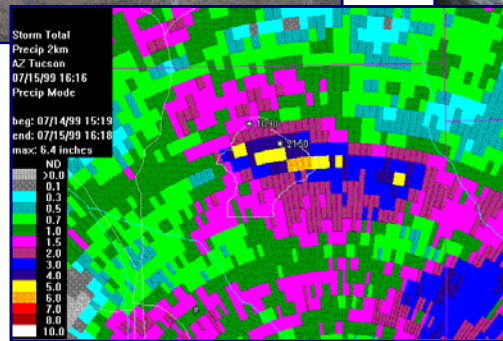
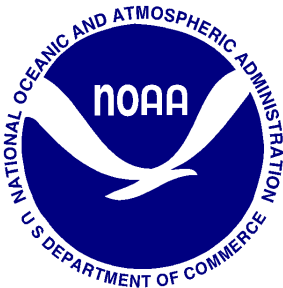


National Weather Service Tucson Weather Forecast Office



Sabino Canyon Flood, 1999

Flood Awareness and Information Guide



*NOAA's National Weather Service
Tucson Weather Forecast Office
Flood Awareness and Information Guide*

June 2004

Last updated March 13, 2007

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Foreword

This guide has been produced in an effort to increase customer, partner, and media awareness and improve education in hydrology. It lists the various types of hydrology products issued by NOAA's National Weather Service (NWS) Tucson Weather Forecast Office (WFO), provides meanings of terms and expressions contained within these products, and presents some basic hydrology and hydrometeorology concepts. It is available to flood control districts, city and county engineers, federal, state, and local partners, media, and Emergency Managers in the state of Arizona to improve communication with the NWS in an effort to better serve the public.

This guide can also be found online, as a pdf file, under the hydrology section of the Tucson WFO web page:

<http://www.wrh.noaa.gov/twc/hydro/FAguide.pdf>

The pdf version of the guide shall be updated routinely.

This guide is divided into three sections:

- Section A General Information
- Section B Hydrological Service
- Section C Future Hydrological Services

Section A

General Information

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Watch vs. Warning vs. Advisory

Following are the National Weather Service definitions for watch, warning, and advisory. These terms form the basis for each product issued to the public.

Watch Issued when the risk of a hazardous weather or hydrologic event is moderate to high, but its occurrence, location, and/or timing is still uncertain. It is intended to provide enough lead time so appropriate actions can be set in motion. Watches evolve into warnings or advisories, or they are canceled.

Warning Issued when a hazardous weather or hydrologic event is occurring, is imminent, or has a very high probability of occurrence. A warning is used for conditions posing a threat to life or property. The NWS is the single "official" voice when issuing warnings for life-threatening situations.

Advisory Issued when a hazardous weather or hydrologic event is occurring, is imminent, or has a very high probability of occurrence. An advisory is used for less serious conditions that cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life and/or property.

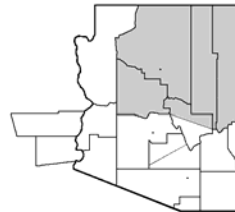
NWS Office Configuration

All National Weather Service Forecast Offices are responsible for issuing public weather forecasts, fire weather forecasts, aviation forecasts, and hydrological forecasts for their area of responsibility. They also issue watches, advisories, warnings, and special statements and supply climate information. Following is a summary of offices which have responsibility within the state of Arizona and their county warning areas. (Note: All offices are open 24 hours per day.)

Flagstaff

Mailing Address:
NOAA's National Weather Service
P.O. Box 16057
Bellemont, Arizona 86015-6057

Telephone: (928) 556-9161
Fax: (928) 774-3914



Home Page: <http://www.wrh.noaa.gov/fgz>

Meteorologist in Charge:	Brian Klimowski.....x222
Warning Coordination Meteorologist:	George Howard.....x223
Science Operations Officer:	Michael Staudenmaierx224

Warning responsibility for the following *Arizona* counties:

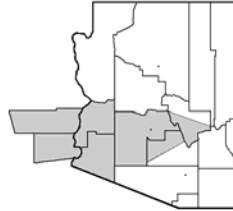
Apache Coconino Gila (Northern portion) Navajo Yavapai

Phoenix

Mailing Address:

NOAA's National Weather Service
PAB 500 P.O. Box 52025
Phoenix, Arizona 85072-2025

Telephone: (602) 275-0073
FAX: (602) 267-8051



Street Address:

National Weather Service
1521 North Project drive
Tempe, Arizona

Home Page: <http://www.wrh.noaa.gov/psr>

Meteorologist in Charge:	Tony Haffer.....x222
Warning Coordination Meteorologist:	David Runyanx223
Science Operations Officer:	Doug Green.....x224
Hydrologist:	Michael McLanex228

Warning responsibility for the following counties:

Arizona

Gila (Southern portion) La Paz Maricopa
Pinal (Northwest portion) Yuma

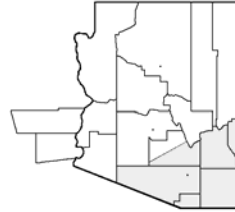
California

Imperial Riverside

Tucson

Mailing Address:

NOAA's National Weather Service
520 N. Park Ave.
Suite 304
Tucson, Arizona 85719



Telephone (520)670-6526
FAX (520)670-5167

Home Page: <http://www.wrh.noaa.gov/twc>

Meteorologist in Charge:	Glen Sampson	x222
Warning Coordination Meteorologist:	Tom Evans	x223
Science Operations Officer:	Erik Pytlak	x224
Acting Hydrologist:	Glenn Lader	x229

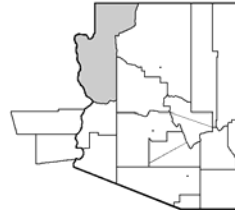
Warning responsibility for the following *Arizona* counties:

Cochise	Graham	Greenlee
Pima	Pinal (Southeast portion)	Santa Cruz
Gila (flood warnings for Winkelman and Hayden along the Gila River)		

Las Vegas, Nevada

Mailing Address:

NOAA's National Weather Service
7851 Dean Martin Drive
Las Vegas, Nevada 89139



Telephone: (702) 263-9744
Fax: (702) 263-9759

WWW Home Page: <http://www.wrh.noaa.gov/vef>

Meteorologist in Charge:	Kim Runk	x222
Warning Coordination Meteorologist:	Andy Bailey	x223
Science Operations Officer:	Stanley Czyzyk	x224

Warning responsibility for the following *Arizona* county:

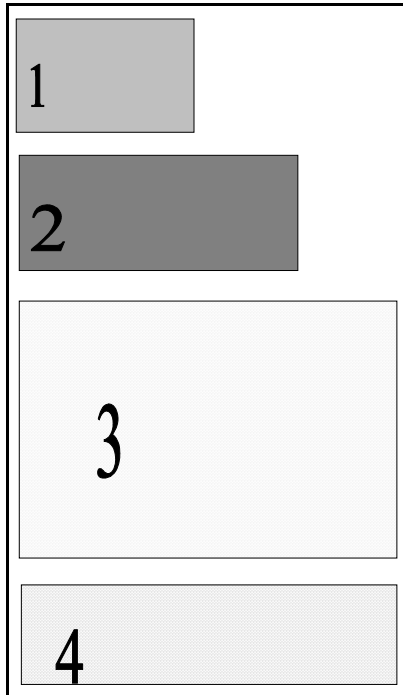
Mohave

Product and Information Dissemination

The following gives a brief description of the basic product format and means for dissemination of products and climate data from the National Weather Service.

Basic Product Format

All National Weather Service products follow a basic format.



1. WMO/UGC Header Takes the following form:

```
TTAA00 KWFO ddhhmm           WMO
Zone (or county) ID-ddhhmm-   UGC
```

It is the block of text that identifies the originating weather office (KWFO), day and time the product is issued (first ddhhmm), forecast zone or county code to which product is directed (zone (or county) ID), and day and time the product is no longer valid (second ddhhmm). It is coded to enable computers to route the information to the proper channels. All times mentioned in the Mass Media Header are in Coordinated Universal Time (UTC).

2. Mass News Disseminator Heading. Gives the name of the product, the originating office and the date and time the product is issued in plain language.

3. Body. The main section of the product. It provides the user with the what, where, and when concerning weather or weather related events.

4. Call-to-Action Statement. A one or two sentence statement at the end of a warning, watch, or advisory that counsels the public on action necessary to protect life and/or property in response to a weather hazard.

NOAA Weather Radio

NOAA Weather Radio (NWR) is a service of the National Weather Service, National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Commerce (DOC). As the "Voice of the National Weather Service," it provides continuous broadcasts of the latest weather information directly from NWS offices. Recorded weather messages are repeated generally every four to six minutes and are routinely revised every one to three hours, or more frequently if needed. All weather radio service to Arizona operates 24 hours daily and is tailored to the weather information needs of the people within the receiving area.

