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Agricultural Impacts of a Very Wet Year 2007

Larry Caldwell, Watershed Specialist
Jim Henley, GIS Specialist
Gary Utley, State Hydrologist
Ken Matlock, State Resource Conservationist

USDA Natural Resources Conservation Service
Stillwater, OK

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Natural Resources Conservation Service

Overview of USDA – NRCS Conservation Programs and Importance of Prediction of Rainfall Data

Larry Caldwell, Watershed Specialist

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Using Precipitation Data to Predict Watershed Dam Spillway Flow and Estimated Flood Control Benefits

Jim Henley, NRCS GIS Specialist

Gary Utley, NRCS State Hydrologist

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Evaluating the Impacts of 100 – 500 Year Storms on Erosion of Cropland Soils in Caddo County, Oklahoma

Ken Matlock

NRCS State Resource Conservationist

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NRCS – What We Do . . .

- Conservation on private land
- Provide voluntary assistance (technical & financial)
- Work in partnership with locally led conservation groups

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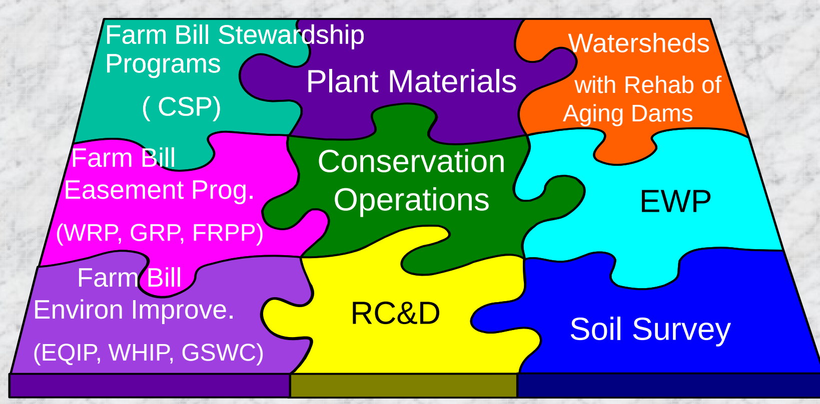
Programs to get Conservation on the Land



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Conservation Programs

- EQIP – Environmental Quality Incentives Program
- WRP – Wetland Reserve Program
- CRP – Conservation Reserve Program (FSA)
- FRPP – Farm & Ranchland Protection Program
- WHIP – Wildlife Habitat Incentives Program
- GRP – Grassland Reserve Program
- CSP – Conservation Security Program
- GSWC – Ground & Surface Water Cons. Program
- Small Watershed Program
- EWP – Emergency Protection Program

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Soil & Water Resource Issues in Oklahoma

- Soil erosion (water and wind)
- Water quantity and quality
  - Flood control
  - Water management
  - Water quality

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Erosion Control Practices

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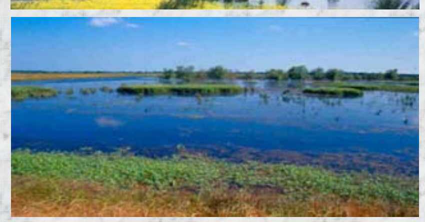
Wetland Restoration

- Benefits are numerous
- 65,000 ac. of wetlands enrolled in Oklahoma



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Conservation Buffers

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Comprehensive Nutrient Management Plans

- Unique to animal feeding operations
- CNMP's provides conservation management practices planned to address soil erosion and water quality concerns

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Everything Done in Conservation Impacts WATER

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USDA Small Watershed Program

Ironically, the USDA Small Watershed Program was a result of the 1930's Dust Bowl

The Dust Bowl Led to Increased Flooding

As Vegetative Cover was Destroyed and Streams Filled With Sediment

Flooding Devastated
Many People's Lives and Property

THE CLINTON DAILY NEWS

New Flood Warning - Torrent Racing Down Washita, Is Report

15 DEAD AND 6 MISSING IN FLOOD

Five Men, Numb With Exposure, Rescued From Tree Tops

RESCUE BOATS BATTLE WATER TO REACH MEN

MOST POPULAR STUDENTS

CLINTON STUDENTS TO TAKE PART IN FINE ARTS MEET

River Bottom Is Hunted for Flood Victims

MANY COUNTY OIL LEASES RECORDED

COUNTY CORN-HOG GROUP ORGANIZES

APPEAL FOR OLD CLOTHES ISSUED

Hammon Flood – April 1934

Flood Control Act of 1936 authorized studies

Flood Control Act of 1944 (Public Law 534) authorized 11 Watershed Projects

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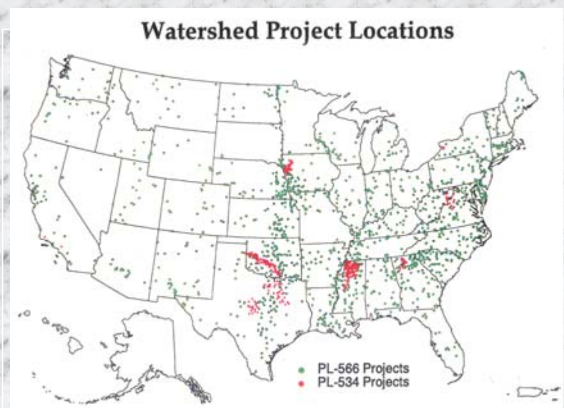
The USDA Small Watershed Program



NRCS has assisted communities build more than 11,000 dams in 2000 Watershed Projects in 47 States since 1948

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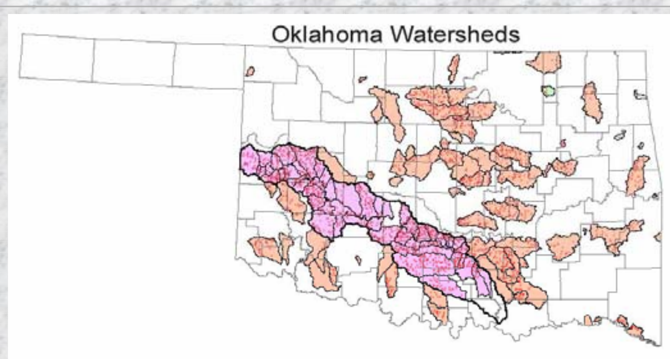
Oklahoma's Watershed Projects



2,105 Dams in 129 Projects (20% of the National Total)

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Watershed Projects Benefit Oklahoma Communities


Watershed projects provide over $75 mil. in benefits each year:

- Flood control
- Water Supply
- Erosion Control
- Recreation
- Wetland Restoration
- Wildlife Habitat




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Watershed Benefits Resulting from the 2007 Storms

$75 million → $340 million !!

