Colorado Water Conservation Board
1997 Colorado Flood Documentation
Technical Addendum

Section II, County Specific Information, Subsections A - G

Riverside Technology, inc.
July 1998

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	5/8/98
Call Placed/Received by:	Bill Owen
Spoke With:	Tom Magnuson
Company/Affiliation:	Pueblo NWS
Phone no.:	(719) 948-3838
Project No.:	D479-52

Comments:

Spoke with Tom about NWS spotter data his office might have collected during the August 1997 storms in SE Colorado. He provided the following list:

- A flash flood warning was issued for Baca County along Hwy 116 on August 5
- The night of August 5 through the morning of August 6 appears to be the period with the most activity. The following are reported rainfall during this period:

  Holly (Prowers County): 3.0 - 3.25 inches
  Sheridan Lake (Kiowa): 5.0 - 6.0
  Kim ? (Las Animas): approx. 2.0
  John Martin Dam (Bent): approx. 1.0
  Brandan (Kiowa): 2.75 -5.0
  Eads (Kiowa): 2.5
  Haswell (Kiowa): 1.3
  Lamar (Prowers): 2.1
  Ordway (Crowley): 1.5
  Sugar City (Crowley): 2.9

- Nothing on August 7 or 9
- August 13:

  6 miles S of Springfield (Baca County): 0.7 inches
  Hastee (Bent): 3.0 (early morning storm)
  Fowler (Otero): 0.8

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/8/98
Call Placed/Received by: Bill Owen
Spoke With: Dan Neuhold
Company/Affiliation: CO Dept. of Nat'l Resources Water Commissions, Dist. 66+67
Phone no.: (719) 336-5364
Project No.: D479-56

Comments:

District 67 - Big Sandy Creek
↳ no significant diversions on this creek

District 66 - Carrizo Creek + Cimarron River
↳ one significant water right
John B. Moya Ditch → located West Carrizo Creek
headgate @ Section 27, T32S, R53W
↳ irrigates approx. 20 acres of alphalfa
water right of 7.5 cfs (creek normally runs @ 3 cfs on average)

Don Taylor is Water Commissioner in District 67 (in Lamar)
Signature Bill Owen

↳ (719) 384-1000 (W)
384-5103 (H)
250-1655 (cell)

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/1/98
Call Placed/Received by: Bill Owen
Spoke With: Dana Christie, Baca County Commissioners office
Company/Affiliation:
Phone no.: 719-523-4021
Project No.: D479-56

Comments:

- does not know of any previous or future mitigation projects
- flooding occurs frequently down in the canyon country of Carrizo Creek; water mostly washes over concrete road slabs in gullies + other creek crossings
- Two Butte flooded 1st time since 1965
- Springfield seldom floods because it lies between two creeks (Bear Creek tribs of watershed
- County shop phone numbers:
  1) Two Butte: 719-326-5921
  2) Campo: 719-787-2433 → milo, wheat, corn grown in Baca
  3) Pritchett: 719-523-4021
- County Sheriff's office: 719-523-6677 → do emergency response efforts they were aware of

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/7/98
Call Placed/Received by: Bill Owen
Spoke With: Clarence Stevenson
Company/Affiliation: Baca County shop - Prichett
Phone no.: (719) 523-4021
Project No.: D479 - 52

Comments:

Mr. Stevenson said he would send us copies of the reports that specified what repairs and associated costs Baca County had to incur due to the flooding in the summer of 1997. In addition, he was going to look for some pictures that he or other county personnel might have taken of the flooding damage.

Signature Bill Owen

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Bill Owen
DATE: 4/7/98

SUBJECT: 1997 Flooding

INDIVIDUAL:
AFFILIATION: Baca Co. Commioners
(Charles Waite, Don Self) → 523-6775
PHONE #: (719) 523 - 4521

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1. *Affected streams and local drainages?*

   Carizzo Creek (near Road M) and Walsh Area

2. *Geographic extent of flooding?*

   Check the FEMA reports for this information

3. *Storm duration? Starting time and ending time of major storm event?*

   Approximately 12 hours

4. *Rainfall amounts? Extent of rainfall?*

   9 inches near Caizzo Creek (approximatley 25 miles SW of Pritchett)
   5 inches 7 miles south of Walsh
   5 inches 7 miles SE of Walsh

5. *Rainfall bucket surveys?*

   No

6. *Precipitation gauging network?*

   No

7. *Documentation of high water marks?*

   Ask the foreman (Clarence Stevenson) at the County shop (719-523-4021); FEMA may have some info'

8. *Estimated peak discharges?*

9. *Estimated flood damages?*

10. *Costs associated with the clean-up effort? Differentiate between local, state, and federal.*

    Approximately $68,000 of repairs

11. *Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.*

12. *Types and amounts of repair work after flooding?*

    Road M (4.4 from county line); particularly where it crossed an unnamed wash

13. *Any previous/recent flood mitigation efforts that reduced damages?*

    No

14. *Any future mitigation needs as a result of the flooding?*

    No

15. *Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?*

16. *Do you have any photos and/or video available? Are the photos in digital format?*

    Ask Stevenson

17. *Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.*

    Check FEMA

18. *Are maps in hardcopy or digital format? (GIS, Autocad, etc.)*

19. *Is there any existing documentation regarding the flooding?*

    Check FEMA

20. *Name of local newspaper? Do they have a web site?*

    Plainsman Herld; No.

21. *Do you have an internet site? Do you know of any related local sites?*

    None that they know of

2. Federal Data

Ok District Phone # 405 - 843 - 7570

Search Results

Found 8 stations.

Station Number	Station Name	County	Hydrologic Unit Code	Basin Name
07154500	Cimarron River Near Kenton, Ok	Cimarron	11040001	Cimarron Headwaters
07154650	Tesesquite Creek Near Kenton, Ok	Cimarron	11040002	Upper Cimarron
07155000	Cimarron River Ab Ute Creek Nr Boise City, Ok	Cimarron	11040002	Upper Cimarron
07155100	Cold Springs Creek Near Wheeless, Ok	Cimarron	11040002	Upper Cimarron
07155500	Cimarron River Near Boise City, Ok	Cimarron	11040002	Upper Cimarron
07155510	Flagg Springs Trib Near Boise City, Ok	Cimarron	11040002	Upper Cimarron
07232250	Beaver River Near Felt, Ok	Cimarron	11100101	Upper Beaver
07232650	Aqua Frio Creek Near Felt, Ok	Cimarron	11100103	Coldwater

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

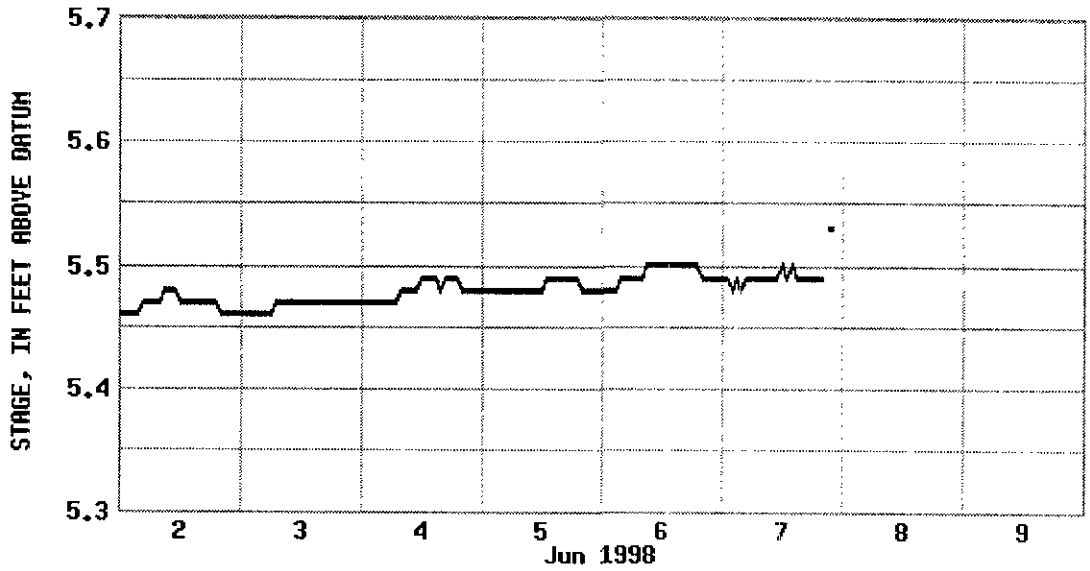
Peakflow data is now available up to WY 1996.

The NWIS-W server's official URL is now http://waterdata.usgs.gov/nwis-w/

Go to the Oklahoma NWIS-W Data Retrieval page
Go to the Oklahoma Water Resources page
Get help with the terms used on these pages
Other states with USGS surface-water data retrieval pages

Comments and questions are welcome! Please visit our feedback page or email h2oteam@qvarsx.er.usgs.gov.

This page was created in real time by the NWIS-W package: (NWIS-W: 3.01pr ; API: 3.0pr ; textsearch: 3.0pr)



- Data used in graph
- Historical daily mean or peakflow data for this station

Station Description

```
STATION.--07154500  CIMARRON RIVER NEAR KENTON, OK
LOCATION.--Lat 36 55'36", long 102 57'31", in SW 1/4 sec.4, T.5 N., R.1 E., Cimarr
   County, Hydrologic Unit 11040001, near right bank on downstream side of pier of
   county road bridge, 1.5 mi upstream from North Carrizo Creek, 1.7 mi northeast
   Kenton, 2.2 mi downstream from Carrizozo Creek, and at mile 594.0.
DRAINAGE AREA.--1,106 mi2, of which 68 mi2 is probably noncontributing.
PERIOD OF RECORD.--April 1904 to July 1905 (gage heights only), October 1950 to
   current year.
REVISED RECORDS.--WSP 1711:  1956 (M).
GAGE.--Water-stage recorder.  Datum of gage is 4,262.08 ft above sea level.  April
   1904 to July 1905 nonrecording gage at site 0.9 mi upstream at different datum.
   Oct. 1, 1950 to Sept. 19, 1967, water-stage recorder at same site and at datum
   5.00 ft higher.
REMARKS.--Records fair. Extensive diversions for irrigation upstream from station.
```

Daily Mean Flow Statistics for 06/08 based on 46 years of record, in ft³/s

Latest flow 06/07 21:30	Minimum	Mean	Maximum	80 percent exceedance	50 percent exceedance	20 percent exceedance
0.1	0.0	45	1,590	0.0	0.42	15

Percent exceedance means that 80, 50, or 20 percent of all daily mean flows for 06/08 have been greater than the the value shown.

Flood thresholds

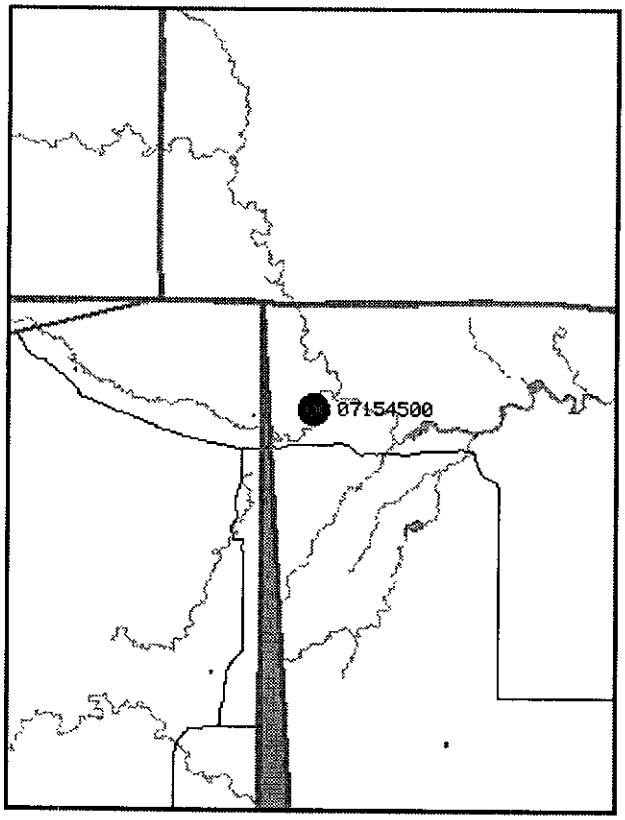
Flow (ft³/s)	Stage (ft)
---	20.0

<http://wwwok.cr.usgs.gov/rt-cgi/gen_tbl_pg>
Return to the Oklahoma District Home Page.

Map of region surrounding Cimarron River Near Kenton, Ok

This map is provided by the US Census Tiger Mapping Server.

Another interface to this service is provided by USGS Mapping Information server.



LEGEND

State
County
Lake/Pond/Ocean
Expressway
Highway
Connector
Stream
Military Area
National Park
City
County

Scale 1:438775 0 5 10 15 mi
0 5 10 15 20 25 km
*average--true scale depends on monitor resolution

Zoom Out || Zoom In

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We

Cimarron R Nr Elkhart, Ks

Station Information

Station Number	Latitude (ddmmss)	Longitude (dddmmss)	County	Basin Name	Drainage Area (miles^2)	Datum (ft above NGVD)
07155590	370730	1015350	Morton	Upper Cimarron	2899.00	3381.89

Data Types Available

- Historical Streamflow Daily Values
- Peak Flow
- Map of region surrounding station
- Current Conditions Data
- EPA "Surf Your Watershed" for Upper Cimarron.

