurance Program as adopted by the Board of County Commissioners.

Objective 1.5: Conduct site investigations, research exposure and hazard data, and evaluate proposed modifications to repair and mitigate stormwater management problems.

Objective 1.6: Develop projects to reduce deficiencies within the stormwater management system as part of the annual budget development process.

Goal 2 – Encourage property owners through an expanded flood hazard communication and outreach program to protect their homes and businesses from flood damage.

Objective 2.1: Educate property owners, including repetitive loss properties, on FEMA grant programs and other methods in order to mitigate possible flood damage.

Objective 2.2: Provide the current floodproofing and retrofitting information to property owners.

Objective 2.3: Effectively communicate flood risk to residents, businesses, contractors, realtors and prospective buyers.

Objective 2.4: Enhance community websites to provide comprehensive flood protection and flood preparedness information.

Goal 3 – Protect critical and essential facilities and infrastructure from the effects of flood hazards.

Objective 3.1: Ensure protection standards for critical facilities meet Florida Building Code standards as adopted by the Board of County Commissioners.

Objective 3.2: Work with appropriate personnel to prioritize critical and essential facilities in need of protection from potential flood damage.

Objective 3.3: Take measures to ensure the continuity of service of all critical facilities in the event of a flood or major storm.

Goal 4 – Encourage protection of natural resources by employing watershed-based approaches that balance environmental, economic, and engineering considerations.

Objective 4.1: Maintain and enforce regulations to protect and restore wetlands and ecological functions for long-term environmental, economic and recreational values.

Objective 4.2: Pursue water management approaches and techniques that improve water quality and protect public health.

Objective 4.3: Preserve and maintain open space in flood prone areas to reduce flood damage to buildings and to provide recreational benefits.

Objective 4.4: Continue to protect aquifers and environmentally sensitive lands from encroachment of development by acquiring lands or requiring buffers and other setbacks mechanisms.

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Goal 5 – Reduce damage to all development including repetitively flooded buildings through flood resilient strategies and measures.

Objective 5.1: Reduce stormwater runoff through adequate stormwater management, flood control, on-site retention and best management practices to mitigate impacts associated with incremental construction and redevelopment projects.

Objective 5.2: Evaluate funding mechanisms to increase stormwater capital improvement projects.

Objective 5.3: Minimize adverse impacts to the floodplain.

7.3 Identification and Analysis of Mitigation Activities

44 CFR Subsection D §201.6(c)(3)(ii): [The mitigation strategy section shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

In order to identify and select mitigation projects to support the mitigation goals, each hazard identified in Section 3 Hazard Identification was evaluated. The following were determined to be priority flood-related hazards:

- Climate Change and Sea Level Rise
- Dam/Levee Failure
- Flood: 100/500 year
- Flood: Stormwater/Localized Flooding
- Hurricane and Tropical Storms

Once it was determined which flood hazards warranted the development of specific mitigation actions, the FMPC analyzed viable mitigation options that supported the identified goals and objectives. The FMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process.

- Prevention (Required to be evaluated)
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information and Outreach

The FMPC was also provided with examples of potential mitigation actions for each of the above categories. The FMPC was instructed to consider both future and existing buildings in evaluating possible mitigation actions. The plans, reports, ordinances, and other documents reviewed for the capability assessment, including the Comprehensive Plan, Local Mitigation Strategy, Code of Ordinances, County Stormwater Management Report, Sustainability Plan, Capital Improvement Program, and Comprehensive Emergency Management Plan as well as the findings of the capability assessment were also presented to the FMPC for consideration in developing mitigation strategies. A facilitated discussion then took place to examine and analyze the options. Appendix B, Mitigation Strategy, provides a detailed discussion organized by CRS mitigation category of possible mitigation alternatives to assist the County in the review and identification of possible mitigation activities. This comprehensive review of possible mitigation activities details why some were appropriate for implementation and why others were not. As promoted by CRS, Prevention type mitigation alternatives were discussed for the flood hazards. This discussion was followed by a brainstorming session that generated a list of preferred mitigation actions by hazard.

7.3.1 Prioritization Process

Once the mitigation actions were identified, the FMPC was provided with a set of prioritization criteria to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. The criteria included the following:

- **Area of Impact:** Does the action have a community-wide impact? Does the action target a hazard area? Does it address a high-risk priority hazard?
- **Goals:** Does the action meet multiple goals?
- **Technical:** Is the action technically feasible? Is it a long-term solution to the problem? Does it capitalize on existing planning mechanisms for implementation?
- **Administrative Resources:** Are there adequate staffing, funding and other capabilities to implement the project? Is there adequate additional capability to ensure ongoing maintenance, if necessary?
- **Political/Legal:** Will there be adequate political and public support for the project? Does the project have a local champion? Does the community have the legal authority to implement the action?
- **Financial:** Can the action be funded through the operating budget? Will the action need to be grant-funded, and has that funding been secured? How much will the project cost?
- **Environmental:** Does the action comply with environmental regulations? Does the action meet the community's environmental goals?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. The four criteria, reflected in the prioritization criteria above, reflect the consideration of benefit-cost analysis for each action:

- Contribution of the action to save life or property
- Availability of funding and perceived cost-effectiveness
- Available technical and administrative resources for implementation
- Ability of the action to address the problem

The consideration of these criteria helped to prioritize and refine mitigation actions but did not constitute a full benefit-cost analysis. The cost-effectiveness of any mitigation alternative will be considered in greater detail through performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this plan.

Using these prioritization criteria, the FMPC was able to score each action on a scale of 0-20 in order to arrive at a priority ranking for each action. See Table 7.1 for details on points available for each criterion. Point totals were divided into priority rankings as follows:

- **Low Priority:** 0 – 8 points
- **Medium Priority:** 9 – 13 points
- **High Priority:** 14 – 20 points

Table 7.1 on the following page details the prioritization ranking for each mitigation action considered by the FMPC.

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Table 7.1 – Mitigation Action Prioritization

Action Item	Mitigation Action Item	Area of Impact			Goals	Technical			Administrative Resources		Political/Legal			Financial			Environmental		Overall Priority Score	Priority Ranking		
		Community-wide	Targets hazard area	Addresses high risk hazard	Meets multiple goals	Feasible	Long-term solution	Existing planning mechanism in place	Project implementation	Maintenance capability	Political support	Local champion	Legal authority	Funded through community funding source	Needs grant funding	Cost					Consistent with federal laws	Consistent with community enviro. goals
																< \$10,000	\$10,000 - \$50,000	> \$50,000				
Points Possible	1	2	2	1	1	1	1	1	1	1	1	1	2	1	1	2	3	1	1			
1	Continue to hold the Orange County Hurricane Expo to provide preparedness information to County residents.	1	-	-	-	1	-	1	1	1	-	1	-	2	-	1	-	-	-	-	9	Medium
2	Speak to Homeowners Associations about flood hazard preparedness and mitigation options.	-	2	-	-	1	-	-	1	-	-	1	-	2	-	1	-	-	-	-	8	Low
3	Send outreach brochure to residents of the SFHA, Repetitive Loss Areas, and to HOAs.	-	2	-	-	1	-	-	1	-	-	-	-	2	-	1	-	-	-	-	7	Low
4	Encourage residents in repetitive loss areas and high-risk flood zones to consider the option of acquisition or elevation.	-	2	2	1	1	1	1	1	1	1	1	-	1	1	-	-	3	1	1	18	High
5	Continue to inspect and maintain waterways, including natural channels, to ensure they are clear of debris.	-	2	-	1	1	-	1	1	1	-	-	1	2	-	-	2	-	-	1	13	Medium
6	Perform engineering studies of the areas surrounding Lake Venus, including the Orlo Vista neighborhood.	-	2	-	-	1	-	1	1	-	1	-	-	-	1	-	-	3	-	-	10	Medium
7	Protect critical facilities and infrastructure from potential flood damage.	-	2	-	1	1	1	-	1	-	1	-	-	2	-	-	2	-	-	-	11	Medium
8	Ensure back up power systems and generators are in place for all critical facilities and emergency shelters.	1	-	-	1	1	-	-	1	-	1	-	-	2	-	-	2	-	-	-	9	Medium
9	Install high water level outfalls in lieu of current drainwells or retrofit existing drainwells throughout the County, including at Lake Price, Lake Pleasant, Mustang Way, and Lake Florence.	1	-	-	1	1	1	1	1	-	-	-	-	2	-	-	-	3	1	-	12	Medium
10	Retrofit culverts along Apopka Boulevard.	-	2	-	-	1	1	1	1	-	-	-	-	2	-	-	-	3	-	-	11	Medium
11	Add flood gauges to improve calibration of current flood modeling system and enable better flood warning.	1	-	-	-	1	1	-	1	1	1	1	-	-	1	-	-	3	-	-	11	Medium
12	Evaluate options for higher regulatory standards to reduce the vulnerability of new development to flooding.	-	2	-	1	1	1	1	1	-	1	-	1	2	-	1	-	-	-	1	13	Medium
13	Consider options for public/private partnership with home improvement stores to encourage homeowners to take mitigation and preparedness actions.	1	-	-	-	1	-	-	1	-	-	1	-	2	-	1	-	-	-	-	7	Low
14	Establish an annual Flood Awareness Week.	1	-	-	-	1	-	-	1	1	1	1	-	2	-	1	-	-	-	-	9	Medium
15	Acquire property and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts	-	2	2	1	1	1	1	1	1	1	1	-	-	1	-	-	3	1	1	19	High

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Action Item	Mitigation Action Item	Area of Impact			Goals	Technical			Administrative Resources		Political/Legal			Financial			Environmental		Overall Priority Score	Priority Ranking		
		Community-wide	Targets hazard area	Addresses high risk hazard	Meets multiple goals	Feasible	Long-term solution	Existing planning mechanism in place	Project implementation	Maintenance capability	Political support	Local champion	Legal authority	Funded through community funding source	Needs grant funding	Cost					Consistent with federal laws	Consistent with community enviro. goals
																< \$10,000	\$10,000 - \$50,000	> \$50,000				
	Points Possible	1	2	2	1	1	1	1	1	1	1	1	2	1	1	2	3	1	1			
16	Acquire properties for a regional stormwater detention basin.	1	-	-	1	1	1	1	1	-	1	-	-	-	1	-	-	3	1	1	13	Medium
17	Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.	1	-	-	1	1	-	1	1	1	1	1	2	-	-	-	3	1	1	16	High	
18	Prepare watershed master plans for all HUC-12 river basins in the County.	1	-	-	1	1	-	1	1	-	1	-	-	1	-	-	3	1	1	12	Medium	
19	Improve/Upgrade pump stations at Bonnie Brook, Long Lake, Verona Park, and Woodsmere.	-	2	-	1	1	1	1	1	-	1	-	-	1	-	-	3	1	1	14	High	
20	Complete restoration of the Little Wekiva River at Edgewater Drive.	-	2	-	1	1	1	1	1	-	1	-	-	1	-	-	3	1	1	14	High	
21	Complete stormwater retrofits on Boggy Creek Pipeline, Control Structure for Pond 6612, and Lake George Outfall.	-	2	-	1	1	1	1	1	-	1	-	-	1	-	-	3	1	1	14	High	
22	Complete canal bank stabilization projects for Wheatberry Ct B-14 and Winter Park Pines Outfall.	-	2	-	1	1	1	1	1	-	1	-	-	1	-	-	3	1	1	14	High	
23	Continue to implement emergency hurricane preparedness procedures as needed and update regularly.	-	2	-	-	1	-	1	1	1	-	-	-	2	-	1	-	-	-	9	Low	

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The FMPC members were also asked to determine an implementation timeline for each project. The priority time frames for project implementation were determined to be as follows:

Short Range = Project can be completed in less than one year from plan adoption

Medium Range = Project can be implemented in more than two years but less than five years

Long Range = Project will likely require more than five years to implement

This timeline distinguishes projects that can be completed within the five-year lifetime of the plan (short and medium range projects) from those that will likely not be completed prior to the required plan update.

The process of establishing a priority ranking and an implementation timeline for each mitigation action allowed the FMPC to come to consensus and to rank the actions in order of relative importance. Using the Implementation Ranking Matrix shown in Figure 7.2, the FMPC ranked each mitigation action on a scale of one to nine, one indicating those actions that should be implemented first and nine signifying the lowest implementation priority. These scores allow the FMPC and those individuals, agencies, and organizations responsible for implementation to plan which actions to pursue first. Note that in this ranking matrix, multiple actions can earn the same overall implementation ranking.

		Implementation Timeline		
		Short	Medium	Long
Priority Ranking	High	1st	2nd	3rd
	Medium	4th	5th	7th
	Low	6th	8th	9th

Figure 7.2 – Implementation Ranking Matrix

The priority ranking, timeline, and overall implementation ranking for each mitigation action is listed in Table 8.3 – Mitigation Action Plan.

7.4 Mitigation Action Plan

44 CFR Subsection D §201.6(c)(3)(iii): [The mitigation strategy section shall include an] action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This action plan was developed to present the recommendations developed by the FMPC for how Orange County can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Emphasis was placed on both future and existing development. The action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. Each action summary also includes a discussion of the benefit-cost review conducted to meet the regulatory requirements of the Disaster Mitigation Act. In order to meet the identified goals, this plan recommends 23 mitigation actions, which are summarized below in Table 7.2. Note: Action item number does not indicate an order of priority.

It is important to note that Orange County has many existing, detailed action descriptions, which include benefit-cost estimates, in other planning documents, such as, stormwater plans, and capital improvement budgets and reports. These actions are considered to be part of this plan, and the details, to avoid duplication, should be referenced in their original source document. The FMPC also realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to the overall goals of this plan.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The County is not obligated by this document to implement any or all of these projects. Rather this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards. The actual selection, prioritization, and implementation of these actions will also be further evaluated in accordance with the CRS mitigation categories and criteria contained in Appendix B.

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Table 7.2 – Summary of Orange County Mitigation Actions

Action Item	Project	Goals Addressed	Mitigation Category	Responsible Department/ Agency/Person	Funding Source	Priority	Timeline	Implementation Ranking
1	Continue to hold the Orange County Hurricane Expo to provide preparedness information to County residents.	2	Public Information & Outreach	Stormwater Management Division	Operating Budget	Medium	Short	4
2	Speak to Homeowners Associations about flood hazard preparedness and mitigation options.	2	Public Information & Outreach	Stormwater Management Division	Operating Budget	Low	Short	6
3	Send outreach brochure to residents of the SFHA, Repetitive Loss Areas, and to HOAs.	2	Public Information & Outreach	Stormwater Management Division	Operating Budget	Low	Short	6
4	Encourage residents in repetitive loss areas and high-risk flood zones to consider the option of acquisition or elevation.	1, 2, 5	Property Protection	Stormwater Management Division	HMGP	High	Medium	2
5	Continue to inspect and maintain waterways, including natural channels, to ensure they are clear of debris.	1, 3, 5	Natural Resource Protection	Stormwater Management Division	Municipal Services Benefits Unit	Medium	Medium	5
6	Perform engineering studies of the areas surrounding Lake Venus, including the Orlo Vista neighborhood.	1	Prevention	Stormwater Management Division	Municipal Services Benefits Unit	Medium	Medium	5
7	Protect critical facilities and infrastructure from potential flood damage.	1, 3	Emergency Services	Stormwater Management Division, Office of Emergency Management	Operating Budget	Medium	Medium	5
8	Ensure back up power systems and generators are in place for all critical facilities and emergency shelters.	1, 3	Emergency Services	Office of Emergency Management	Operating Budget	Medium	Short	4
9	Install high water level outfalls in lieu of current drainwells or retrofit existing drainwells, including at Lake Price, Lake Pleasant, Mustang Way, and Lake Florence.	1, 3, 5	Structural Projects	Stormwater Management Division	Operating Budget	Medium	Medium	5
10	Retrofit culverts along Apopka Boulevard.	1	Structural Projects	Stormwater Management Division	Operating Budget	Medium	Medium	5
11	Add flood gauges to improve calibration of current flood modeling system and enable better flood warning.	1	Emergency Services	Stormwater Management Division	Not yet identified	Medium	Medium	5
12	Evaluate options for higher regulatory standards to reduce the vulnerability of new development to flooding.	1, 3, 5	Prevention	Stormwater Management Division	Operating Budget	Medium	Medium	5
13	Consider options for public/private partnership with home improvement stores to encourage homeowners to take mitigation and preparedness actions.	2	Property Protection	Stormwater Management Division	Operating Budget	Low	Short	6
14	Establish an annual Flood Awareness Week.	2	Public Information & Outreach	Stormwater Management Division	Operating Budget	Medium	Short	4
15	Acquire repetitive loss and other properties and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts	1, 4, 5	Prevention, Natural Resource Protection	Planning & Development Department, Environmental Protection Division	Green PLACE program	High	Medium	2
16	Acquire properties for a regional stormwater detention basin.	1, 4	Structural Projects	Stormwater Management Division	Not yet identified	Medium	Long	7
17	Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.	1, 4	Prevention, Natural Resource Protection	Stormwater Management Division	Operating Budget	High	Medium	2
18	Prepare watershed master plans for all HUC-12 river basins in the County.	1, 4, 5	Prevention	Stormwater Management Division	Operating Budget	Medium	Medium	5
19	Improve/Upgrade pump stations at Bonnie Brook, Long Lake, Verona Park, and Woodsmere.	1, 3, 5	Structural Projects	Stormwater Management Division	Operating Budget	High	Medium	2
20	Complete restoration of the Little Wekiva River at Edgewater Drive.	1, 4, 5	Natural Resource Protection	Stormwater Management Division	Operating Budget	High	Medium	2
21	Complete stormwater retrofits on Boggy Creek Pipeline, Control Structure for Pond 6612, and Lake George Outfall.	1, 3, 5	Structural Projects	Stormwater Management Division	Operating Budget	High	Medium	2
22	Complete canal bank stabilization projects for Wheatberry Ct 8-14 and Winter Park Pines Outfall.	1, 3, 5	Structural Projects	Stormwater Management Division	Operating Budget	High	Medium	2
23	Continue to implement emergency hurricane preparedness procedures as needed and update regularly.	1	Emergency Services	Stormwater Management Division, Office of Emergency Management	Operating Budget	Low	Short	6

7.5 Detailed Flood Hazard Mitigation Actions

1. Continue to hold the Orange County Hurricane Expo to provide preparedness information to County residents.

Hazards Addressed: Hurricane/Tropical Storm; Flood: 100-/500-year

Issue/Background: The Hurricane Expo is an ongoing event to provide residents with information on hurricane risk, including flood.

Other Alternatives: No action; Residents may face complacency about hurricane risk

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used to staff a flood risk awareness and preparedness table at the Expo.

Cost Estimate: Staff time, funds for event space, set up, and materials

Benefits (Losses Avoided): Residents and property owners will learn about hurricane risk and steps to take for preparedness and mitigation.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Short

2. Speak to Homeowners Associations about flood hazard preparedness and mitigation options.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Homeowners Association meetings offer an opportunity to meet with residents and share information about flood hazard risk, preparedness, and mitigation options.

Other Alternatives: Current outreach relies on mailings or events that residents attend.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used for outreach

Cost Estimate: Staff time, funds for outreach materials

Benefits (Losses Avoided): This outreach will bring conversations to residents where it is convenient and more likely to be acted upon. Residents will receive information on flood risk and mitigation options that are relevant to them.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Low

Timeline: Short

3. Send outreach brochure to residents of the SFHA, Repetitive Loss Areas, and HOAs.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: The County mails an outreach brochure on flood risk and preparedness annually.

Other Alternatives: No action; Residents would need to seek out information on their own and could remain uninformed.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used to continue to update outreach materials

Cost Estimate: Staff time to prepare the mailing, funds for outreach materials

Benefits (Losses Avoided): Information on flood risk, preparedness, and mitigation options will reach those who need it most.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Low

Timeline: Short

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4. Encourage residents in repetitive loss areas to consider the option of acquisition.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Repetitive loss properties are likely to continue incurring losses without mitigation. Acquisition and demolition is the only way to ensure no future losses occur.

Other Alternatives: No action. Rely on property owners to pursue mitigation.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used for outreach

Cost Estimate: Staff time to administer outreach and acquisition; acquisition costs will vary

Benefits (Losses Avoided): Removing people and property from repetitive loss areas will reduce exposure and vulnerability to floods in the County, reducing future flood losses.

Potential Funding: The cost will be paid for by the County's operating budget. Acquisition funds are available through the Hazard Mitigation Grant Program (HMGP).

Priority: High

Timeline: Medium

5. Continue to inspect and maintain waterways, including natural channels, to ensure they are clear of debris.

Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: When waterways fill with debris their volume capacity decreases, making them less effective at draining floodwaters.

Other Alternatives: No action; Waterways may fill with debris between current cleanings, causing drainage issues and possible flooding.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used for regular inspection and maintenance

Cost Estimate: Staff time

Benefits (Losses Avoided): Improved maintenance of canals and natural waterways will ensure proper drainage and reduce risk of localized stormwater flooding.

Potential Funding: The cost will be paid for by the County's Municipal Services Benefits Unit (MSBU).

Priority: Medium

Timeline: Medium

6. Perform engineering studies of the areas surrounding Lake Venus, including the Orlo Vista neighborhood.

Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Current flood maps show the Orlo Vista neighborhood as falling outside the SFHA, yet it has been known to experience severe flooding, notably following Hurricane Donna and Hurricane Irma. Performing engineering studies of the area and updating the regulatory floodplain accordingly will ensure that data is more accurate and that regulatory protections can be applied to this area for better property protection in the future.

Other Alternatives: No action; the County will lack the information needed to properly address flood risk in the neighborhood.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division staff capabilities will be used.

Cost Estimate: To be determined

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Benefits (Losses Avoided): Risk in the Orlo Vista neighborhood and surrounding areas will be better understood so that appropriate actions can be taken to mitigate flooding in the area.

Potential Funding: The cost will be paid for by the County's Municipal Services Benefits Unit (MSBU).

Priority: Medium

Timeline: Medium

7. Protect critical facilities and infrastructure from potential flood damage.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Orange County has three critical facilities in high flood risk zones and an additional 192 critical facilities in areas of low flood risk. Additional critical infrastructure may also be vulnerable to flooding. Providing flood protection measures for these facilities will reduce the County's vulnerability to flood hazards.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division and Office of Emergency Management staff capabilities will be used

Cost Estimate: To be determined

Benefits (Losses Avoided): The County's critical facilities and infrastructure will be less vulnerable to flood hazards.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Medium

8. Ensure back up power systems and generators are in place for all critical facilities and emergency shelters.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Providing back up power and redundant systems will help to ensure that critical facilities remain operational during flood hazards even if their main power source is compromised.

Other Alternatives: No action; critical facilities will run the risk of losing power during a hazard event.

Existing Planning Mechanism(s) for Implementation: Orange County Emergency Management and critical facility site staff capabilities will be used

Cost Estimate: To be determined

Benefits (Losses Avoided): The County's critical facilities and infrastructure will be less vulnerable to flood hazards.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Low

Timeline: Short

9. Install high water level outfalls in lieu of current drainwells or retrofit existing drainwells, including at Lake Price, Lake Pleasant, Mustang Way, and Lake Florence.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Drainwells are flood control structures used to drain excess surface water to the underground aquifer. Because stormwater gathers and concentrates pollution, drainwells can threaten water quality by directing untreated stormwater back into the drinking supply. Alternative flood control measures or retrofitted drainwells can mitigate this problem.

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Other Alternatives: It is not feasible to treat stormwater through an alternative method before it reaches drainwells.

Existing Planning Mechanism(s) for Implementation: This project will be implemented through the County's Capital Improvements Program.

Cost Estimate: To be determined

Benefits (Losses Avoided): These projects will protect water quality and manage stormwater flooding issues.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Medium

10. Retrofit culverts along Apopka Boulevard.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Stormwater flooding occurs along Apopka Boulevard due to inadequately-sized culverts.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to oversee these improvements. This project will be implemented through the County's Capital Improvements Program.

Cost Estimate: To be determined

Benefits (Losses Avoided): The improvements will better manage stormwater conveyance along Apopka Boulevard.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Medium

11. Add flood gauges to improve calibration of current flood modeling system and enable better flood warning.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Current flood modeling is limited by a lack of accurate data. Installing additional flood gauges will improve modeling, allowing for better flood warning.

Other Alternatives: Continue using only the existing flood gauges

Existing Planning Mechanism(s) for Implementation: Orange County Emergency Management staff capabilities will be used.

Cost Estimate: Approximately \$18,000 per gauge, plus operating costs.

Benefits (Losses Avoided): Orange County Emergency Management will be able to issue more accurate, timely flood warnings.

Potential Funding: The funding for this project has not yet been identified.

Priority: Medium

Timeline: Medium

12. Evaluate options for higher regulatory standards to reduce the vulnerability of new development to flooding.

Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

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Issue/Background: Higher regulatory standards can ensure that future structures are built to minimize their impact on flooding and their vulnerability to floods.

Other Alternatives: No action; Existing standards will continue to apply.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Division and Planning & GIS staff capabilities will be used.

Cost Estimate: Staff time

Benefits (Losses Avoided): Future development will be built to higher standards, which could reduce flood risk and vulnerability.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Medium

13. Consider options for public/private partnership with home improvement stores to encourage homeowners to take mitigation and preparedness actions.

Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Home improvement stores can help to educate property owners on ways to protect their property from flooding and incorporate mitigation of their property into flood recovery.

Other Alternatives: No action; rely on property owners to mitigate flood risk on their own.

Existing Planning Mechanism(s) for Implementation: The County Stormwater Management staff capabilities will be used to coordinate with home improvement stores to create this partnership.

Cost Estimate: Staff time

Benefits (Losses Avoided): Property owners will know how to mitigate flood risk and will be more likely to take action.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Low

Timeline: Short

14. Establish an annual Flood Awareness Week.

Hazards Addressed: Climate Change; Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Establishing an annual flood awareness week will help to prevent residents from getting complacent about flood risk even during years when there are no flood events.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to plan and coordinate the Flood Awareness Week activities and programming.

Cost Estimate: Staff time, funds for outreach materials and events

Benefits (Losses Avoided): The public, including residents and visitors outside the SFHA and Repetitive Loss Areas, will be more aware of flood risk and their preparedness and mitigation options.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Short

15. Acquire repetitive loss and other properties and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts.

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Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Coordinating land conservation with long-term planning and development can serve to protect vulnerable lands and natural floodplain functions and mitigate future flooding.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Green PLACE program is already active and the County already conducts long-range land use planning; County Planning Department staff capabilities can be used to integrate these activities. The County has already acquired one repetitive loss property on Murdock Street. This acquisition demonstrates the County's ability and opportunity to create open space.

Cost Estimate: Staff time for planning and coordination, funding for land acquisition on case-by-case basis

Benefits (Losses Avoided): Targeting flood prone lands with the Green PLACE program and coordinating this effort with comprehensive planning efforts can help ensure these lands remain undeveloped.

Potential Funding: The project will be funded through the Green PLACE program.

Priority: High

Timeline: Medium

16. Acquire properties for a regional stormwater detention basin.

Hazards Addressed: Climate Change; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Detention ponds capture stormwater runoff and slowly drain it to prevent flooding.

Other Alternatives: No action; rely on alternative stormwater infrastructure, which may prove insufficient.

Existing Planning Mechanism(s) for Implementation: County Stormwater Management Division staff capabilities can be used to manage the facility.

Cost Estimate: Staff time for planning and coordination, funding for land acquisition not yet determined

Benefits (Losses Avoided): A regional stormwater detention basin will reduce the strain on other parts of the County's stormwater infrastructure.

Potential Funding: The funds for this project have not yet been identified.

Priority: Medium

Timeline: Long

17. Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.

Hazards Addressed: Dam Failure; Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Orange County is responsible for managing stormwater runoff and reducing pollution in order to meet requirements of the Clean Water Act. Currently the County uses regulations and public education to prevent pollution.

Other Alternatives: No action; risk not meeting permit requirements

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used.

Cost Estimate: Staff time; outreach materials

Benefits (Losses Avoided): Reducing stormwater pollution protects surface waters and helps mitigate some health risks associated with flooding.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

18. Prepare watershed master plans for all HUC-12 river basins in the County.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;
Issue/Background: New development can create dramatic changes in watershed dynamics making it difficult to predict flooding. Watershed master planning involves surveying the land and modeling the floodplains to get a clearer, more current picture of the watershed.

Other Alternatives: No action; rely on outdated data and models

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to oversee the development of the updated Watershed Master Plans. This project will be implemented through the County's Capital Improvements Program.

Cost Estimate: Varies by location

Benefits (Losses Avoided): Updated watershed master plans will provide more accurate flood risk assessment enabling a better understanding of needs and opportunities for mitigation.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: Medium

Timeline: Medium

19. Improve/Upgrade pump stations at Bonnie Brook, Long Lake, Verona Park, and Woodsmere.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;
Issue/Background: Pump station improvements in these locations will increase the drainage capacity and mitigate surrounding stormwater flooding issues.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management staff capabilities will be used to oversee these improvements. The projects will be implemented through the County's Capital Improvements Program.

Cost Estimate: Varies by location

Benefits (Losses Avoided): Pump station capacities will increase, enabling improved stormwater drainage and reduced flooding.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

20. Complete restoration of the Little Wekiva River at Edgewater Drive.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;
Issue/Background: Restoration of the Little Wekiva River will increase the river's drainage capacity and protect its natural floodplain functions.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to oversee the restoration. The project will be implemented through the County's Capital Improvements Program.

Cost Estimate: To be determined

Benefits (Losses Avoided): The Little Wekiva River will be better able to accommodate floodwaters, mitigating risk of flooding nearby.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

CHAPTER 7: MITIGATION STRATEGY

21. Complete stormwater retrofits on Boggy Creek Pipeline, Control Structure for Pond 6612, and Lake George Outfall.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Orange County Stormwater Management has identified a number of additional stormwater retrofit projects to improve drainage and mitigate stormwater flooding.

Other Alternatives: No action;

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to oversee these improvements. The projects will be implemented through the County's Capital Improvements Program.

Cost Estimate: To be determined

Benefits (Losses Avoided): Retrofits and improvements will increase drainage capacity and mitigate risk of stormwater flooding.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

22. Complete canal bank stabilization projects for Wheatberry Ct B-14 and Winter Park Pines Outfall.

Hazards Addressed: Flood: 100-/500-year; Flood: Stormwater/Localized Flooding; Hurricane/Tropical Storm;

Issue/Background: Canal bank erosion can occur over a long period of time resulting in instability and risk of collapse, which can cause blockages, limit drainage capacity, and result in flooding. Maintenance is necessary to prevent this risk.

Other Alternatives: No action; risk of further canal bank deterioration and possible collapse.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division staff capabilities will be used to oversee these improvements. The projects will be implemented through the County's Capital Improvements Program.

Cost Estimate: To be determined

Benefits (Losses Avoided): Canal bank stabilization will prevent further damage from occurring and avoid increased flood risk as a result of collapse.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

23. Continue to implement emergency hurricane preparedness procedures and update regularly.

Hazards Addressed: Hurricane/Tropical Storm;

Issue/Background: In the days leading up to a projected impact by a hurricane or tropical storm, preparedness actions can dramatically reduce vulnerability and prevent losses due to flooding. Orange County Stormwater Management maintains hurricane preparedness procedures and initiates them as needed. Updating these procedures regularly will ensure their effectiveness.

Other Alternatives: No action; the County may fail to take necessary actions prior to hurricane landfall.

Existing Planning Mechanism(s) for Implementation: Orange County Stormwater Management Division and Office of Emergency Management staff will oversee updates to these procedures.

Cost Estimate: Staff time

Benefits (Losses Avoided): Taking these steps will ensure that all drainage systems are in good condition and that the County is prepared to handle and respond to a hurricane or tropical storm.

Potential Funding: The cost will be paid for by the County's operating budget.

Priority: High

Timeline: Medium

Orange County, Florida

Floodplain Management Plan

December 2017

8 PLAN ADOPTION

44 CFR Subsection D §201.6(c)(5): [The plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

The purpose of formally adopting this plan is to secure buy-in from the County, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan, in accordance with the requirements of DMA 2000. The Orange County Board of County Commissioners will adopt the Floodplain Management Plan by passing a resolution. An example resolution is shown below.

9 PLAN IMPLEMENTATION AND MAINTENANCE

44 CFR Subsection D §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This section provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The section also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

9.1 Implementation

Once adopted, the plan must be implemented in order to be effective. While this plan contains many worthwhile actions, Orange County will need to decide which action(s) to undertake first. The priority assigned the actions in the planning process and funding availability will affect that decision. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

An important implementation mechanism that is highly effective and low-cost is incorporation of the floodplain management plan recommendations and their underlying principles into other plans and mechanisms, such as the County's Comprehensive Plan and Sustainability Plan. Orange County already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits to each program and the community. This effort is achieved through the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the costlier recommended actions. This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the County will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

9.1.1 Responsibility for Implementation of Goals and Activities

Elected officials, officials appointed to head community departments and community staff are charged with implementation of various activities in the plan. During the quarterly reviews as described later in this section, an assessment of progress on each of the goals and activities in the plan will be determined and noted. At that time, recommendations will be made to modify timeframes for completion of activities, funding resources, and responsible entities. On a quarterly basis, the priority standing of various

CHAPTER 9: PLAN IMPLEMENTATION AND MAINTENANCE

activities may also be changed. Some activities that are found not to be achievable may be removed from the plan entirely and activities addressing problems unforeseen during plan development may be added.

9.1.2 Role of FMPC in Implementation, Monitoring and Maintenance

With adoption of this plan, Orange County will be responsible for the plan implementation and maintenance. The FMPC, identified in Section 3, will convene quarterly each year to ensure mitigation strategies are being implemented and the County continues to maintain compliance with the NFIP. As such, Orange County agrees to continue its relationship with the FMPC and:

- ▶ Act as a forum for flood mitigation issues;
- ▶ Disseminate flood mitigation ideas and activities to all participants;
- ▶ Pursue the implementation of high-priority, low/no-cost recommended actions;
- ▶ Ensure flood mitigation remains a consideration for community decision makers;
- ▶ Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- ▶ Monitor and assist in implementation and update of this plan;
- ▶ Report on plan progress and recommended revisions to the County Commission; and
- ▶ Inform and solicit input from the public.

The primary duty is to see the plan successfully carried out and report to the County Commission, FDEM, FEMA, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about flood mitigation, passing concerns on to appropriate entities, and posting relevant information on the County's website (and others as appropriate).

9.2 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized.

9.2.1 Maintenance Schedule

Orange County's Stormwater Management Division is responsible for initiating plan reviews. In order to monitor progress and update the mitigation strategies identified in the action plan, Orange County will revisit this plan quarterly and following a hazard event. The County will submit a five-year written update to FDEM and FEMA Region IV, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With this plan update anticipated to be fully approved and adopted in 2017, the next plan update for the County will occur in 2022.

9.2.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- ▶ Decreased vulnerability as a result of implementing recommended actions;
- ▶ Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- ▶ Increased vulnerability as a result of new development (and/or further annexation).

Updates to this plan will:

- ▶ Consider changes in vulnerability due to action implementation;
- ▶ Document success stories where mitigation efforts have proven effective;

CHAPTER 9: PLAN IMPLEMENTATION AND MAINTENANCE

- ▶ Document areas where mitigation actions were not effective;
- ▶ Document any new hazards that may arise or were previously overlooked;
- ▶ Incorporate new data or studies on hazards and risks;
- ▶ Incorporate new capabilities or changes in capabilities;
- ▶ Incorporate growth and development-related changes to infrastructure inventories; and
- ▶ Incorporate new action recommendations or changes in action prioritization.

Changes will be made to the plan during the update process to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as is appropriate and necessary, and as approved by the County Commission. In keeping with the five-year update process, the FMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the County Commission

Specifically, the County will adhere to the following process for the next update of this FMP:

Quarterly Plan Review Process

For the 2015 floodplain management plan update review process, Orange County's Stormwater Management Division will be responsible for facilitating, coordinating, and scheduling reviews and maintenance of the plan. The review of the Floodplain Management Plan will normally occur on a quarterly basis each year and will be conducted as follows:

- ▶ The County's Stormwater Management Division will provide notice for the meeting with a County News Release.
- ▶ If topics for discussion will directly impact community member or specific groups, they will be notified. Notices will be mailed to the members of the FMPC, federal, state, and local agencies, non-profit groups, local planning agencies, representatives of business interests, neighboring communities, and others advising them of the date, time, and place for the review.
- ▶ Prior to the review, department heads and others tasked with implementation of the various activities will be queried concerning progress on each activity in their area of responsibility and asked to present a report at the review meeting.
- ▶ After the quarterly review meeting, minutes of the meeting and a quarterly report will be prepared by the FMPC. The report will be made available to the County Commission and to the public for informational purposes only.
- ▶ On a yearly basis, a report will be prepared by the FMPC and presented to the County Commission for formal review, and a request will be made that the Commission take action to recognize and adopt any changes resulting from the review. The report will then be forwarded to the ISO/CRS specialist for the CRS program.

Note: Because Orange County abides by the State of Florida "Sunshine Law", all quarterly review meetings will be open to the public.

Criteria for Quarterly Reviews

The criteria recommended in 44 CFR 201 and 206 will be utilized in reviewing and updating the plan. More specifically, the quarterly reviews will include the following information:

Regular Meeting:

- Report on Mitigation Action items.
 - ▶ Community growth or change in the past quarter, if any.
 - ▶ The number of substantially damaged or substantially improved structures by flood zone.

CHAPTER 9: PLAN IMPLEMENTATION AND MAINTENANCE

- ▶ The renovations to public infrastructure including water, sewer, drainage, roads, bridges, gas lines, and buildings.

Meeting if a Natural Disaster Occurs:

- ▶ Natural hazard occurrences that required activation of the Emergency Operations Center (EOC) and whether or not the event resulted in a presidential disaster declaration.
- ▶ Natural hazard occurrences that were not of a magnitude to warrant activation of the EOC or a federal disaster declaration but were severe enough to cause damage in the community or closure of businesses, schools, or public services.
- ▶ The dates of hazard events and descriptions.
- ▶ Documented damages due to the event.
- ▶ Closures of places of employment or schools and the number of days closed.
- ▶ Road or bridge closures due to the hazard and the length of time closed.
- ▶ Assessment of the number of private and public buildings damaged and whether the damage was minor, substantial, major, or if buildings were destroyed. The assessment will include residences, mobile homes, commercial structures, industrial structures, and public buildings, such as schools and public safety buildings.
- ▶ Review of any changes in federal, state, and local policies to determine the impact of these policies on the community and how and if the policy changes can or should be incorporated into the Floodplain Management Plan. Review of the status of implementation of projects (mitigation strategies) including projects completed will be noted. Projects behind schedule will include a reason for delay of implementation.

9.2.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the Floodplain Management Plan recommendations and their underlying principles into other plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As previously stated, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. As described in this plan's capability assessment, Orange County already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include:

- ▶ Orange County Local Mitigation Strategy
- ▶ Comprehensive Plan
- ▶ Comprehensive Emergency Management Plan
- ▶ Ordinances
- ▶ Flood/stormwater management/master plans
- ▶ Other plans, regulations, and practices with a mitigation focus

Those involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc., as appropriate. As described in Section 7.1 Implementation, incorporation into existing planning mechanisms will be done through the routine actions of:

- ▶ Monitoring other planning/program agendas;
- ▶ Attending other planning/program meetings;
- ▶ Participating in other planning processes; and
- ▶ Monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this floodplain management plan.

