



USING FLOOD MODELS TO ASSIST EMERGENCY RESPONDERS:

EXPANDING THE SITUATIONAL AWARENESS OF
THE VICTORIA EMERGENCY OPERATION CENTER

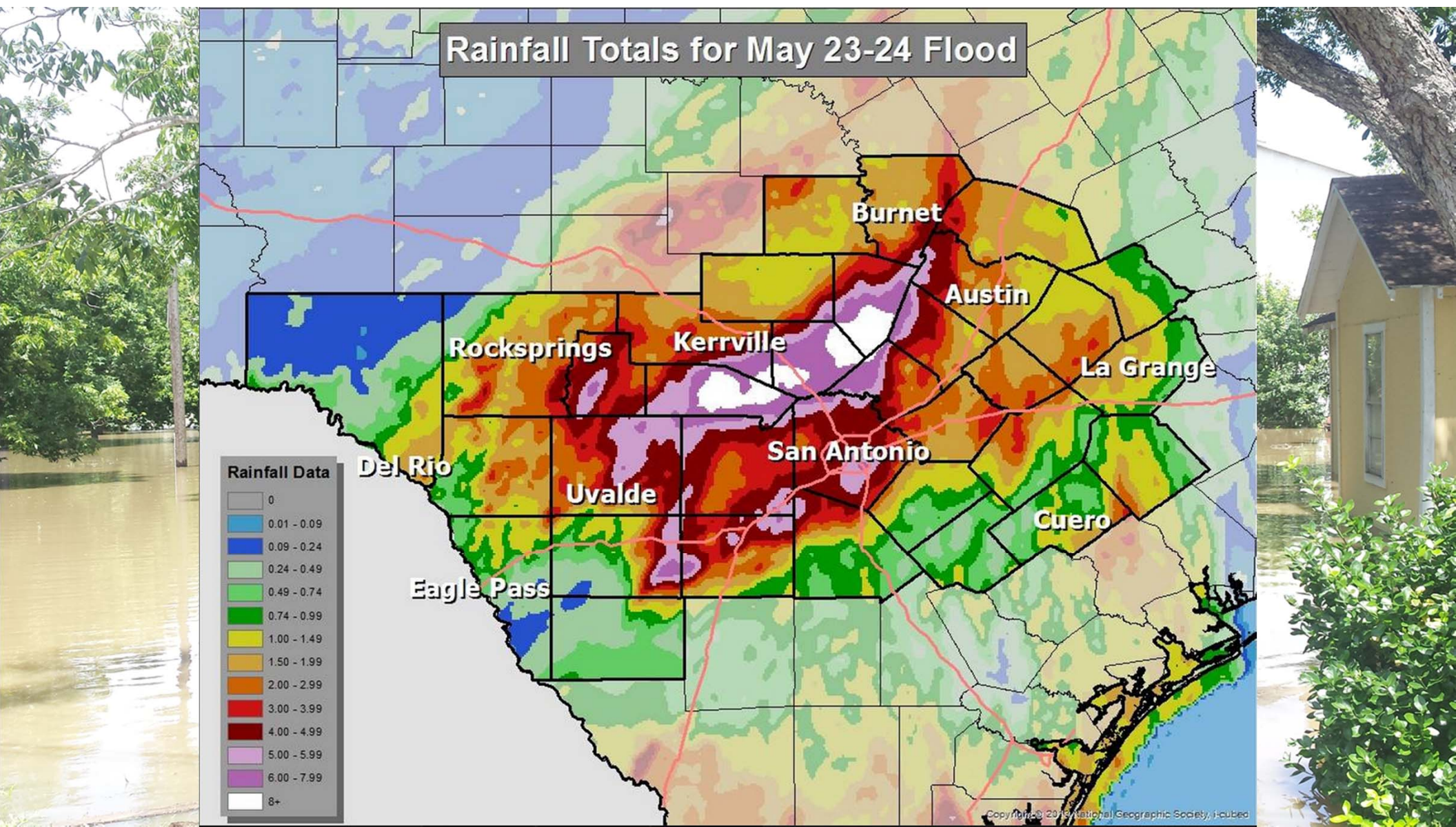
NATIONAL HYDROLOGIC WARNING COUNCIL
AUSTIN, TEXAS

October 29, 2015



LEADING UP TO THE FLOOD EVENT

What should we expect?
How can we obtain better
information?
How can emergency responders
use this?



Rainfall Totals for May 23-24 Flood

Rainfall Data

0
0.01 - 0.09
0.09 - 0.24
0.24 - 0.49
0.49 - 0.74
0.74 - 0.99
1.00 - 1.49
1.50 - 1.99
2.00 - 2.99
3.00 - 3.99
4.00 - 4.99
5.00 - 5.99
6.00 - 7.99
8+

WHAT SHOULD WE EXPECT?

