

# NWS Flood Operations

An aerial photograph of a large dam with water cascading over it. The dam is a long, low structure with a wide spillway. The water is white and turbulent as it falls. The surrounding landscape is green and hilly, with some buildings and roads visible. The sky is overcast with grey clouds.

Bob Carle, Senior Service Hydrologist  
National Weather Service Fort Worth, TX

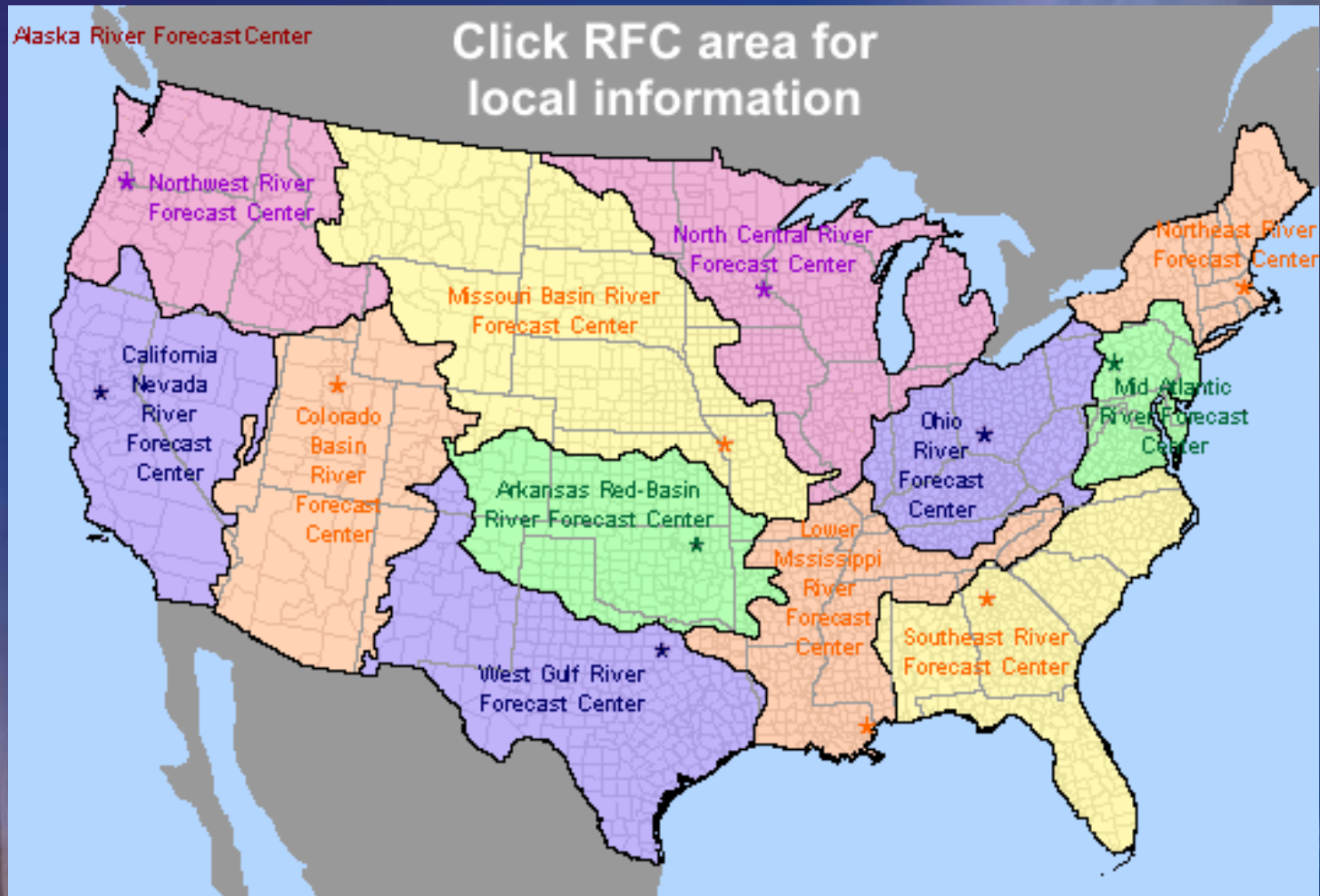
# Flood Operations At The WFO

- There are 2 distinct flood programs at the WFO: River Flood and Flash Flood
- The Flash Flood Program is handled strictly at the WFO
- Forecasters use the same software to issue Flash Flood Warnings as other severe weather products
- WFO has specialized software (FFMP) to monitor heavy rainfall on a small drainage basin scale
- Also monitor real-time rainfall data from local networks

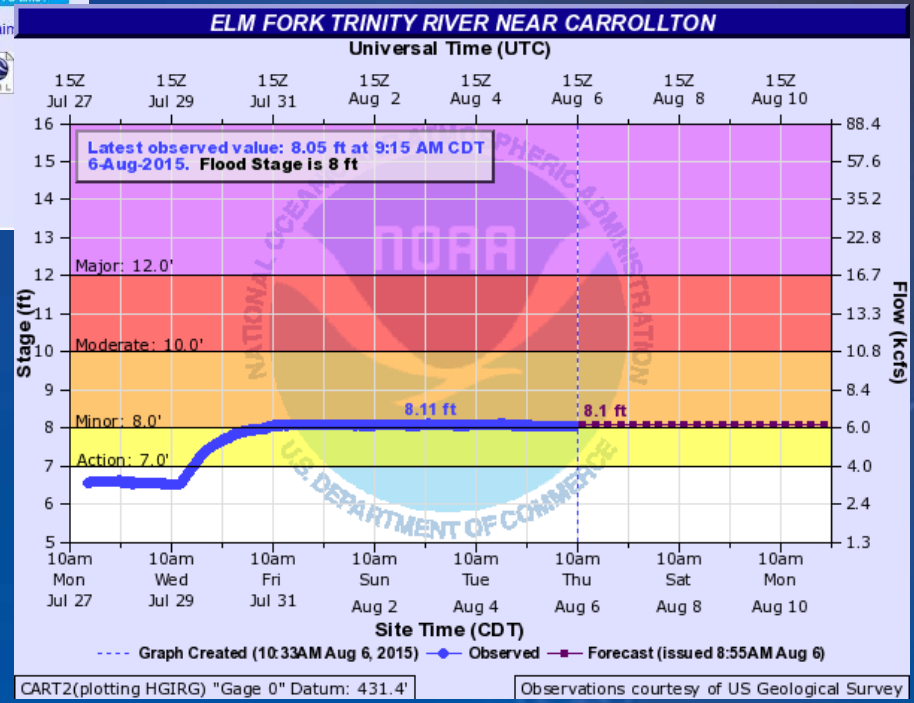
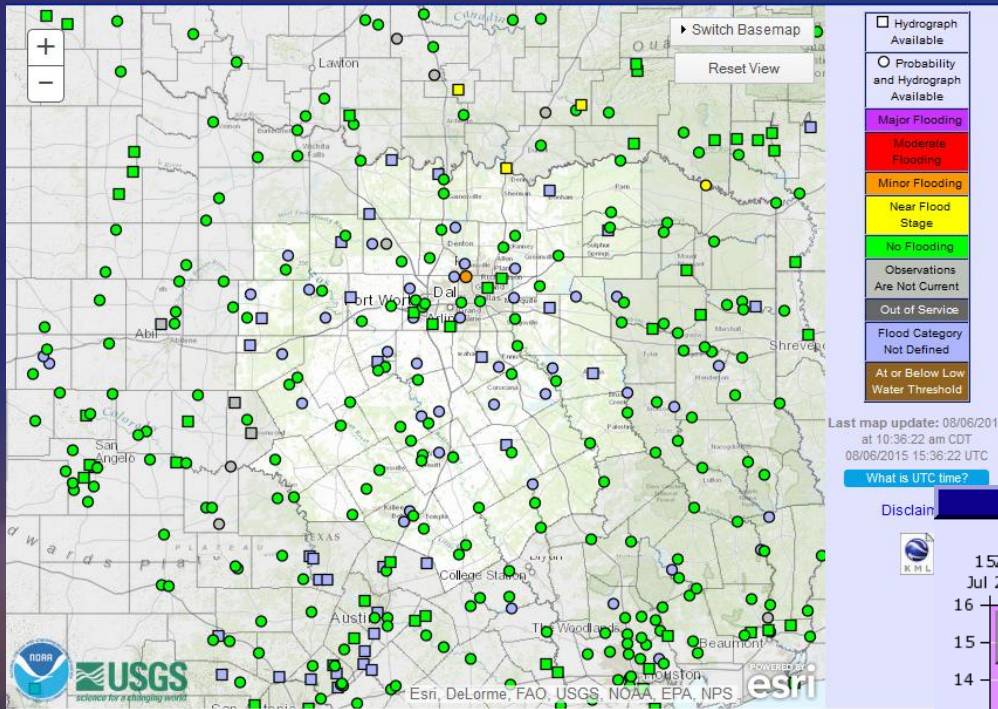
# Flood Operations At The WFO

- The river flood forecasts are produced at the WGRFC and issued by the WFO
- The WFO produces both text and graphic forecast products
- River forecast point flood stages and damage levels are set by the local Weather Forecast Office (WFO) in coordination with county officials and river authorities
- River Forecast Centers produce a suite of rainfall products as well

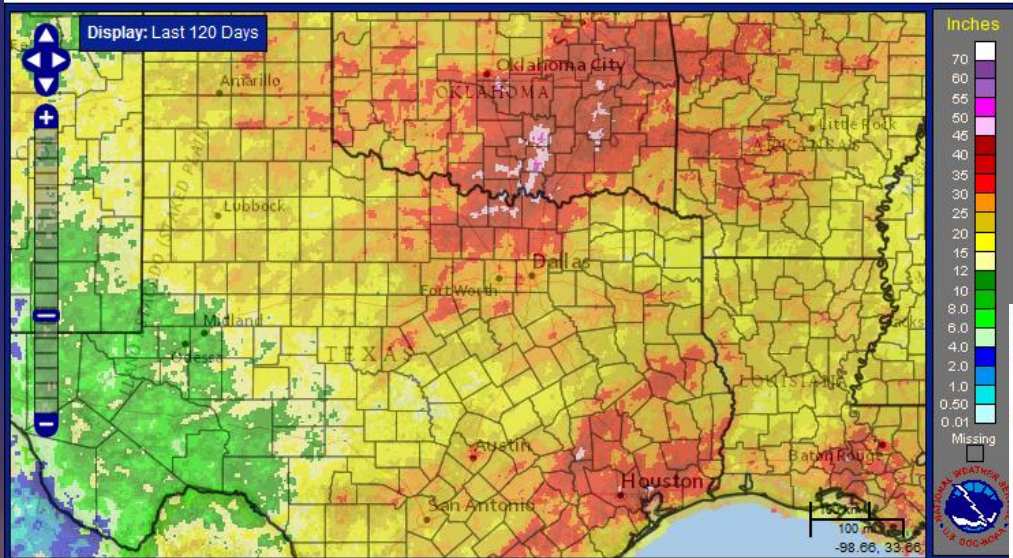
# River Forecast Centers



# AHPS Web Graphics



# RFC Precipitation Products



Rainfall Reports for the Dallas / Fort Worth Hydrologic Service Area  
 National Weather Service...West Gulf RFC...Fort Worth, TX  
 1031 AM CDI Sun Aug 02 2015

Precipitation for the 24 hours ending about 7 a.m. Sunday August 02, 2015

DFW Metroplex...

Waco/Temple/Killeen Corridor...

Red River Valley/Far North Texas...

Wichita Falls/Upper Red River Valley/Far Northwest Texas...

Truscott 5 W	1.56	Truscott 5 N	1.38
Benjamin 0.2 SSE	1.33	Truscott-Brine Lake	0.90
Seymour 1 NNW	0.87	Wichita Falls Arpt/Shepard AFB	0.86
Knox City 3 NW	0.81	Munday	0.78
Seymour 11 NW - Wichita River	0.78	Benjamin 4 W	0.57
Elmer, OK	0.45	Burkburnett-Red River	0.44
Quanah 0.1 NW	0.36	Munday 13 ESE-Millers Ck Res	0.21
Seymour 15 NE	0.17	Goodlett 3 W	0.17
Odell 4 ENE	0.13	Antelope	0.08
Lake Kemp	0.08	Henrietta 3 W-Ltl Wichita Rvr	0.02
Seymour 3 NW	0.02	Charlie 3 SE - Wichita River	0.01
Electra - Beaver Creek	0.01	Kadane Corner 1 SSW	0.01
Vernon - Pease Creek	0.01	Wichita Falls-10th St	0.01

Western North Texas...

Graford 8.1 ENE	0.21	De Leon 4.5 W	0.13
Woodson	0.10	Comanche County Airport	0.02

Eastern North Texas...

Remainder of Dallas / Fort Worth HSA...