9.2.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

Public Involvement Process for Quarterly Reviews

The public will be noticed by a County News Release specifying the date and time for the review and inviting public participation.

Public Involvement for Five-year Update

When the FMPC reconvenes for the update, they will coordinate with all community members participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. As part of this effort, public meetings will be held and public comments will be solicited on the plan update draft. The committee will coordinate this public outreach process with the public information program established pursuant to the 2017 guidelines from the CRS.

Appendix A. PLANNING PROCESS

A.1 Planning Step 1: Organize to Prepare the Plan

Table A.1 – FMPC Meeting Dates

Meeting Type	Meeting Topic	Meeting Date	Meeting Location
FMPC #1 (Kick-off)	4) Introduction to DMA, CRS and the planning process	10/24/2016 10:00 – 11:00 a.m.	Orange County Public Works Administration Bldg., Room 322
	5) Organize resources: the role of the FMPC, planning for public involvement, and coordinating with other agencies and stakeholders		
	6) Introduction to hazard identification		
FMPC #2	4) Determine critical facilities	11/30/2016 2:00 – 3:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	5) Develop areas of localized flooding concern		
	6) Select PPI target areas and audiences		
FMPC #3	4) Review/discussion of flood hazard profiles	1/19/2017 1:00 – 2:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	5) Review/discussion of vulnerability assessment		
	6) Review of existing Goals from Local Mitigation Strategy and Comprehensive Plan		
FMPC #4	4) Review and develop goals	3/23/2017 1:30 – 2:30 p.m.	Orange County Public Works Administration Bldg., Room 322
	5) Discuss community capability		
	6) Develop PPI projects		
FMPC #5	3) Review HIRA and capability	8/7/2017 3:00 – 4:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	4) Develop mitigation strategies		
FMPC #6	3) Review “Draft” Floodplain Management Plan	12/18/2017 2:00 – 3:00 p.m.	Orange County Public Works Administration Bldg., Room 322
	4) Solicit comments and feedback from the FMPC		

Note: All FMPC Meetings were open to the public.

FMPC Meeting Agendas, Minutes, and Sign-in Sheets

Meeting 1: October 24, 2016



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Kick-Off Meeting, October 24, 2016**

1. Trends in Disasters; Why Plan?
2. Disaster Mitigation Act (DMA) Planning Requirements
3. Community Rating System (CRS) Program
 - a. Basics of the CRS Program
 - b. NFIP Flood Insurance Discounts; Policy Base
 - c. Benefits of the CRS Program
4. CRS Program Activities
 - a. Activity 510 Floodplain Management Planning (FMP) Process
 - i. 10-Step Planning Process
 - b. Activity 330 Program for Public Information (PPI)
 - i. 7-Step Planning Process
5. Questions



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Kick-Off Meeting, October 24, 2016**

The Orange County Public Works Departments held the Kick Off meeting for the Floodplain Management Planning Committee (FMPC) in the Orange County Public Works Administration Building, Room 322, starting at 10:00 a.m.

David Stroud, a consultant with Amec Foster Wheeler, opened the meeting by providing the meeting agenda which included: trends in disasters, Disaster Mitigation Act (DMA) planning requirements, basics and benefits of the Community Rating System (CRS) Program, an overview of Activity 510 Floodplain Management Planning (FMP) process, and an overview of Activity 330 Program for Public Information (PPI) process.

Mr. Stroud then provided a PowerPoint presentation which discussed recent trends in disasters which reflect a continual increase in expenses and more disaster declarations. Mr. Stroud also discussed the four phases of DMA along with the ten planning steps of the CRS program. It was demonstrated that each of the 10 CRS planning steps fit within the four phases of DMA to create a seamless planning process. An overview of the CRS Program was also provided including the expected insurance savings benefits to Orange County.

The presentation went on to discuss the 10 CRS planning steps including how the FMPC would function throughout the planning process, what the responsibilities of the FMPC would, a plan for public involvement, the various flood hazards that should likely be profiled in the FMP and how goals and projects would be developed for the plan.

The second part of the presentation covered the PPI. Mr. Stroud explained that the objective of the PPI is to develop an overall outreach program in the County that best meets the needs and objectives of the community by leveraging both public and private resources where messages can be relayed to the public in the most effective manner. Mr. Stroud went on to describe the planning process for developing the PPI.

Before closing the meeting, the FMPC agreed upon the hazards to be addressed in the FMP. The following hazards were identified: Stream Bank Erosion, Dam/Levee Failure, Flood (100-/500-year), Localized Stormwater Flooding, Hurricanes and Tropical Storms, and Repetitive Flooding.

After a question and answer period, the meeting ended at 11:00 a.m.



Orange County Floodplain Management Plan Committee Meeting - October 24, 2016

Name	Department/Agency	E-mail	Phone Number
DAVID STROUD	Amer for RWHEVER	david.stroud@amerfor.com	919-325-6497
Michelle Cechowski	ECFRPC	Michelle@ecfrpc.org	407.402.3761
Eric Alberts	Orlando Health, Inc.	Eric.AAlberts@orlandohealth.com	407-304-6283
Jason Taylor	Orange County Emergency Mgt	jason.taylor@ocfl.net	407-836-9805
Bill GRIFF	South FLWaters Mgt	WGRIFF@SFWMD.gov	407 858 6100
Ramel Seepaul	Orange County SW	ramel.seepaul@ocfl.net	407 836.7983.
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Kelsie Davis	Red Cross	kelsie.davis@redcross.org	407-516-7158
Amy Bradbury	OC Planning	Amy.Bradbury@ocfl.net	407-836-0953

Meeting 2: November 30, 2016



Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Meeting #2, November 30, 2016

1. Where we are in the CRS Planning Process
2. Determine critical facilities to be included in FMP
3. Develop areas of localized flooding concern
 - a. Neighborhoods
 - b. Streets/Intersections
 - c. General areas
4. Program for Public Information
 - a. Delineate Target Areas
 - b. Delineate Target Audiences
5. Next Planning Steps
 - a. Review HIRA
 - b. Develop goals for the FMP
 - c. Formulate messages for the PPI
6. Questions



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Meeting #2, November 30, 2016**

The second meeting of the Floodplain Management Planning Committee (FMPC) was held in the Orange County Public Works Administration Building, Room 322, starting at 2:00 p.m.

Mr. Stroud, a consultant with Amec Foster Wheeler who is facilitating the planning process, began the meeting with a re-introduction to the process and a recap of the status of the plan within the CRS Planning Process.

Mr. Stroud then began a presentation on critical facilities in the County in order to assist the FMPC in paring down the overall list to a manageable number of those facilities most essential or impactful during emergency response and recovery. The list of critical facilities for the FMPC's consideration included emergency services, correctional institutions, hazardous material facilities, schools, shelters, infrastructure, communications, energy, logistics, transportation, and military facilities. The FMPC discussed and prioritized facilities on this list.

Next, Mr. Stroud discussed the localized stormwater flooding hazard, which requires local input in order to ensure the full extent of the hazard is understood and assessed. The FMPC was asked to consider neighborhoods, streets and intersections, and general areas of stormwater flooding to report to the consultant team for analysis.

Mr. Stroud then moved on to a discussion of the Program for Public Information, and led the FMPC in identifying target areas and target audiences for outreach. The FMPC decided on the SFHA, repetitive loss areas, localized flooding areas, and the shaded X-zone for target outreach areas. The FMPC decided on school children, homeowner associations, Spanish-speaking populations, landscapers, and the real estate, lending, and insurance industry for target outreach audiences.

The presentation ended with a brief discussion of next planning steps, which included reviewing the Hazard Identification and Risk Assessment findings, developing goals for the FMP, and formulating messages for the PPI. Mr. Stroud took questions from the group before ending the meeting at 3:00 p.m.



Orange County Floodplain Management Plan Committee Meeting – November 30, 2016

Name	Department/Agency	E-mail	Phone Number
DAVID STRAW	AMER. FISH & WILDLIFE	David.Straw@amerfish.com	(919) 325-6497
Daniel Negron	O.C. Public Works	daniel.negron@ocfl.net	407-836-7743
Rommel Seepaul	"	rommel-seepaul@ocfl.net	407-836-7983
Bill Graf	South FL Water Inst	wgraf@sfwater.org	407-858-6100
Eric Albert	Orlando Health, Inc.	Eric.Albert@orlandohalth.com	407-304-6283
Jason Taylor	OC OEM	jason.taylor@ocfl.net	407-836-9805
Amy Bradburn	OC Planning	Amy.Bradburn@ocfl.net	407-836-0953
Kelsie Davis	Red Cross	Kelsie.davis@redcross.org	407-516-7158
MIKE Drozeck	OC Public Works	MIKE.Drozeck@ocfl.net	407-836-7945

Meeting 3: January 19, 2017



Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Meeting #3, January 19, 2017

1. Flood Hazard Summary
2. Profiling the Flood Hazards
 - a. Natural flood hazards that threaten the planning area
 - b. Discussion of previous occurrences
 - c. Likelihood of future occurrences
3. Vulnerability to the Flood Hazards
 - a. Exposure
 - b. Assets
 - c. Critical Facilities
4. Goals for the FMP
 - a. LMS goals
 - b. Comprehensive plan goals
5. Questions



Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Meeting #3, January 19, 2017

The third meeting of the Floodplain Management Planning Committee (FMPC) was held by the Orange County Public Works Department at the Orange County Public Works Administration Building, Room 322, starting at 1:00 p.m.

David Stroud, a consultant with Amec Foster Wheeler who is facilitating the planning process, began the meeting with a summary of the flood hazards identified thus far that pose a flood risk to the County. Mr. Stroud reviewed these natural hazards, which include climate change, canal bank erosion, dam and levee failure, 100- and 500-year flooding, hurricanes and tropical storms, and localized stormwater flooding, for the FMPC to discuss the findings. Specifically, the presentation outlined the various data sources used to understand these hazards, including past disaster declarations, the Spatial Hazard Events and Losses Data Base for the United States (SHELDUS), the National Inventory of Dams, the National Levee Database, and the National Centers for Environmental Information. Mr. Stroud then discussed the previous occurrences identified for each hazard as well as the likelihood of future occurrences of each hazard based on these findings.

Mr. Stroud noted several areas of remaining data needs, including needing local identification of erosion issues and existing CIP projects.

The presentation then outlined the components of the vulnerability assessment, including the current data obtained for existing buildings and their values as well as the locations of critical facilities throughout the County.

Finally, Mr. Stroud introduced a discussion of goal-setting. He reviewed existing Local Mitigation Strategy goals and comprehensive plan goals related to flooding. Mr. Stroud then led the FMPC in an exercise to identify priorities for goal setting and begin a discussion of preliminary goals.

Before closing the meeting, Mr. Stroud took questions. The meeting ended at 2:00 p.m.



Orange County CRS Floodplain Management Planning Committee – January 19, 2017

Name	Department/Agency	E-mail	Phone Number
Daniel Neyron	Orange County Storm water	daniel.neyron@ocfl.net	407 836 7793
DAVID STROUD	America's Forestry	david.stroud@americaforestry.com	919 325 6497
Eric Albert	Orlando Health E.P.	Eric.Albert@orlandohealth.com	407-304-6283
Amy Bradburn	OC Planning	amy.bradburn@ocfl.net	407-836 0953
Jason Taylor	OC Emergency Mgt.	jason.taylor@ocfl.net	407-836-9805
Kelsie Davis	American Red Cross	kelsie.davis@redcross.org	407-516-7158

Meeting 4: March 23, 2017



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Meeting #4, March 23, 2017**

1. Preliminary Goals Summary
2. Flood Hazards Summary
 - a. Probability of the Hazards
 - b. Impact
 - c. Spatial Extent
 - d. Warning Time
 - e. Duration
3. Priority Risk Index Findings
4. Discussion on Capability
5. Questions



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Meeting #4, March 23, 2017**

The Orange County Public Works Department held the fourth meeting of the Floodplain Management Planning Committee (FMPC) at 1:30 p.m. in the Orange County Public Works Administration Building, Room 322.

David Stroud, a consultant with Amec Foster Wheeler, opened the meeting by providing a summary of the preliminary goals, which were developed based on input and discussion at the previous FMPC meeting. The FMPC reviewed these goals and reached consensus on the final goals for the plan.

Next, Mr. Stroud reviewed each of the identified flood hazards for the plan and discussed the risk and vulnerability associated with each hazard. Each hazard was ranked on five categories that comprise a Priority Risk Index (PRI): probability, impact, spatial extent, warning time, and duration. A PRI score allows diverse hazards to be ranked and compared to one another for the purpose of prioritizing mitigation actions.

The findings indicated that climate change poses a high risk to the County. Dam failure, 100- and 500-year flooding, and localized stormwater flooding each pose a moderate risk to the County.

Mr. Stroud then closed the meeting with a discussion of community capability in order to gather FMPC input to inform the development of the capability assessment. Capability refers to a community's administrative, technical, and financial resources and capacity to enact mitigation actions. The capability assessment identifies both opportunities and gaps in capacity for the County to address through mitigation actions.

Prior to the end of the meeting, Mr. Stroud took questions on the information discussed and the next steps in the project. The meeting was brought to a close at 2:30 p.m.



Orange County Floodplain Management Plan Committee Meeting – March 23, 2017

Name	Department/Agency	E-mail	Phone Number
Daniel Negron	Public Works	daniel.negron@ocfl.net	407 836 7743
David Strawn	Amel Faren Wtkaw	david.straw@ocfl.net	919 325 6477
Amy Bradbury	Planning	amy.bradbury@ocfl.net	407 836 0953
Bill Graf	SFWMD	wsgraf@sfwmd.gov	407 858 6100
Mike Drizzle	OCFL	mike.drizzle@ocfl.net	407 836-7945

Meeting 5:



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Meeting #5, August 7, 2017**

1. Where we are in the Planning Process
2. Flood Hazards Summary
3. FEMA Mitigation Categories
 - a. Mitigation Alternatives
 - i. Alter, Avert, Adapt, Avoid
 - b. Mitigation Action Elements
 - i. Responsible Person/Agency
 - ii. Funding Source
 - iii. Timeline
4. Potential Mitigation Projects
 - a. Local Mitigation Strategy
 - b. Capital Improvements Program
 - c. Other Potential Projects
5. Next Steps
6. Questions



Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Meeting #5, August 7, 2017

The Orange County Public Works Department held the fifth meeting of the Floodplain Management Planning Committee (FMPC) at 3:00 p.m. in the Orange County Public Works Administration Building, Room 322.

David Stroud, a consultant with Amec Foster Wheeler, opened the meeting by providing a summary of the planning process, and the steps still required for completion. The remaining steps include developing possible mitigation strategies, drafting an action plan, adopting the plan, and implementing and monitoring the plan. Public involvement and outreach remains ongoing throughout the planning process.

Next, Mr. Stroud reviewed each of the identified flood hazards for the plan and discussed the risk and vulnerability associated with each hazard. The findings indicated that climate change poses a high risk to the County. Dam failure, 100- and 500-year flooding, and localized stormwater flooding each pose a moderate risk to the County.

Mr. Stroud then discussed FEMA's mitigation alternatives and the categories of actions that the FMPC can consider in developing mitigation alternatives. After introducing the FMPC to these concepts, Mr. Stroud led the FMPC in a brainstorming session to develop mitigation alternatives. The FMPC reviewed actions from existing planning efforts, including the Orange County Local Mitigation Strategy and the Capital Improvement Program. The FMPC also developed several possible new actions, including strategies to address repetitive loss properties, a project to install more flood gauges, developing a stormwater utility, pursuing mitigation banking for wetland remediation, and increasing future education and outreach efforts, including through continuing the Hurricane Expo annually.

After generating a list of potential strategies the FMPC agreed on criteria to evaluate those strategies and generated a final action plan. Mr. Stroud then took questions on the information discussed and the next steps in the project. The meeting was brought to a close at 4:00 p.m.



Orange County Floodplain Management Plan Committee Meeting – August 7, 2017

Name	Department/Agency	E-mail	Phone Number
DAVID STROUD	AMEC FOSTER WHEELER	david.stroud@amer.com	919 325-6497
Eric Albata	Orlando Health / E.P.	Eric.Albata@orlandohealth.com	407-84-0223
Daniel Negron	Public Works	daniel.negron@ocfl.net	407 836 7743
Amy Bradbury	Planning	Amy.Bradbury@ocfl.net	407-836-0953
LUIS MARTINEZ	PUBLIC WORKS	LUIS.MARTINEZ@OCFL.NET	
MIKE DIBZICK	" "	MIKE.DIBZICK@OCFL.NET	407-836-7945

Meeting 6:



**Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Agenda
Meeting #6, December 18, 2017**

1. Where we are in the CRS Planning Process
2. Review of the Draft Floodplain Management Plan
 - a. Structure of the Plan
 - b. Planning Process
 - c. Goals
 - d. Hazard Identification & Risk Assessment
 - i. Assets
 - ii. Critical Facilities
 - e. Mitigation Strategies
 - i. Flood Mitigation Projects
 - ii. Prioritization
3. Maintenance
4. Next Steps
5. Questions



Orange County Floodplain Management Plan
Floodplain Management Planning Committee Meeting Minutes
Meeting #6, December 18, 2017

The Orange County Public Works Department held the final meeting of the Floodplain Management Planning Committee (FMPC) at 2:00 p.m. in the Orange County Public Works Administration Building, Room 322.

David Stroud, a consultant with Amec Foster Wheeler, opened the meeting by providing a summary of the planning process, and the steps still required for completion, which include adopting the plan and implementing and monitoring the plan. Public involvement and outreach remains ongoing throughout the planning process.

The complete Draft Floodplain Management Plan was presented to the FMPC for review. Mr. Stroud began with an overview of the structure of the plan and a brief description of each of the plan chapters. He detailed the planning process documentation as well as the plan goals and objectives. Mr. Stroud then reviewed each of the identified flood hazards for the plan.

Following a review of the HIRA, the results of the mitigation action prioritization were presented and discussed. The FMPC agreed that the prioritization for each action was appropriate. The complete mitigation action plan was presented and reviewed. Mr. Stroud discussed the "Detailed Mitigation Actions" section of the plan and asked that the FMPC pay particular attention to this section when reviewing the plan in order to provide any additional details that may be necessary.

Finally, Mr. Stroud closed by discussing the process for implementation and monitoring of the plan. He explained the FMPC's options for the structure of future meetings and how to ensure the continued maintenance of the plan, including quarterly meetings and regular updates to the plan.

Mr. Stroud then took questions on the information discussed and the next steps in the project. The meeting was brought to a close at 3:00 p.m.

Orange County Floodplain Management Plan Committee Meeting - December 18, 2017



Name	Department/Agency	E-mail	Phone Number
DAVID STRAUD	Ame... for Water	david.straud@ocfl.net	919-325-6497
Daniel Negron	Public Works	daniel.negron@ocfl.net	407-836-7743
LUIS MARTINEZ	PUBLIC WORKS	LUIS.MARTINEZ@OCFL.NET	407-836-7783
GREG GOLGOWSKI	PLANNING	gregory.golgowski@ocfl.net	407-836-5224
Michelle Cechowski	ECFRPC	michelle@ecfrpc.org	407-245-0300
Eric Alberts	Orlando Health, Inc.	Eric.Alberts@orlandohealth.com	407-304-6223
Jason Taylor	OC Emergency Mgmt	jason.taylor@ocfl.net	407-836-9805

APPENDIX A: PLANNING PROCESS

A.2 Planning Step 2: Involve the Public

Table A.2 – Public Meeting Dates

Meeting Type	Meeting Topic	Meeting Date	Meeting Locations
Public Meeting #1	1) Introduction to DMA, CRS and the planning process	10/24/2016 6:00 – 8:00 p.m.	Orange County Public Works Administration Bldg., Main Conference Room
	2) Introduction to hazard identification		
Public Meeting #2	1) Review complete “Draft” Floodplain Management Plan	12/18/2017 6:15 – 8:15 p.m.	Hunters Creek Middle School Cafeteria 13400 Town Loop Blvd, Orlando, FL 32837
	2) Solicit comments and feedback from the public		

Public Meeting Agendas, Meeting Minutes, and Sign-in Sheets

Meeting 1: October 24, 2016



**Orange County Floodplain Management Plan
Public Meeting Agenda
Kick-Off Meeting, October 24, 2016**

1. Trends in Disasters; Why Plan?
2. Disaster Mitigation Act (DMA) Planning Requirements
3. Community Rating System (CRS) Program
 - a. Basics of the CRS Program
 - b. NFIP Flood Insurance Discounts; Policy Base
 - c. Benefits of the CRS Program
4. CRS Program Activities
 - a. Activity 510 Floodplain Management Planning (FMP) Process
 - i. 10-Step Planning Process
 - b. Activity 330 Program for Public Information (PPI)
 - i. 7-Step Planning Process
5. Questions



**Orange County Floodplain Management Plan
Public Meeting Minutes
Kick-Off Meeting, October 24, 2016**

The Orange County Public Works Departments held a public Kick Off meeting in the main conference room of the Orange County Public Works Administration Building, starting at 6:00 p.m.

David Stroud, a consultant with Amec Foster Wheeler, opened the meeting by providing the meeting agenda which included: trends in disasters, Disaster Mitigation Act (DMA) planning requirements, basics and benefits of the Community Rating System (CRS) Program, an overview of Activity 510 Floodplain Management Planning (FMP) process, and an overview of Activity 330 Program for Public Information (PPI) process.

Mr. Stroud then provided a PowerPoint presentation which discussed recent trends in disasters which reflect a continual increase in expenses and more disaster declarations. Mr. Stroud also discussed the four phases of DMA along with the ten planning steps of the CRS program. It was demonstrated that each of the 10 CRS planning steps fit within the four phases of DMA to create a seamless planning process. An overview of the CRS Program was also provided including the expected insurance savings benefits to Orange County.

The presentation went on to discuss the 10 CRS planning steps including how the FMPC would function throughout the planning process, what the responsibilities of the FMPC would, a plan for public involvement, the various flood hazards that should likely be profiled in the FMP and how goals and projects would be developed for the plan.

The second part of the presentation covered the PPI. Mr. Stroud explained that the objective of the PPI is to develop an overall outreach program in the County that best meets the needs and objectives of the community by leveraging both public and private resources where messages can be relayed to the public in the most effective manner. Mr. Stroud went on to describe the planning process for developing the PPI.

Before closing the meeting, the FMPC agreed upon the hazards to be addressed in the FMP. The following hazards were identified: Stream Bank Erosion, Dam/Levee Failure, Flood (100-/500-year), Localized Stormwater Flooding, Hurricanes and Tropical Storms, and Repetitive Flooding.

Mr. Stroud and several members of the FMPC remained available to receive feedback and answer questions about the project and the planning process. The meeting ended at 8 p.m.



Orange County Floodplain Management Plan Public Meeting - October 24, 2016

Name	Department/Agency	E-mail	Phone Number
DAVID STROUD	Amet Foster withdrawal	david.stroud@amefc.com	919-325-6497
M. KRISHNANURTHY	HYDRO MODELING SW	Krishna@hydromodeling.com	407-292-3666
Daniel Negroa	Orange County	daniel.negroa@ocfl.net	407 836 7743
Ramel Seepaul	Orange County	ramel.seepaul@ocfl.com	407-836-7983

Public Meeting #1 Advertisement in Orlando Sentinel

Honda Lion Club will be signing up new members and children ages 12 or younger will receive a free coin. 10 a.m.-4 p.m. Nov. 6, Venue on the Lake: The Maitland Civic Center, 641 S. Maitland Ave., Maitland, admission is free, 407-730-3765.

Fundraiser

Turkey Trot 5K: Seniors First's 25th annual Turkey Trot 5K run/power walk is open to runners of all ages and levels. There will be a costume contest and kids' fun run at 9:15 a.m. Proceeds will benefit Seniors First. 7

benefit the Second Harvest Food Bank of Central Florida's Culinary Training Program. 6-9 p.m. Wednesday, Second Harvest Food Bank of Central Florida, 411 Mercy Drive, Orlando, \$125 per person, 407-514-1070.

5K Pumpkin Run: The seventh annual family-friendly fun run is organized by St. Margaret Mary Catholic Church and St. Stephen Catholic Community to benefit their Haiti Mission projects. 7:30 a.m. Nov. 12, Mead Botanical Garden, 1500 S. Denning Drive, Winter Park, \$20-\$35 depending on age and date.

Jingle Bell Run/Walk for Arthritis: Walkers and runners are invited to wear their most festive apparel, everything from bells on shoelaces to full holiday costumes. Proceeds will benefit the Arthritis Foundation. 8 a.m. Dec. 10, Baldwin Park, New Broad Street, Orlando, \$10-\$45 depending on age and date of registration, 813-559-2088.


Annual Orlando Marathon, Half Marathon

Orange County Hosting Flood Hazard Meeting

Orange County residents can attend a public meeting at the Orange County Public Works Department, 4200 South John Young Parkway, first floor (main conference room) October 24 at 6 p.m. to learn more about the risks of their property to flooding and what can be done to limit potential damage.

Orange County is a participant in FEMA's Community Rating System (CRS) Program which reduces the cost of flood insurance to policy holders. The County is in the process of developing a floodplain management plan, repetitive-loss area analysis and program for public information as part of the CRS Program to help further reduce the cost of flood insurance.

Public Meeting #1 Advertisement on Orange County Website



ORANGE COUNTY
GOVERNMENT
FLORIDA

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[County Calendar](#)

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Meeting Minutes (Non BCC)

OC Serves Volunteer Events

County Commissioners [+]

Board of Zoning Adjustment

Code Enforcement Board

Convention Center Events

Development Review Committee

Planning & Zoning Commission

OC Public Works Flood Hazard Meeting

6:00 PM Monday, 10/24/2016, 6:00 PM - 8:00 PM

Contact: Daniel Negron, P.E., CFM
(407) 836-7743

Location: Orange County Public Works Administration Building,
First Floor, Main conference room,
4200 S John Young Parkway, Orlando FL

Category: Community Meeting

Districts: 1,2,3,4,5,6

This meeting is part of FEMA's Community Rating System (CRS) process for developing a floodplain management plan, repetitive loss area analysis, and program for public information. It also aims to involve residence and answer questions about the risks of their property to flooding and what can be done to limit potential damage.

Additional Information:

- Flood Hazard Meeting

Remind Me of This Event
 Download to Calendar
 E-mail a Friend
 Print

Want to know what's on at your Orange County Parks & Recreation center? Then this link is for you...Just for Fun!

<http://www.ocfla.gov/Home/CountyCalendar.aspx?m=dlrve&id=759343> [10/19/2016 3:07:33 PM]

Orange County, Florida
Floodplain Management Plan
December 2017

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Public Meeting #1 Announcement in Wedgefield Homeowners Assoc. Website



The screenshot shows the homepage of the Wedgefield Homeowners Association website. At the top center is the association's logo, which features a bird perched on a branch within a circular frame of radiating lines. Below the logo, the text "WEDGEFIELD HOMEOWNERS ASSOCIATION" is displayed. A horizontal navigation menu follows, with items: HOME, ABOUT, WATER INFO, CALENDAR, FALL FESTIVAL, LINKS, CODES & COVENANTS, ADS, and NEWS. Below the navigation is a dark banner with the text "WELCOME TO WEDGEFIELD - A Deed Restricted Community". The main content area has a heading "ORANGE COUNTY HOSTING FLOOD HAZARD MEETING" and a sub-heading "webmaster | December 2017". To the left is the Orange County Government logo. The text to the right of the logo reads: "Orange County residents can attend a public meeting at the Orange County Public Works Department, 4200 South John Young Parkway, first floor (main conference room) October 24 at 6 p.m. to learn more about the risks of their property to flooding and what can be done to limit potential damage." Below this, it states: "Orange County is a participant in FEMA's Community Rating System (CRS) Program which reduces the cost of flood insurance to policy holders. The County is in the process of developing a floodplain management plan, repetitive-loss area analysis and program for public information as part of the CRS Program to help further reduce the cost of flood insurance."

Public Meeting #2 Advertisement on Orange County Website

The screenshot shows the Orange County Government website interface. At the top, there are navigation links for Site Map, A To Z Index, Español, Payment Center, OC Anywhere, and social media icons. A search bar and a 'Browse Services' button are also present. Below the navigation is a menu with buttons for Residents, Visitors, Businesses, Employees, and About Us. The main content area features a 'County Calendar' section with a calendar for December 2017, a search interface for meetings, and a detailed advertisement for the 'OC Floodplain Management Plan' on Monday, 12/18/2017, from 6:15 PM to 8:15 PM. The advertisement includes contact information for Daniel Negron, PE., CFM, and a description of the floodplain management plan. A sidebar on the left contains 'Resources' and 'Favorites' sections.

ORANGE COUNTY GOVERNMENT FLORIDA

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Dec 2017 Go

County Calendar

I'm looking for:

Select meeting category

All Meetings in chosen category

Today Go

Use keywords to search for the next 30 days of meetings and events of interest: Search

[<< Return to list](#)

OC Floodplain Management Plan

6:15 PM **Monday, 12/18/2017, 6:15 PM - 8:15 PM**

Contact: Daniel Negron, PE., CFM (407) 836-7743

Location: Hunters Creek Middle School Cafeteria
13400 Town Loop Blvd, Orlando, FL 32837

Category: Community Meeting

Districts: 1,2,3,4,5,6

Over the past 10 months, a committee of Orange County staff and outside citizen stakeholders have developed a floodplain management plan that identified the flood-related hazards, prepared a vulnerability assessment of their impact on people, buildings, and infrastructure and developed mitigation strategies to reduce damage for the different types of flooding within unincorporated Orange County.

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Resources

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Favorites

OC Serves Volunteer Events
County Commissioners [+]
Board of Zoning Adjustment
Code Enforcement Board
Convention Center Events

Public Meeting #2 Advertisement in the Orlando Sentinel – Friday, December 15

Friday, December 15, 2017 Orlando Sentinel | A33

OPINION

State Viewpoint

Body cameras protect the public — and law officers

I relate to police officers' resistance to wearing body cameras. Being a law enforcement officer is an emotionally difficult, dangerous and mostly thankless job. Changes to our regular procedure could put us — and the community — at incredible risk. But I support the use of body-worn cameras by police officers because, when used properly, the devices protect both those of us in uniform and those with whom we interact on a daily basis.

While sheriff of Flagler County, I wasted my officers to be on the cutting edge of police practices and technology. In 2012, I heard the Daytona Police Department had begun to use body cameras with positive results. Under my leadership, our department was one of the first sheriff's offices in Florida to begin using body cameras.

There was an adjustment period, of course, but we ultimately benefited. We were able to obtain evidence we could use against dangerous criminals and gain insight into how civilians and officers interact with each other every day. Though I understand why officers are concerned cameras could make their jobs more difficult, my own experience has shown me otherwise. This is backed up by preliminary research that shows body cameras reduce complaints against officers, saving hours of paperwork and administrative hassle.

For instance, body cameras documented officers for an incident that occurred in Daytona Beach in which a SWAT team entered an apartment where a former NFL player was holding a knife to his girlfriend's throat. The body camera footage



My Word: James Marvix is a former assistant district attorney of Suffolk County, New York, and served two terms as the elected sheriff of Flagler County. He's now a speaker for the Law Enforcement Action Partnership.

showed the officers shouting at the assailant to drop the knife. Instead, he began to plunge the knife into his girlfriend's throat. The officers shot but did not kill the suspect. The body camera video was quickly released — and they avoided what could have been a confusing and sensationalist media story.

While I was sheriff, I received a phone call from a well-respected man in my community who was upset with how some of my deputies had treated him during a traffic stop. Within 10 minutes, I could review a recording of the stop. It was clear that the two deputies had properly stopped the vehicle, and had acted with great restraint as the driver repeatedly threatened and yelled at them. The deputies with their calm demeanor explained the reason for the stop. They did not issue a ticket, but merely explained that the corner where the man had illegally turned was close to a school crossing, and the cars posed a threat to children.

I asked the complaining driver to review the video with me. Afterward, the gentleman was apologetic after realizing he was the person who had been disrespectful — not the deputies. He was retired from law enforcement and became an advocate for body cameras, too, after this incident.

Of course, body cameras, like all equipment available to police, must be used appropriately to maximize everyone's safety and ensure privacy rights are respected. But with proper oversight and regulation, body cameras can be an indispensable crime-fighting tool that can and should be used by all police departments.

Letters To The Editor

Comparing Nixon, Trump

Tom Hanks and Meryl Streep, who are arguably two of our finest actors, are appearing in a new movie called *The Post*. It's a drama vs. experience for older Americans and a cautionary tale for younger citizens. The story takes place 46 years ago when *The New York Times* and the *Washington Post* were at war with another president over publication of the Pentagon Papers.

Richard Nixon tried to prevent their publication, but in a six-to-three vote, the Supreme Court ruled in favor of the press and set a landmark decision regarding press freedom.

Now we have a new and much more dangerous president attacking the First Amendment. He does have a Supreme Court stacked in his favor, social media loaded with false information, zero fact-checking and glibble followers.

He has control of both houses of Congress with a spurious GOP leadership. Our two superpowers from 1971 — the *Times* and the *Post* — are still on the job, but they face a much more potent enemy this time. I suspect even comic-book legend Iron Man is worried.

James Dowdby Orlando

SEND US A LETTER

IDEAL LETTERS TO THE EDITOR ARE BREVY AND TO THE POINT. LETTERS MAY BE EDITED FOR CLARITY, ACCURACY OR LENGTH. SUBMITTERS ASSUME THE WRITER'S NAME, ADDRESS AND PHONE NUMBER.

Mail: 633 N Orange Ave., Orlando, FL 32801
Email: letters@orlandosentinel.com
Online: OrlandoSentinel.com/letters

action projects help to mitigate flooding. As the weather cools and rain subsides, we are reminded of the need to conserve water.

With public water supply the largest category of water use, and irrigation accounting for a large part of residential water use, year-round watering restrictions help ensure efficient use of water. Current watering restrictions specify that watering should only occur one day a week before 10 a.m. or after 4 p.m.

This year, during the cooler months of December through February, the district is asking everyone to skip every other week of watering their lawns. If everyone in our 18-county region participated this season, it could save more than 1 billion gallons of water across north and east-central Florida.

Ann B. Shortt is executive director, St. Johns River Water Management District.

Be fair to the accused

In today's political climate, allegations of sexual abuse are being thrown out like candy at a Halloween "trick or treat." In many cases, there have been no charges or convictions yet the people at the center of the allegations have lost their jobs and reputations and their families' names are forever smeared. This is regardless of whether they committed the crimes, the world doesn't care.

Our justice system is supposed to be based on the principle of "innocent until proven guilty," but with the Internet and social media being so far reaching in a matter of seconds, a person's name and reputation can be quickly destroyed.

Many use the excuse that victims simply do not lie about abuse, and those who have been falsely accused can refute these claims. The pendulum has swung too far in the opposite direction from not believing victims to believing them instantaneously and completely without proof.

It is no way advocating sex crimes, but I am advocating for the rights of the accused. We carry on about the rights of victims, but the accused have a right to a fair trial instead of the kangaroo court correctly taking place. Have we completely lost not only our humanity but our grip on what is right and fair?

Ann Stewart Lady Lake

Don't patronize Lewinsky

With "friends" like My Word columnist Scheiff ("Mistress Lewinsky — a person, not a scandal," Orlando Sentinel, Dec. 5), Lewinsky doesn't need enemies. To refer to her as a "victim" of President Bill Clinton in the 1998 scandal is a patronizing and demeaning view of a woman who, at the age of 22, was perfectly mature enough to make her own decisions about her own actions, for which she no more deserves to be patronized than judged.



Gerry Husband, author of the letter.

Gerry Husband, Maitland

Help save a billion

When it comes to water, the past 12 months demonstrated that although Florida generally receives ample rainfall, it tends to arrive in large gulps. Effects from this spring's drought conditions followed by Hurricane Irma's state-wide saturation have shown that, as stewards of Florida's water, we all must maintain an emphasis on both water conservation and water storage, even when the landscape seems saturated with water.

In the face of drought and abandonment, the St. Johns River Water Management District works to strike a balance between the needs of people and the needs of the environment. During the rainy season, our local and regional flood pro-

COOL CARS

LOOK EVERY SATURDAY IN THE DRIVE SECTION FOR NEW VEHICLES!

Orlando Sentinel



It's a 1953 all over again, and my MGTD roadster convertible is in excellent condition, with a ground-up restoration, seat belts, epoxy painted, always garage kept and a true car show winner many times over! For the particular, it's showing on 14 hours in their Classic Cars section.

1965 Ford Mustang Convertible Shelby GT350 clone. Owned since 1970 by Vance Jachim. Modified to include 307

Orange County Hosting Flood Hazard Meeting

Orange County residents are invited to attend a public meeting at Hunters Creek Middle School Cafeteria, 13400 Town Loop Blvd. December 18th at 6:15pm to learn more about the risks of flooding and mitigation strategies.

Over the past 10 months, a committee of Orange County staff and outside citizen stakeholders have developed a floodplain management plan that identified the flood-related hazards, prepared a vulnerability assessment of their impact on people, buildings, and infrastructure and developed mitigation strategies to reduce damage for the different types of flooding within unincorporated Orange County.

Hurricane Expo



Orange County, Florida
Floodplain Management Plan
December 2017

Public Survey

Orange County distributed a public survey that requested public input into the floodplain management planning process and the identification of mitigation activities that could lessen the risk and impact of future flood hazard events. The survey was provided on Orange County’s website as well as distributed to attendees of the Hurricane Expo.



Orange County received only 2 completed surveys. Below is a summary of the responses.

APPENDIX A: PLANNING PROCESS

Q1. Where do you live?

Answer Choices	Percentage	Number Responding
Unincorporated Orange County	-	0
Other	-	2
Total	-	2

If other: City of Orlando

Q2: Have you ever experienced or been impacted by high water or flooding in Orange County?

Answer Choices	Percentage	Number Responding
Yes	-	0
No	-	2
Total	-	2

If yes, explain: "I've been told there was flooding issues at my small townhome community in the past"

Q3: How concerned are you about the possibility of your community being impacted by flooding?

Answer Choices	Percentage	Number Responding
Extremely concerned	-	1
Somewhat concerned	-	1
Not concerned	-	0
Total	-	2

Q4: Is your home located in a Federal Emergency Management Agency (FEMA) floodplain?

Answer Choices	Percentage	Number Responding
Yes	-	0
No	-	0
I don't know	-	2
Total	-	2

Q5a: Do you have flood insurance for your home/personal property?

Answer Choices	Percentage	Number Responding
Yes	-	0
No	-	2
I don't know	-	0
Total	-	2

Q5b: If "No," why not?

