



**ASFPM 2018 Conference in Phoenix, AZ
Managing Floods Where the Mountains
Meet the Desert - June 19, 2018**



The FCDMC has Levees? A Flood Control District's Perspective on Levee Safety

Frank Brown, Flood Control District of Maricopa County



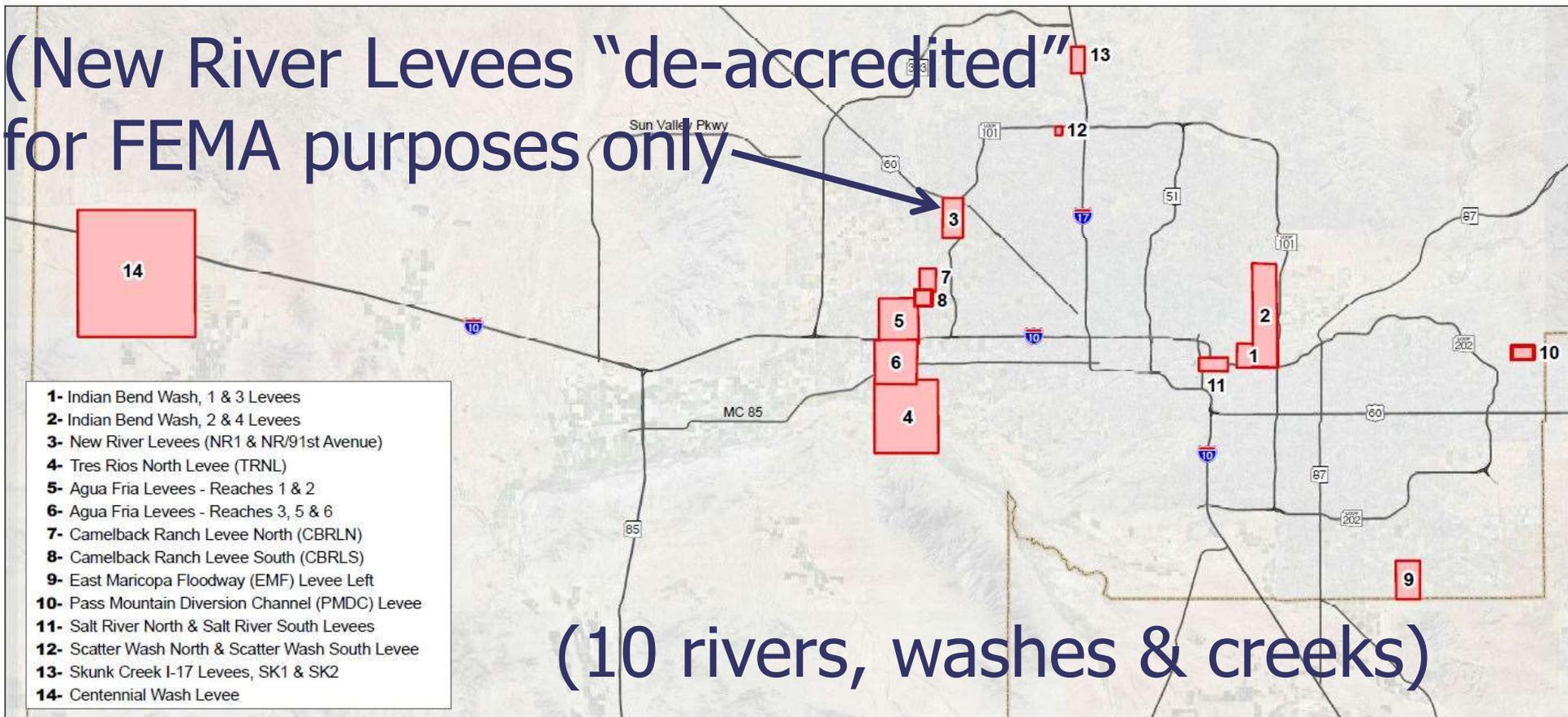
The view from the street



Benefited Area, (acres)	Number of Buildings	Population at Risk	Number of Critical Facilities	Full Cash Value
20,903	20,704	54,018	170	\$6,962,577,609