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Map of region surrounding Cimarron R Nr Elkhart, Ks

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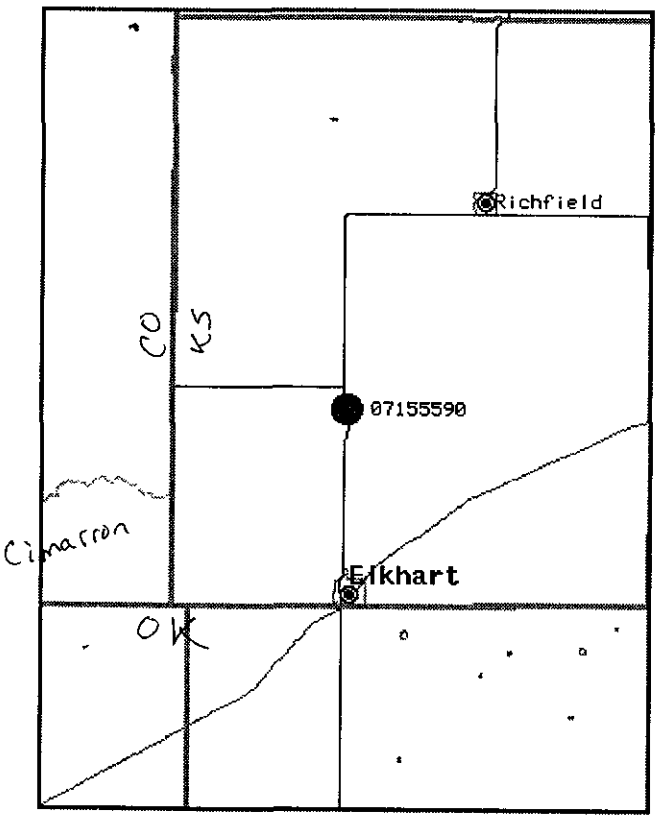


LEGEND

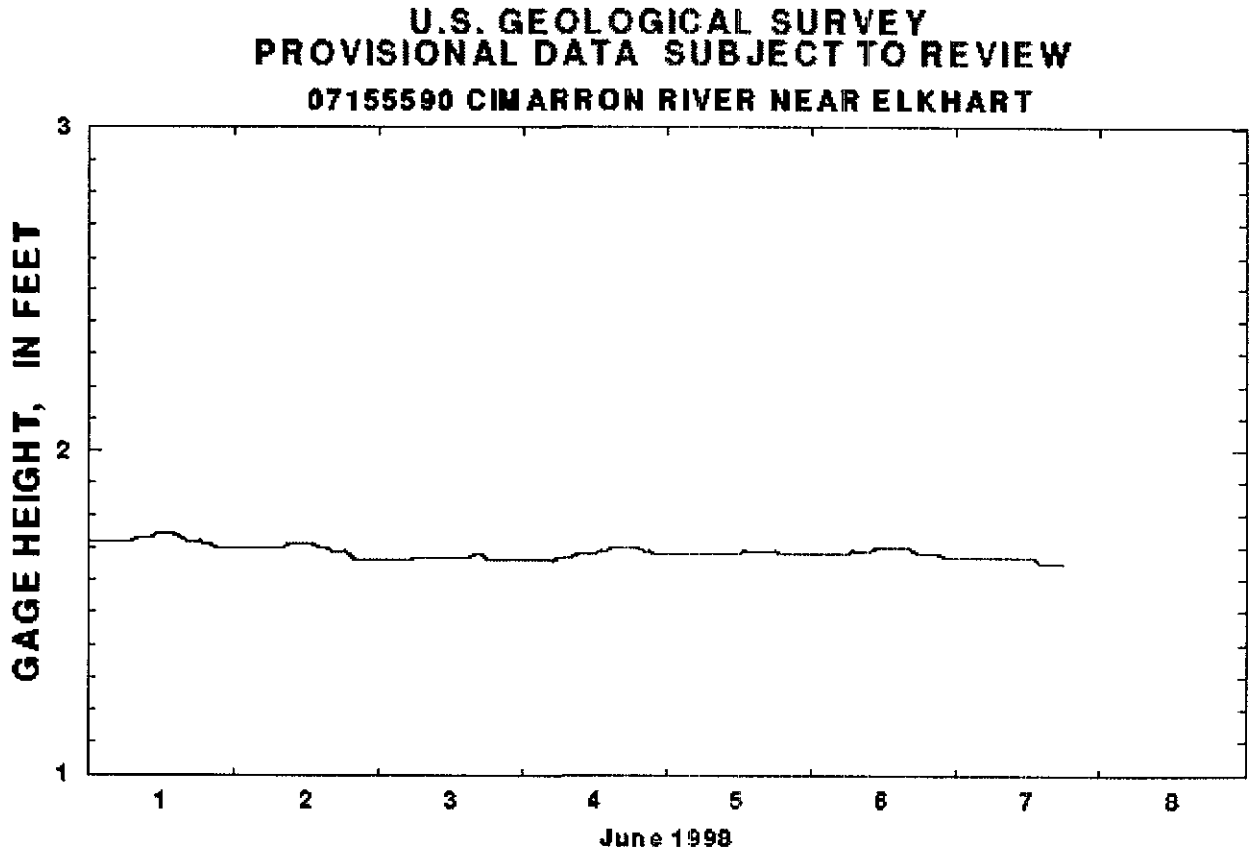
State	Military Area
County	National Park
Lake/Pond/Ocean	City
Expressway	County
Highway	
Connector	
Stream	

Scale 1:437790 0 5 10 15 mi / 0 5 10 15 20 25 km

*average--true scale depends on monitor resolution

Zoom Out || Zoom In

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We



NOTE: Gage Height information may be adversly affected by backwater from ice during cold periods.
Call (785) 832-3536 for more information.

Updated: 06/07/98 22:17:25 CDT

07155590 CIMARRON RIVER NEAR ELKHART, KS

- Streamflow hydrograph
- Complete station data from the 1997 Water Resources Data Report
- Historical and Peak Flow Data
- Map of region surrounding station

07155590 CIMARRON RIVER NEAR ELKHART, KS

LOCATION

Lat 37°07'30", long 101°53'50", in NW¼ NW¼ NW¼ sec.4, T.34 S., R.42 W., Morton County, Hydrologic Unit 11040002, Cimarron National Grasslands, on left bank at downstream side of bridge on Kansas Highway 27, 8.0 mi north of Elkhart, and at mile 499.4.

DRAINAGE AREA

2,899 sq mi, of which 483 sq mi do not contribute directly to surface runoff.

PERIOD OF RECORD

April 1971 to current year.

REVISED RECORDS

WDR KS-84-1: 1983.

GAGE

Water-stage recorder. Datum of gage is 3,381.89 ft above sea level.

REMARKS

Satellite telemeter at station.

Water Resources of Kansas home page || ***Current Streamflow Conditions for Kansas***

USGS home page || ***USGS Water Information*** || ***On-line Help***

The URL for this page is <http://www-ks.cr.usgs.gov/Kansas/rt/html/07155590.html>
Requests for information: info@maildkslwr.cr.usgs.gov
Comments and suggestions: webmaster@maildkslwr.cr.usgs.gov
Last modification: 05/20/1998

STATION (Climatological) Stoington (River Station, if different)

MONTH May 19 97

STATE CO

COUNTY BACA

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP

PRECIPITATION TA

STANDARD TIME IN USE M

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91
(12 93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M	TENDENCY	REMARKS (Special observations, etc..)
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SUM			SUM	1.24													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-7992-1

STATION (Climatological) Stonington (River Station if different)

STATE CO | COUNTY Baca | MONTH June | 19 97 | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 7A | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
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SUM			SUM	.95														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge ...ge.
E. Ice gorge below gage
F. Shore Ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel | Glaze | Thund | Hail | Dam. Winds

OBSERVER Max Smith

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-7992-1

STATION (Climatological) Springfield (River Station, if different)

MONTH July 19 97

STATE CO COUNTY Baca RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 7A | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

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31				.24														
SUM			SUM	1.63														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel. | Glaze | Thund | Hail | Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Max Smith

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7992-1

STATION (Climatological)	(River Station, if different)	MONTH	19
Stonington		Aug	97
STATE	COUNTY	RIVER	
CO	BACA		
TIME (local) OF OBSERVATION	TEMP.	PRECIPITATION	STANDARD TIME IN USE
		7A	M
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
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7				1.06														
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12				.73														
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SUM			SUM	6.10														

2.46
1.06
Tue

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

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B. Frozen, but open at gage.
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OBSERVER Max Smith

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO
05-7992-1

STATION (Climatological) Stonington | (River Station if different) | MONTH Sept | 19 97

STATE CO | COUNTY BACA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 7A | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

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25																		
26																		
27																		
28																		
29																		
30																		
31																		
SUM			SUM	.35 ✓														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge [illegible] ge.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds

OBSERVER Max Smith

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7992-1

STATION (Climatological) Stonington (River Station, if different) | MONTH Oct | 19 97

STATE Colo | COUNTY Baca | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 7A | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1																			
2																			
3																			
4																			
5																			
6																			
7																			maybe / maybe not
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25				1.26	~~1.26~~														
26				1.21	~~T~~	M12"													
27																			
28																			
29																			
30																			
31																			
SUM			SUM	2.47															

Fr.
Rain started Evening of the 24th
by early morning Sat 25th it
had turned to Snow with
white out conditions
Snowed all day Sat 25th and
the night. Wind & Snow
stopped early Sun 26th

CHECK BAR (For wire-weight) NORMAL CK. BAR 12"

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Max Smith

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7992-1

Station: Walsh | County: Baca | State: Colo | Date (Month & yr.): May 97 | Time of Complete Observation (Local time): 8:00 AM | Standard Time in Use: MST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles) Low	24 Hour Movement High	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
																							S.T
1	62	39	51													0458	0613						54
2	80	38	47													0662	0878						53
3	60	30	42													0878	1147						51
4	73	37	52													0991	1270						53
5	81	52	56													1162	1491						56
6	73	52	65													1291	1649						58
7	84	50	65													1466	1869						59
8	80	42	54													1577	2005						58
9	65	33	51													1677	2126						56
10	71	42	55													1812	2290						58
11	80	47	61													1947	2463						60
12	70	42	48										.02			2098	2656						58
13	69	45	56													2158	2739						58
14	85	41	60													2253	2860						60
15	78	47	57										.11			2345	2970						60
16	77	51	66													2439	3078						62
17	86	54	73													2538	3204						63
18	92	54	77													2644	3307						64
19	87	43	44										.04			2786	3532						63
20	61	37	56													2867	3628						59
21	69	54	56													3070	3889						61
22	69	52	55										.16			3291	4167						61
23	80	51	61										.29			3429	4347						61
24	78	47	70													3508	4447						63
25	85	49	71													3619	4584						63
26	77	43	58													3709	4711						63
27	81	44	56													3819	4857						63
28	71	46	53										.06			3895	4953						62
29	76	50	62										.01			4007	5098						63
30	82	53	54										.05			4130	5262						63
31	85	48	67													4230	5370						65
Sum													.74										
Avg.												Greatest	.29					Adjusted Total					

WS FORM 8-92 (5-89)
(PRES. BY WSOM B-17)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: D. E. Volz Research Center

STATION NUMBER: 05-879,-1

Station: Walsh | County: BACA | State: Colo | Date (Month & yr.): June 97 | Time of Complete Observation (Local time): 8:00 AM | Standard Time in Use: DST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc (in & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
																Low	High						S.T.
1	84	51	73													4316	5468	31					65
2	87	56	59										.09			4450	5628	39					68
3	76	56	58													4597	5802	15					66
4	82	49	57													4700	5933	30					65
5	74	51	66													4811	6074	32					66
6	84	54	61													4985	6288	39					67
7	83	58	65										.01			5147	6471	30					68
8	78	55	64													5258	6616	26					67
9	76	57	58										.02			5406	6789	24					67
10	66	54	56										.54			5527	6937		29				64
11	74	55	70													5669	7109	15					65
12	92	61	66													5739	7188	35					68
13	86	54	60													5866	7349	34					67
14	79	55	70													5961	7459	30					68
15	83	59	64										.03			6178	7750	33					68
16	86	53	62										.38			6301	7909	6					65
17	71	50	67													6368	7988	18					64
18	86	54	75													6420	8032	21					67
19	94	58	75													6523	8158	49					69
20	98	62	79													6615	8266	48					71
21	102	58	69													6713	8386	49					71
22	94	62	79													6891	8630	53					71
23	89	61	68													7089	8896	60					72
24	92	58	69										.13			7253	9107	31					71
25	93	56	65										.16			7348	9228	23					69
26	88	53	63										.25			7461	9371	20					69
27	88	60	73													7572	7505	40					71
28	94	58	77													7677	9643	53					72
29	98	57	75													7783	9774	48					73
30	92	59	76													7876	7894	46					73
31																							
Sum													1.61										
Avg.												Greatest						Adjusted Total					

WS FORM B 92 (5-89)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER [illegible]