Average Annual **2007**

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Watershed Flood Control Dams

"Federally- Assisted"
not
"Federally Owned"

Project Sponsors (generally conservation districts or municipalities) are responsible for obtaining landrights, operation and maintenance of the project measures

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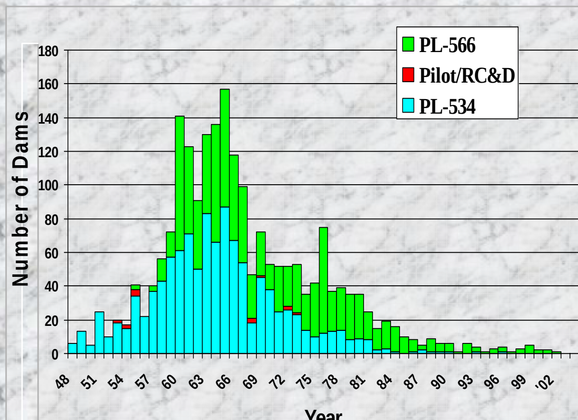
No. of Okla Watershed Dams Built Each Year



- Most watershed dams were designed with a 50 yr. design life
- 194 dams have exceeded their design life to date
- 1317 dams will exceed their design life within the next 10 yrs

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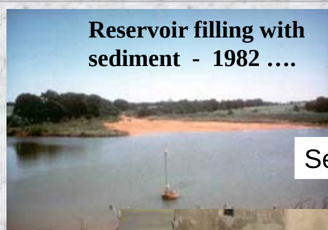
Aging Dams Need Attention !



Sedimentation

Deterioration

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Public Health & Safety Concerns

Downstream development
can put people in harms way

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Dam Failures Do Occur !

Impacts can be devastating
to people, the local economy,
and the environment

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Oklahoma Watershed Rehabilitation Status

36 rehabilitation projects funded to date

- 9 completed
- 4 under construction
- 8 designed; awaiting construction
- 23 authorized & in or awaiting design
- 2 in planning

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Terminology (used interchangeably)

- Dam
- Watershed Dam
- Structure
- Flood Water Retarding Structure (FWRS)
- Flood Control Dam

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How does a Watershed dam reduce downstream flooding???

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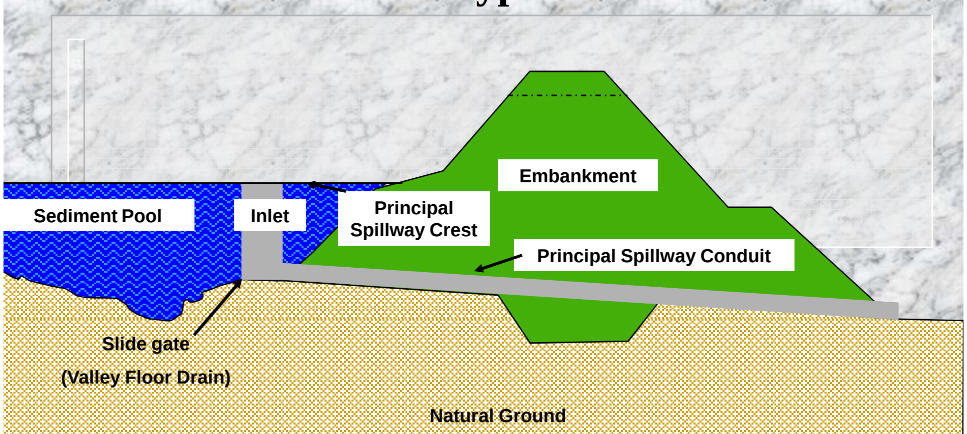
Cross-Section of Typical Flood Control Dam



Reservoir (sediment pool) provides storage for sediment for the life of the dam

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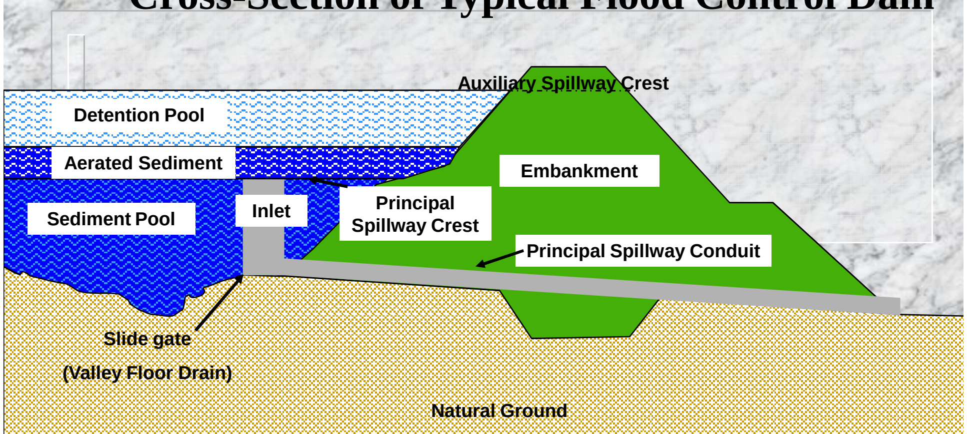
Cross-Section of Typical Flood Control Dam

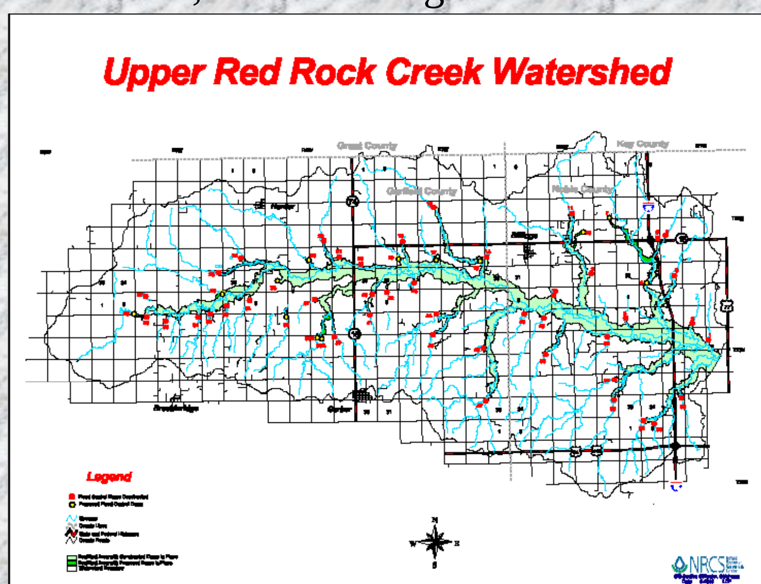


Detention storage is the functioning portion of the lake

Storm runoff is temporarily stored in the reservoir …

…and slowly discharging the storm runoff for several days.