During severe weather or other civil emergencies, NWS personnel can preempt the routine weather broadcasts and substitute special warning and information messages. They can also activate specially designed warning receivers. Such receivers either sound an alarm, to indicate that an emergency exists and alert the listener to turn the receiver up to an audible volume or, when operated in a muted mode, are automatically turned on so that the warning message is heard.

Commercial radio and TV stations are authorized to rebroadcast any material, especially weather watches and warnings, transmitted over the weather radio, subject only to minimal restrictions stated in FCC Public Notice 70-1108-52876.

Following is a table of weather radio frequencies and call signs in use across Arizona and the location of the programming office. The broadcasts can usually be heard as far as 40 miles from the antenna site, sometimes more. The effective range depends on many factors, particularly the height of the broadcast antenna, terrain, quality of the receiver, weather conditions, and type of receiving antenna.

	<u>Station</u>	<u>Call Sign</u>	<u>Programming Office</u>	<u>Frequency</u>
1.	Bullhead City	KQC45	Las Vegas, NV	162.500Mhz
2.	Farmington	WXJ37	Albuquerque, NM	162.475Mhz
3.	Flagstaff	WXK76	Flagstaff, AZ	162.400Mhz
4.	Payson	WWG41	Flagstaff, AZ	162.425Mhz
5.	Globe	WWG42	Phoenix, AZ	162.500Mhz
6.	Grand Canyon	WWF52	Flagstaff, AZ	162.475Mhz
7.	Greer	KXI23	Flagstaff, AZ	162.525Mhz
8.	Safford	KXI24	Tucson, AZ	162.550Mhz
9.	Kingman	KXI83	Las Vegas, NV	162.425Mhz
10.	Lake Havasu City	KXI84	Las Vegas, NV	162.400Mhz
11.	Lake Powell	WXM89	Salt Lake City, UT	162.550Mhz
12.	Las Vegas	WXL36	Las Vegas, NV	162.550Mhz
13.	Nogales	WNG703	Tucson, AZ	162.500Mhz
14.	Mt. Potosi	WNG634	Las Vegas, NV	162.400Mhz
15.	Phoenix	KEC94	Phoenix, AZ	162.550Mhz
16.	Prescott	WWF98	Flagstaff, AZ	162.525Mhz
17.	St. George	WWF51	Salt Lake City, UT	162.475Mhz
18.	Show Low	WNG548	Flagstaff, AZ	162.400Mhz
19.	Tucson	WXL30	Tucson, AZ	162.400Mhz
20.	Window Rock	WWF99	Flagstaff, AZ	162.550Mhz
21.	Yuma	WXL87	Phoenix, AZ	162.550Mhz

National Warning System (NAWAS)

Funded by the Federal Emergency Management Administration (FEMA), the National Warning System (NAWAS) is a comprehensive party-line network of telephone circuits connecting more than 1,500 state and federal warning points throughout the United States. Although NAWAS is a national system, the day-to-day operation is under the

control of individual states. Each state has its own plan for NAWAS during weather emergencies.

NAWAS is used to warn the public, through local governments, about the potential for loss of life and/or property. Such threatening situations are not limited to meteorological or hydrological events. The warning messages can include, but are not limited to, dam breaks, earthquakes, volcanoes, major fires, terrorist activities, landslides, and hazardous materials releases.

When a warning is issued, the NWS calls the Arizona Warning Point to verify that our warnings and watches have reached the affected counties and other officials. Should the event be very serious, a roll call will be requested for all the counties involved which ensures dissemination of the product.

Storm Ready Program

StormReady is a nationwide program that helps communities better protect their citizens during severe weather—from tornadoes to tsunamis. The program encourages communities to take a proactive approach to improving local hazardous weather operations. StormReady provides emergency managers with clear-cut guidelines on how to improve their hazardous weather operations. Nearly 90% of all presidentially declared disasters are weather related, leading to around 500 deaths per year and nearly \$14 billion in damage. To help Americans guard against the ravages of severe weather, the National Weather Service (NWS) has designed the StormReady program. StormReady arms America's communities with the communication and safety skills they need to save lives and property. Many laws and regulations exist to help local emergency managers deal with hazardous material spills, search and rescue operations, medical crises, etc., but there are few guidelines dealing with the specifics of hazardous weather response. NWS recognized this need and designed StormReady—a program to help communities of all kinds: towns, cities, counties, Tribal Nations, Universities and industrial complexes implement procedures to reduce the potential for disastrous, weather-related, consequences. To be certified as StormReady, communities must meet guidelines established by the NWS in partnership with federal, state, and local emergency management professionals. The StormReady program is intended to:

- < Improve the timeliness and effectiveness of hazardous weather warnings for the public.
- < Provide detailed and clear recommendations which will help local emergency managers establish and improve effective hazardous weather operations.
- < Help local emergency managers justify costs and purchases needed to support their hazardous weather-related program.
- < Reward local hazardous-weather mitigation programs that have achieved a desired performance level.
- < Provide a means of acquiring additional Community Rating System points assigned by the National Flood Insurance Program (NFIP).
- < Provide an “image incentive” to communities, which once certified, can identify

themselves as StormReady.

< Encourage the enhancement of hazardous weather preparedness programs in jurisdictions surrounding StormReady communities and counties.

StormReady is a voluntary program offered to provide guidance and incentive to officials interested in improving their hazardous weather operations. **Implied or explicit references to “requirements” are made with regard to the voluntary participants in the StormReady program and should *not* be construed as being state or federal mandates.**

Section B

Hydrological Service

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River Forecast Centers and Forecast Points

NWS hydrology is divided into two main functional groups. One is the WFO and the other is the River Forecast Center (RFC). There are 13 RFC's for the Country and its territories. Each RFC is assigned a major basin. RFC's maintain and calibrate rainfall-runoff models for various rivers within their basin of responsibility. The RFC which covers southeastern Arizona is the Colorado Basin River Forecast Center (CBRFC):

<http://www.cbrfc.noaa.gov/>

Their web page contains a wealth of information which includes:

- An interactive map which shows river forecast and data points and their status with respect to bankfull and flood stage.
- Rainfall-runoff model output.
- Water supply forecasts.
- Snow data.
- Soil moisture data.
- Climate information.
- Publications, presentations, and reports.

CBRFC runs their models on a large number of points throughout southeast Arizona. All of these can be viewed from their web page. This includes both data points and river forecast points. River forecast points receive the majority of CBRFC attention during a high water or flood event. During such an event, a CBRFC forecaster takes the model output, for a given forecast point, and issues a flood forecast to the WFO.

Through collaboration, a best forecast for the point is reached. This best forecast in turn becomes the official forecast which the WFO issues to the public. During a flood, please refer to ONLY the official forecast issued by the Tucson WFO.

Forecast points may be supported by CBRFC or by the local office. The later are referred to as local forecast points. Local forecast points are based on procedures developed by the local forecast office. CBRFC-supported forecast points may be either river forecast points or guidance forecast points. River forecast points tend to be along mainstem rivers whereas guidance forecast points are usually along tributary/headwater streams or represent special forecasting challenges.

In southeastern Arizona, there is one local river forecast points:

- Gila River at Coolidge Dam (San Carlos Reservoir)

Gila River at Coolidge Dam uses the level of water in San Carlos Reservoir to predict the discharge from Coolidge Dam. CBRFC provides an inflow forecast for the reservoir.