STATION NUMBER 05-4793-1

Station: Walsh | County: Baca | State: Colo | Date (Month & yr.): July 97 | Time of Complete Observation (Local time): 8:00 AM | Standard Time in Use: DST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet-bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc. (in & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
																Low	High						S.T
1	103	71	74													8023		69					75
2	103	53	66													8132		66					74
3	87	63	66													8322		60					74
4	79	51	69													8461		50					73
5	92	58	70													8662		41					73
6	87	54	75										.07			8770		39					74
7	91	63	71													8957		50					73
8	99	61	74													9067		53					75
9	98	56	65										.01			9155		39					74
10	92	65	77													9274		48					75
11	98	64	73													9473		58					76
12	93	60	76													9643		63					76
13	101	64	80													9786		65					76
14	94	61	71													9897		61					76
15	94	64	78										.04			0050		48					77
16	102	63	81										.06			0140		40					75
17	102	61	80													0214		51					76
18	101	58	69													0308		48					75
19	94	64	71													0452		48					73
20	95	61	70										.25			0553		21					73
21	88	63	72										.10			0609		14					74
22	90	62	70													0675		28					75
23	97	66	76													0723		37					76
24	98	68	79													0935		58					76
25	101	69	79													1081		59					76
26	99	60	81													1207		56					76
27	100	67	82													1316		60					77
28	100	65	67										.50			1417		8					75
29	85	65	66										.04			1514		19					75
30	84	62	67										.60			1667			33				74
31	86	67	73										.01			1815		30					75
Sum													1.68										
Avg.												Greatest	1.0					Adjusted Total					

WS FORM B-92 (5-89)

(PRES. BY WSOM B-17)

U.S. DEPARTMENT OF COMMERCE NOAA NATIONAL WEATHER SERVICE

OBSERVER: A. E. Colorado Research Center

STATION NUMBER: 05-879,-1

Station: Walsh	County: BACA	State: Colo	Date (Month & yr.): Aug 97	Time of Complete Observation (Local time): 8:00 AM	Standard Time in Use: DST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F — 24 Hours Ending at Observation: Max.	Min.	At Observation: Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ___: Dry-bulb	Wet bulb	Dew Point	PRECIPITATION — Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc (in & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND — Anemometer Dial Reading (Miles) Low	24 Hour Movement High	EVAPORATION (Inches & hundredths) — Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F — 24 Hours Ending at Observation: Max.	Min.	ADDITIONAL DATA/REMARKS S.T
1	96	67	75													1952	6042	42					75
2	93	66	82										.19			2063	6197	8					76
3	92	66	74										.32			2126	6309	10					76
4	88	64	71													2176	6390	30					77
5	89	68	68													2266	6533	40					77
6	73	63	65										2.17			2376	6724		182				73
7	65	50	59										.10			2472	6867		13				68
8	75	56	63													2549	7006	30					69
9	88	63	78													2615	7131	31					71
10	87	58	62										1.52			2735	7369		112				70
11	73	57	65										.78			2831	7485		50				69
12	76	59	64										.54			2922	7624		80				70
13	81	62	65													2999	7735	26					71
14	86	60	71													3106	7892	26					71
15	90	60	72													3188	8013	36					72
16	92	59	73													3253	8114	37					72
17	95	57	66													3393	8317	39					72
18	77	61	68													3482	8442	25					72
19	82	60	67													3586	8588	26					72
20	90	57	73													3667	8710	23					72
21	91	57	69													3731	8802	32					73
22	95	62	67													3828	8943	47					74
23	88	60	75													3890	9034	34					74
24	93	64	80										.73			4046	9264		11				74
25	91	63	70													4151	9424	47					74
26	93	60	74													4273	9603	44					74
27	94	61	71													4410	9801	45					74
28	93	62	73													4479	9905	38					74
29	96	66	73													4570	0034	41					75
30	93	61	75													4676	0184	38					75
31	91	60	66										.04			4751	0292	25					74
Sum													6.39										
Avg.												Greatest						Adjusted Total					

WS FORM B-92 (5-89)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: U.S. Plains Research Center

STATION NUMBER: 05-8793-1

Station: Walsh | County: Baca | State: Colo | Date (Month & yr.): Sept 97 | Time of Complete Observation (Local time): 8:00 AM | Standard Time in Use: DST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hour Ending at Observation Max.	24 Hour Ending at Observation Min.	At Observation Dry-bulb	At Observation Wet-bulb	At Observation Dew Point	Supplemental Readings at ____ Dry-bulb	Supplemental Readings at ____ Wet-bulb	Supplemental Readings at ____ Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc. (in. & hundredths)	24 Hour Amounts: Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles) Low	WIND: 24 Hour Movement High	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	WATER TEMP. °F: 24 Hours Ending at Observation Min.	ADDITIONAL DATA/REMARKS: S.T.
1	88	60	72													4857	0444	40					74
2	92	64	68													4976	0615	41					74
3	75	59	69													5077	0763	15					74
4	73	57	68													5203	0948	21					74
5	83	60	65													5351	1162	30					73
6	89	61	75													5412	1250	26					73
7	95	58	69										.21			5490	1360	24					73
8	87	55	68													5578	1486	32					72
9	89	55	58													5662	1616	33					72
10	71	57	65													5733	1720	12					71
11	84	51	64													5861	1909	33					71
12	89	62	67													6057	2197	46					71
13	89	55	70													6149	2333	34					71
14	94	61	67													6278	2509	42					71
15	92	59	66													6372	2649	37					71
16	95	65	69													6461	2780	45					72
17	86	53	71													6541	2895	41					70
18	87	59	72													6624	3011	35					70
19	97	56	64													6733	3177	54					70
20	82	42	42										.12			6919	3447	28					64
21	50	42	46										.27			7017	3572		24				62
22	65	46	58										.05			7215	3860	9					62
23	76	51	51										.06			7413	4141	17					62
24	63	47	50													7577	4369	14					61
25	67	43	63													7684	4510	21					61
26	81	48	61													7729	4571	22					62
27	89	60	62													7830	4716	34					64
28	86	53	60													7963	4907	36					63
29	75	49	53													8044	5022	30					62
30	86	45	55													8102	5103	34					62
31																							
Sum													.71										
Avg.												Greatest	.27					Adjusted Total					

WS FORM B-92 (5-89)

(PRES. BY WSOM B-17)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: D. E. & Research Center

STATION NUMBER: 05-87[illegible]-1

Station: Walsh	County: Baca	State: Colo	Date (Month & yr.): Oct 97	Time of Complete Observation (Local time): 8:00 AM	Standard Time in Use: DST

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation: Max.	Min.	At Observation: Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____: Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted Snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles) Low	24 Hour Movement High	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled; or Amount Removed −	Amount of Evaporation	WATER TEMP. °F 24 Hours Ending at Observation: Max.	Min.	ADDITIONAL DATA/REMARKS S.T
1	85	49	57													8197	5225	30					— 63
2	89	57	68													8298	5365	35					— 63
3	90	57	64													8497	5652	58					— 64
4	87	45	58													8618	5825	36					— 64
5	83	53	63													8728	5980	35					— 64
6	90	62	71													8903	6228	42					— 66
7	84	61	62													9136	6573	45					— 66
8	80	55	60										1.13			9424	6989		48				— 64
9	72	37	42													9524	7125	30					— 58
10	68	42	62													9694	7367	20					— 60
11	78	61	64													9963	7763	30					— 62
12	77	50	53										.05			0257	8268	32					— 62
13	56	34	38													Broke	8535	19					— 55
14	61	29	39														8608	18					— 53
15	69	36	48														8691	17					— 54
16	73	34	40														8835						— 53
17	65	35	42														8891						— 53
18	72	39	60														9028						— 53
19	80	41	45														9131						— 54
20	57	42	43														9278						— 53
21	53	40	41										.12				9405						— 53
22	48	37	40														9559						— 51
23	71	39	41														9694						— 53
24	70	33	38														9799						— 52
25	58	18	38										.48	.50	.50		0146						— 48
26	22	13	20										1.27	8.5	9		0734						— 40
27	33	13	26												8		0899						— 40
28	49	26	38												6		0990						— 42
29	48	26	42												4		1122						— 43
30	60	31	47												2		1179						— 45
31	60	38	53												0		1214						— 45
Sum													3.05	9.0									
Avg.												Greatest		8.5				Adjusted Total					

WS FORM B-92 (5-89)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: [illegible signature]

STATION NUMBER: 05-8793-1

STATION (Climatological) Campo 7 Mile South (First station if different) | MONTH May | 19 97

STATE Co | COUNTY BACA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24 HR AMOUNTS Rain, melted snow, etc (ins and hundredths)	Snow, ice pellets, (ins and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins)	Draw a straight line (——) through hours precipitation was observed, and a waved line (∿∿∿) through hours precipitation probably occurred unobserved. A M NOON P M	WEATHER (Calendar Day) Mark 'X' for all types occurring each day Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT - - - A M	TENDENCY	REMARKS (Special observations, etc.,)
1	66	39	51	0														
2	84	34	49	0														
3	64	27	39	0														
4	72	39	47	0														
5	79	47	58	0														
6	73	47	59	0														
7	83	49	59	.18														
8	80	45	52	0														
9	66	39	45	0														
10	68	38	58	0														
11	79	42	50	0														
12	73	43	44	.01														
13	71	42	57	0														
14	87	45	55	0														
15	77	49	56	.04														
16	76	50	58	0														
17	86	51	60	0														
18	92	53	73	0														
19	89	43	44	.03														
20	57	38	50	0														
21	70	50	56	0														
22	70	53	57	.06														
23	79	47	56	.02														
24	81	45	61	0														
25	87	44	48	0														
26	82	46	54	0														
27	83	38	58	0														
28	73	46	52	0														
29	78	50	57	0														
30	83	50	55	0														
31	72	48	62	0														
SUM			SUM	1.34			CHECK BAR (For wire-weight) NORMAL CK. BAR	Fog	Ice Pel	Glaze	Thund	Hail	Dam. Winds					

CONDITION OF RIVER AT GAGE

A. Obstructed by ...sh Ice.
B. Frozen, but ...age.
C. Upper surf ...oth Ice.
D. Ice gorge ab... ...ge.
E. Ice gorge below gage
F. Shore Ice.
G. Floating Ice.
H. Pool stage.

READING	DATE

OBSERVER Fred C. Tanner

REVISING OFFICE

STATION INDEX NO 05-1268-1

STATION (Climatological) Campo 7 mile South (River gage, if different)

MONTH June 19 97

STATE CO

COUNTY BACA

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP 7AM

PRECIPITATION 7AM

STANDARD TIME IN USE MST

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (∿∿∿) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	87	55	71	0														
2	95	58	63	0														
3	76	55	60	0														
4	84	51	54	0														
5	77	57	60	0														
6	84	55	58	0														
7	83	58	61	.24														
8	74	55	55	.03														
9	75	57	57	0														
10	75	42	55	.05														
11	75	41	63	0														
12	93	60	65	0														
13	87	54	58	.15														
14	81	50	60	0														
15	83	57	61	.03														
16	89	53	63	.02														
17	74	48	55	.05														
18	87	49	60	0														
19	94	59	63	0														
20	101	58	71	.02														
21	103	52	74	0														
22	92	62	72	0														
23	91	60	64	0														
24	91	58	59	.07														
25	95	51	64	.05														
26	98	55	58	.02														
27	89	55	62	0														
28	96	54	68	0														
29	92	58	67	0														
30	95	56	66	0														
31	[redacted]																	
SUM			SUM	1.73														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface [illegible]th ice.
D. Ice gorge ab[illegible]
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER

SUPERVISING OFFICE

STATION INDEX NO 05-1268-

STATION (Climatological) Campo 7 Mile South (River Station, if different) | MONTH July | 19 97

STATE Co | COUNTY Baca | RIVER J

TIME (local) OF OBSERVATION RIVER | TEMP. 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	105	51	74	0														
2	105	55	65	0														
3	87	63	74	0														
4	81	49	60	0														
5	89	59	63	0														
6	91	52	56	.60														
7	88	60	62	.15														
8	95	59	68	.01														
9	96	59	62	0														
10	93	62	72	0														
11	95	64	68	0														
12	93	57	64	0														
13	100	59	66	0														
14	95	66	70	0														
15	99	58	66	0														
16	103	63	69	0														
17	103	61	68	0														
18	102	61	66	0														
19	94	60	64	0														
20	94	62	65	.20														
21	93	63	65	.48														
22	88	63	65	.07														
23	93	64	67	0														
24	95	65	71	0														
25	97	64	74	0														
26	97	65	73	0														
27	98	65	68	0														
28	99	65	66	0														
29	97	65	69	.02														
30	94	63	68	.85														
31	86	67	70	0														
SUM.			SUM.	2.33														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface [illegible]th ice.
D. Ice gorge ab
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Fred C Janney

SUPERVISING OFFICE

STATION INDEX NO. 05-1268-

STATION (Climatological) Campo 7 Mile South (River Station, if different) | MONTH Aug | 19 97

STATE Colo | COUNTY Baca | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MIN.	TEMPERATURE F. AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	PRECIPITATION 24-HR AMOUNTS Snow, ice pellets, (ins. and tenths)	PRECIPITATION At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	RIVER STAGE GAGE READING AT ___ A.M.	RIVER STAGE TENDENCY	REMARKS (Special observations, etc.,)
1	89	66	67	0													
2	94	66	68	0													
3	93	63	69	0													
4	90	62	67	0													
5	89	64	68	0													
6	79	57	66	.83													
7	69	49	55	0													
8	74	46	58	0													
9	88	44	66	0													
10	92	58	60	1.45													
11	73	48	63	.58													
12	82	57	61	1.31													
13	80	50	64	0													
14	87	57	60	0													
15	90	56	62	0													
16	93	58	64	0													
17	94	57	60	0													
18	96	62	64	.02													
19	86	58	66	0													
20	92	62	68	.01													
21	91	58	68	0													
22	95	64	67	0													
23	87	60	65	0													
24	94	63	67	0													
25	93	61	65	0													
26	94	59	60	0													
27	95	60	62	0													
28	96	61	62	0													
29	97	52	67	0													
30	95	56	60	.06													
31	93	53	(M)	.03													
SUM			SUM	4.39													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11

Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Fred C Zanner

SUPERVISING OFFICE

STATION INDEX NO. 05-1268-1

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) Campo 7 Miles South (River Station if different) | MONTH Sept | 19 97

STATE Co | COUNTY BACA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	88	55	65	0													
2	95	64	67	0													
3	74	62	69	0													
4	75	48	64	0													
5	83	60	62	0													
6	92	62	78	0													
7	93	60	61	.08													
8	89	57	61	0													
9	92	47	59	0													
10	70	58	61	0													
11	85	57	61	0													
12	89	58	70	0													
13	94	55	69	0													
14	93	54	59	0													
15	95	50	61	0													
16	99	60	65	0													
17	87	51	57	0													
18	87	55	62	0													
19	84	58	69	0													
20	84	43	43	.45													
21	62	43	45	.05													
22	66	45	57	.09													
23	74	52	52	.07													
24	62	43	46	0													
25	69	41	48	0													
26	81	48	52	0													
27	89	52	64	0													
28	87	51	57	0													
29	74	43	44	0													
30	87	39	55	0													
31																	
SUM			SUM	0.74 ✓													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Fred Tanner

SUPERVISING OFFICE

STATION INDEX NO 05-1268-1

STATION (Climatological) Campo 7 miles South (River Station, if different) | MONTH Oct | 19 97

STATE Colo | COUNTY BACA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M	TENDENCY	REMARKS (Special observations, etc.,)
1	85	49	49	0													
2	87	48	58	0													
3	90	57	63	0													
4	88	51	66	0													
5	89	48	48	0													
6	90	57	58	0													
7	84	58	58	0													
8	74	52	55	1.16													
9	74	36	53	0													
10	69	46	59	0													
11	79	59	62	0													
12	76	51	51	0													
13	61	36	41	0													
14	63	30	37	0													
15	70	33	43	0													
16	74	36	44	0													
17	66	32	44	0													
18	73	33	35	0													
19	83	35	48	0													
20	56	41	43	0													
21	52	40	41	.28													
22	50	31	40	0													
23	72	33	45	0													
24	70	39	40	0													
25	62	16	19	.60	3"	5"											
26	32	12	25	.41	16"	16"											Blowing Snow Very hard to get a good reading Estimate
27	33	25	38	6		16"											
28	54	26	41	0		8											
29	54	26	27	0		T											
30	46	25	28	0													
31	46	28	42	0													
SUM			SUM	2.41													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface 'h ice.
D. Ice gorge abc
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Fred Tanner

SU[illegible]ISING OFFICE

STATION INDEX NO 05-1268-1

3. Local Data

State Code	County Code	Site Name	HQ State	HQ County
8	9	BACA COUNTY FSA OFFICE	8	9

CED	Contact Name
T. QUIZZY LUSK	T. LUSK

5/8/98 ↓ Doesn't recall any farm-land damages as a result of ~~the~~ rains or flooding (mostly grassland upstream of Two Buttes

~~X~~ call back at 8:00 am 5/7/98

Area Name	State Name	Site Type Name	Site District	Transmission ID	Time Zone
Southwest	Colorado	FSA County Office	1	AHG	Mountain

Top of Page

Phone #	(719)523-6251	ext.	
Fax #	(719)523-6263	ext.	

Top of Page

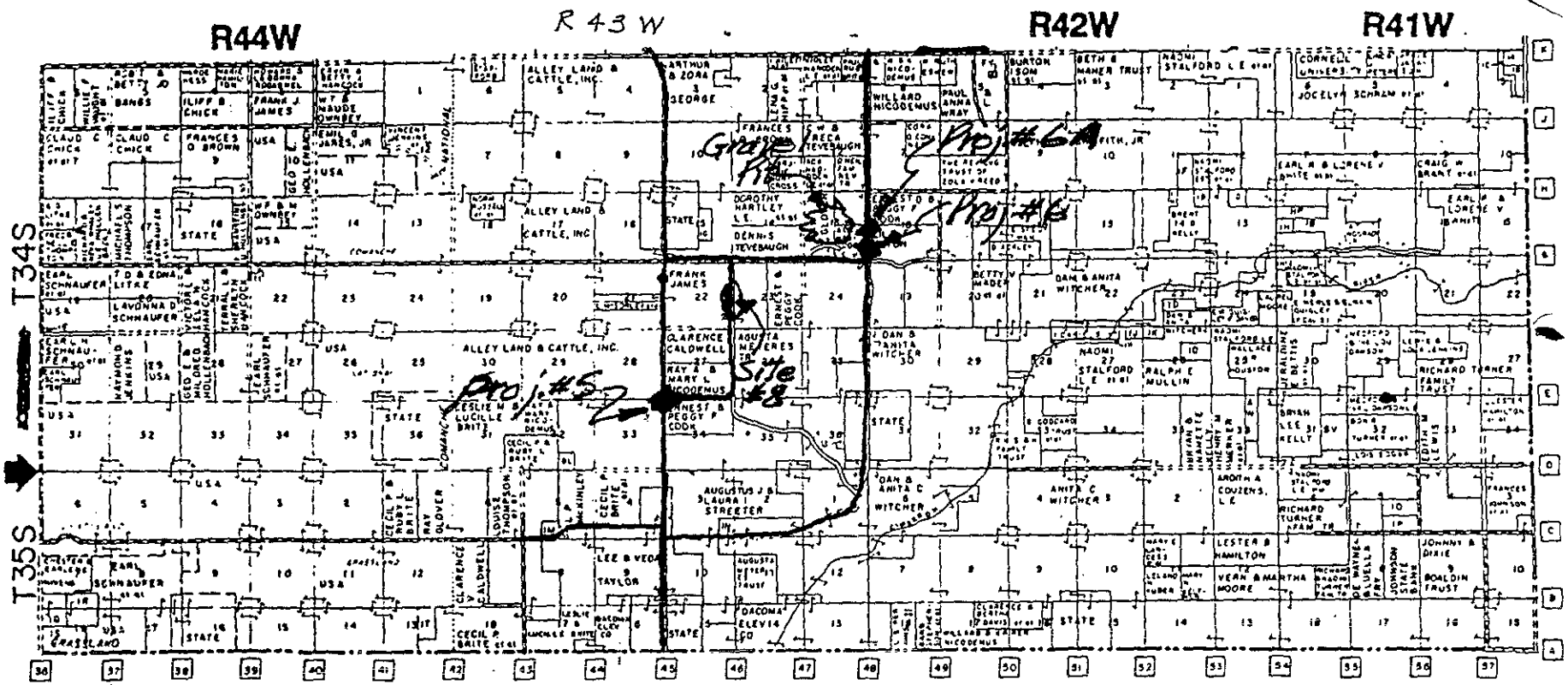
	MAIL ADDRESS		STREET ADDRESS
Address	P O BOX 398	Address	27200 HWY 287
Address		Address	
City	SPRINGFIELD	City	SPRINGFIELD
State	CO	State	CO
Zip	81073	Zip	81073

Top of Page

Send a question, idea or comment to the County Office via the State Office.

If any of the information on this page is incorrect, please notify us.

