

# Questions concerning the Halloween Flood in Onion Creek

Presentation by David R. Maidment  
Center for Research in Water Resources  
University of Texas at Austin

Public Safety Commission  
City of Austin

7 July 2014

# David R. Maidment

- On the faculty of the University of Texas at Austin since 1981 in the Civil, Architectural and Environmental Engineering Department
- Teach hydrology, hydraulics and geographic information systems in water resources
- Chair of National Academy of Science Reviews of FEMA Floodplain Mapping in 2007 and 2009, and presently on the National Academies Committee on Flood Insurance Affordability
- Chair of the National Academies Mapping Sciences Committee

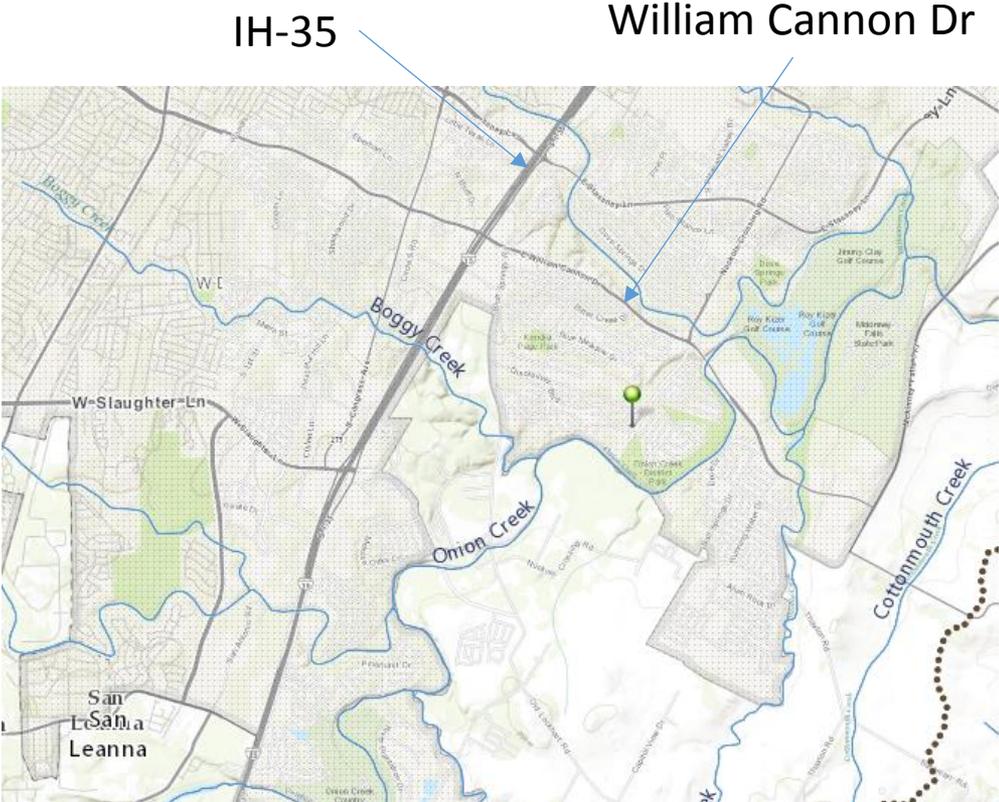
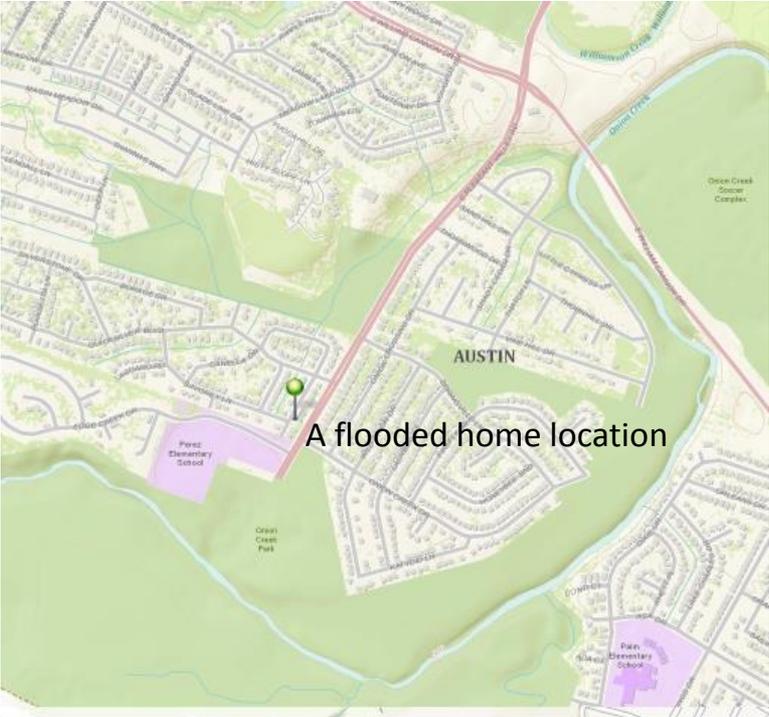
# Three Questions Posed by the City of Austin

1. Unique characteristics of the Onion Creek watershed and to compare and contrast the Halloween flood with previous floods in that watershed
2. Impervious cover and its effect on the flood waters that day
3. Future risk, particularly in light of continued rapid urban growth in this part of central Texas

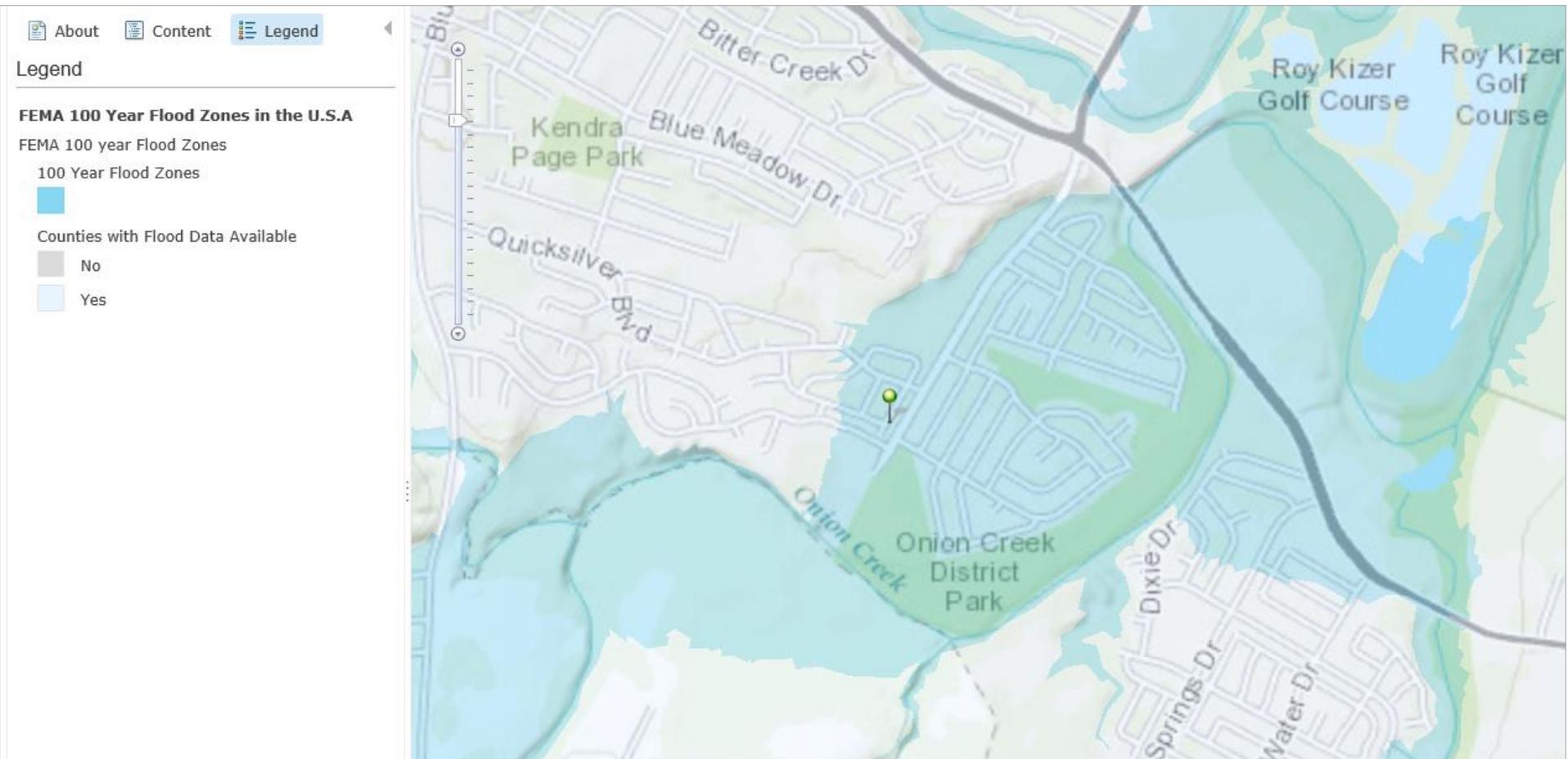
# Three Questions

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# Onion Creek Flooding, 30-31 October 2013