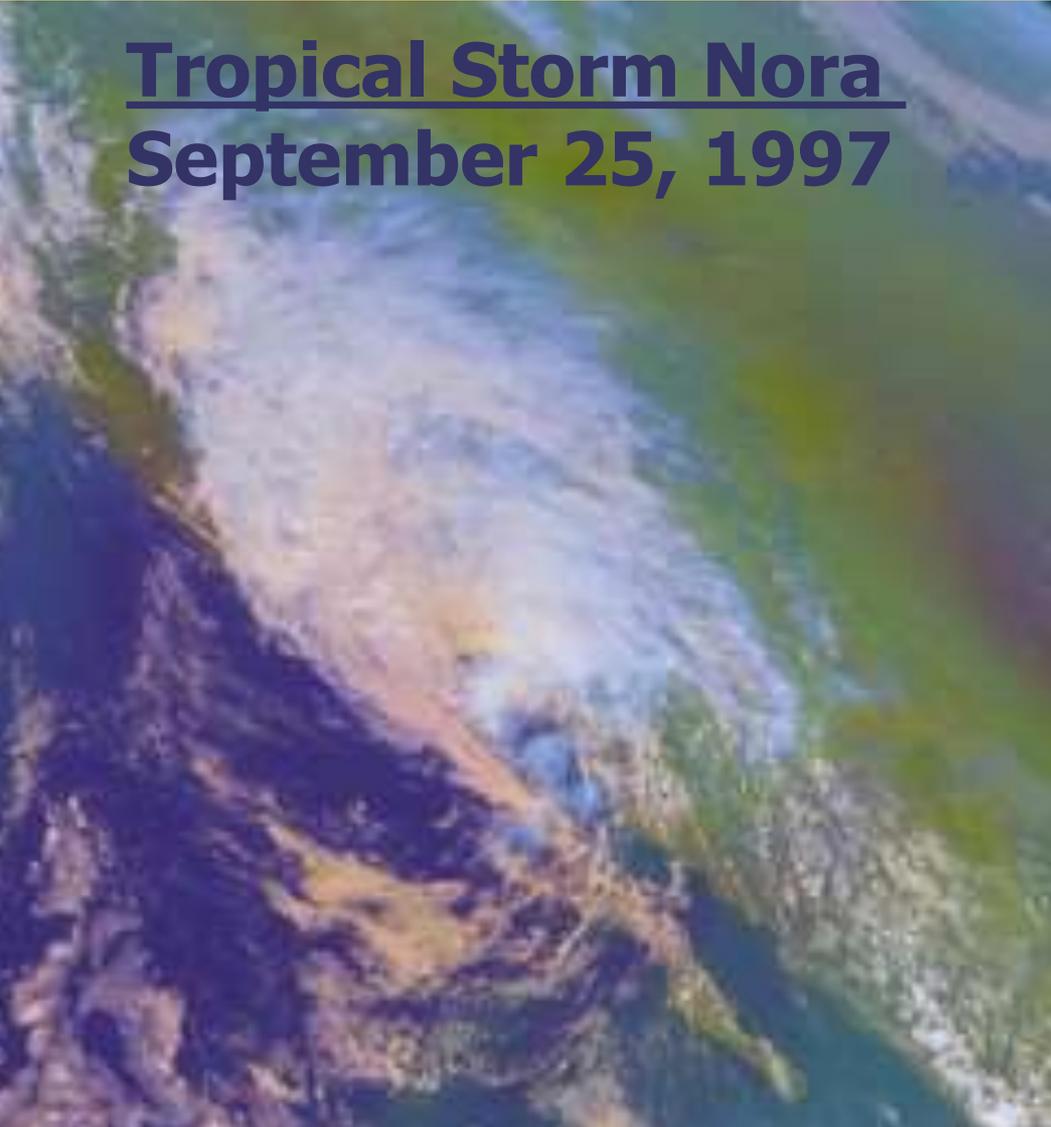
Location of District Owned Levees



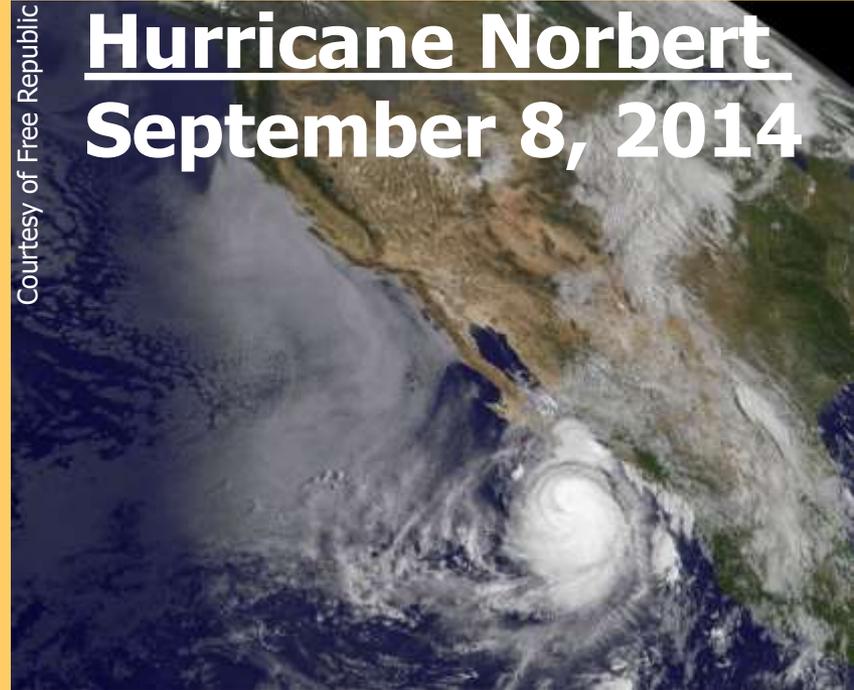
Why? Hurricane Remnants & Tropical Storms



Tropical Storm Nora
September 25, 1997



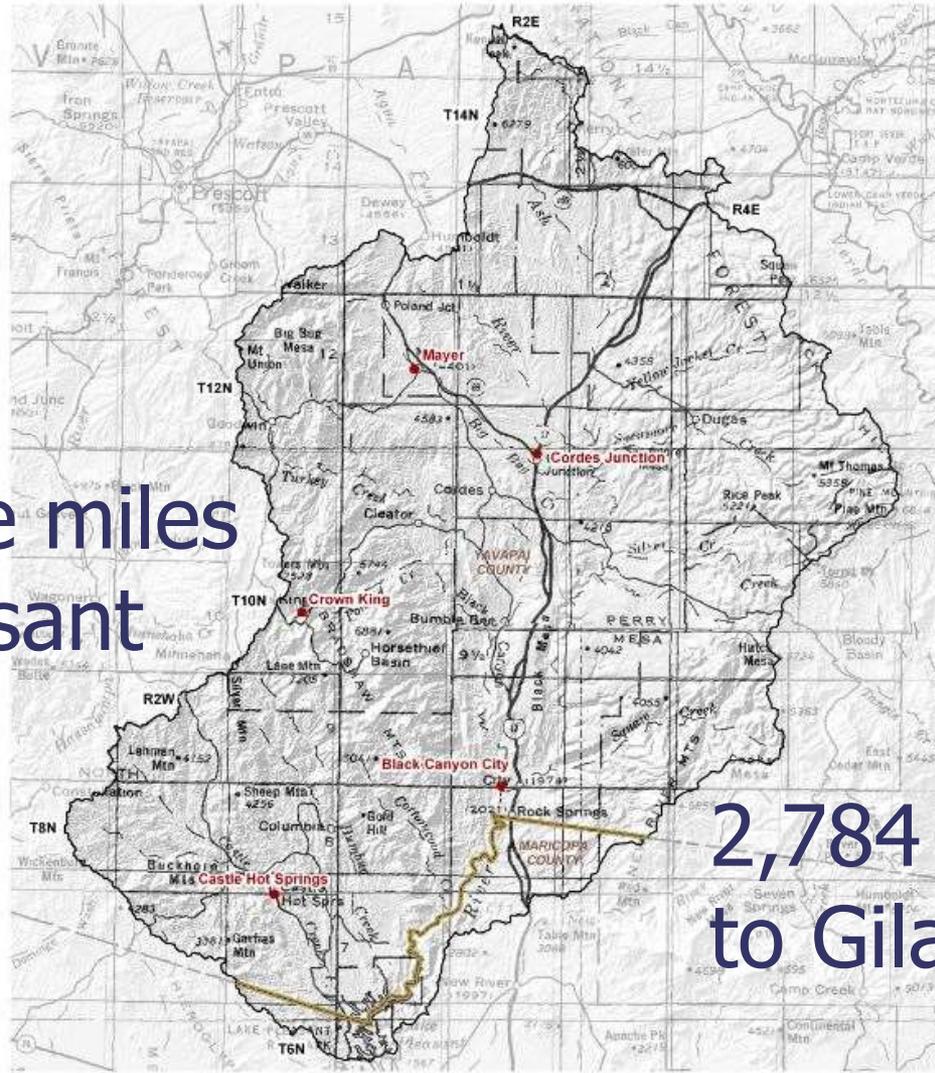
Hurricane Norbert
September 8, 2014



Courtesy of Free Republic



1,459 square miles
to Lake Pleasant



2,784 square miles
to Gila River



Base Map: USGS 1:500,000, 1981



Figure 5.1-1
Agua Fria Basin
Geographic Features

COUNTY 
City, Town or Place 



Why? Snow, Rain, Flooding

Crown King
Gage No. 5715
12/29/97

AGUA
FRIA
RIVER

GILA RIVER
(begins in NM)