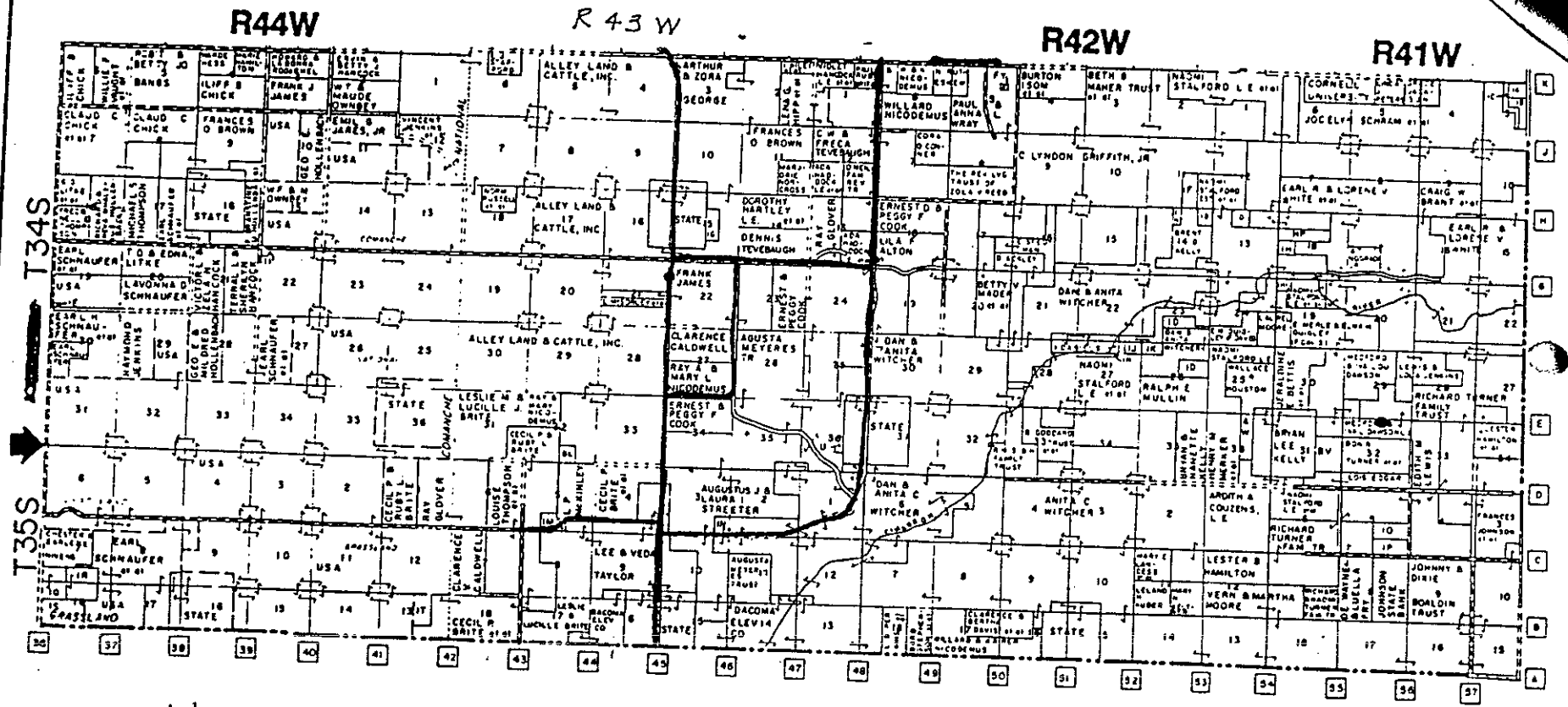
Top of Page



MAP of
Damaged Roads in S.E. Baca County

Baca County

PAGE 9 OF 13
DISASTER NO. 1156
DSR NO. 10602
PA NO. 009-00000

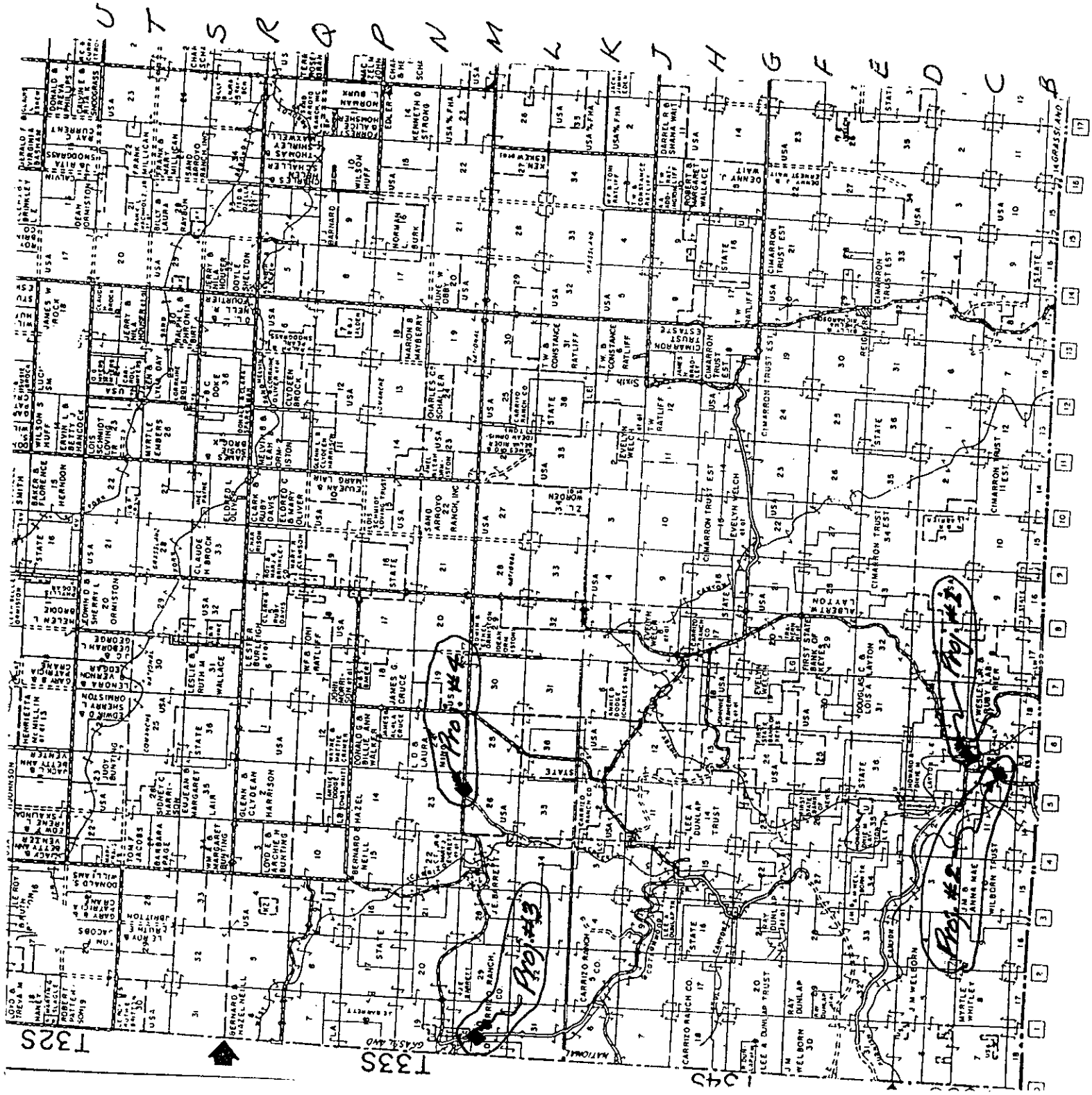


MAP of
Damaged Roads in S.E. Baca County

PAGE 5 OF 11
DISASTER NO. 1186
DSR NO. 10601
PA NO. 009-00000

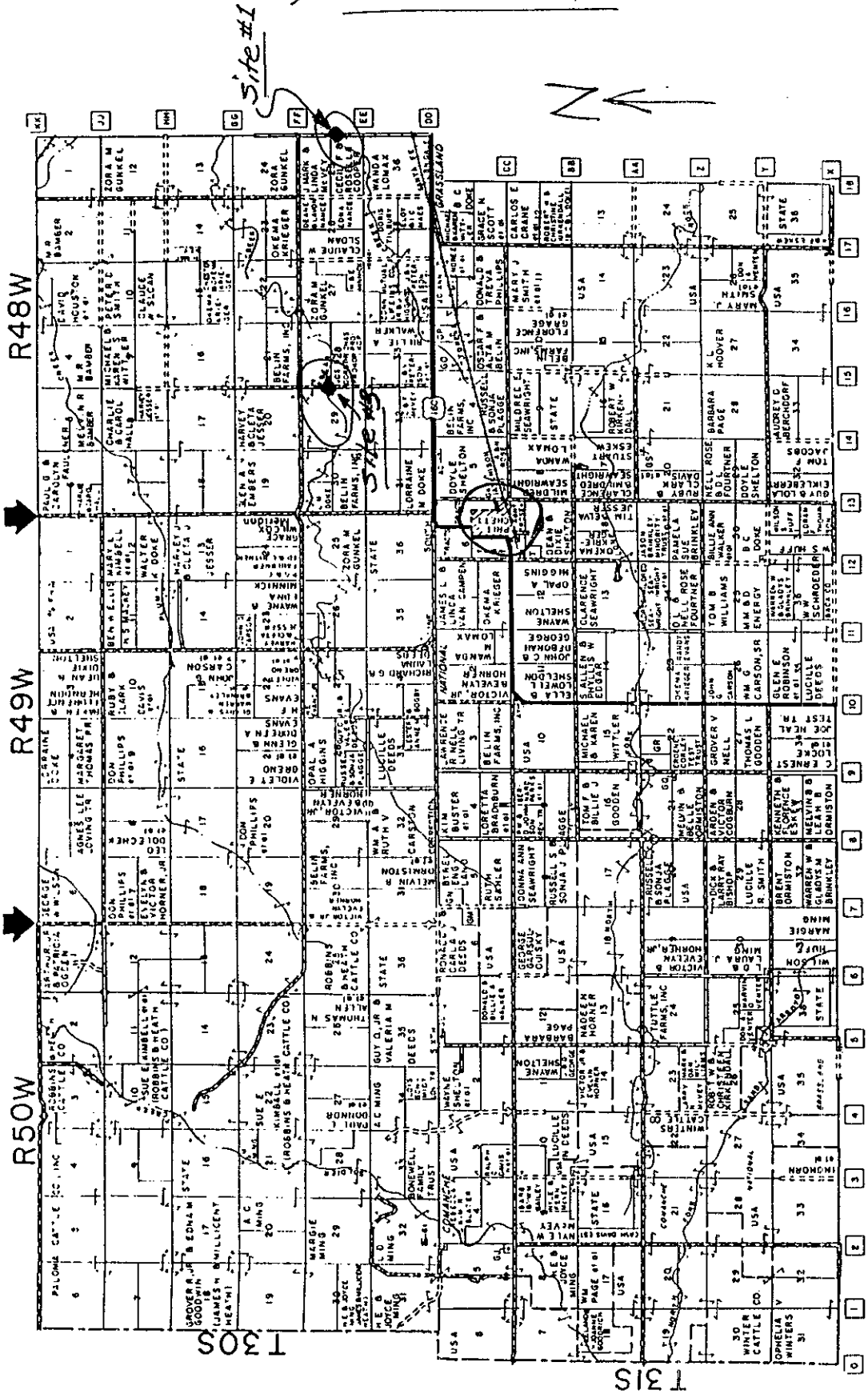
MAP
for
Projects 1,2,3 & 4

N



MAP

for Sites 1 & 3



RECEIVED APR 0 9 1998

BACA COUNTY DISTRICT NO. 3

#1

For Month of Rd M & about Rd 4.4

Item

DATE	OPERATOR'S NAME	UNIT NO.	QUANTITY	PART NUMBER	PART NAME	PRICE EACH	MACHINE NAME
8/18/97	CMP		from Colo		Springs		2,442.00
8/18/97	200		Loaded Mile @ 3.00				600.00
			~~Jeff 1775~~		10 yd Cement		720.00
			Baca Welding		(4 4 x 8		208.00
					12 gage Steel		
8/18/97							9
8/19/97	Clearance &	Jeff		& Byron			30 hrs
8/21/97	11	11		11			30 hrs
8/25/97		11		11			10 hrs

STANFIELD-GUYMON FORM BC-11

BACA COUNTY DISTRICT NO. 3

For Month of Aug #2

Item Rd 5.5 + South of Rd B C

DATE	OPERATOR'S NAME	UNIT NO.	QUANTITY	PART NUMBER	PART NAME	PRICE EACH	MACHINE NAME
8/13/97	Carroll - Clinton - Robert - Byron						42 hrs
8/14/97	" - James - " - " - DALE						52 hrs
8/15/97	" - Clinton - "				"		42
8/18/97	"	"	"		"		42
~~8/18/97~~							
~~8/18/97~~							
8/13/97	(C2) + (C3) + (C5)			Truck + Bottom Dump			15 hrs
8/13/97	(C47)		950F	cat			5 hrs
8/14/97	(C31) 140H						10½ hrs
8/14/97	C2 + C3 + C5 + C47						42 hrs
8/15/97	C2 + C3 + C5 + C47 + C31						52 hrs
8/18/97	C2 + C3 + C5 + C47 + C31						25 hrs
	Cement + Car Hatt						750 00
	(C31) 140H		31 hrs			@	2325 00
	(C47) 950F		35 hrs			@	4200 00
	Shell 10 loads @ 6 00 + 3 00 per loader Mile						90 00
	Travel 30 loads @ 6 00 + 3 00 per loader Mi						900 00
							8,265 00
	All Sand + Gravel + Dirt @ 6.00 per load						
	3.00 per loaded Mile. Loader at 47.50 per hr						
	Loader at 120 00 per day						

STANFIELD-GUYMON FORM BC-11

BACA COUNTY DISTRICT NO. 3

For Month of Proj # 3

Item ~~Rd. 5~~ Rd .05 & South M

DATE	OPERATOR'S NAME	UNIT NO.	QUANTITY	PART NUMBER	PART NAME	PRICE EACH	MACHINE NAME
8/11/97	Clarence	- Jeff	- Byron	+ BACK	HOE		31½ hrs
8/12/97	"	"	& James	+	"	33 ~~37½~~	
8/13/97	"	"		"	+ 950B + BACKHOE		31½
8/14/97	"	"	+ CLINTON	+	"	"	31½
950B	~~63 hrs~~	31 hrs		= 3,720 00			
580 Super K		31 hrs		= 2,325 00			
36" X 30' CMAP				= 551 10			
				$6,596 10			

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: July 8, 1998
Call Placed/Received by: Bill Ellett
Spoke With: Bob Jarrett,
Company/Affiliation: USGS
Phone no.: (303) ~~236-6447~~ 236-6447
Project No.: XR004

Comments: Left a message that we need return interval for 0.6 inches and 2 inches of rainfall at Witter Gulch

7/9/98
- Bob thinks this was a 50-100 year event
- 80% of 24 hr/100 events occurr within 1 hour
- Compare NOAA Atlas 2 w/ UDFCD estimates at nearest township/range/section.
- On Buffalo Creek, radar image underestimated total rainfall by 50%.
- Bob is very impressed that the Clear Ck County radar image shows ~2 inches ppt on Aug. 3.
- Bob says our work is invaluable - very complimentary on our efforts.

Signature W. J. Ellett

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/25/98
Call Placed/Received by: Bill Ellett
Spoke With: Jim Cannady
Company/Affiliation: Supervisor, Clear Ck County Road & Bridge Dept.
Phone no.: (303) 569-3251 x-317
Project No.: ~~0479-51~~
⇒ XR004-51

Comments:

- Jim said summer flooding is common in Clear Ck County. Winter of 94-95 had 240% snowpack. This caused flooding from snowmelt on Leavenworth and S. Clear Cks. Considerable damage in Georgetown
- At least one location floods every year during the 90's and there were several floods in 1980's.
- County is prone to flooding from "supercells."
- In Witter Gulch, 1997, most damage was in the lower 2 miles of watershed. This area has more development and the canyon narrows - more defined channel. Also, more building on floodplain.
- Since 1992 they have been trying to improve drainage control / structures in Witter Gulch.
- Only emergency response was by Road & Bridge dept. to provide access to residential areas. (Fix roads & culverts).

Signature W. J. Ellett

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phn_log.doc

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: WJE
DATE: May 29, 1998
SUBJECT: 1997 Flooding

INDIVIDUAL: Jim Cannady
AFFILIATION: Road Supervisor, County
PHONE #: (303) 679-2317
569-7251
mobile 570-0312

1. Affected streams and local drainages?
   Bear Ck, Central Clear Ck basin
   Witter Gulch, Indian Ck, Kentucky Ck

2. Geographic extent of flooding?
   Entire Bear Ck. basin
   Clear Ck from Fall River east to county line.

3. Storm duration? Starting time and ending time of major storm event?
   6:15 pm - 10:30 pm Aug. 3

4. Rainfall amounts? Extent of rainfall?
   Unofficial Clear Ck 1 - 2½ inches
   Bear Ck 7 inches

5. Rainfall bucket surveys?
   Bear Ck foreman ^ up to 10 inches
   measured

6. Precipitation gauging network?
   Don't have one.

7. Documentation of high water marks?
   Photographs, physically marking HWM so that water resources can make measurements, (DWR)

8. Estimated peak discharges?

9. Estimated flood damages? $250,000 (road repair only) gravel & pavement
Utilities are additional. Telephone
some home owners driveways

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.

$15,400 local
10,800 state
104,740 federal

$49,606 – with Gulch
Damage Survey Report ~$54,000 for with Gulch

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.

< $10,000

12. Types and amounts of repair work after flooding?

road repairs, culvert replacement, regrading, ditch repair, pavement repair.

13. Any previous/recent flood mitigation efforts that reduced damages?

Yes, infrastructure drainage improvement plan 1995. installation of culverts in strategic locations. Reduced damage e.g. as much as 80 % Bear Ck basin Engineer cost + Circle K Ranch sub div.

14. Any future mitigation needs as a result of the flooding?

Yes, need to reconstruct intersection of Murphy Rd. & Upper Bear Ck Rd. (Engineering thrust now) New drainage improvement in Wither Gulch. (Installation of ~18 corrugated metal culverts

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

Man-made pond washed out & several ditch & embankment failures.

16. Do you have any photos and/or video available? Are the photos in digital format?

Do have some photos of road washouts.

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

Upper Clear Ck basin has watershed map - Water Resources - GIS

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

19. Is there any existing documentation regarding the flooding?

Yes, several thousand pages. FEMA documentation

20. Name of local newspaper? Do they have a web site?

Clear Ck Current had limited articals.

(303) 567-4491

21. Do you have an internet site? Do you know of any related local sites?

County offices have one.

* Call Laura Ohman

rebury some gas lines ~$10,000

Johnnie Knowl, Public Service Co. (303) 670-6204

Phil Ryman Public Service Co. (303) 670-6296 6/5/98

Sue Lane - US Forest Service
(303) 567-3028
6/5/98
Sue said the forest Service did not have any flood related costs last summer.