Answer Choices	Percentage	Number Responding
My home is not located in a floodplain	-	0
I rent	-	0
It's too expensive	-	0
I never really considered it	-	1
I don't need it because my home is elevated or otherwise protected	-	0
I don't need it because it never floods	-	0
Other	-	1
Total	-	2

If other: "When I got insurance I wasn't aware of any threats of flooding; no flooding during 2004 Hurricane season"

APPENDIX A: PLANNING PROCESS

Q6: Have you taken any actions to protect your home from flood damage?

Answer Choices	Percentage	Number Responding
Yes	-	0
No	-	2
Total	-	2

If yes, explain:

Q7: Do you know what government agency/office to contact regarding the risks associated with flooding?

Answer Choices	Percentage	Number Responding
Yes	-	1
No	-	1
Total	-	2

Q8: What is the most effective way for you to receive information about how to make your home or neighborhood more resistant to flood damage?

Answer Choices	Percentage	Number Responding
Newspaper	-	0
Television advertising or programs	-	0
Radio advertising or programs	-	0
Public workshops/meetings	-	0
School meetings	-	0
Mail	-	2
Email	-	0
Orange County website	-	0
Social media	-	0
Total	-	2

*Note: Respondents were able to choose more than one answer choice

Q9: What are some steps your local government could take to reduce the risk of flooding in your neighborhood?

- ▶ “Become more aware when approving new development how it may change runoff flow from other properties as well as rising surface waters; consider alternative green infrastructure for handling stormwater”

APPENDIX A: PLANNING PROCESS

Orange County posted the Draft Risk and Vulnerability Assessment for public review and comment on its website.

The screenshot shows the Orange County Government website. At the top, there is a navigation bar with links for Site Map, A To Z Index, Español, Payment Center, OC Anywhere, and social media icons. Below this is a search bar and a 'Browse Services' button. The main navigation menu includes links for Residents, Visitors, Businesses, Employees, and About Us. The page is titled 'Flood Awareness' with the tagline 'Stay safe, be prepared'. A call to action box asks visitors to help Orange County become less vulnerable to flooding by commenting on the Floodplain Management Plan. The main content area is divided into three sections: National Flood Insurance Program, Lake Monitoring and Lake Fact Sheets, and a section for the Floodplain Management Plan. The National Flood Insurance Program section describes the program and mentions that Orange County has earned a class 5 rating, resulting in a 25% discount on their premium. The Lake Monitoring and Lake Fact Sheets section provides information on the data included in the sheets, such as official lake names, drainage basins, base flood elevations, normal high water elevations, and control structures. A sidebar on the left lists various resources and links, including the Flood Management Plan Questionnaire, FEMA, Water Atlas, Floodsmart, FEMA Community Rating System, U.S. Geological Survey, Flood Protection Tips, Monthly Monitored Lakes, Orange County Rainfall Stations Map, 2014 Stormwater Management Annual Report, and Stormwater Library List.

Orange County posted the Hazard Identification and Risk Assessment Section of the plan on its website for review by the public. (Note: the link name was not correct.)

APPENDIX A: PLANNING PROCESS

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Like 0

AT A GLANCE

- Flood Management Plan - Draft (12-17-2017)**
- FEMA
- Water Atlas
- Floodsmart
- FEMA Community Rating System
- U.S. Geological Survey

RESOURCES

Flood Awareness
Stay safe, be prepared

Headlines « » **Please help Orange County become less vulnerable to flooding by commenting on the Floodplain Management Plan.**

NATIONAL FLOOD INSURANCE PROGRAM

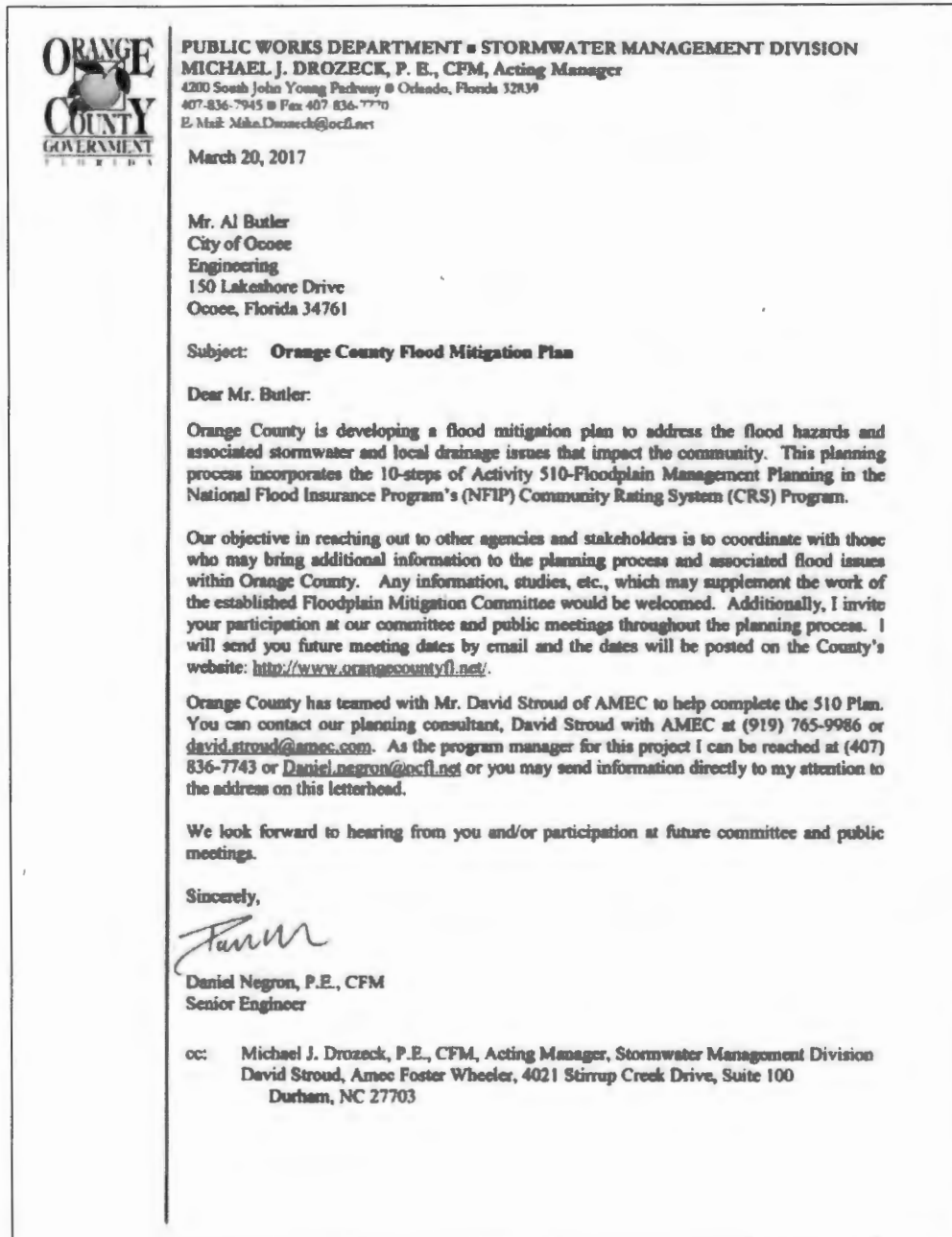
The NFIP is a Federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding.

Orange County posted the entire Draft Floodplain Management Plan on its website for public review and comment.

APPENDIX A: PLANNING PROCESS

A.3 Planning Step 3: Coordinate

This planning step credits the incorporation of other plans and other agencies' efforts into the development of the floodplain management plan. Other agencies and organizations must be contacted to determine if they have studies, plans and information pertinent to the floodplain management plan, to determine if their programs or initiatives may affect the community's program, and to see if they could support the community's efforts. An example invitation letter is shown below. A copy of all invitation letters can be provided upon request. A coordination letter distribution list is included in Table A.3 on the following page.



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Table A.3 – FMPC Invitation List

	<i>First Name</i>	<i>Last Name</i>	<i>Organization</i>	<i>Address 1</i>	<i>Address 2</i>
ORANGE COUNTY, FL FLOODPLAIN MANAGEMENT PLAN LIST OF STAKEHOLDERS					
<i>Educational Institutions</i>					
1	Hayley	Markman	University of Central Florida	PO Box 163500	Orlando, FL 32816
2	Kate	Hardie	Orange County Public Schools	445 W Amelia St	Orlando, FL 32801
3	Ken	Olsen	Valencia College	1800 S. Kirkman Rd	Orlando, FL 32811
4	Scott	Rayburn	Rollins College	1000 Holt Ave.	Winter Park, FL 32792
<i>Surrounding Municipalities</i>					
5	Allison	McGillis	City of Winter Park Planning & Community Development	401 South Park Avenue	Winter Park, FL 32789
6	Al	Butler	City of Ocoee Engineering	150 Lakeshore Dr.	Ocoee, FL 34761
7	Yolanda	Quiceno	City of Belle Isle City Clerk	1600 Nela Ave.	Belle Isle, FL 32809
8	Manny	Soto	City of Orlando Emergency Manager	PO Box 2846	Orlando, FL 32803
9	Steve	Pash	City of Winter Garden Community Development Director	300 West Plant St	Winter Garden, FL 34787
10	Robert	Smith	Town of Windermere Town Manager	614 Main Street	Windermere, FL 34786
11	Mike	Parker	Town of Oakland Public Works Director	230 North Tubb Street	Oakland, FL 34760
12	Robert	Mitchell	Reedy Creek Improvement District	P.O. Box 10170	Lake Buena Vista, FL 32830
13	Richard	Wells	City of Maitland, Community Development Directory	1776 Independence Lane	Maitland, FL 32751
14	Bea	Meeks	City of Edgewood City Clerk	405 Larue Ave.	Edgewood, FL 32809
15	David	Moon	City of Apopka Planning Manager	120 E. Main Street	Apopka, FL 32703
16	Damaris	Persaud	Town of Eatonville	307 East Kennedy Blvd.	Eatonville, FL 32751
17	Dawn	Mullins	Rainger Drainage District	19950 Nugent St.	Orlando, FL 32833
<i>Federal Government</i>					

APPENDIX A: PLANNING PROCESS

	<i>First Name</i>	<i>Last Name</i>	<i>Organization</i>	<i>Address 1</i>	<i>Address 2</i>
18	Susan	Wilson	Floodplain Management and Insurance Branch Chief - FEMA Region IV	3303 Chamblee Tucker Road	Atlanta, GA 30341
19	Janice	Mitchell	CRS Coordinator - FEMA Region IV	3303 Chamblee Tucker Road	Atlanta, GA 30341
20	Heidi	Liles	ISO/CRS Specialist	284 W. Sabal Palm Place	Longwood, FL 32779
21	Sherry	Harper	ISO/CRS Specialist	2382 Susan Drive	Crestview, FL 32536
22	Jason	Hunter	NFIP - FEMA Region IV	3303 Chamblee Tucker Road	Atlanta, GA 30341
State Government					
23	Carly	Swartz	Florida Division of Emergency Management	2555 Shumard Oak Boulevard	Tallahassee, Florida 32399-2100
24	Shannon	Wright	Florida Fish and Wildlife Conservation Commission, Northeast Region	1239 SW 10th Street	Ocala, FL 34471
25	Sean	Gallagher	Florida Forest Service	8431 S. Orange Blossom Trail	Orlando, FL 32809
Business Community & Non-Profits Organizations					
26	Gail	Wilds	Wedgfield Homeowners Association	PO Box 623	Christmas, FL 32709
27	Jason	McCright	Vista Lakes Community Development District	5845 Manchester Bridge Drive	Orlando, FL 32829
28	Keila	Walker	Greater Orlando Aviation Authority	One Airport Blvd.	Orlando, FL 32827
29	Rodney	Kapel	Universal Orlando	1000 Universal Studios Plaza	Orlando, FL 32819
30	Anthony	Washington	MetroPlan Orlando	315 E. Robinson St., Ste 355	Orlando, FL 32801
31	Lucas	McCurdy	Coastal Reconstruction	3660 Howell Branch Ct.	Winter Park, FL 32792
32	Andy	Canion	St. Johns River Water Management District	P.O. Box 1429	Palatka, FL 32178-1429
33	William	Graf	South Florida Water Management District	1707 Orlando Central Parkway, Suite 200	Orlando, FL 32809
34	Wes	Johnson	Orange County Neighborhood Preservation & Revitalization	450 E South St.	Orlando, FL 32801

Appendix B. MITIGATION STRATEGY

44 CFR Subsection D §201.6(c)(3)(ii): [The mitigation strategy section shall include] a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

As part of the process of developing the mitigation action plan found in Section 7.4, the FMPC reviewed and considered a comprehensive range of mitigation options before selecting the 23 actions identified for implementation. This section summarizes the full range of mitigation measures evaluated and considered by the FMPC, including a review of the categories of mitigation measures outlined in the 2017 CRS Coordinator's Manual, a discussion of current local implementation and CRS credits earned for those measures, and a list of the specific mitigation projects considered and recommended for implementation.

Mitigation alternatives considered for implementation by the Orange County FMPC were evaluated and prioritized using the criteria discussed in Section 7.3.1 Prioritization Process.

B.1 Categories of Mitigation Measures Considered

Once it was determined which flood hazards warranted the development of specific mitigation actions, the FMPC analyzed viable mitigation options that supported the identified goals and objectives. The FMPC was provided with the following list of mitigation categories which are utilized as part of the CRS planning process.

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

B.2 Alternative Mitigation Measures per Category

Note: the CRS Credit Sections are based on the 2017 CRS Coordinator's Manual.

B.2.1 Prevention & Regulatory Measures

Prevention measures are designed to keep a problem - such as flooding - from occurring or from getting worse. The objective of preventive measures is to ensure that future development is not exposed to damage and does not cause an increase in damages to other properties. Building, zoning, planning and code enforcement offices usually administer preventive measures. Some examples of types of preventive measures include:

- Comprehensive or land use plan
- Building codes
- Zoning ordinance
- Floodplain management regulations
- Subdivision ordinance
- Stormwater management regulations
- Open space preservation

Comprehensive or Land Use Plan

A Comprehensive Plan, in broad terms, is a policy statement to guide the future placement and development of community facilities. It is the basis for a community's zoning, subdivision and design regulations and a community's official maps and amendments to the zoning, subdivision and design ordinances. The future land use element of the plan represents the community's vision for its development and redevelopment during the subject planning period. The future land use maps serve as the foundation for subsequent development of more detailed Land Development Regulations and special area plans. These regulations and plans must be consistent with and further the implementation of the future land use element of the Comprehensive Growth Management Plan and its goals, objectives and policies.

Local Implementation

Florida's Growth Management Act requires the state's counties and municipalities to adopt Comprehensive Plans that guide future growth and development. The Orange County Growth Management Plan was most recently amended in 2016. The goals and objectives from this Plan are summarized in Section 6.

Capital Improvement Plan

Another means of planning is to prepare a capital improvement plan, which forecasts needed capital improvements and identifies funding. Florida's Community Planning Act of 2011 requires local governments to review the Capital Improvement Element of the comprehensive plan on an annual basis and to update the 5-year capital improvement schedule. The Orange County Comprehensive Plan contains a Capital Improvements element that lays out objectives and criteria for developing the capital improvements plan. Orange County's Capital Improvements Program is generated and maintained by County department/division and is updated annually. The Capital Improvement Plan is essential for funding and implementing structural mitigation projects.

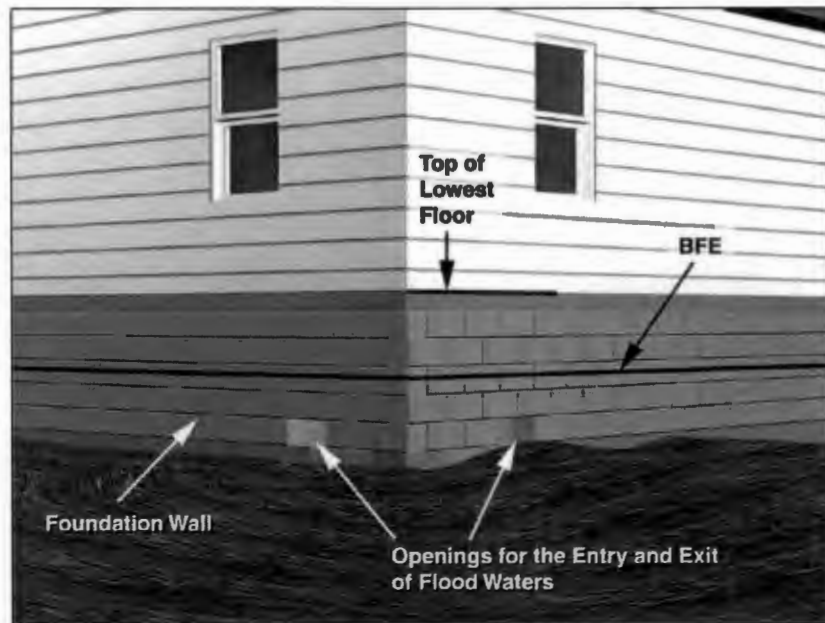
Reducing Future Flood Losses

Zoning and comprehensive planning should work together to reduce future flood losses by directing development away from hazard prone areas as well as funding mitigation projects.

Building Codes

Building codes provide one of the best methods of addressing natural hazards. When properly designed and constructed according to code, the average building can withstand many of the impacts of natural hazards. Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Building codes can ensure that the first floors of new buildings are constructed to be higher than the elevation of the 100-year flood (the flood that is expected to have a one percent chance of occurring in any given year). This is shown in Figure B.1.

Just as important as having code standards is the enforcement of the code. Adequate inspections are needed during construction to ensure that the builder understands the requirements and is following them. Making sure a structure is properly elevated and anchored requires site inspections at each step.



Source: FEMA Publication: *Above the Flood: Elevating Your Floodprone House, 2000*

Figure B.1 – Building Codes and Flood Elevations

Local Implementation

Starting with the 2010 edition, the Florida Building Code (FBC) includes flood provisions that are consistent with the NFIP requirements for buildings and structures. All counties, cities and towns are required to enforce the FBC. The code includes some added height for buildings through reference to ASCE 24.

Communities in the NFIP Community Rating System are required to use the NFIP Elevation Certificate. Orange County maintains NFIP Elevation Certificates and conducts annual audits for the CRS program.

Reducing Future Flood Losses

Future flood losses will be reduced through the implementation and enforcement of the 2014 Florida Building Code. The 2014 FBC refers to local floodplain management ordinances for adoption of flood hazard maps and gives communities the opportunity to adopt higher standards.

CRS Credit

The CRS encourages strong building codes. It provides credit in two ways: points are awarded based on the community's Building Code Effectiveness Grading Schedule (BCEGS) classification and points are awarded for adopting the International Code series. Orange County has a BCEGS rating of 4 for residential and 4 for commercial. The County has adopted the *2014 Florida Building Code* which is based on national model building codes and national consensus standards and amended where necessary for Florida's specific needs. The Florida Building Code is updated every three years.

Zoning Ordinance

Planning and zoning activities direct development away from hazardous areas, particularly floodplains and wetlands. They do this by designating land uses that are compatible with the natural conditions of land that is prone to flooding, such as open space or recreation. Planning and zoning activities can also provide benefits by simply allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach.

Local Implementation

The Land Development Code (LDC) is the principal regulatory tool for implementing a community's Growth Management Plan. The State of Florida requires all counties, cities and towns to create and abide

APPENDIX B: MITIGATION STRATEGY

by the Land Development Code. The LDC contains land use and zoning standards, site design standards, and environmental regulations that development must meet in the community. Criteria are provided to ensure that all growth meets the objectives of the Growth Management Plan. Orange County enforces a Land Development Code.

Reducing Future Flood Losses

Zoning and comprehensive planning should work together to reduce future flood losses by directing development away from hazard prone areas as well as funding mitigation projects through capital improvement planning.

CRS Credit

CRS credits are available for regulations that encourage developers to preserve floodplains or other hazardous areas away from development. There is no credit for adopting a zoning ordinance, but the zoning ordinance can enable these other CRS-credited activities such as open space preservation and higher regulatory standards.

Floodplain Management Regulations

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities that participate in the NFIP agree to regulate new construction in the area subject to inundation by the 100-year (base) flood. The floodplain subject to these requirements is shown as an A or V Zone on the Flood Insurance Rate Map (FIRM).

There are five major floodplain regulatory requirements. Additional floodplain regulatory requirements may be set by state and local laws.

- 1) All development in the 100-year floodplain must have a permit from the community. The NFIP regulations define "development" as any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.
- 2) Development along a river or other channel cannot obstruct flows so as to cause an increase in flooding on other properties. An analysis must be conducted to demonstrate that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.
- 3) New buildings may be built in the floodplain, but they must be protected from damage from the base flood. In riverine floodplains, the lowest floor of residential buildings must be elevated to be at or above the base flood elevation (BFE). Nonresidential buildings must be either elevated or floodproofed.
- 4) Under the NFIP, a "substantially improved" building is treated as a new building. The NFIP regulations define "substantial improvement" as any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the start of construction of the improvement. This requirement also applies to buildings that are substantially damaged.
- 5) Communities are encouraged to adopt local ordinances that are more comprehensive or provide more protection than the federal criteria. The NFIP's Community Rating System provides insurance premium credits to recognize the additional flood protection benefit of higher regulatory standards.

Local Implementation

Orange County updated its floodplain management ordinance after a new Flood Insurance Rate Map (FIRM) became effective in 2009. The effective map is based on updated hydrological, hydraulic, and topographical methods and data and identifies risk from riverine and lacustrine flooding sources.

Orange County Flood Damage Prevention Ordinance

Orange County's current Floodplain Management Ordinance, adopted in 2009, reduces flood losses by:

- Restricting or prohibiting uses which are dangerous to health, safety and property due to water or erosion hazards, which result in damaging increases in erosion or in flood heights and velocities;
- Requiring that uses vulnerable to floods including facilities which serve such uses be protected against flood damage throughout their intended life span;
- Controlling the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters;
- Controlling filling, grading, dredging and other development which may increase erosion or flood damage; and
- Preventing or regulating the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

The ordinance requires the following in Special Flood Hazard Areas where base-flood elevation data have been provided:

- **Residential Construction.** New construction and substantial improvement of any residential structure (including manufactured home) shall have the lowest floor, including basement, **elevated no lower than one foot above the BFE.** Should solid foundation perimeter walls be used to elevate a structure, there must be a minimum of two openings on different sides of each enclosed area sufficient to facilitate automatic equalization of flood hydrostatic forces in accordance with the ordinance.
- **Non-Residential Construction.** New construction and substantial improvement of any commercial, industrial, or nonresidential structure (including manufactured home) shall have the lowest floor, including basement, **elevated to no lower than one foot above the BFE.** Structures located in A-Zones may be floodproofed, in lieu of being elevated, provided that all areas of the structure/building components, together with attendant utilities and sanitary facilities, below the base flood elevation plus one (1) foot are watertight with walls substantially impermeable to the passage of water, and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. A Florida registered professional engineer shall certify, in accordance with section 19-69, that the standards of this subsection are satisfied using the FEMA floodproofing certificate.
- **Enclosures below the Lowest Floor.** New construction and substantial improvements that include fully enclosed areas formed by foundation and other exterior walls below the lowest floor elevation shall be designed to preclude finished living space and designed to **allow for the entry and exit of floodwaters to automatically equalize hydrostatic flood forces on exterior walls.**
 - Designs for complying with this requirement must be either certified by a Florida registered professional engineer or meet or exceed the following minimum criteria:
 - Provide a minimum of two openings on different sides of each enclosed area having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding;
 - The bottom of all openings shall be no higher than one foot above the foundation adjacent interior grade (which must be equal to or higher in elevation than the adjacent exterior grade); and

APPENDIX B: MITIGATION STRATEGY

- Openings may be equipped with screens, louvers, valves, or other coverings or devices provided they meet the required net area of the openings and permit the automatic flow of floodwaters in both directions.
- Electrical, plumbing, and other utility connections shall be placed a minimum of one foot above the base flood elevation.
- Fully enclosed areas below the lowest floor shall solely be used for parking of vehicles, storage, and building access. Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage door), limited storage of maintenance equipment used in connection with the premises (standard exterior door), or entry to the living area (stairway or elevator).
- The interior portion of such enclosed area shall not be partitioned or finished into separate rooms.
- **Critical Facilities.** Critical facilities shall be constructed on properly compacted fill and, to the extent possible, have the lowest floor (including basement) elevated at least one foot above the elevation of the 0.2 percent annual chance floodplain.
- Adequate drainage paths around structures shall be provided on slopes to guide water away from structures within areas of shallow flooding.
- Located within the areas of special flood hazard established by this chapter are areas designated as regulatory floodways. Since the regulatory floodway is an extremely hazardous area due to the high velocity of floodwaters which carry debris, potential projectiles and have significant erosion potential, the following provisions, in addition to those set forth in subsections (1) through (5) above shall apply:
 - Placement of any encroachments, including fill, new construction, substantial improvements, and other developments, including, but not limited to bridges and culverts, within the regulatory floodway shall be prohibited unless certification (with supporting technical data) by a Florida registered professional engineer is provided through hydraulic and hydrologic analysis performed in accordance with standard engineering practices which demonstrates that encroachments would not result in any increase in flood levels during occurrence of the base flood discharge;
 - Development, including new construction and substantial improvements within the regulatory floodway, that increases the water surface elevation of the base flood may be allowed, provided that the applicant first applies, with the county's endorsement evidenced by the execution of the community acknowledgement form, for a conditional FIRM revision, and receives the approval of FEMA.

Other standards in the ordinance address manufactured homes and recreational vehicles, A-zones without base flood elevations and regulatory floodways, and subdivision requirements.

CRS Credit

Orange County currently receives credit for Activity 430 – Higher Regulatory Standards. This credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, protection of floodplain storage capacity, protection of natural and beneficial functions, other higher regulatory standards, and land development criteria, and state mandated regulatory standards. Credit is also provided for a BCEGS Classification of 4/4, the adoption and implementation of the Florida Building Codes, and for staff education and certification as a floodplain manager.

Reducing Future Flood Losses

Examples of additional higher regulatory approaches and the benefits they could provide to Orange County include:

- Requiring compensatory storage preserves areas of the floodplain that can store flood water and minimizes increases in flood heights due to development

APPENDIX B: MITIGATION STRATEGY

- Requiring full compliance with floodplain management regulations when proposed improvements or repairs are less than 50% of a building's value brings more nonconforming buildings up to current flood protection standards
- Standards for protecting buildings from local drainage problems reduce flood losses and flood insurance claims, especially outside the floodplain
- Requiring new manufactured housing in existing manufactured housing parks to meet the same level of protection as is required for other new buildings reduces flood losses and flood insurance claims

Subdivision Ordinance

Subdivision ordinances are intended to encourage planned development that accounts for infrastructure needs of growth as well as the vision and goals of the comprehensive plan related to new development.

Local Implementation

Orange County has a subdivision ordinance in place that stipulates drainage and stormwater requirements for all development. Specifically, new subdivisions must provide for pollution abatement, groundwater recharge, and protection from flooding. All subdivisions must limit runoff to pre-construction conditions, and must provide a drainage map and drainage plans.

Reducing Future Flood Losses

Enforcement of the subdivision ordinance can reduce future flood losses by ensuring the adequate provision of infrastructure necessary to manage stormwater on site with each new development.

CRS Credit

CRS credits are available for regulations that encourage developers to preserve floodplains or other hazardous areas away from development. There is no credit for adopting a subdivision ordinance, but it can enable other CRS-credited activities, such as higher regulatory standards. Orange County currently receives credit for Activity 430 – Higher Regulatory Standards.

Stormwater Management Regulations

Stormwater runoff is increased when natural ground cover is replaced by urban development. Development in the watershed that drains to a river can aggravate downstream flooding, overload the community's drainage system, cause erosion, and impair water quality. There are three ways to prevent flooding problems caused by stormwater runoff:

- 1) Regulating development in the floodplain to ensure that it will be protected from flooding and that it won't divert floodwaters onto other properties;
- 2) Regulating all development to ensure that the post-development peak runoff will not be greater than it was under pre-development conditions; and
- 3) Setting construction standards so buildings are protected from shallow water.

Local Implementation

The Orange County Planning and Development Ordinance stipulates stormwater standards under its site development regulations. The standards include requirements for pollution abatement, recharge, rate of discharge limitations, and protection from flooding depending on the category a property falls into. Properties are categorized based on size and amount of impervious surface. Among its requirements, the ordinance states that the rate of discharge from a site must be limited to the pre-development conditions based on a twenty-five-year frequency storm event. Orange County also incorporates a stormwater management element in its comprehensive plan, with objectives to reduce flooding, regulate development to better manage stormwater, fix existing drainage problems, and protect natural drainage features.

Reducing Future Flood Losses

Stormwater management and the requirement that post development runoff cannot exceed pre-development conditions is a great way to prevent future flood losses. Orange County also has a stormwater utility, which enables stormwater assessments based on impervious surface area on developed properties in order to generate a dedicated funding source for stormwater management projects within the stormwater service area. This funding source for maintenance and drainage projects can reduce future flood losses.

CRS Credit

Orange County currently receives credit for Activity 450 – Stormwater Management. The community enforces regulations for stormwater management, freeboard in non-SFHA zones, soil and erosion control, and water quality.

Open Space Preservation

Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. Open space can be maintained in agricultural use or can serve as parks, greenway corridors and golf courses.

Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the part set aside in the easement.

Although there are some federal programs that can help acquire or reserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes. These are usually linear areas along property lines or channels. Maintenance easements also can be donated by streamside property owners in return for a community maintenance program.

Local Implementation

The State of Florida Local Government Comprehensive Planning and Land Development Regulation Act requires a "recreation and open space element indicating a comprehensive system of public and private sites for recreation, including but not limited to: natural reservations, parks and playgrounds, parkways, beaches and public access to beaches, open spaces and other recreational facilities."

The Orange County Comprehensive Plan contains an open space element with the goal of protecting and preserving open space resources in the County. The County's open space objectives include setting open space requirements for public and private development, maintaining the Environmentally Sensitive Lands Program to acquire and maintain open space, and protecting the Wekiva Springshed. The future land use map contains three designations to permanently establish open space, as follows:

- **Parks and Recreation Space:** refers to undeveloped or developed lands as passive and active parks;
- **Conservation:** recognizes lands designated for conserving natural resources; and
- **Preservation:** recognizes publicly or privately-owned lands of significant environmental importance for the purposes of environmental protection. Publicly owned lands shall be lands owned by federal, state, or local governments acquired for environmental protection. Privately owned lands are limited to those used for wetland mitigation banks as well as compatible very-low impact recreational or educational uses that use natural amenities of site for public benefit.

Orange County also implements the Green Park Land Acquisition and Conservation for Environmental Protection (Green PLACE) program, through which the County and its partners purchase and preserve and

APPENDIX B: MITIGATION STRATEGY

restore sensitive lands. The County has a goal to preserve 88,000 acres of environmentally sensitive land through this program.

Reducing Future Flood Losses

Creating or maintaining open space is the primary way to reduce future flood losses. Orange County has many open space and natural parcels which serve to reduce future flood losses by remaining open. These parks and natural preserved areas create opportunities for the public to benefit from education and recreation while eliminating potential for future flooding.

CRS Credit

Preserving flood prone areas as open space is one of the highest priorities of the Community Rating System. Credit is based on the area of the floodplain that is designated as public undeveloped properties, parks, wildlife refuges, golf courses, or other uses that can be kept vacant through ownership or regulations. Orange County receives credit for Activity 420 – Open Space Protection for preserving 87,957 acres of SFHA.

Table B.1 – Prevention Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Prevention Measures Considered by FMPC			
-	Continue to maintain or work to improve the County's BCEGS ratings.	Reduced vulnerability in new development will be pursued through higher regulatory standards.	n/a
-	Consider implementing LID principles and practices to new development, redevelopment and retrofits to existing development.	Stormwater management improvements will be pursued through higher regulatory standards and NPDES permit compliance.	n/a
Prevention Measures and Funding Recommended for Implementation			
6	Perform engineering studies of the areas surrounding Lake Venus, including the Orlo Vista neighborhood.	Current flood maps show low risk for Orlo Vista, yet it is known to experience severe flooding, notably following Hurricane Donna and Hurricane Irma.	Municipal Services Benefits Unit
12	Evaluate options for higher regulatory standards to reduce the vulnerability of new development to flooding.	Higher regulatory standards can ensure that future structures are built to minimize their impact on flooding and their vulnerability to floods.	Operating budget
15	Acquire property and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts.	Coordinating land conservation with long-term planning and development can serve to protect vulnerable lands and natural floodplain functions and mitigate future flooding.	Green PLACE program funding
17	Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.	Managing runoff and reducing stormwater pollution protects surface waters and helps mitigate health risks associated with flooding.	Operating budget
18	Prepare watershed master plans for all HUC-12 river basins in the County.	Updated watershed master plans will provide more accurate flood risk data enabling a better understanding of needs and opportunities for mitigation.	Operating budget

B.2.2 Property Protection Measures

Property protection measures are used to modify buildings or property subject to damage. Property protection measures fall under three approaches:

- Modify the site to keep the hazard from reaching the building,
- Modify the building (retrofit) so it can withstand the impacts of the hazard, and
- Insure the property to provide financial relief after the damage occurs.

Property protection measures are normally implemented by the property owner, although in many cases technical and financial assistance can be provided by a government agency.

Keeping the Hazard Away

Generally, natural hazards do not damage vacant areas. The major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. For example, a berm can be built to prevent floodwaters from reaching a house.

Flooding

There are five common methods to keep a flood from reaching and damaging a building:

- Erect a barrier between the building and the source of the flooding.
- Move the building out of the flood prone area.
- Elevate the building above the flood level.
- Demolish the building.
- Replace the building with a new one that is elevated above the flood level.

Barriers

A flood protection barrier can be built of dirt or soil (a "berm") or concrete or steel (a "floodwall"). Careful design is needed so as not to create flooding or drainage problems on neighboring properties. Depending on how porous the ground is, if floodwaters will stay up for more than an hour or two, the design needs to account for leaks, seepage of water underneath, and rainwater that will fall inside the perimeter. This is usually done with a sump or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier.

Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and properly maintained. A berm can also settle over time, lowering its protection level. A floodwall can crack, weaken, and lose its watertight seal. Therefore, barriers need careful design and maintenance (and insurance on the building, in case of failure).

Relocation

Moving a building to higher ground is the surest and safest way to protect it from flooding. In areas subject to flash flooding, deep waters, or other high hazard, relocation is often the only safe approach. Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of the existing lot) available.

Building Elevation

Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under or around the building, causing little or no damage to the structure or its contents. Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

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Demolition

Some buildings, especially heavily damaged or repetitively flooded ones, are not worth the expense to protect them from future damages. It is cheaper to demolish them and either replace them with new, flood protected structures, or relocate the occupants to a safer site. Demolition is also appropriate for buildings that are difficult to move - such as larger, slab foundation or masonry structures - and for dilapidated structures that are not worth protecting. Generally, demolition projects are undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public open space use, like a park.

Pilot Reconstruction

If a building is not in good shape, elevating it may not be worthwhile or it may even be dangerous. An alternative is to demolish the structure and build a new one on the site that meets or exceeds all flood protection codes. FEMA funding programs refer to this approach as "pilot reconstruction." It is still a pilot program, and not a regularly funded option. Certain rules must be followed to qualify for federal funds for pilot reconstruction:

- Pilot reconstruction is only possible after it has been shown that acquisition or elevation are not feasible, based on the program's criteria.
- Funds are only available to people who owned the property at the time of the event for which funding is authorized.
- It must be demonstrated that the benefits exceed the costs.
- The new building must be elevated to the advisory base flood elevation.
- The new building must not exceed more than 10% of the old building's square footage.
- The new building must meet all flood and wind protection codes.
- There must be a deed restriction that states the owner will buy and keep a flood insurance policy.
- The maximum federal grant is 75% of the cost, up to \$150,000. FEMA is developing a detailed list of eligible costs to ensure that disaster funds are not used to upgrade homes.

Local Implementation

Orange County does not currently receive credit for Activity 520 – Acquisition and Relocation or Activity 530 – Flood Protection.

CRS Credit

The CRS provides the most credit points for acquisition and relocation under Activity 520, because this measure permanently removes insurable buildings from the floodplain. The CRS credits barriers and elevating existing buildings under Activity 530. Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building. Because barriers are less secure than elevation, not as many points are provided. Higher scores are possible, but they are based on the number of buildings removed compared to the number remaining in the floodplain.

Retrofitting

An alternative to keeping the hazard away from a building is to modify or retrofit the site or building to minimize or prevent damage. There are a variety of techniques to do this, as described below.

Dry Floodproofing

Dry floodproofing means making all areas below the flood protection level watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows and vents, are closed, either permanently, with removable shields, or with sandbags. Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under state, FEMA and local regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long

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as the building is not substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.

Dry floodproofing is only effective for shallow flooding, such as repetitive drainage problems. It does not protect from the deep flooding along lakes and larger rivers caused by hurricanes or other storms.

Wet Floodproofing

The alternative to dry floodproofing is wet floodproofing: water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

Local Implementation

Orange County does not currently receive credit for Activity 530 – Flood Protection.

CRS Credit

The credit for Activity 530 is based on the number of insurable buildings in the regulatory floodplain that have been retrofitted since the date of the community's original Flood Insurance Rate Map (FIRM). For the purposes of this activity, an accessory structure such as a garage or shed is not counted as an insurable building. Extra credit is given for protecting buildings on FEMA's repetitive loss list and for protecting buildings that are critical facilities. Flood protection techniques that are recognized by this activity include retrofitting projects and structural flood control projects. The credit points are based on the effectiveness of the technique in preventing flood damage.

Insurance

Technically, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild, and hopefully afford to incorporate other property protection measures in the process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without requiring human intervention for the measure to work.

Private Property

Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the NFIP. Flood insurance coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area. Most people purchase flood insurance because it is required by the bank when they get a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Contents coverage can be purchased separately. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building. Most people don't realize that there is a 30-day waiting period to purchase a flood insurance policy and there are limits on coverage.

Public Property

Governments can purchase commercial insurance policies. Larger local governments often self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can drain the government's budget. Communities cannot expect federal disaster assistance to make up the difference after a flood.

Under Section 406(d) of the Stafford Act:

"If an eligible insurable facility damaged by flooding is located in a [mapped floodplain] ... and the facility is not covered (or is underinsured) by flood insurance on the date of such flooding, FEMA is required to reduce Federal disaster assistance by the maximum amount of insurance proceeds

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that would have been received had the buildings and contents been fully covered under a National Flood Insurance Program (NFIP) standard flood insurance policy. [Generally, the maximum amount of proceeds for a non-residential property is \$500,000.]

[Communities] Need to:

- Identify all insurable facilities, and the type and amount of coverage (including deductibles and policy limits) for each. The anticipated insurance proceeds will be deducted from the total eligible damages to the facilities.
- Identify all facilities that have previously received Federal disaster assistance for which insurance was required. Determine if insurance has been maintained. A failure to maintain the required insurance for the hazard that caused the disaster will render ineligible for Public Assistance funding...
- [Communities] must obtain and maintain insurance to cover [their] facility - buildings, equipment, contents and vehicles - for the hazard that caused the damage in order to receive Public Assistance funding. Such coverage must, at a minimum, be in the amount of the eligible project costs. FEMA will not provide assistance for that facility in future disasters if the requirement to purchase insurance is not met. - FEMA Response and Recovery Directorate Policy No. 9580.3, August 23, 2000

In other words, the law expects public agencies to be fully insured as a condition of receiving federal disaster assistance.