In southeastern Arizona there are nine CBRFC-supported river forecast points:

- San Francisco River at Clifton
- Gila River at Duncan
- Gila River near Solomon (Head of Safford Valley)
- Gila River near Calva
- Gila River at Kelvin
- Santa Cruz River near Tubac
- Santa Cruz River at Continental/Green Valley
- Santa Cruz River at Congress Street
- Santa Cruz River at Cortaro

In southeast Arizona there are nine CBRFC-supported guidance forecast points:

- Eagle Creek near Morenci
- Bonita Creek near Morenci
- Brawley Wash near Three Points
- San Pedro River at Palominas
- San Pedro River at Charleston
- San Pedro River near Tombstone
- San Pedro River near Redington
- Aravaipa Creek near Mammoth
- Santa Cruz River at Trico Road near Marana

Below is a table of river forecast points, guidance forecast points, and local forecast points along with their bankfull, minor, moderate, and major flood stages:

NWS Location ID	Forecast Point Name	Forecast Point Type	Bankfull Stage (ft)	Minor Flood Stage (ft)	Moderate Flood Stage (ft)	Major Flood Stage (ft)
SFCA3	San Francisco at Clifton	River Forecast Point	19.0	22.0	25.0	28.0
DUUA3	Gila River at Duncan	River Forecast Point	14.0	15.0	20.0	24.0
ECMA3	Eagle Creek near Morenci	Guidance Forecast Point	10.0	15.0	17.0	18.0
BNMA3	Bonita Creek near	Guidance	11.0	13.0	16.0	18.0

	Morenci	Forecast Point				
GLHA3	Gila River near Solomon (Head of Safford Valley)	River Forecast Point	13.0	17.0	20.0	21.0
GLCA3	Gila River near Calva	River Forecast Point	15.0	20.0	24.0	27.0
CLDA3	Gila River at Coolidge Dam/San Carlos Reservoir	Local Forecast Point	2511.0	2515.0	2521.0	1523.0
GLKA3	Gila River at Kelvin	River Forecast Point	19.0	21.0	26.0	30.0
STBA3	Santa Cruz River near Tubac	River Forecast Point	26.0	28.0	29.0	32.0
SCCA3	Santa Cruz River at Continental/ Green Valley	River Forecast Point	11.0	14.0	15.0	16.0
TSCA3	Santa Cruz River at Congress Street	River Forecast Point	9.0	11.0	13.0	15.0
CSCA3	Santa Cruz River at Cortaro	River Forecast Point	13.0	14.0	15.0	16.0
BWTA3	Brawley Wash near Three points	Guidance Forecast Point	13.0	15.0	16.0	18.0
SPPA3	San Pedro River at Palominas	Guidance Forecast Point	15.0	17.0	18.0	19.0
SAPA3	San Pedro River at Charleston	Guidance Forecast Point	11.0	12.0	13.0	15.0
SPTA3	San Pedro River near Tombstone	Guidance Forecast Point	13.0	15.0	17.0	20.0
SPRA3	San Pedro River near Redington	Guidance Forecast Point	19.0	20.0	21.0	25.0
ARVA3	Aravaipa Creek near Mammoth	Guidance Forecast Point	14.0	15.0	17.0	18.0
SCTA3	Santa Cruz River	Guidance	14.0	16.0	18.0	20.0

	at Trico Road near Marana	Forecast Point				
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Notes:

NWS form E-19 is used to document a forecast point. This form is provided to county emergency managers when a forecast point is established or when significant changes are made. E-19's older than 10 years should be discarded and replaced with new ones.

If a new river forecast point is desired, an official request should be made, by the county manager/emergency manager to the local office. The purpose of the new forecast point, reach of river for which you desire the forecast, and users of the new service should be discussed.

Hydrologic Service Product Examples

The hydrologic service program is designed to address the rapid onset of flooding following heavy rains in a short period and flooding of "main stem" rivers caused by persistent rainy periods with or without melting snow.

Below is a summary table of product descriptions.

PRODUCT	DESCRIPTION
FLOOD WATCH	Indicates that flooding or flash flooding is a possibility in the watch area. Those in the watch area are urged to be ready to take quick action if a flood or flash flood warning is issued or flooding is observed.
FLOOD WARNING	Issued when a river forecast point has or is expected to rise above flood stage.
FLOOD STATEMENT	Used to issue an Urban and Small Stream Advisory. Used as a follow-up to Flood Warnings. The statement will contain the latest information on the event.
FLASH FLOOD STATEMENT	Used as a follow-up to Flash Flood Warnings. The statement will contain the latest information on the event.
URBAN AND SMALL STREAM ADVISORY	Used to inform the public of nuisance flooding that does not pose a threat to life and property. Issued using a flood statement.
FLASH FLOOD WARNING	Issued for rapid flooding that threatens life/property. Flash flooding typically occurs within 6 hours after heavy rainfall has ended. It could be issued for rural or urban areas as well as for small streams and creeks. The degree of flash flooding depends on local terrain, ground cover,

	degree of urbanization, amount of man-made changes to the natural river banks, and initial ground or river conditions. Dam breaks can also create flash flooding.
SMALL STREAM FLOOD WARNING	Issued for flooding along small streams and washes that threatens life/property. Flooding typically occurs 6 to 12 hours after heavy rainfall has ended.
RIVER STATEMENT	Used to provide information about non-flooding situations on main stem rivers.
MISCELLANEOUS HYDROLOGIC DATA REPORT	Used to provide a weekly summary of the lake level of San Carlos Reservoir.
SPRING SNOWMELT OUTLOOK	Issued when a moderate to high risk of spring snowmelt flooding is expected.
DRY SEASON HYDROLOGIC OUTLOOK	Issued to provide local interests with current conditions and a short term outlook during prolonged dry spells.
CIVIL EMERGENCY MESSAGE	Can be used to disseminate information quickly regarding life threatening spills into rivers. Must be requested by county emergency manager.
HAZARDOUS WEATHER OUTLOOK	Informs public, media, and emergency managers of hazardous weather conditions. Includes heavy rainfall and flooding potential.
PUBLIC INFORMATION STATEMENT	Issued to convey events of general interest to the public. Includes rainfall summaries from recent storms.

The following is a brief summary of the different hydrologic warnings, watches, advisories, and general information products issued by the NWS.

Flood Watch (FFA)

A Flood Watch is issued when one of the following conditions is met:

- Hydrometeorological conditions are such that life-threatening flash flooding may occur in several areas within the next 24 to 36 hours, but is not imminent. A minimum of one flash flood is expected to occur in the area over this time period.
- A dam or levee has become unstable, but is not yet in danger of failing.
- Hydrometeorological conditions are such that widespread and life-threatening small stream and urban flooding is possible within the next 24 to 36 hours, but not imminent.
- At least one River Forecast Point or Local River Forecast Point is *likely* (greater than 50% chance) to exceed flood stage within the next 24 hours, based on CBRFC model guidance using either upstream conditions alone, or expected precipitation within the next 24 hours.

- A FFA product is issued to update or cancel a flood watch.

Flash Flood Watch Example:

WGUS65 KTWC 081700
FFATWC

URGENT - IMMEDIATE BROADCAST REQUESTED
FLOOD WATCH
NATIONAL WEATHER SERVICE TUCSON AZ
1000 AM MST THU AUG 18 2005

...FLASH FLOOD WATCH FOR NORTHERN GREENLEE COUNTY IN EFFECT UNTIL
1000 PM MST TONIGHT...

AZ030-130400-
/NEW.KTWC.FF.A.0001.050818T1700Z-050819T0500Z/
/00000.0.RS.000000T0000Z.000000T0000Z.000000T0000Z.OO/
UPPER GILA RIVER VALLEY -
1000 AM MST THU AUG 18 2005

...FLASH FLOOD WATCH IN EFFECT THROUGH 1000 PM TONIGHT...

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A

* FLASH FLOOD WATCH FOR GREENLEE COUNTY.

* UNTIL 1000 PM TONIGHT

* AT 955 AM MST...THUNDERSTORMS HAVE ALREADY BEGUN TO DEVELOP IN
ERNEST. THIS FOLLOWS AN ACTIVE DAY OF FLASH FLOODING THROUGHOUT
NORTHERN GREENLEE COUNTY YESTERDAY...WHERE WARD CANYON IN CLIFTON
AND TURKEY CREEK NORTH OF CLIFTON HAD REPORTS OF FLASH FLOODING.

A FLASH FLOOD WATCH MEANS THAT CONDITIONS MAY DEVELOP THAT LEAD
TO FLASH FLOODING. FLASH FLOODING IS A VERY DANGEROUS SITUATION.

YOU SHOULD MONITOR LATER FORECASTS AND BE PREPARED TO TAKE ACTION
SHOULD FLASH FLOOD WARNINGS BE ISSUED.

DAM SAFETY EXPERTS...WITH STATE AND LOCAL EMERGENCY SERVICES...
ARE ENROUTE TO THE DAM AND WILL ISSUE A PUBLIC STATEMENT AS
CONDITIONS WARRANT. PLAN NOW SO YOU WILL KNOW WHAT TO DO IN AN
EMERGENCY. KEEP INFORMED BY LISTENING TO LOCAL RADIO AND
TELEVISION FOR STATEMENTS AND POSSIBLE EVACUATION.

\$\$

Flash Flood Watch for Dam Failure Example:

WGUS65 KTWC 121947

FFATWC

URGENT - IMMEDIATE BROADCAST REQUESTED
FLOOD WATCH
NATIONAL WEATHER SERVICE TUCSON AZ
1247 PM MST MON DEC 12 2005

...FLASH FLOOD WATCH FOR FRYE CREEK BELOW FRYE MESA DAM IN GRAHAM
COUNTY IN EFFECT UNTIL 100 PM MST TUESDAY AFTERNOON...