## Overlays:

- States  Counties  River Basins  
 River Forecast Center Boundaries

## Precipitation Opacity:



Image Last Updated: 08/06/2015 14:58UTC

Image Valid:  
 04/08/2015 14:00 UTC to  
 08/06/2015 14:00 UTC

## Available Precipitation Images:

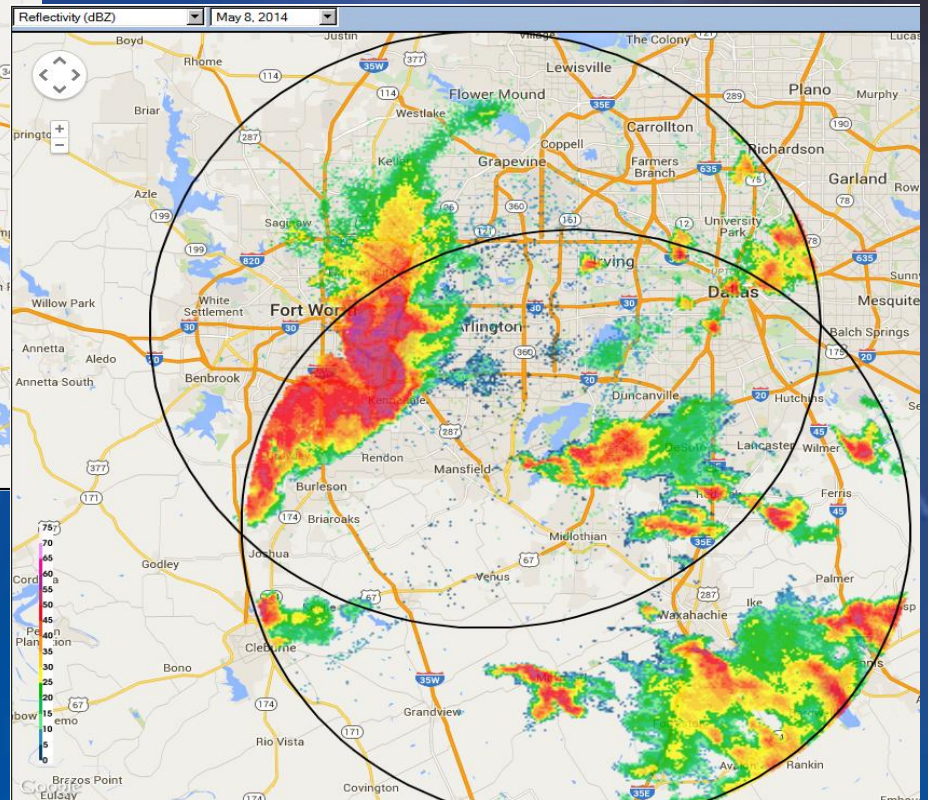
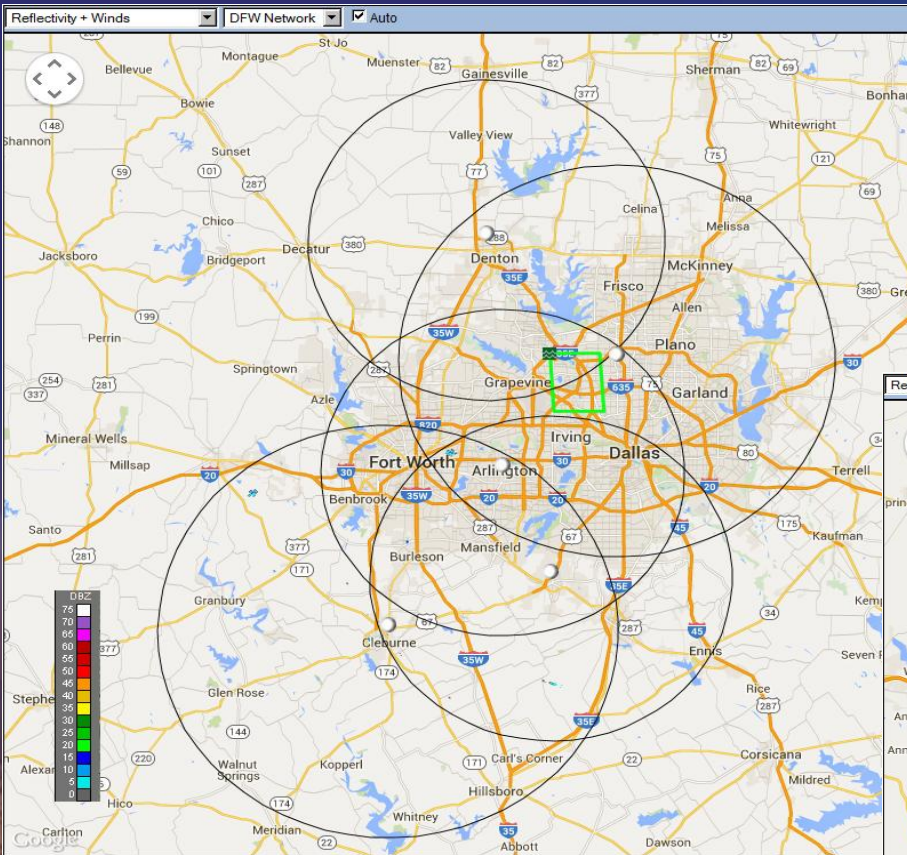
- Since 12Z  Last 3 Hours  Last Six Hours  Last 12 Hours  Last Day (24hrs)  
 Last 2 Days  Last 3 Days  Last 4 Days  Last 5 Days  Last 7 Days  
 Last 14 Days  Last 30 Days  Last 60 Days  Last 90 Days  Last 120 Days  
 Hourly Archive

[Click here for daily precip accumulation](#)

# CASA Radar Project

- Original plan called for 8 radars around the Metroplex
- 5 are currently installed and operational, 2 more installed in October
- Data is 1 minute interval
- Radar rotates but does not tilt, beam height is around 800 feet, radar range is about 25 miles
- Precipitation Estimate products have recently been added
- Data has only been available via the Internet but software upgrade at the WFO will allow us to see the data in our AWIPS displays

# CASA Network







Questions???

Bob Carle

[bob.carle@noaa.gov](mailto:bob.carle@noaa.gov)

817-429-2631 x228

# FEMA Community Rating System (CRS)

## *Flood Insurance Rate Adjustments*

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SAMANTHA LAMANNA, NCTCOG

# National Flood Insurance Program (NFIP)

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Created in 1968 by Congress to provide a means for property owners to financially protect themselves from flood losses

Administered by Federal Emergency Management Agency (FEMA)

The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP.

Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding.

# FEMA's Community Rating System (CRS)

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Voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.

- Partnership between Floodplain Managers and Elected Officials is essential

Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

- Reduce flood damage to insurable property;
- Strengthen and support the insurance aspects of the NFIP, and
- Encourage a comprehensive approach to floodplain management.

# CRS Program Basics

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4 Series of Activities:

300 Public Information

400 Mapping and Regulations

500 Flood Damage Reduction

600 Warning and Response

Communities are scored on:

19 Activities

94 Elements

# Activities with Ordinance Credits

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The following activities can receive CRS credit for ordinance language submitted to FEMA:

Activity 340: Hazard Disclosure

Activity 410: Floodplain Mapping

Activity 420: Open Space Preservation

Activity 430: Higher Regulatory Standards

Activity 450: Stormwater Management

Activity 510: Floodplain Management Planning

Activity 540: Drainage System Maintenance

# CRS Program Basics

<u>Class</u>	<u>Points</u>	<u>SFHA</u>	<u>Non-SFHA</u>
1	4,500	45%	10%
2	4,000	40%	10%
3	3,500	35%	10%
4	3,000	30%	10%
5	2,500	25%	10%
6	2,000	20%	10%
7	1,500	15%	5%
8	1,000	10%	5%
9	500	5%	5%
10	< 500	0	0

# CRS Program Benefits

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Money stays in the community

Insurance savings offset costs

Better floodplain management program

More organized program

Public information builds awareness

Incentive to keep implementing



# Becoming a CRS Community

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Must be a member of the NFIP

Designate a CRS Coordinator

- Keep records, initiate public information programs, develop higher regulatory standards

Complete Application letter, signed by the community's Chief Executive Officer

Schedule an Initial Verification Visit with FEMA

FEMA completes Verification Visit and determines CRS Class

Annual recertification occurs yearly

# CRS Program Participation

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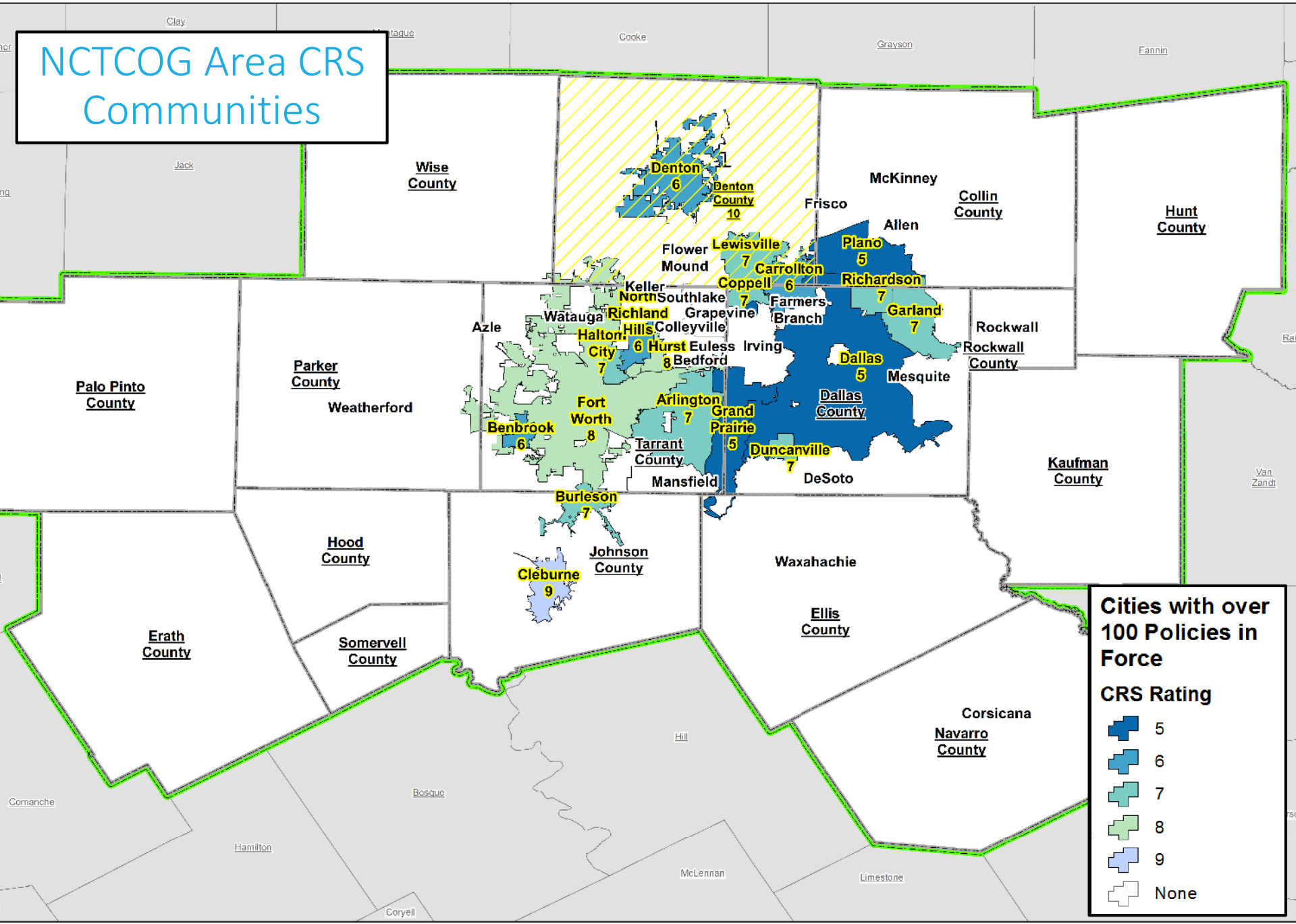
United States: 1,296 Communities

FEMA Region 6 (TX, OK, AR, LA, NM): 156  
Communities

Texas: 63 Communities

NCTCOG Area: 21 Communities

# NCTCOG Area CRS Communities



**Cities with over 100 Policies in Force**

**CRS Rating**

- 5
- 6
- 7
- 8
- 9
- None

	<b>Entity</b>	<b>CRS Rating</b>	<b>CRS Savings</b>	<b>Policies in Force</b>	<b>Insurance in Force</b>	<b>Annual Premiums</b>	<b>Estimated CRS Savings</b>
	Dallas	5	25%	3329	\$932,345,500	\$2,864,787	\$716,197
	Grand Prairie	5	25%	273	\$76,469,700	\$157,318	\$39,330
	Plano	5	25%	801	\$225,561,600	\$435,980	\$108,995
	Benbrook	6	20%	345	\$772,653,700	\$292,832	\$58,566
	Carrollton	6	20%	359	\$110,033,900	\$324,699	\$64,940
	Denton	6	20%	481	\$102,503,900	\$377,779	\$75,556
	North Richland Hills	6	20%	268	\$66,003,700	\$161,885	\$32,377
	Arlington	7	15%	1658	\$405,827,800	\$974,400	\$146,160
	Burleson	7	15%	122	\$28,946,600	\$68,853	\$10,328
	Coppell	7	15%	248	\$79,563,500	\$121,333	\$18,200
	Duncanville	7	15%	188	\$42,783,200	\$167,412	\$25,112
	Garland	7	15%	450	\$103,913,900	\$404,120	\$60,618
	Haltom City	7	15%	317	\$60,608,400	\$431,568	\$64,735
	Lewisville	7	15%	150	\$42,342,500	\$102,503	\$15,375
	Richardson	7	15%	303	\$83,381,500	\$209,711	\$31,457
	Fort Worth	8	10%	2309	\$559,944,100	\$1,961,902	\$196,190
	Hurst	8	10%	247	\$56,701,300	\$211,364	\$21,136
	Richland Hills	8	10%	117	\$20,303,000	\$106,186	\$10,619
	Cleburne	9	5%	158	\$25,613,200	\$95,650	\$4,783
	Denton County	10	0%	357	\$97,951,200	\$210,022	\$0