Several dams store the floodwaters and slowly release them, thus reducing downstream flooding



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Why we need to predict "hot-spots" immediately after a large storm:

- Identify potential spillway flows
- Provide early warning for potential problems with high hazard dams
- Identify potential eligibility for Emergency Watershed Program

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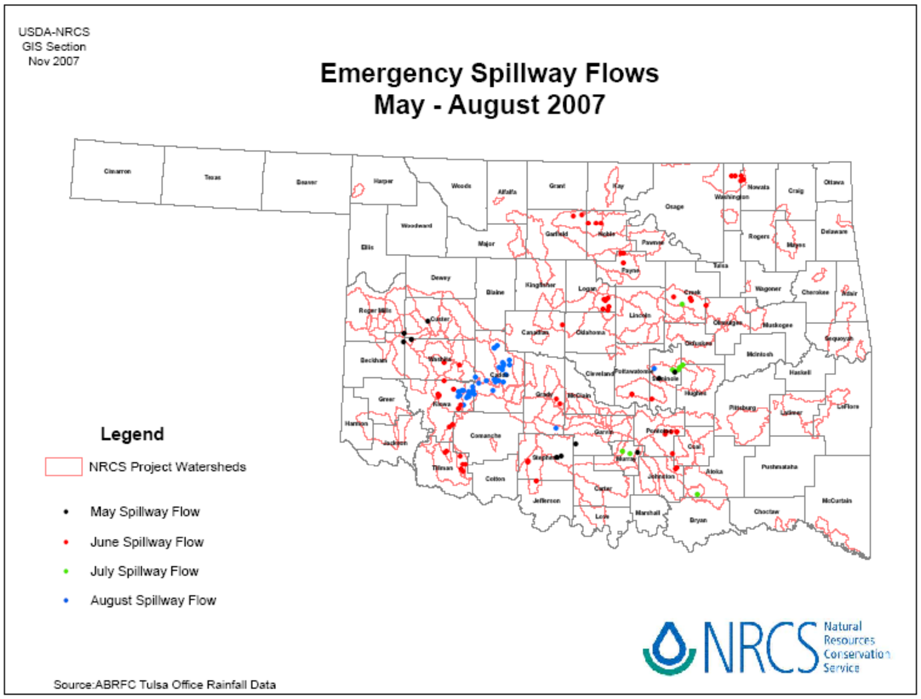
Some examples of problems resulting from the 2007 storms:

Storm Period	No. of Spwy Flows
May 4 - 9	6
May 26 - 30	5
June various dates 1 -24	10
June 26 -30	44
July 1 - 2	4
July 9 - 12	14
August 18 - 19	38
Total *	121

* 7 spillways flowed twice

Max. Depth of Spwy Flow	No. of Spwy Flows
1.0 ft or less	65
1.1 - 2.0 ft	23
2.1 - 3.0 ft	14
3.1 - 4.0 ft	5
4.1 - 5.0 ft.	2
?	12
Total *	121

*7 spillways flowed twice
3 dams actually overtopped



Of 114 Sites with reported spillway flows,
only 29 showed damage to Auxiliary Spillways

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Developing the Spillway Flow Prediction Model

Jim Henley

GIS Manager

Oklahoma NRCS

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Model Objectives

- Gather accurate rainfall data
- Query rainfall data for target areas (project dam drainage areas)
- Assign storm frequency to storm event on an individual project dam
- Develop a report showing significant rainfall on a project dam basis
- Automatically generate e-mail to NRCS State Engineer

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Collecting Rainfall Data

- Determined that the National Weather Service 4 km. grid precipitation data met our needs for both accuracy and data density
- Partnered with the Arkansas-Red River Basin River Forecast Center (ABRFC) Tulsa Office staff to work out data transfer needs
- Currently using 1 day data, but 6 hour data is available.

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National Weather Service 4 kilometer grid for Oklahoma

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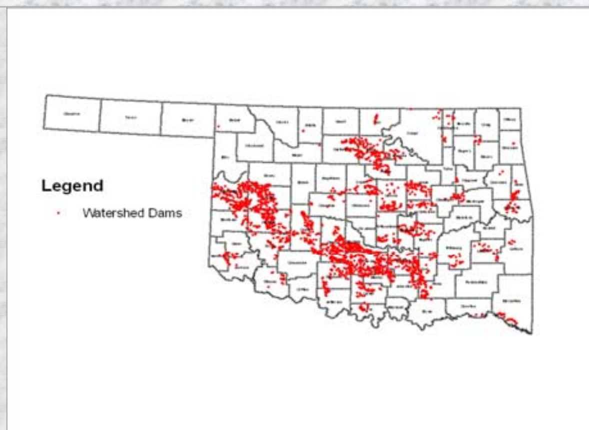
Flood Control Project Dam Locations



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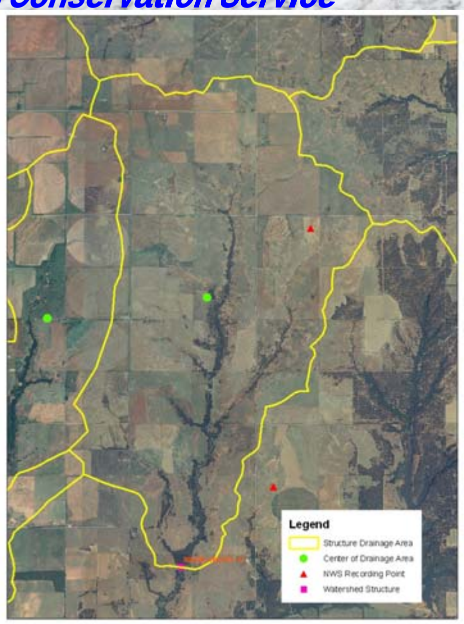
The rainfall data from the NWS 4 km grid is spatially joined with the center point of the watershed structure drainage area giving each point a 4km. grid identifier



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Query the Rainfall Data

- **The 24 hour rainfall data is downloaded daily from ABRFC**
- **The rainfall data is linked to a Microsoft Access Database**
- **An Access database join is made using the 4km. grid point identifiers joining them to the center points of the flood control dam drainage areas.**

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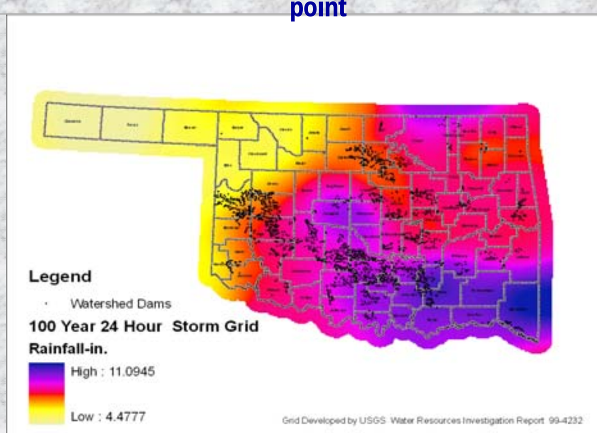
USGS grids from Report 99-4232 were used to develop tables that assign rainfall frequency and duration information to the drainage area center point



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Example of Database Query on Rainfall and Storm Frequency