Dave Albers - US west 6/5/98
(701) 792-6292

The Town of Georgetown

P.O. Box 426
Georgetown, Colorado 80444

Local: 569-2555 Denver: 623-6882

FAX COVER PAGE

****

PLEASE DELIVER THE FOLLOWING PAGES

TO: BILL ELLETT (970) 484-7593

FROM: MEGAN WAGERS

RE: FLOOD SURVEY

TOTAL NUMBER OF PAGES INCLUDING COVER PAGE ONE

DATE: 042998 TIME: 9:15am

IF YOU DID NOT RECEIVE ALL PAGES
PLEASE CALL 569-2555 LOCAL / -FAX #569-2705

COMMENTS

BILL: NO FLOODING IN GEORGETOWN LAST YEAR. YOU MAY WANT TO CHECK WITH CLEAR CREEK COUNTY TO SEE IF THEY EXPERIENCED ANY FLOODING THROUGHOUT THE COUNTY. THEIR PHONE NUMBER IS (303) 569-3251 EXT. 382 LAURA OMAN.

Riverside Technology, inc.
5840 Banneker Road, Suite 170 • Columbia, MD 21044
410/740-8220 • FAX 410/740-8221

Subject: Bob Jarrett USGS
Computed: wje Date: 6/6/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: 0479 Task: 52
Page _____ of _____

(303) 236 ~~4882~~ 6447

Talked w/ Bob Jarrett of USGS in Denver about Clear Ck County flooding. Bob said that there really is a lot of disagreement/uncertainty about how intense the Aug. 3 event was. He said it was probably only about 2 inches, but that amount could be a 100-yr event in that high country. It was more intense than most people had ever seen up there even though most runnoff was associated with gravel roads & driveways and developed areas.

6/8/98 Dave Alvers - US West - No damage

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/8/98
Call Placed/Received by: Bill Ellett
Spoke With: Laura ~~Ohman~~ Oman, Director
Company/Affiliation: Clear Ck County Office of Emgy. Mngmt.
Phone no.: (303) ~~567-0277~~ 569-3251 x-382.
Project No.: D479-51 ~~[illegible]~~

~~[illegible]~~ (303) 567-0277 (home)

Comments:

- Same storm as one that hit Ft. Collins. (really?)
- Storm set over two little ridges.
- Rained as much as 11" in 3 hrs, or as little as 2" depending on location & who you ask.
- very high intensity electrical storm.
- This intense of storm hasn't been seen by local residents in at least 25 years.
- Entire storm lasted about 3 hours.

Signature W. J. Ellett

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/27/98
Call Placed/Received by: Bill Ellett
Spoke With: Bobbi Hawks
Company/Affiliation: Clear Ck County Commissioners office
Phone no.: (303) 569-3251
Project No.: 0479 – 51

Comments:

Left messages with county commissioner's office, planning director, and road supervisor. Also, tried to call Donnette Oxley - Floodplain Administrator, but line kept disconnecting. (x-343)

Also, left message w/ Laura Ohmon @ (303) 569-3251, ext. 382.

Also, left messages with (303) 569-2555 Wagers Megan (?), City clerk in Georgetown and the City Clerk in Silver Plume (303) 569-2363.

Signature W. J. Ellett

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	4/28/98
Call Placed/Received by:	Bill Elliott
Spoke With:	Wendy Heffner, City Clerk
Company/Affiliation:	Idaho Springs
Phone no.:	(303) 567-4421
Project No.:	0479-51

Comments:

No flooding occurred in Idaho Springs during the summer of 1997.

Signature W. J. Elliott

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	4/27/98
Call Placed/Received by:	Bill Ellett
Spoke With:	Empire city clerk
Company/Affiliation:	
Phone no.:	(303) 569-2978
Project No.:	0479-51

Comments:

No flooding occurred in Empire during the summer of 1997. Clear Creek Channel is deep near Empire.

Signature W. J. Ellett

D479

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: **Megan**
Town of Georgetown

FAX NO.: (303) 569-2705

FROM: Bill Ellett

DATE: April 27, 1998

NO. OF PAGES: We are sending __4_____ Page(s) (Including this Page)

SUBJECT: Documentation for flooding during the summer of 1997

COMMENTS:

Hi Megan,

Attached is the list of questions I mentioned on the phone. At this time, the CWBC is only interested in documenting flooding that occurred last summer. If none occurred in Georgetown, then it would help if I could reference you or Ted. If nothing else, this would help document the extent of flooding that occurred last summer in other parts of Clear Creek County.

Thank you very much for you time. I look forward to hearing from you or Ted.

Bill Ellett

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573

0479 ✓

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: **Jim Cannady**
Clear Creek County Road Supervisor

FAX NO.: (303) 679-2446 mobile phone: (303) 570-0221

FROM: Bill Ellett

DATE: May 6, 1998

NO. OF PAGES: We are sending ____4_____ Page(s) (Including this Page)

SUBJECT: Documentation for flooding during the summer of 1997

COMMENTS:

Hi Jim,

I appreciate your willingness to provide information about last summer's flooding in Clear Creek County. As I mentioned on the phone, our company is under contract with the Colorado Water Conservation Board to document flooding that occurred last summer in much of eastern Colorado and along the Front Range. I have also tried to contact other people in Clear Creek County, but several of them told me that you were the best source of information.

Attached a list of questions/issues for your review that we would like to address in our documentation of flooding in Clear Creek County. It would be helpful we could discuss these items on the phone, or if you prefer, perhaps you could provide written answers. Whatever is easiest for you.

Thanks again for your cooperation. I look forward to hearing from you.

Bill Ellett

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573

D479

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: **Laura Ohmon**

FAX NO.: (303) 567-0277

FROM: Bill Ellett

DATE: May 8, 1998

NO. OF PAGES: We are sending ____4_____ Page(s) (Including this Page)

SUBJECT: Documentation for flooding during the summer of 1997

COMMENTS:

Hi Laura,

Thank you for calling me back. I appreciate your willingness to help document flooding last summer in Clear Creek County. I have attached several pages of questions we have put together to try to focus out research efforts. I hope they will be helpful to you in understanding the kinds of issues that we think need to be documented. If there are other things you think are important, please do not hesitate to include them.

Thank you very much for your time. I look forward to hearing from you and from Brain Hyde.

Bill Ellett

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573

D479

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: **Bob Jarrett**
U.S. Geological Survey

FAX NO.: (303) 236-5034

FROM: Bill Ellett

DATE: June 6, 1998

NO. OF PAGES: We are sending ___8_____ Page(s) (Including this Page)

SUBJECT: Documentation for Clear Creek County flooding

COMMENTS:

Hi Bob,

Thank you for agreeing to review this documentation of Clear Creek County flooding from last summer. The focus is on flooding in Witter Gulch because that is where most of the flood damage costs were incurred. I would like to incorporate your suggestions as soon as possible. Thanks again for your help.

Bill Ellett

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573

2. Federal Data

X-POP3-Rcpt: kstewart@eazy
Return-Path: rjarrett@brrcrmail.cr.usgs.gov
Date: Wed, 15 Oct 1997 17:08:59 -0600
To: kstewart@udfcd.org, burbonas@udfcd.org, brian.hyde@state.co.us
From: "Robert D Jarrett, Hydrologist, Denver, CO "<rjarrett@usgs.gov> (Bob Jarrett)
Subject: Witter Gulch, Clear Creek County 8/3/97 storm
Cc: "Robert D Jarrett, Hydrologist, Denver, CO "<rjarrett@usgs.gov>,
tom.browning@state.co.us,
"Mark E Smith, Hydrologist, Denver, CO "<mesmith@usgs.gov>,
"Jerry E Vaill Jr., Hydrologist, Grand Junction, CO "<jevaill@usgs.gov>,
nolan@ulysses.atmos.colostate.edu,
"Gregory B Oneill, Supervisory Hydrologic Tech, Denver, CO "<gboneill@usgs.gov>,
hms@interserv.com, LARRY.TUNNELL@NOAA.GOV, mgrimm@fema.gov

On October 10-11, 1997, I visited Buffalo Creek and Clear Creek County (referred to as Witter Gulch and Corral Creek storm) related to flash flooding on 8/31/97 and 8/3/97, respectively. In this email, I summarize the Witter Gulch flood; separately, a summary is being prepared for the August 31, 1997 flood in the Buffalo Creek area. [From Kevin Stewart "This storm resulted in a presidential disaster declaration for Clear Creek County. Unconfirmed reports of rainfall exceeding 10 inches."] My site visits and documentation were made to assist CWCB, Clear Creek County, and UDFCD officials with determining the magnitude of storm runoff on 8/3, which also complements flood research I am conducting. The main focus of this research is to visit recent flood sites to relate actual flood height (HWMs) and height of paleostage indicators (PSIs) of flood-deposited sediments and tree scars. PSIs then can be used long after a flood (which hasn't been documented by standard flood methods) to estimate flood magnitude and time since the flood. This writeup is preliminary (and unedited), although final peak discharges likely won't vary by more than 5-10 percent. With these caveats, feel free to pass this info on to others.

Witter Gulch, roughly 5 sq. mi., is a southeasterly flowing tributary to Bear Creek at the Clear Creek-Jefferson County line. Witter Gulch Road, which is oriented southwest to northwest through the center of the basin from Upper Bear Creek Road (at the county line) to State Highway 103 about 2 miles east of Squaw Pass. Elevations range from about 7,400 feet to 10,086 feet (Hicks Mountain on the southwest basin boundary) and the basin length is about 4 miles, which indicates the ruggedness of the mountain basin. Most of the basin is densely vegetated with spruce, pine, and aspen and has a dense undercover with a thick duff (organic leaf litter) layer. Development in Witter Gulch basin is limited to perhaps several hundred homes and slightly more than 20 percent of the basin are Denver Mountain Park Sites. Most roads are gravel (very low infiltration, thus, exacerbating runoff) except about the lower 2 miles of Witter Gulch Road.

1. METHODS. I obtained 5 cross sections (or sites; locations shown on fig. 1) in Witter Gulch using a cloth tape located at high-water marks (HWMs) end points and measuring depth with a survey rod (fig. 2). Three sites (one cross section = a site) were located in the lower mile of Witter Gulch (site 1 near the confluence with Bear Creek, site 2 is located upstream from the first crossing of Witter Gulch Road, and site 3 upstream

from Oak Way), site 4 is located about halfway up Witter Gulch about 0.5 mile upstream from the intersection of Stagecoach, Circle K, and Witter Gulch Roads), and site 5 is located near the lowest "switchback" on Witter Gulch Road about 1 mile below to the Hwy 103 basin boundary. An additional 7 cross sections were obtained in nearby basins (Corral Creek, Pedee Creek, Hicks Mountain tributaries, Yankee Creek, and Murphy Gulch (fig. 1).

Local channel slopes and Manning's n values were obtained for each cross section. HWMs primarily were fine leaf/needle litter, slack-water (sediment) deposits (SWDs), wash lines, and bent grass. The HWMs are very well preserved, in very good agreement at each site (fig. 3, cross section for Witter Gulch upstream from Oak Way). HWMs generally were rated as "good" or "good to excellent," which is typical preservation of HWMs in Colorado. Photographs of cross sections and HWMs also were taken at most sites. Peak discharges were computed using the average of estimates using slope-conveyance and critical-depth methods for each cross section; generally, peak discharge estimates for each method varied by 10 percent or less.

Estimates of 8/3 rainfall were made from geomorphic indicators (similar to those made for the Buffalo Creek storm of July 12, 1996). These indicators include the amount of sediments mobilized on hillslopes, distance transported, width and depth of rill/gully development, and peak discharge estimates.

2. RESULTS

A. Peak-discharges estimates.

SITE NUMBER -- PEAK DISCHARGE in cubic feet per second (cfs).

1 &2. Witter Gulch -- 130 and 135 cfs, respectively.
3. Witter Gulch -- 210 cfs.
4. Witter Gulch -- 150 cfs.
5. Witter Gulch -- 55 cfs.
6. Pedee Creek u/s from Vance Creek -- <10 cfs.
7. Pedee Creek d/s from Vance Creek -- <50 cfs.
8. Corral Creek d/s from Vance Creek -- <50 cfs. Note, maximum peak discharge in 1997 (from snowmelt or rainfall runoff) from older HWMs was estimated to be about 100 cfs.
9. Hicks Mountain southwest tributary -- <5 cfs.
10. Hicks Mountain southeast tributary -- <5 cfs.
11. Yankee Creek -- <10 cfs.
12. Murphy Gulch -- 40 cfs.

Bear Creek channel near Witter Gulch is sufficiently large from high elevation, snowmelt runoff (typically, annual peak flows ~250-550 cfs), which precludes evidence of recent smaller flows, and it was late Saturday (and raining); thus, no peak discharge estimate in Bear Creek. The discharge would have been smaller than the combined flow from sites 1 and 8-12 or less than 175 cfs. This estimate does not incorporate attenuation of peak flow, etc.

B. Rainfall estimates.

Recent rill development is very limited in the study area. Rills generally were less than 1 inch deep and 2 inches wide on unvegetated, steep hillslopes suggesting moderately intense rainfall for this storm. Gully development (generally <1 ft deep) from runoff along the sides of roads and locally where this runoff flowed over steep slopes. Small sediment deposits (alluvial fans, SWDs, and flood bars) generally only developed in areas draining gravel roads. Notable deposits are in the vicinity of site 4 (which is the area of the greatest concentration of homes, driveways, and gravel roads) and on Murphy Gulch at Upper Bear Creek Road (d/s from site 12). Runoff from undeveloped areas within the study area was negligible. >From past experience, particularly 1996 Buffalo Creek storms, Virginia Canyon near Idaho Springs storm of 1991, and runoff from sites 1-12 of the "Witter Gulch" storm, the peak discharges probably were produced by 1 to 2 inches of rain in a short duration (likely less than 60 minutes -typical thunderstorm duration) and very localized (e.g., minimal increase in peak flows from site 3 to 1 on Witter Gulch, and lack of runoff in other basins). This interpretation does not discount the rainfall amounts from local residents in the Witter Gulch area. It is likely that such rainfall totals reflect total amounts of rainfall in much longer durations (a day or more).