# CRS Users Groups

38 Groups formed in US

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Share how activities done

Discuss common concerns

Talks by ISO/Tech reviewer

Joint projects

Get new communities in CRS

Organize training

Discuss webinar content together

2013 Manual change feedback



# North Central Texas CRS Users Group - Past Meetings

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Date	Title
10/22/2014	Developing Outreach Projects (Activity 330)
11/19/2014	Flood Warning & Response (Activity 610)
12/17/2014	Developing a PPI, CIP, and Using FloodSmart
01/20/2015	Preparing for a Verification Visit
02/17/2015	Introduction to CRS
03/18/2015	Developing a PPI and CIP
04/22/2015	Drainage System Maintenance (Activity 540)
05/20/2015	CRS and Higher Regulatory Standards
06/17/2015	CRS and Natural Floodplain Functions
7/22/2015	Preparing an Impact Adjustment Map



# North Central Texas CRS Users Group – Next Meeting

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Date	Title
8/19/2015	Preparing an Annual Recertification

Thank You

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# Development and Floodplain Management

Steven Eubanks, P.E., CFM  
Chief Stormwater Engineer  
City of Fort Worth



Venice

SANTA CROCE

CANNAREGIO

Galleria Giorgio Franchetti alla Ca' d'Oro

SAN POLO

Venezia

Canal Grande

SAN MARCO

Piazza San Marco

CASTELLO

DORSODURO

Collezione Peggy Guggenheim

Dorsoduro

La Biennale di Venezia - Giardini

GIUDECCA

Giudecca

Laguna Veneta

Cimitero Ortodosso Greco

Venice, IT - Rabac, HR

Venezia, IT - Pola, HR

Venice, IT - Rabac, HR

Pola, HR - Venezia, IT

Venice, IT - Rabac, HR

Google



Map

Traffic







SE - CHEN  
SINGAPORE



I-55

Downtown Jackson



MAR  
AP

STREET  
APARTMENTS

ONE  
WAY  
←







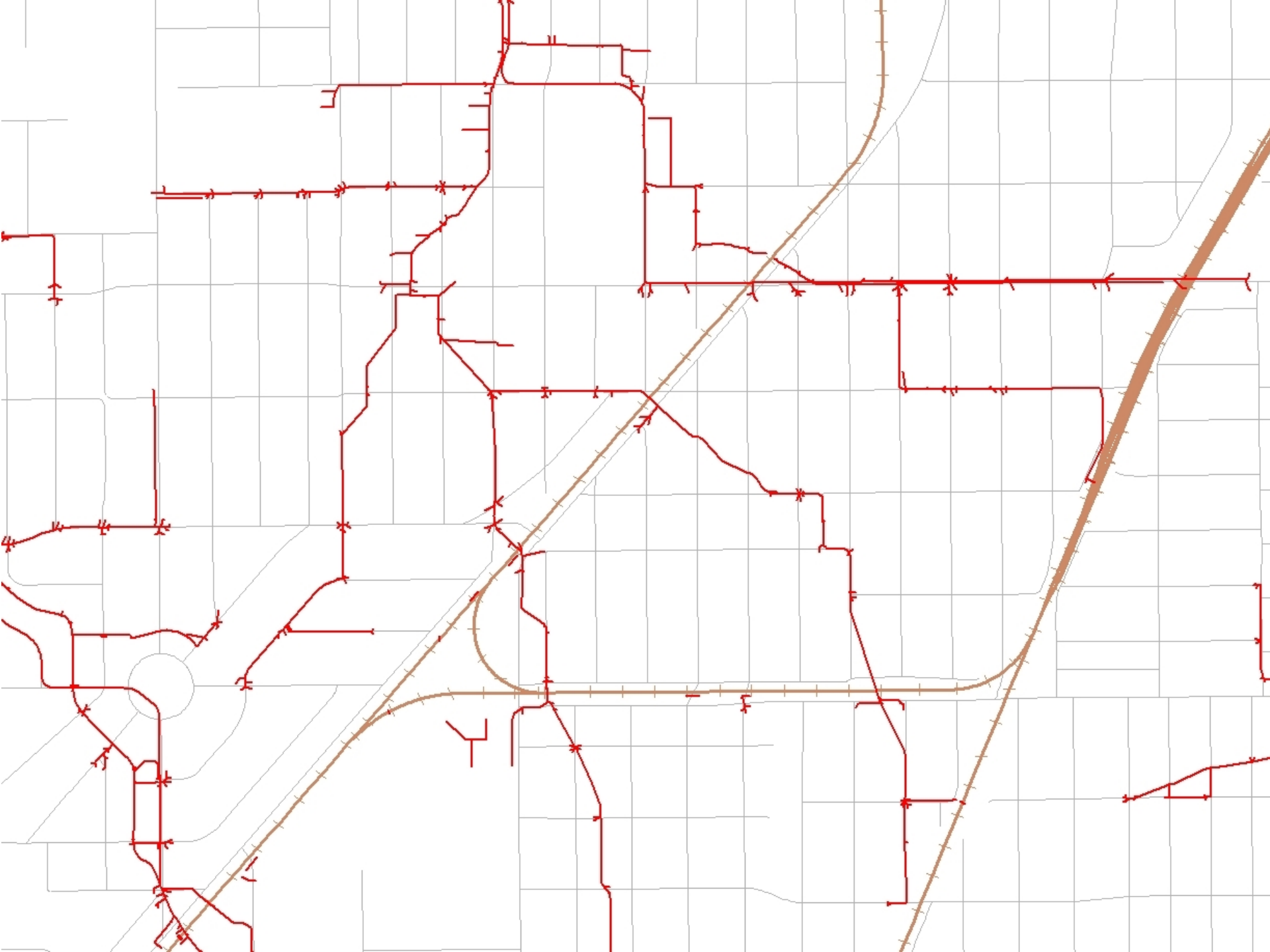


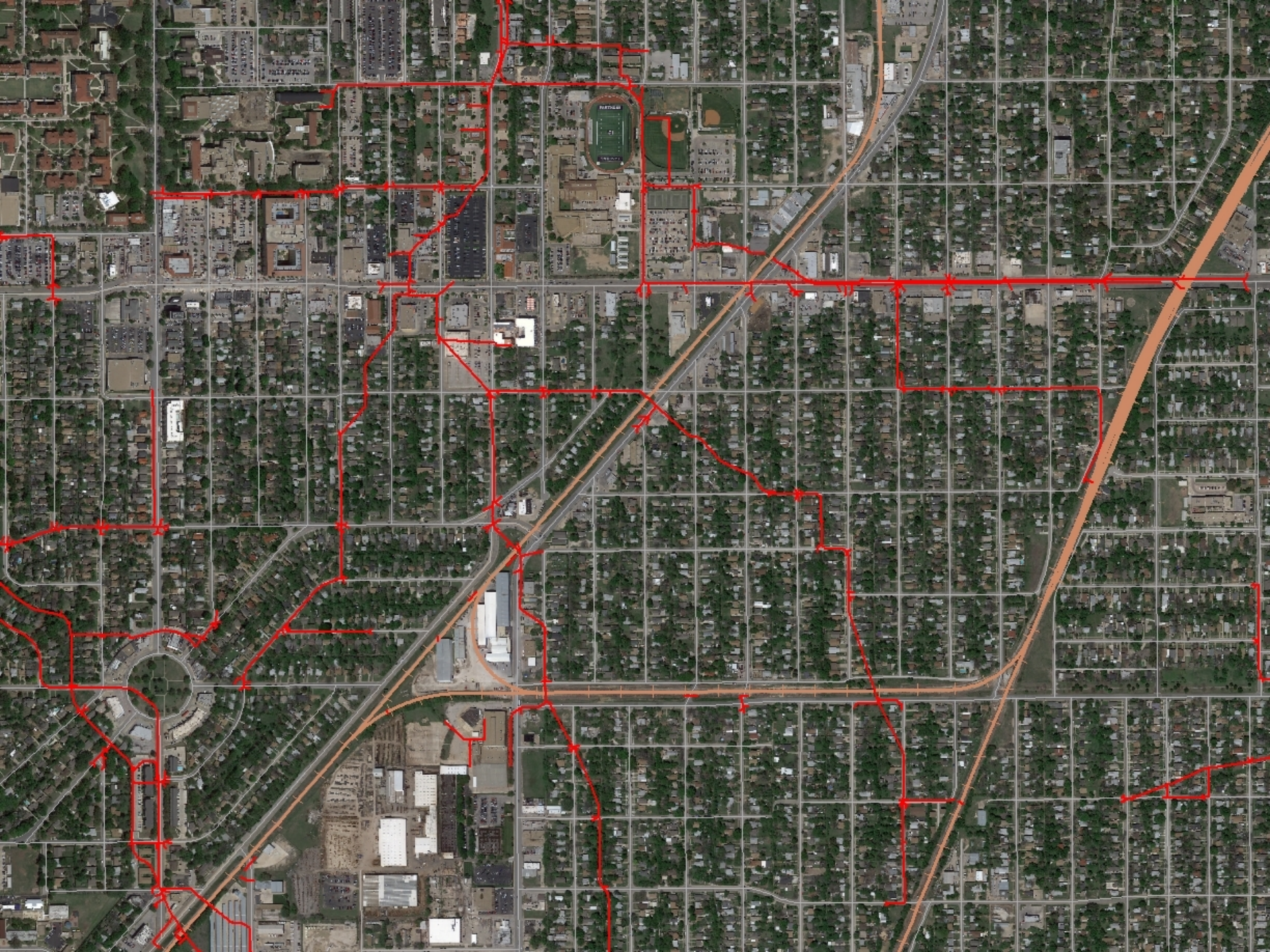


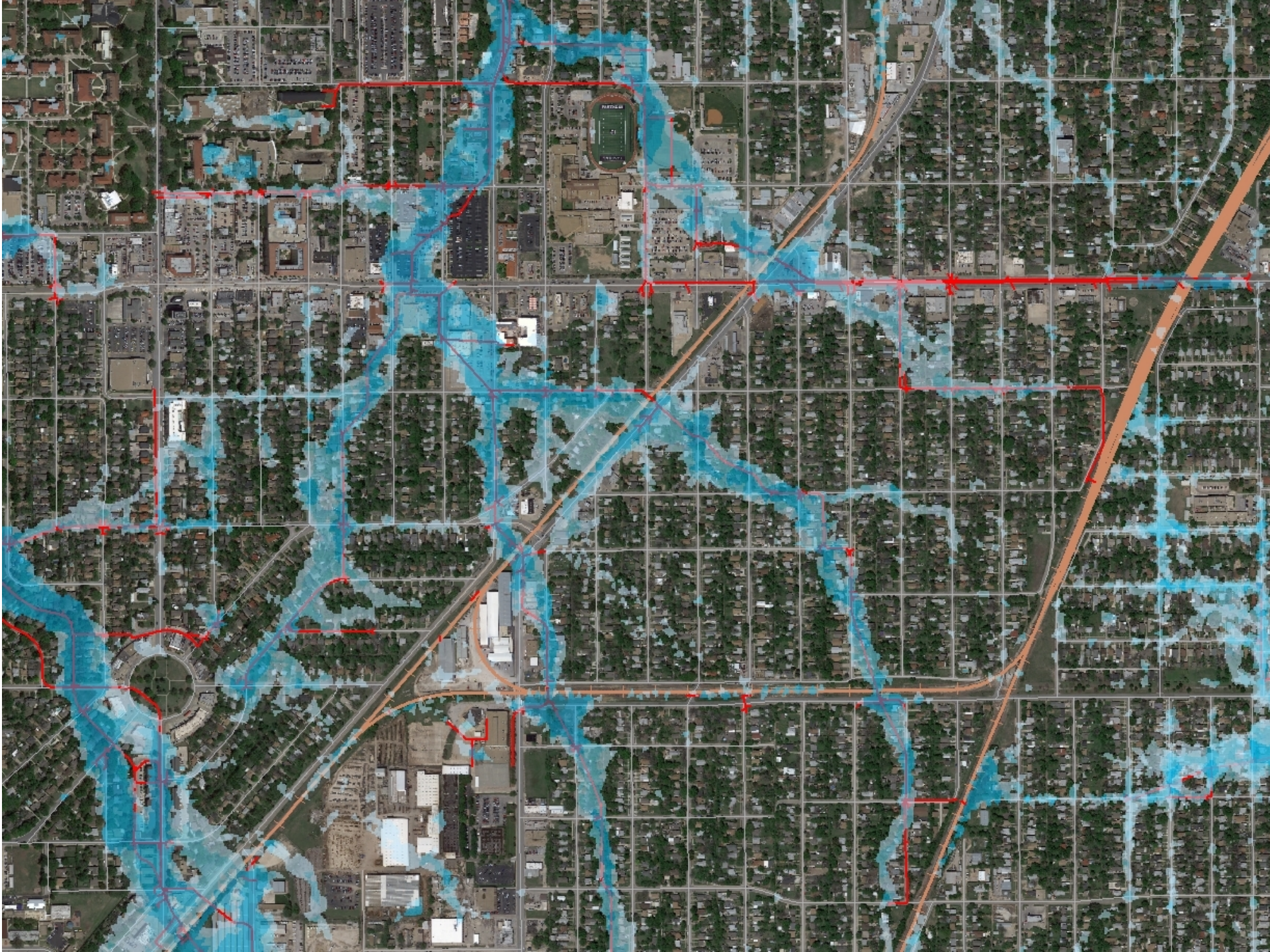
Development and Floodplain Management

# HISTORIC DEVELOPMENT























05/02/2007

Development and Floodplain Management

# LAWS AND REGULATIONS

# National Flood Insurance Program

- Established in 1968 to cover flooding (not covered on homeowners policies)
- Administered by FEMA
- Voluntary community participation
- To participate, a community must adopt a floodplain protection ordinance
- Subject to periodic review by FEMA



# Section 404, Clean Water Act

- U.S. Army Corps of Engineers
- Protects “Waters of the United States”
- Includes wetlands and small streams
- Requires permits to disturb “Waters”
- Must mitigate loss of habitat
- Discourages stream channelization and concrete lining

# Texas Water Code §11.086

- a) No person may divert or impound the natural flow of surface waters in this state, or permit a diversion or impounding by him to continue, in a manner that damages the property of another by the overflow of the water diverted or impounded.
- b) A person whose property is injured by an overflow of water caused by an unlawful diversion or impounding has remedies at law and in equity and may recover damages occasioned by the overflow.