DAM_NAME	COUNTY	Rainfall	1 Day Storm	12 Hour Storm	6 Hour Storm	3 Hour Storm
TONKAWA CREEK 4	CADDO	8.56	100 Year	100 Year	100 Year	500 Year
TONKAWA CREEK 8	CADDO	8.56	100 Year	100 Year	100 Year	500 Year
SUGAR CREEK 3	CADDO	8.5	100 Year	100 Year	100 Year	500 Year
SUGAR CREEK L-43	CADDO	8.5	100 Year	100 Year	100 Year	500 Year
SUGAR CREEK L-45	CADDO	8.5	100 Year	100 Year	100 Year	500 Year
SUGAR CREEK 105	CADDO	8.44	50 Year	100 Year	100 Year	500 Year
SUGAR CREEK 31	CADDO	8.44	50 Year	100 Year	100 Year	500 Year
SUGAR CREEK 23	CADDO	8.43	50 Year	100 Year	100 Year	500 Year
FORT COBB LATERALS 7	CADDO	8.41	100 Year	100 Year	100 Year	500 Year
COBB-FAST RUNNER 3	CADDO	8.41	50 Year	100 Year	100 Year	500 Year
COBB-FAST RUNNER 2	CADDO	8.41	50 Year	100 Year	100 Year	500 Year
SUGAR CREEK 4-A	CADDO	8.36	50 Year	100 Year	100 Year	500 Year
FORT COBB LATERALS 10	CADDO	8.32	50 Year	100 Year	100 Year	500 Year
SUGAR CREEK 21	CADDO	8.3	50 Year	100 Year	100 Year	500 Year
SADDLE MOUNTAIN CREEK 7	KIOWA	8.24	100 Year	100 Year	100 Year	500 Year
SUGAR CREEK L-44	CADDO	8.23	50 Year	100 Year	100 Year	500 Year
FORT COBB LATERALS 9	CADDO	8.17	50 Year	100 Year	100 Year	500 Year
FORT COBB LATERALS 11	CADDO	8.17	50 Year	100 Year	100 Year	500 Year
IONINE CREEK 102	GRADY	8.13	50 Year	100 Year	100 Year	500 Year
IONINE CREEK 101	GRADY	8.13	50 Year	100 Year	100 Year	500 Year
SUGAR CREEK 38	CADDO	8.13	50 Year	100 Year	100 Year	500 Year
FORT COBB LATERALS 12	CADDO	8.06	50 Year	100 Year	100 Year	500 Year

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A Microsoft Word report is generated within Access listing flood control project dams that have experienced at least a three hour duration two year frequency storm. This report is attached to an automatically generated e-mail to the NRCS State Engineer.

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Example Storm Report

Project Dam Rainfall and Storm Frequency Report
August 18, 2007

DAM NAME	COUNTY	Rain	1 Day Storm	12 Hr. Storm	6 Hr. Storm	3 Hr. Storm
SADDLE MOUNTAIN CREEK 5	KIOWA	12.9	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 12	KIOWA	12.78	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 2	KIOWA	12.78	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 3	CADDO	12.36	500 Year	500 Year	500 Year	500 Year
FORT COBB LATERALS 1	CADDO	11.79	500 Year	500 Year	500 Year	500 Year
FORT COBB LATERALS 2	CADDO	11.56	500 Year	500 Year	500 Year	500 Year
FORT COBB LATERALS 101	CADDO	11.56	500 Year	500 Year	500 Year	500 Year
COWDEN LATERALS 12	CADDO	10.95	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 11	KIOWA	10.93	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 4	KIOWA	10.93	500 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 10	KIOWA	10.93	500 Year	500 Year	500 Year	500 Year
COWDEN LATERALS 11	CADDO	10.29	100 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 6	KIOWA	10.14	500 Year	500 Year	500 Year	500 Year
SPRING CREEK 2	CADDO	10.01	100 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 1	KIOWA	9.61	100 Year	500 Year	500 Year	500 Year
SADDLE MOUNTAIN CREEK 101	KIOWA	9.61	100 Year	500 Year	500 Year	500 Year
SUGAR CREEK 40	CADDO	9.58	100 Year	500 Year	500 Year	500 Year
COWDEN LATERALS 14	CADDO	9.47	100 Year	500 Year	500 Year	500 Year
COWDEN LATERALS 13	CADDO	9.47	100 Year	500 Year	500 Year	500 Year
SUGAR CREEK L-46	CADDO	9.29	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 1	CADDO	9.29	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 35	CADDO	9.18	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 36	CADDO	9.18	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 102	CADDO	9.18	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 210	CADDO	9.11	100 Year	100 Year	500 Year	500 Year
SUGAR CREEK 103	CADDO	9.09	100 Year	100 Year	500 Year	500 Year

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Emergency Watershed Protection Program (EWP)

- **Rainfall Data can also be used to identify storm events that meet thresholds for the EWP program**
- **Identify impacted watersheds and county locations so county commissioners can be contacted to access damages**
- **Results in quicker response to large storm events. Can help obligate federal assistance dollars quicker.**

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Oklahoma 10 Digit Hydrologic Unit Watersheds

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24 hour Storm by Watershed

Lat	Lon	HUC_10	Watershed	COUNTY	Town	Dist_Town	Rainfall	Frequency	ID
34.9465	-98.6452	111303020	City of Anadarko-Washita River	Kiowa	Alden	3.915149927	12.9	500 Year	313729
34.9824	-98.6403	111303020	City of Anadarko-Washita River	Kiowa	Alden	3.122610092	12.78	500 Year	314780
34.9146	-98.6938	111303020	City of Anadarko-Washita River	Kiowa	Alden	7.418710232	12.43	500 Year	312677
35.0143	-98.5916	111303020	City of Anadarko-Washita River	Caddo	Alden	2.722790003	12.38	500 Year	315832
34.9784	-98.5965	111303020	City of Anadarko-Washita River	Caddo	Alden	0.653859019	12.36	500 Year	314781
34.9106	-98.6501	111303020	City of Anadarko-Washita River	Kiowa	Alden	5.787360191	12.22	500 Year	312678
35.0461	-98.5428	111303020	City of Anadarko-Washita River	Caddo	Carnegie	5.264160156	12.12	500 Year	316884
34.9505	-98.689	111303020	City of Anadarko-Washita River	Kiowa	Alden	6.075479984	12.06	500 Year	313728
35.0102	-98.5478	111303020	City of Anadarko-Washita River	Caddo	Alden	3.217959881	11.91	500 Year	315833
35.0502	-98.5867	111303020	City of Anadarko-Washita River	Caddo	Carnegie	3.833280087	11.79	500 Year	316883
35.082	-98.5379	111303020	City of Anadarko-Washita River	Caddo	Carnegie	4.000999928	11.56	500 Year	317935
35.0183	-98.6355	111303020	City of Anadarko-Washita River	Kiowa	Alden	4.095620155	11.38	500 Year	315831
35.7623	-98.3975	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	2.564970016	11.37	500 Year	337905
35.7262	-98.4027	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	1.385859966	11.35	500 Year	336854
34.9425	-98.6015	111302020	Upper East Cache Creek	Caddo	Alden	2.458009958	11.35	500 Year	313730
35.7581	-98.353	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	2.463959932	11.17	100 Year	337906
35.7942	-98.3478	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	4.846620083	10.99	100 Year	338957
35.1139	-98.489	111303020	City of Anadarko-Washita River	Caddo	Fort Cobb	3.180860043	10.95	100 Year	318987
34.9864	-98.6841	111303020	City of Anadarko-Washita River	Kiowa	Alden	5.601230145	10.93	500 Year	314779
35.69	-98.4078	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	3.170079947	10.89	100 Year	335803
34.9743	-98.5527	111302020	Upper East Cache Creek	Caddo	Alden	1.844740033	10.79	100 Year	314782
35.6983	-98.4967	110902010	Town of Bridge Port-Canadian River	Blaine	Greenfield	6.947050095	10.68	100 Year	335801
35.6942	-98.4523	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	4.788469791	10.64	100 Year	335802
35.722	-98.3582	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	1.205160022	10.63	100 Year	336855
35.7345	-98.4916	111003010	Town of Calumet-North Canadian River	Blaine	Greenfield	6.342040062	10.63	100 Year	336852

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NWS Rainfall Data - How can we use it ?