AZ030-130400-
/NEW.KTWC.FF.A.0001.051212T1947Z-051213T2000Z/
/00000.0.RS.000000T0000Z.000000T0000Z.000000T0000Z.OO/
UPPER GILA RIVER VALLEY -
1247 PM MST MON DEC 12 2005

...FLASH FLOOD WATCH IN EFFECT THROUGH THURSDAY MORNING...

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A

* FLASH FLOOD WATCH FOR FRYE CREEK BELOW FRYE MESA DAM IN GRAHAM
COUNTY.

* UNTIL 100 PM TUESDAY AFTERNOON

* AT 1205 PM...THE US GEOLOGICAL SURVEY REPORTED THE FRYE MESA
DAM SPILLWAY WAS PARTLY BLOCKED DUE TO TREE DEBRIS AND WATER WAS
SPILLING OVER THE DAM STRUCTURE. A POSSIBLE STRUCTURAL DEFECT WAS
ALSO SPOTTED.

* THE NEAREST DOWNSTREAM COMMUNITY IS DALEY ESTATES. A RAPID
FAILURE AT THE DAM WOULD RESULT IN A FLOOD WAVE REACHING DALEY
ESTATES IN JUST UNDER AN HOUR...AND THE TOWN OF THATCHER SHORTLY
AFTER.

A FLASH FLOOD WATCH MEANS THAT CONDITIONS MAY DEVELOP THAT LEAD
TO FLASH FLOODING. FLASH FLOODING IS A VERY DANGEROUS SITUATION.

YOU SHOULD MONITOR LATER FORECASTS AND BE PREPARED TO TAKE ACTION
SHOULD FLASH FLOOD WARNINGS BE ISSUED.

DAM SAFETY EXPERTS...WITH STATE AND LOCAL EMERGENCY SERVICES...
ARE ENROUTE TO THE DAM AND WILL ISSUE A PUBLIC STATEMENT AS
CONDITIONS WARRANT. PLAN NOW SO YOU WILL KNOW WHAT TO DO IN AN
EMERGENCY. KEEP INFORMED BY LISTENING TO LOCAL RADIO AND
TELEVISION FOR STATEMENTS AND POSSIBLE EVACUATION.

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Flood Watch Example:

WGUS65 KTWC 121947
FFATWC

URGENT - IMMEDIATE BROADCAST REQUESTED
FLOOD WATCH
NATIONAL WEATHER SERVICE TUCSON AZ
1247 PM MST MON DEC 12 2005

...FLOOD WATCH ISSUED FOR THE UPPER GILA RIVER BASIN AND
SMALL
STREAMS EAST OF TUCSON...

.A SUBTROPICAL STORM SYSTEM NOW ENTERING SOUTHERN
CALIFORNIA WILL MOVE ACROSS SOUTHERN ARIZONA TONIGHT. WITH
THE SNOW LEVEL EXPECTED TO REMAIN NEAR 9000 FEET...MOST OF
THE PRECIPITATION WILL FALL AS RAIN ON THE MOUNTAINS.
PORTIONS OF THE WHITE AND GILA MOUNTAINS HAVE 2 TO 3 FEET
OF SNOW ON THE GROUND...MOST OF WHICH IS EXPECTED TO MELT
AS 1 TO 3 INCHES OF RAIN FALLS ON TOP. THIS COMBINATION OF
RAPID SNOW MELT AND HEAVY RAIN COULD CAUSE RIVERS AND
STREAMS TO RISE RAPIDLY TODAY AND TONIGHT.

BECAUSE SNOW DEPTHS OVER E COCHISE COUNTY AND NORTHERN
SONORA MOUNTAINS ARE NOT AS GREAT...THE THREAT OF MAINSTEM
FLOODING ON THE SAN PERDO RIVER IS LOW. HOWEVER...SMALL
STREAMS IN COCHISE COUNTY WILL STILL BE VULNERABLE TO FLOOD
PROBLEMS SINCE RAINFALL IN THIS AREA WILL BE A BIT HEAVIER.

AZZ019-030-035-130400-
/NEW.KTWC.FA.A.0001.051212T1947Z-051215T1800Z/
/00000.0.RS.000000T0000Z.000000T0000Z.000000T0000Z.OO/
NORTHERN GREENLEE COUNTY-UPPER GILA RIVER VALLEY-COCHISE
COUNTY-
1247 PM MST MON DEC 12 2005

...FLOOD WATCH IN EFFECT THROUGH THURSDAY MORNING...

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A

- * FLOOD WATCH FOR PORTIONS OF ARIZONA AND SOUTHEAST
ARIZONA...INCLUDING NORTHERN GREENLEE COUNTY...COCHISE
COUNTY AND UPPER GILA RIVER VALLEY.
- * THROUGH THURSDAY MORNING
- * A PROLONGED HEAVY RAIN EVENT IS POSSIBLE...ESPECIALLY

OVER THE SOUTHERN WHITE MOUNTAINS AND AREAS EAST OF TUCSON. THIS COULD CAUSE SIGNIFICANT RISES ON SMALL STREAMS. THE UPPER GILA RIVER UPSTREAM FROM SAN CARLOS RESERVOIR IS PARTICULARLY VULNERABLE TO RAPID RISES.

A FLOOD WATCH MEANS THERE IS A POTENTIAL FOR FLOODING BASED ON CURRENT FORECASTS.

YOU SHOULD MONITOR LATER FORECASTS AND BE ALERT FOR POSSIBLE FLOOD WARNINGS. THOSE LIVING IN AREAS PRONE TO FLOODING SHOULD BE PREPARED TO TAKE ACTION SHOULD FLOODING DEVELOP.

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Flood Warning (FLW)

A Flood Warning is issued when:

- A mainstem river has risen above flood stage.
- A mainstem river is forecast to rise above flood stage within the next 24 hours.
- A mainstem river's expected crest/peak flow has been revised upward by at least one flood category (previous forecast called for minor flooding; new forecast calls for moderate or major flooding).

River Flood Warning:

WGUS45 KTWC 131815
FLWTWC
AZZ033-140615-

BULLETIN - EAS ACTIVATION REQUESTED
FLOOD WARNING
NATIONAL WEATHER SERVICE TUCSON AZ
1115 AM MST MON OCT 13 2006

...THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A FLOOD WARNING FOR THE FOLLOWING RIVERS IN SOUTHEAST ARIZONA...

SANTA CRUZ RIVER AT TUBAC AFFECTING SANTA CRUZ COUNTY
SANTA CRUZ RIVER AT CONTINENTAL/GREEN VALLEY AFFECTING PIMA COUNTY

.HEAVY RAINFALL IN THE OVERNIGHT AND EARLY MORNING PERIOD FROM DECAYING TROPICAL SYSTEM MITCHELL HAS CAUSED SIGNIFICANT RUNOFF INTO THE SANTA CRUZ RIVER. THE SANTA CRUZ RIVER HAS ALREADY EXCEEDED BANKFULL AT TUBAC.

DO NOT DRIVE AROUND ANY BARRICADES. NEVER DRIVE CARS...TRUCKS OR SPORT UTILITY VEHICLES THROUGH FLOODED AREAS. STAY AWAY FROM THE RIVER BANK.

ADDITIONAL INFORMATION IS AVAILABLE AT [HTTP://WEATHER.GOV/TUCSON](http://weather.gov/tucson)

AZZ034-140614-

FORECAST INFORMATION FOR
SANTA CRUZ RIVER NEAR TUBAC

- * MODERATE FLOODING IS FORECAST
- * 11 AM STAGE: 26.4 FEET...OR 10500 CUBIC FEET PER SECOND
- * FLOOD STAGE: 28 FEET
- * RISE ABOVE FLOOD STAGE THIS AFTERNOON
- * CREST BETWEEN 29.0 AND 30.0 FEET TONIGHT...OR 20000 CUBIC FEET PER SECOND
- * AT 29 FEET...FIELDS IN THE VICINITY OF TUBAC BEGIN TO FLOOD...LOW LYING HOMES IN TUBAC FLOOD.

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AZZ033-140614-

FORECAST INFORMATION FOR
SANTA CRUZ RIVER AT CONTINENTAL/GREEN VALLEY

- * MINOR FLOODING IS FORECAST
- * 11 AM STAGE: 6.4 FEET...OR 2500 CUBIC FEET PER SECOND
- * FLOOD STAGE: 14 FEET
- * RISE TO FLOOD STAGE TONIGHT
- * CREST AT ABOUT 14.0 FEET TONIGHT...OR 27500 CUBIC FEET PER SECOND
- * AT 14 FEET...BRIDGE APPROACHES NEAR GREEN VALLEY AND SAHUARITA ARE THREATENED...INCLUDING PIMA MINE RD. BANK EROSION IS LIKELY OUTSIDE SOIL CEMENT PROTECTION.