SALT RIVER (shown)

Station 4758, Salt River @ 67th Ave., 03/18/2010

**13% of US population lives in delineated floodplain;
less than 5% for Maricopa County**



2017 FLOOD FACTS

COMMUNITY RATING SYSTEM ACTIVITY 330

Hurricane Sandy and other recent, high-profile flooding disasters in the United States have led to the development of more stringent, expanded enforcement of federal regulations.

Table 4 Flood Control District Levees

	Name	Built By	Year Completed
22	Scatter Wash North Levee #1901064146	ADOT	1991
23	Scatter Wash South Levee #1901064147	ADOT	1991



**Levee Certification Package
Scatter Wash Levees Near W. 39th Avenue and SR L101
North Levee ID # 1901064146 and South Levee ID # 1901064147
Maricopa County, Arizona**

July 21, 2014

Prepared for:



**Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009**

§ 65.10 Mapping of areas protected by levee systems.

lieu of these structural requirements, a **Federal** agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.

Certification Letter reviewed and accepted. Levee segment will be accredited on DFIRM.

(as found at R9map.org)

Water	Comments	Action Taken
Skun	Certification Letter for DFIRM	Certification Letter reviewed and accepted. Levee segment will be accredited on DFIRM.



**US Army Corps
of Engineers**
Los Angeles District
Geotechnical Branch
Dam and Levee Safety Section

**NATIONAL FLOOD INSURANCE PROGRAM, LEVEE SYSTEM
EVALUATION REPORT (NLSEER) FOR TRES RIOS NORTH LEVEE,
MARICOPA COUNTY, ARIZONA**



NATIONAL FLOOD INSURANCE PROGRAM, LEVEE SYSTEM EVALUATION REPORT (NLSEER) FOR TRES RIOS NORTH LEVEE, MARICOPA COUNTY, ARIZONA



Center: Tres Rios North Levee looking downstream.
Lower Left: Downstream end of interior drainage outlet flap gates.
Upper Right: Near upstream end on levee crest looking upstream.

by
US Army Corps of Engineers
Los Angeles District, Geotechnical Branch
915 Wilshire Boulevard, Los Angeles CA 90017
November 2012



USACE improved PI Reports

- Rehabilitation Program, PL 84-99, 33 CFR 203 (RP code) with Periodic Inspections (& repairs)

Then: 2010 Agua Fria Levees Inspection
= 64 pages for all 5 levees

Now: each levee PI Report
= 400 to 564 pages

Corps Issues New 408 Guidance for Modifications of Authorized Projects

By Scott L. Shapiro on September 23,
2014

Posted in Federal Regulations, Flood
Control, U.S. Army Corps of
Engineers

The U.S. Army Corps of Engineers (USACE) issued a new engineering **circular** (EC 1165-2-216) to provide policy and guidance for processing requests to alter USACE civil works projects pursuant to 33 U.S.C. section 408. This new **circular** collects existing guidance from several informal documents, codifies USACE practice from some USACE Districts that process many 408 ...

33 USC 408
(Rivers & Harbors
Appropriations Act of
1899)
Title 33 – Navigation
and Navigable Waters
Section 408 – Taking
possession of, use of,
or injury
to harbor or river
improvements.

Rivers and Harbors Act 1899

**Unlawful for any person or persons
to build upon, alter, deface work
built by the US
to prevent floods
unless Secretary of the Army
grants permission**

The Jam Above the Bridge at Grand Rapids

U.S. ARMY CORPS OF ENGINEERS – Los Angeles District

APPLICATION FOR SECTION 408 PERMIT

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, 33 USC 408; Taking Possession of, Use of, or Injury to Harbor or River Improvements, (Section 408); 33 CFR 208.10 – Local Flood Protection Works; Maintenance and Operation of Structures and Facilities. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit to modify and/or alter a US Army Corps of Engineers Civil Works Project. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. PERMIT APPLICATION NO.	2. REFERENCE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE
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(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. AGENCY RESPONSIBLE for O&M of Feature (Permit will be issued to ...) Agency/Company -- Flood Control District of Maricopa County	6. PERMIT APPLICANT / DESIGNEE Name -- William D. Wiley, P.E. Title -- Chief Engineer and General Manager
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13. PROJECT DESCRIPTION
 15" sewer line jacked and bored under _____ levee. This work was accepted by the FCDMC.

17. Project Purpose (Describe the reason or purpose of the project, i.e. what will it be used for and why?)
 To provide sewer for _____ residents.





Levee Vegetation - now

- 2016 Levee Vegetation (ETL 1110-2-583)
- 2017 re-consider vegetation policy, Variance requests on hold



Federal oversight - FEMA



2016 FEMA now

REQUIRES EAPs for levee certification

FEMA Policy #FP 204-078-1 (Rev 7)

SID #	Effective Date	Implementation Description	Category	Standard Type	Standard
444	11/30/2016	Effective for new applications submitted to FEMA for levee accreditation	Levee	Program Standard	Levee systems can only be accredited when compliance with 44 CFR Part 65.10 is demonstrated. Compliance includes demonstrating that an emergency preparedness plan has been adopted by the community that at a minimum, includes the area impacted by the levee system, and includes procedures for emergency operation and public evacuation, meeting the standards of 65.10(c)(3).