# FEMA Flood Hazard Zone



# Drainage Area above Home

Drainage area = 732 km<sup>2</sup>, or 282 miles<sup>2</sup>

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- Layers
  - Output Snapped Points [121818\_10312013]
  - Output Watershed [121818\_10312013]
  - 1
  - Basemap
  - World\_Topo\_Map

Catalog

Location: Watershed

- Home - Documents\ArcGIS
- Folder Connections
  - C:\
  - Z:\
  - Z:\giswr2012
  - Z:\giswr2013
- Toolboxes
- Database Servers
- Database Connections
  - Add Database Connection
- GIS Servers
  - Add ArcGIS Server
  - Add ArcIMS Server
  - Add WCS Server
  - Add WMS Server
  - Add WMTS Server
  - ArcGIS on 129.116.104.176 (user)
  - arcgis on crwr-arcgis01.austin.utexas.edu
  - arcgis on elevation.arcgis.com\_443
- Tools
  - Elevation
  - Hydrology
    - Watershed
- WorldElevation
  - NED30m
- arcgis on landscape1.arcgis.com\_443
- arcgis on landscape1.arcgis.com\_443
- arcgis on landscape2.arcgis.com\_443

Table

Output Watershed [121818\_10312013]

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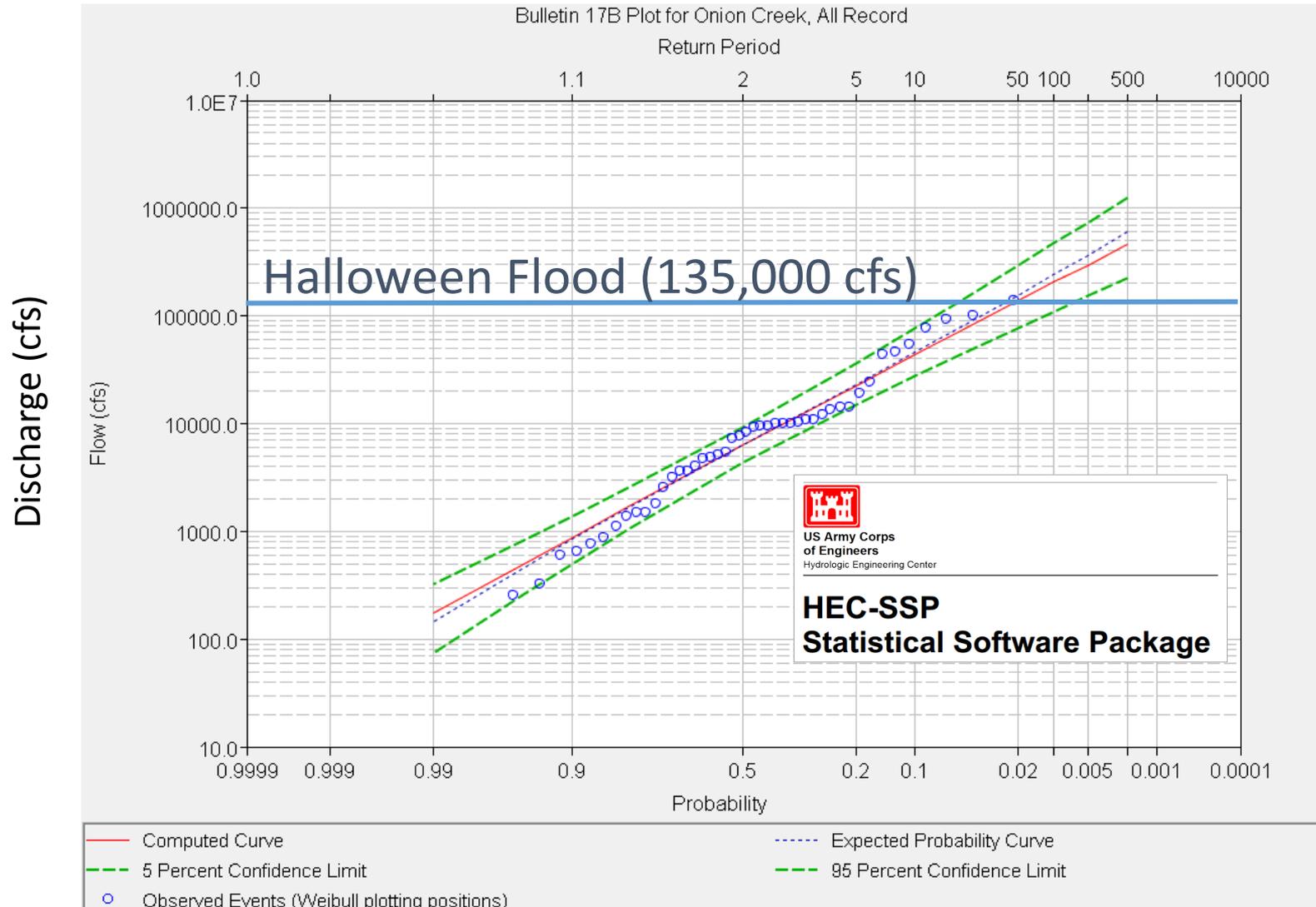
(0 out of 1 Selected)

Output Watershed [121818\_10312013]

Watershed delineation using ESRI Watershed Delineation Services

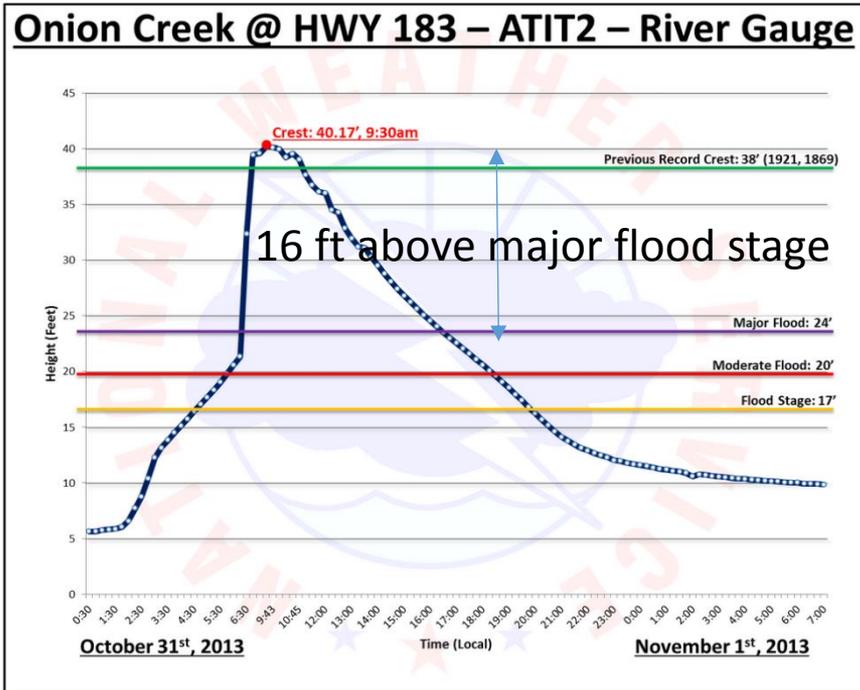
# Frequency Analysis of Halloween Flood

Return Period (Years)