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Flood Statement (FLS)

Flood Statements are issued:

- At least once during the duration of an Urban and Small Stream Flood Warning or Urban and Small Stream Flood Advisory.
- Every 6-12 hours during a River Flood Warning.
- When a River Flood Warning or Urban and Small Stream Flood Warning expires or is cancelled.
- At the initial issuance of an Urban and Small Stream Flood Advisory. An Urban and Small Stream Flood Advisory is used to inform the public of nuisance flooding that does not pose a threat to life and property. Issued when heavy rain

will cause flooding of streets and low-lying places in urban areas or if small rural or urban streams are expected to reach or exceed bankfull.

Urban and Small Stream Flood Advisory Example:

WGUS85 KTWC 070145
FLSTWC
AZZ033-070245-

FLOOD STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
645 PM MST SAT SEP 6 2003

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED AN URBAN AND SMALL STREAM FLOOD ADVISORY EFFECTIVE UNTIL 745 PM MST SATURDAY EVENING FOR PEOPLE IN THE FOLLOWING COUNTY

IN ARIZONA...
EAST CENTRAL PIMA

THIS ADVISORY INCLUDES...
CORONA DE TUCSON AND VAIL

AT 636 PM MST...AUTOMATED GAUGES INDICATED HEAVY RAIN NEAR CORONA DE TUCSON. MOVEMENT OF THE STORMS IS TO THE SOUTHEAST AT 10 MPH.

BE ESPECIALLY CAUTIOUS NEAR STREAMS...NORMALLY DRY WASHES...AND FLOOD-PRONE ROADWAYS. DO NOT DRIVE INTO FLOODED AREAS. SLOW DOWN AND ALLOW EXTRA STOPPING DISTANCE.

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Flash Flood Warning (FFW)

A Flash Flood Warning is issued when:

- Hydrometeorological conditions are such that life-threatening and rapid flooding is imminent.
- A dam or levee impounding a sufficient amount of water to cause life threatening and rapid flooding has failed.
- A reliable report of flash flooding is received.
- A reliable report of a mudslide, emanating from a burn area, is received.

A flash flood is considered:

- A foot or higher wall of water traveling down a dry wash.
- 8 inches or more of moving water over a secondary roadway.
- A rapidly changing situation which could cause loss of life or property damage.

Flash Flood Warning Example:

WGUS55 KTWC 142328
FFWTWC
AZC021-150030-

BULLETIN - EAS ACTIVATION REQUESTED
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE TUCSON AZ
426 PM MST THU AUG 14 2003

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A

- * FLASH FLOOD WARNING FOR...
SOUTHEASTERN PINAL COUNTY IN ARIZONA

- * UNTIL 530 PM MST

- * AT 423 PM MST...SEVERE WEATHER SPOTTERS REPORTED VERY HEAVY
RAIN OVER ORACLE. A SPOTTER IN ORACLE REPORTED 1.8 INCHES OF RAIN
IN LESS THAN 25 MINUTES AND WASHES ARE RUNNING.

LAT...LON 3261 11094 3254 11078 3256 11049 3273 11062
\$\$

Flash Flood Warning for Dam Failure Example:

WGUS55 KTWC 252133
FFWTWC
AZC023-252350-

BULLETIN - EAS ACTIVATION REQUESTED
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE TUCSON AZ
230 PM MST MON AUG 25 2003

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A

- * FLASH FLOOD WARNING FOR DAM FAILURE IN...
CENTRAL SANTA CRUZ COUNTY IN ARIZONA

- * UNTIL 445 PM MST

- * AT 225 PM MST...PATAGONIA LAKE DAM BEGAN TO FAIL WITH COMPLETE
COLLAPSE OF THE DAM STRUCTURE EXPECTED.

- * A 15 FOOT WALL OF WATER WILL REACH RIO RICO AND INTERSTATE 19
BETWEEN 400 AND 430 PM.

THIS IS A PARTICULARLY DANGEROUS SITUATION. PEOPLE SHOULD MOVE

AWAY FROM SONOITA CREEK IMMEDIATELY!

LAT...LON 3148 11052 3172 11050 3172 11090 3147 11092
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Flash Flood Statement (FFS)

Flash Flood Statements are issued:

- At least once during the duration of a flash flood warning.
- When a Flash Flood Warning expires or is cancelled.

Flash Flood Statement Example:

WGUS75 KTWC 070053
FFSTWC
AZZ029-070200-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
554 PM MST SAT SEP 6 2003

...A FLASH FLOOD WARNING CONTINUES FOR SOUTH CENTRAL PINAL COUNTY
UNTIL 700 PM MST...

AT 551 PM MST NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED
THAT MODERATE RAINFALL WAS STILL OCCURRING ACROSS SOUTH CENTRAL
PINAL COUNTY. THE WARNING AREA IS GENERALLY IN A REMOTE AREA 5
MILES SOUTHWEST OF FRIENDLY CORNERS AND ALSO JUST EAST OF INDIAN
NATION HIGHWAY 15. DOPPLER RADAR ESTIMATED RAINFALL TOTALS OF ONE
TO TWO AND A HALF INCHES OF RAIN HAS FALLEN.

SMALL STREAMS...SECONDARY ROADS...AND NORMALLY DRY WASHES WILL
FLOOD QUICKLY. DO NOT DRIVE INTO FLOODED AREAS. MOVE TO HIGHER
GROUND.
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Small Stream Flood Warning (FLW)

A Small Stream Flood Warning is issued when:

- Hydrometeorological conditions are such that life-threatening flooding is imminent, but that specific crests and peak flows cannot be determined and the event occurs 6 or more hours after the causative heavy rainfall has ended.
- A reliable report of flooding is received.

When flood waters may collect in unnamed and/or ungauged streams or at gauged sites which are not forecast points, a Small Stream Flood Warning (FLW) is typically issued. This differs from a River Flood Warning (FLW) which is issued for reaches of rivers associated with River Forecast Points.

These warnings are issued for longer-fuse flood situations, usually associated with the remnants of a tropical storm, when heavy winter rains are combining with rapid mountain snow melt, or consecutive days of widespread monsoon rainfall over a basin.

Small Stream Flood Warning Example:

WGUS45 KTWC 281707
FLWTWC
AZZ032-282300-

BULLETIN - EAS ACTIVATION REQUESTED
FLOOD WARNING
NATIONAL WEATHER SERVICE TUCSON AZ
955 AM MST MON JUL 28 2003

THE NATIONAL WEATHER SERVICE IN TUCSON HAS ISSUED A FLOOD WARNING FOR SMALL STREAMS AND RURAL AREAS EFFECTIVE UNTIL 400 PM MST MONDAY AFTERNOON FOR PEOPLE IN THE FOLLOWING COUNTY

IN ARIZONA...
CENTRAL PIMA

THIS WARNING INCLUDES
KOM VO

RADAR INDICATED HEAVY RAINS OVER CENTRAL PIMA COUNTY SATURDAY NIGHT...EARLY SUNDAY MORNING...AND SUNDAY NIGHT. THESE RAINS HAVE PRODUCED SIGNIFICANT RUNOFF IN THE VAMORI WASH. VAMORI WASH AT KOM VO HAS RISEN TO CLOSE TO NINE FEET AND CONTINUES TO RISE. CONSIDERABLE OVBANK FLOW AND SHEET FLOODING IS EXPECTED IN LOW LYING AREA.

LIFE-THREATENING FLOODING OF SMALL STREAMS...SECONDARY ROADS...AND NORMALLY DRY WASHES IS EXPECTED. MOTORISTS ALONG HIGHWAY 21 SHOULD EXERCISE CAUTION. DO NOT DRIVE INTO FLOODED AREAS.
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SCHAFFNER

River Statement (RVS)

A River Statement is issued when:

- A River Forecast Point or Local River Forecast Point is expected to rise to or above bankfull stage, but not reach flood stage.
- A noteworthy or significant rise is expected on a gauged river.
- A toxic or dangerous substance is released into a flowing river. If the situation is life threatening, a Civil Emergency Message (CEM) may be used (see section below).
- A flood stage is changed by the NWS Service Hydrologist.
- Any other situation involving rivers, streams or washes not covered by other hydrologic products.
- Each morning when the morning river stage and flow report for the upper Gila River is issued. This information is used for water supply planning and monitoring flow after upstream heavy rains.