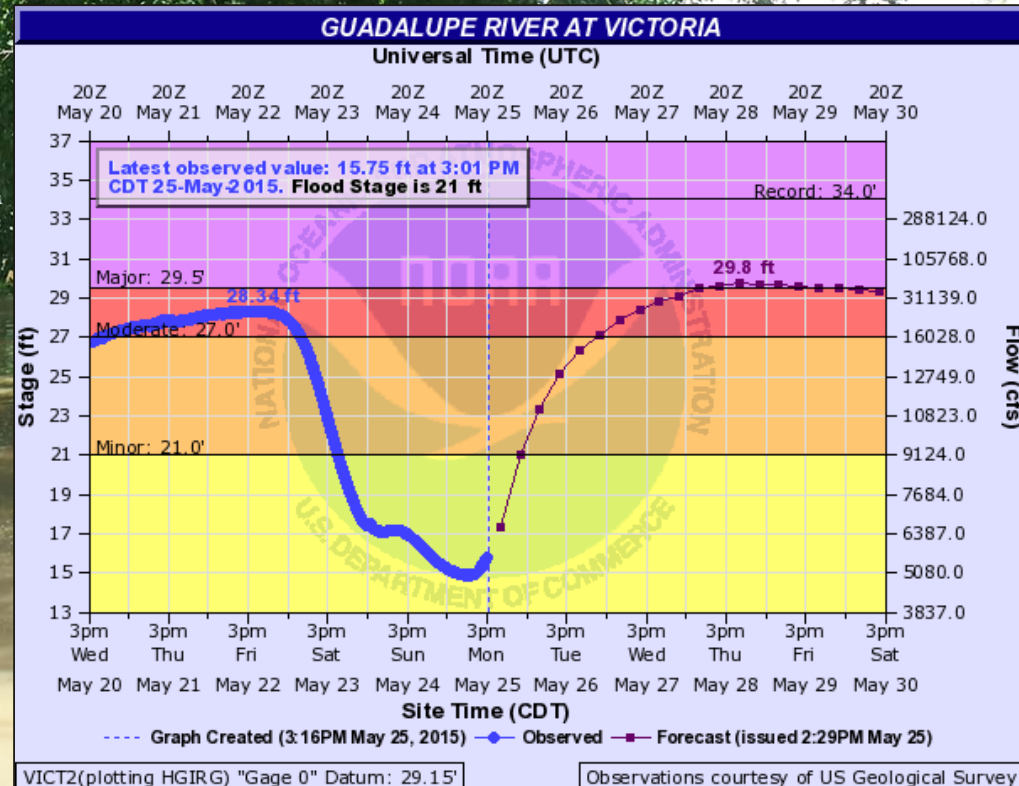
FORECASTED FLOODING — MONDAY, MAY 25

Guadalupe River forecast to rise to 29.8' on or about the early morning hours of Thursday, May 28th

The previous week the river crested at 28.34'

EOC activated and responding

The Floodplain Manager was tasked to identify areas to be impacted by new flood rise forecast



WHAT SHOULD WE EXPECT?

IMPACT SHEET — HISTORY

Following the 1998 Guadalupe River Flood it was discovered River Impact Data was maintained by several groups:

- National Weather Service
- Guadalupe Blanco River Authority
- County Commissioners
- Public Works employees
- First Responders
- TXDOT
- City and County Residents



Guadalupe River at Victoria Rising River Impact Areas vs. River Gauge Readings These elevations can and do vary during each flood event.

River Gauge Reading	Normal Conditions (up to 12')	Near Flood Stage (12'-26')
	Minor Flooding (26'-28')	Moderate/Major Flooding (28'+)
34.04	#1 Flood of Record on 10/20/1998 (466,000 cfs)	
34.0	This is the flood of record (34.04 feet)...which occurred on October 20 1998. Disastrous flooding occurs. The AEP power plant on Bottom Road is under water and electricity maybe shut off to that side of town. 600 homes were flooded on the west side of town. A large number of city blocks in Victoria were under water.	
500 year	0.2% Chance Frequency Flood (347,000 cfs) established by USGS in October 2006	
200 year	0.5% Chance Frequency Flood (250,000 cfs) established by USGS in October 2006	
33.3	Flow line of pipe at Billy Bournias Memorial Picnic Area	
100 year	1% Chance Frequency Flood (192,000 cfs) established by USGS in October 2006	
31.22	#2 Flood of Record on 07/03/1936 (179,000 cfs)	
50 year	2% Chance Frequency Flood (145,000 cfs) established by USGS in October 2006	
25 year	4% Chance Frequency Flood (106,000 cfs) established by USGS in October 2006	
31.10	#3 Flood of Record on 09/02/1981 (105,000 cfs)	
31.0	Major lowland flooding occurs. The river generally floods 40 square blocks of Greens Addition Subdivision...and areas west of Moody Street between Water Street and Constitution Street	
30.97	#4 Flood of Record on 11/26/2004 (No Data)	
30.67	#5 Flood of Record on 09/21/1967 (70,000 cfs)	
30.5	Near fifty homes in the Greens Addition Subdivision...and the area west of Moody Street between Water and Constitution Streets flood. The levees downstream near the Guadalupe and San Antonio Rivers and may be impacted. Hundreds of cattle are cut off and drowned below Cuero to near Tivoli. HWY 35 floods for several miles. Much of the flood plain near and below the San Antonio River confluence is several miles wide...flooding and isolating a large residential area	
30.45	#6 Flood of Record on 06/07/1987 (83,400 cfs)	
30.37	#7 Flood of Record on 05/16/1972 (58,500 cfs)	
30.36	#8 Flood of Record on 07/11/2002 (66,120 cfs)	
10 year	10% Chance Frequency Flood (65,700 cfs) established by USGS in October 2006	
30.35	#9 Flood of Record on 06/22/1961 (55,800 cfs)	
30.3	Water on the inside lane of Moody Street at Wolfram Street	
30.28	#10 Flood of Record on 02/26/1958 (58,300 cfs)	
30.20	#11 Flood of Record on 06/01/1929 (79,000 cfs)	
30.13	#12 Flood of Record on 12/25/1991 (61,500 cfs)	
30.09	#13 Flood of Record on 04/24/1977 (54,500 cfs)	
30.03	#14 Flood of Record on 12/26/1991 (No Data)	
29.92	#15 Flood of Record on 05/02/1957 (35,300 cfs)	
29.8	Water starts to flood houses at the west end of Convent Street near the old landfill	
29.80	#16 Flood of Record on 07/09/1942 (56,000 cfs)	
29.6	Water will enter the Texas Zoo if entrance gates are not closed off with flood gates and sandbags	
29.5	Major lowland flooding occurs. The lowest homes in the Greens Addition Subdivision in Victoria...Riverside Park...much of the Riverside Golf Course...including the golf cart sheds...and the Texas Zoo flood. A fishing resort below HWY 35 near Tivoli floods...and many homes above HWY 35 near Tivoli are surrounded by flow several hundred yards wide. Hundreds of cattle in the flood plain below Cuero are cut off and may drown. Riverside camp grounds in Tivoli approaches to HWY 59 begin to flood	
29.5	Water begins to encroach into the Greens Addition roadway ditches	
29.5	Water is just starting to flow over the river bank in the Greens Addition at the end of Gunther Street.	
29.0	Water is crossing Fordyce Road at the large culvert between the lakes and the main portion of Saxet Lake Park is closed and water covering some of the picnic areas and roads. Gates are located at two intersections (1) Fordyce Road and Fox Road (2) Fordyce Road and Timber Drive, these roads are locked and no traffic will be allowed through. Water now under the US Business 59, East and West Relief Bridges.	
29.0	Water over Constitution and Craig - Areas west of Moody Street (US Business 59) between Water and Constitution Street is threaten	
28.8 - 29.1	Water flowing over McCright Drive and starts flowing around the upstream end of the levee at Constitution and Craig Streets	
28.6	Water over McCright flowing into Golf Course	