Statewide Analysis

- **Emergency Response (EWP)**
- **Irrigation Water Management**

Watershed / Structure Analysis

- **Develop Watershed Benefits by Storm**
- **Run Daily Water Budget to Predict AS Flows**

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Developing Watershed Benefits by Storm

Goal : Develop an automated model that uses daily rainfall data to compute the economic benefits provided by each FWRS should a storm occur. The model will also accumulate results, generate reports of economic benefits, and Email them to all responsible parties.

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Developing Watershed Benefits by Storm

General Procedure Using Excel Macros

- Load and Archive NWS 24-HR Rainfall by FWRS
- Interpolate Storm Frequency using USGS-DDF Curves
- Generate Benefits of FWRS using Economic Tables
- Adjust Benefits by Drainage Area Controlled
- Accumulate Benefits by Category
- Develop, Save, & Email Needed Reports

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Benefits Can Be Accumulated & Reported by :

Individual Watersheds

Project > Pilot - PL-534 - PL-566 - RC&D

Various Legal Boundaries :

- County Boundaries
- Conservation Districts
- Congressional Districts

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Developing Watershed Benefits by Storm

Challenges :

- Model is Data Intensive
- Rainfall Events seldom cooperate and occur within a single reporting period (GMT)
- Economic Data changes over time

Input Data to Model will be Updated as Needed

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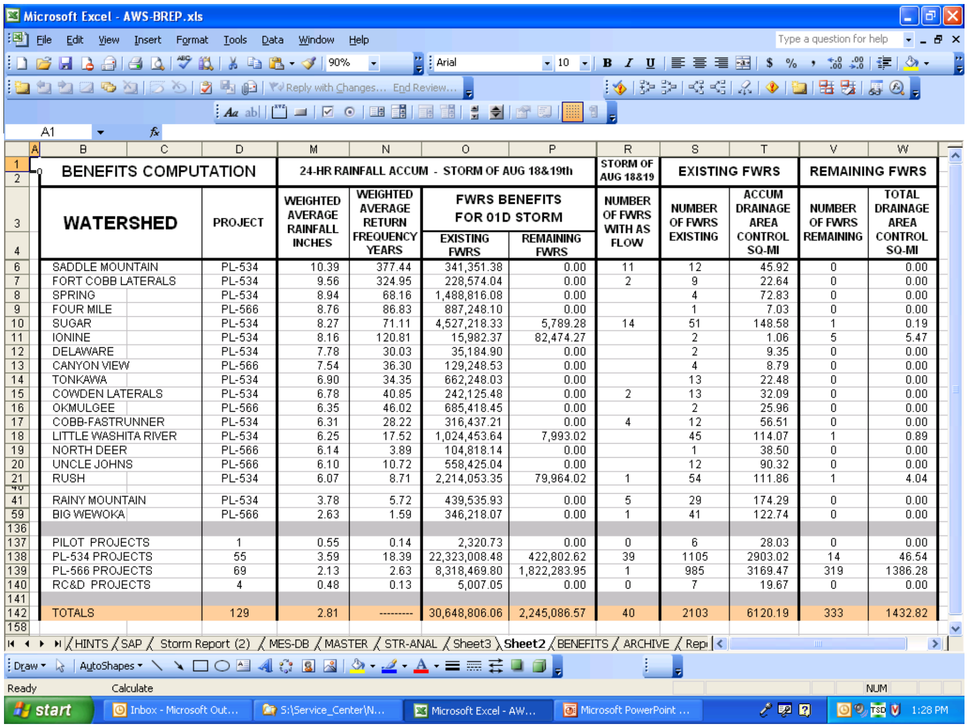
Developing Watershed Benefits by Storm

Future Enhancements :

- Running Total of Year-to-Date Benefits
- Running Total of last 3-Day & 7-Day Benefits
- Ability to compute and accumulate benefits for any historical storm of any duration using archived NWS rainfall data



	BENEFITS COMPUTATION		24-HR RAINFALL ACCUM - STORM OF AUG 18&19th				STORM OF AUG 18&19	EXISTING FWRS		REMAINING FWRS	
	WATERSHED	PROJECT	WEIGHTED AVERAGE RAINFALL INCHES	WEIGHTED AVERAGE RETURN FREQUENCY YEARS	FWRS BENEFITS FOR 01D STORM: EXISTING FWRS	FWRS BENEFITS FOR 01D STORM: REMAINING FWRS	NUMBER OF FWRS WITH AS FLOW	NUMBER OF FWRS EXISTING	ACCUM DRAINAGE AREA CONTROL SQ-MI	NUMBER OF FWRS REMAINING	TOTAL DRAINAGE AREA CONTROL SQ-MI
6	SADDLE MOUNTAIN	PL-534	10.39	377.44	341,351.38	0.00	11	12	45.92	0	0.00
7	FORT COBB LATERALS	PL-534	9.56	324.95	228,574.04	0.00	2	9	22.64	0	0.00
8	SPRING	PL-534	8.94	68.16	1,488,816.08	0.00		4	72.83	0	0.00
9	FOUR MILE	PL-566	8.76	86.83	887,248.10	0.00		1	7.03	0	0.00
10	SUGAR	PL-534	8.27	71.11	4,527,218.33	5,789.28	14	51	148.58	1	0.19
11	IONINE	PL-534	8.16	120.81	15,982.37	82,474.27		2	1.06	5	5.47
12	DELAWARE	PL-534	7.78	30.03	35,184.90	0.00		2	9.35	0	0.00
13	CANYON VIEW	PL-566	7.54	36.30	129,248.53	0.00		4	8.79	0	0.00
14	TONKAWA	PL-534	6.90	34.35	662,248.03	0.00		13	22.48	0	0.00
15	COWDEN LATERALS	PL-534	6.78	40.85	242,125.48	0.00	2	13	32.09	0	0.00
16	OKMULGEE	PL-566	6.35	46.02	685,418.45	0.00		2	25.96	0	0.00
17	COBB-FASTRUNNER	PL-534	6.31	28.22	316,437.21	0.00	4	12	56.51	0	0.00
18	LITTLE WASHITA RIVER	PL-534	6.25	17.52	1,024,453.64	7,993.02		45	114.07	1	0.89
19	NORTH DEER	PL-566	6.14	3.89	104,818.14	0.00		1	38.50	0	0.00
20	UNCLE JOHNS	PL-566	6.10	10.72	558,425.04	0.00		12	90.32	0	0.00
21	RUSH	PL-534	6.07	8.71	2,214,053.35	79,964.02	1	54	111.86	1	4.04
41	RAINY MOUNTAIN	PL-534	3.78	5.72	439,535.93	0.00	5	29	174.29	0	0.00
59	BIG WEWOKA	PL-566	2.63	1.59	346,218.07	0.00	1	41	122.74	0	0.00
136											
137	PILOT PROJECTS	1	0.55	0.14	2,320.73	0.00	0	6	28.03	0	0.00
138	PL-534 PROJECTS	55	3.59	18.39	22,323,008.48	422,802.62	39	1105	2903.02	14	46.54
139	PL-566 PROJECTS	69	2.13	2.63	8,318,469.80	1,822,283.95	1	985	3169.47	319	1386.28
140	RC&D PROJECTS	4	0.48	0.13	5,007.05	0.00	0	7	19.67	0	0.00
141											
142	TOTALS	129	2.81	---------	30,648,806.06	2,245,086.57	40	2103	6120.19	333	1432.82