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***EAP Plus* Community Rating System (CRS)
Levee Safety Activity Credits**



New River 1 Levee

Quick Reference Emergency Action Plan



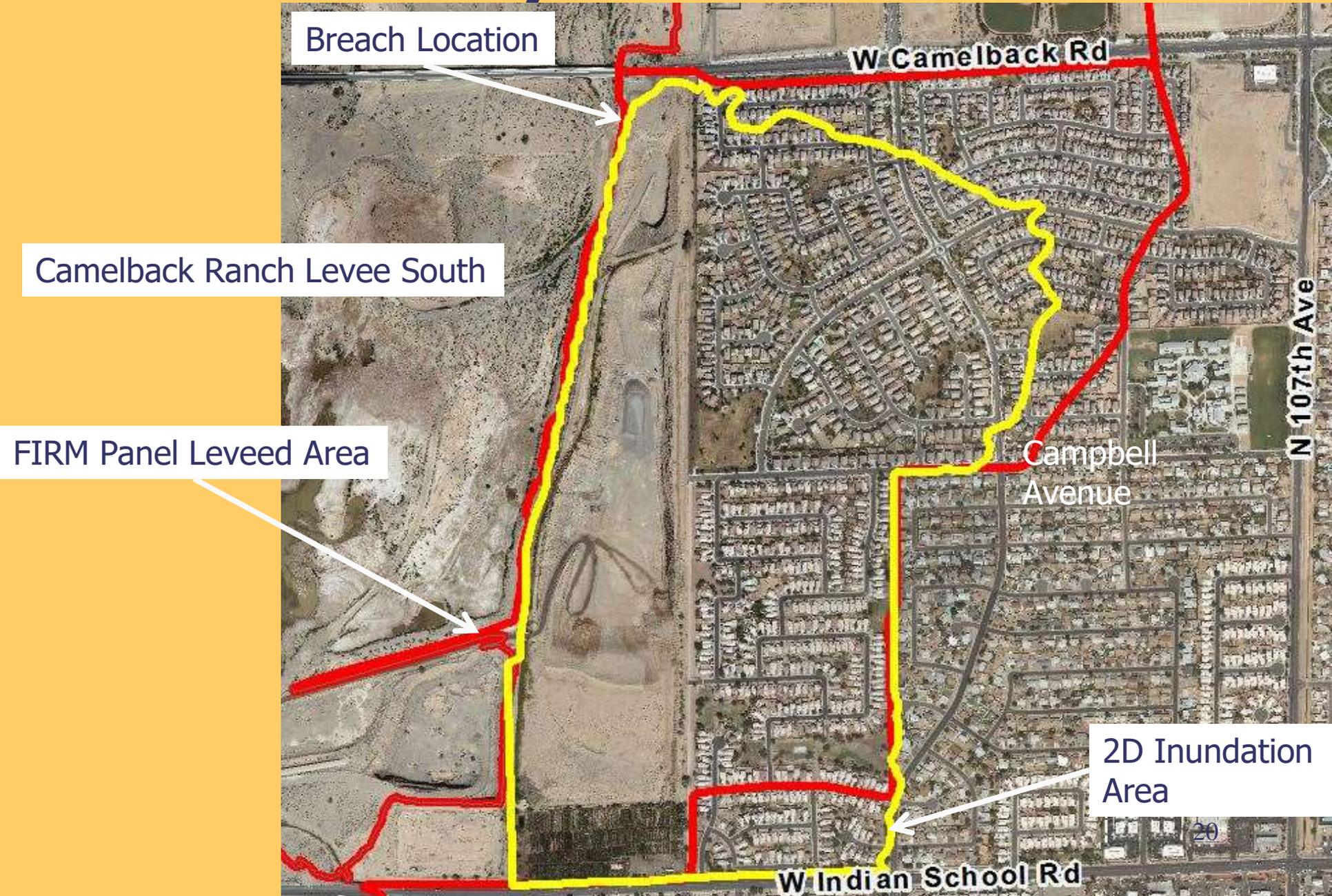
New River 1 Levee -- observation point at Olive AV Bridge & New River

Quick Levee Facts: |

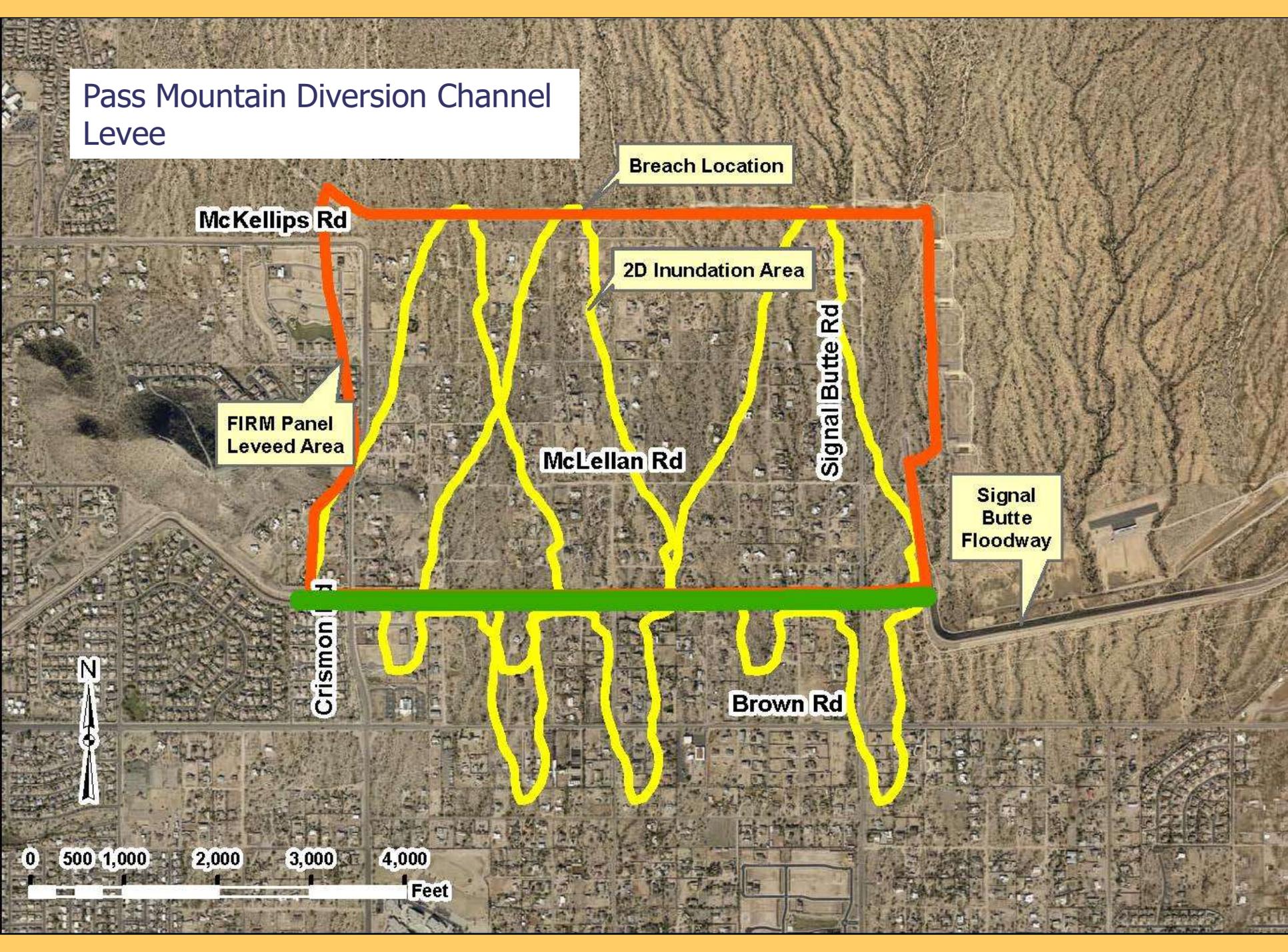
Purpose: To reduce hazards to life and property