Upper Gila River Statement Example:

FGUS85 KTWC 091746
RVSTWC

HYDROLOGIC STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
945 AM MST TUE DECEMBER 9 2003

...RIVER STATEMENT...

...MORNING RIVER REPORT FOR USGS GAGES IN THE UPPER GILA BASIN...

	FLOOD STAGE	STAGE (FT)	24 HOUR TREND (FT)	FLOW (CFS)	TIME (MST)
GILA R. NEAR VIRDEN NM...	15	3.5	+0.1	184	600 AM
SAN FRANCISCO R. AT CLIFTON	23	11.1	0.0	188	900 AM
GILA R. NEAR SOLOMON 8NE	17	6.3	-0.2	310	900 AM

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River Statement for Non-life-threatening Hazardous Material Release into a River Example:

FGUS85 KTWC 091900
RVSTWC

HYDROLOGIC STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
100 PM MST FRI MAY 9 2003

...RIVER STATEMENT...

...FUEL OIL RELEASE INTO THE GILA RIVER NEAR SAFFORD...

THE GRAHAM COUNTY SHERIFF REPORTED THAT JUST AFTER NOON...A TANKER TRUCK CARRYING FUEL OIL WAS INVOLVED IN A COLLISION WITH ANOTHER TRUCK AND FELL OFF THE 8TH STREET BRIDGE IN SAFFORD. THE TANK HAS RUPTURED...SPILLING AN UNKNOWN AMOUNT OF FUEL OIL INTO THE RIVER.

PEOPLE ARE ADVISED TO MOVE AWAY FROM THE GILA RIVER DOWNSTREAM FROM SAFFORD TO THE TOWN OF CALVA. ALTHOUGH THE FUEL OIL WILL DISSIPATE SOMEWHAT AS IT MOVES DOWNSTREAM...A SIGNIFICANT FISH KILL IS LIKELY...AND THE OIL WILL CAUSE A STRONG ODOR.
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Non-routine River Statement Example:

FGUS85 KTWC 252237
RVSTWC

HYDROLOGIC STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
430 PM MST WED OCT 11 2000

...RIVER STATEMENT...

THE PIMA COUNTY OFFICE OF EMERGENCY MANAGEMENT REPORTS THAT SEVERAL PEOPLE HAVE ATTEMPTED TO CANOE DOWN THE RILLITO RIVER NEAR DODGE BLVD. IN TUCSON. WHILE THIS MAY BE TEMPTING SINCE THERE IS APPROXIMATELY 9 FEET OF WATER FLOWING IN THE CHANNEL...THE SWIFT CURRENT IS EXTREMELY DANGEROUS.

DO NOT ATTEMPT TO ENGAUGE IN RECREATIONAL ACTIVITIES ALONG THE RILLITO RIVER TONIGHT. THE RIVER IS EXPECTED TO REMAIN QUITE HIGH AND POSE A DANGER TO PEOPLE WHO STAND ALONG ITS BANKS. THE CURRENT IS SO SWIFT THAT IT MAY BE IMPOSSIBLE FOR RESCUERS TO REACH YOU IN TIME.

Miscellaneous Hydrologic Data Report (RRM)

WFO Tucson issues one routine Miscellaneous Hydrologic Data Report. This report provides lake elevation and storage at San Carlos Reservoir and is issued every Tuesday morning and more frequently if the lake approaches the flood control spillways. If the lake reaches within 3 feet of the control spillways (2508.00 feet), this information is collected and transmitted daily until the lake falls below the 2508.00 feet mark.

Weekly Product for San Carlos Reservoir Example:

SRUS45 KTWC 021446
RRMTWC

MISCELLANEOUS HYDROLOGIC DATA REPORT
NATIONAL WEATHER SERVICE TUCSON AZ
745 AM MST TUE DEC 2 2003

...SOUTHEAST ARIZONA RESERVOIR STATUS...

.B TUS 1202 MS DH09/LSIRZ			
:DAM/RESERVOIR	STORAGE	PCT	ELEVATION
:	K-AC-FT	FULL	(FEET)
:GILA RIVER			
:COOLIDGE-SAN CARLOS :CLDA3	29505	3.3	2415.29

.END
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Spring Snowmelt Outlook (ESF)

Spring snowmelt flooding occasionally occurs in the Tucson Hydrologic Service Area (HSA), usually along the Gila River where much of the headwaters lie within mountains over 6000 feet high. During most winters when the risk is low, the bi-weekly statewide Spring Snowmelt Outlook issued by WFO Phoenix will provide the needed information to key users. However, when there is a **moderate or high** risk of snowmelt flooding within the HSA, WFO Tucson will likely issue a snowmelt outlook of its own to better define conditions within our service area.

Spring Snowmelt Outlook Outline

FGUS75 KTWC 141659
ESFTWC

HYDROLOGIC OUTLOOK
NATIONAL WEATHER SERVICE TUCSON AZ
1000 AM MST SAT FEB 14 2003

SPRING SNOWMELT OUTLOOK FOR SOUTHEAST ARIZONA

1. PAST AND PRESENT WEATHER CONDITIONS
2. WATER RESOURCE CONDITIONS
3. FORECAST FLOOD CONDITIONS
4. TWO-WEEK FORECAST
5. 30 AND 90 DAY FORECAST
6. CLIMATE STATISTICS

THE NEXT SUMMARY WILL BE ISSUED ON SATURDAY, FEBRUARY 28.
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Dry Season Hydrologic Outlook (ESF)

Because of the desert climate, WFO Tucson is subject to frequent dry spells. However, dry spells lasting over a few months or years can cause significant problems for agriculture, ranching, and rural areas unable to obtain potable ground water.

Hydrologic Outlooks for the entire state are routinely issued by WFO Phoenix. In most short-term dry spells, this statewide product will suffice in providing needed information to local customers. However, when total rainfall falls below 60 percent of normal anywhere in the HSA for longer than 6 to 12 months, local action is initiated by WFO Tucson to help key customers to respond. The decision to initiate the issuance of this special product rests with the Tucson Meteorologist in Charge (MIC) in consultation with the Tucson Service Hydrologist (SH), Tucson Warning Coordination Meteorologist (WCM), Senior Service Hydrologist (SSH) in Phoenix, and National Weather Service Western Region Hydrologic and Climate Services Division.

In the event of a longer-term dry spell, usually as a result of minimal winter precipitation after a rather dry monsoon season, WFO Tucson will issue semi-weekly hydrologic outlooks. This product is not meant to replace or contradict the statewide water supply outlook, but to supplement it with a summary of regional hydrologic conditions, and more importantly, to amplify the longer-range forecasts issued by the Climate Prediction Center (CPC).

Civil Emergency Message (CEM)

Details concerning a spill can be disseminated via a River Statement (RVS). If lives are threatened and county officials request that we disseminate information as quickly as possible, a Civil Emergency Message (CEM) can be used.

Life-threatening Materials Release into a River Example:

WOUS85 KTWC 270120
CEMTUS
AZZ030-270600-

BULLETIN - EAS ACTIVATION REQUESTED
CIVIL EMERGENCY MESSAGE
NATIONAL WEATHER SERVICE TUCSON AZ
620 PM MST MON MAY 26 2003

...SODIUM CYANIDE RELEASED INTO EAGLE CREEK...

THIS MESSAGE IS BEING ISSUED AT THE REQUEST OF THE GREENLEE COUNTY EMERGENCY MANAGER. AN ACCIDENT AT THE MORENCI COPPER MINE THIS AFTERNOON HAS RESULTED IN A RELEASE OF SODIUM CYANIDE INTO EAGLE CREEK ABOUT 5 MILES WEST OF MORENCI. BECAUSE THE CREEK ONLY CONTAINS A SMALL AMOUNT OF RUNNING WATER...CONCENTRATIONS OF THIS EXTREMELY DANGEROUS CHEMICAL ARE LIKELY TO REMAIN HIGH AS IT SPREADS DOWNSTREAM TOWARD THE GILA RIVER.

PEOPLE ALONG THE ENTIRE CREEK SHOULD MOVE AWAY FROM THE AREA IMMEDIATELY. TUNE TO THE LOCAL EAS RADIO STATION FOR FURTHER INFORMATION FROM THE GRAHAM AND GREENLEE COUNTY OFFICES OF EMERGENCY MANAGEMENT.
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Non-Hydrologic Service Product Examples

While not hydrological products, there are several products below which provide useful hydrologic information.

Hazardous Weather Outlook (HWO)

A Hazardous Weather Outlook (HWO) is issued to inform the public, media, and emergency managers of the potential for winter weather, fire weather, convective weather, **tropical weather or flood hazards**.