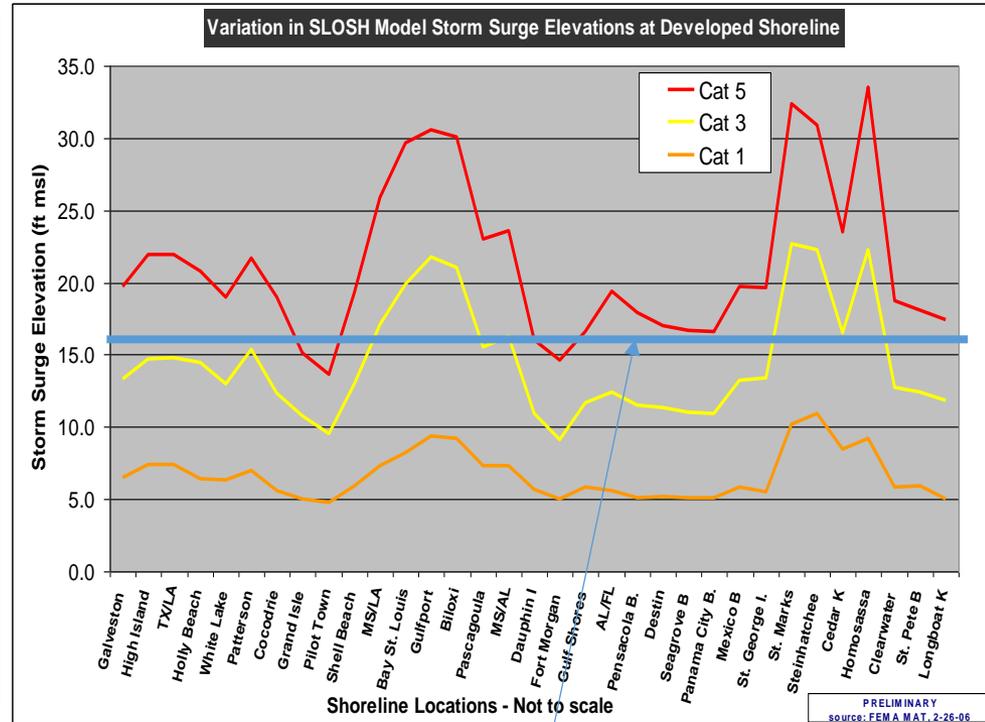


# Flood Water Elevations

## Halloween Flood



## Hurricane Storm Surge on Gulf Coast



16 ft of storm surge ~ Cat 3 hurricane

# Responses to Question One

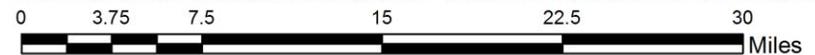
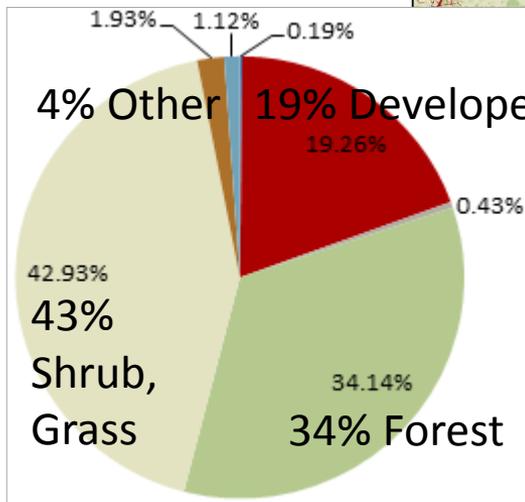
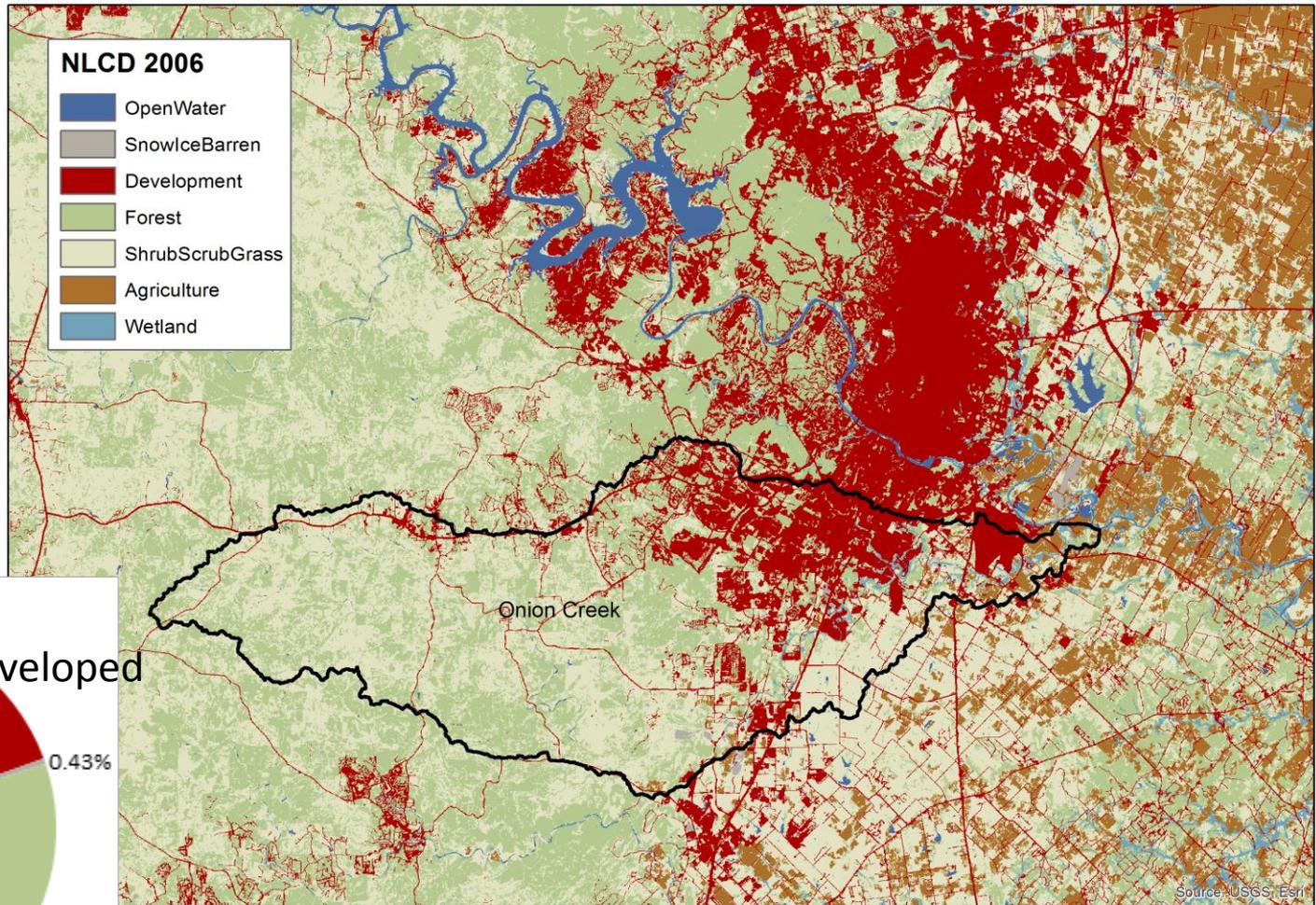
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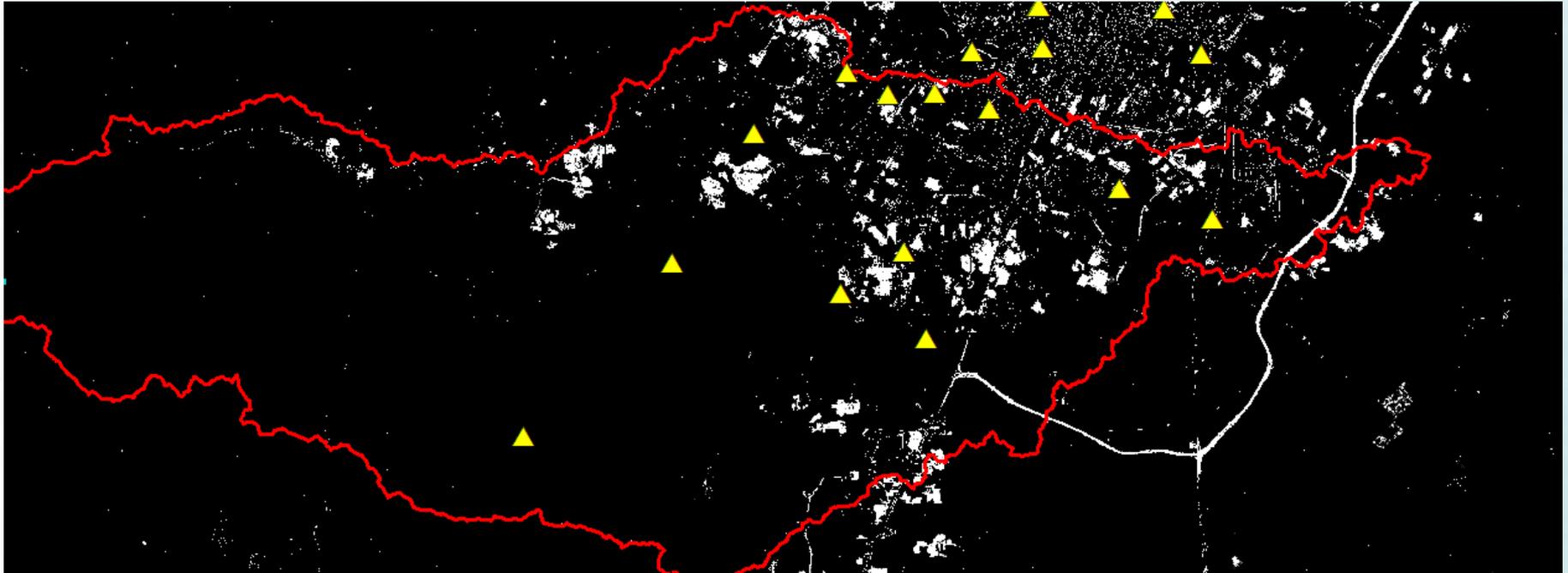
- *Onion Creek has a huge watershed equivalent in area to the entire City of Austin*
- *The area flooded during the Halloween flood is within the 100-year floodplain defined by FEMA*
- *The magnitude of the observed flood is within the range that could have been anticipated from past flood events. It is not “off the charts”*
- *The flood peak stage was about 16 ft above “major flood stage” ~ Category 3 hurricane storm surge on the Gulf Coast*