Design Flood Event: SPF flood event

FIRM Overlay with 2D Inundation



Pass Mountain Diversion Channel Levee



Breach Location

McKellips Rd

2D Inundation Area

FIRM Panel Leveed Area

McLellan Rd

Signal Butte Rd

Signal Butte Floodway

Crismon Rd

Brown Rd



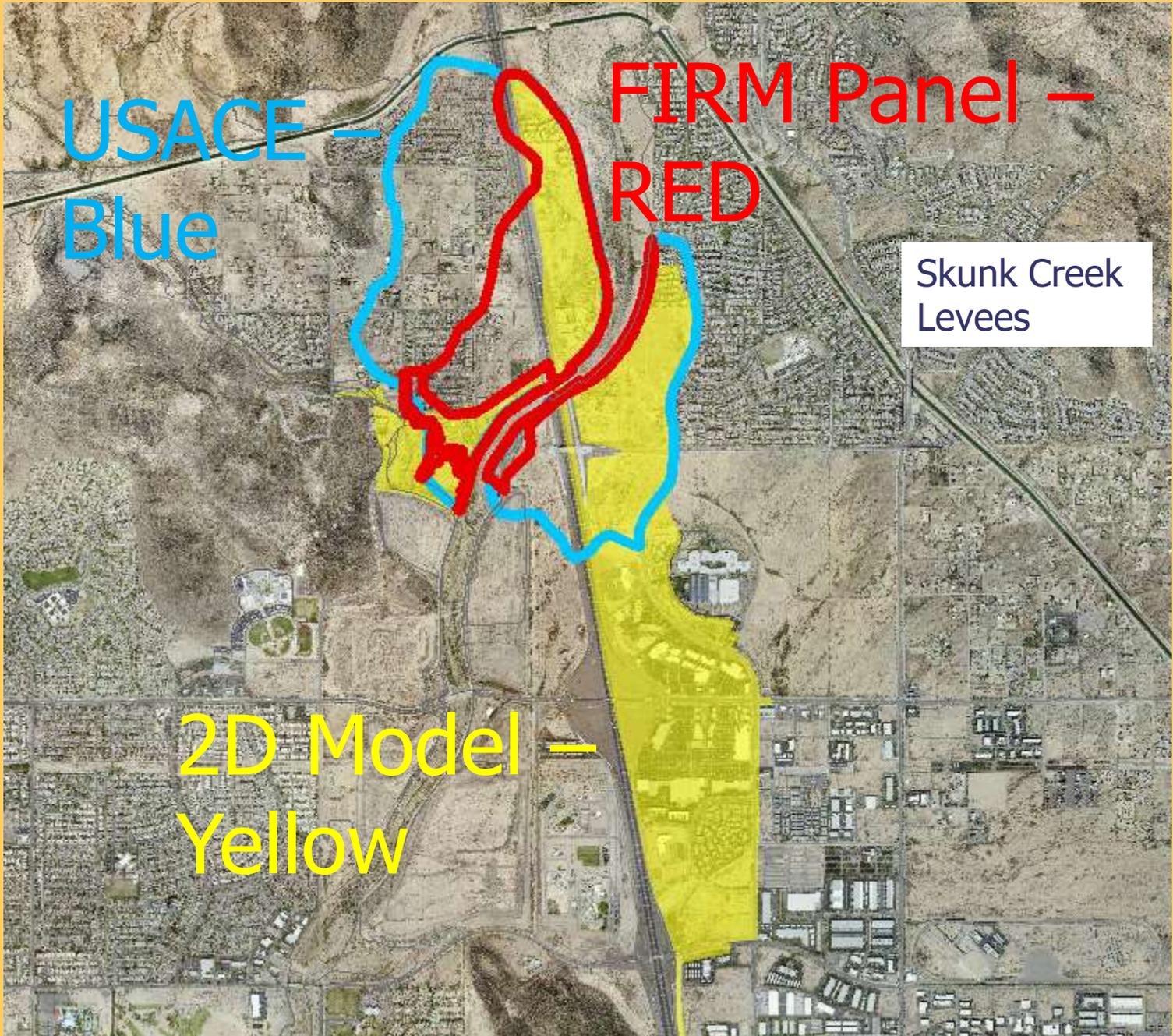


USACE –
Blue

FIRM Panel –
RED

Skunk Creek
Levees

2D Model –
Yellow





NLD profile & overtopping

Browser address bar: <https://levees.sec.usace.army.mil/#/levees/system/3805030001/profile>

Navigation: HOME SEARCH DASHBOARD MAP MORE SIGN IN

Agua Fria River 6

Location: Avondale, Maricopa County, Arizona | USACE Districts: Los Angeles | FEMA Regions: 9

Menu: SEGMENTS RISK FEMA - NFIP/FIRM FEATURES PROFILE INSPECTIONS ATTACHMENTS

Levee Elevation Profile

EXPORT AS CSV

Distance along levee (ft)	Levee Elevation (ft)	Surface Elevation (ft)
0	961.0	957.0
50	959.0	958.0
100	958.5	958.0
150	958.0	958.0
200	958.0	958.0
250	958.0	958.0
300	958.0	958.0
320	958.0	958.0
350	958.0	958.0
400	958.0	958.0
450	958.0	958.0
500	958.5	958.0