WHAT SHOULD WE EXPECT?

IMPACT SHEET — HISTORY

We began to accumulate and consolidate the impact data from the various sources.

The data is used by:

- The Office of Emergency Management
- First Responders
- City/County Public Works groups

Victoria experienced Flood Events in 2002, 2004 and 2007.

Following each event the Impact Data was reviewed, revised and updated.



Guadalupe River at Victoria Rising River Impact Areas vs. River Gauge Readings These elevations can and do vary during each flood event.

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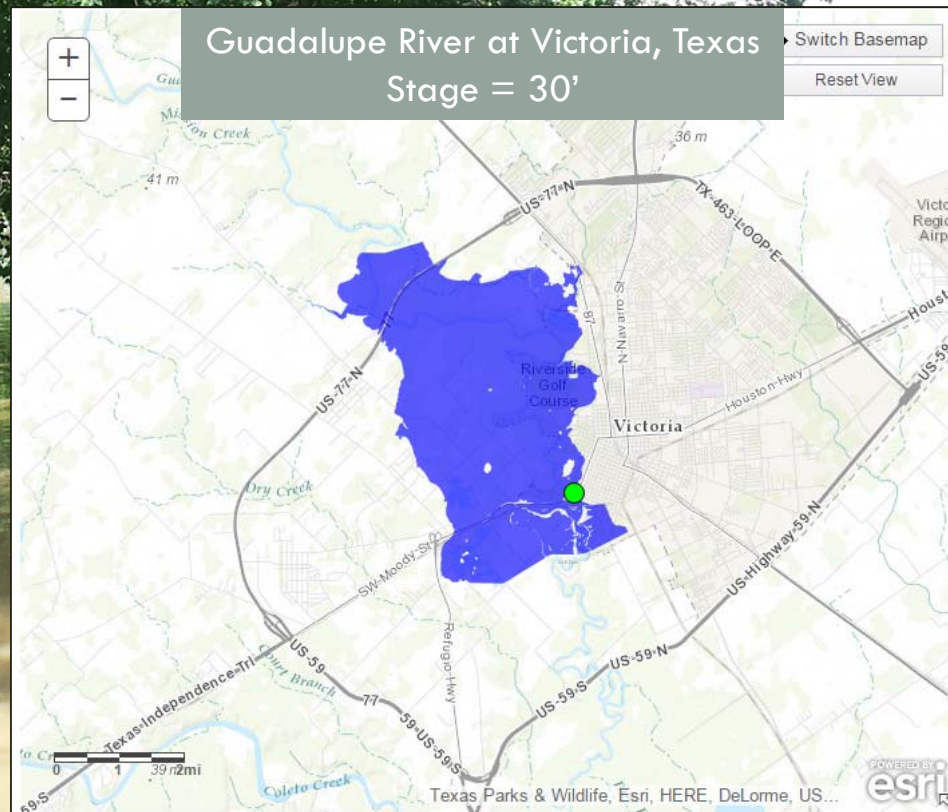
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WHAT SHOULD WE EXPECT?

EXISTING NWS SHAPEFILES

The NWS West Gulf River Forecast Center developed a tool for Victoria in their Advanced Hydrologic Prediction Service.

The tool provided inundation exhibits for various gauge heights.

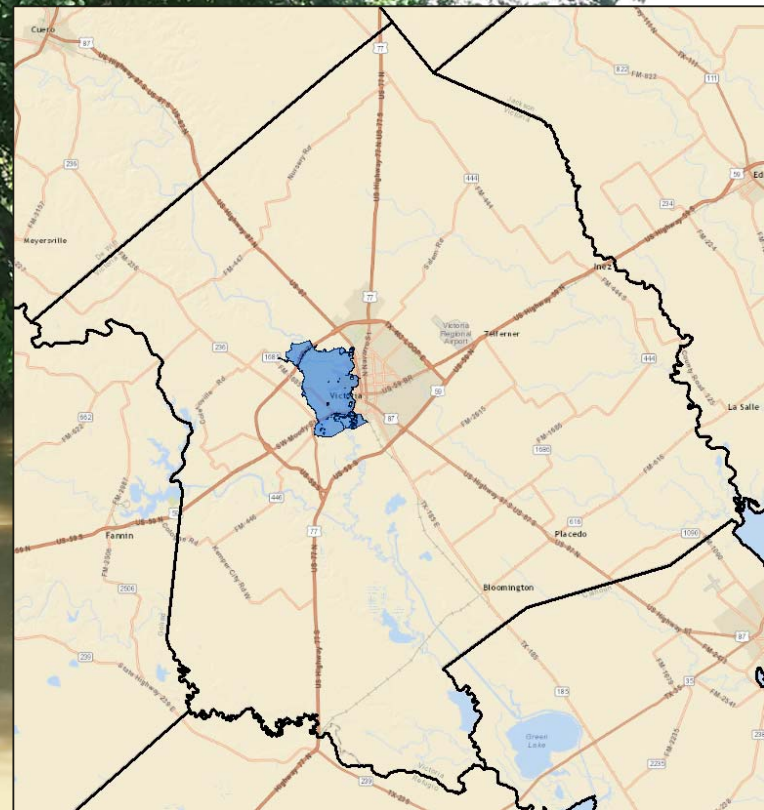


WHAT SHOULD WE EXPECT?