# Three Questions

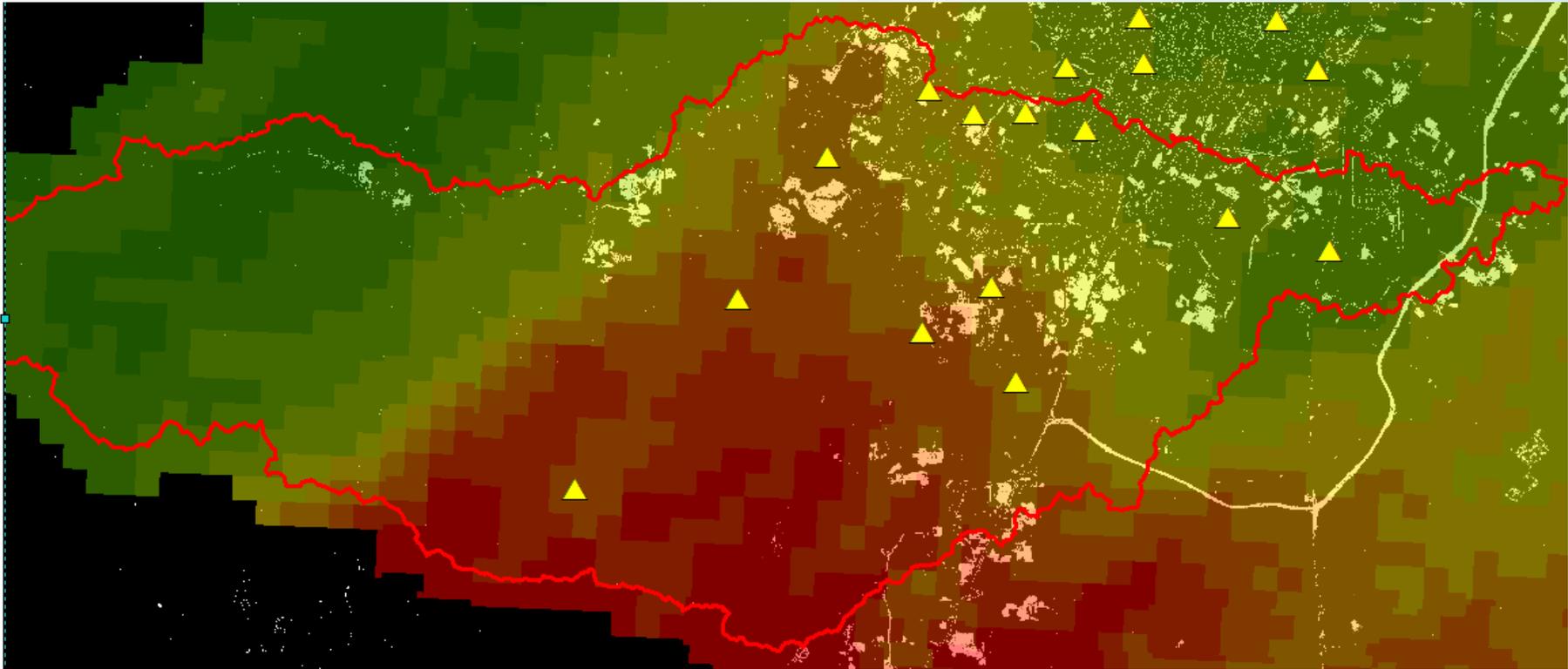
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# Land Cover in the Onion Creek Watershed (2006)





From NLCD – Change in Impervious Cover from 2001  
to 2011



Change in Impervious Cover from 2001 – 2011 with Halloween Rainfall

# Upper Onion Creek Future Conditions Study (City of Austin)

- Hays County Master Plan
  - % impervious cover increased to **15%** in each subbasin unless already greater than 15%, then left unmodified
  - Average increase in design flow at Twin Creeks gage
    - 25-year flow increases from 47,300 to 50,200 cfs
    - 100-year flow increases from 87,600 to 89,300 cfs
- Evaluation of Increased Development in Buda Area
  - % impervious cover within Buda ETJ increased to **47%**
  - Less than 0.5% incremental increase in flow over master plan
- Note: Hays County master plan design flows are lower than the effective FEMA flows. For details please refer to City of Austin Watershed Protection Department