Map controls: Categorize by, Basemap: Basic, LEGEND

Coordinates: 33.423844, -112.333330

Address: 12S UB 76040 99070

The Fight before the Flood Fight

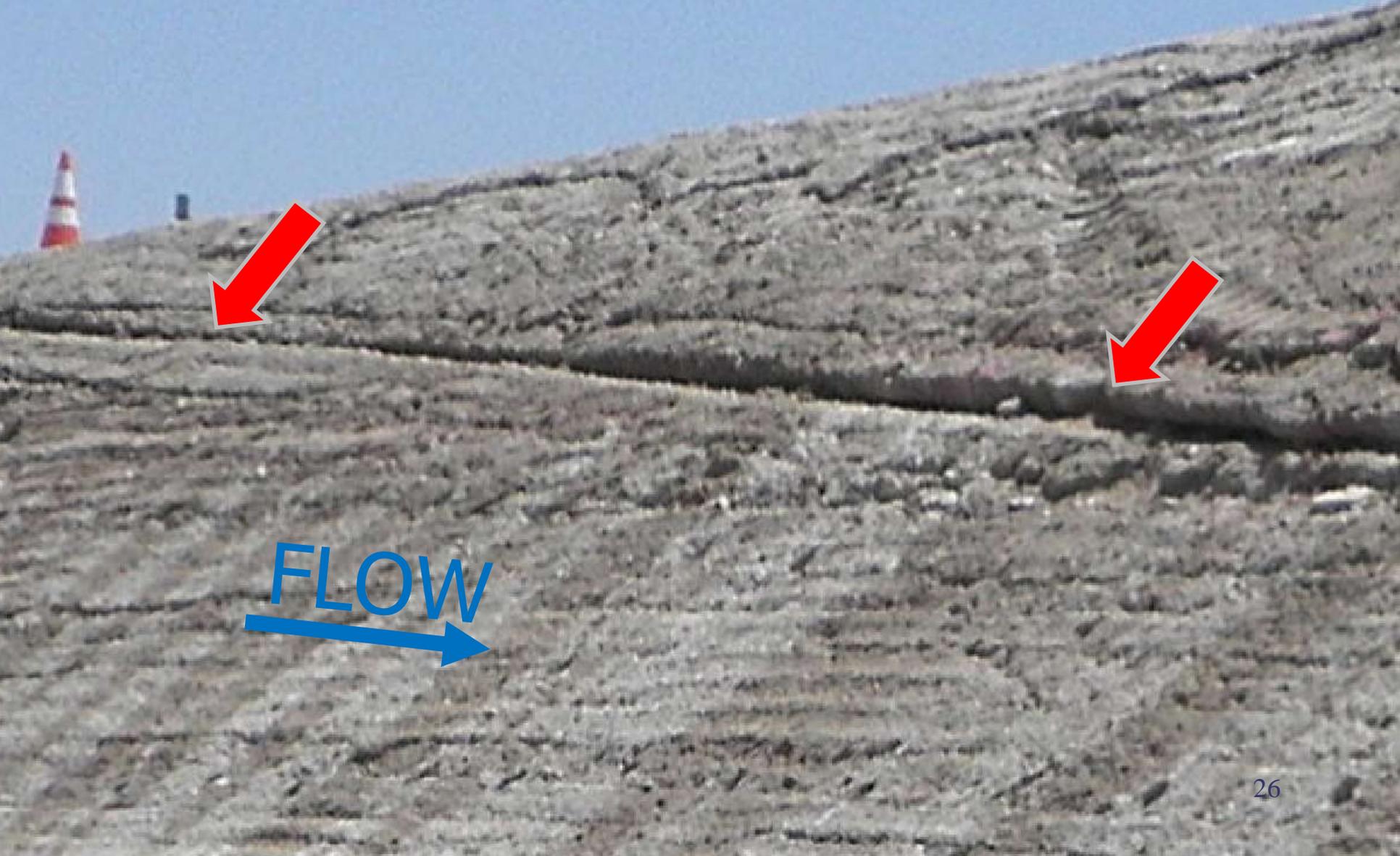


Flood Fighting



07/19/2015 18:14

Weak CSA Lift



Class A Shotcrete Levee Repair



2-60 inch RCP abandoned in place



(153 cubic yards later)