C. Interpretations/Comments

Undeveloped basins (no gravel roads or homes) in the study area had minimal (<5 cfs) runoff during 1997. Rainfall runoff on 8/3 were caused by runoff from gravel roads, particularly in the center of the Witter Gulch basin. [This has been noted for other foothills streams such as Buffalo Creek in 1996/97, Virginia Canyon at Idaho Springs in 1991, and Cub Creek near Evergreen on June 6, 1997.] Dense vegetation and thick duff on undisturbed hillslopes in foothills and mountain basins such as Witter Gulch also helps minimize runoff. Damage to public utilities resulted from moderate erosion on steep slopes rather than natural stream channels. Many culverts in Witter Gulch were obstructed by woody debris and/or have a flow capacity of less than 100 to 200 cfs. These culverts, particularly driveway crossing streams, overtopped causing water to flow along roads further contributing to erosion and deposition of flood sediments. These backwater/overflow areas help attenuate peak flows (re: sites 4 to 3).

Additional onsite investigations can be made to further refine areas and magnitudes of runoff. A systematic bucket survey may provide some information about rainfall amounts and duration of the 8/3 peak flows if residents recall the storm. Similarly, rainfall estimates for 8/3 could be reconstructed from radar. This small storm does not appear to warrant such a reconstruction as there are far better recent extreme rainstorms in Colorado (e.g., Pawnee Creek/Sterling) where limited resources could better be utilized. Such documentation would provide additional insight about rainfall-runoff processes.

encl via fax ("cc" list will be mailed).

Robert D Jarrett
"capt'n flood"
U.S. Geological Survey
Box 25046, MS 412
Denver, CO 80225

Phone: 303-236-6447
Fax: 303-236-5034
Internet: rjarrett@usgs.gov

Robert D Jarrett, H, 10:18 AM 10/9/97 , Re: Witter Gulch flash flood,

X-POP3-Rcpt: kstewart@eazy
Return-Path: rjarrett@brrcrmail.cr.usgs.gov
Date: Thu, 9 Oct 1997 10:18:30 -0600
To: Kevin Stewart <kstewart@udfcd.org>
From: "Robert D Jarrett, Hydrologist, Denver, CO "<rjarrett@usgs.gov> (Bob Jarrett)
Subject: Re: Witter Gulch flash flood, evening of 97-Aug-3
Cc: "Robert D Jarrett, Hydrologist, Denver, CO" <rjarrett@usgs.gov>,
tom.browning@state.co.us, hms@interserv.com, brian.hyde@state.co.us,
nolan@ulysses.atmos.colostate.edu,
"Mark E Smith, Hydrologist, Denver, CO "<mesmith@usgs.gov>,
"Jerry E Vaill Jr., Hydrologist, Grand Junction, CO "<jevaill@usgs.gov>,
mgrimm@fema.gov

FAX 236-5034

Kevin

I hope to get up to Witter Gulch friday or Saturday; goal to identify basins affected by the 8/3/97 rainstorm. My objective is to use the data I collect primarily to estimate the rainfall characteristics of the storm from geomorphic indicators. Per a discussion with Brian Hyde, my fieldwork will include peak discharge estimates for several sites in the WG basin (and likely on on Bear Creek -as best as I can tell, Witter Gulch enters Bear Creek a short distance upstream from his paleoflood site (MS thesis). If you would like a XS at your gage, I'll do my best to get one and provide a rating curve (like for Cub Creek). Can you fax (236-5034) maps of UDFCD streamflow gages near Witter Gl (Bear Cr at Rosedale?). Thanks

best regards, bob
****

Kevin

10/6 Response 3:53

Thanks for the heads up. That one doesn't ring a bell nor do I remember hearing about it (Tom, does this sound familiar??). I take it that Witter Gulch is a trib of Upper Bear Creek (approximate location in terms of miles upstream from Evergreen Lake or County line?). Once I locate the site, I'll head up there and will let you know what I find out.

bob

>Bob,
>
>Have you conducted any paleo investigations for this event? I just learned
>last week that this T-storm resulted in a presidential disaster declaration
>for Clear Creek County. Watershed elevs. range from 7400-10,000' plus.
>Unconfirmed reports of rainfall exceeding 10-inches. I'm not sure I believe
>these numbers. Storm duration was about 1-hour. We have hydrographs at
>Rosedale and Evergreen Dam for this event. We have also archived the radar
>data. ALERT rainfalll at Rosedale was 0.59". Large hail also reported.
>Lightning was continuous. I remember this Sunday boomer vividly. Henz and
>I were both concerned about it's possible impacts. District was not affected.
>
>Kevin

Robert D Jarrett
"capt'n flood"
U.S. Geological Survey
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Denver, CO 80225

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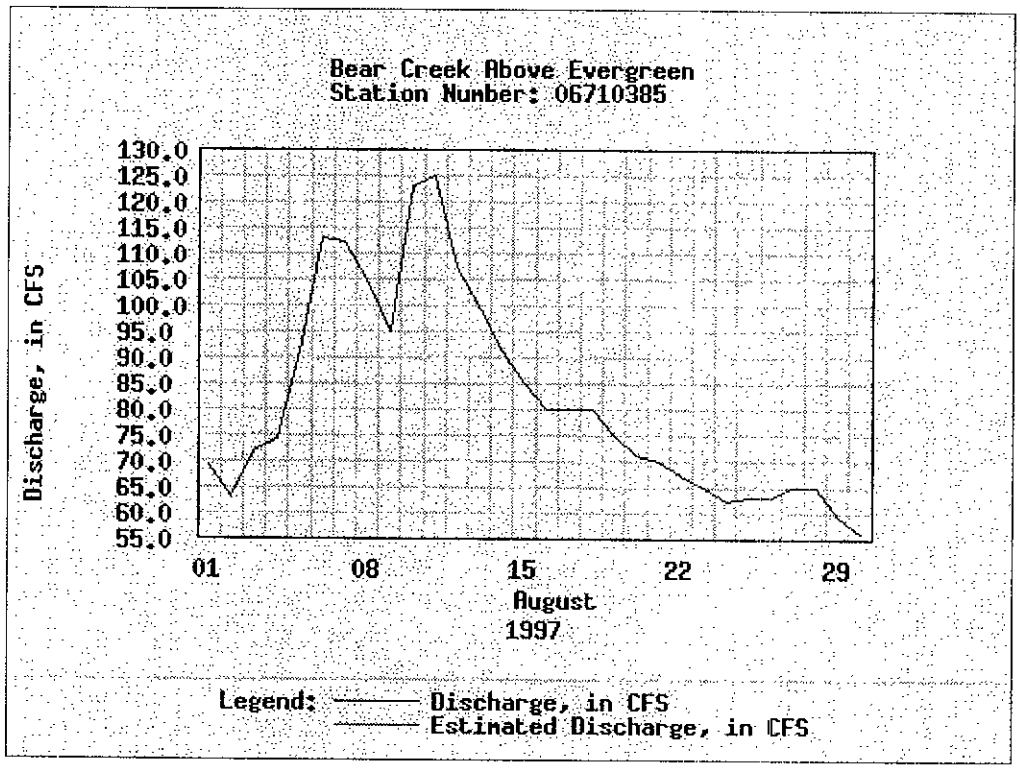
Historical Streamflow Daily Values Graph for Bear Creek Above Evergreen



Some stations have red data points. These represent days for which data was estimated, rather than recorded.

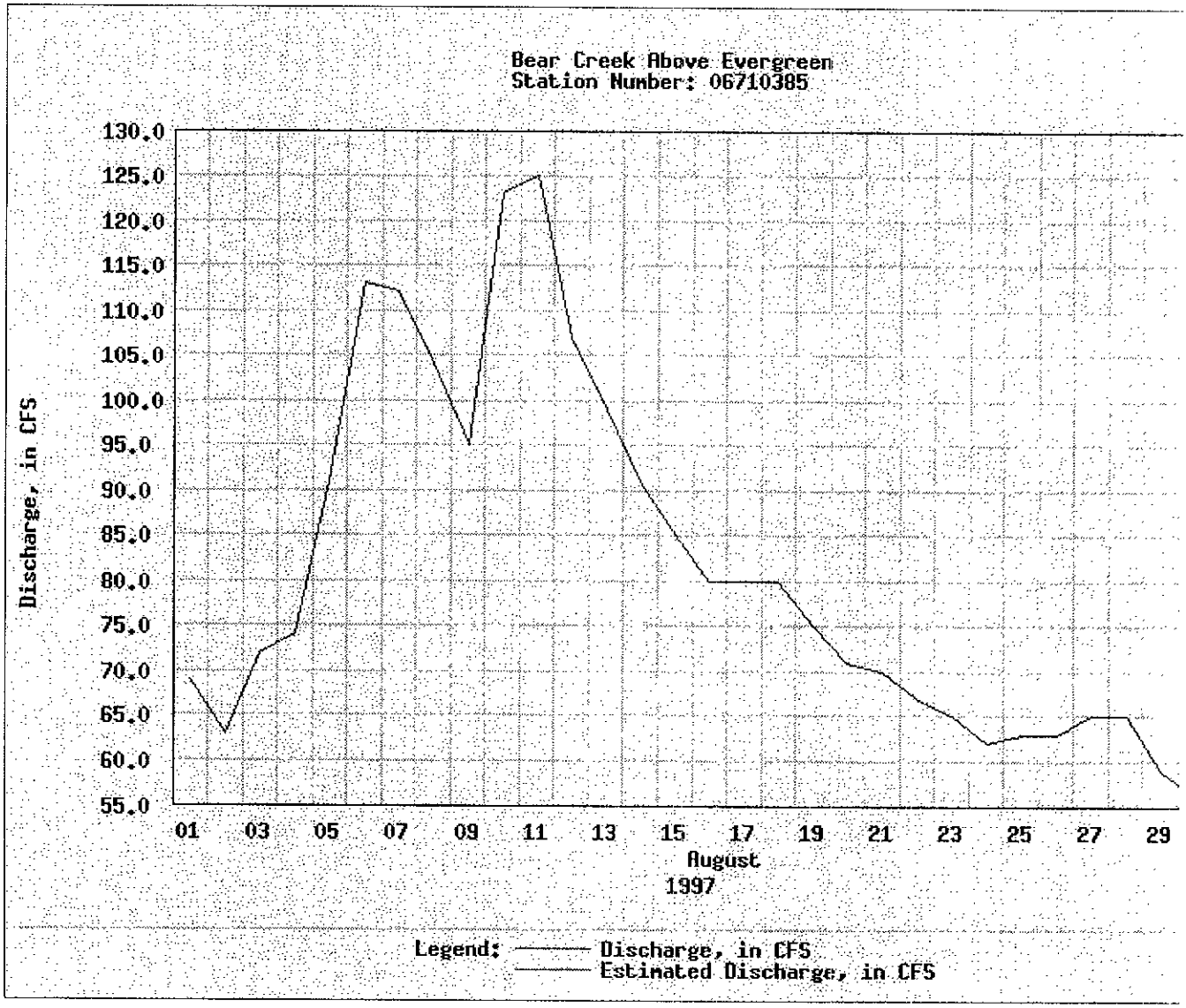
We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

Peakflow data is now available up to WY 1996.

The NWIS-W server's official URL is now http://waterdata.usgs.gov/nwis-w/

←Go to the Colorado NWIS-W Data Retrieval page
←Go to the Colorado Water Resources page

Historical Streamflow Daily Values Graph for Bear Creek Above Evergreen



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map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

Peakflow data is now available up to WY 1996.

The NWIS-W server's official URL is now http://waterdata.usgs.gov/nwis-w/

Go to the Colorado NWIS-W Data Retrieval page
Go to the Colorado Water Resources page
Get help with the terms used on these pages
Other states with USGS surface-water data retrieval pages

Comments and questions are welcome! Please visit our feedback page or email h2oteam@qvarsx.er.usgs.gov.