# Actual Rainfall Totals

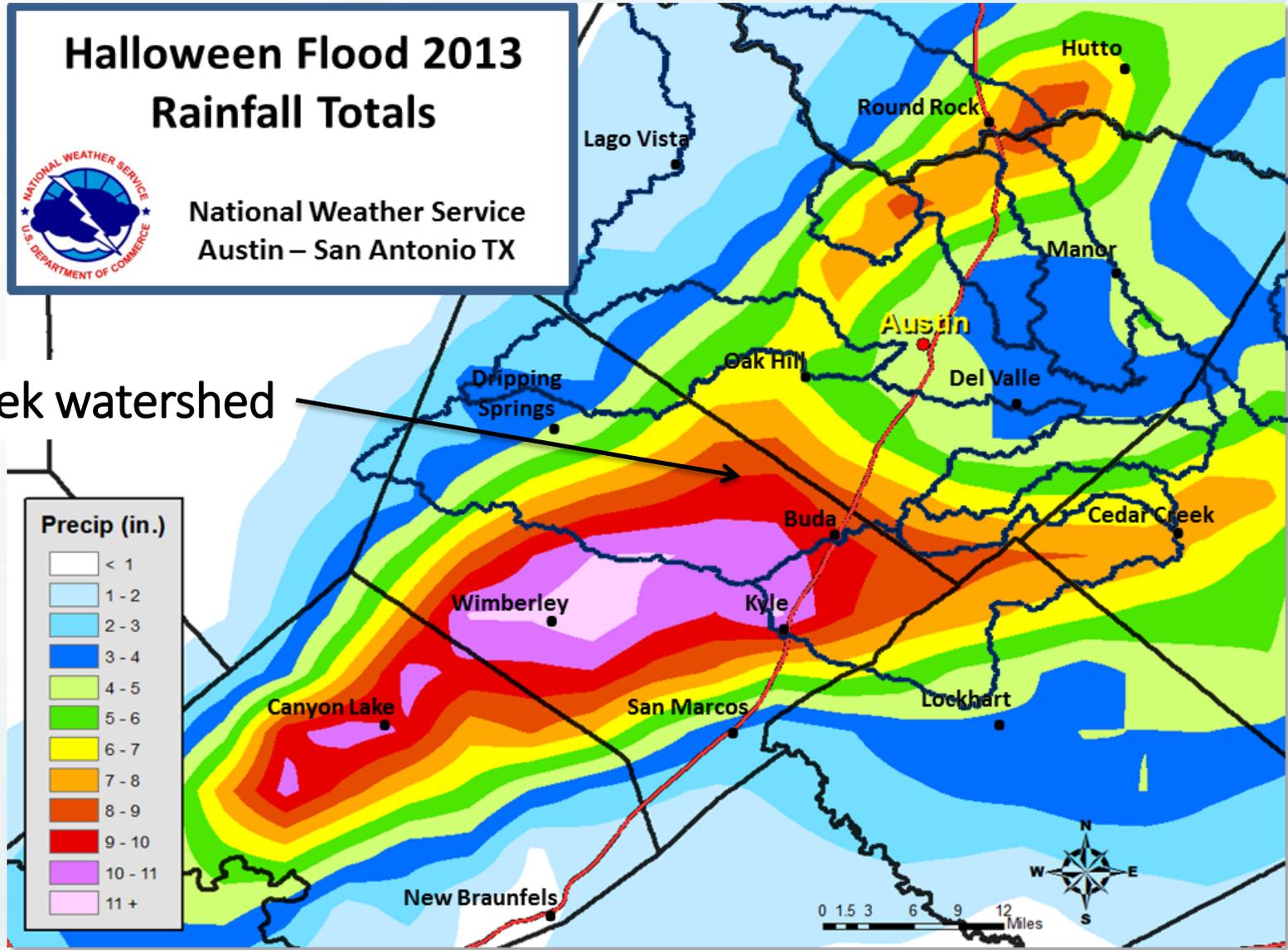
## Halloween Flood 2013 Rainfall Totals



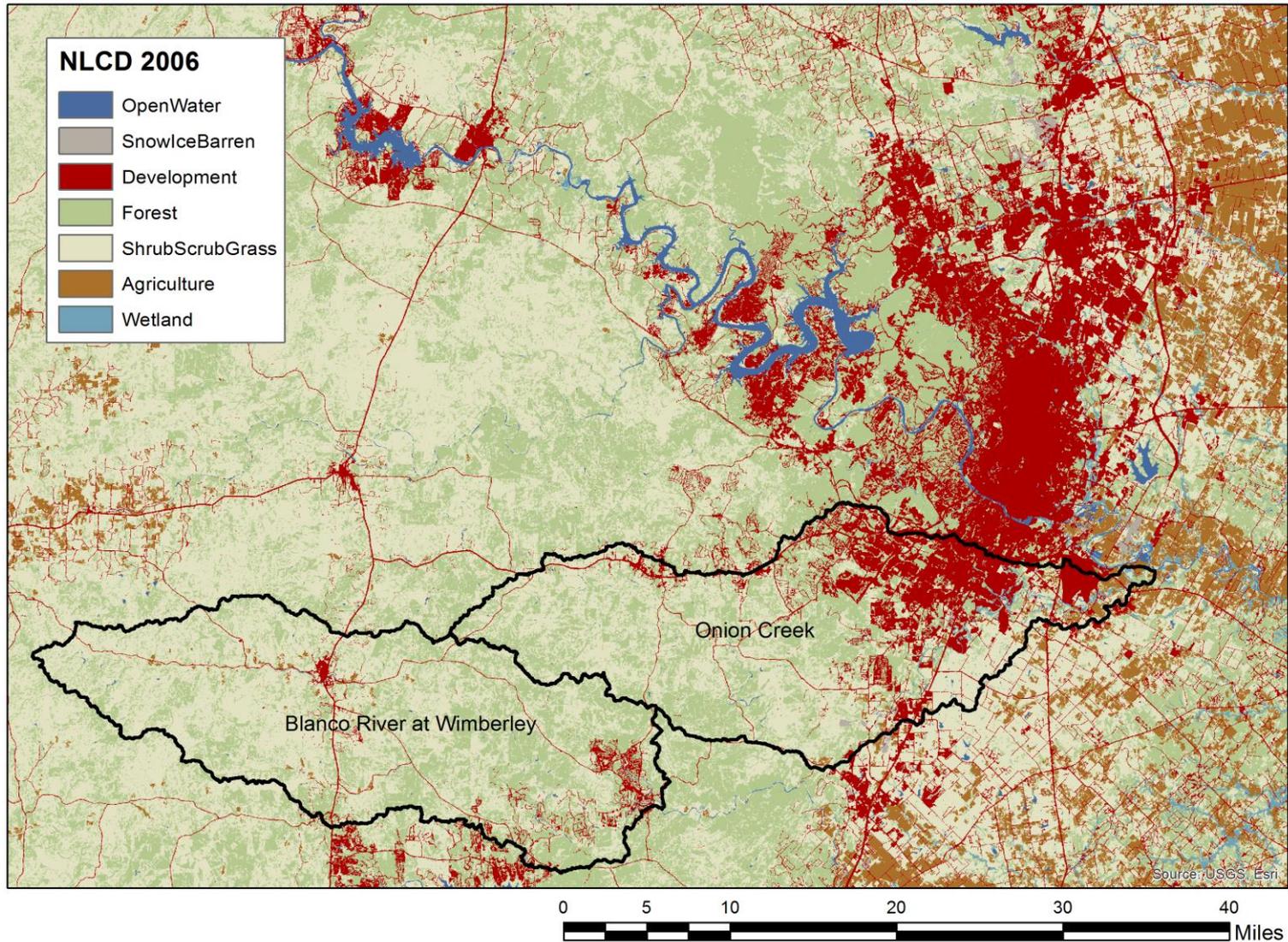
National Weather Service  
Austin – San Antonio TX

Onion Creek watershed

Precip (in.)



# Onion Creek and the Blanco River



## Responses to Question Two

### *Impervious cover and its effect on the flood waters that day*

- Onion Creek is about **20% developed**, concentrated in the lower end of the watershed
- In Halloween Flood, the major rainfall was **over the rural part of Onion Creek** not the urbanized part
- **Urbanization did not have a major effect** on the Halloween flood but could do so in future storms if rainfall were centered on the lower part of the watershed

# Three Questions

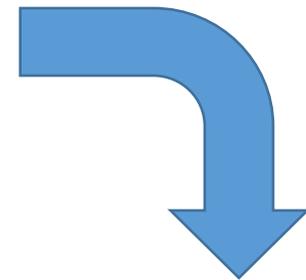
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# Anne Castle, Asst Secretary for Water and Science, Dept of Interior

- “Today we have unprecedented opportunities to use science and technology to create a better understanding of one of our most precious resources – water”
- “I am committed to working with you to do that”
- New Open Water Data Initiative



Chair





## Overview: National Water Center (NWC)

- **National Water Center**
  - Opened by **National Weather Service** at the University of Alabama in Tuscaloosa in May 2014
  - Will synthesize work of present 13 regional River Forecast Centers
  - Like National Hurricane Center
  - Offers new opportunities to integrate national and local efforts for flood forecasting



INTEGRATED WATER RESOURCES  
SCIENCE AND SERVICES (IWRSS)

SUMMIT TO SEA

# National Water Data Infrastructure

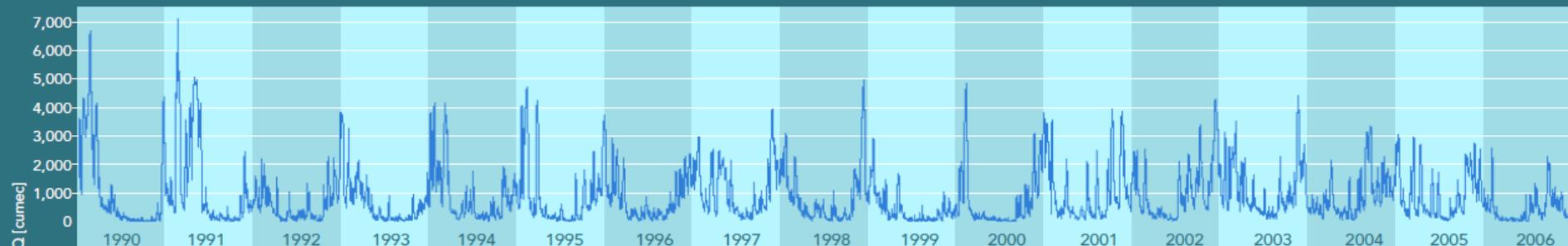
David R. Maidment,  
University of Texas at Austin