"It is absolutely absurd that in one of the most prestigious neighborhoods in Arlington they're looking at condemning one of our homes!"

# Suit over flooded home to be heard

By SALLY CLAIRNER  
ARLINGTON — Neighborly  
of Lake Arlington

Craig Sullivan is suing the city of Arlington for an allegedly improperly installed drainage system that caused his home to be flooded and ruined.



In this July photo, Craig Sullivan points out concrete frames along the hillside. The Dallas runoff water from a new neighborhood into a storm drain Sullivan says runoff water has destabilized his home's foundation.

The lawsuit initially named the city and the county as defendants.

"When you're out in the county, the amount of drainage you have is zero."

— Jane Calhoun, vice president, Coalition of American Homeowners

...doors had to be raised...  
...even higher."

...County, Arlington...



Samantha Garbarino and her husband, Anthony, put up hay bales in front of their house on Serrano County property to block runoff from a nearby development that is in Fort Worth.

# Runoff causes mess

### Drainage from subdivision creates quagmire for residents, jurisdiction issue for officials

By ANDREA JAKES  
ARLINGTON — When it rains in north Tarrant County, it doesn't just pour into Samantha's and Anthony Garbarino's ranch-style home. It floods inches of rainwater seeped into their house and ruined hardwood floors and carpeting since construction on a new subdivision began uphill from their home. The Garbarinos now live on the bare concrete foundation.

Their family's front yard is barraged with sudden gushing floodwaters when it rains.

And it's come — five times into their house since construction of the subdivision began. The water comes from the runoff from the subdivision tank before it enters a culvert. The release from a flow is so fast that it is impossible to stop.



Anthony and Samantha Garbarino lay flooding in and around their home starts from their drain pipes near their property. The Garbarinos claim that the pipes are undersized and not maintained.

## LAWSUITS

Continued from p. 1

much, they say, that it can't be contained by the open ditches that quickly fill up with orange sediment.

After a few minutes of rain, water is lapping around the house, seeping all inside the house were sinking into the ground.

Garbarino and three neighbors, Michael Helen Steiner and Anthony M. Development and Mousyedi and Property Corp., are involved in the Villages at Woodland Springs. They Carter & Burgess engineers for the development. Samantha Garbarino says flooding in and around their home starts from their drain pipes near their property. The Garbarinos claim that the pipes are undersized and not maintained.



Map shows location of the Villages at Woodland Springs.

the court date, which hasn't been set, Calhoun declined to comment on a proposed injunction.

Carter & Burgess officials are declining to comment as they review the case, said Chris Chilton, company spokesman.

Burgess Earth, engineer for the unincorporated parts of the county, said the county does not see plans for developments that are in Fort Worth, even if they could affect county residents. In most cases, the system works fine.

"Thankfully, it doesn't always present a problem," Lamb said.

"Unfortunately, here I don't know what happened to my house, but I might have to sue the county for the repairs to their house and a fix for the development."

Those working on a solution have had meetings to discuss the problem, but the county has not yet agreed to a settlement.

But Calhoun said his company's project has already been well studied.

"I think the major point is that studies have been done before we started to build. I think we've done a lot of things to make sure this is a safe project that we're there."

# Keller drainage lawsuit may affect liability law

By Mark Mitchell  
Star-Telegram Staff Writer

KELLER—Two families who sued the city have been awarded \$287,000 in a drainage case that attorneys said could grow to have statewide ramifications.

In the case said that the city's engineers, and the city's attorneys, did not stop the flow, he said. "The case stands for the idea that if the city will approve something, they need to make sure what they approve doesn't cause other people," Casey said. "They need to look at the plan and make sure they look at the downstream consequences of the development."

Two families who sued the city have been awarded \$287,000 in a drainage case that attorneys said could grow to have statewide ramifications.

## Tray say well

The rainwater has been pouring into the house of the two families who sued the city. The case is expected to issue his attorneys for both sides said. It is possible that Walker will ask the parties to re-enter settlement negotiations, Lowry said. If there is a settlement and the case is not appealed, no precedent would be set, said Rodney Cobb, an attorney with the Illinois-based American Planners Association.

"Both parties have a responsibility to settle," Lowry said. "The county could have the right to sue the city, but the city could sue the county, too."

Feb. 18, 2000 at

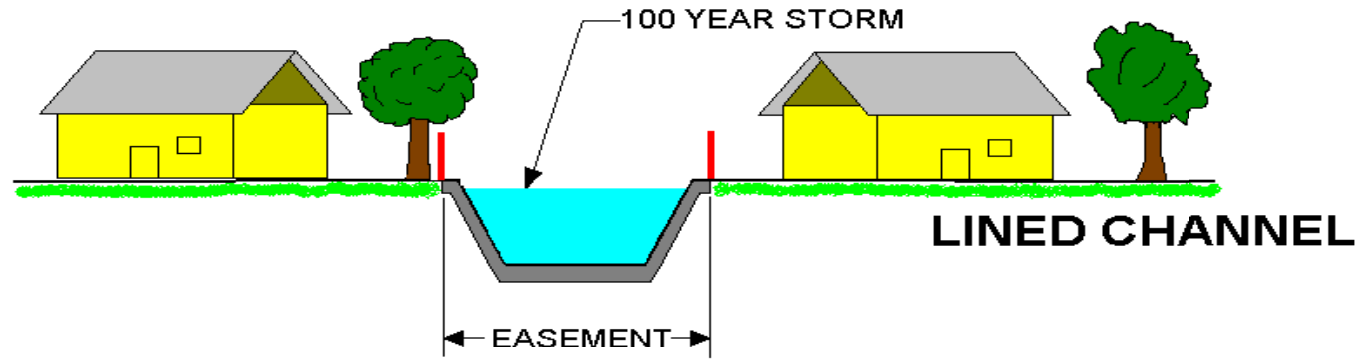
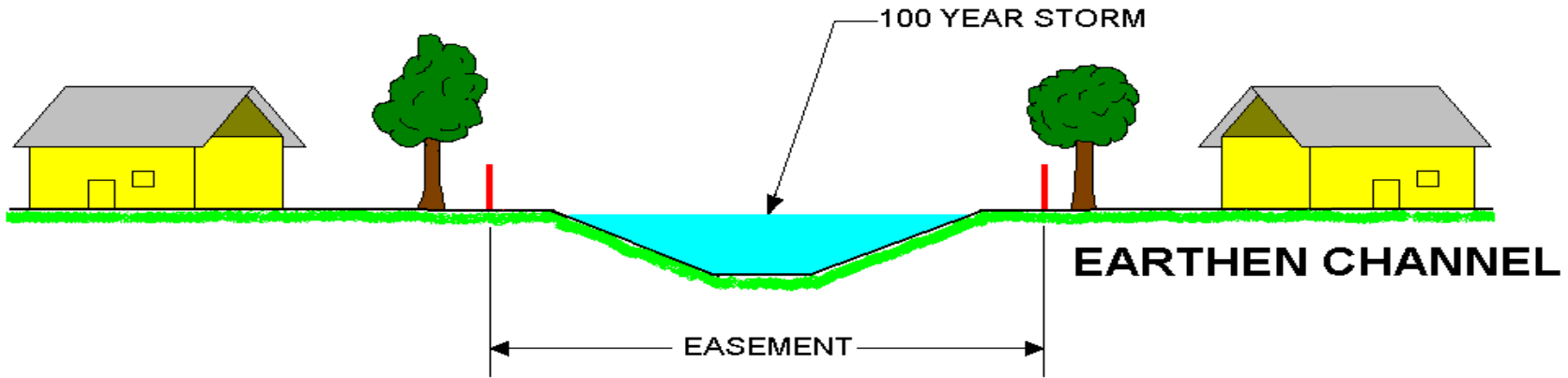
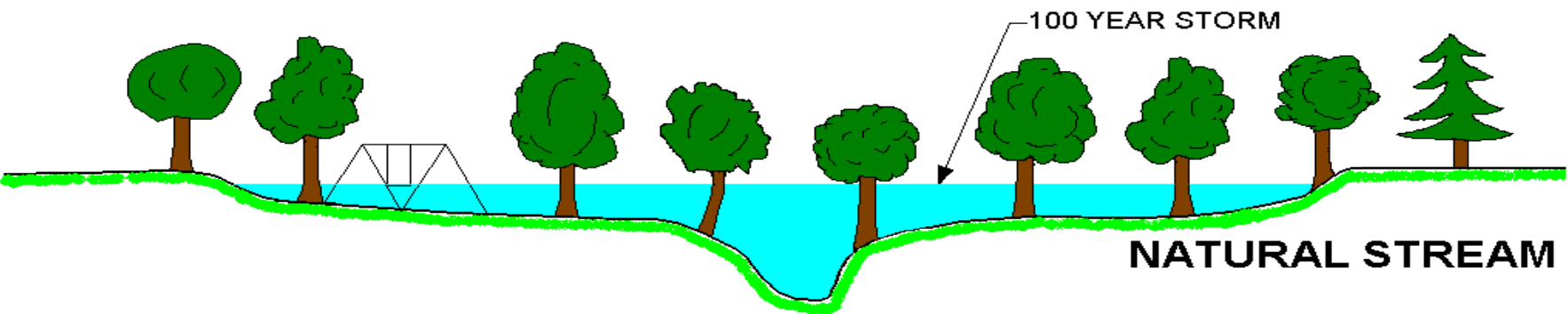
# Lawsuits over drainage have been common.

# No Adverse Impact

- *“No Adverse Impact floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners.”* (ASFPM, 2008)
- Consistent with Texas Water Code §11.086 and similar laws in other states.