Local Implementation

Flood insurance information for the County is provided in Section 5.3.3. A Program for Public Information is in conjunction with this plan.

CRS Credit

There is no credit for purchasing flood insurance, but the CRS does provide credit for local public information programs that explain flood insurance to property owners. Orange County currently receives credit for Activity 330 – Outreach Projects.

Table B.2 – Property Protection Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Prevention Measures Considered by FMPC			
-	Increase flood insurance policy coverage throughout the County	This outcome will be pursued through broader public information and outreach actions.	n/a
-	Encourage homeowners to take responsibility for protecting their own properties by providing retrofitting advice and assistance.	The County already provides technical assistance. Publicity of this service will be pursued through public information and outreach actions, and expansion of this service will be pursued through partnerships with home improvement stores.	n/a
Prevention Measures and Funding Recommended for Implementation			
4	Encourage residents in repetitive loss areas and high-risk flood zones to consider the option of acquisition or elevation.	Repetitive loss properties are likely to continue incurring losses without mitigation. Acquisition and demolition is the only way to guarantee no future losses occur.	HMGP
13	Consider options for public/private partnership with home improvement stores to encourage homeowners to take mitigation and preparedness actions.	Home improvement stores can help to educate property owners on ways to protect their property from flooding and incorporate mitigation of their property into flood recovery.	Operating budget

B.2.3 Natural Resource Protection

Resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. These activities enable the naturally beneficial functions of fields, floodplains, wetlands, and other natural lands to operate more effectively. Natural and beneficial functions of watersheds, floodplains and wetlands include:

- Reduction in runoff from rainwater and snow melt in pervious areas
- Infiltration that absorbs overland flood flow
- Removal and filtering of excess nutrients, pollutants and sediments
- Storage of floodwaters
- Absorption of flood energy and reduction in flood scour
- Water quality improvement
- Groundwater recharge
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

As development occurs, many of the above benefits can be achieved through regulatory steps for protecting natural areas or natural functions. This section covers the resource protection programs and standards that can help mitigate the impact of natural hazards, while they improve the overall environment. Seven areas are reviewed:

- Wetland protection
- Erosion and sedimentation control
- Stream restoration
- Best management practices
- Dumping regulations
- Urban forestry
- Farmland protection

Wetland Protection

Wetlands are often found in floodplains and topographically depressed areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, improving water quality, and they provide habitat for many species of fish, wildlife, and plants.

Local Implementation

Orange County's Land Development Code contains a section on wetland conservation areas that specifies the characteristics of wetlands that should be considered conservation lands. All development applications subject to wetland conservation regulations that would have an adverse impact on wetlands are required to mitigate those impacts.

CRS Credit

There is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations. Orange County currently receives credit for Activity 420 – Open Space Preservation.

Erosion and Sedimentation Control

Construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. Erosion also occurs along stream banks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil.

Sediment suspended in the water tends to settle out where flowing water slows down. This can clog storm drains, drain tiles, culverts and ditches and reduce the water transport and storage capacity of river

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and stream channels, lakes and wetlands. When channels are constricted and flooding cannot deposit sediment in the bottomlands, even more sediment is left in the channels. The result is either clogged streams or increased dredging costs.

Not only are the drainage channels less able to perform their job, but the sediment in the water reduces light, oxygen and water quality, and often carries chemicals, heavy metals and other pollutants. Sediment has been identified by the US EPA as the nation's number one nonpoint source pollutant for aquatic life.

There are two principal strategies to address these problems: minimize erosion and control sedimentation. Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices.

If erosion occurs, other measures are used to capture sediment before it leaves the site. Silt fences, sediment traps and vegetated filter strips are commonly used to control sediment transport. Runoff from the site can be slowed down by terraces, contour strip farming, no-till farm practices, hay or straw bales, constructed wetlands, and impoundments (e.g., sediment basins and farm ponds). Slowing surface water runoff on the way to a drainage channel increases infiltration into the soil and reduces the volume of topsoil eroded from the site.

Erosion and sedimentation control regulations mandate that these types of practices be incorporated into construction plans. The most common approach is to require permit applicants to submit an erosion and sediment control plan for the construction project. This allows the applicant to determine the best practices for the site.

Local Implementation

Since June 2003 all sites disturbing 1 or more acres must have an "NPDES Construction General Permit" through the Florida Department of Environmental Protection. FDEP has been delegated authority by the EPA to administer and enforce the program. A stormwater pollution prevention plan must be developed and a Notice of Intent (NOI) must be filed with FDEP.

CRS Credit

Credit is available for the Erosion and Sediment Control (ESC) element under Activity 450 if the community requires that erosion and sediment control measures be taken on land that is disturbed during development. To receive ESC credit, the community's regulations must apply to all construction sites within the community. Orange County currently receives credit under the ESC element for Activity 450 – Stormwater Management.

Stream Restoration

There is a growing movement that has several names, such as "stream conservation," "bioengineering," or "riparian corridor restoration." The objective of these approaches is to return streams, stream banks and adjacent land to a more natural condition, including the natural meanders. Another term is "ecological restoration," which restores native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water

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- Increases the beauty of the land and its property value
- Prevents property loss due to erosion
- Provides recreational opportunities, such as hunting, fishing and bird watching
- Reduces long-term maintenance costs

Local Implementation

The following restoration-related policies can be found in the community's Comprehensive Plan:

Orange County Conservation Element

- Orange County shall on an ongoing basis identify and prioritize lakes that are in need of restoration, through the analysis of specific water quality parameters and following the water quality guidelines of the Florida Department of Environmental Protection (FDEP) and Orange County Ordinances.
- Orange County, in conjunction with the Water Management Districts and other State agencies, shall on an ongoing basis, seek funding and implementation of lake management plans for those water bodies in greatest need of restoration.
- Orange County shall maintain acceptable water quality standards for surface water bodies, ensuring an aquatic environment that meets or exceeds Orange County, State and Federal standards.
- Orange County shall continue to protect shoreline vegetation by restricting the removal of desirable native vegetation through implementation of the Land Development Code and the Lakeshore Protection Ordinance requirements.

The Orange County Land Development Code contains requirements for management of stewardship lands as well as open space design guidelines. The Land Development Code is used to implement the policies and objectives set forth in the Growth Management Plan.

CRS Credit

Orange County currently receives credit for Activity 420 – Open Space Preservation. The CRS provides credit for preserving open space in its natural condition or restored to a state approximating its natural condition. There are also credits for channel setbacks, buffers and protecting shorelines.

Best Management Practices

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the US EPA. Nonpoint source pollutants come from non-specific locations and harder to regulate. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, other chemicals, animal wastes, oils from street surfaces and industrial areas, and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.

The term "best management practices" (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). They can prevent increases in downstream flooding by attenuating runoff and enhancing infiltration of stormwater. They also minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple usages of drainage and storage facilities.

Local Implementation

Orange County's stormwater collection system (called a Municipal Separate Storm Sewer System, or MS4) is covered under an NPDES Phase II MS4 Stormwater Permit (Permit ID FLS0000011). Elements of the Permit require the County to have a "Stormwater Management Program" (SWMP) that reasonably attempts to prevent pollution from entering the stormwater collection system from non-point sources.

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CRS Credit

Orange County currently receives credit under the Water Quality (WQ) element for Activity 450 – Stormwater Management. To receive WQ credit, under Activity 450, the community's stormwater management regulations must either specify one or more measures or refer to BMPs as published in an official government reference.

Dumping Regulations

BMPs usually address pollutants that are liquids or are suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels' and wetlands' abilities to convey or clean stormwater.

Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Waterway dumping regulations need to also apply to "non-objectionable" materials, such as grass clippings or tree branches, which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard without realizing that is needed to drain street runoff. They may not understand how regarding their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Local Implementation

Orange County has an ordinance in place which make it unlawful for anyone to deposit waste, grass, weeds, brush or other refuse in any street, ditch or watercourse, or on others' property, or on public property.

CRS Credit

Orange County currently receives credit for Activity 540 – Drainage System Maintenance. Credit is provided under the Stream Dumping Regulations (SDR) element if the community has and publicizes regulations prohibiting dumping in streams and ditches.

Farmland Protection

Farmland protection is an important piece of comprehensive planning and zoning throughout the United States. The purpose of farmland protection is to provide mechanisms for prime, unique, or important agricultural land to remain as such, and to be protected from conversion to nonagricultural uses.

Frequently, farm owners sell their land to residential or commercial developers and the property is converted to non-agricultural land uses. With development comes more buildings, roads and other infrastructure. Urban sprawl occurs, which can lead to additional stormwater runoff and emergency management difficulties.

Farms on the edge of cities are often appraised based on the price they could be sold for to urban developers. This may drive farmers to sell to developers because their marginal farm operations cannot afford to be taxed as urban land. The Farmland Protection Program in the United States Department of Agriculture's 2002 Farm Bill (Part 519) allows for funds to go to state, tribal, and local governments as well as nonprofit organizations to help purchase easements on agricultural land to protect against the development of the land. Eligible land includes cropland, rangeland, grassland, pastureland, or forest land that is part of an agricultural operation. Certain lands within historical or archaeological resources are also included.

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The hazard mitigation benefits of farmland protection are similar to those of open space preservation:

- Farmland is preserved for future generation,
- Farmland in the floodplain keeps damageable structures out of harm's way
- Farmland keeps more stormwater on site and lets less stormwater runoff downstream
- Rural economic stability and development is sustained
- Ecosystems are maintained, restored, or enhanced
- The rural character and scenic beauty of the area is maintained

Local Implementation

Orange County uses an Urban Service Area to limit growth in low-density areas. In conjunction with the Urban Service Area, the Orange County Comprehensive Plan has two types of future land use designations for rural areas, both of which apply to land outside the County's Urban Service Area. The Rural/Agricultural designation promotes long-term viability of agricultural uses as an economic asset while allowing single family residential on large lots. The Rural Settlement designation recognizes and preserves existing development patterns, provides for a rural residential lifestyle, and manages the transition of rural areas near the Urban Service Area. There are four different Rural Settlement designations, which differ based on the acreage and density allowed.

CRS Credit

Orange County currently receives credit for Activity 420 – Open Space Preservation. The CRS provides credit for preserving open space in its natural condition or restored to a state approximating its natural condition.

Table B.3 – Natural Resource Protection Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Natural Resource Protection Measures Considered by FMPC			
-	Educate the public on natural resource protection and nonpoint source pollution prevention.	This action will be integrated into broader public information and outreach actions.	n/a
-	Identify parcels not well suited for development and encourage a public/private partnership to maintain them as open space.	The County already pursues open space preservation through its Green PLACE program, which is being recommended for continuation and expansion.	n/a
Natural Resource Protection Measures and Funding Recommended for Implementation			
5	Continue to inspect and maintain waterways, including natural channels, to ensure they are clear of debris.	Improved maintenance of waterways will ensure proper drainage and reduce risk of localized stormwater flooding.	Operating budget
15	Acquire property and equipment in the floodplain to preserve wetlands and create open space. Coordinate this effort with the existing Green PLACE program and with comprehensive planning efforts.	Coordinating land conservation with long-term planning can serve to protect vulnerable lands and natural floodplain functions and mitigate future flooding.	Green PLACE program funding
17	Improve stormwater quality to ensure compliance with NPDES permit and pollutant TMDLs.	Managing runoff and reducing stormwater pollution protects surface waters and mitigates health risks of flooding.	Operating budget
20	Complete restoration of the little Wekiva River at Edgewater Drive.	Restoration of the Little Wekiva River will increase the river's drainage capacity and protect its natural floodplain functions.	Operating budget

B.2.4 Emergency Services Measures

Emergency services measures protect people during and after a disaster. A good emergency management program addresses all hazards, and it involves all local government departments. At the state level, emergency services programs are coordinated by the Florida Department of Emergency Management (FDEM). Locally, Orange County's emergency services are coordinated by the Orange County Office of Emergency Management.

This section reviews emergency services measures following a chronological order of responding to an emergency. It starts with identifying an impending problem (threat recognition) and continues through post-disaster activities.

Threat Recognition

The first step in responding to a flood is to know when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

The National Weather Service (NWS) is the prime agency for detecting meteorological threats. Severe weather warnings are transmitted through NOAA's Weather Radio System. Local emergency managers can then provide more site-specific and timely recognition after the Weather Service issues a watch or a warning. A flood threat recognition system predicts the time and height of a flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On smaller rivers and streams, locally established rainfall and river gauges are needed to establish a flood threat recognition system. The NWS may issue a "flash flood watch." This is issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available. In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide notice of potential local or flash flooding.

Local Implementation

Flood Threat Recognition comes to the Office of Emergency Management via several sources:

1. Through the National Weather Service Office via its products: Flash Flood Warning and Flood Warning. The difference between "Flash Flood" and "Flood" is that the first is for flooding which occurs within 6 hours of the causative event (rain), while the second is for residual flooding greater than 6 hours after the end of the rain.
2. Florida Division of Emergency Management (FDEM), the State Watch Office (SWO): FDEM has a staff meteorologist who could also be made available to the county and/or who also would issue flood threat advisories to affected counties.

CRS Credit

Orange County currently receives credit for Activity 610 – Flood Warning Program. Credit can be received for using National Hurricane Center warnings and river flood stage predictions for the NWS's gages. The actual score is based on how much of the community's floodplain is affected by these systems.

Warning

The next step in emergency response following threat recognition is to notify the public and staff of other agencies and critical facilities. More people can implement protection measures if warnings are early and include specific detail.

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The NWS issues notices to the public using two levels of notification:

- **Watch:** conditions are right for flooding, thunderstorms, tornadoes or winter storms.
- **Warning:** a flood, tornado, etc., has started or been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- Email notifications

Multiple or redundant systems are most effective because if people do not hear one warning, they may still get the message from another part of the system. Each has advantages and disadvantages:

- Radio and television provide a lot of information, but people have to know when to turn them on. They are most appropriate for hazards that develop over more than a day, such as a tropical storm, hurricane, or winter storm.
- NOAA Weather Radio can provide short messages of any impending weather hazard or emergency and advise people to turn on their televisions for more information, but not everyone has a Weather Radio.
- Outdoor warning sirens can reach many people quickly as long as they are outdoors. They do not reach people in tightly-insulated buildings or those around loud noise, such as at a factory, during a thunderstorm, or in air conditioned homes. They do not explain what hazard is coming, but people should know to turn on a radio or television when they hear the siren.
- Automated telephone notification services are also fast, but can be expensive and do not work when phone lines are down. Nor do they work for unlisted numbers, call screening services, or cellular service, unless people sign up for notifications.

Just as important as issuing a warning is telling people what to do in case of an emergency. A warning program should include a public information component.

StormReady

The National Weather Service established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather-related warnings for the public. To be designated StormReady, a community must:



- Establish a 24-hour warning point and emergency operations center
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises

Being designated a StormReady community by the National Weather Service is a good measure of a community's emergency warning program for weather hazards. It is also credited by the CRS.

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Local Implementation

Orange County's Office of Emergency Management administers/disseminates flood warning information. The County uses OC Alert, a reverse 9-11 calling system, to send special alerts and emergency notifications. The County also uses innovative smartphone app technology to both keep residents informed and collect information from residents on localized issues. Additionally, the County uses a number of community newsletters to share important non-emergency information. The County's Public Warning Systems also include NOAA weather radio, media coordination, the Orange County website, partners such as 2-1-1, door-to-door notification by first responders, CodeRed, the Emergency Alert System, Orange County 3-1-1, Orange TV, Facebook, and Twitter.

The National Weather Service Office (NWSO) in Melbourne, Florida will issue flood advisory, watches and warning information to both Government and the citizens. The State Watch Office will follow-up the NWSO's warning information with direct contact with the local Emergency Management Office.

Orange County is currently designated as a StormReady community.

CRS Credit

Orange County currently receives credit for Activity 610 – Flood Warning Program for a program that provides timely identification of impending flood threats, disseminates warnings to appropriate floodplain residents, and coordinates flood response activities. Community Rating System credits are based on the number and types of warning media that can reach the community's flood prone population. Depending on the location, communities can receive credit for the telephone calling system and more credits if there are additional measures, like telephone trees. Credit is also provided for the designation as a Storm Ready Community by the National Weather Service.

Response

The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency preparedness)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Holding children at school or releasing children from school (school superintendent)
- Opening evacuation shelters (the American Red Cross)
- Monitoring water levels (public works)
- Establishing security and other protection measures (police)

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

A flood stage forecast map shows areas that will be under water at various flood stages. Different flood levels are shown as color coded areas, so the emergency manager can quickly see what will be affected. Emergency management staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, and who to warn. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed to respond to the predicted flood level.

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Emergency response plans should be updated annually to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and of changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner possible.

Local Implementation

Orange County maintains the 2013 Comprehensive Emergency Management Plan. The County bears the initial responsibility for warning the public of a threat, disaster response and recovery operations. As a corollary to this principal, each level within local government will accomplish the functions for which it is responsible, requesting relief from the next higher level of government only after resources at that level are inadequate to respond to the flood emergency or disaster. Requests for assistance will be made to the Florida Division of Emergency Management only after the Board of County Commissioners has declared a State of Local Emergency.

CRS Credit

Orange County currently receive credit for Activity 610 – Flood Warning Program. Flood Response Operations (FRO) credit is based on the extent of coverage and level of detail that the community's flood warning and response plan provides for the flood response operations. For full credit, the plan must a) describe the actions to be taken, b) identify the office or official responsible for the action, c) define the time needed to carry out the activity, and d) contain other critical information that designated agencies and organizations will need in order to perform their assigned responsibilities. Bonus credit is provided if there is a list of the personnel, equipment, facilities, supplies and other resources needed to complete each task.

Evacuation and Shelter

There are six key components to a successful evacuation:

- Adequate warning
- Adequate routes
- Proper timing to ensure the routes are clear
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., the handicapped, prisoners, hospital patients, and schoolchildren)

Those who cannot get out of harm's way need shelter. Typically, the American Red Cross will staff a shelter and ensure that there is adequate food, bedding, and wash facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring in their pets, and the potential for an overcrowded facility.

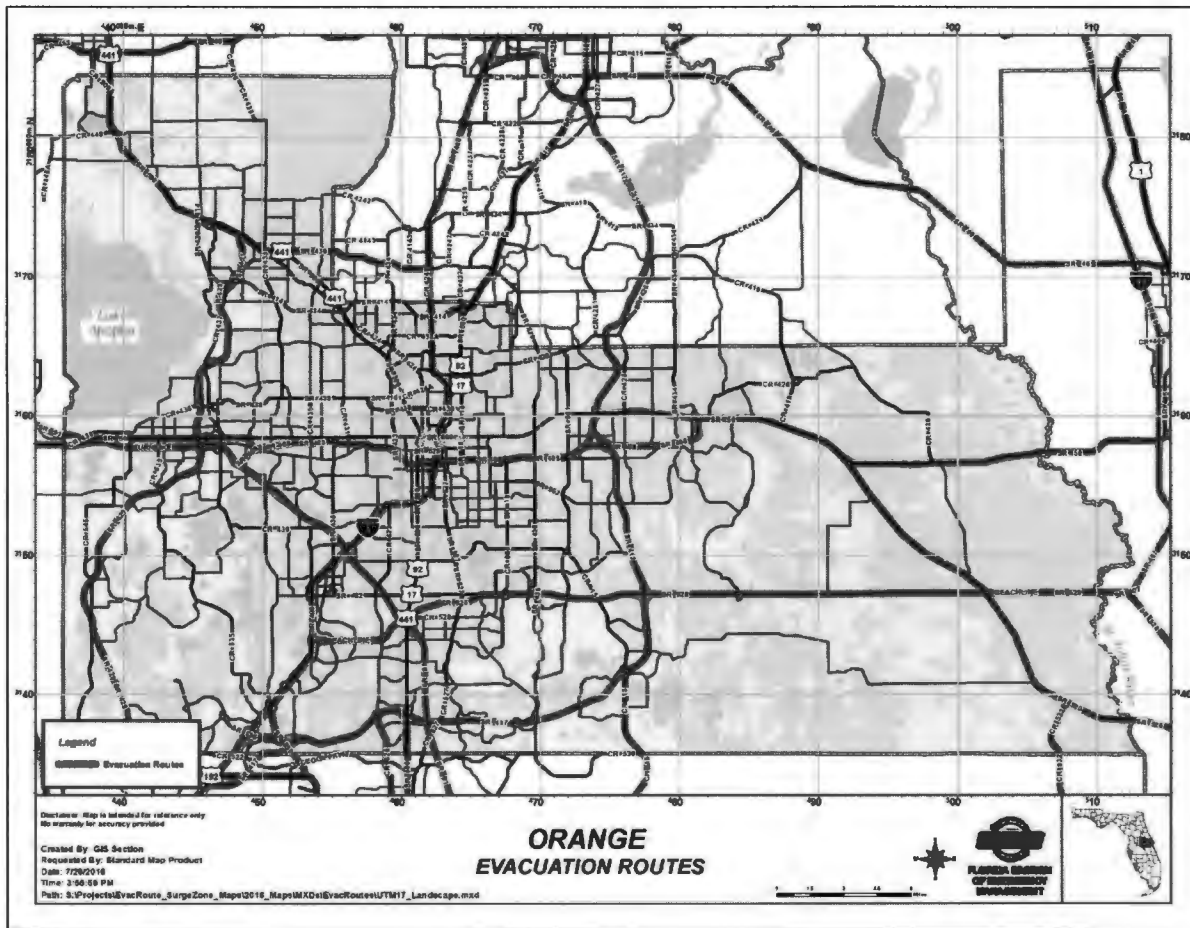
Local Implementation

Orange County publicizes major evacuation routes, which are shown in Figure B.2 on the following page.

Orange County has six local shelters: Apopka High School, Corner Lake Middle School, Timber Creek High School, Odyssey Middle School, Bithlo Community Park, and Barnett Park. The park shelters are pet friendly.

CRS Credit

Because it is primarily concerned with protecting insurable buildings, the CRS does not provide any special credit for evacuation or sheltering of people (minimal credit is given in Activity 510 - Floodplain Management for evacuation policies and procedures). It is assumed that the emergency response plan would include all necessary actions in response to a flood.



Source: floridadisaster.org

Figure B.2 – Orange County Evacuation Routes

Post-Disaster Recovery and Mitigation

After a disaster, communities should undertake activities to protect public health and safety and facilitate recovery. Appropriate measures include:

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Monitoring for diseases
- Vaccinating residents for tetanus and other diseases
- Clearing streets
- Cleaning up debris and garbage

Following a disaster, there should be an effort to help prepare people and property for the next disaster. Such an effort would include:

- Public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Identifying other mitigation measures that can lessen the impact of the next disaster

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- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long-term mitigation activities
- Applying for post-disaster mitigation funds

Local Implementation

The Orange County Office of Emergency Management maintains the 2012 Post-Disaster Redevelopment Plan to guide recovery and mitigation and the 2013 Comprehensive Emergency Management Plan, which also addresses recovery and mitigation functions.

Regulating Reconstruction

Requiring permits for building repairs and conducting inspections are vital activities to ensure that damaged structures are safe for people to reenter and repair. There is a special requirement to do this in floodplains, regardless of the type of disaster or the cause of damage. The NFIP requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building's market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building must be elevated above the base flood elevation.

Local Implementation

Orange County's Floodplain Management Ordinance requires that substantial improvement of any residential building (including manufactured home) shall have the lowest floor, including basement, elevated to no lower than one foot above the BFE.

CRS Credit

The CRS does credit post-disaster mitigation procedures if the policies and procedures are incorporated into a flood mitigation or multi-hazard plan through Activity 510 – Floodplain Management Planning.

Table B.4 – Emergency Services Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Emergency Services Measures Considered by FMPC			
-	Install storm shutters on the County Courthouse building.	The courthouse is not an essential critical facility used for sheltering or emergency response. Project not an immediate priority.	n/a
Emergency Services Measures and Funding Recommended for Implementation			
7	Protect critical facilities and infrastructure from potential flood damage.	The County's critical facilities and infrastructure will be less vulnerable to flood hazards.	Operating budget
8	Ensure back up power systems and generators are in place for all critical facilities and emergency shelters.	The County's critical facilities and infrastructure will be less vulnerable to flood hazards.	Operating budget
11	Add flood gauges to improve calibration of current flood modeling system and enable better flood warning.	Adding flood gauges will improve threat recognition, enabling more accurate warnings to the public.	To be determined
23	Continue to implement emergency hurricane preparedness procedures as needed and update regularly.	Taking these steps will ensure that all drainage systems are in good condition and that the County is prepared to handle and respond to a hurricane or tropical storm.	Operating budget

B.2.5 Structural Projects

Four general types of flood control projects are reviewed here: levees, reservoirs, diversions, and dredging. These projects have three advantages not provided by other mitigation measures:

- They can stop most flooding, protecting streets and landscaping in addition to buildings
- Many projects can be built without disrupting citizens' homes and businesses
- They are constructed and maintained by a government agency, a more dependable long-term management arrangement than depending on many individual private property owners

However, as shown below, structural measures also have shortcomings. The appropriateness of using flood control depends on individual project area circumstances.

- **Advantages**
 - They may provide the greatest amount of protection for land area used
 - Because of land limitations, they may be the only practical solution in some circumstances
 - They can incorporate other benefits into structural project design, such as water supply and recreational uses
 - Regional detention may be more cost-efficient and effective than requiring numerous small detention basins
- **Disadvantages**
 - They can disturb the land and disrupt the natural water flows, often destroying wildlife habitat
 - They require regular maintenance
 - They are built to a certain flood protection level that can be exceeded by larger floods
 - They can create a false sense of security
 - They promote more intensive land use and development in the floodplain

Levees and Floodwalls

Probably the best-known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour. Key considerations when evaluating the use of a levee include:

- Design and permitting costs
- Right of way acquisition
- Removal of fill to compensate for the floodwater storage that will be displaced by the levee
- Internal drainage of surface flows from the area inside the levee
- Cost of construction
- Cost of maintenance
- Mitigation of adverse impacts to wetlands and other habitats
- Loss of river access and views
- Creating a false sense of security, because while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee

Reservoirs and Detention

Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower flood heights by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flood has subsided, and then the water in the reservoir

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or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream.

Reservoirs can be dry and remain idle until a large rain event occurs, or they may be designed so that a lake or pond is created. The lake may provide recreational benefits or water supply (which could also help mitigate a drought).

Flood control reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs, or detention basins, are built to protect property from the stormwater runoff impacts of new development.

Diversion

A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During floods, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river.

Dredging

Dredging is often viewed as a form of conveyance improvement. However, it has the following problems:

- Given the large volume of water that comes downstream during a flood, removing a foot or two from the bottom of the channel will have little effect on flood heights.
- Dredging is often cost prohibitive because the dredged material must be disposed of somewhere.
- Unless in-stream or tributary erosion is corrected upstream, the dredged areas usually fill back in within a few years, and the process and the expense have to be repeated.
- If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed.

To protect the natural values of the stream, federal law requires a U.S. Army Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires a lot of advance planning and many safeguards to protect habitats, which adds to the cost of the project.

Local Implementation

Orange County does not currently receive credit for Activity 530 – Flood Protection.

CRS Credit

Structural flood control projects that provide 100-year flood protection and that result in revisions to the Flood Insurance Rate Map are not credited by the CRS in order to avoid duplicating the larger premium reduction provided by removing properties from the mapped floodplain.

The CRS credits smaller flood control projects that meet the following criteria:

- They must provide protection to at least the 25-year flood
- They must meet certain environmental protection criteria
- They must meet federal, state and local regulations, such as the Corps of Engineers' 404 permit and State dam safety rules
- They must meet certain maintenance requirements

These criteria ensure that credited projects are well-planned and permitted. Any of the measures reviewed in this section would be recognized under Activity 530 - Flood Protection. Credits are based on the type of project, how many buildings are protected, and the level of flood protection provided.

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Table B.5 – Structural Projects Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Structural Project Measures Considered by FMPC			
-	Dredge and grade Elba Way.	Project not an immediate priority.	n/a
Structural Project Measures and Funding Recommended for Implementation			
9	Install high water level outfalls in lieu of current drainwells or retrofit existing drainwells, including at Lake Price, Lake Pleasant, Mustang Way, and Lake Florence.	Will improve stormwater quality and manage runoff.	Operating budget
10	Retrofit culverts along Apopka Boulevard.	Will address a specific, known stormwater flooding problem.	Operating budget
16	Acquire properties for a regional stormwater detention basin.	Will reduce the strain on surrounding stormwater infrastructure.	Operating budget
19	Improve/Upgrade pump stations at Bonnie Brook, Long Lake, Verona Park, and Woodsmere.	Will address specific, known stormwater flooding problems.	Operating budget
21	Complete stormwater retrofits on Boggy Creek Pipeline, Control Structure for Pond 6612, and Lake George Outfall.	Will address specific, known stormwater flooding problems.	Operating budget
22	Complete canal bank stabilization projects for Wheatberry Ct B-14 and Winter Park Pines Outfall.	Will address specific, known stormwater flooding problems.	Operating budget

B.2.6 Public Information & Outreach

Outreach Projects

Outreach projects are the first step in the process of orienting property owners to the hazards they face and to the concept of property protection. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties.

Awareness of the hazard is not enough; people need to be told what they can do about the hazard. Thus, projects should include information on safety, health and property protection measures. Research has shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Community newsletters/direct mailings: The most effective types of outreach projects are mailed or distributed to everyone in the community. In the case of floods, they can be sent only to floodplain property owners.

News media: Local newspapers can be strong allies in efforts to inform the public. Local radio stations and cable TV channels can also help. These media offer interview formats and cable TV may be willing to broadcast videos on the hazards.

Other approaches: Examples of other outreach projects include:

- Presentations at meetings of neighborhood, civic or business groups
- Displays in public buildings or shopping malls

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- Signs in parks, along trails and on waterfronts that explain the natural features (such as the river) and their relation to the hazards (such as floods)
- Brochures available in municipal buildings and libraries
- Special meetings, workshops and seminars

Local Implementation

A community brochure is mailed to all properties in the County on an annual basis. The County also displays flood information in public buildings and at community events. One of Orange County's recurring outreach events is an annual Hurricane Expo, where residents can receive information on flood risk and preparedness. Documents relating to floodplain management are available in the reference section of the Orange County Public Library, and the County provides some flood related information on its website.

Special information programs have been established for people with special needs such as the elderly and individuals with disabilities. These individuals are encouraged to pre-register with the Emergency Management Department who will advise them of their vulnerability to flooding and items that they should bring to a shelter in the event of an evacuation. The Emergency Management Department will also arrange for transportation to shelter if needed.

CRS Credit

Orange County currently receives credit under Activity 330 – Outreach Projects as well as Activity 350 – Flood Protection Information.

Real Estate Disclosure

After a flood or other natural disaster, people often say they would have taken steps to protect themselves if they had known they had purchased a property exposed to a hazard. There are some federal and state requirements about such disclosures:

- Federal law: Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building whether the property is in a floodplain as shown on the Flood Insurance Rate Map. If so, flood insurance is required for buildings located within the floodplain if the mortgage or loan is federally insured.
- State law: State laws set standards for real estate sales and licensing of agents and brokers.

Local Implementation

Orange County currently receives credit under Activity 340 – Hazard Disclosure for state and community regulations requiring disclosure of flood hazards.

Libraries and Websites

The two previous activities tell people that they are exposed to a hazard. The next step is to provide information to those who want to know more. The community library and local websites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources. Books and pamphlets on hazard mitigation can be given to libraries, and many of these can be obtained for free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures and other projects, which can augment the activities of the local government. Today, websites are commonly used as research tools. They provide fast access to a wealth of public and private sites for information. Through links to other websites, there is almost no limit to the amount of up to date information that can be accessed on the Internet.

In addition to online floodplain maps, websites can link to information for homeowners on how to retrofit for floods or a website about floods for children.

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Local Implementation

Documents related to floodplain management are available in the reference section of the Orange County Public Library. Floodplain information is also displayed on the County's website.

CRS Credit

Orange County currently receives credit under Activity 350 – Flood Protection Information. The Community Rating System provides credits for having a variety of flood references in the local public library and for providing similar material on municipal websites.

Technical Assistance

Hazard Information

Residents and business owners that are aware of the potential hazards can take steps to avoid problems or reduce their exposure to flooding. Communities can easily provide map information from FEMA's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is located outside the mapped floodplain.

Some communities supplement what is shown on the FIRM with information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. They should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never flood.

Property Protection Assistance

While general information provided by outreach projects or the library is beneficial, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track. Building or public works department staffs can provide the following types of assistance:

- Visit properties and offer protection suggestions
- Recommend or identify qualified or licensed contractors
- Inspect homes for anchoring of roofing and the home to the foundation
- Explain when building permits are needed for home improvements.

Local Implementation

Orange County maintains records on the community's Flood Insurance Rate Map and responds to requests on whether a property is located in a Special Flood Hazard Area. The County participates in a variety of Public Outreach events for various hazards that could impact Orange County property and citizens, including holding an annual Hurricane Expo to provide information on risk, preparedness, and property protection options. County staff offer technical assistance and make site visits to review local flood concerns and drainage complaints.

CRS Credit

Orange County currently receives credit under Activity 360 – Flood Protection Assistance for providing site specific flood and flood related data to interested property owners and annually publicizing the service.

Program for Public Information

A Program for Public Information (PPI) is an ongoing public information effort to design and transmit the messages that the community determines are most important to its flood safety and the protection of its

APPENDIX B: MITIGATION STRATEGY

floodplains’ natural functions. It is a review of local conditions, local public information needs, and a recommended plan of activities. A PPI consists of the following parts:

- The local flood hazard
- The property protection measures appropriate for the flood hazard
- Flood safety measures appropriate for the local situation
- The public information activities currently being implemented within the community, including those being carried out by non-government agencies
- Goals for the community's public information program
- The outreach projects that will be done each year to reach the goals
- The process that will be followed to monitor and evaluate the projects

Local Implementation

The development of a PPI for Orange County is underway in conjunction with this 2017 FMP.

CRS Credit

The CRS provides credit for a PPI under Activity 330 – Outreach Projects.

Table B.6 – Public Information and Outreach Mitigation Options and Recommended Projects

Action #	Mitigation Action	Reason for Pursuing / Not Pursuing	Funding
Public Information and Outreach Measures Considered by FMPC			
-	Work to improve flood insurance coverage in the community.	Will be pursued through specific outreach events, including Hurricane Expo and partnership with home improvement stores.	n/a
-	Work with Insurance and Real Estate Agents to educate them on flood risk.	Will be achieved through the development of a PPI.	n/a
Public Information and Outreach Measures and Funding Recommended for Implementation			
1	Continue to hold the Orange County Hurricane Expo to provide preparedness information to County residents.	The Hurricane Expo is an ongoing event to provide residents with information on hurricane risk, preparedness, and property protection.	Operating budget
2	Speak to Homeowners Associations about flood hazard preparedness and mitigation options.	Homeowners Association meetings offer an opportunity to meet with residents and share information about flood hazard risk, preparedness, and mitigation options.	Operating budget
3	Send outreach brochure to residents of the SFHA, Repetitive Loss Areas, and to HOAs.	Information on flood risk, preparedness, and mitigation options will reach those who need it most.	Operating budget
14	Establish an annual Flood Awareness Week.	Establishing an annual flood awareness week will help to prevent residents from getting complacent about flood risk even during years when there are no flood events.	Operating budget

APPENDIX C: REFERENCES

Orange County Florida Comprehensive Plan, 2016.

Orange County Code of Ordinances.

Orange County Local Mitigation Strategy, 2009.

Orange County Local Mitigation Strategy, 2016.

Orange County Stormwater Management Report, 2014.

Orange County Sustainability Plan, 2015.

Orange County Infill Master Plan, 2008.

State of Florida Hazard Mitigation Plan, August 2013.

State of Florida Critical Erosion Report, June 2012.

Geosyntec Consultants, Emergency Action Plan for Michaels, Banner and Cheney Dams, Preliminary Results December 2016.

Orange County Flood Insurance Study, 2009.

Orange County Flood Insurance Study, 2015.

Orange County Capital Improvement Program, FY2016-2020.

FEMA/ISO. Repetitive Loss and Flood Insurance Data.

Orange County Comprehensive Emergency Management Plan, 2013.

Regional Assessment of Tsunami Potential in the Gulf of Mexico: U.S. Geological Survey Administrative Report. 2009.

Sea Level Change Considerations for Civil Works Programs: United States Army Corps of Engineers Circular No. 1165-2-212. 2011.

National Research Council 1987 National Research Council (1987) Responding to Changes in Sea Level: Engineering Implications. National Academy Press: Washington, D.C.

IPCC, 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

APPENDIX C: REFERENCES

IPCC, 2007a. Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. A-2 EC 1165-2-212 1 Oct 11 Miller, eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, 2007b. IPCC Fourth Assessment Report Annex 1: Glossary. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, 2007c. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change." (M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden and C. E. Hanson, eds.). Cambridge University Press, Cambridge, UK.

Union of Concerned Scientists. Encroaching Tides: How Sea level Rise and Tidal Flooding Threaten U.S. East and Gulf Coast Communities over the Next 30 Years. October 2014.

South Florida Water Management District. Climate Change & Water Management in South Florida. November 2009.

National Oceanic and Atmospheric Agency (NOAA) National Climatic Data Center, Storm Events Database, 2017.

U.S. Census Bureau, American Community Survey 2015 Five-Year Estimates.

U.S. Census Bureau, 2010 Census.

Stockdon, H.F., Doran, K.J., Thompson, D.M., Sopkin, K.L., and Plant, N.G., 2013, National Assessment of Hurricane-Induced Coastal Erosion Hazards: Southeast Atlantic Coast: U.S. Geological Survey Open-File Report 2013-1130, 28 p., <http://pubs.usgs.gov/of/2013/1130>.

U.S. Army Corps of Engineering, National Inventory of Dams, 2017.

U.S. Army Corps of Engineering, National Levee Database, 2017.

Climate Central. 2014. Surgingseas.org/

Federal Emergency Management Agency, Community Information System, 2017.

Federal Emergency Management Agency, What is a Levee Fact Sheet, August 2011.

Department of Atmospheric Sciences at the University of Illinois at Urbana-Champaign.

Global Climate Change Impacts in the United States. Karl, T.R., J. M. Melillo, and T. C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA. 2009.

Orange County, Florida
Floodplain Management Plan
December 2017

APPENDIX C: REFERENCES

NOAA Weather Prediction Center. (n.d.). Hurricanes and extreme rainfall.
http://www.wpc.ncep.noaa.gov/research/mcs_web_test_test_files/Page1637.htm



REPETITIVE LOSS AREA ANALYSIS

Orange County, Florida

May 2018

County Version



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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.