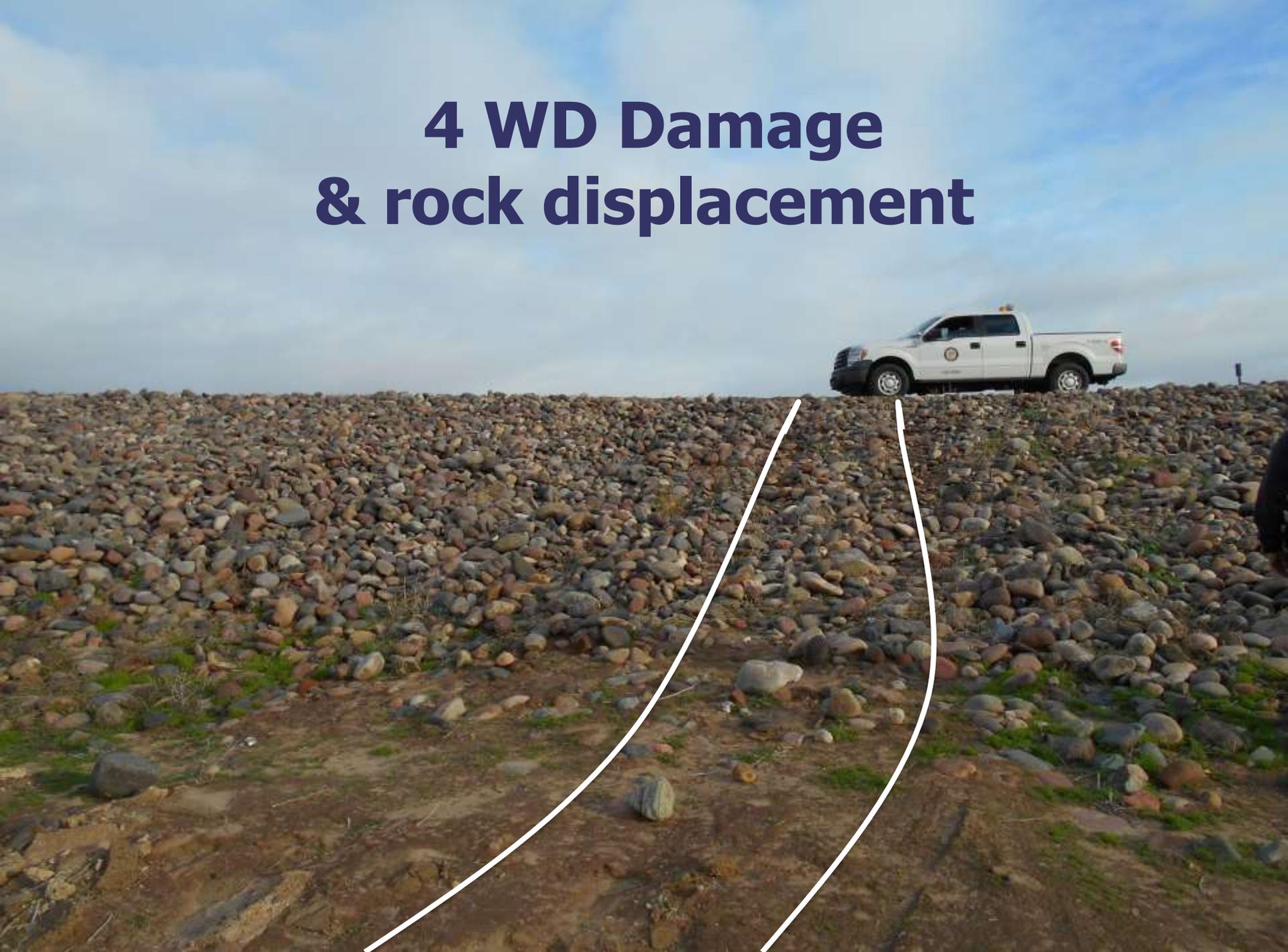
Levee Topping Issue

20 feet or more!



02.26.2013 10:20

4 WD Damage & rock displacement





Increased Inspection Frequency

- Flapgates operated every quarter
- Pipes inspected by camera every 5 years (new policy '14)
- Engineering inspection every 3 years
- Regular O&M inspections



Station 377+00 (North) Open

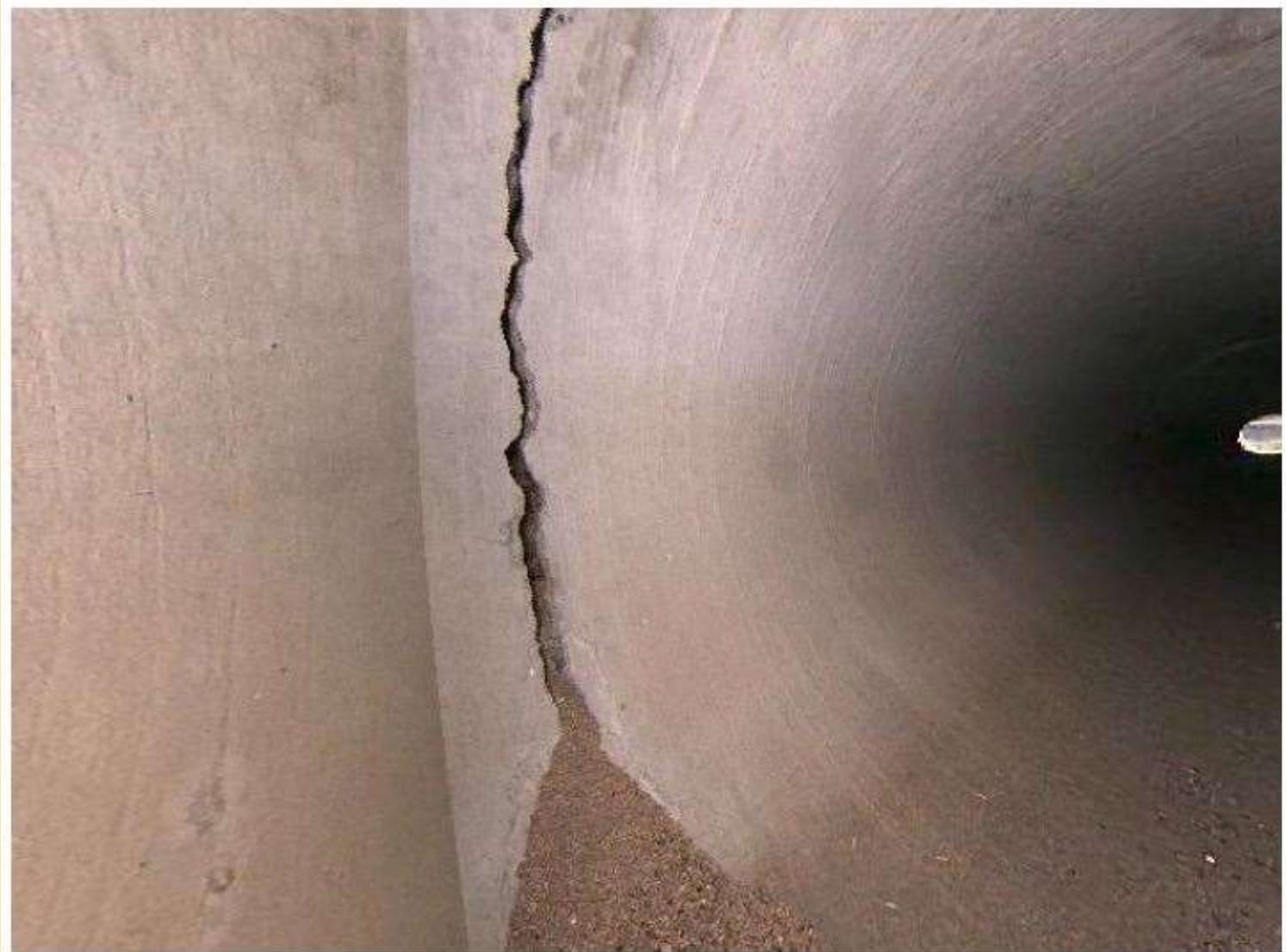
Levee Safety & Pipe Inspections



Levee Safety & Pipe Inspections



Levee Safety & Pipe Inspections



Maintenance, Maintenance, Maintenance





What could be next at Federal Level?

- WRRDA 2014 National Levee Safety Program authorized at State level & not funded, possibly could be / should be funded
- Flood Insurance required for leveed areas, possibly
- More rules, more regulations, more policies
- Re-certifications renewals?
- Vegetation Policy update
- Increased outreach to increase public awareness



Levee System Summary Brookside Levee Fort Worth, Texas

U.S. ARMY CORPS OF ENGINEERS

13 November 2016

BUILDING STRONG

USACE Flood Risk Management: The United States Army Corps of Engineers (USACE) periodically inspects and analyzes risk for Flood Risk Management systems that include levees, river channels, and drainage structures in order to evaluate operations and maintenance, assess system integrity, determine flood risk, and to increase public awareness. Flood Risk Management systems, specifically levees, reduce flood risk, but never completely eliminates it. Therefore, risk assessments on levees systems throughout the nation have been conducted by USACE to determine the likelihood of flooding, system failure, and consequences (life safety and economic). The factors that are used to determine risk are: flood frequency, levee condition and historical performance, and consequences. Completion of a risk assessment results in a levee earning a levee safety risk classification. There are five USACE levee safety program risk classifications (or Levee Safety Action Classifications) that express urgency or action to reduce risk: Very High, High, Moderate, Low, or Normal. These classifications are used to communicate risk to levee sponsors and the general public.