NWS National Water Center Opening  
Tuscaloosa, Alabama  
13 May 2014

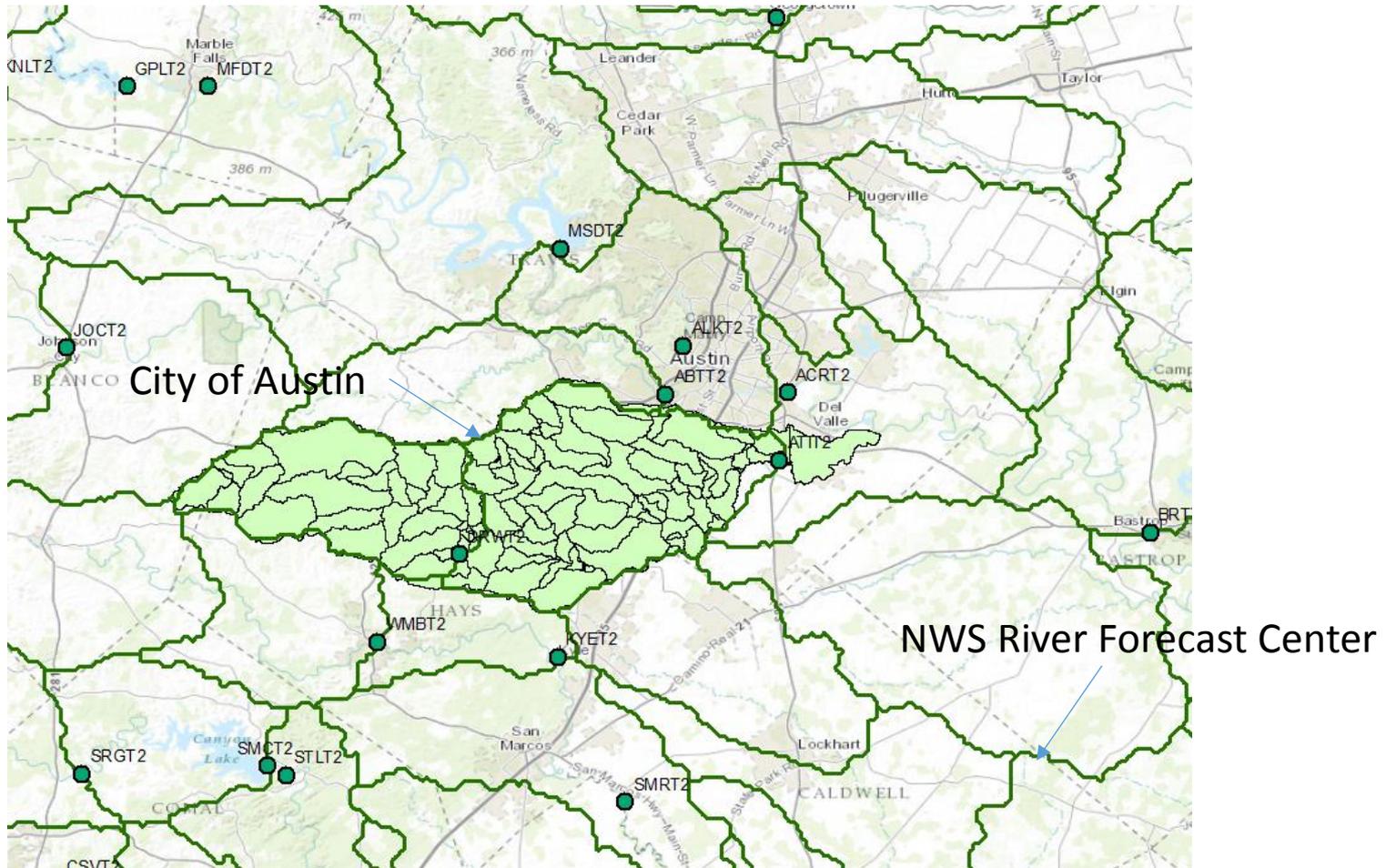
1m 2m 6m 1y 2y From 21/10/1980 To 30/04/2014



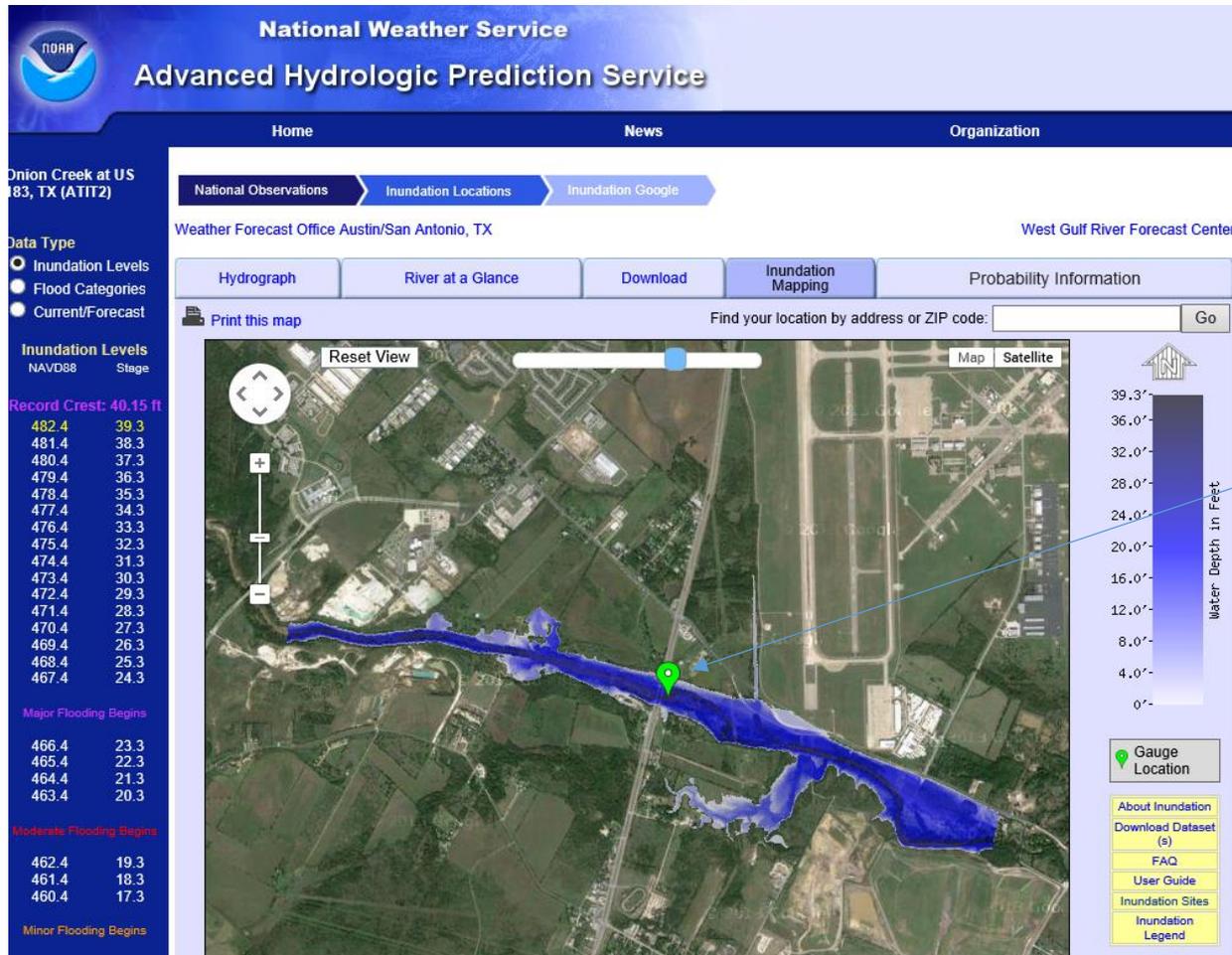
Main Coffeerville + D Near Coffeerville, AL Merrill, Miss



# National and Local Flood Modeling



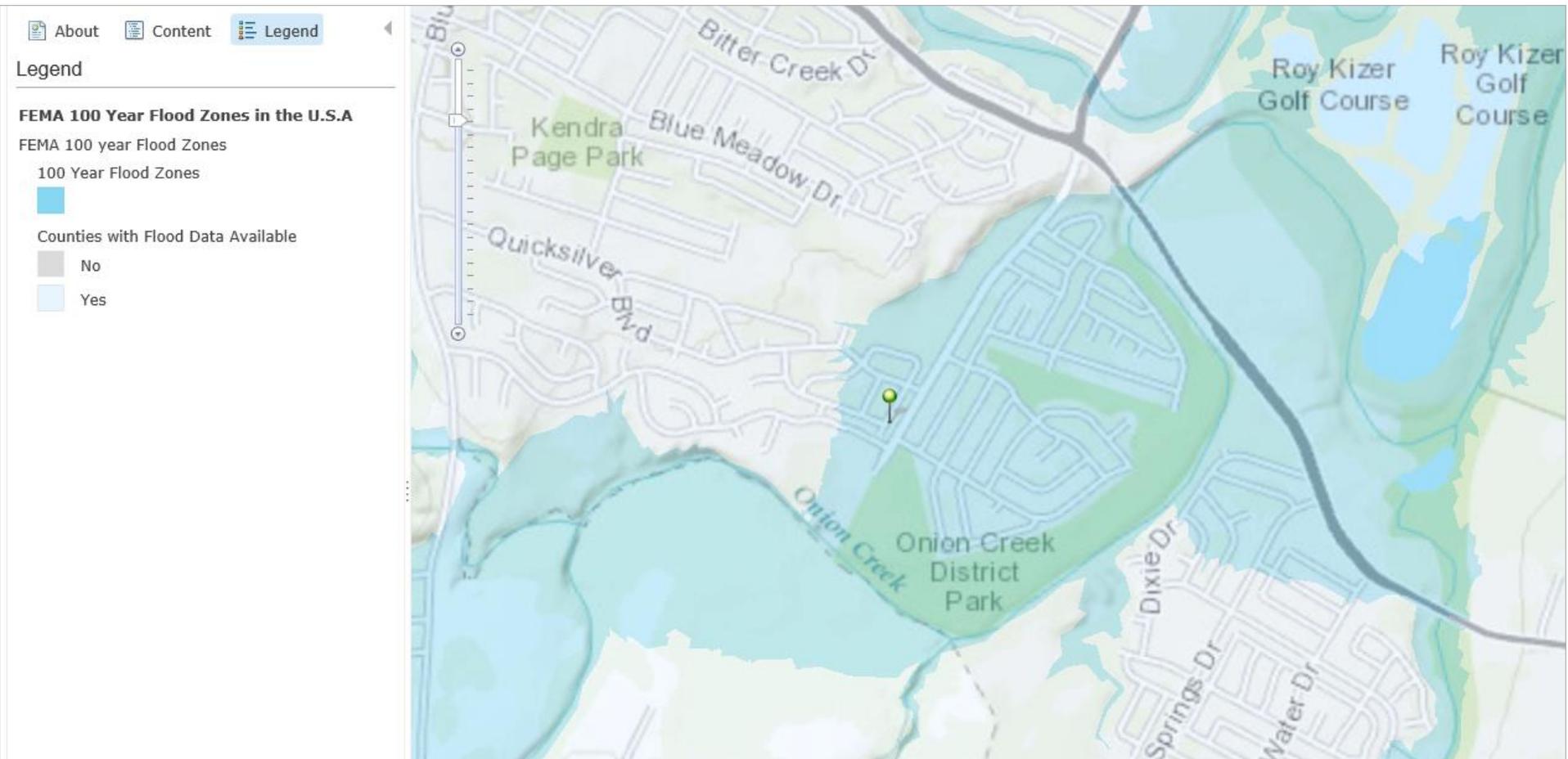
# Real-Time Flood Inundation Mapping on Onion Creek (USGS/NWS)