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 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. According to a 2008 Government Accountability Office (GAO) report, repetitive loss properties represent only 1 percent of all policies, but have accounted for about 30 percent of claims paid. A 2014 follow up GAO report found that the number of repetitive loss structures is growing.



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. However, 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 these properties.

Orange County (CID-120179) has been a regular participant in the NFIP since December 1, 1981. In addition to meeting the basic requirements of the NFIP, the County has completed additional components to participate in the Community Rating System (CRS) program. Orange County is currently a CRS Class 5 which rewards all policyholders in the SFHA with a 25 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. Orange County has been participating in the CRS program since October 1, 1991.

As of June 21, 2017, there are currently 9,859 NFIP Policies in force in Orange County with insurance coverage of nearly \$2.489 billion. The County has 233 paid losses against the NFIP totaling more than \$2.8 million with 11 of those losses being substantial damage claims since 1978.

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 with 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 Orange County are currently insured (see the Repetitive Loss Requirement Section).

According to repetitive loss data received from FEMA in September 2016, there are a total of 10 unmitigated and 4 mitigated repetitive loss properties within Orange County. One of these properties is classified as severe repetitive loss, and it remains unmitigated. The county is completing the process of mitigating another of these properties through acquisition and demolition. An updated Activity 510 Floodplain Mitigation Plan (FMP) is currently under development for the County. Since the FMP examines flooding issues as a whole within Orange County and does not assess individual properties, the County has opted to complete a Repetitive Loss Area Analysis (RLAA) using the 2017 *CRS Coordinator's Manual*. The RLAA will benefit the County by examining potential mitigation measures for specific repetitive loss areas and increasing its credit in the CRS Program.

Setting

Orange County is an inland county in central Florida, home to 22 unincorporated communities in addition to the City of Orlando, which is the County seat, and 12 other incorporated municipalities. This analysis covers only the unincorporated areas of Orange County. The County is bordered to the north and northwest by Seminole and Volusia Counties; south and southwest by Osceola and Polk Counties; east by Brevard County, and west by Lake County. According to the U.S. Census Bureau, Orange County (including all incorporated areas) has a total area of 1,003 square miles, of which 903 square miles is land and 100 square miles (9.9% of total area) is water.

Figure 1.1 depicts Orange County's location within the State as well as the incorporated municipalities. Figure 1.2 depicts the major drainage basins that cover the County.

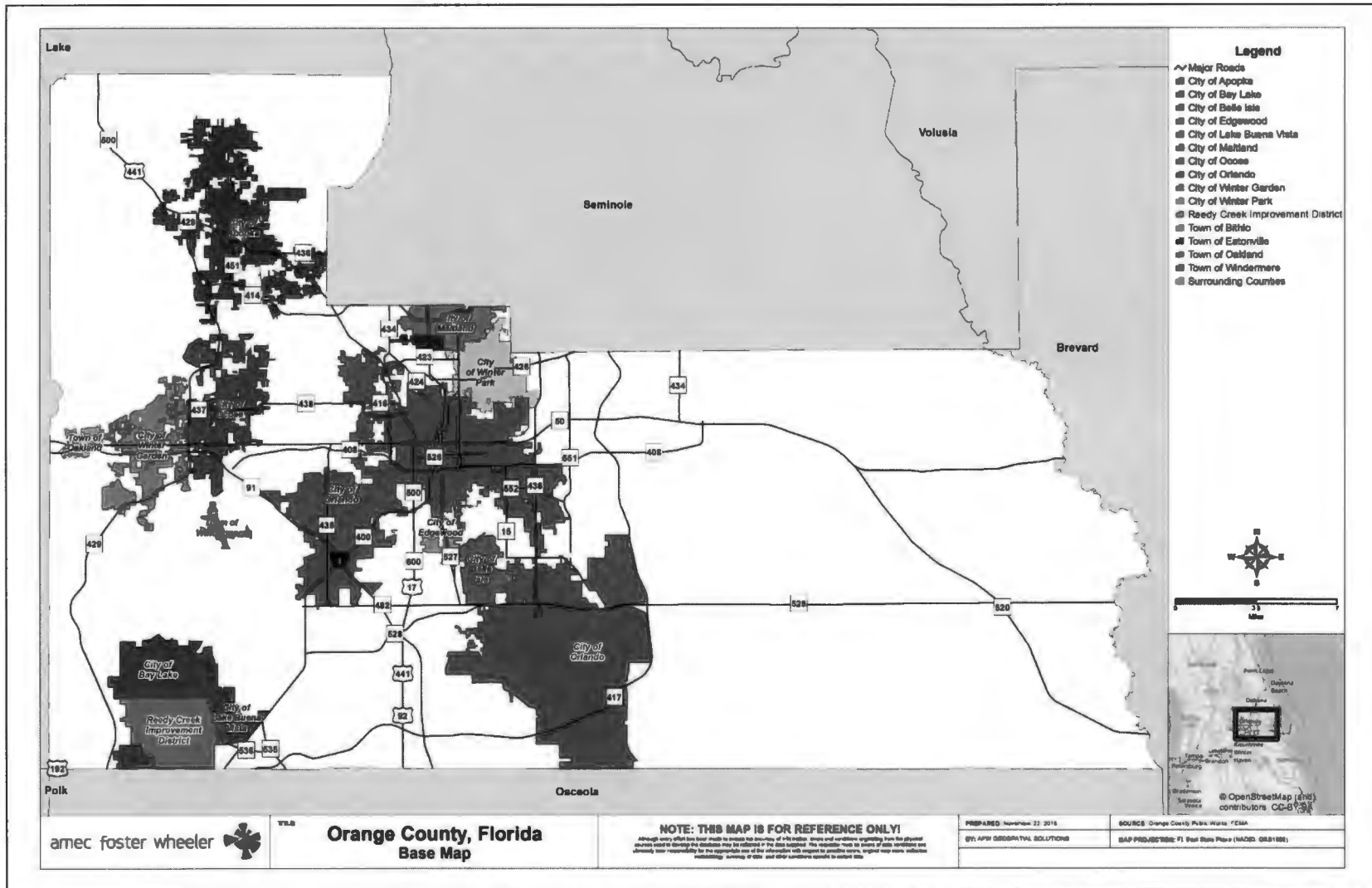


Figure 1.1 – Orange County Location Map

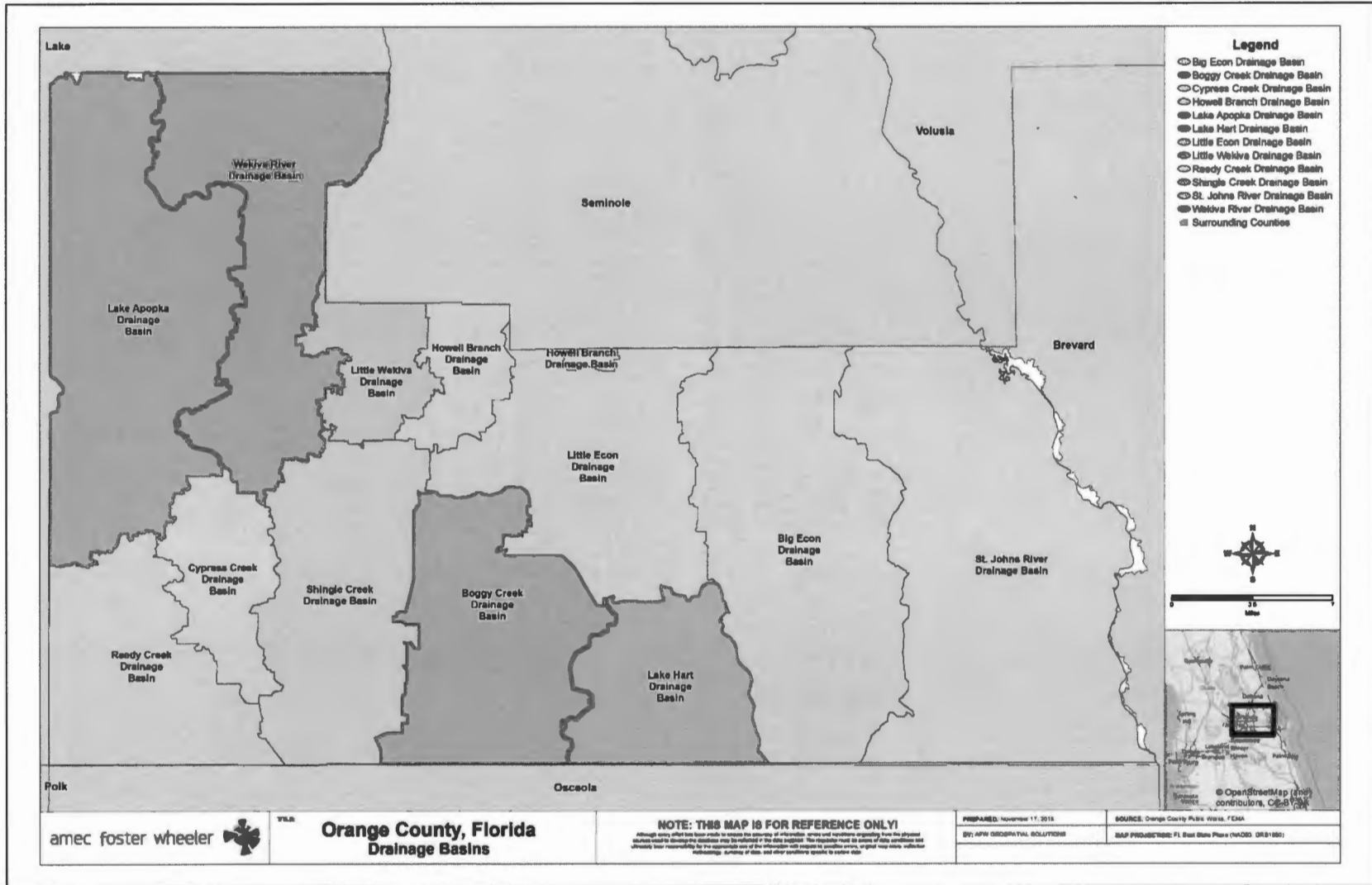


Figure 1.2 – Orange County Drainage Map

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 50, 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 50 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 FEMA for Orange County contained a total of 10 unmitigated repetitive loss properties, the County is designated as a Category B repetitive loss community. Note: one of these 10 properties is already undergoing mitigation by the County through acquisition and demolition. Therefore, for the purpose of this assessment, there are considered to be nine unmitigated repetitive loss properties.

Mapping Repetitive Loss Areas

Nine Repetitive Loss Areas were identified within Orange County in accordance with the principles outlined in the CRS guidance titled *Mapping Repetitive Loss Areas* dated August 15, 2008. The 9 Repetitive Loss Areas included the 9 unmitigated repetitive loss properties and an additional 23 properties identified by reviewing historic loss properties (those with one paid claim against the NFIP) and properties that have the same or similar flood conditions but have not had any claims paid against the NFIP. Therefore, a total of 32 properties were included within this RLAA.

A detailed map of each Repetitive Loss Area is provided in Section 2. An overview map of the Orange County Repetitive Loss Areas is shown in Figure 1.3 on the following page.

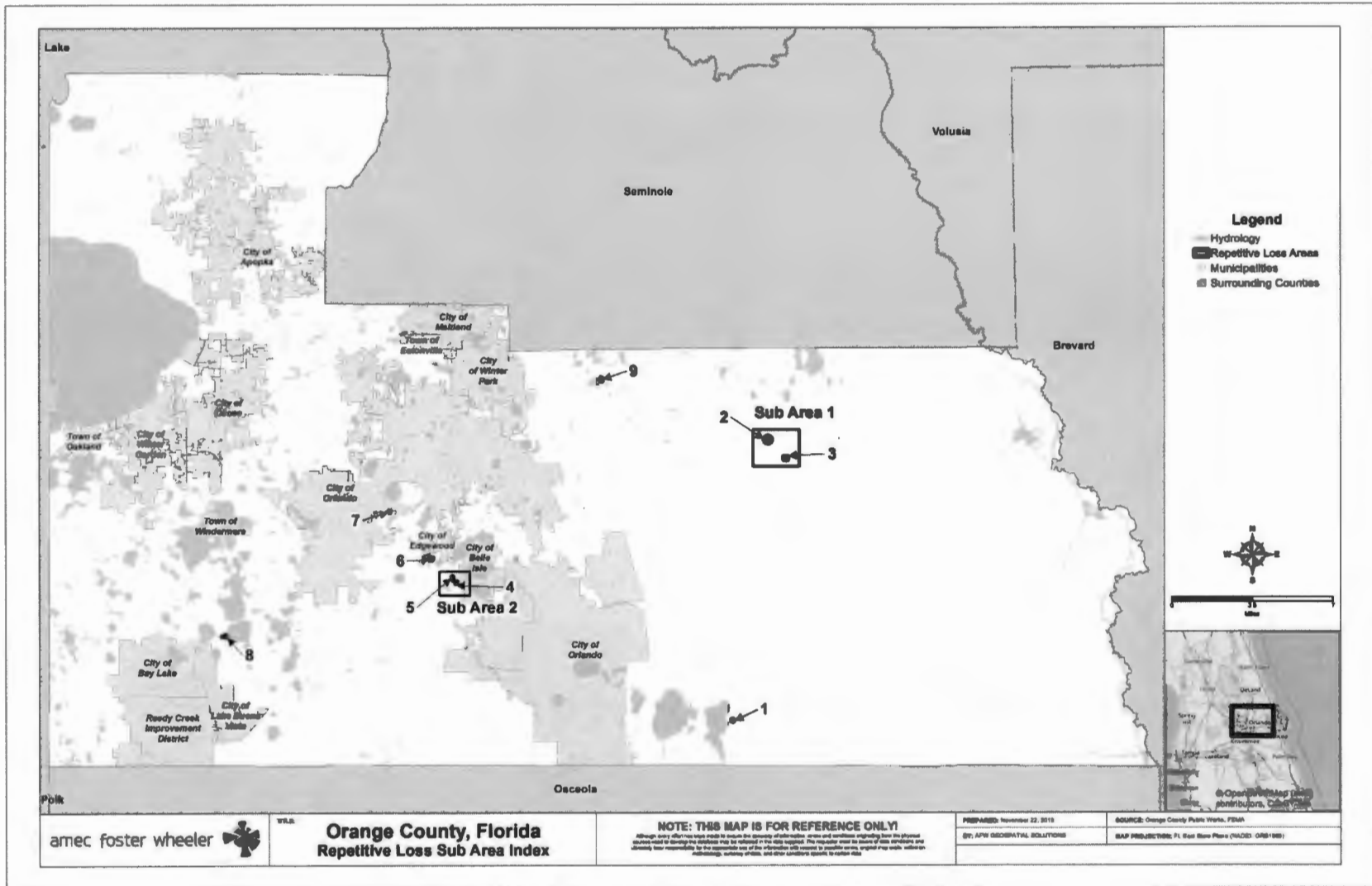


Figure 1.3 – Orange County Repetitive Loss Areas

2 The RLAA Process

The RLAA planning process incorporated requirements from Section 510 of the 2017 *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 or 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 in the repetitive loss area 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.a. 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 nine identified Repetitive Loss Areas. Figure 2.1 on the following page shows an example of the property owner notification letter. Letters were mailed to property owners of all 32 identified properties within the repetitive loss areas, including historical claims properties (those with one paid claim against the NFIP) and additional properties with similar flooding conditions but which have no claims paid against the NFIP. The letters were mailed on March 28th, 2018. Copies of all mailed letters are maintained on file with the Orange County Stormwater Management Division. In accordance with the Privacy Act of 1974, the letters will not be shared with the general public.

Mailed Questionnaire

A property owner questionnaire was included with each letter mailed to building owners. 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 2.2 and 2.3 on the following pages.



[DATE]

[NAME]

[ADDRESS]

[CITY], FL

Property Address: XXXXXX

Parcel Number: 1234567890

Dear Property Owner:

As part of Orange County's participation in the National Flood Insurance Program's (NFIP) Community Rating System (CRS), the Public Works 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, Orange County 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 Public Works Department or by calling (407) 836-7743.

You can help us perform this analysis by **completing this questionnaire and returning to me at Stormwater Management Division, 4200 South John Young Parkway, Orlando, FL 32839**. If you have any questions, please call me at (407) 836-7743.

Sincerely,

Daniel Negron, M.Eng., P.E., CFM
Senior Engineer
Orange County Public Works

Figure 2.1 – Example RLAA Property Notification Letter



REPETITIVE LOSS PROPERTY QUESTIONNAIRE

Name: _____

Property Address: _____

1. How many years have you lived in the home/building at this address?

<input type="checkbox"/> Less than 1	<input type="checkbox"/> 5-10 years
<input type="checkbox"/> 1-5 years	<input type="checkbox"/> 10+ years

2. Do you rent or own this home/building?

<input type="checkbox"/> Rent
<input type="checkbox"/> Own

3. What type of foundation does the home/building have?

<input type="checkbox"/> Slab	<input type="checkbox"/> Basement
<input type="checkbox"/> Crawl Space	<input type="checkbox"/> Other: _____

4. Has this home/building or property ever been flooded or had a water problem?

<input type="checkbox"/> Yes
<input type="checkbox"/> No (If "no", please skip to question 9)

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

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

<input type="checkbox"/> In basement: _____ deep	<input type="checkbox"/> Over 1 st floor: _____ deep
<input type="checkbox"/> In crawl space: _____ deep	<input type="checkbox"/> In yard only: _____ deep
<input type="checkbox"/> Water was kept out of house by sandbagging, sewer valve, or other protective measure	

7. What was the longest time that water stayed in the house/building? _____

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

<input type="checkbox"/> Storm sewer backup	<input type="checkbox"/> Saturated ground / leaks in basement walls
<input type="checkbox"/> Sanitary sewer backup	<input type="checkbox"/> Overbank flooding from: _____
<input type="checkbox"/> Standing water next to house/building	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Drainage from nearby properties	

9. Have you installed any flood protection measures on the property?

<input type="checkbox"/> Sump pump	<input type="checkbox"/> Backup power system / generator
<input type="checkbox"/> Waterproofed the outside walls	<input type="checkbox"/> Sandbagged
<input type="checkbox"/> Re-graded yard to keep water away	<input type="checkbox"/> Other: _____
<input type="checkbox"/> Moved things out of basement	

Figure 2.2 – RLAA Survey, Page 1



**REPETITIVE LOSS PROPERTY
QUESTIONNAIRE (CONTINUED)**

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

11. Do you have FEMA Flood Insurance?

- Yes
- No
- I don't know

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

- Yes
- No

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

Please help us by completing this survey and returning it to:

Daniel Negron, Senior Engineer
Orange County Public Works Administration Building
4200 South John Young Parkway
Orlando, FL 32839

Surveys can also be emailed to Daniel.Negron@ocfl.net

Figure 2.3 – RLAA Survey, Page 2

Of the 32 mailed notification letters and questionnaires, Orange County received three responses which corresponds to a response rate of approximately nine percent. The questionnaire responses are summarized below. Note: Respondents may have skipped questions and/or provided more than one response to a question.

Q1: How many years have you occupied the building at this address?

Answer Choices	Number Responding
Less than 1	0
1-5	1
5-10	0
10+	2
Total	3

Q2: Do you rent or own this building?

Answer Choices	Number Responding
Rent	0
Own	3
Total	3

Q3: What type of foundation does the building have?

Answer Choices	Number Responding
Slab	2
Crawl Space	1
Basement	0
Other	0
Total	3

Q4: Has this building or property ever been flooded or had a water problem?

Answer Choices	Number Responding
Yes	2
No	1
Total	3

Q5: In what year(s) did it flood?

- 2004, 2005, 2017
- 2003, 2004, 2012, 2017

Q6: Where did you get water and how deep did it get?

Answer Choices	Number Responding
In basement	0
In crawl space	0
Over 1 st floor	1
In yard only	1
Water was kept out of house by sandbagging, sewer valve, or other protective measure	0
Total	2

Q7: What was the longest time that water stayed in the house/building?

- Never in house – yard only
- 24 hrs

Q8: What do you feel was the cause of your flooding? Check all that affect your home/building.

	Number Responding
Storm sewer backup	0
Sanitary sewer backup	0
Standing water next to house/building	1
Drainage from nearby properties	2
Saturated ground / leaks in basement walls	0
Overbank flooding from: _____	0
Other	1
Total	4

Other: Ditch maintenance

Q9: Have you installed any flood protection measures on the property?

Answer Choices	Number Responding
Sump pump	1
Waterproofed the outside walls	0
Re-graded yard to keep water away	0
Moved things out of basement	0
Backup power system / generator	2
Sandbagged	1
None	1
Other	0
Total	5

Q10: Did any of the measures checked in item 9 work? If so, which ones? If not, do you know why they did not work?

- Yes - Generator to power house, well pump, and sump pump
- No

Q11: Is your building located in a Federal Emergency Management Agency (FEMA) floodplain?

Answer Choices	Number Responding
Yes	0
No	3
I don't know	0
Total	3

Q12: Do you have FEMA Flood Insurance?

Answer Choices	Number Responding
Yes	0
No	3
I don't know	0
Total	3

Q13: Do you want information on protecting your building from flooding?

Answer Choices	Number Responding
Yes	2
No	1
Total	3

Q14: Please include any additional information and comments you may have about flooding in your area:

- Lousy drainage ditch maintenance. Many pipes are crushed at inlets and impede proper water flow

The County did not receive enough survey responses to draw any general trends or conclusions about repetitive flooding or mitigation options. However, the County can still use these returned surveys to follow up with property owners about their specific flood issues and provide individual advice and assistance. Any surveys received after the posted deadline may also be used in this way.

STEP 2. Contact Agencies and Organizations

Orange County 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 reports which were analyzed and reviewed included:

- Orange County Code of Ordinances
 - Zoning Ordinance
 - Subdivision Regulations
 - Open Space Ordinance
 - Floodplain Management Ordinance
 - Stormwater Management Ordinance
- Orange County Local Mitigation Strategy, 2009
- Orange County Local Mitigation Strategy, 2016
- Orange County Florida Comprehensive Plan, 2016
- Orange County Comprehensive Plan Stormwater Management Element, 2009
- Orange County Stormwater Management Report, 2014
- Orange County Infill Master Plan, 2008
- State of Florida Hazard Mitigation Plan, August 2013
- State of Florida Critical Erosion Report, June 2012
- Little Econ Dam Report and Emergency Action Plan
- Orange County Flood Insurance Study, 2009
- Orange County Flood Insurance Study, 2015
- Orange County Capital Improvement Program, FY2016-2020
- Engineering Evaluation of Repetitive Loss Properties, Technical Memorandum, 2012
- FEMA/ISO – Repetitive Loss and Flood Insurance Data, 2016

Summary of Studies and Reports

FEMA Flood Insurance Study

FEMA most recent FIS for Orange County, FL is in preliminary phase and is dated October 30, 2015. The FIS revises and updates information on the existence and severity of flood hazards within the County. The FIS also includes revised digital Flood Insurance Rate Maps (FIRMs) which reflect updated Special Flood Hazard Areas (SFHAs) and flood zones for the County.

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 2016 – 2020 Capital Improvement Program presents the five-year capital plan for Orange County. This planning document is a five-year outlook for anticipated capital projects designed to facilitate decision makers in the replacement of capital assets. The projects are primarily related to improvement in public service, parks and recreation, public utilities and facilities. Stormwater Management accounts

for \$8.9M of the total \$54M in projected funding needs for the 2016/2017 fiscal year. These stormwater projects account for \$82.9m of the \$4.25b budgeted through the CIP.

Orange County Comprehensive Plan, Adopted 2009, Updated 2016

The Orange County 2010 - 2030 Comprehensive Plan is intended to ensure that in the future, Orange County develops and grows in ways that enhance the community's vitality and overall quality of life. It builds on the existing conditions and trends in the community, and lays out objectives and policies to meet the community's goals. The Plan addresses numerous facets of the community, including future land use, conservation, open space, and stormwater management.

Orange County Local Mitigation Strategy, Updated 2016

The primary reason for developing a hazard mitigation plan is to reduce a community's exposure to natural hazards by taking proactive, pre-disaster planning steps to limit development in hazard sensitive areas, particularly floodplain or flood hazard areas. The second reason is to comply with the hazard mitigation planning requirements established by the Federal Emergency Management Agency (FEMA) and the Florida Division of Emergency Management. Orange County adopted its updated Local Mitigation Strategy 2016. The LMS contains multiple new mitigation actions for the County related to flood hazards, including improving stormwater drainage measures, retrofitting flood control devices, elevating structures in the floodplain, and clearing waterways of debris.

Orange County Comprehensive Emergency Operations Plan, 2013

The purpose of the County's Comprehensive Emergency Operations Plan (CEMP) is to establish the operations protocol for all emergencies and disasters in Orange County. The CEMP defines responsibilities for all levels of emergency response. The plan is not limited to response and recovery activities, but instead addresses all five phases of emergency management, including prevention, preparedness, and mitigation. Mitigation is also built into the process for post-disaster recovery through development regulations, planning, and funding limitations.

Engineering Evaluation of Repetitive Loss Properties, 2012

This technical memorandum prepared for Orange County by Singhofen & Associates, Inc. in 2012 provides a detailed analysis of nine repetitive loss properties in the county and recommends mitigation options. The findings of this report were used to supplement the research and field observations conducted for this Repetitive Loss Area Analysis.

STEP 3. Building Data Collection

The on-site field survey for this analysis was conducted on April 12, 2018 and April 20, 2018. 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 A. (Note: In accordance with the Privacy Act of 1974, Appendix A 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
- Likely areas and severity of damage on property
- Presence of any HVAC units that would be vulnerable

Table 2.1 details the percentage of each repetitive loss area that falls within the 100-year, 500-year or Unshaded Zone X flood zone.

Table 2.1 – Repetitive Loss Area Percentage by Flood Zone

Repetitive Loss Area	Percentage of Area		
	Zone AE or Zone A 100-yr	Zone X Shaded 500-yr	Zone X Unshaded
1	0%	0%	100%
2	76.8%	9.6%	13.6%
3	89.5%	10.5%	0%
4	0%	0%	100%
5	0%	0%	100%
6	47.1%	0%	52.9%
7	0%	0%	100%
8	20%	0%	80%
9	19.5%	0%	80.5%

Source: 9/25/2009 DFIRM

Problem Statement 1

Riverine Flooding

Two of the nine identified Repetitive Loss Areas are located within the Big Econ Drainage Basins along the Econlockhatchee River. All or portions of these Repetitive Loss Areas are located within the 100-/500-year floodplain. The approach to reducing repetitive flooding in these areas will require a combination of floodproofing techniques, education, and drainage improvement projects. Alternatively, acquisition or relocation may also be appropriate in these areas.

Much of the repetitive loss flooding in these areas results from prolonged heavy rainfall and causes damage to residential and commercial buildings. Flash flooding can occur if conveyance is obstructed by debris, sediment and other materials that limit the volume of drainage.

Some losses are due to heavy rainfall associated with hurricanes and tropical storms. Orange County was recently affected by Hurricane Matthew in 2016 and Hurricane Irma in 2017. Some of the losses also date back to Hurricane Charlie in 2004 and before.

Subarea 1

Repetitive Loss Area 2 is located almost completely within the 100-yr and 500-yr floodplain. The Econlockhatchee River flows directly through this Repetitive Loss Area. Only one property is located in this repetitive loss area; further investigation during field data collection did not find that other nearby properties faced similar flood conditions.

Repetitive Loss Area 3 is located entirely within the 100-yr and 500-yr floodplain. The Econlockhatchee River flows northeast of this Repetitive Loss Area. A drainage canal runs along the road in front of these properties.

Table 2.2 – Subarea 1 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
2	1	0	0	1	Hamilton Drive, Lockwood Drive
3	1	0	2	3	Bearle Road
Total	2	0	1	4	

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

One occupant in this subarea stated that during the last hurricane there was 5 feet of water on their property. Of those structures observable from the street, two have their first-floor elevation below grade. All of the observable structures are wood frame, with a mix of crawlspace, pier/post/column, and slab on grade foundations. One HVAC unit was seen elevated above the first-floor elevation.

Subarea 1 contains 4 properties. The Repetitive Loss Areas are shown in relation to FEMA flood zones in Figure 2.4 and Figure 2.5 on the following pages.

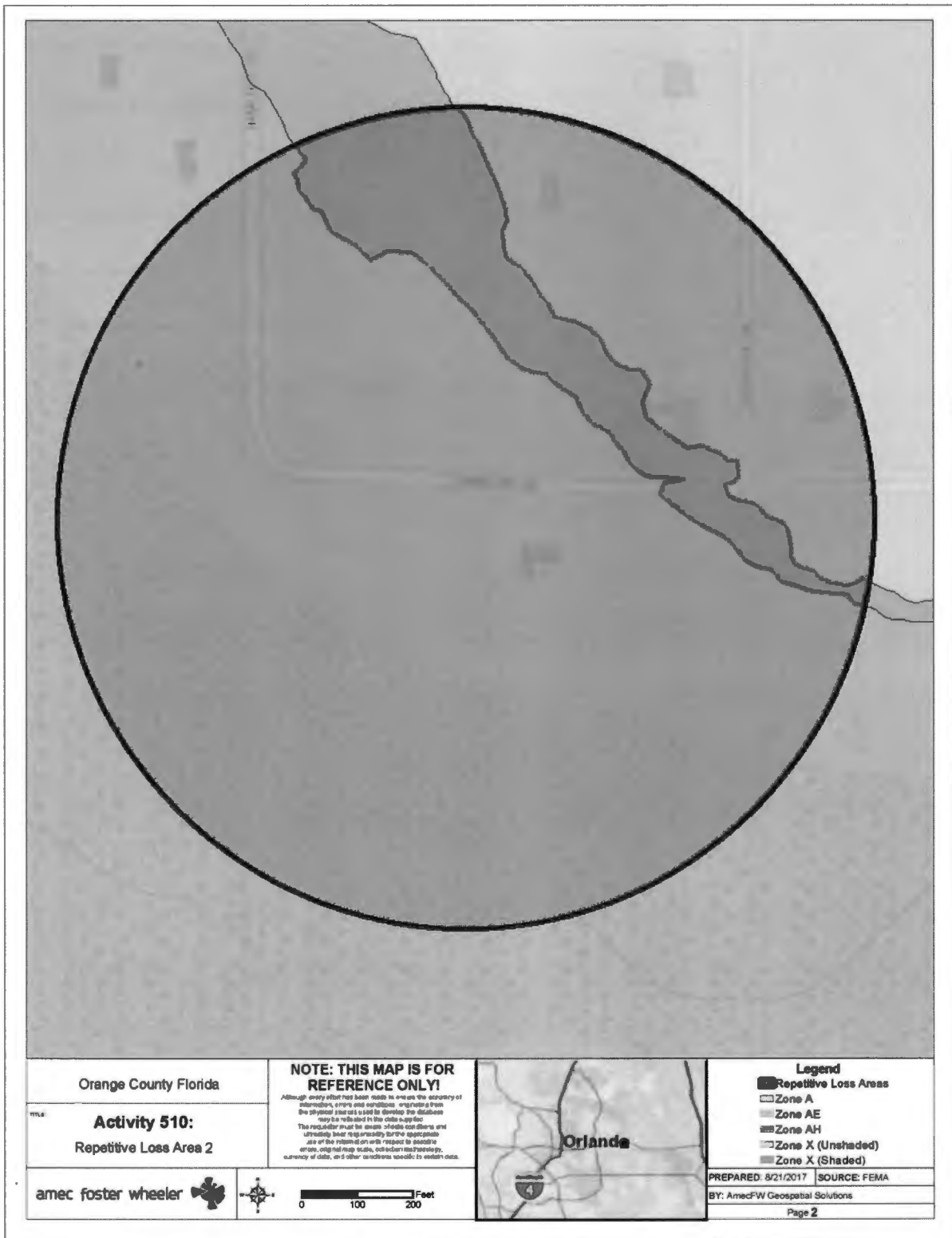


Figure 2.4 – Repetitive Loss Area 2



Figure 2.5 – Repetitive Loss Area 3

Example Properties



Structure elevated above grade with crawl space



Drainage ditch along roadway



Split-level structure with first-floor below grade

STEP 4. Review Alternative Mitigation Approaches

Mitigation Alternatives

According to the 2017 CRS Coordinator's Manual, mitigation measures should fall into one of the following floodplain management categories:

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

Property protection is essential to mitigating repetitive loss properties and reducing future flood losses. There are many ways to protect a property from flood damage. Property protection measures recognized in the 2017 CRS Coordinator's Manual include relocation, acquisition, building elevation, retrofitting, sewer backup protection, and insurance. Different measures are appropriate for different flood hazards, building types and building conditions. Figure 2.6 below, found in the 2017 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 floodproof the building so water cannot get into it.
- Wet floodproof 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: 2017 CRS Coordinators Manual.

Figure 2.6 – Typical Property Protection Measures

For this riverine flooding problem area, undergoing significant property protection measures to remove the properties from flood risk, either through elevation or through acquisition and demolition, is the only way to avoid future flood losses. Providing flood protection through structural projects may eliminate some building damage and road closures in these areas, but cannot guarantee that future flood losses will be avoided. These structural methods require large capital expenditures and cooperation from private property owners and therefore may be difficult to implement. Promoting floodproofing techniques and flood insurance and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in this area. The County's websites, e-mail distribution lists, and press releases can help get these messages out to residents.

Mitigation Funding

There are several types of mitigation measures, listed in Table 2.3, 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 2.3 – 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
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

Potential Mitigation Measures

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. This alternative is limited in central Florida.
- For basements, especially with combined storm sewer and sewer systems, backflow preventer valves can prevent storm water and sewer from entering crawlspaces and basements. Not viable in central Florida.
- Acquire and/or relocate properties; target abandoned properties.
- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE.
- 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.

- Install drain pumps in lakes to reduce lake levels.

Non-Structural Alternatives:

- Relocate internal supplies especially chemicals and other products/goods above the flooding depth.
- Improve the County's floodplain and zoning ordinances to expand conservation and open space areas.
- Consider expanding riparian impervious surface setbacks.
- Increase public education through posting information about local flood hazards on County website, posting signs at various locations in neighborhoods, or discussing flood protection measures at homeowner's association meetings and other County events.
- Promote the purchase of flood insurance even in X or C Zones.
- Implement volume control and runoff reduction measures in the County's Stormwater Management Ordinance.

Current Mitigation Projects

Watershed Master Plans

The County maintains master plans on all major watersheds in the County. As far as those watersheds containing repetitive loss areas, the County is currently updating master plans for the Big Econ, Cypress Creek, Little Econ, Shingle Creek, Boggy Creek and Lake Hart watersheds. The Reddy Creek and Lake Apopka basin watershed master plans have already been updated. Updating the plans involves surveying and studying the watersheds using LiDAR data, modeling the flood conditions, mapping the floodplains, and evaluating their level of service. Once complete, the plans serve as a valuable tool for understanding flood risk in the County and planning drainage improvements and other mitigation measures.

Advantages and Disadvantages of Mitigation Measures

Seven primary mitigation measures are discussed here: acquisition, relocation, barriers, floodproofing, drainage, elevation, and insurance. In general, the cost of acquisition and relocation will be higher than other mitigation measures but can completely mitigate risk of 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 and may impact flood risk on other properties. Where drainage issues are the source of repetitive flooding, drainage improvements can provide flood mitigation benefits to multiple properties. Each of these solutions is discussed in greater detail below.

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

Table 2.4 – Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.5 – Advantages and Disadvantages of Relocation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.6 – Advantages and Disadvantages of Barriers

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.7 – Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors. 	<ul style="list-style-type: none"> • 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 2.8 – Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program. 	<ul style="list-style-type: none"> • 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 2.9 – Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
<ul style="list-style-type: none"> • Could 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. 	<ul style="list-style-type: none"> • 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 2.10 – Advantages and Disadvantages of Elevation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

NOTE: Elevating a structure with a slab-on-grade foundation can cost over 30 percent more than elevating a structure on a crawlspace foundation. Many of the properties located in Orange County's Repetitive Loss Areas have slab-on-grade foundations, which may mean this mitigation alternative will be cost-prohibitive.

Flood Insurance:

Insurance differs from other property protection activities in that it does not mitigate or prevent damage caused by a flood. However, flood insurance does help the owner repair and rebuild their property after a flood, and it can enable the owner to afford incorporating other property protection measures in that process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without requiring human intervention for the measure to work.

Table 2.11 – Advantages and Disadvantages of Flood Insurance

Advantages	Disadvantages
<ul style="list-style-type: none"> • Provides protection outside of what is covered by a homeowners' insurance policy. • Can help to fund other property protection measures after a flood through increased cost of compliance (ICC) coverage. • Provides protection for both structure and contents. • Can be purchased anywhere in a community, including outside of a flood zone. 	<ul style="list-style-type: none"> • Cost may be prohibitive. • Policyholders may have trouble understanding policy and filing claims. • Does not prevent or mitigate damage.

STEP 5. Conclusion and Recommendations

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, it is recommended that Orange County implement additional mitigation measures for these Repetitive Loss Areas. Table 2.12 examines past and current mitigation actions throughout the County that may be relevant in this area.

Table 2.12 – Past and Current Mitigation Actions

Past and Current Mitigation Actions	
1	The County is undergoing watershed master planning to better plan for future drainage improvements.
2	The County has previously eliminated four properties from the repetitive loss list through flood protection and is in the process of mitigating another repetitive loss property through acquisition and demolition.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense, including one property owner building a floodwall on their property.
4	The County has undertaken capital improvement projects to improve drainage and conducts stormwater drainage system maintenance including installation of drain pumps in lakes to lower levels.

Prioritization

In order to facilitate the implementation of the following recommended mitigation actions, a prioritization schedule is included based on the following:

- Cost
- Funding Availability
- Staff Resources
- Willingness of Property Owner to Participate
- Additional Planning Requirement

The priority rating for the following mitigation actions is summarized in Table 2.13. Each of the above prioritization variables was rated on a scale of 1 to 5, with 5 indicating the greatest difficulty for implementation. The weight of each variable is indicated in the prioritization table. Those mitigation actions with the lowest overall priority scores are expected to be the easiest to implement and should therefore be implemented first. An overall priority rating of high, medium, or low is assigned to each recommended action, using the following scale:

- High Priority (should be completed within 2 years): Score of 0.00 – 1.99
- Medium Priority (should be completed within 2 to 4 years): Score of 2.00 – 3.99
- Low Priority (should be completed within 4 to 5 years): Score of 4.00 – 5.00

Recommendations

The following recommendations detail the actions the County will take to reduce flooding and flood losses in these Repetitive Loss Areas. Flood protection measures will be the most effective in these areas; therefore, the County will target these Repetitive Loss Areas for building acquisition and demolition projects. The County will also discuss the possibility of building elevation with homeowners who don't want to sell their homes. Given that acquisition can be a lengthy process and floods can occur at any time, the County will pursue other alternatives in the interim, including encouraging property owners to use

floodproofing measures to help protect lower levels of their property. The County 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.

Mitigation Action 1: Flood Insurance Outreach

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The County will continue, on an **annual basis**, to target all properties in the repetitive loss areas reminding them of the advantages of maintaining flood insurance through its annual outreach effort. Repetitive Loss Areas are a target area in the County's Program for Public Information (PPI).