A hazard is defined as any weather phenomena meeting outlook, advisory, watch or warning criteria. When an advisory, watch or warning is in effect, the HWO will contain an appropriate headline for the non-routine forecast issued. The HWO is not used to replace or supplement any other NWS product.

Hazardous Weather Outlook Example:

FLUS45 KTWC 141859
HWOTWC
AZZ019-029>035-151400-

HAZARDOUS WEATHER OUTLOOK
NATIONAL WEATHER SERVICE TUCSON AZ
12 NOON MST THU AUG 14 2003

THIS HAZARDOUS WEATHER OUTLOOK IS FOR SOUTHEAST ARIZONA

.DAY ONE...TODAY

...FLASH FLOOD WATCH IN EFFECT FROM 2 PM MST THIS AFTERNOON UNTIL 12 MIDNIGHT TONIGHT FOR SOUTHEAST PINAL COUNTY...ALL OF PIMA COUNTY AND SANTA CRUZ COUNTY...

SYNOPSIS...THUNDERSTORMS SHOULD FORM ON THE RIM TODAY AND MOVE SOUTHWEST ACROSS THE AREA THIS EVENING. THE POTENTIAL FOR SEVERE THUNDERSTORMS AND PRECIPITATION IN EXCESS OF ONE INCH IT IS ABOVE CLIMATOLOGY...ESPECIALLY FROM TUCSON WEST.

DISCUSSION...A FEW LIGHT SHOWERS WERE PRESENT SOUTHEAST OF TUCSON THIS MORNING AS DEBRIS CLOUD COVER FROM WEDNESDAY NIGHT CONVECTION CONTINUES TO MOVE SOUTHWEST. THE UPPER LOW THAT WAS IN TEXAS OVER THE PAST TWO DAYS HAS MIGRATED WEST AND IS SITUATED THIS AFTERNOON IN CHIHUAHUA MEXICO. MODERATE NORTHEAST FLOW AHEAD OF THIS SYSTEM WILL MOVE STORMS THAT DEVELOP ON THE RIM COUNTRY DOWN INTO THE LOWER VALLEYS THIS AFTERNOON AND EVENING AND INTO THE LOW DESERTS WEST OF TUCSON TONIGHT. THE THREAT OF SEVERE WEATHER (I.E. DAMAGING WINDS

AND HAIL) WILL BE HIGHER THAN NORMAL FROM TUCSON WEST BUT NEAR CLIMATOLOGY IN THE EAST...WHERE SOME DRIER AIR HAS MOVED IN. A VERY MOIST ATMOSPHERE IS IN PLACE FROM TUCSON WEST...WHERE PRECIPITABLE WATER VALUES RANGE FROM 1.50 INCHES TO TWO INCHES. THIS AREA WILL SEE THE BEST CHANCE OF HEAVY RAIN. THUS THE CHANCE OF ONE INCH PRECIPITATION IS RATHER HIGH FROM TUCSON WEST...WHERE A FLASH FLOOD WATCH IS IN EFFECT UNTIL 12 MIDNIGHT...BUT NEAR CLIMATOLOGY EAST OF TUCSON. MOVEMENT OF THE STORMS WILL BE GENERALLY WEST TO SOUTHWEST AROUND 10 TO 15 MPH.

.DAYS TWO THROUGH SEVEN...FRIDAY THROUGH WEDNESDAY

THE PROBABILITY FOR WIDESPREAD HAZARDOUS WEATHER IS LOW.

THE UPPER LOW IN CHIHUAHUA MEXICO WILL MOVE INTO THE STATE FRIDAY AND WILL CONTINUE TO HELP FOCUS THUNDERSTORM DEVELOPMENT FRIDAY AND FRIDAY NIGHT. THE UPSWING IN THUNDERSTORM COVERAGE WILL CONTINUE AND THE CHANCE FOR HEAVY RAIN WILL REMAIN AT A LEVEL HIGHER THAN NORMAL.

.SPOTTER INFORMATION STATEMENT...

WEATHER SPOTTERS ARE ENCOURAGED TO REPORT SIGNIFICANT WEATHER CONDITIONS ACCORDING TO STANDARD OPERATING PROCEDURES.

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Public Information Statement (PNS)

Public information statements (PNS) are issued for current or expected events of general interest to the public. A PNS can be used to convey operational information to the news media such as changes in product format, issuance times, or new products or services. PNS of hydrological interest include rainfall summaries and tropical storm information. Rainfall summaries tend to be issued from ALERT gauges and Skywarn Spotter reports from throughout southeast Arizona after a significant storm or afternoon/evening of monsoon activity. The forecaster has the option of issuing a 6 hour, 12 hour, or 24-hour rainfall summary PNS. Due to reporting frequency of ALERT gauges and the nature of our hydrological database, the 24-hour Rainfall Summary PNS is the most often issued.

24-Hour Rainfall Summary PNS Example:

NOUS45 KTWC 140443
PNSTWC

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE TUCSON AZ
935 PM MST WED AUG 13 2003

HERE ARE THE LATEST RAINFALL REPORTS AS OF 935 PM...

TUCSON INT'L AP.....0.05
DAVIS-MONTHAN AFB.....0.01

U OF A CAMPUS.....0.40
 6TH AND COLUMBUS.....0.49
 5TH AND ALVERNON.....0.51
 AJO AND CAMINO VERDE.....0.45

HERE ARE THE LATEST RAINFALL REPORTS FROM ALERT GAUGES ACROSS
 SOUTHEAST ARIZONA...

GAUGE LOCATION	24-HOUR RAINFALL
WEST TUCSON/THREE POINTS...	
VALHALLA/RYAN FIELD 4SE	0.32
HILLTOP RD/THREE POINTS	0.12
AVRA VALLEY AIRPARK	0.08
CANADA DEL ORO WASH/NORTHWEST TUCSON...	
ORACLE RIDGE	0.08
DODGE TANK/CATALINA 5E	0.47
CHERRY SPRINGS/CATALINA 6E	0.27
CATALINA STATE PARK	0.04
CDO WASH/GOLDER RANCH RD	0.71
MOORE RD/LA CHOLLA BLVD	0.28
CATALINA MOUNTAINS AND FOOTHILLS...	
SABINO DAM	0.12
FINGER ROCK WASH/SKYLINE DR	0.08
CENTRAL TUCSON...	
SPEEDWAY BLVD/CRAYCROFT RD	0.47
RILLITO R/DODGE BLVD	0.04
ALAMO WASH/GLENN AVE	0.16
TANQUE VERDE CREEK/NORTHEAST TUCSON...	
TANQUE VERDE/TANQUE VERDE RD	0.16
TANQUE VERDE/SABINO CANYON RD	0.24
BEAR CANYON RD/KAYENTA DR	0.12
AGUA CALIENTE/HOUGHTON RD	0.19
SPEEDWAY BLVD/HARRISON RD	0.20
BROADWAY BLVD/TANQUE VERDE LOOP	0.08
CIENEGA CREEK/VAIL...	
RANCHO DEL LAGO/VAIL 3NW	0.07
PANTANO WASH/VAIL	0.12
CIENEGA CREEK/INTERSTATE 10	1.22
MESCAL	0.08
DAVIDSON CANYON/INTERSTATE 10	0.20
EMPIRE MOUNTAIN	0.63
SOUTH TUCSON/GREEN VALLEY/SIERRITA MOUNTAINS...	
CORONA DE TUCSON	0.08
KEYSTONE PEAK/SIERRITA MOUNTAINS	0.11
SANTA CRUZ COUNTY...	
RED MOUNTAIN	0.08
PORTRERO CANYON/NOGALES	0.63
NOGALES WASH	0.20
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Section C

Future Hydrological Service

Advanced Hydrologic Prediction Service (AHPS) 38

Advanced Hydrologic Prediction Service (AHPS)

The Advanced Hydrologic Prediction Service (AHPS) is a 10 year effort to modernize the NWS hydrology program. Fiscal year 2004 (FY04) was the second year that the program was fully funded by Congress.

AHPS has a wide range of goals. These include, but are not limited to:

- More accurate and comprehensive predictions of river height and flood potential
- Longer term forecasts, from days to months, with probabilistic information to assist in risk based decision making
- High resolution, visually oriented forecast products at 4,000 locations nation wide
- Distribution of graphical information on NWS Web sites

The national AHPS web page can be found at:

<http://www.nws.noaa.gov/oh/ahps/>

The national page contains brochures, fact sheets, and videos.