LIMITED MAPPING EXTENTS

The NWS WGRFC AHPS tool was very useful in and around the populated areas of the City of Victoria.

The Victoria Emergency Operation Center needed a tool that would provide inundation predictions County-Wide.



WHAT SHOULD WE EXPECT? **FLOODPLAIN MAP**

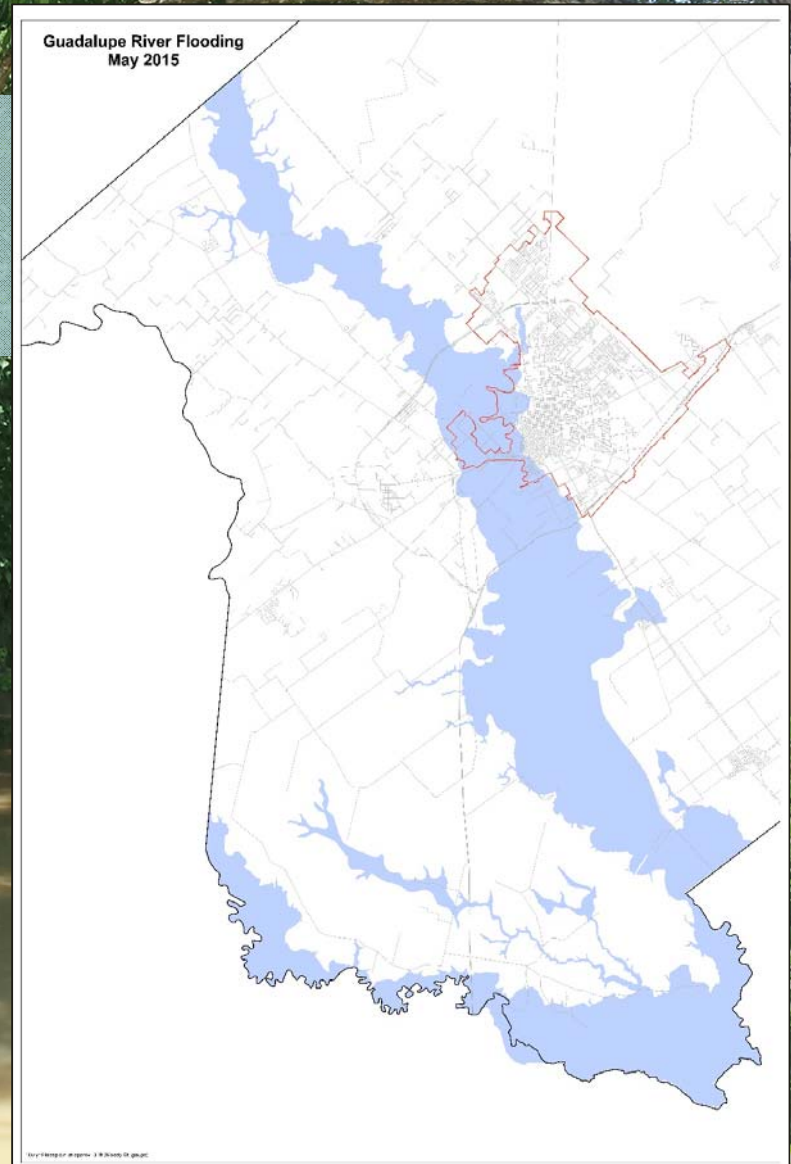
BEST AVAILABLE DATA

The only other County-Wide exhibit showing areas that would be impacted by flooding was the preliminary floodplain map (11/22/10).

The forecasted crest was 29.8' gauge height.

This elevation correlates to 58.95' mean sea level.

The 1% BFE at the River Gauge is 60.0' mean sea level, an equivalent gauge reading of 30.85'





HOW CAN WE OBTAIN BETTER
INFORMATION?