Development and Floodplain Management

# DEVELOPMENT TRENDS













DANA

QUETTA

CINNAMON HILL

CARTAGENA

ROTA

ROTA

LADERA

PUERTO

BRIARWILD

MILL POND

WILLOW WAY

CAPILLA

KINGSWOOD

QUAIL HOLLOW

WELCH

WIND CHIME

KILDEE

SPARROW

FRANCISCO

BETTIS

ARBOR GATE

OLD MILL



DANA

QUETA

FOXBRIDGE

CINNAMON HILL

CARTAGENA

ROTA

ROTA

LADER

BRIARWILD

MILL POND

WILLOW WAY

PUERTO

RE

CAPILLA

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WIND CHIME

KILDEE

SPARROW

FRANCISCO

BETTIS

ARBOR GATE

OLD MILL

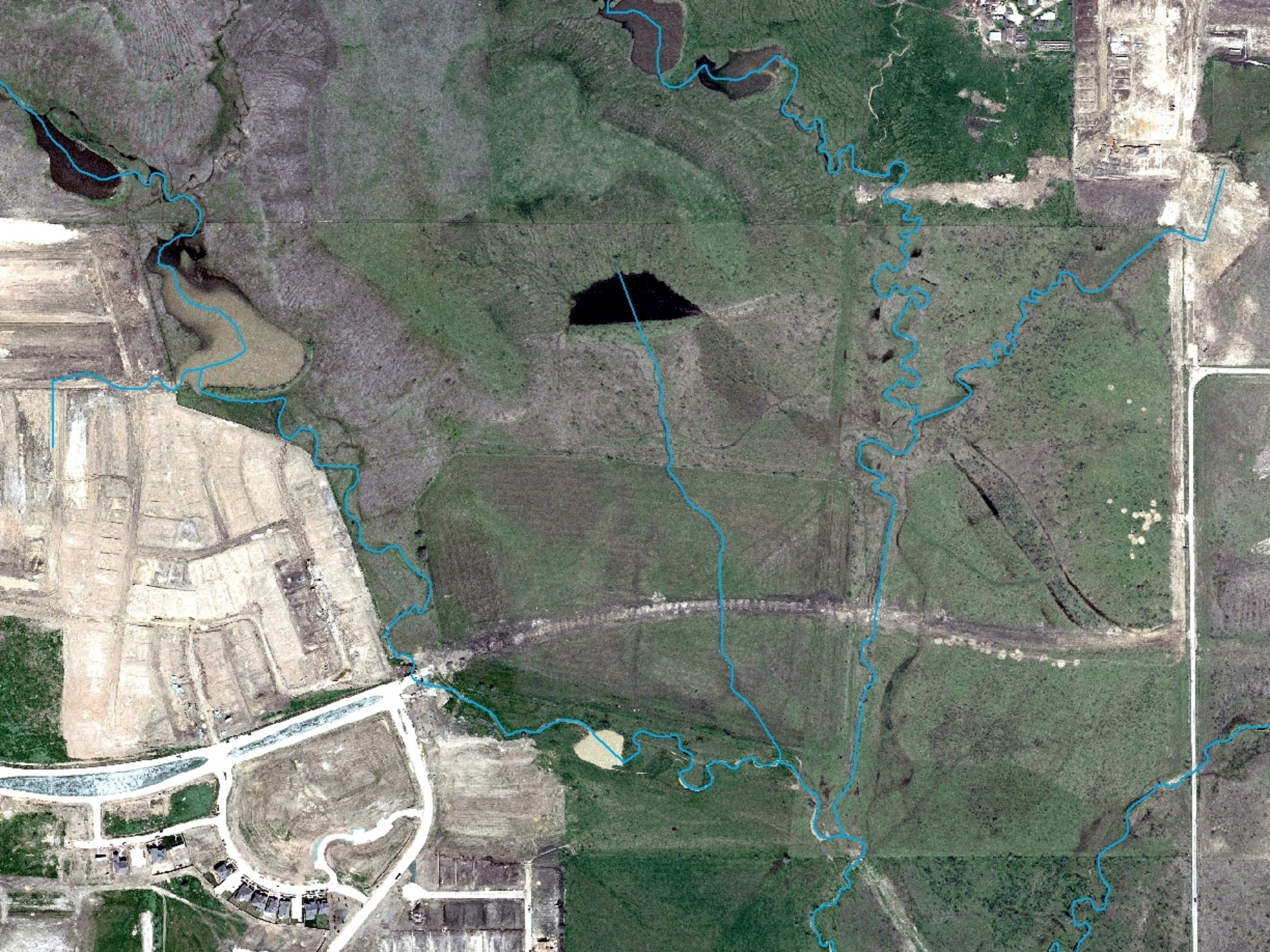


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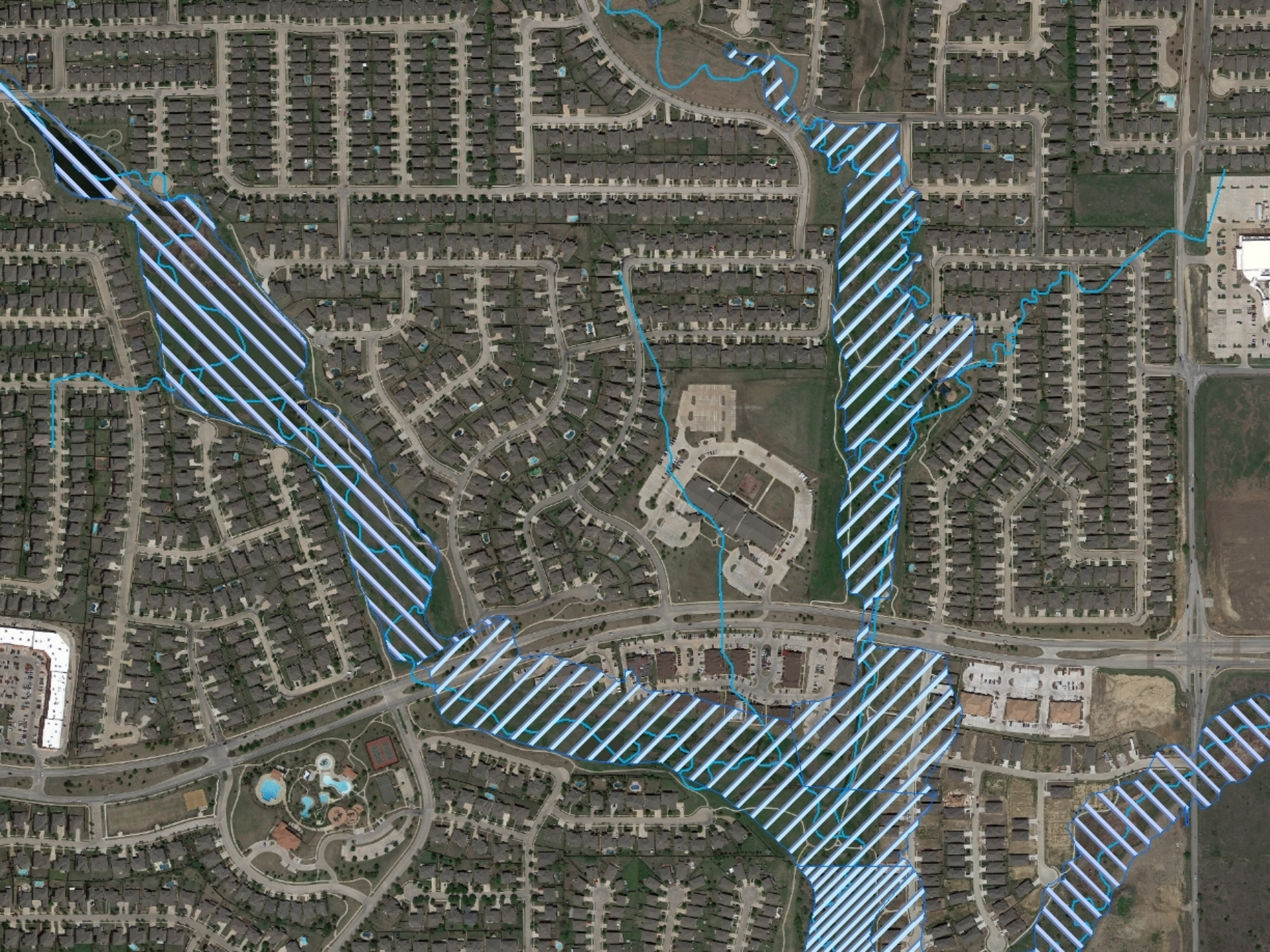
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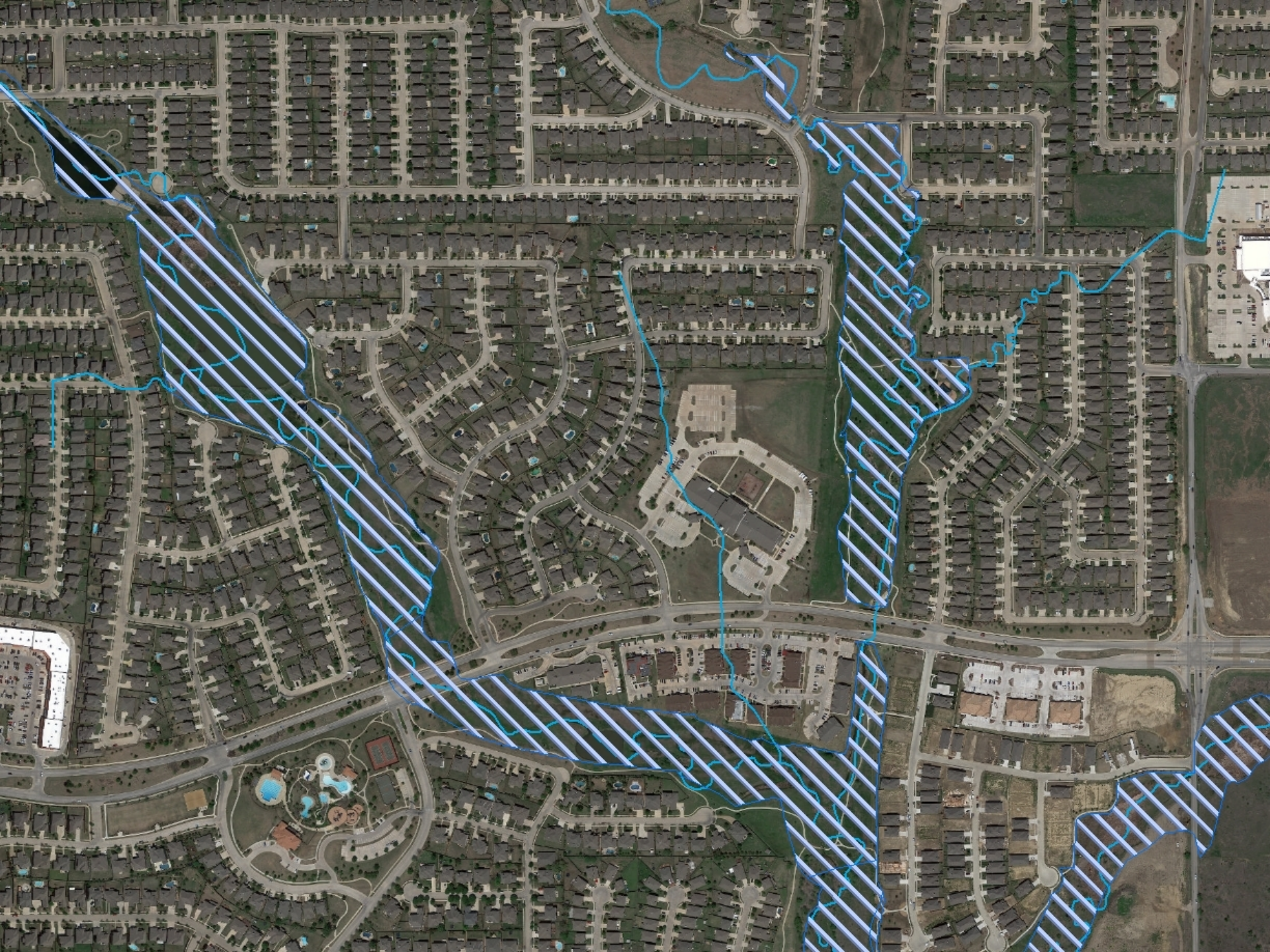
Google

Image capture













Google

Development and Floodplain Management

# DETENTION AND GREEN INFRASTRUCTURE

Not like this!



# Aesthetics and water quality



# Neighborhood Open Space





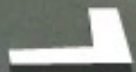
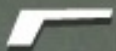








TPC Pkwy









# Conclusion

- “Don’t make things worse.”
- Open space is a community asset and drives up property values.
- In areas of redevelopment, cities and development interests should look for partnership opportunities.

Questions?

# Dallas Flood Management



August, 2015



# Overview

- Brief System Description
- Recent Flood Hydrology
- Flood Warning Communications
- System Operations
- Continuous Improvement



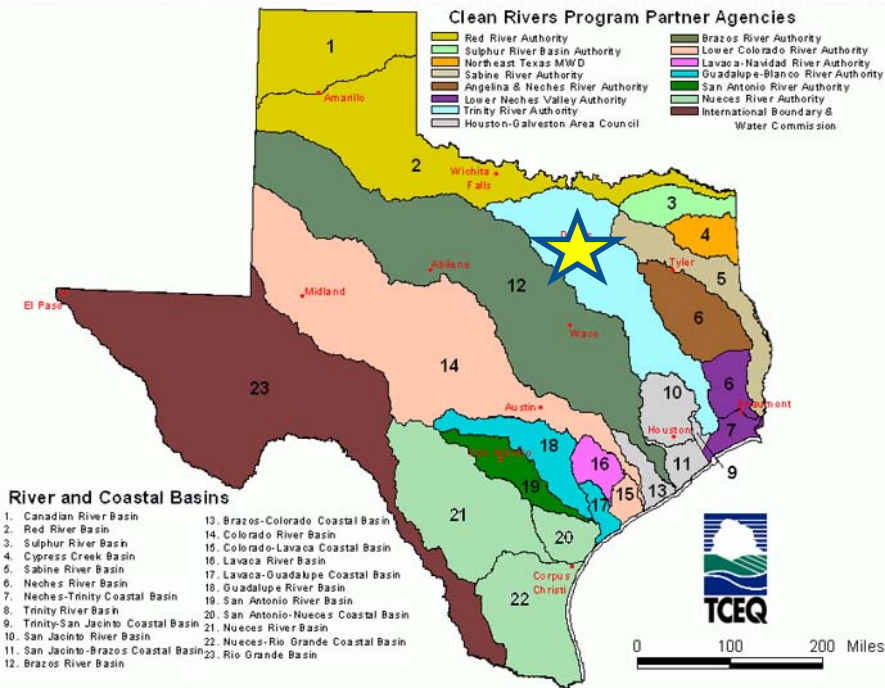
# System Description

# Flood Management in Dallas:

- Is a combination of :
  - **Regional Drainage Infrastructure:** Dams, multi-purpose reservoirs, channels and wetlands on the river-side of the levees to convey large volume events and protect urbanized areas; and
  - **Local, “Interior” Drainage Infrastructure:** local drainage systems (pump stations, pressure sewers, streams, creeks, channels, and storm sewers) to address runoff from the land-side of levees to convey it into the Trinity River).