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Watershed Benefits - Year-to-Date

Watershed Monetary Benefits (Millions)				10/12/2007
Benefits (2105 Dams in place)				
	May & June	July	August	Total 2007
Agriculture	153.5	10.6	16.2	180.3
Non-Agriculture	136.5	9.4	14.4	160.3
Totals	290	20	30.6	340.6
Foregone Benefits (330 Dams not built)				
	May & June	July	August	Total 2007
Agriculture	24.4	0.8	1.2	26.4
Non-Agriculture	21.6	0.7	1.1	23.4
Totals	46	1.5	2.3	49.8

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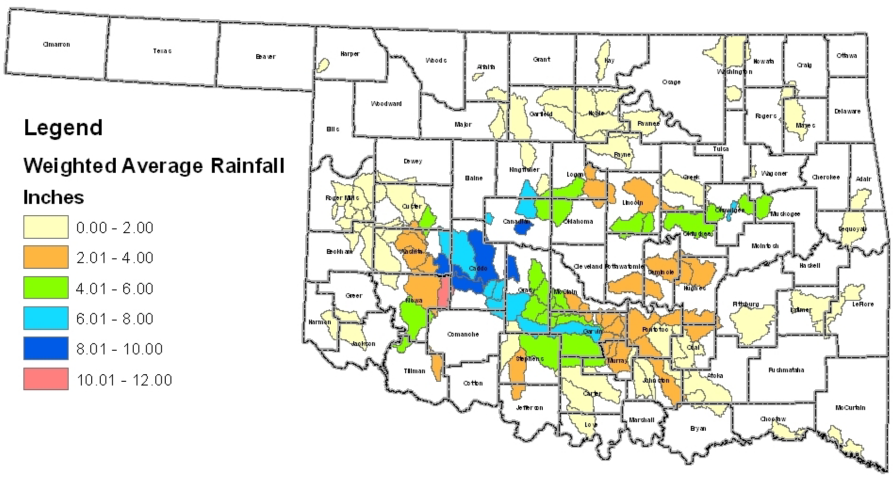
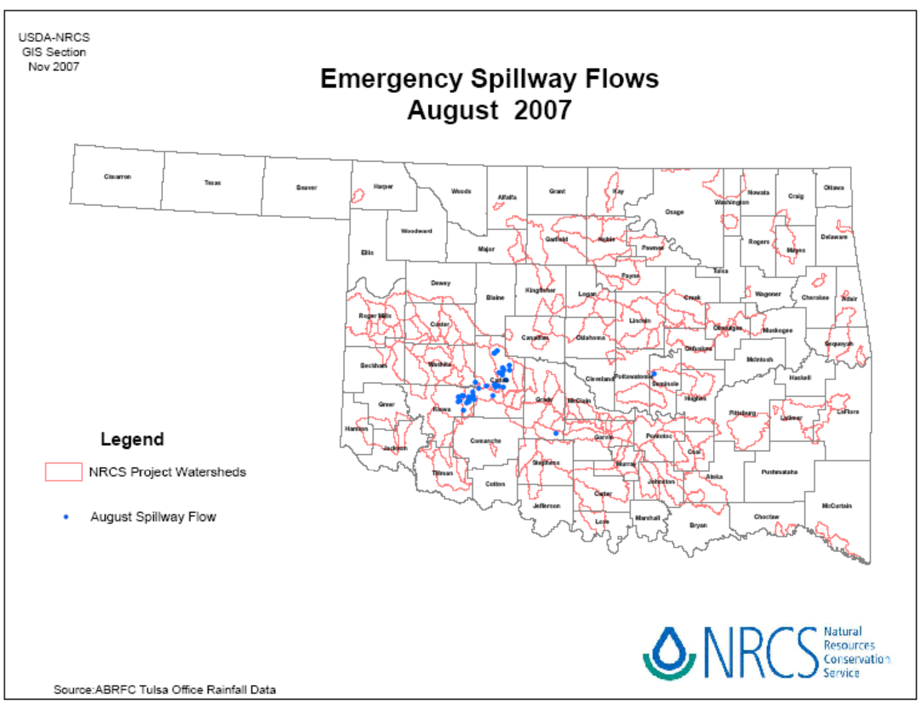
Weighted Average Rainfall by Watershed – AUG/18-19/2007





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Predicting Auxiliary Spillway Flows

- The majority of NRCS auxiliary spillway flows occur as a result of multiple waves of storms occurring within a short duration. (With the possible exception of this year)
- In order to develop a model that accurately predicts auxiliary spillway flow, it is necessary to consider the status of each structure at the start of each storm event.

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Run Daily Water Budget to Predict AS Flows

Goal : Develop an automated model that uses NWS 24-HR rainfall data to run a daily water budget for each FWRS. The model will compute percent capacity full and predict auxiliary spillway flow. The model will also generate reports of predicted flows and Email them to all responsible parties.

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Run Daily Water Budget to Predict AS Flows

General Procedure using Excel (For Each FWRS)

- Load Archived SAP (Storage Accumulation as % of Total)
- Load and Archive Daily Rainfall
- Generate Runoff Curve Number based on AMC
- Compute Volume of Existing Storage in FWRS from SAP
- Compute Volume of Storm Runoff using CN Method
- Compute Volume of Direct RF based on Surface Area
- Compute Volume of Discharge From Principle Spillway
- Compute Water Budget – Compute & Archive New SAP
- Develop, Save, & Email Needed Reports

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Run Daily Water Budget to Predict AS Flows

Challenges :

- Model is Data Intensive
- Output from Principle Spillway is Difficult to Model
- Is Spring Flow - Base Flow - Seepage Significant ?
- Is Base Data (RCN, DA, SA, Qps) for all FWRS Correct ?
- Is the Original Detention Storage Volume Data Correct ?
- Has Excess Sedimentation occurred in Detention Pool ?

<< Input Data to Model will be Adjusted as Needed >>

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Run Daily Water Budget to Predict AS Flows

Future Enhancements :

The NWS has forecasted rainfall models available for the 06, 12, 18, and 24 hour future periods as well as a running total rainfall for the current day.