In less than 24 hours

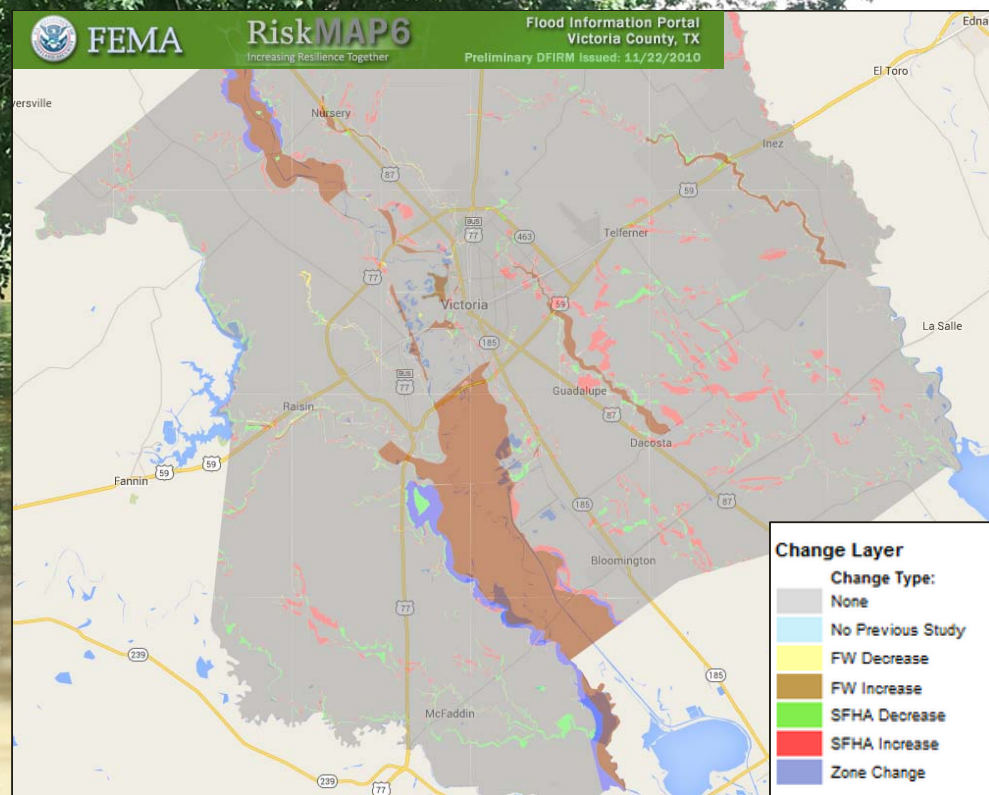
HOW CAN WE OBTAIN BETTER INFORMATION? LATEST FEMA MODELS AND MAPS

Effective maps:

- 8/4/1987
- 11/20/1998
- 7/21/1999

Revised (preliminary, unadopted) maps:

- 11/22/2010
- Halff Associates study of the Guadalupe River prepared in 2007 with the Map Modernization project (currently unadopted)

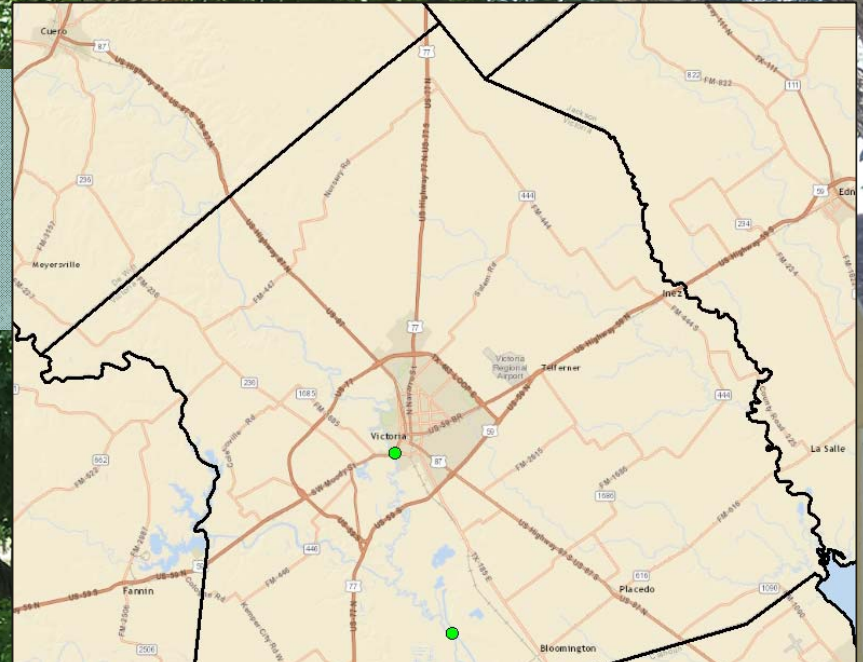


HOW CAN WE OBTAIN BETTER INFORMATION? RIVER GAUGES

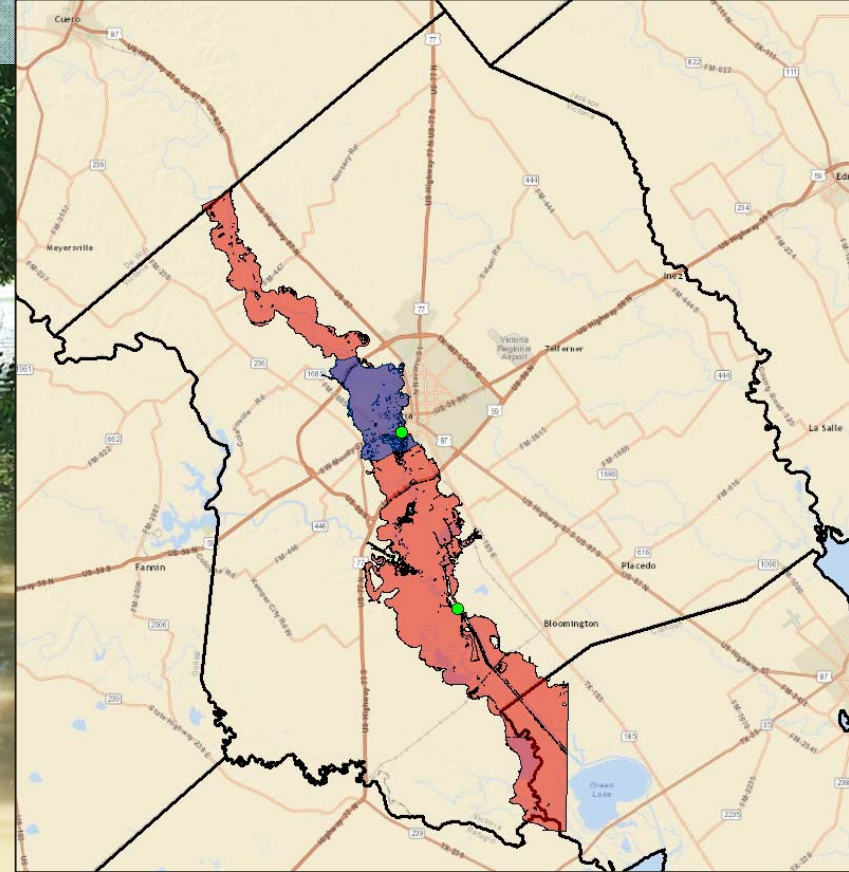
- Unknown: County-wide flood extents
- Known: River gauge elevation associated with the flood wave
- Interim Solution: Input flows that yield the projected gauge elevation

Limitations

- No flow change locations
- Steady flow
- Reach not calibrated



A map of the Victoria, British Columbia region. The city of Victoria is highlighted in blue. Major roads and highways are shown in orange and red, with route numbers like 1, 15, 20, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100. The map also shows surrounding areas like Courtenay, Nanaimo, and Port Angeles.