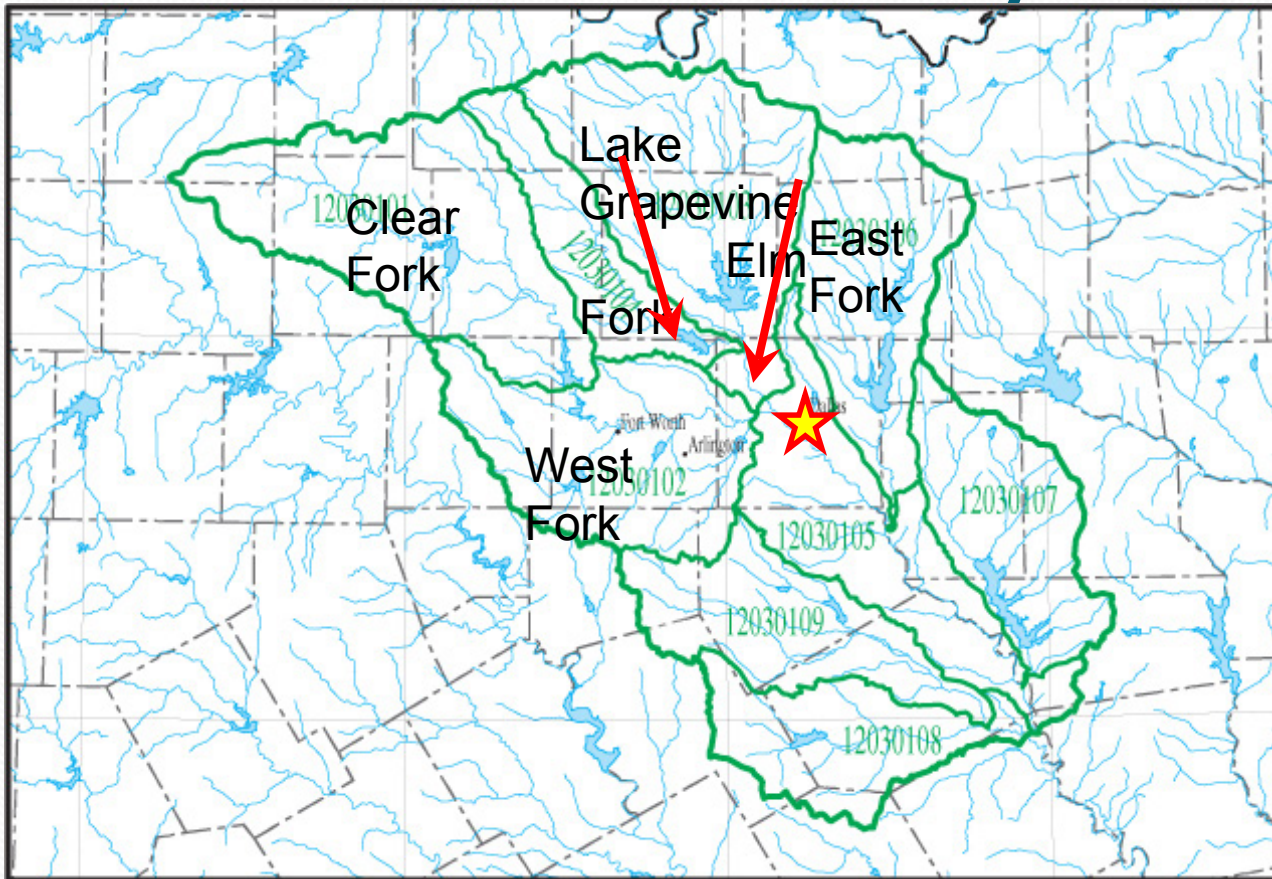


# Trinity River Watershed

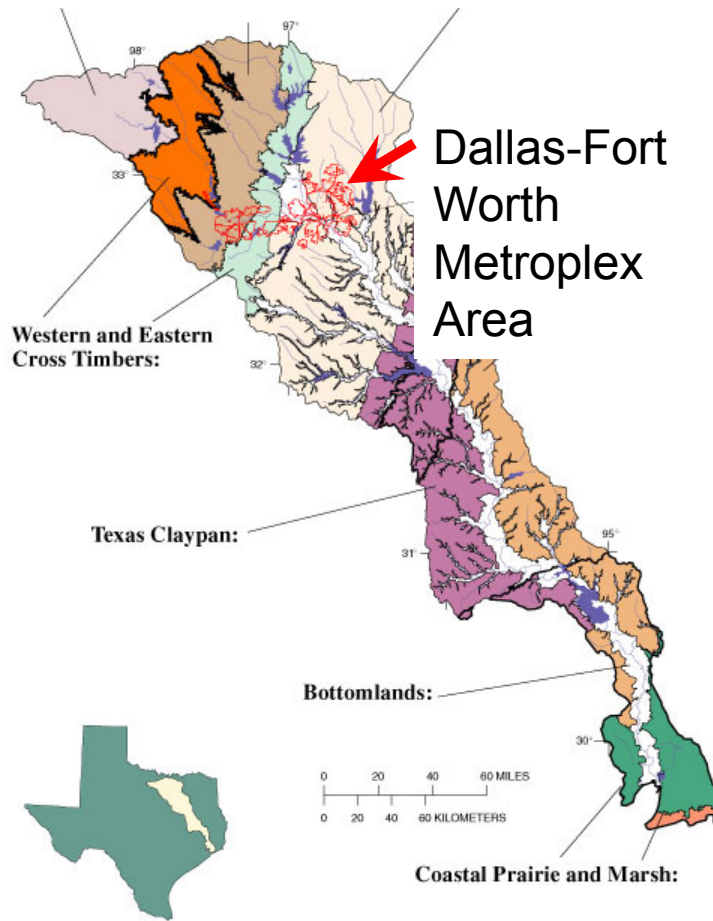


- Trinity River watershed extends from near Oklahoma border to Galveston Bay (shown in aqua)
- Trinity River drains a total area of >16,000 square miles
- About 6,050 square miles drain through Dallas Floodway

# Four Sub-watersheds Meet Above Dallas Floodway



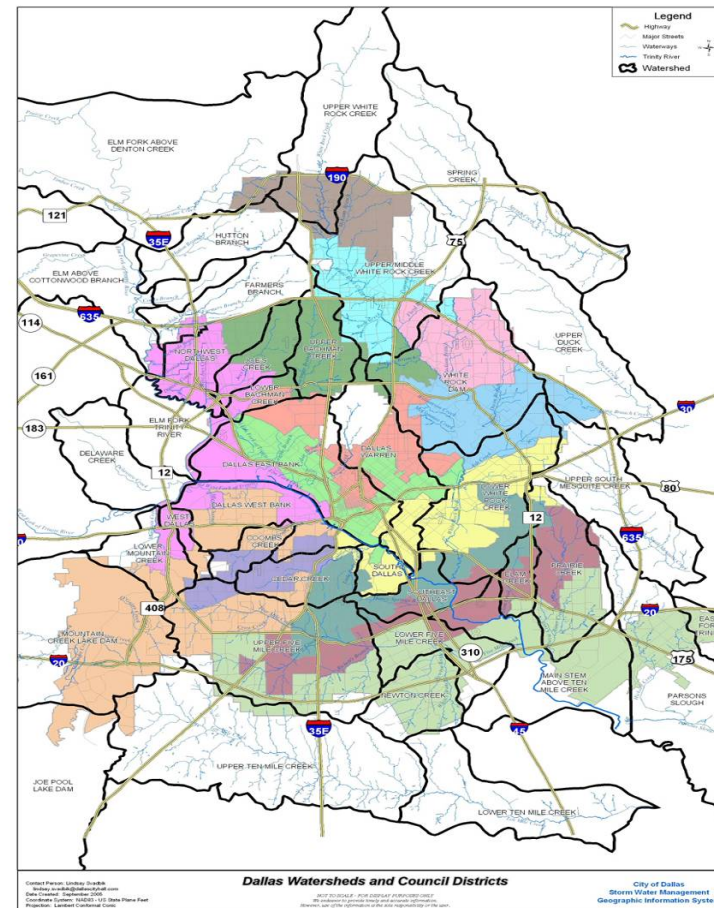
# Current Land use & Development



- Less than 5% of the Trinity River watershed is developed (red outline on maps)
- Dominant land use is agricultural range land.

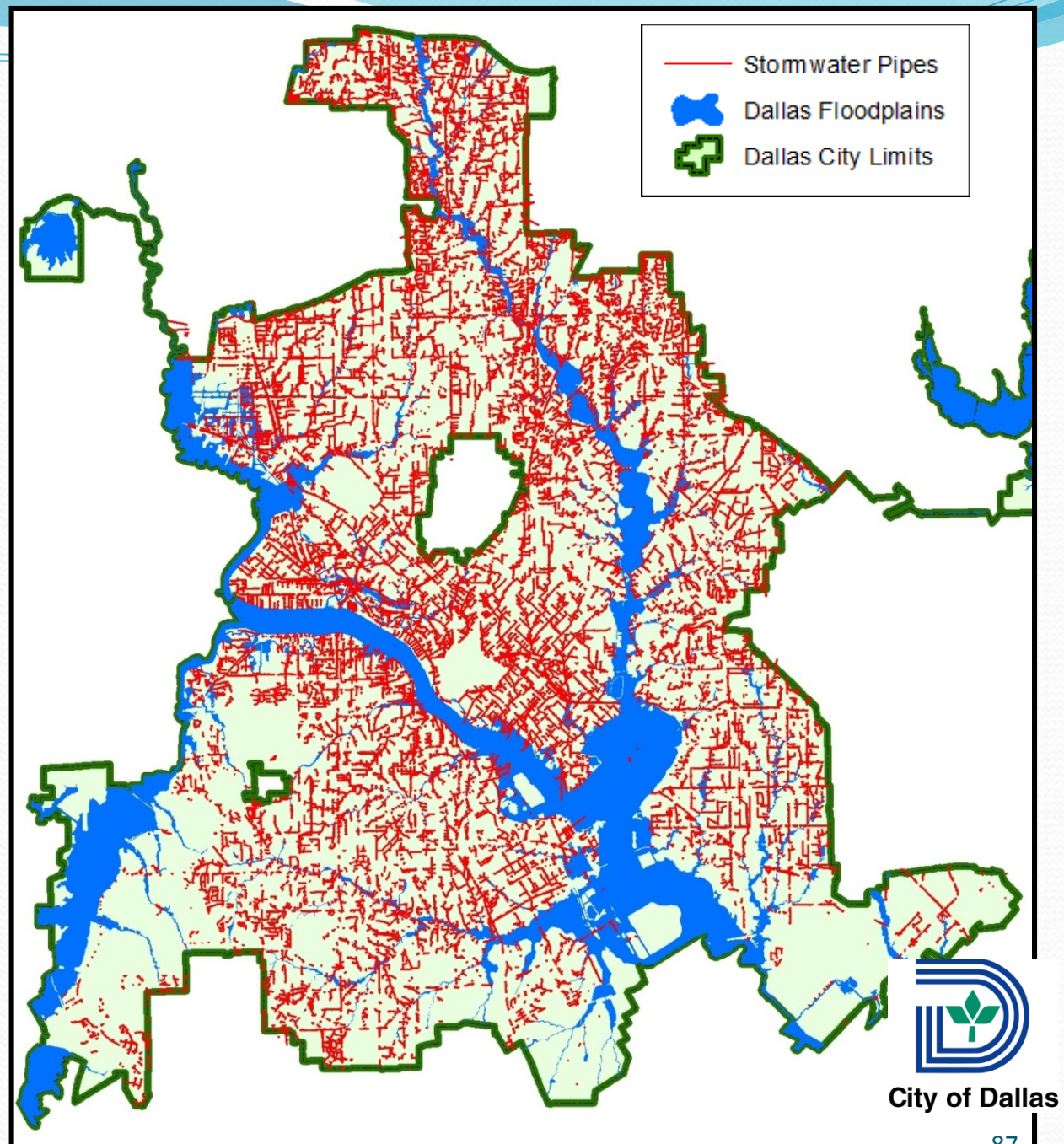
# Local Drainage System Description

- Phase 1 Municipal Separate Storm Sewer System (TCEQ permit to discharge to Trinity River)
- 32 12-Digit HUC sub-watersheds in/ near Dallas – 700 square miles
- Drains portions of Dallas, Collin, Denton, Kaufman and Rockwall Counties
- 385 square miles in Dallas proper

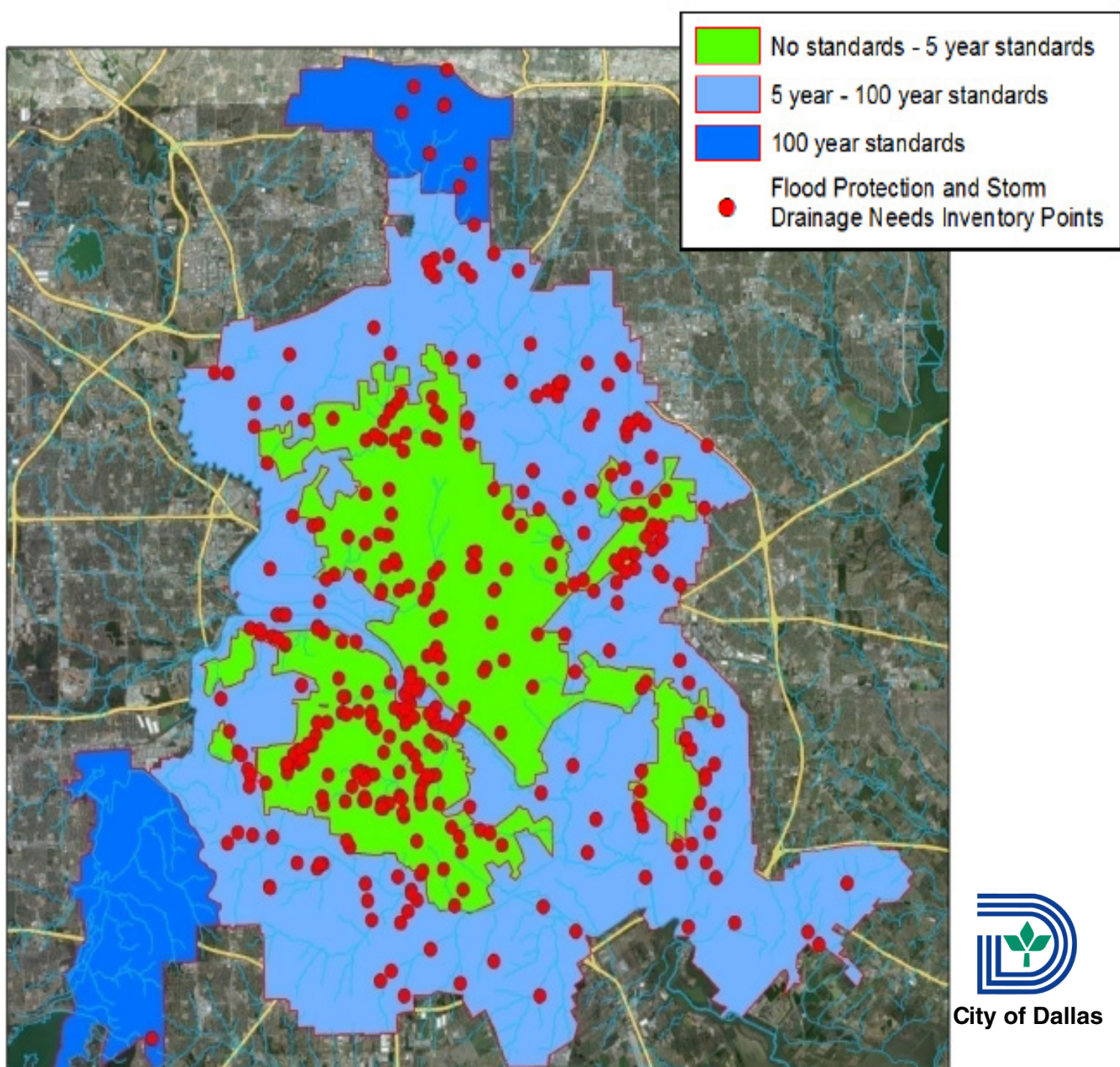


## Storm Drainage

- 1,800 miles of Storm Drainage Pipes
- 115 miles of City owned creeks
- 48 miles of lined channels
- 180 ponds
- 11,000 outfalls
- 65,000 inlets