Responsibility

The County's Public Works Department Stormwater Management Division will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas through annual outreach and other efforts.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 2: Property Protection Outreach

Property owners should not store personal property in basements and crawl spaces and lower levels of buildings since personal property is not covered by a flood insurance policy without contents coverage. The County will increase its outreach efforts on an **annual basis** for the identified repetitive loss areas to include this specific information in the outreach materials.

Responsibility

The County's Public Works Department Stormwater Management Division will provide suggestions of floodproofing techniques to all property owners within the repetitive loss areas.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 3: Floodproofing

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

Responsibility

The County's Public Works Department Stormwater Management Division will promote effective flood protection and floodproofing measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost of flood protection measures 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 County's operating budget.

Priority: Medium

Mitigation Action 4: Acquisition and Demolition

Pursue the acquisition and/or demolition mitigation of high-risk flood-prone properties. The properties in these riverine flooding problem areas that face the greatest flood risk are the highest priorities for this type of mitigation because drainage improvements, barriers, and other major projects are unlikely to provide an adequate level of protection.

Responsibility

The County's Public Works Department Stormwater Management Division 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 County's operating budget.

Priority: Low

Mitigation Action 5: Drainage-Related CIP Projects

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

Responsibility

The County's Public Works Department Stormwater Management Division.

Funding

The cost will be paid for by the County's operating budget.

Priority: Medium

Mitigation Action 6: Flood Protection Assistance

Encourage property owners to elevate inside and outside mechanical equipment above the BFE, install flood resistant materials in crawl spaces, and consider additional flood protection measures such as elevating HVAC units.

Responsibility

The County's Public Works Department Stormwater Management Division will promote effective flood protection measures in an **on-going** program by providing advice and assistance to property owners who may wish to implement such measures.

Funding

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

Priority: Medium

Mitigation Action 7: Watershed Master Plans

Complete the updates to the Boggy Creek and Lake Hart Watershed Master Plans. The floodplain modeling and mapping involved in these projects may assist in better understanding the flood dynamics affecting the repetitive loss areas in these watersheds and help to identify further steps for flood prevention.

Responsibility

The County's Public Works Department Stormwater Management Division will lead the watershed master planning process for all of the County's watersheds.

Funding

The cost will be paid for by the County's operating budget.

Priority: Medium

Prioritization Table

Table 2.13 – Prioritization of Recommended Mitigation Actions

Mitigation Action #	Prioritization Variables (Weight)					Total
	Cost (30%)	Funding Availability (25%)	Property Owner Willingness (20%)	Staff Resources (15%)	Planning Needs (10%)	
1: Flood insurance outreach	2	2	1	1	1	1.55
2: Property protection outreach	2	2	1	1	1	1.55
3: Floodproofing	2	3	4	2	2	2.65
4: Acquisition and demolition	5	3	5	3	4	4.05
5: Drainage-related CIP projects	4	2	2	3	4	2.95
6: Flood protection assistance	2	2	3	2	1	2.10
8: Watershed Master Plans	5	2	1	2	3	2.80

Problem Statement 2

Lake Flooding

Three of the nine identified Repetitive Loss Areas are located near or adjacent to the following lakes: Lake Mary Jane, Lake Irma, and Lake Sheen. These Repetitive Loss Areas are located partially within the 100-/500-year floodplain but are generally subject to periodic flooding from heavy rains causing high lake stages and overbank flooding.

In many cases, flooding in these areas is also the result of inadequate lake outfall and drainage systems. These deficiencies, when coupled with prolonged heavy rainfall, result in flash flooding. Specifically, flash flooding can occur when the capacity of the lake or lake outfall is exceeded or if conveyance is obstructed by debris, sediment and other materials that limit the volume of drainage. In these areas, heavy rains can overwhelm the capacity of the lakes and lake outfalls, causing damage to surrounding buildings and infrastructure.

Some losses are due to heavy rainfall associated with hurricanes and tropical storms. Orange County was recently affected by Hurricane Matthew in 2016 and Hurricane Irma in 2017. Some of the earlier losses can be attributed to Hurricane Charlie in 2004.

The approach to reducing repetitive flooding in these areas will require a combination of floodproofing techniques, education, and drainage improvement projects.

Area 1

Repetitive Loss Area 1 is located in the Unshaded Zone X flood zone near the eastern shore of Lake Mary Jane. Frequent wet and/or flooded conditions with standing water levels 2” to 3” above the ground have been reported in this area. One property owner indicated that drainage from nearby properties and insufficient ditch maintenance causes flooding issues in the area and that up to three feet of water have flooded the yard. The western portion of this area contains some wetland area, which is also where the drainage outfall for Devonshire Road to Lake Mary Jane is located. Flooding in this area was reported to have occurred in 2004, 2005, and 2017. It was noted that all three of the observable HVAC units in this area were not elevated.

Table 2.14 – Area 1 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
1	1	0	3	4	Devonshire Road
Total	1	0	3	4	

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

Area 1 contains 4 properties. The Repetitive Loss Area is shown in relation to FEMA flood zones in Figure 2.7 on the following page.

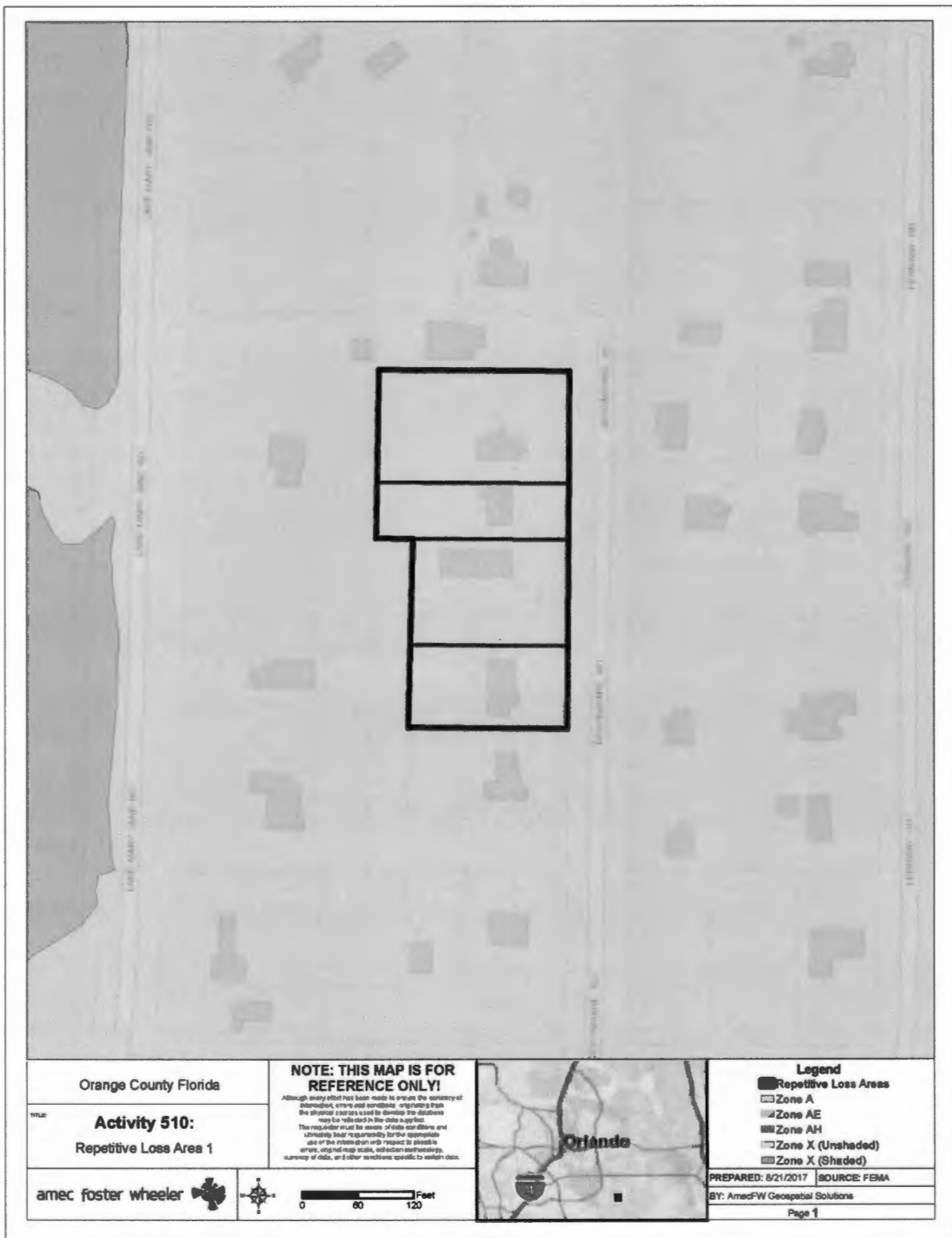


Figure 2.7 – Repetitive Loss Area 1

Example Properties



Drainage feature in front of property near roadway; HVAC unit not elevated



Drainage feature in from of property near roadway



Elevated deck and slab-on-grade foundation

Area 6

Repetitive Loss Area 6 is located partially within the 100-yr and 500-yr floodplain and partially within the Unshaded Zone X. The area is adjacent to Lake Jessamine but flooding occurs typically from the eastern side of the area as a result of inadequate drainage to the lake. These properties all contain residential concrete structures with slab-on-grade foundations. Structures in this area are all elevated less than a foot above grade; however, in one case the surrounding front yard sits higher than the structure. One property owner in this area has attempted to improve drainage on their property by excavating a ditch and removing barriers to the flow of water away from the structure.

Table 2.15 – Area 6 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
6	1	0	2	3	Parkdale Dr.
Total	1	0	2	3	

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

There are three properties in total in Area 6. The Repetitive Loss Area is shown in relation to FEMA flood zones in Figure 2.8 on the following page.



Figure 2.8 – Repetitive Loss Area 6

Example Properties



HVAC unit not elevated



Front yard at higher elevation than structure



Area 8

Repetitive Loss Area 8 is located almost completely within the Unshaded Zone X, however structures in this area are clustered near an area of the 100-yr and 500-yr floodplain near Lake Sheen. Flooding in this area likely occurs during flash flooding events as a result of inadequate drainage to Lake Sheen. Properties in this area were not sufficiently visible from the road for assessment of structural and site characteristics. Based on a review of 2018 Google imagery, all four properties appear to be residential structures, and two of the structures are large, multi-story buildings. A drainage feature runs along the road in front of part of this area.

Table 2.16 – Area 8 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
8	1	0	3	4	Winter Garden Vineland Rd.
Total	1	0	3	4	

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

Area 8 contains a total of four properties. The Repetitive Loss Area is shown in relation to FEMA flood zones in Figure 2.9 on the following page.

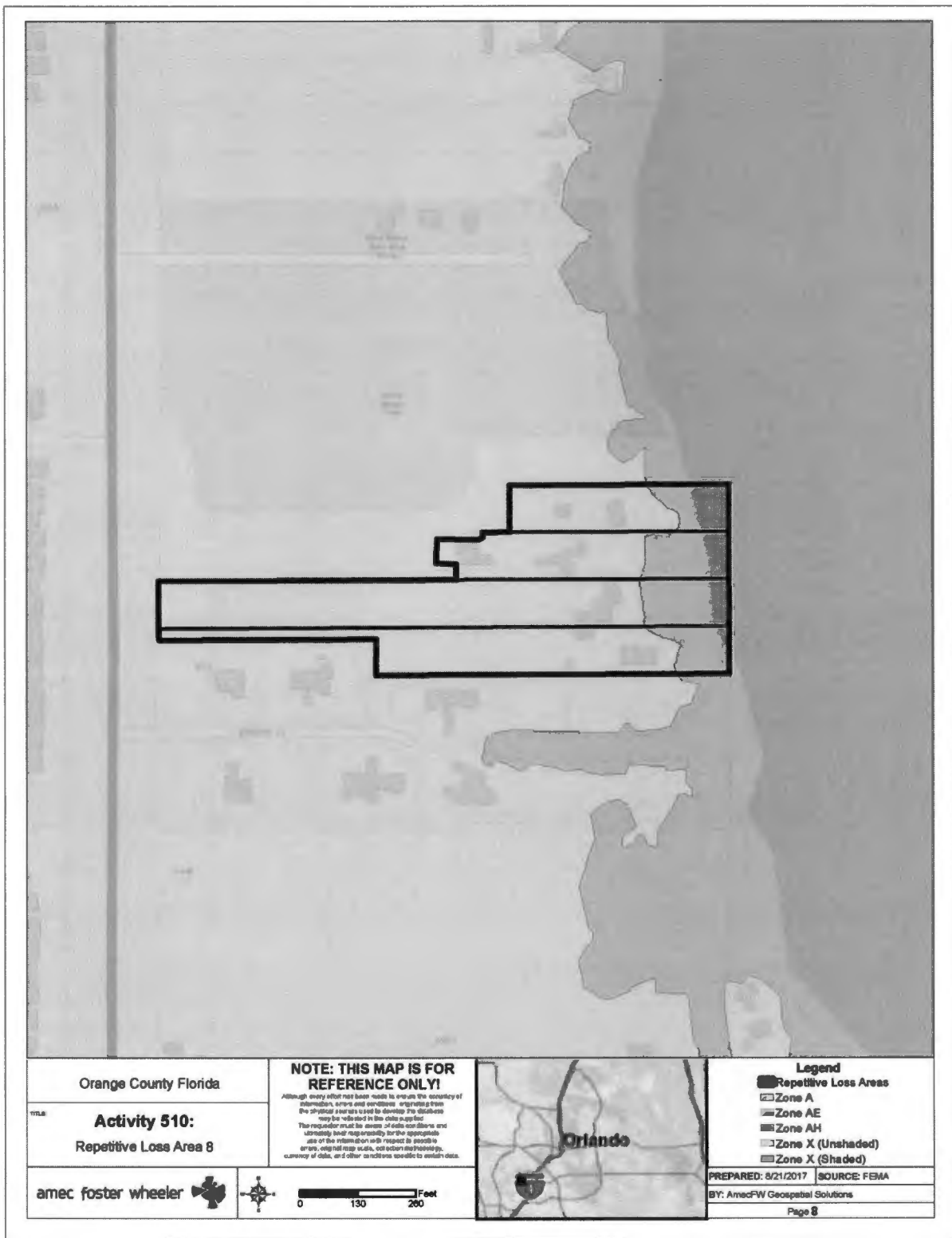


Figure 2.9 – Repetitive Loss Area 8

Example Properties



Drainage ditch and culverts along roadway and under driveways

Area 9

Repetitive Loss Area 9 is located primarily within the Unshaded Zone X; however, the area is adjacent to Lake Irma and part of the area falls within the 100-yr floodplain. One property owner who has owned their home for less than 5 years reported that they have not experienced any flooding on their property. Of the four homes that were observable from the street, three have their first-floor elevation at grade and one is between 1-2 feet above the street elevation. All five structures are concrete with slab on grade foundations.

Table 2.17 – Area 9 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
9	1	0	4	5	N. Econlockhatchee Tr.
Total	1	0	4	5	

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

There are 5 properties located in Area 9. The Repetitive Loss Area is shown in relation to FEMA flood zones in Figure 2.10 on the following page.

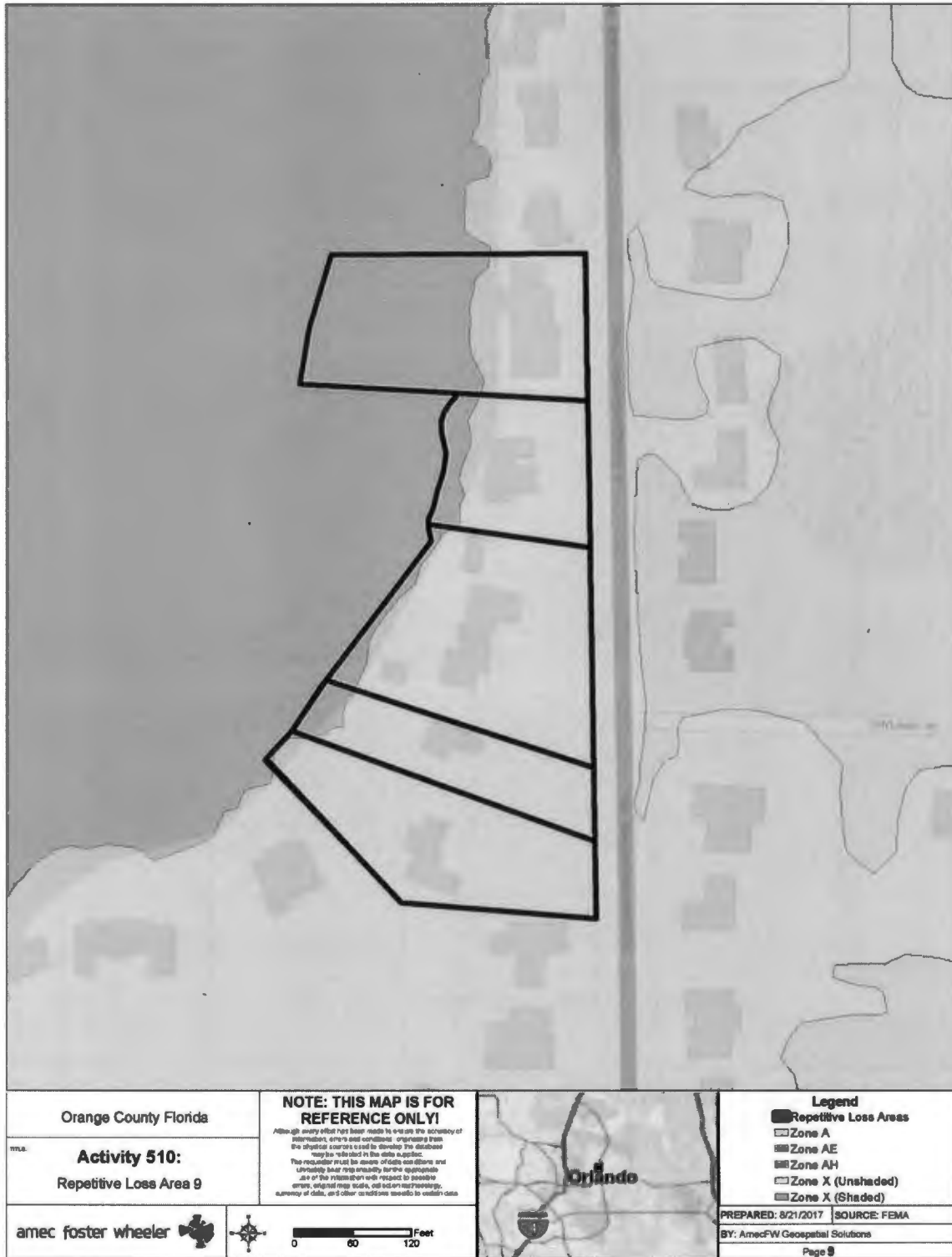


Figure 2.10 – Repetitive Loss Area 9

Example Properties



Drainage swale in front yard



Drainage feature along road and under driveway



Drainage swale in front yard along road

STEP 4. Review Alternative Mitigation Approaches

Mitigation Alternatives

According to the 2017 CRS Coordinator's Manual, mitigation measures should fall into one of the following floodplain management categories:

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

Property protection is essential to mitigating repetitive loss properties and reducing future flood losses. There are many ways to protect a property from flood damage. Property protection measures recognized in the 2017 CRS Coordinator's Manual include relocation, acquisition, building elevation, retrofitting, sewer backup protection, and insurance. Different measures are appropriate for different flood hazards, building types and building conditions. Figure 2.11 below, found in the 2017 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 floodproof the building so water cannot get into it.
- Wet floodproof 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: 2017 CRS Coordinators Manual.

Figure 2.11 – Typical Property Protection Measures

Improving the stormwater drainage system and storage capacity around lakes and lake outfalls can reduce overtopping and stormwater flooding from heavy rains and eliminate some building damage and road closures in these areas. These structural methods require large capital expenditures and cooperation from private property owners. Promoting floodproofing techniques and flood insurance and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in this area. The County's websites, e-mail distribution lists, and press releases can help get these messages out to business owners and residents.

Mitigation Funding

There are several types of mitigation measures, listed in Table 2.18, 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 2.18 – 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
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

Potential Mitigation Measures

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. This option is not viable in central Florida.
- Acquire and/or relocate properties/target abandoned properties.
- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE.
- 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 including chemicals and other products/goods above the flooding depth.
- Improve the County's floodplain and zoning ordinances to create conservation and open space areas.
- Consider expanding riparian impervious surface setbacks.
- Improve public education through posting information about local flood hazards on County website, posting signs at various locations in neighborhoods, or discussing flood protection measures at homeowner's association meetings.
- Promote the purchase of flood insurance.
- Implement volume control and runoff reduction measures in the County's Stormwater Management Ordinance.

Current Mitigation Projects

Watershed Master Plans

The County maintains master plans on all major watersheds in the County. As far as those watersheds containing repetitive loss areas, the County is currently updating master plans for the Big Econ, Cypress Creek, Little Econ, and Shingle Creek watersheds, and plans to update the Boggy Creek and Lake Hart watershed master plans. Updating the plans involves surveying and studying the watersheds using LiDAR data, modeling the flood conditions, mapping the floodplains, and evaluating their level of service. Once complete, the plans serve as a valuable tool for understanding flood risk in the County and planning drainage improvements and other mitigation measures.

Stormwater Retrofits

The County is currently completing multiple projects related to stormwater issues in the watersheds that contain these repetitive loss areas. The projects underway include pipeline improvements in the B-14 canal, an update of the emergency action plan for Cheney, Michaels, and Banner dams, a study of the Lake George outfall, and bank stabilization in the Sky Lake Canal and the Wheatberry Court B-14 canal.

Advantages and Disadvantages of Mitigation Measures

Seven primary mitigation measures are discussed here: acquisition, relocation, barriers, floodproofing, drainage, elevation, and insurance. In general, the cost of acquisition and relocation will be higher than other mitigation measures but can completely mitigate risk of 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 and may impact flood risk on other properties. Where drainage issues are the source of repetitive flooding, drainage improvements can provide flood mitigation benefits to multiple properties. Each of these solutions is discussed in greater detail below.

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

Table 2.19 – Advantages and Disadvantages of Acquisition

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.20 – Advantages and Disadvantages of Relocation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.21 – Advantages and Disadvantages of Barriers

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.22 – Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors. 	<ul style="list-style-type: none"> • 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 2.23 – Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program. 	<ul style="list-style-type: none"> • 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 2.24 – Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
<ul style="list-style-type: none"> • Could 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. 	<ul style="list-style-type: none"> • 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 2.25 – Advantages and Disadvantages of Elevation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

NOTE: Elevating a structure with a slab-on-grade foundation can cost over 30 percent more than elevating a structure on a crawlspace foundation. Many of the properties located in Orange County’s Repetitive Loss Areas have slab-on-grade foundations, which may mean this mitigation alternative will be cost-prohibitive.

Flood Insurance:

Insurance differs from other property protection activities in that it does not mitigate or prevent damage caused by a flood. However, flood insurance does help the owner repair and rebuild their property after a flood, and it can enable the owner to afford incorporating other property protection measures in that process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without requiring human intervention for the measure to work.

Table 2.26 – Advantages and Disadvantages of Flood Insurance

Advantages	Disadvantages
<ul style="list-style-type: none"> • Provides protection outside of what is covered by a homeowners’ insurance policy. • Can help to fund other property protection measures after a flood through increased cost of compliance (ICC) coverage. • Provides protection for both structure and contents. • Can be purchased anywhere in a community, including outside of a flood zone. 	<ul style="list-style-type: none"> • Cost may be prohibitive. • Policyholders may have trouble understanding policy and filing claims. • Does not prevent or mitigate damage.

STEP 5. Conclusion and Recommendations

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, Orange County proposes that mitigation measures should be implemented for the Repetitive Loss Areas. Table 2.16 examines past and current mitigation actions in this area.

Table 2.27 – Past and Current Mitigation Actions

Past and Current Mitigation Actions	
1	The County is completing stormwater retrofits through its capital improvements program and is undergoing watershed master planning to better plan for future drainage improvements.
2	The County has previously eliminated four properties from the repetitive loss list through flood protection and is in the process of mitigating another repetitive loss property through acquisition and demolition.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense, such as elevating HVAC equipment and digging drainage ditches.
4	The County has undertaken capital improvement projects to improve drainage and regularly conducts stormwater drainage system maintenance.

Prioritization

In order to facilitate the implementation of the following recommended mitigation actions, a prioritization schedule is included based on the following:

- Cost
- Funding Availability
- Staff Resources
- Willingness of Property Owner to Participate
- Additional Planning Requirement

The priority rating for the following mitigation actions is summarized in Table 2.13. Each of the above prioritization variables was rated on a scale of 1 to 5, with 5 indicating the greatest difficulty for implementation. The weight of each variable is indicated in the prioritization table. Those mitigation actions with the lowest overall priority scores are expected to be the easiest to implement and should therefore be implemented first. An overall priority rating of high, medium, or low is assigned to each recommended action, using the following scale:

- High Priority (should be completed within 2 years): Score of 0.00 – 1.99
- Medium Priority (should be completed within 2 to 4 years): Score of 2.00 – 3.99
- Low Priority (should be completed within 4 to 5 years): Score of 4.00 – 5.00

Recommendations

The following recommendations detail the actions the County will take to reduce flooding and flood losses in these Repetitive Loss Areas. Structural projects to increase drainage capacity may be sufficient to resolve stormwater flooding issues in some of these areas. In some cases, acquisition and demolition may be the most effective mitigation. The County will also discuss the possibility of building elevation with homeowners who don't want to sell their homes. Given that drainage improvement projects and property acquisitions take a long time to implement and floods can occur at any time, the County will pursue other

alternatives in the interim, including encouraging property owners to use floodproofing measures to help protect lower levels of their property. The County 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.

Mitigation Action 1: Flood Insurance Outreach

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The County will continue, on an **annual basis**, to target all properties in the repetitive loss areas reminding them of the advantages of maintaining flood insurance through its annual outreach effort. Repetitive Loss Areas are a target area in the County's Program for Public Information (PPI).

Responsibility

The County's Public Works Department Stormwater Management Division will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas through annual outreach and other efforts.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 2: Property Protection Outreach

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

Responsibility

The County's Public Works Department Stormwater Management Division will provide the most relevant up-to-date information to all property owners within the repetitive loss areas.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 3: Floodproofing

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

Responsibility

The County's Public Works Department Stormwater Management Division will promote effective flood protection and floodproofing measures and provide advice and assistance to property owners who may wish to implement such measures in an **on-going** program.

Funding

The cost of flood protection measures 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 County's operating budget.

Priority: Medium

Mitigation Action 4: Acquisition and Demolition

Continue acquisition and demolition mitigation of high-risk flood-prone properties. Prioritize properties with the greatest flood risk and where drainage improvements will not provide an adequate level of protection. This option should be pursued where property owners are willing to participate.

Responsibility

The County's Public Works Department Stormwater Management Division will continue to target properties for acquisition/demolition.

Funding

The acquisition and demolition can be paid for using FEMA mitigation grant funds and/or through County Stormwater Utility funds. Staff time to develop the list of target properties will require funds from the County's operating budget.

Priority: Low

Mitigation Action 5: Drainage-Related CIP Projects

Continue implementing stormwater retrofit, pump station, and pond retrofit projects identified in the Capital Improvements Plan for the Boggy Creek and Little Econ watersheds. These projects are further detailed in the CIP, and include a pond embankment evaluation, improvements to the Verona Park pump station, retrofits of the Boggy Creek Pipeline and the control structure for Pond 6612, and bank stabilization of the Winter Park Pines outfall, the Sky Lake canal, and the Wheatberry Court B-14 canal. Prioritize CIP projects to focus on drainage improvements in those basins containing repetitive loss areas. In addition to planned improvements, the County should assess options for improvements along Econlockhatchee Trail, Parkdale Drive, and Winter Garden Vineland Road.

Responsibility

The County's Public Works Department Stormwater Management Division will work with engineering consultants to plan and complete these projects.

Funding

Funding will be allocated through the County's Capital Improvements Plan.

Priority: Medium

Mitigation Action 6: Flood Protection Assistance

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

Responsibility

The County's Public Works Department Stormwater Management Division 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 floodproofing measures may require additional funds from the County's operating budget.

Priority: Medium

Mitigation Action 7: Drainage Maintenance Outreach

Property owners should keep drainage features, including drainage swales between lots, open and clear of debris. Permanent structures and storage should not be located in these areas, as any obstructions may reduce the capacity and efficacy of the drainage features.

Responsibility

The County's Public Works Department Stormwater Management Division will incorporate information on the importance of drainage maintenance and building responsibly into flood protection outreach and assistance services.

Funding

The cost will be paid for by the County's operating budget.

Priority: Medium

Mitigation Action 7: Lake Drainage Wells

Where flooding is caused by lake overtopping, Orange County will install lake drainage wells to lower lake flood levels. This option may be appropriate for Lake Mary Jane, Lake Sheen, and Lake Irma, but requires further investigation.

Responsibility

The County's Public Works Department Stormwater Management Division will assess the need for lake drain pumps and implement where appropriate.

Funding

The cost will be paid for by the County's stormwater utility and capital improvements funding.

Priority: Medium

Prioritization Table

Table 2.28 – Prioritization of Recommended Mitigation Actions

Mitigation Action #	Prioritization Variables (Weight)					Total
	Cost (30%)	Funding Availability (25%)	Property Owner Willingness (20%)	Staff Resources (15%)	Planning Needs (10%)	
1: Flood insurance outreach	2	2	1	1	1	1.55
2: Property protection outreach	2	2	1	1	1	1.55
3: Floodproofing	2	3	4	2	2	2.65
4: Acquisition and demolition	5	3	5	3	4	4.05
5: Drainage-related CIP projects	4	2	3	3	4	3.15
6: Flood protection assistance	2	2	3	2	1	2.10
7: Drainage maintenance outreach	2	2	4	2	2	2.40
8: Lake Drain Pumps	3	2	1	3	2	2.25

Problem Statement 3

Localized/Stormwater Flooding

Three of the nine identified Repetitive Loss Areas are located outside the 100-/500-year floodplain in areas subject to periodic flooding from heavy rains and localized stormwater flooding. The approach to reducing repetitive flooding in these areas will require a combination of floodproofing techniques, education, and drainage improvement projects.

Most of the repetitive loss flooding in these areas results from prolonged heavy rainfall that produces flash flooding, causing damage to residential and commercial buildings as well as numerous street closures due to floodwaters overtopping the roadway. 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.

Some losses are due to heavy rainfall associated with hurricanes and tropical storms. Orange County was recently affected by Hurricane Matthew in 2016 and Hurricane Irma in 2017. Some of the past flood losses were due to Hurricane Charlie in 2004 and other previous events.

Subarea 2

Repetitive Loss Area 4 is located entirely within the Unshaded Zone X. Structures in this area are primarily concrete buildings with slab on grade foundations. Most structures are 2-family residential buildings, with the exception of a single family residential structure. All buildings sit at least 1-2 feet above street elevation and most have front lawns sloping down toward the street. Two HVAC units were observed elevated to the first-floor elevation; however, two others seen were not elevated at all. A retention pond sits to the southeast of this area, and may be a potential source of flooding. Several properties have drainage swales between lots; however, not all swales are observable due to fencing, and some are blocked additions. Those properties without clear drainage pathways between lots may be more vulnerable to flooding.

Repetitive Loss Area 5 is located entirely within the Unshaded Zone X. There are three commercial buildings in this area with slab on grade foundations and a mix of concrete and wood frame construction. One HVAC unit was seen not elevated, while on another property all HVAC units were elevated well above the first-floor.

Table 2.29 – Subarea 2 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
4	1	0	5	6	Pot O Gold Ln.
5	1	0	2	3	S. Orange Ave. & E. Lancaster Rd.
Total	3	0	7	9	

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

There are 9 properties in total in Subarea 2. The Repetitive Loss Areas are shown in relation to FEMA flood zones in Figure 2.12 and Figure 2.13 on the following pages.

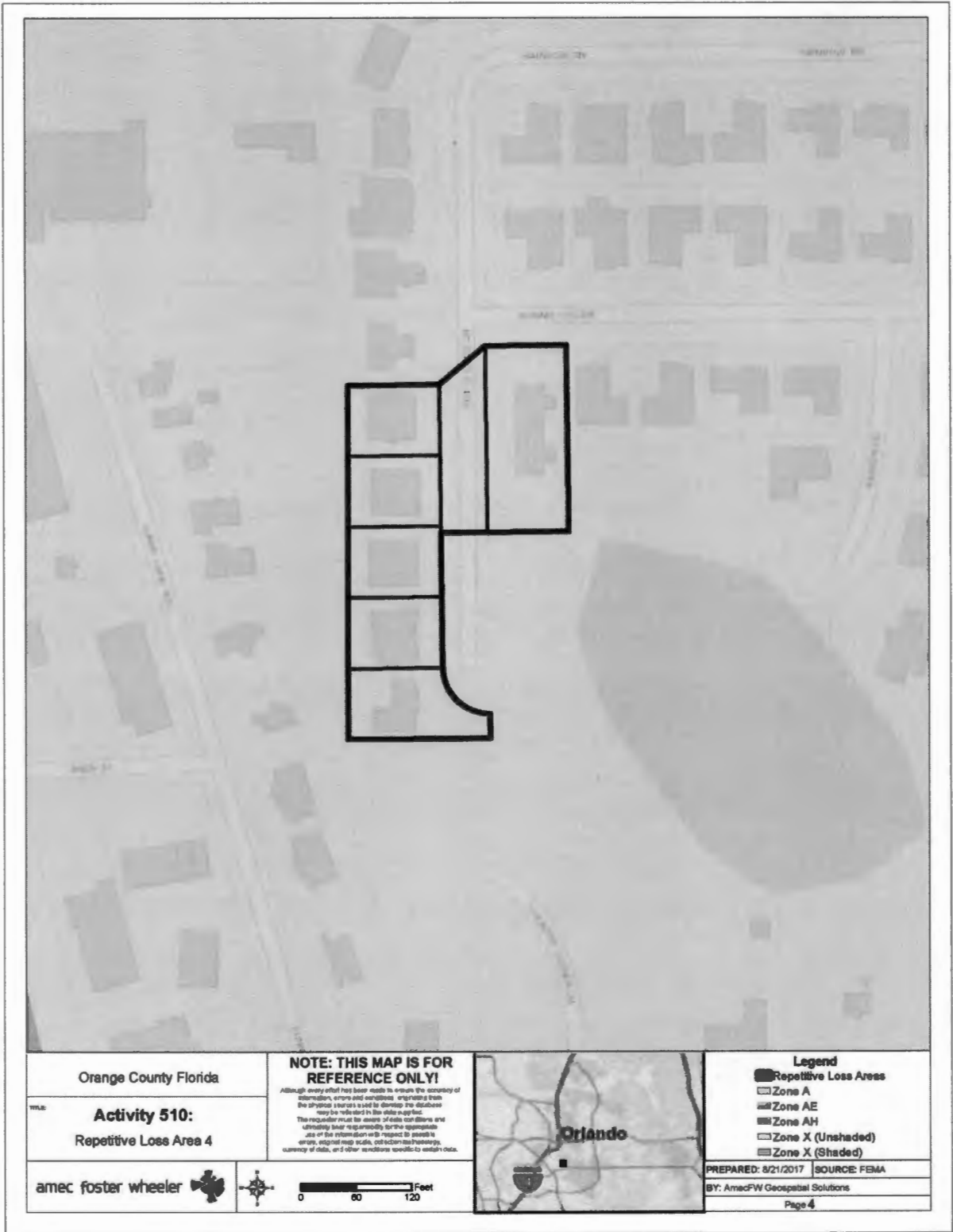


Figure 2.12 – Repetitive Loss Area 4



Figure 2.13 – Repetitive Loss Area 5

Example Properties



Drainage swale between lots



HVAC unit elevated to first-floor elevation; drainage area filled by addition



HVAC unit not elevated



HVAC elevated above first-floor

Area 7

Repetitive Loss Area 7 is located entirely within the Unshaded Zone X. All properties in this area are manufactured homes with crawlspace foundations. None of the three properties have their HVAC units elevated. All three properties have gutters. These properties sit just south of Interstate 4 and there is a drainage ditch along the interstate and behind these manufactured homes most likely contributed to the flooding of these properties.

Table 2.30 – Area 7 Overview

Repetitive Loss Area	# of RL Properties	# of Historic RL Properties	# of Additional Properties	Total # of Properties in RL Area	Road Names
7	1	0	2	3	Mo Ho Dr.
Total	1	0	2	3	

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

Area 7 contains three properties. The Repetitive Loss Area is shown in relation to FEMA flood zones in Figure 2.14 on the following page.

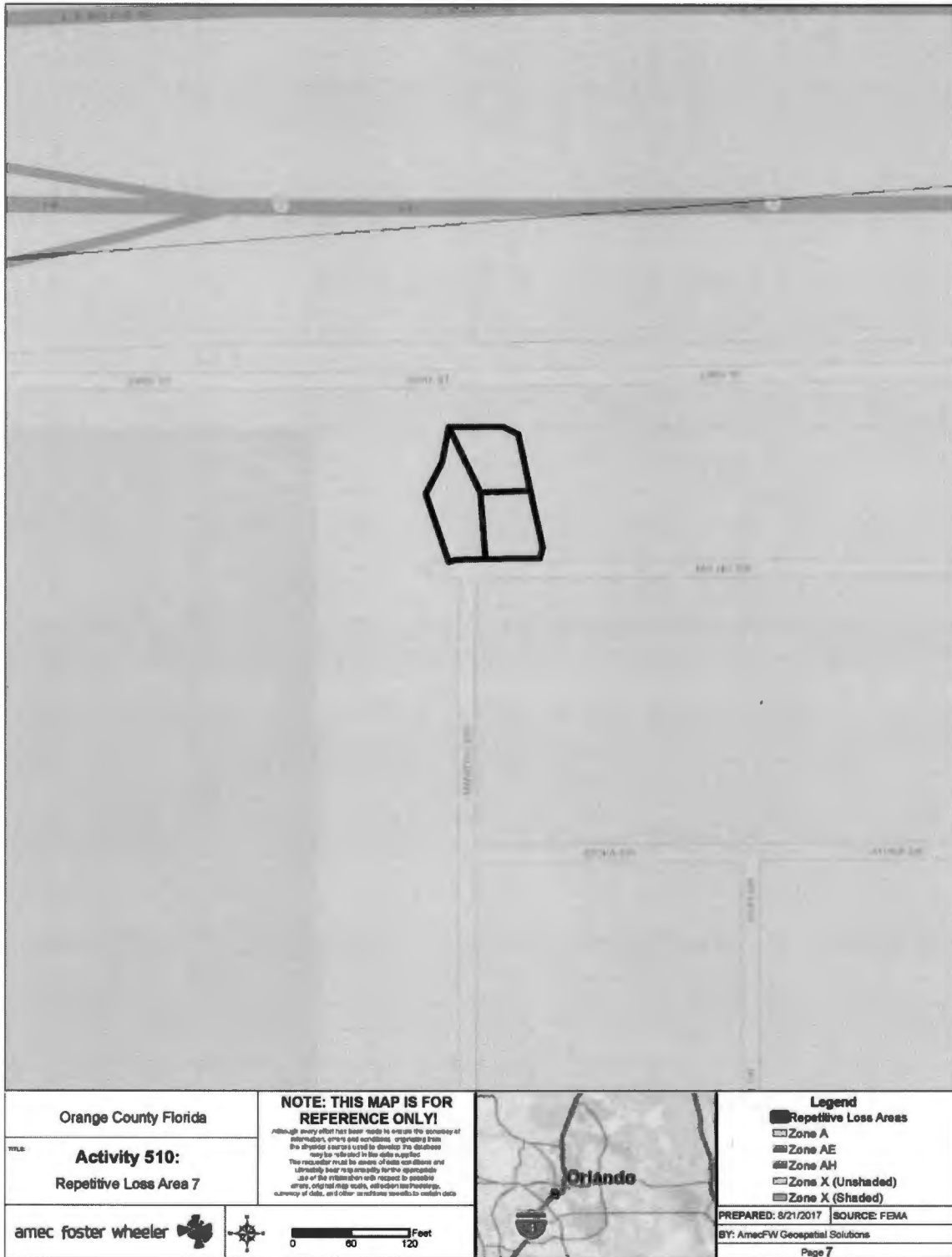


Figure 2.14 – Repetitive Loss Area 7

Example Properties



HVAC unit not elevated



HVAC unit not elevated



STEP 4. Review Alternative Mitigation Approaches

Mitigation Alternatives

According to the 2017 CRS Coordinator's Manual, mitigation measures should fall into one of the following floodplain management categories:

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

Property protection is essential to mitigating repetitive loss properties and reducing future flood losses. There are many ways to protect a property from flood damage. Property protection measures recognized in the 2017 CRS Coordinator's Manual include relocation, acquisition, building elevation, retrofitting, sewer backup protection, and insurance. Different measures are appropriate for different flood hazards, building types and building conditions. Figure 2.15 below, found in the 2017 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 floodproof the building so water cannot get into it.
- Wet floodproof 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: 2017 CRS Coordinators Manual.