The Tucson AHPS web page can be found at:

<http://ahps2.wrh.noaa.gov/ahps2/index.php?wfo=twc>

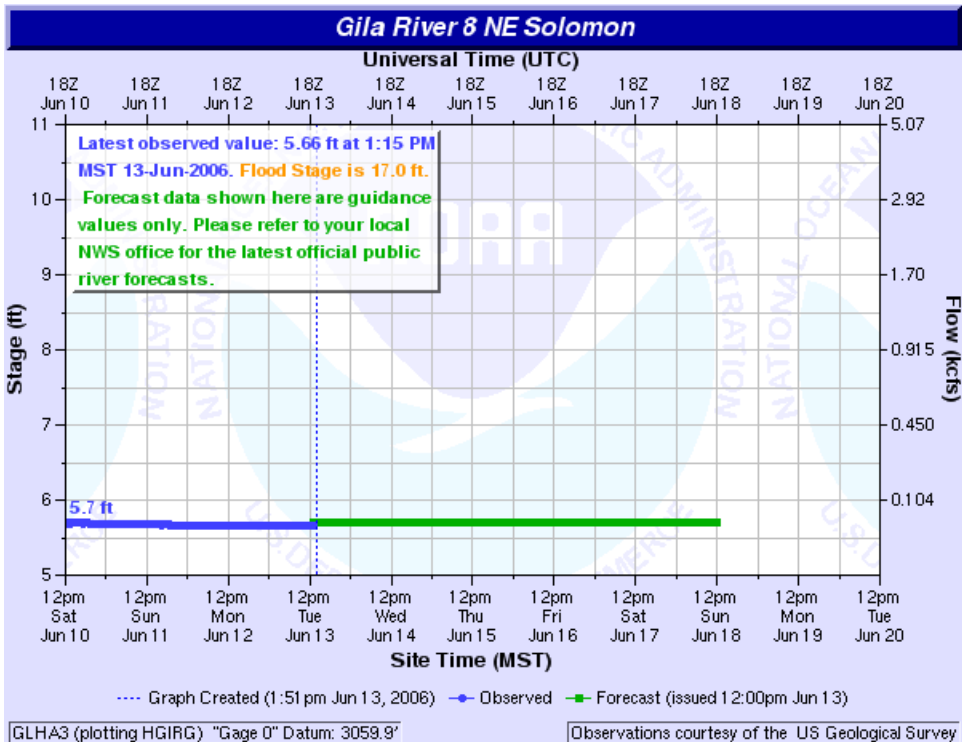
The Tucson AHPS web page contains a map of the Tucson HSA and its 19 forecast points. As with the CBRFC web page, these change color as they approach/exceed bankfull and flood stage. Unlike the CBRFC web page, which displays all data and forecast points, this page only displays forecast points. For each forecast point, a damage table is provided of what gets impacted at various river stages.

Currently, none of the special AHPS services are available for the Tucson HSA. It will be several years before probabilistic forecasts and interactive flood maps will be available. It is also undecided which parts of the Tucson HSA will have these products available.

Below is an image of the Tucson AHPS page map:



Below is an image of the AHPS hydrograph for Gila River near Solomon:



Appendix A: Flash Flood Safety Rules

When a flash flood warning is issued for your area, or the moment you first realize that a flash flood is imminent, act quickly to save yourself. You may only have seconds.

- (1) Get out of areas subject to flooding. This includes dips, low spots, canyons, washes, etc.
- (2) Avoid already flooded and high velocity flow areas. Do not attempt to cross a flowing stream on foot. **Two feet of rushing water will carry away all vehicles including heavy sports utility vehicles (SUVs) and pickups.**
- (3) If driving, do not drive across flooded roads or bridges—they may be washed out.
- (4) If the vehicle stalls, abandon it immediately; seek higher ground--rapidly rising water may engulf the vehicle and its occupants and sweep them away.
- (5) Be especially cautious at night when it is harder to recognize flood dangers.
- (6) Do not camp or park your vehicle along streams and washes, particularly during threatening conditions.
- (7) Always remember the NWS slogan and campaign:
Turn Around Don't Drown

For additional on flash floods and other mainstem flooding:

**NWS Brochure
*Floods the Awesome Power***

http://www.nws.noaa.gov/om/brochures/Floodsbrochure_9_04_low.pdf

Appendix B: Glossary

Advanced Hydrologic Prediction Service (AHPS) - A 10 year effort to modernize the NWS hydrology program.

Basin – Land area drained by a river or stream, commonly referred to as a drainage basin, drainage area, or in some cases watershed.

Bankfull Stage – An elevation/river stage surface elevation at a given location along a river which is intended to represent the maximum water level that will not overflow the river banks. Bankfull stages are set for all USGS data points by the NWS. In some special circumstances, bankfull stage may be set lower than the top of the river banks...such as when structures or roadways are built into the floodplain.

Colorado Basin River Forecast Center (CBRFC) – The River Forecast Center (RFC) responsibility for the lower Colorado River basin including all of southeast Arizona.

Discharge – The volumetric rate, a flow of fluid passing a point per unit of time, commonly expressed as cubic feet per second (cfs).

E-19 – NWS form used to document forecast point information. It contains maps, damage table, flood and bankfull stages, and other information. Emergency managers should have one of these for each river forecast point within their county. Copies older than 10 years should be discarded.

Flash Flood – A flood caused by water which rises rapidly from a normal level to inundation within six hours.

Flood – Any relatively high streamflow that overtops natural or artificial banks (of the stream) and/or causes property damage and/or surpasses the flood stage for a river forecast point.

Flood Stage – An established stream level (gauge height) at a given gauge location at which high water begins to have some adverse impact either at, upstream, or downstream from the gauge location.

Flood Warning – A NWS product issued for a specific location(s) to provide notice that all or portions of a river or rivers will equal or exceed flood stage. Actions to be taken to mitigate losses are determined by the level of severity indicated in the flood warning product. Flood warnings are issued by WFO Tucson and not the river forecast center.

Headwater Basin – A sub-basin (small drainage basin) at the headwaters of a river.

Hydrologic Model - A conceptual model or physically based procedure for numerically simulating a process or processes which occur in a watershed.

Hydrometeorological - A term referring to the inter-relationships between the atmosphere and the land phases of water as it moves through the hydrologic cycle.

Infiltration - Movement of water into soil or porous rock.

Main Stem - The reach of a river/stream formed by its tributaries. The name of the main stem river is often used when referring to the entire basin or watershed (e.g. the basin which the mainstem Gila River is in is referred to as the Gila River Basin).

Major Flooding - A general term indicating extensive inundation and property damage. Usually characterized by the evacuation of people and livestock and the closure of both primary and secondary roads.

Minor Flooding – A general term used to categorize flooding with minimal or no property damage but the possibility of some public inconvenience. This is equal to the flood stage of a river forecast point in most cases.

Moderate Flooding - A general term used to categorize flooding in which results in the flooding of secondary roads, requires transfer of movable property to higher elevations, and may involve some evacuations.

Reach – A segment of a river/stream channel between an upstream and downstream point, often used to describe the length of a channel which is reasonably uniform with respect to discharge, depth, cross-sectional area, and slope. Forecast Points have defined a reach for which a flood warning is issued.

Reaction Time - The time between peak rainfall and the resultant flood crest. This can vary for a given basin based on antecedent conditions and particulars of the storm(s) in question. Reaction time may also be known as concentration time.

Real Time Forecast - A forecast that updates as (real time) data becomes available.

Severe Weather – Weather activity of an exceptional nature that exceeds predetermined criteria at which life and/or property are known to be threatened.

Site Specific - Term used in conjunction with “forecast” or “warning” or “model” to convey the fact that a hydrologic (stream) forecast is produced for an individual stream location as opposed to a general area (e.g. reach of river, city, zone, or county).

Site Specific Model - A hydrologic forecast model to be run at the local Weather Forecast Office (WFO) to model small rivers and streams that use River Forecast Center soil moisture, USGS or other high-quality stage, and NWS precipitation data.

Skywarn Spotter Network - A network of volunteer severe weather spotter trained by the NWS. Each spotter receives training in how to spot severe weather and is provided a

rain gauge. Skywarn training sessions are typically held in the spring to prepare spotters for the upcoming monsoon season. You may contact your local NWS office for a listing of spotter classes in your area.

Staff Gauge - A vertical staff graduated in appropriate units which is placed so that a portion of the gauge is in the water at all times. Observers read the stage directly off of the staff gauge.

Stage - Height of water surface in a river/stream above a predetermined point that may be on or near the channel floor, used interchangeably with gauge height.

Streamflow - Water flowing in a stream channel; often used interchangeably with discharge.

Stream gauge - A site along a river/stream where the stage is read either by eye or measured with recording equipment. In almost all cases, stream gauges report their information via satellite, radio telemetry, or phone lines.

Travel Time - The time between the passage of a flood wave crest from one location to another.

Water Equivalent - The amount of water, in inches, obtained by melting a snow sample.