The majority of the needs in the City are associated with areas developed with inadequate standards

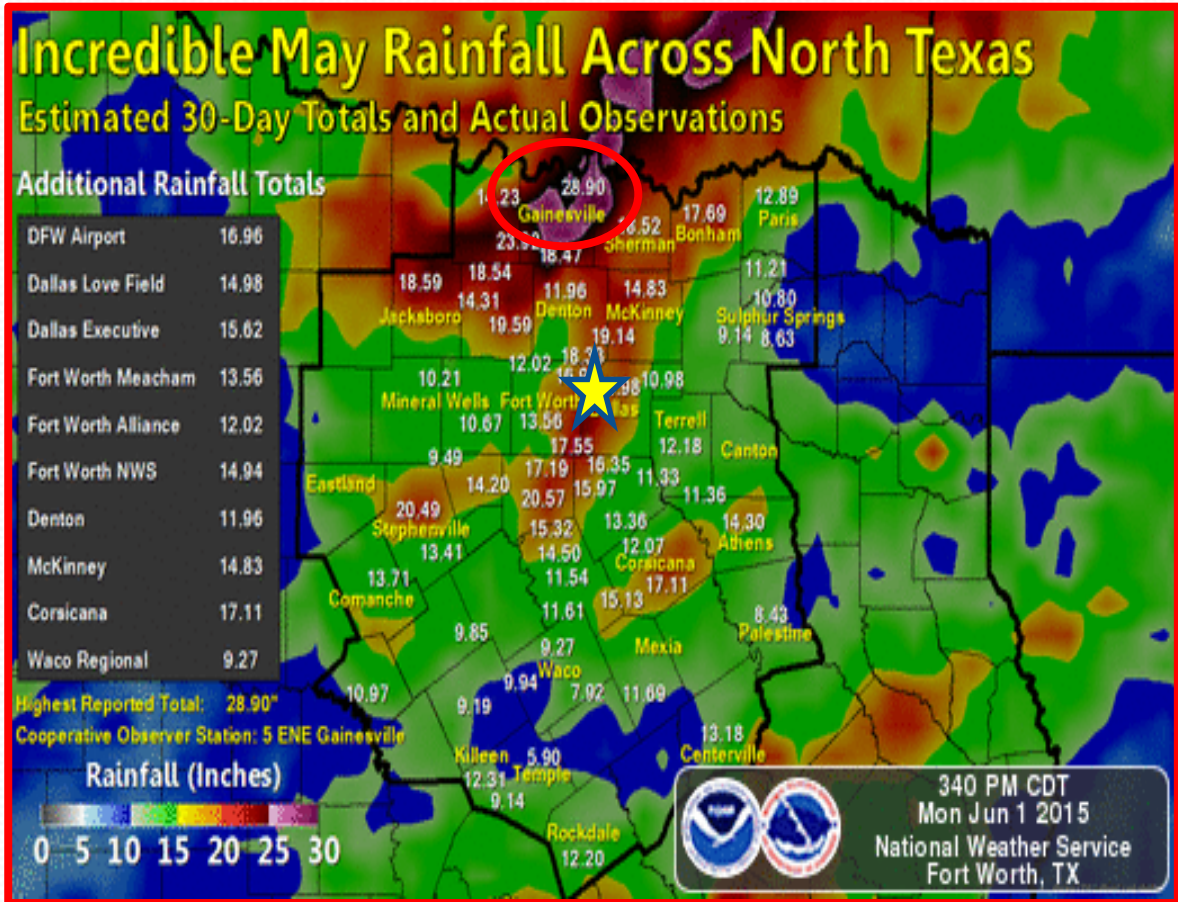


City of Dallas



# Recent Flood Hydrology

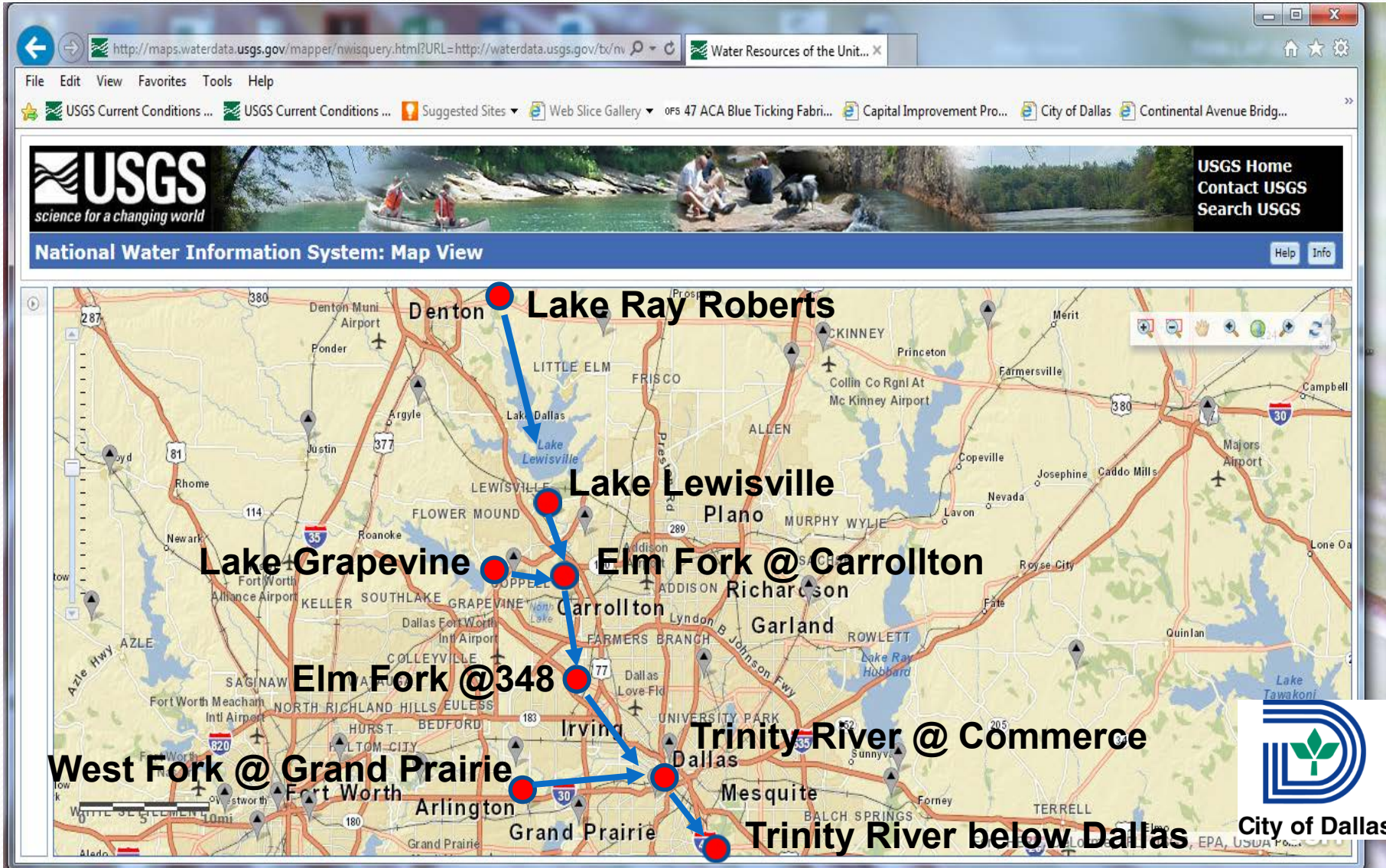
# Recent Rainfall Distribution



- May 2015:
  - **28.9** inches – upper part of watershed
  - **16.96** inches – DFW Airport
- 2014 @ DFW: **21.3** inches/year
- Average DFW Rainfall: **35.6** inches/year



# USGS River Gage Locations



# Flood Warning System

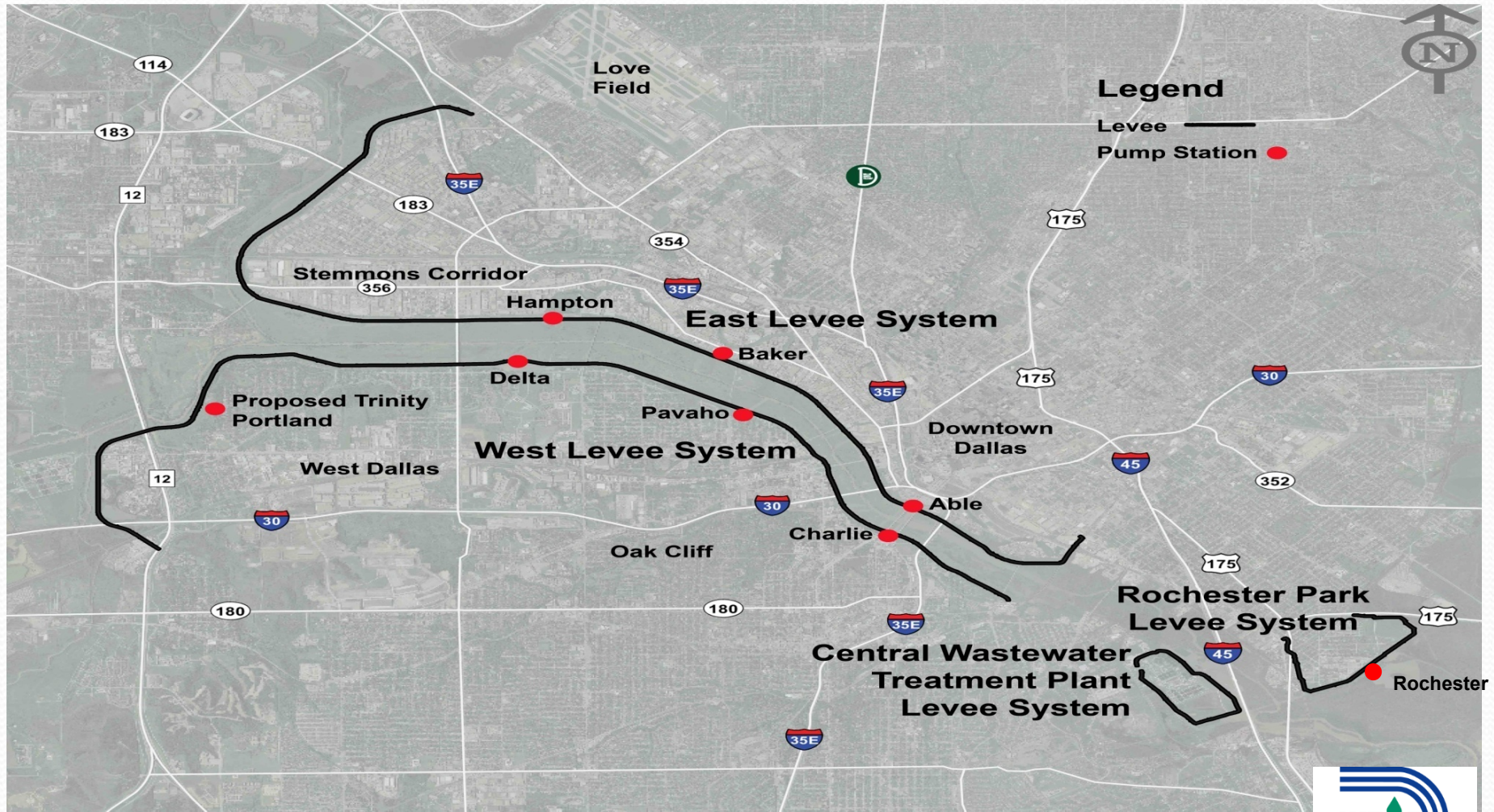
# Flood Risk Reduction

- 200,000 people work or live behind the levees
- \$12.2 billion in floodplain investment