Figure 2.15 – Typical Property Protection Measures

Improving the stormwater drainage system and storage capacity throughout these Repetitive Loss Areas and their watersheds can eliminate some building damage and road closures in these areas. These structural methods require large capital expenditures and cooperation from private property owners. Promoting floodproofing techniques and flood insurance and increasing public education and awareness of the flood hazards can be the next best alternative for property owners in this area; however, these methods will not reduce flooding but will only potentially reduce flood damages. The County's websites, e-mail distribution lists, and press releases can help get these messages out to business owners and residents.

Mitigation Funding

There are several types of mitigation measures, listed in Table 2.3, 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 2.31 – 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
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

Potential Mitigation Measures

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. This option is not viable in central Florida.
- Acquire and/or relocate properties/target abandoned properties.
- Elevate structures and damage-prone components, such as the furnace or air conditioning unit, above the base flood elevation BFE.
- 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 including chemicals and other products/goods above the flooding depth.
- Improve the County's floodplain and zoning ordinances.
- Consider expanding riparian impervious surface setbacks.
- Improve public education through posting information about local flood hazards on County website, posting signs at various locations in neighborhoods, or discussing flood protection measures at homeowner's association meetings.
- Promote the purchase of flood insurance.
- Implement volume control and runoff reduction measures in the County's Stormwater Management Ordinance.

Current Mitigation Projects

Watershed Master Plans

The County maintains master plans on all major watersheds in the County. As far as those watersheds containing repetitive loss areas, the County is currently updating master plans for the Big Econ, Cypress Creek, Little Econ, and Shingle Creek watersheds, and plans to update the Boggy Creek and Lake Hart watershed master plans. Updating the plans involves surveying and studying the watersheds using LiDAR data, modeling the flood conditions, mapping the floodplains, and evaluating their level of service. Once complete, the plans serve as a valuable tool for understanding flood risk in the County and planning drainage improvements and other mitigation measures.

Stormwater Retrofits

The County is currently completing multiple projects related to stormwater issues in the Boggy Creek and Shingle Creek watersheds, which contains these repetitive loss areas. The projects underway include pipeline improvements in the B-14 canal, a study of the Lake George outfall, modeling and analysis of Sandy Lake, and bank stabilization in the Sky Lake canal and the Wheatberry Court B-14 canal.

Advantages and Disadvantages of Mitigation Measures

Seven primary mitigation measures are discussed here: acquisition, relocation, barriers, floodproofing, drainage, elevation, and insurance. In general, the cost of acquisition and relocation will be higher than other mitigation measures but can completely mitigate risk of 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 and may impact flood risk on other properties. Where drainage issues are the source of repetitive flooding, drainage improvements can provide flood mitigation benefits to multiple properties. Each of these solutions is discussed in greater detail below.

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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:

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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 2.33 – Advantages and Disadvantages of Relocation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.34 – Advantages and Disadvantages of Barriers

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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 2.35 – Advantages and Disadvantages of Wet Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other mitigation measures. • Allows internal and external hydrostatic pressures to equalize, lessening the loads on walls and floors. 	<ul style="list-style-type: none"> • 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 2.36 – Advantages and Disadvantages of Dry Floodproofing

Advantages	Disadvantages
<ul style="list-style-type: none"> • Often less costly than other retrofitting methods • Does not require additional land. • May be funded by a FEMA mitigation grant program. 	<ul style="list-style-type: none"> • 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 2.37 – Advantages and Disadvantages of Drainage Improvements

Advantages	Disadvantages
<ul style="list-style-type: none"> • Could 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. 	<ul style="list-style-type: none"> • 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 2.38 – Advantages and Disadvantages of Elevation

Advantages	Disadvantages
<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.

NOTE: Elevating a structure with a slab-on-grade foundation can cost over 30 percent more than elevating a structure on a crawlspace foundation. Many of the properties located in Orange County's Repetitive Loss Areas have slab-on-grade foundations, which may mean this mitigation alternative will be cost-prohibitive.

Flood Insurance:

Insurance differs from other property protection activities in that it does not mitigate or prevent damage caused by a flood. However, flood insurance does help the owner repair and rebuild their property after a flood, and it can enable the owner to afford incorporating other property protection measures in that process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without requiring human intervention for the measure to work.

Table 2.39 – Advantages and Disadvantages of Flood Insurance

Advantages	Disadvantages
<ul style="list-style-type: none"> • Provides protection outside of what is covered by a homeowners' insurance policy. • Can help to fund other property protection measures after a flood through increased cost of compliance (ICC) coverage. • Provides protection for both structure and contents. • Can be purchased anywhere in a community, including outside of a flood zone. 	<ul style="list-style-type: none"> • Cost may be prohibitive. • Policyholders may have trouble understanding policy and filing claims. • Does not prevent or mitigate damage.

STEP 5. Conclusion and Recommendations

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, Orange County proposes that mitigation measures should be implemented for the Repetitive Loss Areas. Table 2.40 examines past and current mitigation actions in this area.

Table 2.40 – Past and Current Mitigation Actions

Past and Current Mitigation Actions	
1	The County is completing stormwater retrofits through its capital improvements program and is undergoing watershed master planning to better plan for future drainage improvements.
2	The County has previously eliminated four properties from the repetitive loss list through flood protection and is in the process of mitigating another repetitive loss property through acquisition and demolition.
3	Property owners are aware of flooding causes. Some property owners have undertaken specific floodproofing measures at their own expense, such as elevating HVAC units.
4	The County has undertaken capital improvement projects to improve drainage within these areas' watersheds.

Prioritization

In order to facilitate the implementation of the following recommended mitigation actions, a prioritization schedule is included based on the following:

- Cost
- Funding Availability
- Staff Resources
- Willingness of Property Owner to Participate
- Additional Planning Requirement

The priority rating for the following mitigation actions is summarized in Table 2.13. Each of the above prioritization variables was rated on a scale of 1 to 5, with 5 indicating the greatest difficulty for implementation. The weight of each variable is indicated in the prioritization table. Those mitigation actions with the lowest overall priority scores are expected to be the easiest to implement and should therefore be implemented first. An overall priority rating of high, medium, or low is assigned to each recommended action, using the following scale:

- High Priority (should be completed within 2 years): Score of 0.00 – 1.99
- Medium Priority (should be completed within 2 to 4 years): Score of 2.00 – 3.99
- Low Priority (should be completed within 4 to 5 years): Score of 4.00 – 5.00

Recommendations

The following recommendations detail the actions the County will take to reduce flooding and flood losses in these Repetitive Loss Areas. Structural projects to increase drainage capacity may be sufficient to resolve stormwater flooding issues in some of these areas. In some cases, acquisition and demolition may be the most effective mitigation. The County will also discuss the possibility of building elevation with homeowners who don't want to sell their homes. Given that drainage improvement projects and property acquisitions take a long time to implement and floods can occur at any time, the County will pursue other

alternatives in the interim, including encouraging property owners to use floodproofing measures to help protect lower levels of their property. The County 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.

Mitigation Action 1: Flood Insurance Outreach

Property owners should obtain and keep a flood insurance policy on their structures (building and contents coverage). The County will continue, on an **annual basis**, to target all properties in the repetitive loss areas reminding them of the advantages of maintaining flood insurance through its annual outreach effort. Repetitive Loss Areas are a target area in the County's Program for Public Information (PPI).

Responsibility

The County's Public Works Department Stormwater Management Division will provide the most relevant up-to-date flood insurance information to all property owners within the repetitive loss areas through annual outreach and other efforts.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 2: Property Protection Outreach

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

Responsibility

The County's Public Works Department Stormwater Management Division will provide the most relevant up-to-date information to all property owners within the repetitive loss areas.

Funding

The cost will be paid for from Orange County's operating budget.

Priority: High

Mitigation Action 3: Floodproofing

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

Responsibility

The County's Public Works Department Stormwater Management Division 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 County's operating budget.

Priority: Medium

Mitigation Action 4: Acquisition and Demolition

Continue pursuing the acquisition and demolition of high-risk repetitive loss properties. The highest priorities are properties at the greatest flood risk and where drainage improvements will not provide an adequate level of protection. Acquisition and demolition is the only way to guarantee that future losses are avoided. This option should be pursued where property owners are willing to participate.

Responsibility

The County's Public Works Department Stormwater Management Division will continue to review properties in repetitive loss areas to identify target properties for mitigation and will conduct outreach to owners of target properties for agreement to participate in acquisition.

Funding

The acquisition and demolition will be paid for using FEMA mitigation grant funds.

Priority: Medium

Mitigation Action 5: Drainage-Related CIP Projects

The County will continue pursuing stormwater retrofit and pump station projects identified in the Capital Improvements Plan for the Boggy Creek and Shingle Creek watersheds. These projects are further detailed in the CIP and include retrofits of the Boggy Creek Pipeline, upgrades to the Bonnie Brook pump station, and bank stabilization of the Sky Lake canal and the Wheatberry Court B-14 canal. In addition to these planned improvements, the County should assess options for improvements along Pot O Gold Lane and South Orange Ave.

Responsibility

The County's Public Works Department Stormwater Management Division will work with engineering consultants to plan and complete these projects.

Funding

Funding will be allocated through the County's Capital Improvements Plan.

Priority: Medium

Mitigation Action 6: Flood Protection Assistance

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

Responsibility

The County's Public Works Department Stormwater Management Division 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 floodproofing measures may require additional funds from the County's operating budget.

Priority: Medium

Mitigation Action 7: Elevation

Encourage property owners of manufactured homes and structures with crawlspace foundations to consider elevating their homes.

Responsibility

The County's Public Works Department Stormwater Management Division will promote elevation, where appropriate and cost effective, through targeted outreach.

Funding

Funding may be available through FEMA HMGP and Orange County's Stormwater Utility. Outreach and assistance will require staff time and additional funds from the County's operating budget.

Priority: Medium

Prioritization Table

Table 2.41 – Prioritization of Recommended Mitigation Actions

Mitigation Action #	Prioritization Variables (Weight)					Total
	Cost (30%)	Funding Availability (25%)	Property Owner Willingness (20%)	Staff Resources (15%)	Planning Needs (10%)	
1: Flood insurance outreach	2	2	1	1	1	1.55
2: Property protection outreach	2	2	1	1	1	1.55
3: Floodproofing	2	3	4	2	2	2.65
4: Acquisition and demolition	5	3	5	3	4	4.05
5: Drainage-related CIP projects	4	2	2	3	4	2.95
6: Flood protection assistance	2	2	3	2	1	2.10

3 References

- Orange County, Comprehensive Plan. Effective August 29, 2016.
- Orange County, Capital Improvement Program. FY 2016-2020.
- Orange County, Local Mitigation Strategy. 2009.
- Orange County, Local Mitigation Strategy. 2016.
- Orange County Code of Ordinances
- Orange County, Comprehensive Plan Stormwater Management Element, 2009.
- Orange County, Stormwater Management Report, 2014
- Orange County, Infill Master Plan, 2008
- State of Florida Hazard Mitigation Plan, August 2013
- Orange County Capital Improvement Program, FY2016-2020
- Singhofen & Associates, Inc. Engineering Evaluation of Repetitive Loss Properties, Technical Memorandum, 2012
- FEMA/ISO – Repetitive Loss and Flood Insurance Data, 2016
- Federal Emergency Management Agency/ISO, Orange County Repetitive Loss Data, 2016.
- Federal Emergency Management Agency, National Flood Insurance Program, Community Rating System CRS Coordinator’s Manual. FIA-15/2017. 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, Orange County, Florida and Incorporated Areas, Revised September 29, 2009.
- Federal Emergency Management Agency, Flood Insurance Study, Orange County, Florida and Incorporated Areas, Preliminary October 30, 2015.

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

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

Appendix A – Building Survey Data

Note: In accordance with the Privacy Act of 1974, Appendix A will not be shared with the general public.



Orange County, FL Program for Public Information

July 2018







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Orange County, Florida
Program for Public Information (PPI)

Background

The Community Rating System (CRS) is a part of the National Flood Insurance Program (NFIP). It provides reductions to flood insurance premiums in participating communities. The reductions are based on community floodplain management programs, including public information activities. To keep those discounts, communities must continue to implement their programs and provide status reports to the NFIP each year. Orange County (the "County") has been an active participant of the CRS since 1991. The County is currently rated as a Class 5 which rewards residents with a 25 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.

A Program for Public Information (PPI) is an ongoing effort to prepare, implement, and monitor a range of public information activities. The objective of CRS credit for a PPI is to provide additional credit for information programs that are designed to meet local needs and that are monitored, evaluated, and revised to improve their effectiveness. The County has developed its PPI in accordance with the CRS credit criteria found within Activity 330 of the 2017 CRS Coordinator's Manual.

Over the years, the County, through numerous departments and in coordination with stakeholder groups and outside agencies, has prepared multiple outreach messages to educate the public on the hazards associated with flooding. With advances in technology and greater familiarity with web-based services, the County has realized that mailing information directly to property owners may not be the most effective method to get certain messages across. The PPI planning process provided an opportunity for the County to consider other options for disseminating messages about the flood hazard to the community.

This PPI was created in coordination with a Floodplain Management Plan (FMP). A Floodplain Management Planning Committee (FMPC) was established to oversee the development of not only the FMP, but also the PPI. This single committee had the opportunity to learn more detail about the major flooding problems in the County along with the unique problems associated with repetitive loss properties. Therefore; this committee will be referred to as the PPI Committee throughout this document.

Step 1: Establish a PPI Committee

A PPI should assess all the community's needs for flood-related information and coordinate all the resources that can deliver information. It should recommend a range of activities that convey information to residents, businesses, tourists, school children, and other audiences in and around the community. It should have an objective review of what is being done and how public information activities could be improved. Therefore, a PPI needs to be developed by a committee that consists of members from both inside and outside local government. The committee could be an existing committee, such as a mitigation planning committee or advisory board, or a subcommittee of an existing group, as long as it meets the membership criteria found within Activity 330.



1.1 Membership and Stakeholders

The PPI Committee’s membership must meet the following CRS criteria:

- ◆ There must be at least five people on the committee;
- ◆ There must be representation from the community’s floodplain management office;
- ◆ There must be representation from the community’s public information office (if one exists); and,
- ◆ At least half of the members must be from outside the local government (“stakeholders”).

The CRS encourages engagement of groups and people outside the local government in planning and conducting outreach projects. As outlined above, at least one-half of the members of the PPI committee must be representatives from outside the local government. These could be members of the public, representatives of key community organizations, and/or agencies and organizations that would likely implement the recommended outreach projects.

The participants comprising the PPI Committee for the County were selected in accordance with the above CRS criteria and included the following:

1. Jason Taylor – Orange County Emergency Management
2. Daniel Negron – Orange County Stormwater (Floodplain Manager)
3. Amy Bradbury – Orange County Planning Division
4. Gregory Golgowski – Orange County Planning Division* - **Just a substitute at last meeting**
5. Nadia Vanderhoof – Orange County Communications (PIO Officer)
6. Kelsie Davis – Red Cross
7. Bill Graf – South Florida Water Management District (SFWMD)
8. Michelle Cechowski – East Central Florida Regional Planning Council (ECFRPC)
9. Eric Alberts – Orlando Health, Inc

*Substituted at the last meeting for Amy Bradbury

In addition to the above members, Mike Drozeck and Luis Martinez of Orange County Public Works served in an advisory capacity to the FMPC/PPI Committee.

Committee Meetings

The PPI committee met four times during the planning process to complete the outreach program. During the planning process, the PPI Committee communicated through face-to-face meetings, email and telephone conversations. The meeting dates and topics discussed are detailed below in Table 1.

Table 1 – Summary of PPI Committee Meeting Dates

	Meeting Topic	Meeting Date	Meeting Location
PPI #1	Assessment of the community’s current public information needs and overview of the PPI planning process	October 24, 2016	Orange County Public Works Administration Bldg., Room 322
PPI #2	Assessment of the flood hazard, exposed buildings, flood insurance coverage, and identification of target audiences and areas	November 30, 2016	Orange County Public Works Administration Bldg., Room 322
PPI #3	Define outreach messages and other potential outreach projects along with dissemination methods.	August 7, 2017	Orange County Public Works Administration Bldg., Room 322
PPI #4	Review the Draft PPI	December 18, 2017	Hunters Creek Middle School Cafeteria, 13400 Town Loop Blvd.



Goals for the PPI

The PPI committee developed three primary goals to guide the overall implementation of this document to better educate the public about the flood risks affecting the County and how to protect themselves as well as their homes and businesses from flood damage; and to understand the importance of obtaining and maintaining flood insurance.

Goal 1: Recognize the risk associated with flooding and what individuals can do to reduce damage to property and save lives.

Goal 2: Promote the purchase of flood insurance to ensure greater protection of property within the County.

Goal 3: Increase the preparedness capability of the public to respond to and recover from flood events.

Step 2: Assess the Community's Public Information Needs

Orange County is located within the State of Florida. As of the 2010 census, the population was 1,145,956, making it the fifth-most populous county in Florida. The county seat is Orlando. Orange County covers 903 square miles of land and 100 square miles of water. The floodplains of Orange County consist of lowlands adjacent to the streams and lakes. The topography of Orange County is relatively flat with some gently rolling hills.

Floods can occur in Orange County at any time during the year. However, flooding most frequently occurs during the rainy season, which extends from June to October. Flooding is more severe when the ground has been saturated due to previous heavy rainfall and a high the ground water table. Flooding around lakes is typically a result of prolonged heavy rainfall on lakes that are already high due to a wetter than normal year. Historically, flooding along streams is due to prolonged heavy rainfall over the drainage area draining to the stream. Major storms affecting the Orange County area include Hurricanes Donna (1960), Frances (2004), and Jeanne (2004). Not only do hurricanes create floods, but they may cause erosion along the banks of rivers and streams.

2.1 Delineate Target Areas

In order to develop an effective local outreach program that raises public awareness about flood related issues, it is necessary to identify and assess the areas within the community that are considered to be flood-prone. The PPI Committee identified the following target areas and concluded that outreach projects should be directed to all properties (residential, commercial and public) within these areas:

Target Area #1: Special Flood Hazard Areas within the County

According to a Flood Insurance Study prepared by FEMA, released Preliminary on October 30, 2015, approximately 30% of the County is located within a Special Flood Hazard Area (SFHA). Figure 1 reflects the mapped flood insurance zones for the County. Figure 2 depicts the depth of flooding that can be expected within the County during the 100-yr flood event.

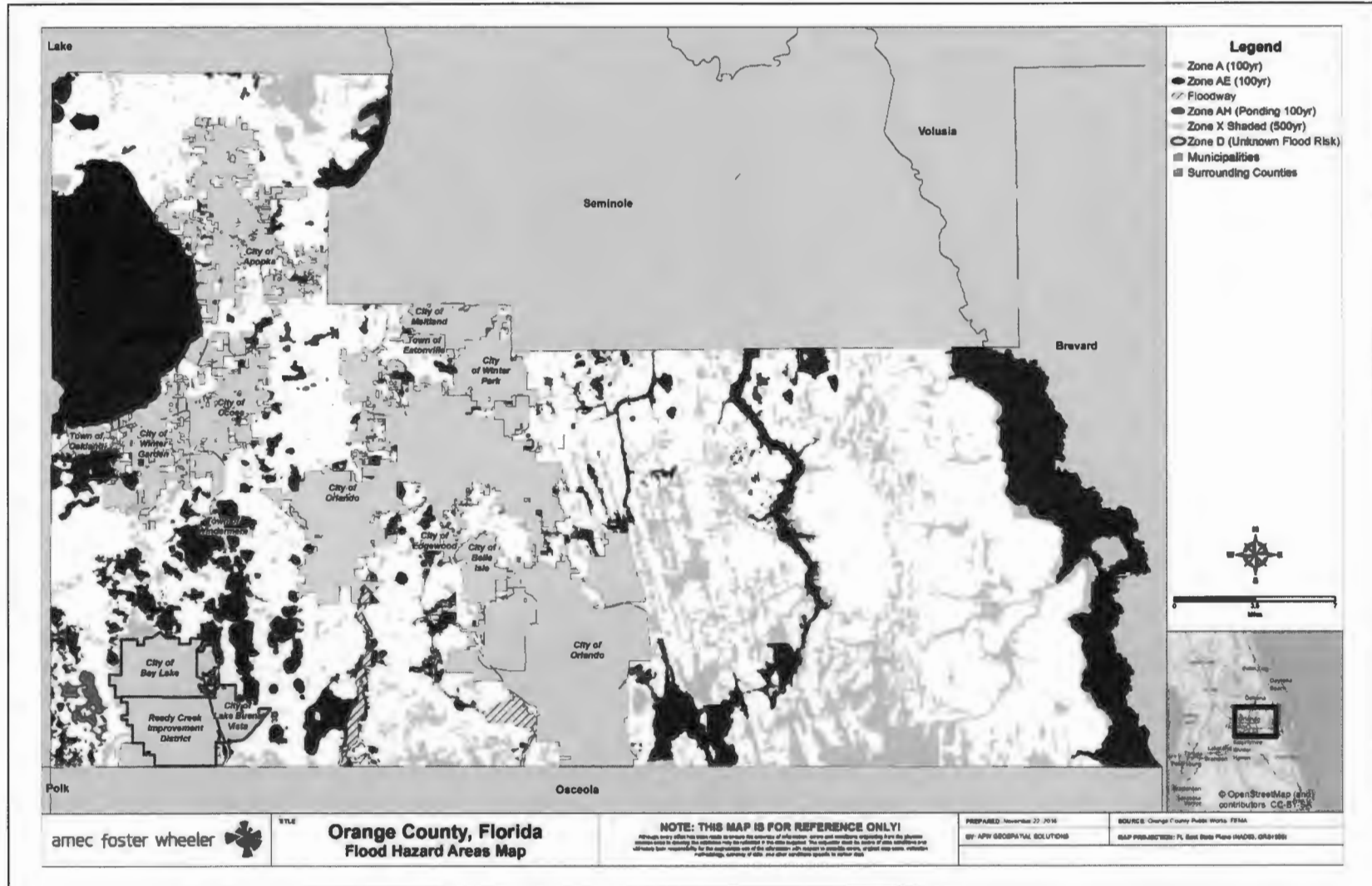


Figure 1 – Orange County Special Flood Hazard Areas

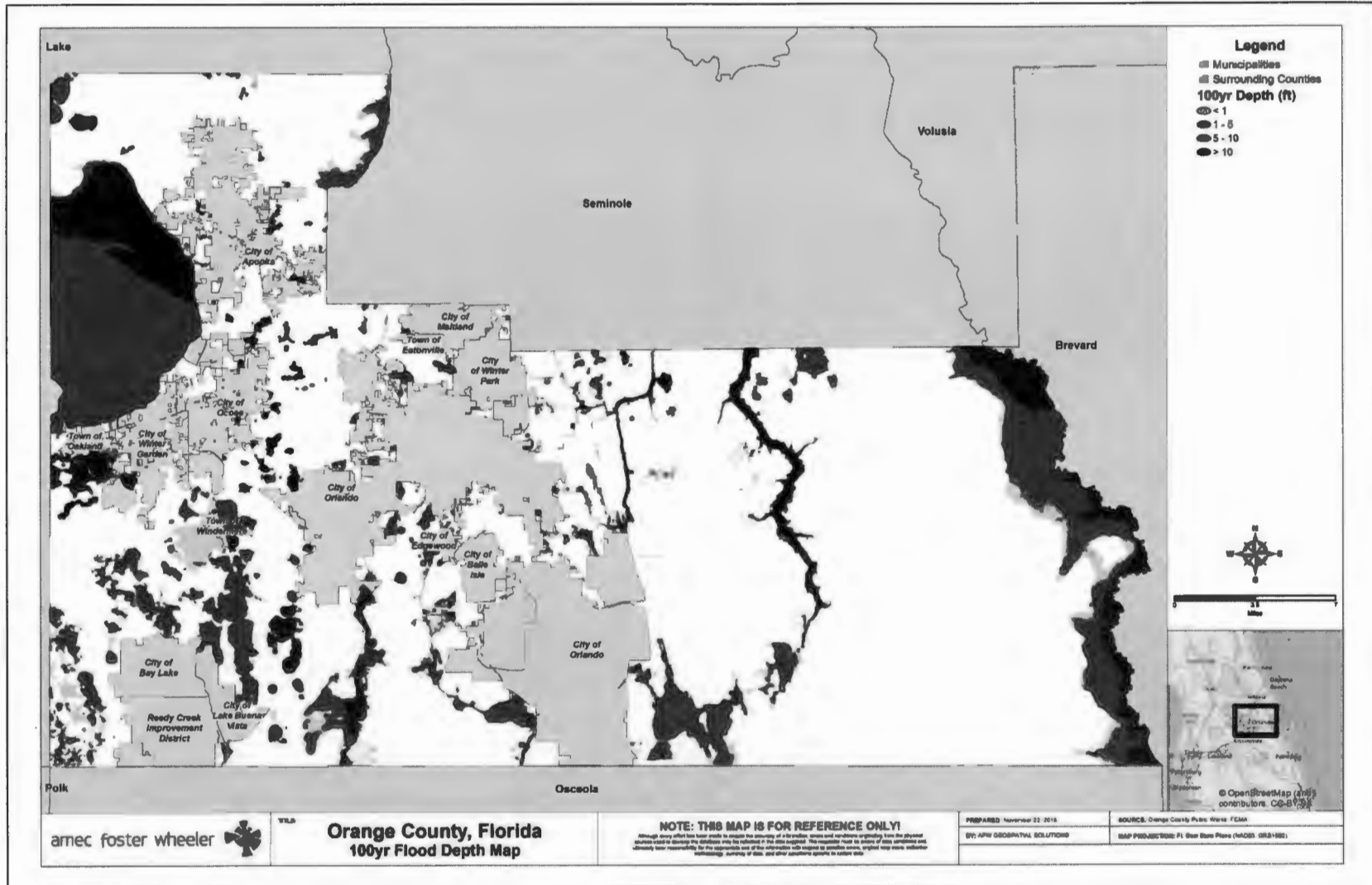


Figure 2 – Orange County 100-year Flood Depths

Table 2 is a summary table that shows the building count and improved value of parcels by FEMA flood zone. Based on this analysis, 7,117 improved parcels fall within the 1% annual chance floodplain for a total value of \$4,241,415,034. Additionally, there are 236,965 improved parcels outside of the SFHA with a value of \$82,665,645,919. Note: Improved parcels indicate that a structure is present; however, the structure may or may not be insurable.

Table 2 – Building Count by FEMA Flood Zone

Occupancy Type	Total Building Count	Improved Value	Estimated Content Value	Total Value
Zone AH				
Agricultural	1	\$11,628	\$11,628	\$23,256
Commercial	0	\$0	\$0	\$0
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	0	\$0	\$0	\$0
Total	1	\$11,628	\$11,628	\$23,256
Zone A				
Agricultural	71	\$10,115,149	\$10,115,149	\$20,230,298
Commercial	20	\$11,464,554	\$11,464,554	\$22,929,108
Education	2	\$85,888	\$42,944	\$0
Government	0	\$0	\$0	\$0
Industrial	13	\$37,569,954	\$56,354,931	\$93,924,885
Religious	0	\$0	\$0	\$0
Residential	2677	\$853,691,473	\$426,845,737	\$1,280,537,210
Total	2783	\$912,927,018	\$504,823,315	\$1,417,750,333
Zone D				
Agricultural	0	\$0	\$0	\$0
Commercial	0	\$0	\$0	\$0
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	1	\$440,302,320	\$220,151,160	\$660,453,480
Total	1	\$440,302,320	\$220,151,160	\$660,453,480
Zone AE				
Agricultural	85	\$22,282,908	\$22,282,908	\$44,565,816
Commercial	59	\$23,894,943	\$23,894,943	\$47,789,886
Education	5	\$20,448,226	\$11,849,819	\$0
Government	0	\$0	\$0	\$0
Industrial	113	\$106,591,474	\$159,887,211	\$266,478,685
Religious	0	\$0	\$0	\$0
Residential	4070	\$1,181,370,355	\$590,685,178	\$1,772,055,533
Total	4332	\$1,354,587,906	\$808,600,059	\$2,163,187,965
Zone X (500-yr)				
Agricultural	9	\$918,675	\$918,675	\$1,837,350
Commercial	6	\$3,196,707	\$3,196,707	\$6,393,414

Occupancy Type	Total Building Count	Estimated Content		
		Improved Value	Value	Total Value
Education	0	\$0	\$0	\$0
Government	0	\$0	\$0	\$0
Industrial	0	\$0	\$0	\$0
Religious	0	\$0	\$0	\$0
Residential	1,382	\$322,864,461	\$161,432,231	\$484,296,692
Total	1,397	\$326,979,843	\$165,547,613	\$492,527,456
Agricultural	905	\$406,607,249	\$406,607,249	\$813,214,498
Commercial	4,757	\$2,906,656,996	\$2,906,656,996	\$5,813,313,992
Education	114	\$670,789,217	\$423,670,715	\$1,094,459,932
Government	2	\$816,550	\$816,550	\$1,633,100
Industrial	2,275	\$2,182,605,602	\$3,273,908,403	\$5,456,514,005
Religious	0	\$0	\$0	\$0
Residential	226,912	\$45,995,988,624	\$22,997,994,312	\$68,993,982,936
Total	234,965	\$52,163,464,238	\$30,009,654,225	\$82,173,118,463

Source: Orange County Tax Assessor's Data, FEMA DFIRM (Preliminary 10/30/15)

¹Total value does not include land value.

Target Area #2: Localized Stormwater Flooding Locations

Orange County has an extensive natural and manmade drainage system which is susceptible to clogged inlets, blocked drainage outfalls, improper grade, and overtopping due to heavy rain events. Flooding of these systems is common, particularly due to the County's low elevation, flat terrain, and consistent level of seasonally concentrated annual precipitation resulting from heavy rainstorms, tropical storms, and hurricanes. The locations of localized flooding, as identified by the Orange County Stormwater Division, are shown in Figure 3 on the following page.

Target Area #3: Repetitive Loss Areas

Properties categorized as repetitive loss properties have a greater need for flood protection. According to 2016 NFIP records, there are 4 mitigated repetitive loss properties and 10 unmitigated repetitive loss properties in Orange County Unincorporated Areas.

Since FEMA wants communities to address their repetitive loss problems because of the large drain on the NFIP Fund, the PPI committee wanted to take further action to specifically target repetitive loss areas. The committee identified 9 repetitive loss areas within the County with a total of 37 properties. These designated areas consist of repetitive loss properties, historical claims properties, and properties without any claims but with similar flood conditions to the repetitive loss and historical claims properties. Figure 3 on the following page illustrates the location of the repetitive loss areas and historical claims in relation to areas of localized flooding and major flooding problems noted by the County. The details of the repetitive loss areas are included within the County's Repetitive Loss Area Analysis (RLAA).

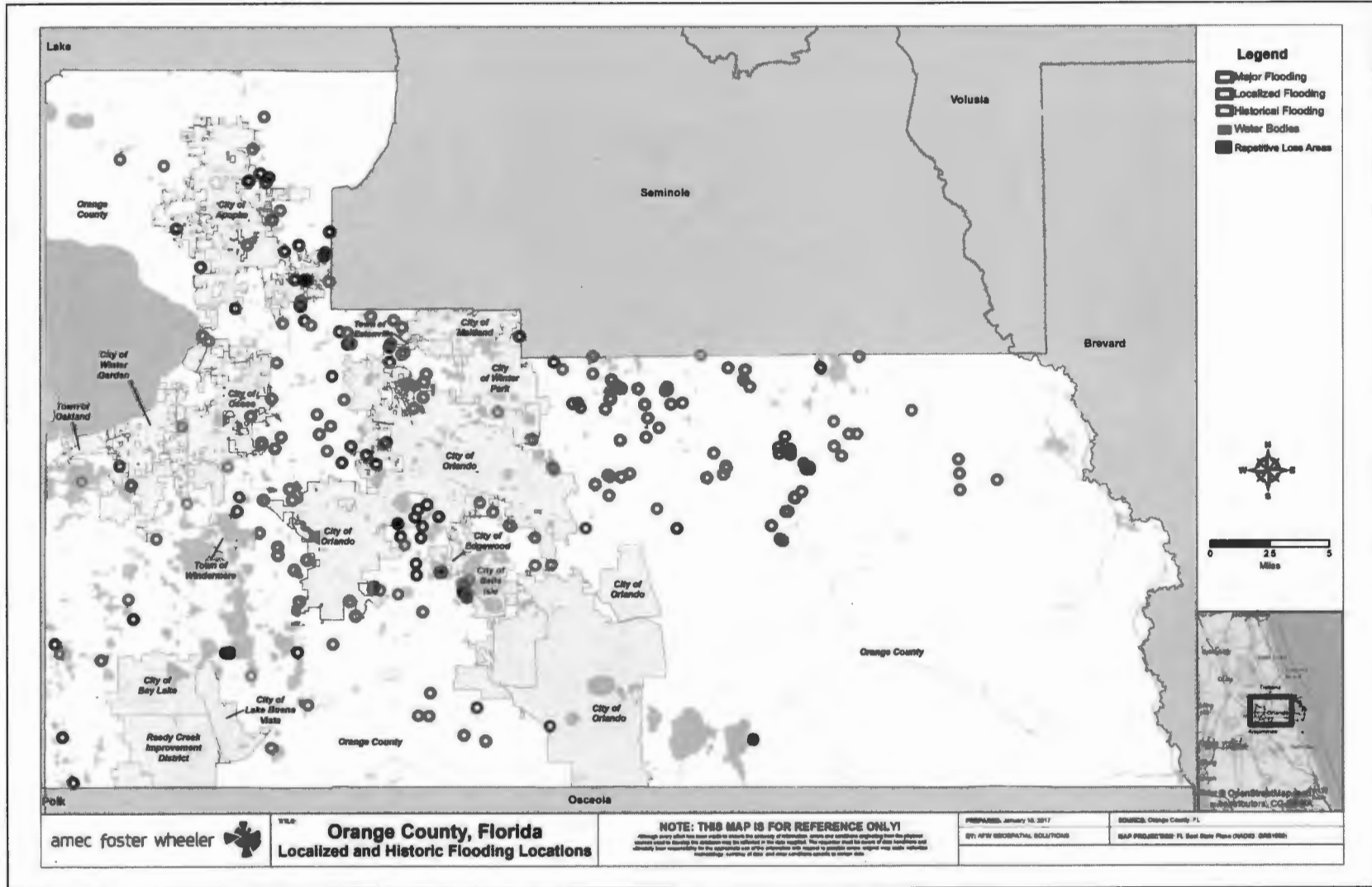


Figure 3 – Repetitive Loss Properties and FEMA Flood Zones



An analysis of repetitive loss was completed to examine the number of insured repetitive loss properties against FEMA flood zones. According to 2016 NFIP records, there are 10 unmitigated properties and 4 mitigated properties with a total payment of \$1,032,693.23. Of the 10 unmitigated repetitive loss properties, only half are insured. Table 3 details repetitive loss building counts, FEMA flood zones and total payment.

Table 3 – Repetitive Loss Buildings by Flood Zone

Flood Zone	Mitigation		Building Count		Total Building Payment	Total Content Payment	Total Paid
	Mitigated	Unmitigated	Insured	Uninsured			
X		X		X	\$46,135.36	\$0.00	\$46,135.36
A03	X		X		48,962.38	0.00	48,962.38
X	X			X	166,533.43	37,023.81	203,557.24
X		X	X		\$220,389.95	\$30,688.36	\$251,078.31
X	X		X		13,039.15	3,370.08	16,409.23
AE		X		X	\$20,878.61	\$1,106.73	\$21,985.34
X		X		X	\$24,028.53	\$0.00	\$24,028.53
AE		X		X	\$8,224.20	\$0.00	\$8,224.20
X		X	X		\$43,996.28	\$18,675.82	\$62,672.10
AE		X	X		\$112,804.53	\$43,882.24	\$156,686.77
AE	X			X	10,291.45	982.22	11,273.67
X		X	X		\$112,481.30	\$30,313.03	\$142,794.33
X		X		X	\$3,402.68	\$0.00	\$3,402.68
X		X	X		\$29,221.90	\$6,261.19	\$35,483.09
Total	4	10	7	7	\$860,389.75	\$172,303.48	\$1,032,693.23

Source: NFIP Repetitive Loss Data, 2016

Target Area #4: Shaded X Zone

Because floods can happen almost anywhere and outside of the 1% annual chance flood or high-risk Zones A/AE/AH, the PPI Committee wanted to make sure that a focus of flood preparedness extended beyond the boundaries of the SFHA. Specifically, the PPI committee wanted to focus flood outreach on the residents and business owners within the moderate risk Shaded X flood zone (500-yr floodplain). The mapped flood insurance zones for the County are shown in Figure 1. The Shaded X Zone accounts for 8,231 acres in Orange County, or 2% of the County’s total land area.