HOW CAN EMERGENCY RESPONDERS USE THIS?

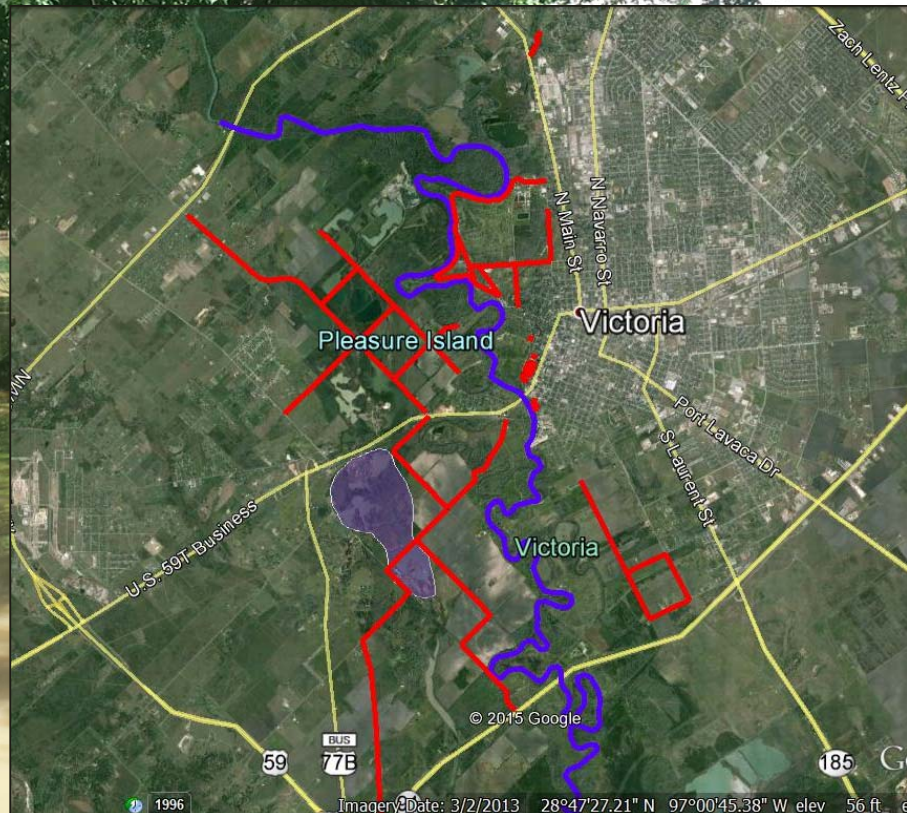
GOOGLE EARTH KMZ FILES

EOC Command Staff

- Scope of Incident
- Situational Awareness
- Response Strategies
- Neighborhood Canvassing
- Law Enforcement Strategies
- Critical Infrastructure Impacts

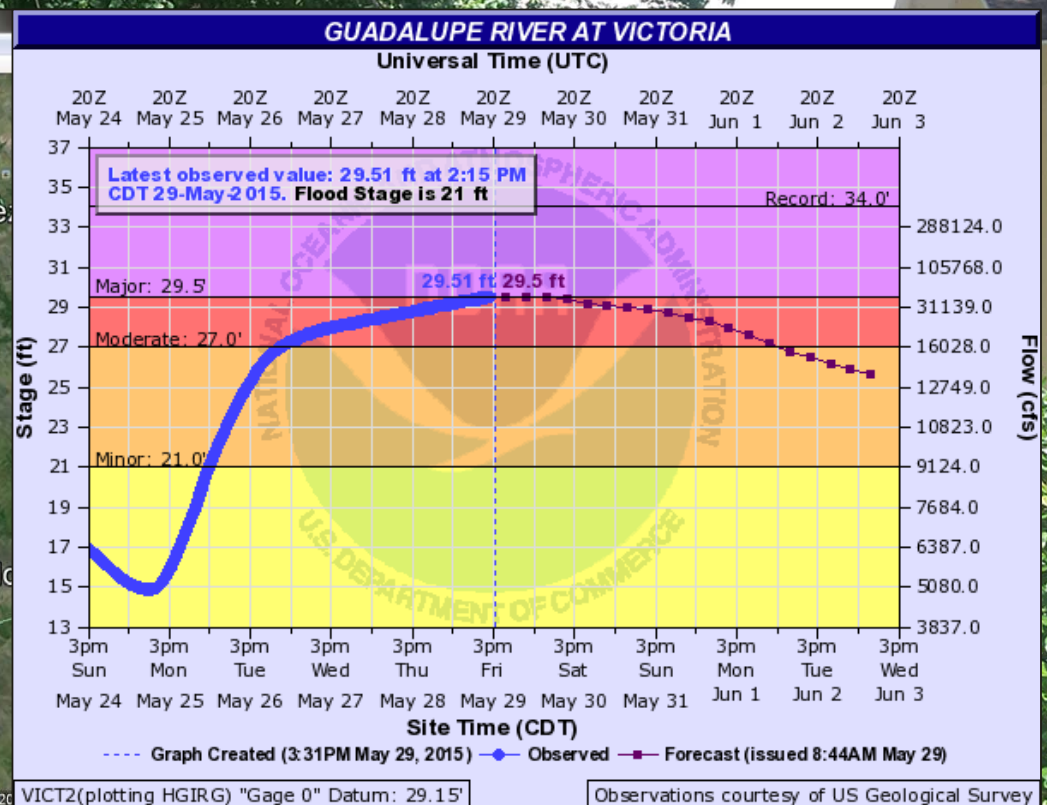
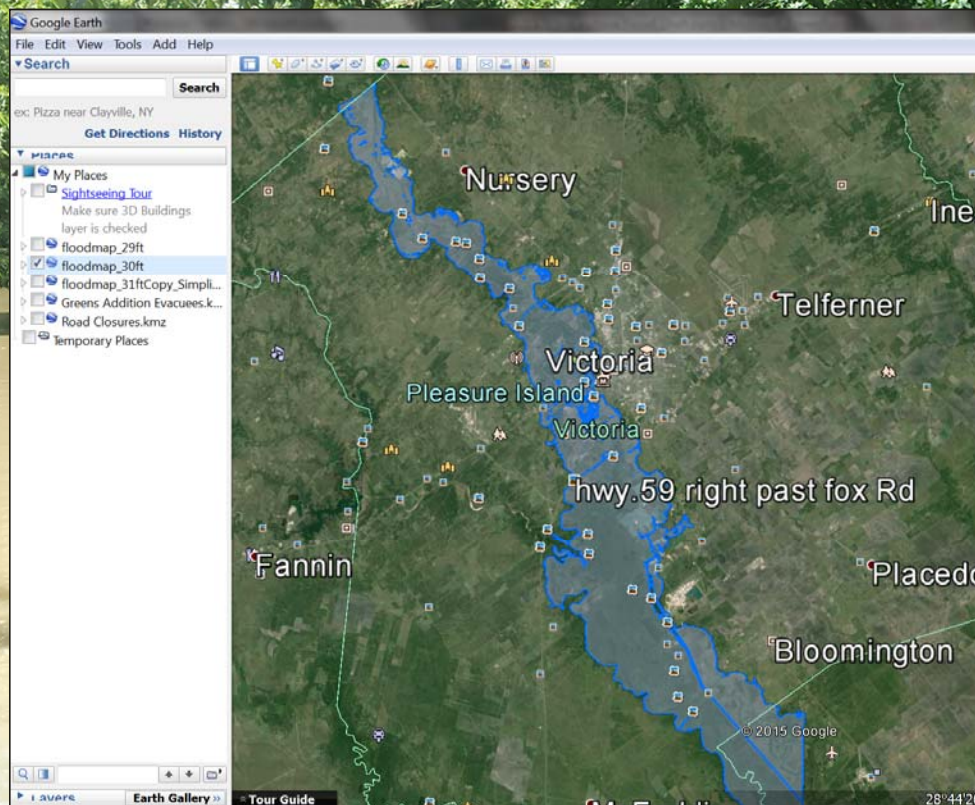
First Responders-TXDOT-Public Works