In addition to having the ability to compute the existing conditions at each site, the use of these forecasted rainfall models would allow NRCS to predict future conditions at each FWRS and monitor and/or respond as needed.

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Example of Predicted AS Flow Report

10-18-2007 - RESULTS OF AUXILIARY SPILLWAY (AS) FLOW PREDICTIVE MODEL

STARTING 1017@0600 % FULL	SITE LOCATION WATERSHED NAME	FWRS #	COUNTY NAME	CURRENT STATUS 1018 @ 0600 RAINFALL	% FULL	12-HR PROJECTION 1018 @ 1800 RAINFALL	% FULL	24-HR PROJECTION 1019 @ 0600 RAINFALL	% FULL
5.2	JACK	XX	TILLMAN	7.90	102.3	1.34	105.0	0.06	99.6
34.3	UNCLE JOHN	XX	KINGFISHER	4.95	85.3	3.12	110.0	1.10	112.2
15.5	DOUBLE	XX	WASHINGTON	1.85	30.8	3.32	77.7	3.42	107.8

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Caddo County - Storm of Aug 18-19, 2007

Soil Erosion

Sugar Creek near Gracemont

Soil Deposition

Washita River Floodplain near Washita

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Evaluating the Impacts of 100 – 500 Year Storms on Erosion of Cropland Soils in Caddo County, Oklahoma

Ken Matlock
State Resource Conservationist
Oklahoma NRCS

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Evaluation Tools for Erosion

- What is available for evaluating potential impacts from rainfall events?

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Cropland Soil Erosion

- Types of erosion
  - Sheet and Rill
  - Ephemeral Gully

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Sheet and Rill Erosion

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Revised Universal Soil Loss Equation v.2

- **NRCS uses the Revised Universal Soil Loss Equation v.2 (RUSLE2) as a tool to predict soil loss occurring from sheet and rill erosion on cropland. These soil loss rates are calculated on a tons per acre per year basis (T/AC/Yr).**

- **The RULSE2 model is designed to predict an average soil loss erosion rate occurring over a long term period at the field level using onsite factors.**

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RUSLE2 Factors

- R – Rainfall/Runoff
  - ➔ Rainfall amount, duration and intensity
- K – Soil Erodibility
  - ➔ How easily the soil particles are detached or separated
- L – Length of Slope
  - ➔ The length of overland flow of runoff until it reaches a defined channel or deposition occurs
- S – Percent Slope
  - ➔ The actual slope steepness of the site
- C – Cover Management
  - ➔ Type, condition and management of plant or residue cover on the soil surface
- P – Support Practices
  - ➔ Contouring, Terraces, Buffers etc.

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Revised Universal Soil Loss Equation v.2

- RUSLE2 should not be used to predict erosion rates from individual storm events.
- RUSLE2 <u>may</u> be considered to estimate sheet and rill erosion based on average factors from areas larger than normal field size.

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Ephemeral Gully Erosion on Cropland

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Predicting Ephemeral Gully Erosion on Cropland

- RUSLE2 is not designed to predict or estimate ephemeral gully erosion.
- Calculations for gully erosion are by volume and are usually derived visually on site.
- Predicting potential ephemeral gully erosion may be done using rainfall and slope information in the watershed.

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Ephemeral Gully Erosion on Cropland

- **Ephemeral gully erosion is dependent on the concentrated overland flow of water.**
  - Rainfall amounts, steepness of slope, and soil hydrologic groups are dominant factors.
  - The soil erodibility and crop/tillage management play a much smaller role.

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Predicting Ephemeral Gully Erosion on Cropland

- We can use remote assessment GIS tools to help identify areas in the watershed where cropland ephemeral gully erosion (hotspots) may occur from major storm events.
- For example, using Caddo county, we can identify landuse, determine land slopes, plot rainfall amounts and identify soil type on a watershed basis to develop priority areas where potential erosion may occur as well as where conservation practices may be needed or (residue management, terraces, waterways, and ponds) may need rebuilding and/or repair.

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Evaluation Tools for Erosion

On August 18, 2007 Caddo County experienced a storm event ranging from a 100 year to 500 year frequency across the county.

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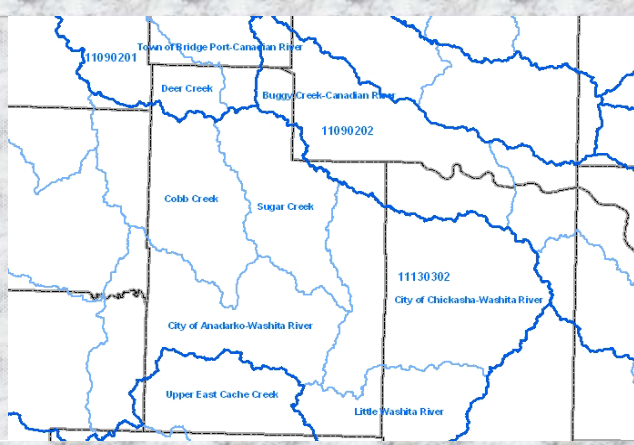
Caddo County Sub-basins and Watersheds



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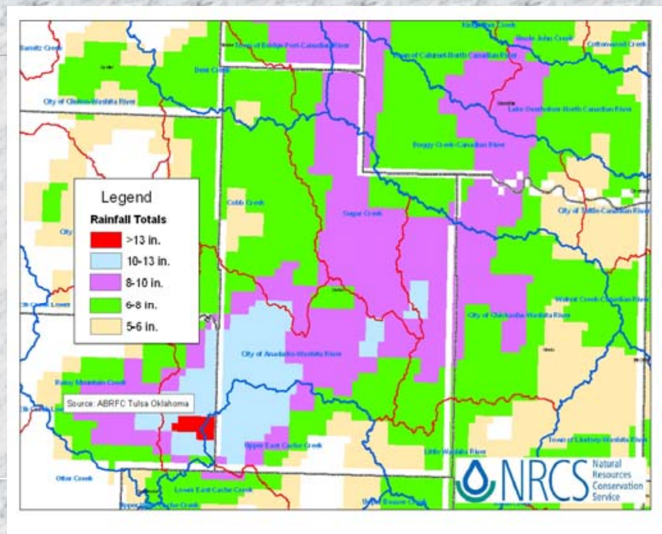
Rainfall Amounts



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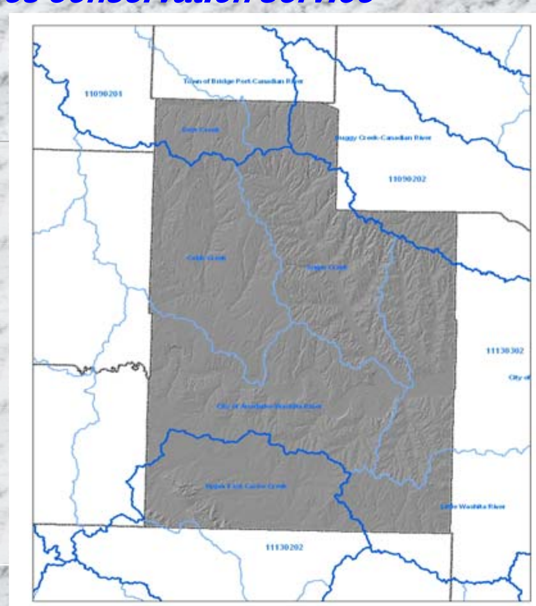
Hillshade developed from elevations in Caddo county. This gives a good generalized look at drainage and slopes.