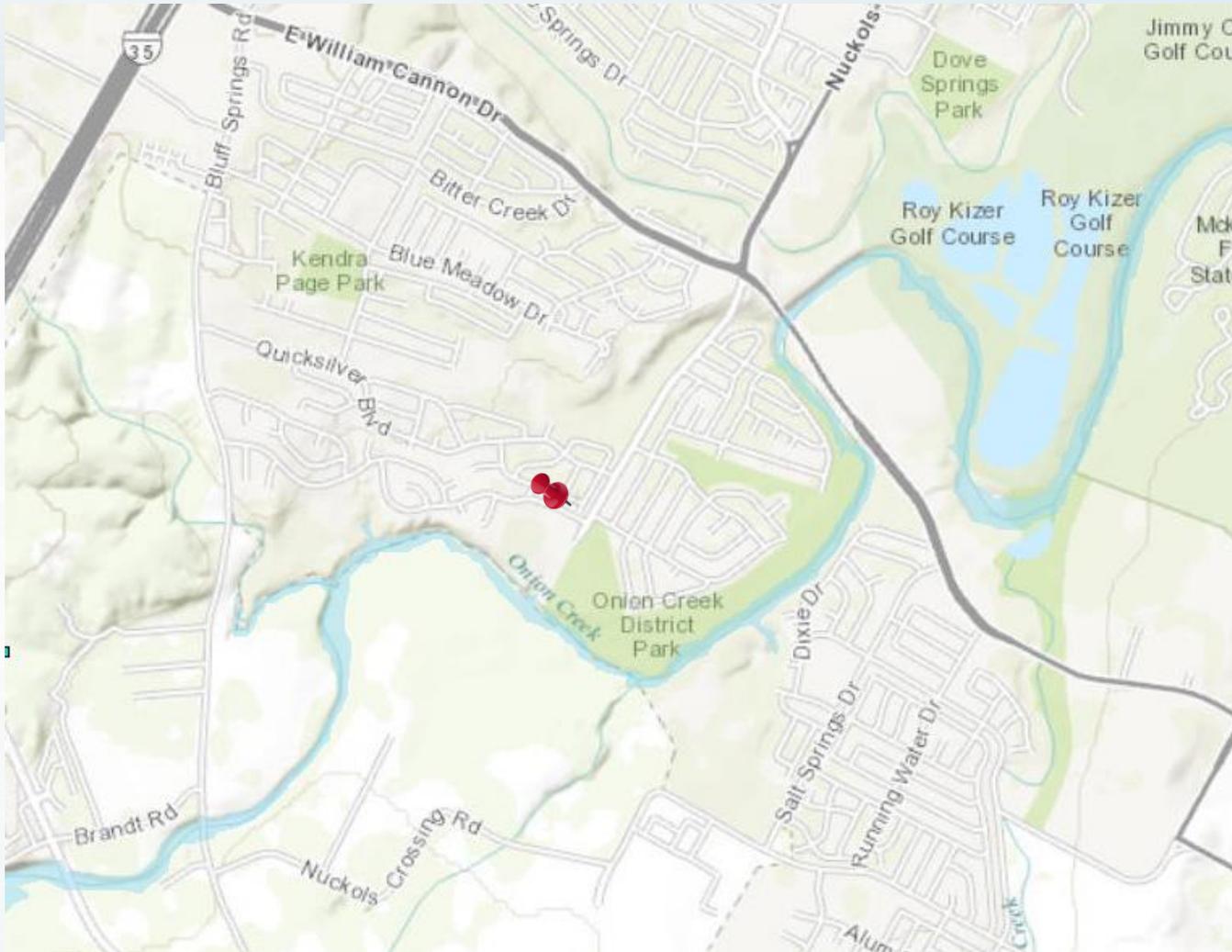


Gage at Highway 183

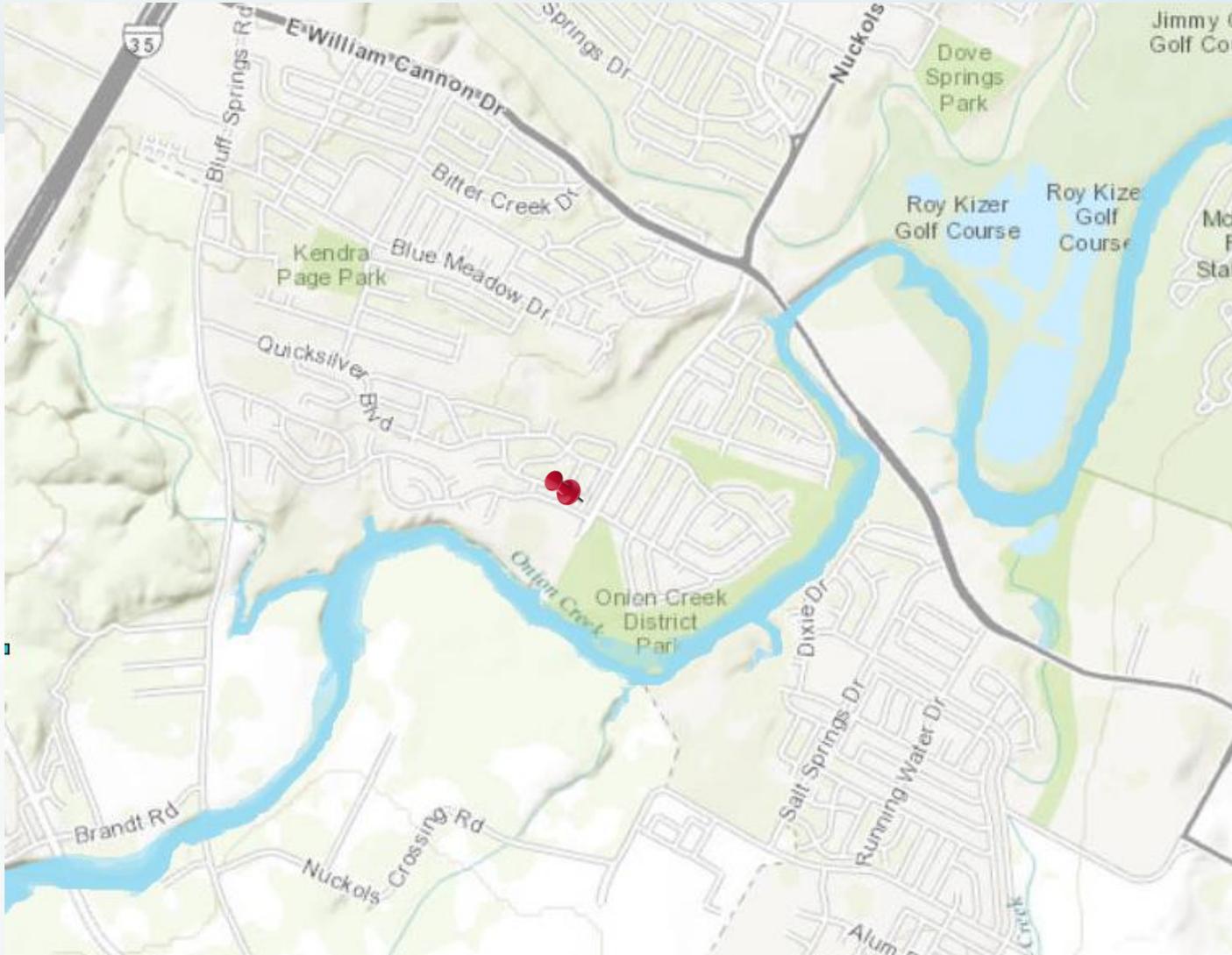
[http://water.weather.gov/ahps2/inundation/inundation\\_google.php?gage=atit2](http://water.weather.gov/ahps2/inundation/inundation_google.php?gage=atit2)