**2015 May/June Event**

# Dallas Floodway System Map

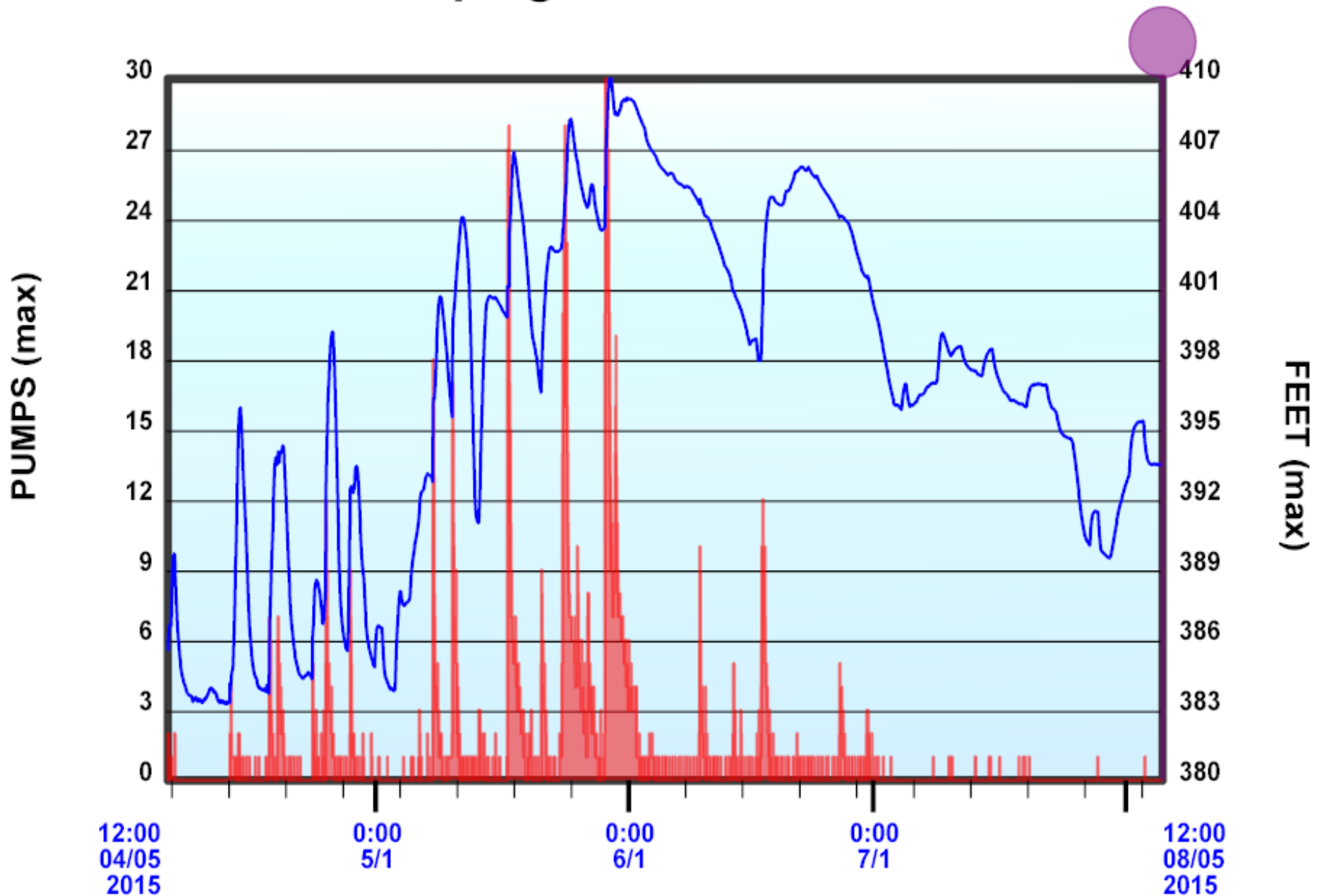


# Pumping Systems

- At peak of event through Dallas, 33 pumps were operating
- Provided opportunity to thoroughly test/run Baker and Pavaho Pump Stations
- System functioned as designed



# Pumping and Pavaho River





# Pumping Operations – SCADA

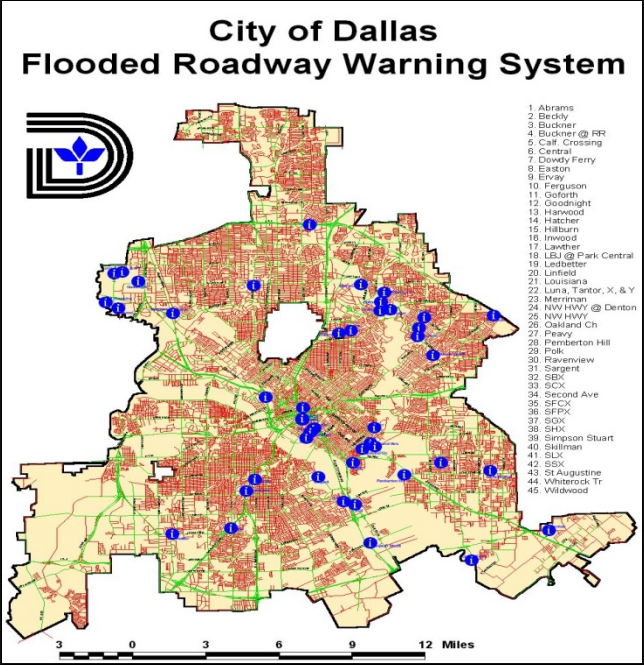
	ELEV RISE	INTRUD	LOW FLOW	1st PUMP	2nd PUMP	3rd PUMP	4th PUMP	5th PUMP
LAX	378.65		●	●	●	●		
SAX	0.00			●	●			
OBX	380.84			●	●	●	●	
NBX	0.00		●	●	●	●	●	●
NHX	380.13		●	●	●	●	●	●
OHX	0.00		●	●	●	●	●	
DX	390.17		●	●	●	●	●	
PX	383.64		●	●	●	●	●	
CX	383.73		●	●	●	●	●	
RX	380.80		●	●	●	●	●	
CPX	0.00		●	●	●		●	

TRWS MASTER

Sumps  
Graph

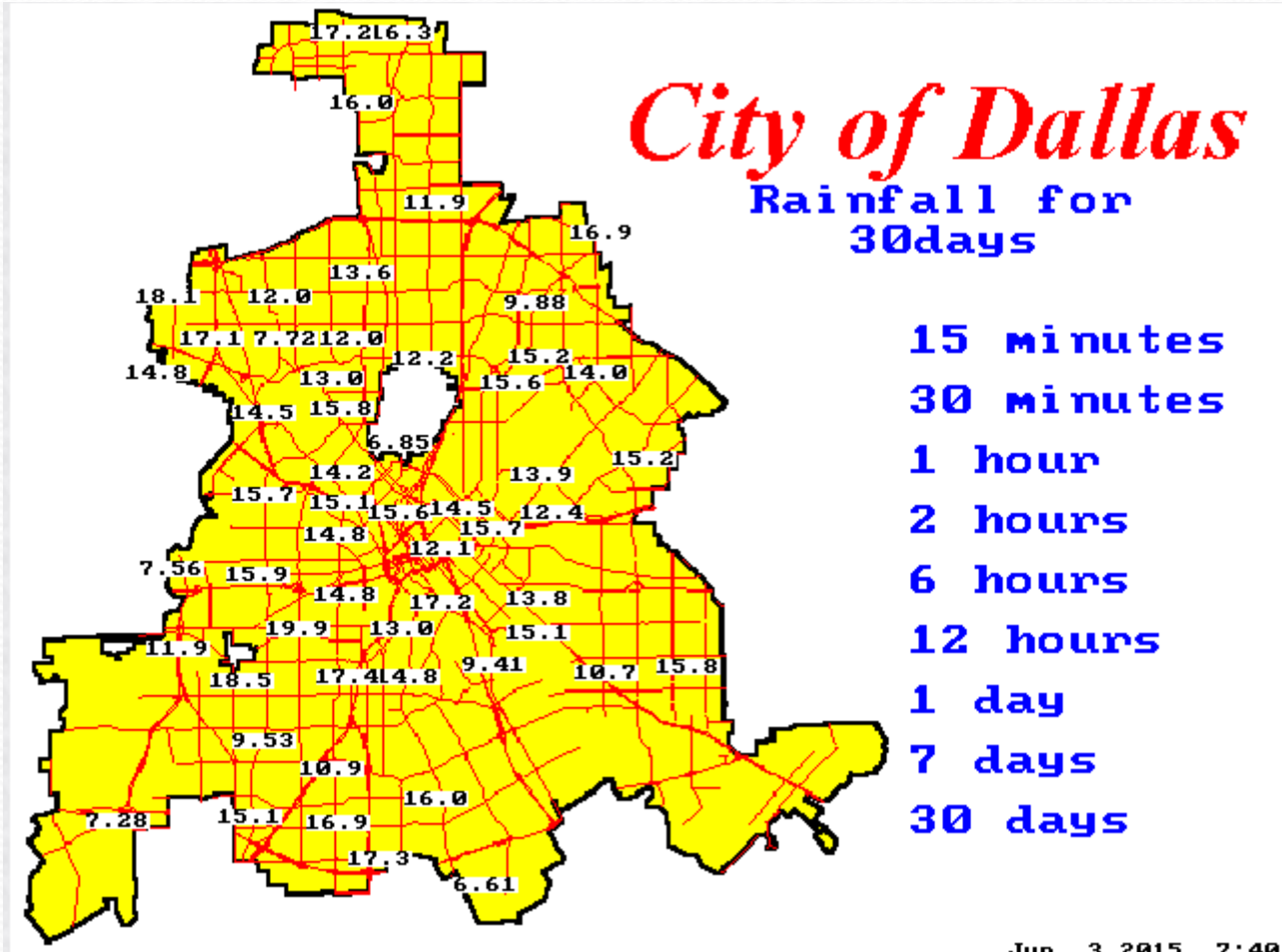
ACK ALARMS

# Flooded Roadway Warning System (FRWS)



**40 FRWS Locations Citywide  
8 Underground lift stations**

# Total rainfall in 30 days



Jun 3 2015 7:40

# Recent Flooding

# Localized Flooding

- Loop 12/Singleton Area  
(West Fork Trinity River)
- Luna Road/I35  
(Elm Fork Trinity River)
- Peavy Road (Dixon Branch  
u/s White Rock Lake)
- Goforth & Lawther  
(White Rock Creek)
- Other Street Flooding



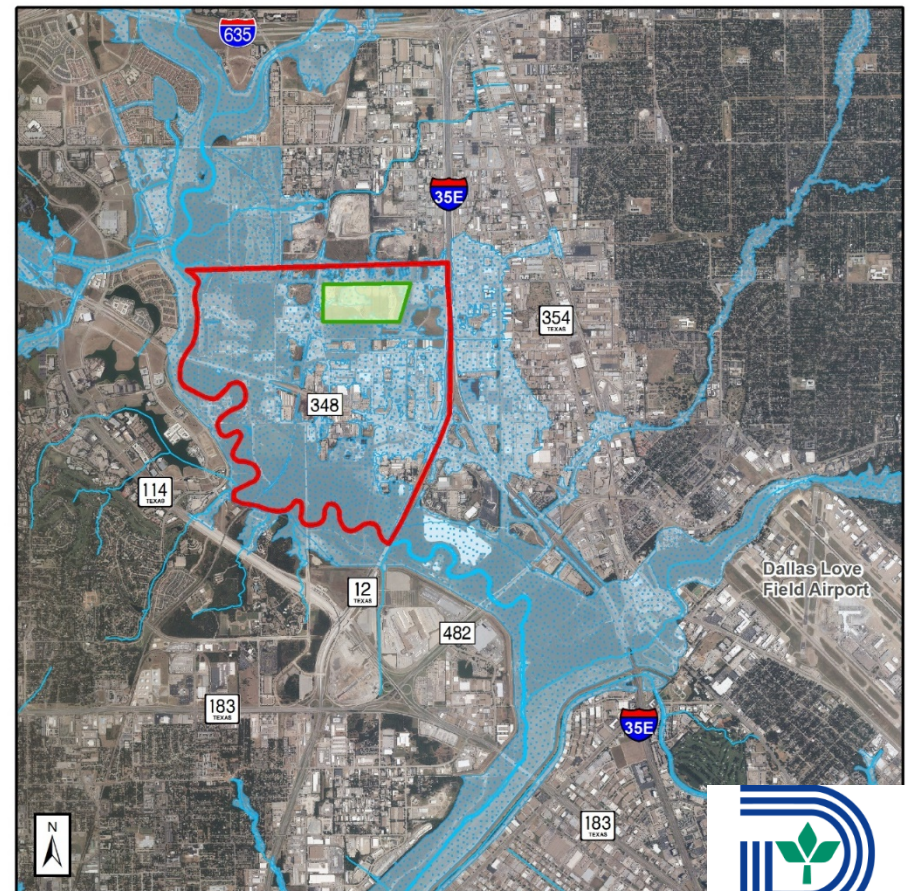
# Loop 12/Singleton Area

- Identified Flood prone Area in Needs Inventory
- Flood peak occurred on May 30, 2015
- TxDOT, TRA, TWM used 26 pumps at height of storm to pump down adjacent sump



# Elm Fork Area Flooding

- Closed Roads on May 30, 2015 due to high water on Elm Fork
- DAS Animal shelter
- No homes in area
- Also in an area with identified flood risk



# Community Response Management System (CRMS)

- Over 750 calls received:
  - 670 – Flooded roadways
  - 27 – Rescues, no boat
  - 18 – Boat rescues
  - 5 – Swift Water Rescue





# Continuous Improvement

# Successes

- System performed as designed
- Protected majority of areas from flooding
- Communication and teamwork with all internal and external partners including USACE, TXDOT, Dallas County, DISD, Hospitals, Red Cross, Downtown agencies and all related emergency task forces
- Support from internal departments
- Trained work force – pro active actions

# Future Opportunities for Improvement

- Work with UTA in combining data of the region
- Upgrade flood warning system
- Evaluate new technologies
- Upgrade electronics hardware and software

# Common Challenges

- Funding
- Aging Infrastructure
- Floodplain Development
- Hiring Talent
- New Regulations and Policies
- New Technology

# Questions?

City of Dallas

Trinity Watershed Management

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