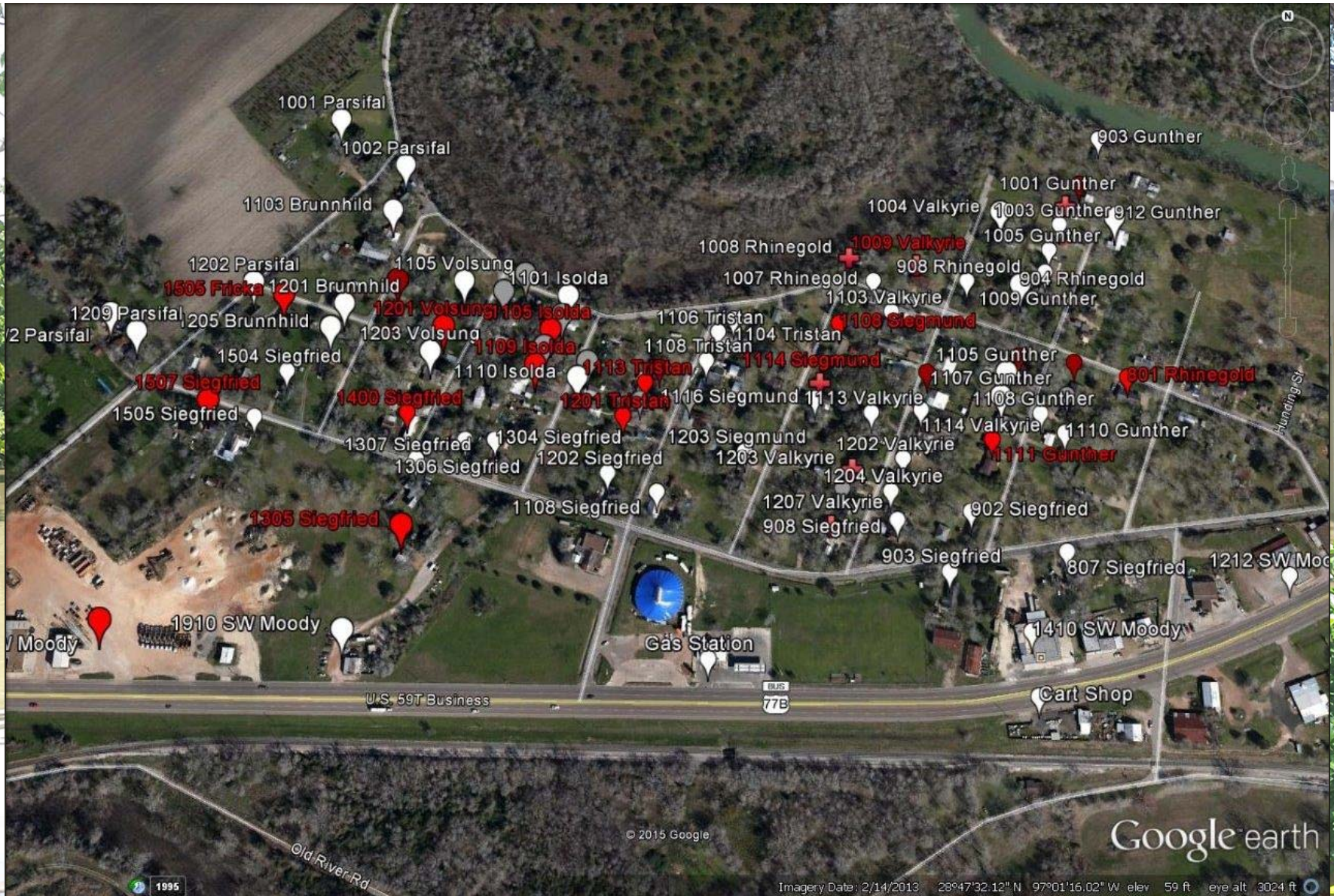
- Reverse 911 Warning Call
- Road Closures
- Public Works Response Strategies



HOW CAN EMERGENCY RESPONDERS USE THIS?