# FEMA Flood Hazard Zone

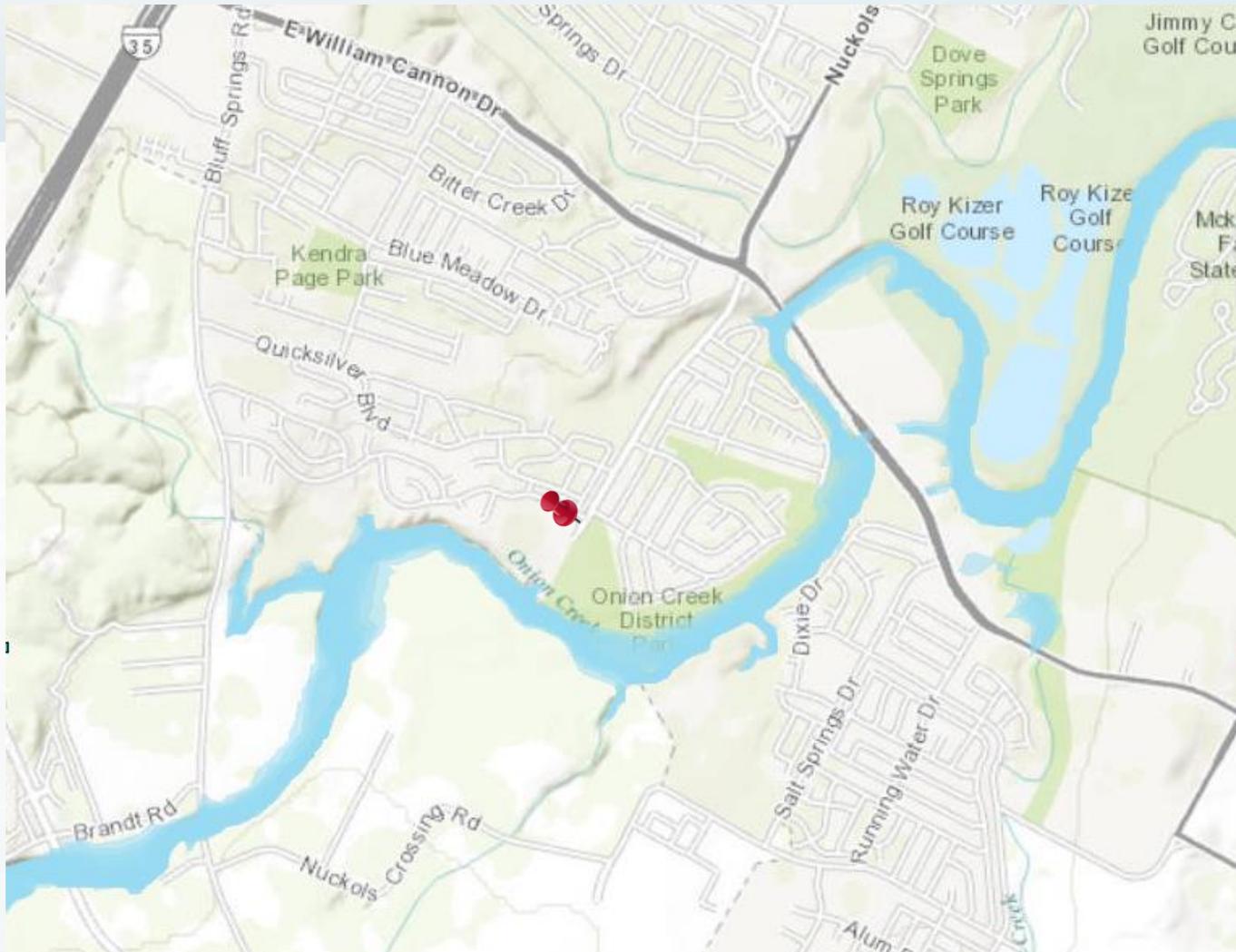




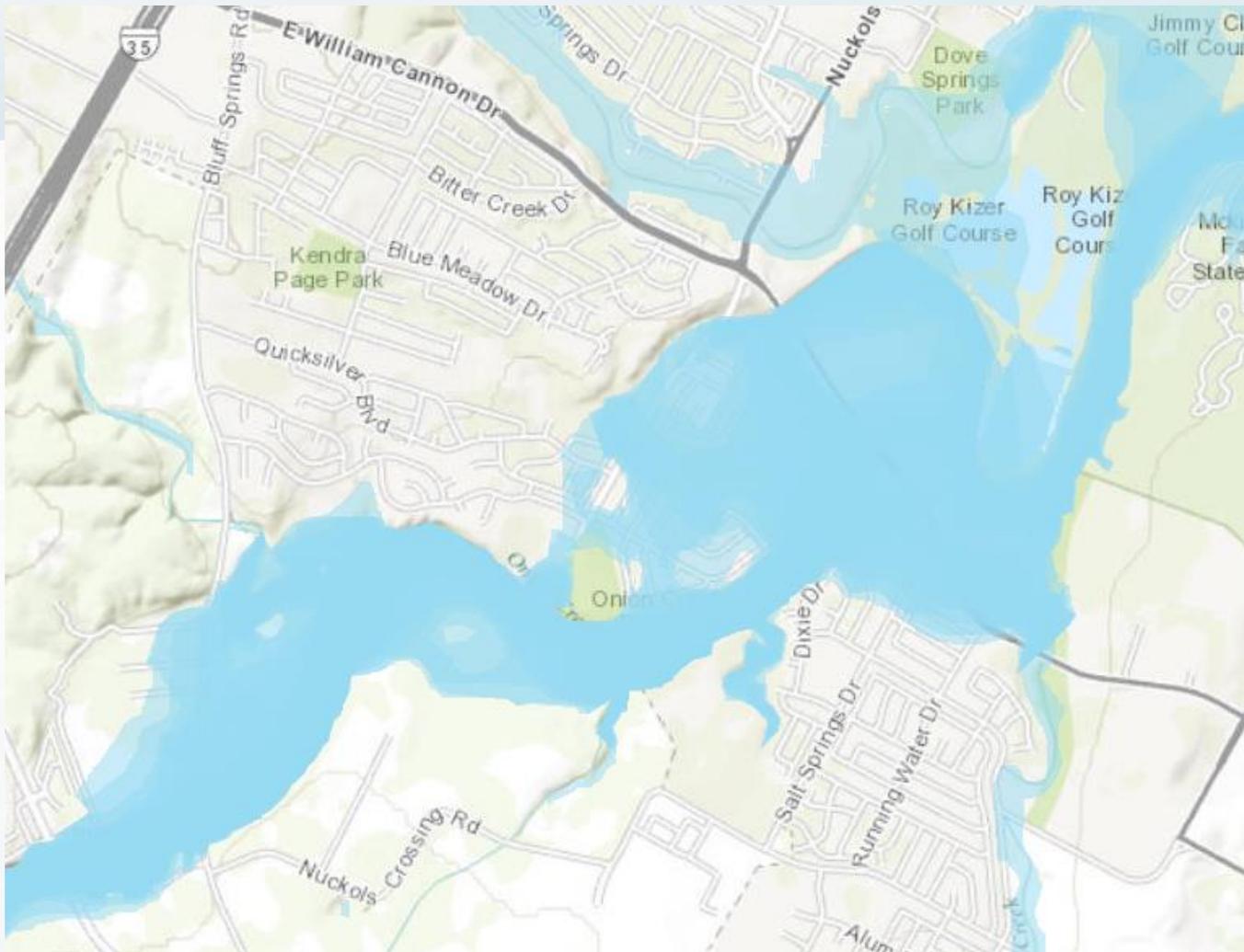
17' AHPS Flood  
Warning Stage



21' NWS issues Flood Warning for Onion Creek  
(issued at 02:44)



25' NWS issues Flood Warning for Onion Creek at 03:40 – gauge will rise to 25.9'



41' -- At 10:07 -- peak of USGS gauge -- 40.97'

# Inundation Mapping

- Flood emergency response is tied to the extent of inundation
- Prepare flood response plan using a “library of inundation maps”
  - 1 ft level increments on all major streams
- During flood events make probabilistic projections of what flood stage will be reached
- Work with National Weather Service through National Water Center to create an improved real-time flood data, modeling and inundation mapping procedure

# Responses to Question Three

*Future risk, particularly in light of continued rapid urban growth in this part of central Texas*

- *Flooding is a regional phenomenon*
- *More detailed modeling of flooding at NWS is feasible through National Water Center*
- *Flood inundation mapping is the key interface between hydrology and flood emergency response planning*
- *Propose Austin and Halloween Flood as **a case study for the National Water Center***