Project Description: The Fort Worth Floodway project effectively reduces flood risk for various commercial and residential areas in Fort Worth. The project was designed and built in 1950s and 1960s by USACE and is currently operated by Tarrant Regional Water District. It is comprised of 10 levees, widened river channels, and drainage structures that prevent flooding. Brookside levee is one of ten floodway levees that are located in Fort Worth. Brookside Levee is located on the West Fork of the Trinity River. The levee is approximately 1.9 miles long, 15 feet high, and 10-foot wide at its top. This levee was constructed with densely compacted clay soils. This levee contains 2 gated culverts that are used for transporting storm water from the leveed area into the Trinity River.

Risk Characterization: Brookside Levee has never been loaded with flood waters, and therefore remains untested. However, there are no documented cases of system instability that would highlight areas of possible poor performance. The maximum predicted flood could impact approximately 1,823 people, 738 structures, and an estimated 97 million dollars of possible flood related damages. Brookside Levee's threatened population for a breach prior to overtopping, defined as a levee break that occurs before water reaches the top of the levee, is 234 during the day and 422 during the night. The threatened population during a flood event that exceeds the height of the levee, known as overtopping, is 28 during the day and 51 during the night. The estimated loss of life prior to overtopping and overtopping is projected to be very low. The estimated frequency of an overtopping is very rare, about 500 year flood event (0.20% chance of occurring in any given year). The comprehensive risk assessment was conducted for Brookside Levee and resulted in an overall "Low Urgency of Action". This classification can also be defined as low risk with respect to flood frequency, levee failure, and consequences. During a significant flood event, the Brookside Levee is expected to perform as designed. There is an Emergency Action Plan in place to notify residents that may be impacted of potential flooding with evacuation notification and egress routes identified.

In summary, Fort Worth Floodway Levees are well maintained and provide a high degree of flood risk reduction. Despite these findings, it is very important that the community that resides or works within leveed areas always remain vigilant of potential flood risks and exercise emergency preparedness to ensure safety.

U.S. ARMY CORPS OF ENGINEERS – FORT WORTH DISTRICT
819 TAYLOR ST, FORT WORTH, TEXAS 76102
[HTTP://WWW.SWF.USACE.ARMY.MIL](http://www.swf.usace.army.mil)

What is driving the risk?

The Brookside levee is well maintained in accordance with USACE criteria, however there are risks associated with all flood management systems including levees. The risks associated with this levee were determined to be low.

What is being done about it?

The sponsor has an emergency action plan that includes response levels, communication plan, flood fighting activities, and training with available supplies. With respect to flood frequency, egress routes, and the flood warning capabilities it is likely that the population will be greatly reduced before and during a flood event. The City of Fort Worth has an active warning system utilizing door-to-door, media, GIS, and reverse 911.

Latest Inspection Information:	Brookside levee is inspected annually with comprehensive Periodic Inspections every 3 years with support from the Sponsor. Inspections are intended to verify and evaluate system operation and levee Sponsor maintenance activities. Detailed Periodic Inspection findings are provided in the Executive Summary that is located at the USACE National Levee Database website (http://nld.usace.army.mil) -> Select the "Advanced Reporting" link, then go to the "NLD Media" link.
Rehabilitation Program Eligibility Status:	The Brookside Levee is currently active in the USACE Rehabilitation Program and eligible for post-flood rehabilitation assistance under Public Law 84-99.
National Flood Insurance Program (NFIP) Status:	The Brookside Levee is Accredited on FEMA Flood Insurance Rate maps: This information is current as of May 14 th , 2016. Access NFIP flood hazard mapping products, including Flood Insurance Rate Maps, at the FEMA Flood Map Service Center website: https://msc.fema.gov/ .

Who Can I Contact?

Local Emergency Management Agency	In the event of a flood and/or the prospect of flooding, you may contact the following organizations: Fort Worth Emergency Management Office: (817) 392-6170 After Hours: (817) 392-8866 http://fortworthtexas.gov/emo/ Tarrant County Emergency Management Office: (817) 884-2850 After Hours: (817) 884-1473 http://access.tarrantcounty.com/
Levee Sponsors	Tarrant Regional Water District (TRWD) – (817) 335-2491
Community/County	City of Fort Worth/Tarrant County
FEMA National Flood Insurance Program	For general questions about the NFIP, contact the FEMA Map Information and Xchange (FMIX): 1-877-336-2627 (toll free), or email at: FEMAMapSpecialist@riskmapcds.com For questions about FEMA flood hazard mapping for this levee system, contact: FEMA Region 6 POC: Jerry Clark POC: Alan Johnson FRC 800 North Loop 288 Office: 940-898-5270 Office: 940-383-7338 Denton, TX 76209-3698 Main Number: 940-898-5399
National Levee Database	http://nld.usace.army.mil

FLOOD RISK ASSOCIATED WITH LEVEES CAN CHANGE
Know your risk, know your role, and take action!

U.S. ARMY CORPS OF ENGINEERS – FORT WORTH DISTRICT
819 TAYLOR ST, FORT WORTH, TEXAS 76102
[HTTP://WWW.SWF.USACE.ARMY.MIL](http://www.swf.usace.army.mil)

Levee System Summary



What could be next at local / FCDMC Level?

- FCDMC Levee Safety Program Proposed
- Individual Structure Assessment (limited scope)
- FMEA as needed
- Levee Settlement & Face Erosion Markers re-survey
- High quality, measurable drone imagery - assist flood fights
- Risk Management & Risk Reduction

Sharpened levee safety focus regardless of federal regs.

New River Levee Trail



Tempe Rio Salado Multiuse Path, FCD Levee west of Town Lake



Frank Brown, P.E., CFM, Civil Engineer
Civil Structures Branch, FCDMC Engineering Division
602-506-4617 or FrankBrown@mail.maricopa.gov

PMDC Levee Trail

PMDC Levee & Public Education

Please do not shortcut!

**Shortcutting on the engineered levee makes
ruts which may weaken the levee in a flood.**