GOOGLE EARTH KMZ FILES







AFTER THE FLOOD EVENT

How did model results fare?
What are future considerations?
How will this be used moving forward?



HOW DID THE MODEL RESULTS FARE?

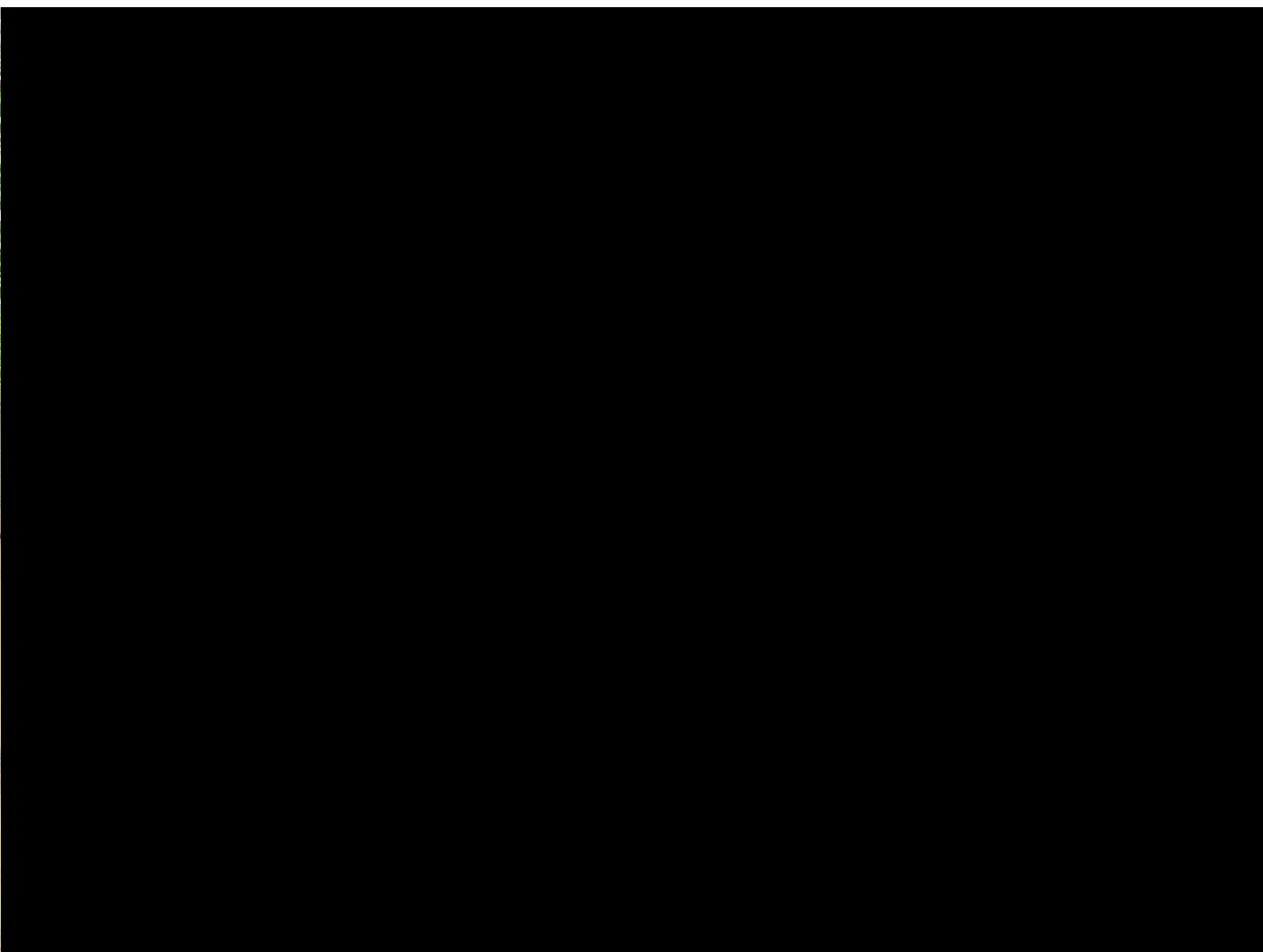
INUNDATION COMPARISON — DRONE VIDEOS

As part of the flood model assessment and Data Impact Sheet we tasked a Fire Fighter who owned an aerial drone with video capability.

We identified about five key areas to collect video during the river rise and as the river crested.

We are still evaluating this video.

The video is time stamped and we downloaded the USGS River Gauge data to use in our evaluations.



WHAT ARE FUTURE CONSIDERATIONS? UPDATED DATA AND MODELS

Higher DEM resolution

- 3m vs. 140cm topography (currently obtaining)

Additional gauges

- Consider proximity

Model calibration

- Observed high water marks, flows, and aerial imagery



The background of the slide is a photograph of a river with green trees on the banks. A semi-transparent teal banner is at the top, and a semi-transparent grey box is on the left side containing the text.

HOW WILL THIS BE USED MOVING FORWARD?

UPDATES AND COMMUNICATION

Hazard Mitigation Action Plan Update

- Request Detail LiDAR Topography
- Refine and Expand Model Runs
 - Multiple River Gauge Elevations
 - New Shape Files
 - Google Earth KMZ files

Victoria OEM Drone(s)

Update River Impact Sheet

Communicate and Share Data

- NWS Corpus Christi
- West Gulf River Forecast Center
- Guadalupe Blanco River Authority



QUESTIONS?

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