Summary

An analysis of the four target areas described above concluded the following which was considered in the formulation of messages for the PPI:

1. The entire County and all flood zones are subject to flooding, and the PPI should strive to reach all residents and businesses within the County, especially within the SFHA.
2. Areas of localized stormwater flooding coincide with repetitive loss areas.
3. Repetitive loss locations are distributed across flood zones with 64% of properties located outside of the SFHA in Zone X.
4. There are 1,397 buildings located within the Shaded Zone X flood zone with an estimated value of \$492,527,456. These property owners need to be made aware that they are subject to flood risk and that flood insurance is available to them.

2.2 Assess Flood Insurance Coverage

One valuable source of information on flood hazards is current flood insurance data for active policies and past claims. Flood insurance is required as a condition of federal aid or a mortgage or loan that is federally insured for a building located in a FEMA flood zone. NFIP data for the County was analyzed to examine the following points:

1. Where do active flood insurance policies exist?
2. Where have flood insurance claims been paid in the past?
3. How many buildings are exposed to the flood hazard versus how many buildings have coverage?
4. How does the average amount of coverage compare to the amount of expected flood damage from the 100-yr flood?

Figure 4 on the following page depicts the location of active flood insurance policies as well as policies with claims. Figure 5 shows those active policies and the location of water bodies and conservation lands, in order to better understand where there are policy gaps, geographically. There are significant concentrations of policies within the AE Zone, but some gaps remain, especially in the A Zone. Additionally, it is worth noting that there are some Preferred Risk Policies throughout the Shaded and Unshaded X-Zones, as detailed in the Flood Insurance data that follows.

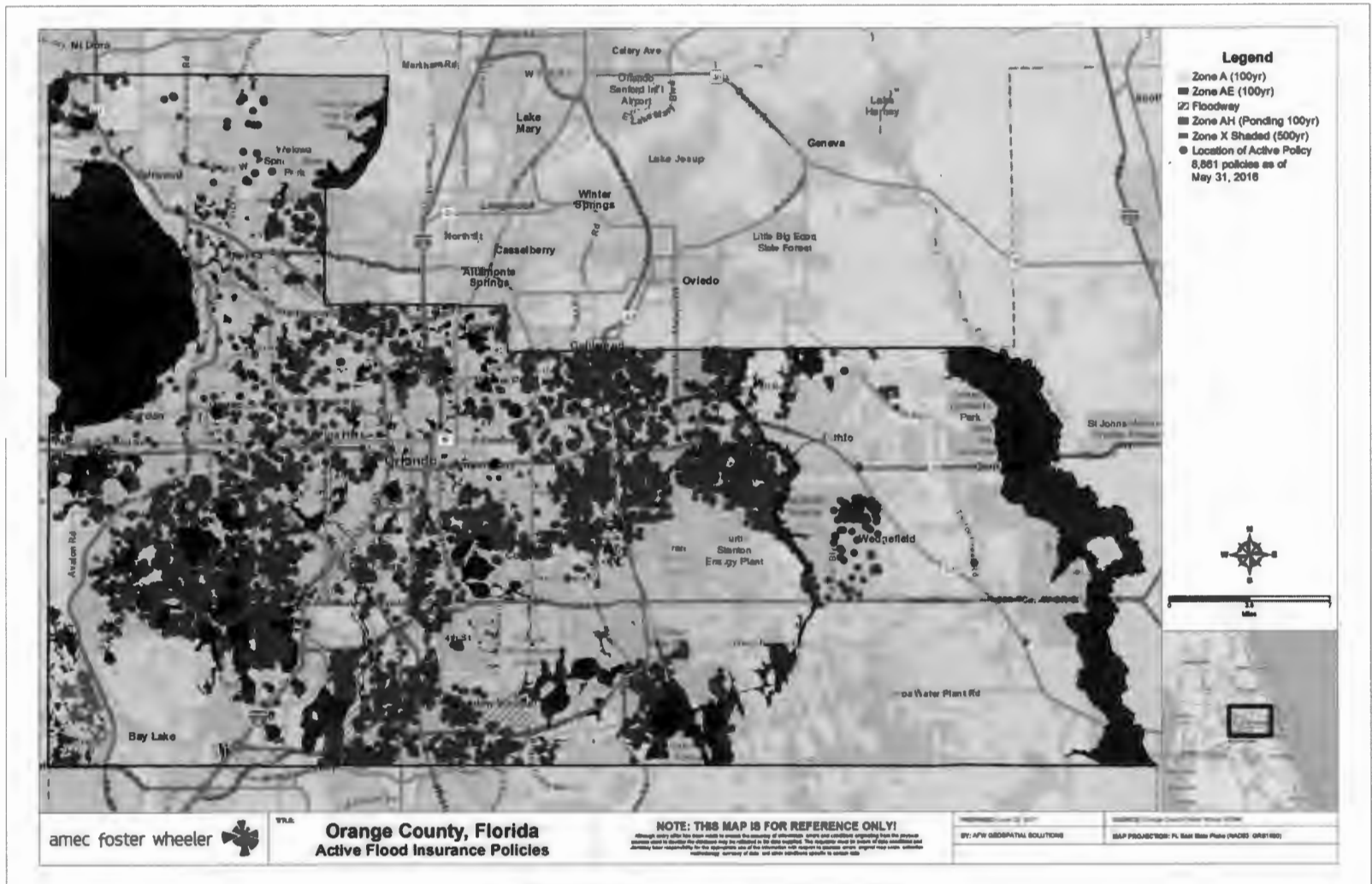


Figure 4 – Flood Insurance Policies in Force and FEMA Flood Zones

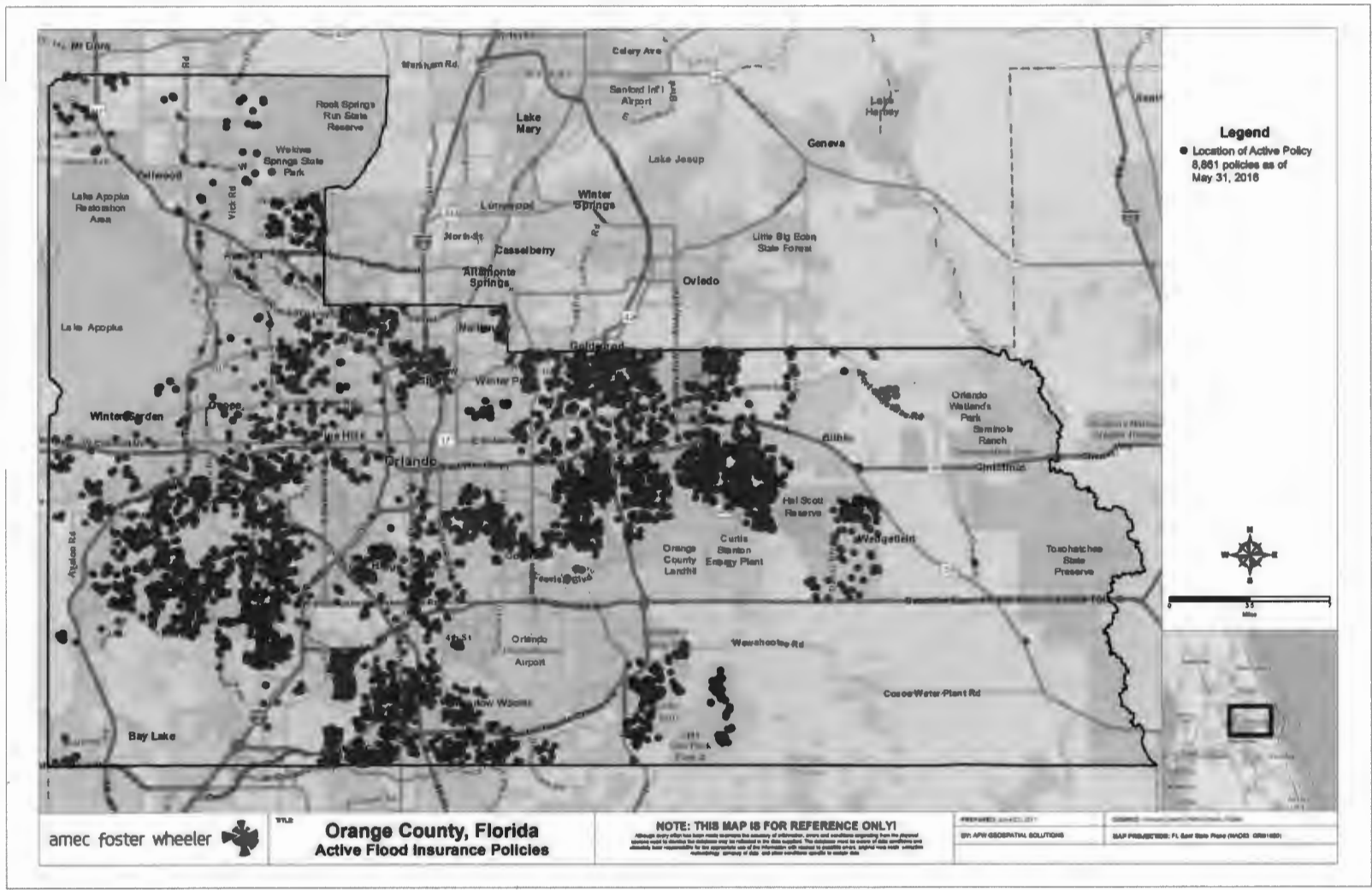


Figure 5 - Flood Insurance Policies in Force



Orange County has been a Regular participant in the NFIP since December 1982. The following tables reflect NFIP policy and claims data for the County categorized by structure type, flood zone, Pre-FIRM and Post-FIRM.

Table 4 – NFIP Policy and Claims Data by Occupancy Type

Occupancy	Number of Policies in Force	Total Premium	Insurance in Force	Number of Closed Paid Losses	Total of Closed Paid Losses
Single Family	7,807	\$3,406,093	\$2,118,965,800	202	\$2,206,850.36
2-4 Family	88	\$39,701	\$16,646,900	3	\$28,318.99
All Other Residential	1,659	\$435,438	\$205,075,200	12	\$150,790.91
Non Residential	305	\$506,499	\$148,082,100	16	\$442,190.67
Total	9,859	\$4,387,731	\$2,488,770,000	233	\$2,828,148.00

Source: FEMA Community Information System as of 06/20/2017

Table 5 – NFIP Policy and Claims Data by Flood Zone

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	2,507	\$1,235,628	\$536,556,600	72	\$831,341.06
A Zones	1,197	\$861,959	\$266,538,900	27	\$344,513.03
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	2	\$26,654.08
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	1,062	\$451,412	\$201,871,500	41	\$764,095.84
Preferred	5,093	\$1,838,732	\$1,483,803,000	82	\$851,821.19
Total	9,859	\$4,387,731	\$2,488,770,000	224	\$2,818,424.00

Source: FEMA Community Information System as of 06/20/2017

Table 6 – NFIP Policy and Claims Data Pre-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	904	\$662,290	\$180,981,100	41	\$312,454.48
A Zones	292	\$275,775	\$55,347,000	11	\$205,311.54
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	0	\$0.00
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	545	\$172,420	\$79,960,800	35	\$616,990.45
Preferred	1,020	\$365,182	\$277,908,000	44	\$544,073.79
Total	2,761	\$1,475,667	\$594,196,900	131	\$1,678,829.00

Source: FEMA Community Information System as of 06/20/2017

Table 7 – NFIP Policy and Claims Data Post-FIRM

Flood Zone	Number of Policies in Force	Total Premium	Total Coverage	Number of Closed Paid Losses	Total of Closed Paid Losses
A01-30 & AE Zones	1,603	\$573,338	\$355,575,500	31	\$518,886.58
A Zones	905	\$586,184	\$211,191,900	16	\$139,201.49
AO Zones	0	\$0	\$0	0	\$0.00
AH Zones	0	\$0	\$0	2	\$26,654.08
AR Zones	0	\$0	\$0	0	\$0.00
A99 Zones	0	\$0	\$0	0	\$0.00
V01-30 & VE Zones	0	\$0	\$0	0	\$0.00
V Zones	0	\$0	\$0	0	\$0.00
D Zones	0	\$0	\$0	0	\$0.00
B, C & X Zone					
Standard	517	\$278,992	\$121,910,700	6	\$147,105.39
Preferred	4,073	\$1,473,550	\$1,205,895,000	39	\$312,473.85
Total	7,098	\$2,912,064	\$1,894,573,100	94	\$1,144,320.00

Source: FEMA Community Information System as of 06/20/2017

Table 8 compares the policies in force with the number of buildings located within each flood zone and identifies the percent of buildings insured.

Table 8 – Percentage of Buildings Insured

Flood Zone	Number of Policies in Force	Number of Buildings	% Insured
A01-30 & AE Zones	2,507	4,332	57.9%
A Zone	1,197	2,783	43.0%
AH Zone	0	1	0%
B, C & X Zone	6,155	236,362	2.6%
D Zone	0	1	0%
Total	9,859	243,479	4.0%

Source: FEMA Community Information System, September 2016

Table 9 compares number of buildings present, number of policies in force, total coverage and a calculation of loss estimate values for the 100-year flood.

Table 9 – Flood Loss Estimates by Flood Zone

Flood Zone	Number of Buildings	Number of Policies in Force	Total Value ¹	Total Coverage	Loss Estimate
A01-30 & AE Zones	4,332	2,507	\$2,163,187,965	\$536,556,600	\$537,306,881
A Zone	2,783	1,197	\$1,417,750,333	\$266,538,900	n/a*
AH Zone	1	0	\$23,256	\$0	n/a*
Total	7,116	3,704	\$3,580,961,554	\$803,095,500	n/a*

Source: Orange County Tax Assessor's Data, FEMA DFIRM (Preliminary 10/30/15)

¹Total value does not include land value.

*Loss estimates could not be calculated because flood depths were not available for Zones A and AH.

The notable statistic in Table 8 is that while there are 7,115 buildings located within the 100-yr flood zone, only 52% of these buildings carry an active flood insurance policy. Furthermore, only 2.6% of buildings within the X Zone are insured, but as the repetitive loss figures previously showed, flooding is not limited to the 100-yr flood zones.



An analysis of existing flood insurance coverage for Zone AE shows that existing building coverage does not meet the loss estimate for the 100-yr flood zone. Moreover, this statistic does not take into account the large number of uninsured proprietries (48%) that would have no coverage in the event of a flood loss. Therefore, there is a need to increase the flood insurance coverage in the County by increasing the number of policyholders. Total building content value within the 100-yr flood zone is currently estimated at \$1,313,435,002.

Insurance Assessment Conclusions:

1. 4% of all flood zones are covered by a flood insurance policy; therefore, 96% are not.
2. Only 2.6% of the buildings in the X Zones have a flood insurance policy and 57.4% of those policies are preferred risk policies.
3. A higher percentage of buildings located in the AE Zone are insured as compared to the entire floodplain.

Insurance Assessment Recommendations

1. Increase the number of Flood Insurance Policies in AE and A Zones.
2. Concentrate on retention of flood policies in the AE and A Zones.
3. Increase the number of Standard and Preferred Risk Flood Insurance Policies in the Shaded X and X Zones.

Repetitive Flooding: An analysis of repetitive loss was completed to examine the number of insured repetitive loss properties against FEMA flood zones. According to 2016 NFIP records, there are 10 unmitigated properties with a total payment of \$752,490.71. Of the 10 unmitigated repetitive loss properties, only half of the properties are insured. Table 10 details repetitive loss building counts, FEMA flood zones and total payment.

Table 10 – Repetitive Loss Summary Table (Unmitigated Properties)

Flood Zone	Building Count		Total Building	Total Content	Total Paid
	Insured	Uninsured	Payment	Payment	
X		X	\$46,135.36	\$0.00	\$46,135.36
X	X		\$220,389.95	\$30,688.36	\$251,078.31
AE		X	\$20,878.61	\$1,106.73	\$21,985.34
X		X	\$24,028.53	\$0.00	\$24,028.53
AE		X	\$8,224.20	\$0.00	\$8,224.20
X	X		\$43,996.28	\$18,675.82	\$62,672.10
AE	X		\$112,804.53	\$43,882.24	\$156,686.77
X	X		\$112,481.30	\$30,313.03	\$142,794.33
X		X	\$3,402.68	\$0.00	\$3,402.68
X	X		\$29,221.90	\$6,261.19	\$35,483.09
Total	5	5	\$621,156.33	\$130,927.37	\$752,490.71

Source: NFIP Repetitive Loss Data, 2016

2.3 Determine Target Audiences

According to the 2010 US Census, 30% of County residents are Hispanic or Latino and 34% of residences have a language other than English spoken in the home. The 2015 American Community Survey 5-Year Estimate reports that 24.2% of the population speaks Spanish and 36.6% of those Spanish speakers speak English “less than ‘very well’”. Approximately 18% of the population is considered as living below the poverty level. These social and economic factors were considered by the committee in ensuring that the right messages, tools and resources were used to overcome obstacles. The committee recognized that messages would need to be distributed in different forms and using different sources in order to reach all target audiences. The following groups have been identified as target audiences who need special messages on flood protection:

Target Audience #1: Homeowners Associations

Homeowners Associations have access to entire neighborhoods and often host neighborhood events. Educating and partnering with this audience would be an efficient way to reach large groups of residents at one time.

Target Audience #2: Spanish Speaking Population

With nearly a quarter of the population speaking Spanish and over a third of those Spanish-speakers having a low proficiency in English, the PPI committee recognized that providing Spanish materials and messaging targeted toward the Spanish-speaking population will ensure that this large portion of the population does not miss important flood-related information due to a language barrier.

Target Audience #3: Landscapers

There has been a consistent problem with landscapers sweeping vegetation/debris into nearby storm drains which clogs the system and causes stormwater to back-up and overflow into the surrounding area.

Target Audience #4: Real Estate, Lending and Insurance Companies

This group plays a key role in conveying information about flood insurance to homeowners. The PPI Committee will make sure this group is informed and equipped with the tools needed to convey flood risk and flood insurance information to residents.

2.4 Inventory of Other Public Information Efforts

A key part of developing a public information program is becoming aware of other public information activities targeted at County residents. The information in Table 11 came from past projects, staff research, and PPI Committee members. Knowing what messages are currently reaching the residents of the County is essential in determining what types of projects or messages are effective and which ones may need to be revised or what new projects are necessary to encourage residents and businesses to adopt behaviors to protect their property and their lives and to make the County more resilient.

Table 11 – Existing Public Information Efforts

Organization	Project	Subject Matter	Frequency
Stormwater Management Division	Distribute rain gauges	Flood awareness; Protect water resources	Year-Round
Stormwater Management Division	“A Citizen’s Guide to Flood Protection” brochure, mailed to all properties in community	Various flood-related topics	Annually
Stormwater Management Division	“Retention Pond Maintenance” brochure, available at Public Works Department	Protect natural floodplain functions; Protect your property from the hazard	Year-Round
Stormwater Management Division	Hurricane Expo	Hurricane preparedness; General preparedness	Annually
St. Johns River Water Management District	“Neighborhood Guide to Stormwater Systems” pamphlet, available at Public Works Department	Know your flood hazard; Protect natural floodplain functions; Protect your property from the hazard	Year-Round
Stormwater Management Division	“Why You Need Flood Insurance” brochure, copy available in Public Works Dept.	Insure your property; (also available in Spanish)	Year-Round
Stormwater Management Division	“Floodsmart.gov Know Your Risk” NFIP Guide mailed upon request; copy available in Public Works Dept.	Know your flood hazard; Insure your property	Year-Round
Stormwater Management Division	“Preferred Risk Policy” brochure targeting business owners; copy available in Public Works Dept.	Insure your property	Year-Round
Stormwater Management Division	“Nothing Can Dampen the Joy of Home Ownership...” brochure targeting homeowners; copy available in Public Works Dept.	Insure your property	Year-Round
Stormwater Management Division	“Flood Preparation and Safety” brochure, copy available in Public Works Dept.	General preparedness; Know your flood hazard; Protect yourself and your family	Year-Round
Stormwater Management Division	“Increased Cost of Compliance Coverage” brochure; copy available in Public Works Dept.	Flood protection options and ICC coverage for these options	Year-Round
Stormwater Management Division	“Flood Insurance Requirements for Recipients of Federal Disaster Assistance” pamphlet; copy available in Public Works Dept.	Insure your property; Anyone can get flood insurance	Year-Round
Stormwater Management Division	One-on-one technical assistance and advice regarding flooding and drainage issues on private property	Flood protection, Build responsibly	Year-Round

Organization	Project	Subject Matter	Frequency
County Public Library	Various Publications	Various flood-related topics	Year-Round
County website	Website	Various flood-related topics	Year-Round
Stormwater Management Division	No Dumping Signage along canal and streams and on top of storm drain inlets	Protect Natural Floodplain Functions	Year-Round
Florida Division of Emergency Management	Website and Various Publications	Hurricane Preparedness, Response, Recovery and Mitigation and various flood-related topics and brochures, Get a Family and Business Plan	Year-Round
Florida – Ready.Gov	Website	Hurricane Preparedness, Preparing Your Home, After a Hurricane, Hurricane Plan, Flood Safety, Flood Preparedness, Flood Plan, Flood Insurance	Year-Round



Examples of Existing Outreach Projects

Step 3: Formulate Messages

After reviewing the Community Needs Assessment, the PPI Committee reviewed the existing outreach projects and their dissemination methods and developed the following priority messages. Table 8 summarizes each message and the desired outcome. Topics A through F are the CRS Activity 330 Priority Topics and Topics G through J are the additional topics which were identified by the PPI Committee.

The 10 topics identified below are covered by various projects which are listed in Table 9. In addition, the seven Target Audiences are addressed through the projects as well.

Table 12 – Messages and Desired Outcomes

Topic	Message	Outcome(s)
A. Know your flood hazard	1. Your property is subject to flooding	Increase number of FIRM inquires
	2. Your property is in a repetitively flooded area	Reduce future repetitive loss properties
	3. Don't drive through flooded streets (know where to drive and where not to drive)	Reduce damages to vehicles, emergency rescues, and responders
B. Insure your property	1. You need to buy flood insurance	Increase number of flood insurance policies
	2. Your homeowner's policy does not cover flood damage	Increase number of flood insurance policies
	3. Buy renters contents insurance to protect your valuables from flood damage	Reduce damage to contents
C. Protect yourself and your family	1. Turn around don't drown	Reduce rescues and deaths
	2. Know the flood warning signals	Reduce rescues and deaths
D. Protect your property from the hazard	1. Elevate HVAC exterior units	Reduce number of flood damaged HVAC units
	2. Get the proper permits before you begin work	Reduce red tag violations
	3. Don't throw trash or debris in streams, channels or open bodies of water	Reduce pollution and overbank flow
	4. Grant monies are available to help elevate your home	Increase financial opportunities
E. Build responsibly	1. Get a permit before you start construction	Reduce citations
	2. Know the substantial damage rules	Reduce citations
	3. Keep areas open (setbacks) between homes and property lines	Maintain proper drainage
F. Protect natural floodplain functions	1. Don't dump in storm drains	Improve water quality
	2. Report erosion control measures not working	Contain erosion on construction sites
	3. Don't disturb natural floodplain areas	Reduce grading, fill, and earth movement
G. Hurricane Preparedness	1. Prepare a safety checklist and emergency supply Kit	Protect family and reduce damage

Topic	Message	Outcome(s)
H. General Preparedness	1. Identify and document your personal belongings	Reduce delays in receiving insurance payments by having important documents ready (insurance papers, etc.)
I. Be aware of other hazards (Sink Holes)	1. Check for cracks in pavement and yards and know risks of Karsts soils	Reduce potential damage to life and property
J. Buy flood insurance Outside of SFHA	1. Protect your property in low risk flood zones from localized stormwater flooding	Increase number of Preferred Risk Policies (PRP) in X and C Zones

Step 4: Identify Outreach Projects to Convey the Messages

The overall strategy is to make information available to target audiences in a manner that will encourage each audience to adapt behaviors to improve preparedness and decrease future flood damage. The PPI Committee identified 18 existing and new projects and initiatives that would be implemented during 2017/2018. These projects are further organized by target area, audience and message in Table 13.

In addition to projects that are implemented every year, the PPI Committee recommends Flood Response Projects which are projects that will be implemented during and after a flood. These projects are drafted and made ready for production and dissemination after a flood warning. These projects are listed at the end of Table 13.

Existing public outreach efforts are identified in Section 2.4. New projects identified by the PPI Committee include:

- Target the SFHA with an updated flood brochure covering all 10 flood-related topics including the 6 CRS priority topics.*
- Target properties in repetitive loss areas with an updated flood brochure.
- Meet with homeowners' associations to discuss the 10 flood-related topics, including the 6 CRS priority topics.
- Update the County's website to include a more flood-related information including where to get more detailed assistance.
- Develop new brochures on specific topics such as elevating your HVAC units to reduce future flood claims.

*The committee decided as a result of recent flooding from Hurricane Irma that it would be more important for the updated brochure to include the statement "Are you prepared for a flood in your neighborhood?" as opposed to "You are receiving this brochure because you are located in or near an SFHA."

Step 5: Examine Other Public Information Initiatives

The PPI Committee and County staff worked together to identify other Public Information Initiatives (PII) which provide additional information to citizens in the County and to improve access to information and services provided by the County. Those other public information initiatives include:



Activity 310: Make all Elevation Certificates accessible on the County's website. See **OP# 8** on page 24. EC's can be retrieved via this link <https://fasttrack.ocfl.net/OnlineServices/PermitsAllTypes.aspx>. This project will allow insurance and real estate professionals along with lenders and property owners to access important elevation information about a particular property in a more expedient manner.

Activity 320: Publicize Activity 320 on the County's website to encourage more map inquiry requests from the public by listing the types of information and the benefits of this information to the public. The service is already publicized annually in a community-wide outreach brochure. However, this information will be also added to the community's website to make it more visible to the public as a service the County offers. See **OP# 5** on page 24.

Activity 350: Enhancement of the County's website to house all Elevation Certificates, all LOMA's, and updated Activity 330 brochure with the six priority topics and four additional topics along with the publication of activities 320 and 360. This updated website will also have a dedicated Hurricane Preparedness page with such topics as "Managing Stormwater and Debris Cleanup." Additionally, provide links to various stakeholder groups such as Floodsmart, FEMA, Orange County Emergency Management, Florida Emergency Management, etc. See **OP# 8** on page 24.

Activity 360: Publicize Activity 360 on the County's website so a wider audience is aware of this service. Additionally, this service will be discussed at homeowner association meetings so that an even wider audience is aware that the County provides this service. Therefore, residents will have 3 different ways to remind them that they can call Orange County if they are experiencing flooding conditions on their property and the Public Works Department can respond and provide a resolution to the property owner. See **OP# 6** on page 24 and **OP# 16** on page 26.

Flood Response Preparations: Orange County has pre-planned and developed a set of public information projects that will be implemented during and after a flood. See the set of projects (FRP #1-9) on pages 28-29. Implementation procedures are as follows:

- FRP #4, FRP #5, and FRP #8 will be publicized on the County's website and on social media. These projects are already developed and available in digital format to be shared on these platforms.
- FRP #1, FRP #2, FRP # 3, FRP #6, FRP #7, and FRP #9 are available in paper and digital formats. These documents will be on hand to make available for download from the County website, provide to flooded property owners, and/or distribute from locations throughout the County.

Step 6: Implement, Monitor and Evaluate the Program

6.1 Adoption: This document will become effective when it is adopted by the County Board of Commissioners.

6.2 Evaluation: The PPI Committee along with County Staff will monitor the projects as they are developed, as well as the results. They will record inputs from PPI Committee members and suggestions from other County employees and stakeholders participating in the activities. That input will be sent by e-mail to committee members for consideration and evaluation.

The PPI Committee will meet once per year to review the implementation of these projects and initiatives. At that time, the status of the projects will be explained and progress toward the outcomes will be discussed. The Committee will recommend to the appropriate County offices and the stakeholders who implement projects whether the projects should be changed or discontinued. The Committee will meet and review the outcomes of each individual activity to change, add, or approve them. Table 13 will be



revised as needed. The Committee will post the updated PPI on the County website and provide the PPI to local media and the County Board of Commissioners for informational purposes annually. The outcomes and revisions will be submitted as part of the County's annual recertification package to the Community Rating System.



Table 13 – PPI Projects and Initiatives

Target Area & Audience(s)	Topic(s) (See Table 8)	Message(s) (See Table 8)	Project(s)	Assignment	Schedule	Stakeholder
Outreach Projects						
Target Area #1: Special Flood Hazard Area (SFHA)	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic C Protect Yourself and Your Family Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic F Protect Natural Floodplain Functions Topic G Hurricane Preparedness Topic H General Preparedness Topic I Be Aware of Other Hazards Topic J Anyone Can Buy Flood Insurance	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Elevate exterior HVAC units Get permit before you start construction Don't dump in storm drains Report erosion control measures not working Prepare a safety checklist Identify and document your personal belongings Check of cracks in pavement and yards Buy lower cost Preferred Risk Policies (PRP) to protect your home 	OP #1 Updated Flood Protection Brochure will be mailed to all property owners in SFHA annually	Orange County Stormwater Management	April/May	N/A
			OP #2 Updated Flood Protection Brochure placed at 5 different locations in the County (Public Works, Administration Building, Barnett Park, Property Appraiser, Supervisor of Elections, South Econ Park Senior Renaissance Center)	Orange County Stormwater Management	Year-Round	N/A
			OP #3 Publicize the Floodsmart.gov website on the County's website and on the Flood Protection Brochure that is distributed to SFHA & Repetitive Loss Areas	Orange County Stormwater Management	Year-Round	N/A
			OP #4 Map Inquiry Service: Provide information on areas that have local storm water flooding, repetitive loss, and flood depths, and publicize this service on website along with information on the FIRM including floodway info	Orange County Stormwater Management; Orange County GIS	Year-Round	N/A
			OP #5 Flood Protection Assistance: Publicize Service on County's website, Flood Protection Brochure and in meetings with HOA's (see OP #16)	Orange County Stormwater Management	Year-Round	Homeowner's Associations
			OP #6 Update County's website to include flood outreach information (10 topics), elevation certificates, LOMAs and Hurricane Preparedness page, links to Floodsmart.gov, Orange County Emergency Management, State of Florida Emergency Management, and FEMA.	Orange County Stormwater Management; Orange County Office of Public Engagement & Citizen Advocacy	Annually	State of Florida, and FEMA
	Topic D Protect Your Property from the Hazard Topic E Build responsibly	<ul style="list-style-type: none"> Elevate exterior HVAC units Keep areas open (setbacks) between homes and property lines 	OP #7 Brochure for Orange County to distribute to HVAC contractors on benefits of elevating HVAC Units and brochure on benefits of building responsibly in the SFHA (Placed at 5 locations in OP# 2)	Orange County Stormwater Management	Year-Round	General contractors and HVAC contractors
	Topic D Protect Your Property from the Hazard Topic F Protect Natural Floodplain Functions	<ul style="list-style-type: none"> Don't throw trash or debris in streams, channels and open bodies of waters (because the house you flood, may be your own.) Don't dump in storm drains 	OP #8 Signage placed throughout the community and SFHA which says don't throw trash and debris down storm drainage inlets and signage along canals which says don't throw trash and debris into canals.	Orange County Stormwater Management/Public Works	Year-Round	N/A



Target Area & Audience(s)	Topic(s) (See Table B)	Message(s) (See Table B)	Project(s)	Assignment	Schedule	Stakeholder
Outreach Projects						
Target Area #2: Localized Stormwater Flooding Locations	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic C Protect Yourself and Your Family Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic F Protect Natural Floodplain Functions <i>continued from above</i> Topic H General Preparedness	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Elevate exterior HVAC units Get permit before you start construction Don't dump in storm drains Identify and document your personal belongings 	OP #9 See projects OP #4 and OP #5 above, as they also apply in Localized Stormwater Flooding Locations	Orange County Stormwater Management	Year-Round	Homeowner's Associations
Target Area #3: Repetitive Loss Properties/Areas	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic C Protect Yourself and Your Family Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic F Protect Natural Floodplain Functions Topic H General Preparedness	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Elevate exterior HVAC units Get permit before you start construction Don't dump in storm drains Identify and document your personal belongings 	OP #10 Updated Flood Protection Brochure mailed each year to all properties in Repetitive Loss Areas	Orange County Stormwater Management	April	N/A
			OP #11 See projects OP #3 through OP #6 above as they also apply in Repetitive Loss Areas	Orange County Stormwater Management	Various	Various
Target Area #4: Shaded X Zone	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic C Protect Yourself and Your Family Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic F Protect Natural Floodplain Functions Topic G Hurricane Preparedness Topic H General Preparedness	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Elevate exterior HVAC units Get permit before you start construction Don't dump in storm drains Prepare a safety checklist 	OP #12 Continue to hold the Hurricane Expo annually to provide preparedness, response, and recovery information to all County residents including information on the 10 topics in the updated Flood Protection Brochure	Orange County Stormwater Management	June	Florida Department of Emergency Management
			OP #13 Promote Flood Insurance in X Zones by providing Insurance agents with flood insurance brochures from FEMA to be mailed with the 320 letters to insurance agents	Orange County Stormwater Management	May	Insurance Agents



Target Area & Audience(s)	Topic(s) (See Table B)	Message(s) (See Table B)	Project(s)	Assignment	Schedule	Stakeholder
Outreach Projects						
	<i>continued from previous</i> Topic I Be Aware of Other Hazards Topic J Anyone Can Buy Flood Insurance	<i>continued from previous</i> <ul style="list-style-type: none"> Identify and document your personal belongings Check for cracks in pavement and yards Know risks of Karst soils Buy lower cost Preferred Risk Policies (PRP) to protect your home 	OP #14 The St. John's Water Management District Brochure "Neighborhood Guide to Stormwater Systems" (placed at 5 locations in OP# 2)	Orange County Stormwater Management; Orange County Office	Annually	St. Johns River Water Management District
Target Audience #1: Homeowners Associations	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic C Protect Yourself and Your Family Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic F Protect Natural Floodplain Functions Topic G Hurricane Preparedness Topic H General Preparedness Topic I Be Aware of Other Hazards Topic J Anyone Can Buy Flood Insurance	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Elevate exterior HVAC units Get permit before you start construction Don't dump in storm drains Prepare a safety checklist Identify and document your personal belongings Check for cracks in pavement and yards Buy lower cost Preferred Risk Policies (PRP) to protect your home 	OP #15 Speak to a Homeowner's Associations each year on topics of Flood Hazard, Flood Insurance, Property Protection, Family Protection, Building Responsibly, Protection of Natural Floodplain Functions, Sinkholes and Hurricane Preparedness (All topics on the updated Flood Protection Brochure)	Orange County Stormwater Management	April and September	Homeowner's Associations/State of Florida
Target Audience #2: Spanish Speaking Population	Topic A Know Your Flood Hazard Topic B Insure Your Property Topic J Anyone Can Buy Flood Insurance	<ul style="list-style-type: none"> Your property is subject to flooding You need to buy flood insurance Buy renters contents insurance to protect your valuables from flood damage Buy lower cost Preferred Risk Policies (PRP) to protect your home 	OP #16 FEMA NFIP Insurance Brochure in Spanish available at 5 locations in County and 311 reporting line has Spanish speaking operators to report any flooding issues	Orange County Stormwater Management	Year-Round	FEMA/Spanish speaking population in County
Target Audience #3: Landscapers	Topic F Protect Natural Floodplain Functions	<ul style="list-style-type: none"> Don't dump in storm drains Don't disturb natural floodplain areas 	OP #17 Develop information brochure to inform landscapers not to blow grass clippings or leaves into storm drains	Orange County Stormwater Management; Orange County Office of Public Engagement & Citizen Advocacy	October	Landscapers in County



Target Area & Audience(s)	Topic(s) (See Table 8)	Message(s) (See Table 8)	Project(s)	Assignment	Schedule	Stakeholder
Outreach Projects						
Target Audience #4: Real Estate, Lending, and Insurance Companies	Topic B Insure Your Property	<ul style="list-style-type: none"> Buy flood insurance outside of SFHA in X-Zone or C-Zone You need to buy flood insurance Buy lower cost Preferred Risk Policies (PRP) to protect your home 	OP #18 Provide NFIP brochures on benefits of flood insurance and that insurance can be purchased anywhere in the County to lenders, and insurance companies to be mailed with 320 mailing.	Orange County Stormwater Management	May	FEMA (NFIP), Real Estate Agents, Lenders, Insurance Agents
Flood Response Projects						
Flooded property owners and residents	Topic C Protect Yourself and Your Family Topic B Insure Your Property Topic D Protect Your Property from the Hazard Topic E Build Responsibly Topic J Hurricane Preparedness	<ul style="list-style-type: none"> Your property is subject to flooding Don't drive through flooded streets Turn around don't drown You need to buy flood insurance Elevate exterior HVAC units Get permit before you start construction Buy flood insurance outside of SFHA in X-Zone or C-Zone Grant monies are available to help elevate your home Know the substantial damage rules Keep areas open (setbacks) between homes and property lines Get the proper permits before you begin work 	FRP #1 Provide "After a Flood: The First Steps" brochure to flooded property owners which provides information on the dangers of flood water, listen for local warnings, don't drive through flooded streets, stay healthy (emotional stress), and cleaning up and repairing your home	Orange County Stormwater Management	Ready to go before, during and after a flood	FEMA and American Red Cross
			FRP #2 Provide copies of "Repairing your flooded home" FEMA 234 publication to flooded property owners which provides information on protecting your home from further damage, getting organized, drying out your flooded home, restoring utilities, clean up, rebuilding and preparing for the next flood.	Orange County Stormwater Management	Ready to go before, during and after a flood	FEMA and American Red Cross
			FRP #3 Provide information on the County's Substantial Damage rules	Orange County Stormwater Management	Ready to go before, during and after a flood	N/A
			FRP #4 Provide information on the need for a building permit on the County's website and on social media	Orange County Stormwater Management	Ready to go before, during and after a flood	N/A
			FRP #5 Promote the availability and benefits of flood insurance on the County's Website and on social media	Orange County Stormwater Management	Ready to go before, during and after a flood	N/A



Target Area & Audience(s)	Topic(s) (See Table B)	Message(s) (See Table B)	Project(s)	Assignment	Schedule	Stakeholder
Flood Response Projects						
			FRP #6 FEMA Brochures for residents and businesses on Flood Preparation and Safety, Nothing can Dampen the Joy of Home Ownership, Flood Insurance Requirements for Recipients of Federal Disaster Assistance, Increased Cost of Compliance Coverage, Preferred Risk Policy	Orange County Stormwater Management	Ready to go before, during and after a flood	FEMA and Floodsmart
			FRP #7 Updated Flood Protection Brochure for residents and business before, during and after a flood event	Orange County Stormwater Management	Ready to go before, during and after a flood	
			FRP #8 Links on website for sandbag pick up locations, FEMA Video on Preparedness and FEMA & CDC Video Mold Safety after a Disaster	Orange County Stormwater Management	Ready to go before, during and after a flood	FEMA and Centers for Disease Control
			FRP #9 Provide FEMA's Homeowner's Guide to Retrofitting including the flood hazards, protecting people, protecting property & building responsibly	Orange County Stormwater Management	Ready to go before, during and after a flood	FEMA

End of Report