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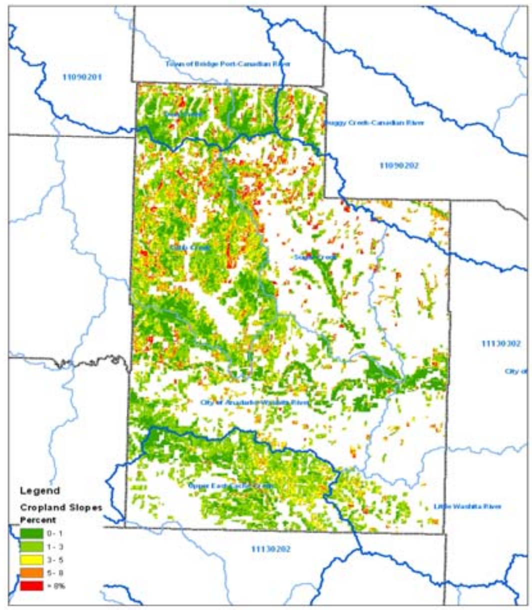
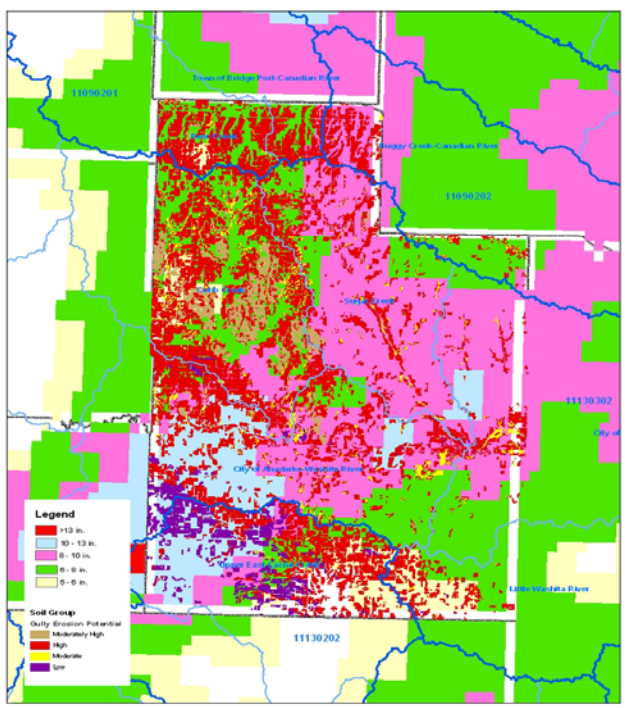
Slopes on cropland fields developed from 30 meter National Elevation Dataset



Soil gully erosion potential overlaying rainfall data providing potential gully erosion and soil deposition



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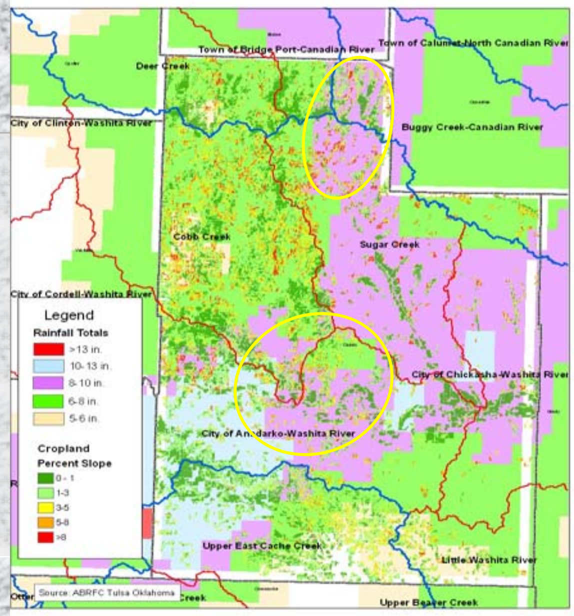
Cropland slope with rainfall amounts Yellow circles show combinations of rainfall and slopes that have a high potential for developing ephemeral and gully erosion



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Predicting Ephemeral and Gully Erosion on Cropland

- Based upon this analysis using the GIS remote assessment tool, the Cobb Creek watershed, the upper end of the Sugar Creek watershed, and the Buggy Creek watershed all have a high potential for cropland erosion damage from this storm event


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Helping People Help the Land
Our Vision
Productive Lands –
Healthy Environment
NRCS
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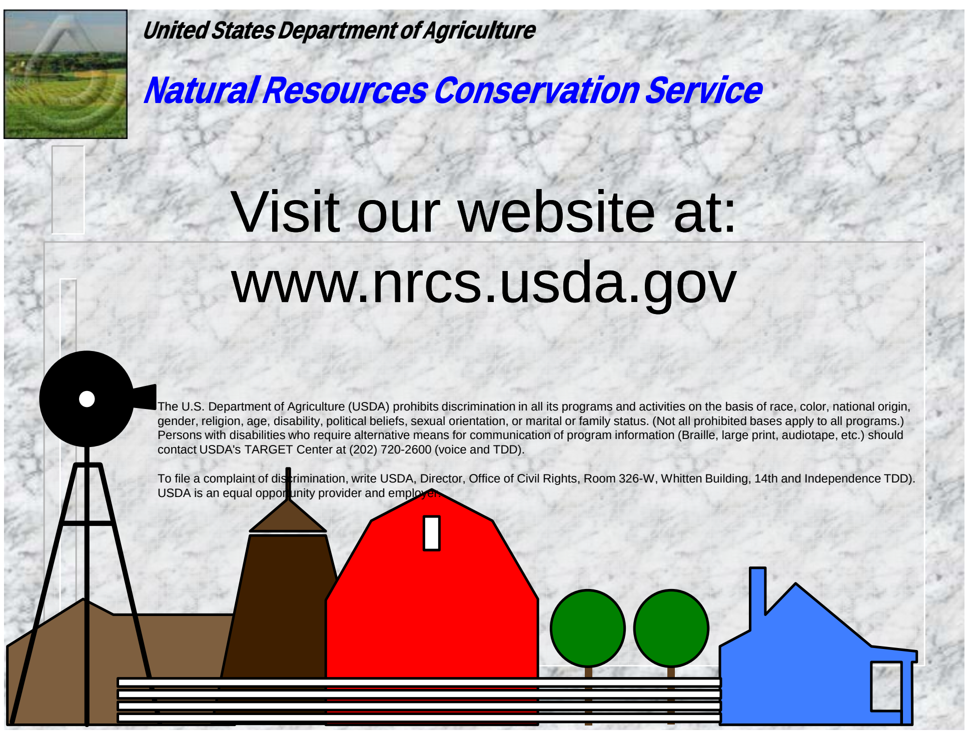
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Any Burning Questions?