This page was created in real time by the NWIS-W package: (NWIS-W: 3.01pr ; API: 3.0pr ; hist: 3.0pr)

UNEDITED LOCAL CLIMATOLOGICAL DATA [NOAA, National Climatic Data Center] MONTH: 08/1997

Station Location: DENVER, CO (DEN) lat: 39° 52', lon: -104° 40'
Elev(Ground): 5414 FeetTime Zone: Mountain Standard WBAN: 03017

date	Temperature (Fahrenheit)						Deg Days Base 65 Degrees		Significant Weather	Snow/Ice on Gnd(In)		Precipitation (In)		Pressure (inches of Hg)		Wind Speed=mph Dir=tens of degrees							date
	Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling		0600 LST Depth	1200 LST Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea level	Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	max 5-sec Dir	max 2-min Speed	max 2-min Dir	
01	84	62	73	1	59	64	0	8	TS	M	-	-	0.00	24.80	30.11	1.9	20	7.3	25	5	22	5	01
02	88	62	75	3	60	63	0	10	TS TSRA TSRAGS	M	-	-	0.36	24.79	30.07	6.7	16	10.2	40	19	33	19	02
03	87	59	73	1	57	63	0	8	GR FG	M	-	-	0.00	24.81	30.10	4.3	17	8.3	20	12	16	12	03
04	84	58	71	-1	59	62	0	6	-	0.0	-	-	0.54	24.88	30.20	3.7	15	9.7	32	28	29	28	04
05	73	59	66	-6	61	62	0	1	TS TSRA RA FG	M	-	-	0.56	24.80	30.12	1.0	8	9.3	24	31	22	32	05
06	64	55	60*	-12	55	56	5	0	RA FG+ FG BCFG	M	-	-	0.46	24.87	30.22	4.9	31	10.8	25	2	22	3	06
07	76	53	65	-7	51	57	0	0	RA FG+ FG BCFG	M	-	-	0.00	24.73	30.06	7.9	18	10.0	25	20	21	20	07
08	89	59	74	2	49	59	0	9	-	M	-	-	0.00	24.52	29.74	10.0	21	11.7	24	19	18	20	08
09	69	57	63	-8	51	56	2	0	-	M	-	-	0.11	24.66	29.95	1.4	4	8.3	25	2	21	1	09
10	68	56	62	-9	58	59	3	0	RA FG	M	-	-	0.11	24.66	29.97	2.4	31	9.2	24	33	23	33	10
11	74	56	65	-6	57	59	0	0	RA FG+ FG HZ	M	-	-	0.18	24.68	30.00	2.1	5	6.2	24	34	20	34	11
12	76	52*	64	-7	55	58	1	0	TS TSRA RA FG+ FG	M	-	-	0.90	24.77	30.11	5.2	13	8.6	25	10	23	12	12
13	83	53	68	-3	50	57	0	3	HZ	M	-	-	0.00	24.67	29.98	6.2	25	10.0	26	33	23	31	13
14	79	57	68	-3	43	54	0	3	TS TSGS TSRA GR	M	-	-	0.00	24.48	29.74	12.5	26	14.4	37	28	31	28	14
15	88	59	74	4	46	57	0	9	RA FG+ FG	M	-	-	0.00	24.39	29.97	8.5	20	10.1	20	14	16	20	15
16	77	54	66	-4	54	58	0	1	FG	M	-	-	0.03	24.54	29.81	2.3	4	10.1	45	32	38	32	16
17	78	54	66	-4	56	59	0	1	-	M	-	-	0.02	24.71	30.03	6.6	14	12.4	37	28	30	29	17
18	81	56	69	-1	54	58	0	4	-	M	-	-	0.13	24.66	29.95	5.9	21	9.6	39	27	36	28	18
19	77	57	67	-2	50	57	0	2	TS TSRA	M	-	-	T	24.70	29.99	9.3	21	12.5	29	2	24	2	19
20	82	55	69	0	53	59	0	4	TS TSRA FG	M	-	-	0.00	24.78	30.08	2.4	21	8.0	20	21	17	20	20
21	89	59	74	5	51	59	0	9	TS TSRA	M	-	-	T	24.76	30.04	3.9	28	8.8	43	34	36	34	21
22	86	54	70	1	50	58	0	5	HZ	M	-	-	T	24.80	30.09	3.5	20	8.8	40	35	33	35	22
23	89	57	73	4	49	59	0	8	-	M	-	-	0.00	24.74	30.01	3.9	22	7.8	20	21	17	21	23
24	92*	62	77	9	49	60	0	12	-	M	-	-	T	24.68	29.90	8.0	22	11.1	28	21	23	19	24
25	89	60	75	7	53	61	0	10	TS TSRA	M	-	-	0.08	24.69	29.93	6.6	22	11.3	37	18	32	19	25
26	86	60	73	5	56	62	0	8	-	M	-	-	T	24.68	29.92	5.6	22	9.0	30	25	25	25	26
27	86	59	73	5	54	58	0	8	-	M	-	-	T	.00	-	4.5	24	8.3	20	25	16	22	27
28	89	64	77*	10	52	61	0	12	TS TSRA	M	-	-	T	24.61	29.85	6.5	21	8.9	22	19	20	19	28
29	87	58	73	7	49	59	0	8	-	0.0	-	-	T	24.59	29.82	4.7	25	11.1	26	2	23	1	29
30	83	54	69	3	51	58	0	4	-	M	-	-	0.00	24.64	29.91	6.7	17	8.7	21	16	18	17	30
31	85	59	72	6	55	60	0	7	TS	M	-	-	0.04	24.61	29.88	10.5	19	12.5	33	24	28	23	31
									-														
									-														

								TS TSRA										
81.9	57.4	69.7	--------	53.1	59.1	.4	5.2	<Monthly Averages	Totals>		3.52	23.89	29.99	3.8	20.7	9.8	<Monthly Average	
		-.1	--------	<----------Departure From Normal---------->							1.87							

Degree Days Monthly Season to Date

	Total	Departure	Total	Departure
Heating:	11	0		
Cooling:	160	0		

Greatest 24-hr Precipitation: 0.90 date: 12
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: 0 date:

Sea Level Pressure Date Time

Maximum:	30.30	6	1206
Minimum :	29.52	15	1731

Number of Days with ----->

Max temp >= 90	: 1
Max temp <= 32	: 0
Thunderstorms	: 12
Min temp <= 32	: 0
Min temp <= 0	: 0
Heavy Fog	: 5
Precipitation >= .01 inch	: 13
Precipitation >= .10 inch	: 9
Snowfall >= 1.0 inch	: 0

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Tom Browning

FAX NO.: 303-866-4474

FROM: Markus Ritsch

DATE: June 10, 1998

NO. OF PAGES: We are sending 3 Page(s) (Including this Page)

SUBJECT:

COMMENTS:

Tom, this is the figure we have from Bob. Hope this is what you were looking for. If not give me a call & I'll look for it.

Markus

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573

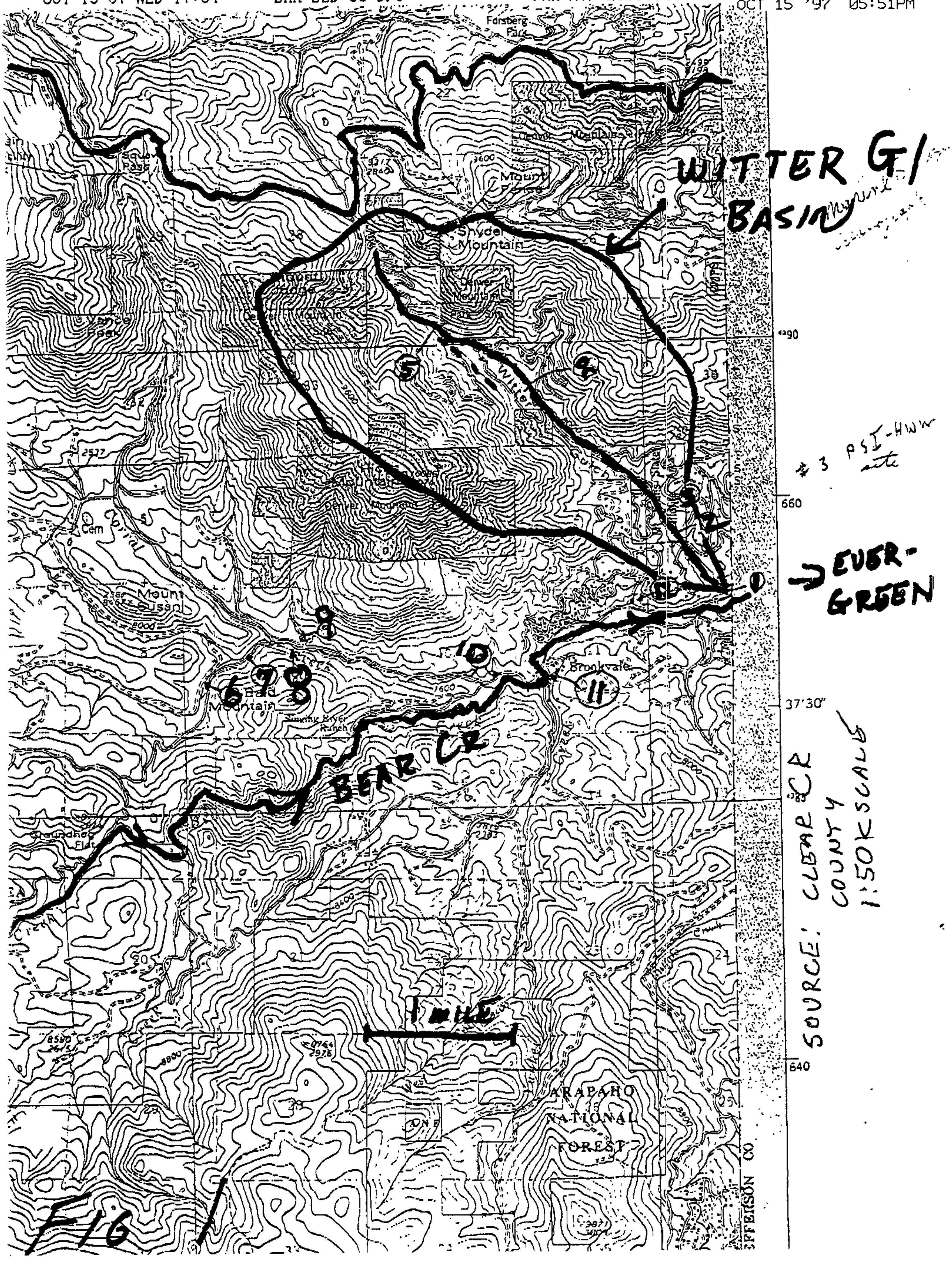
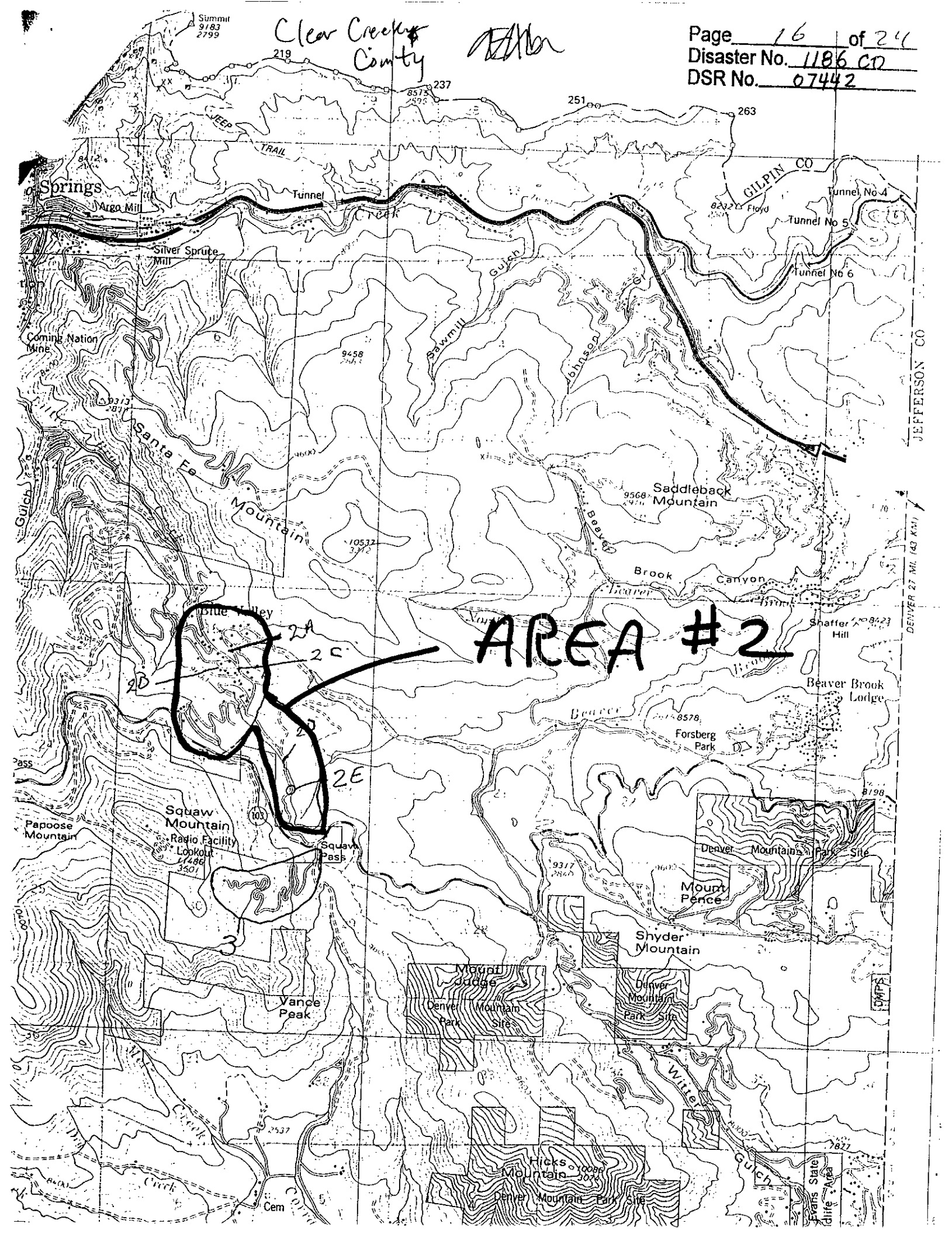
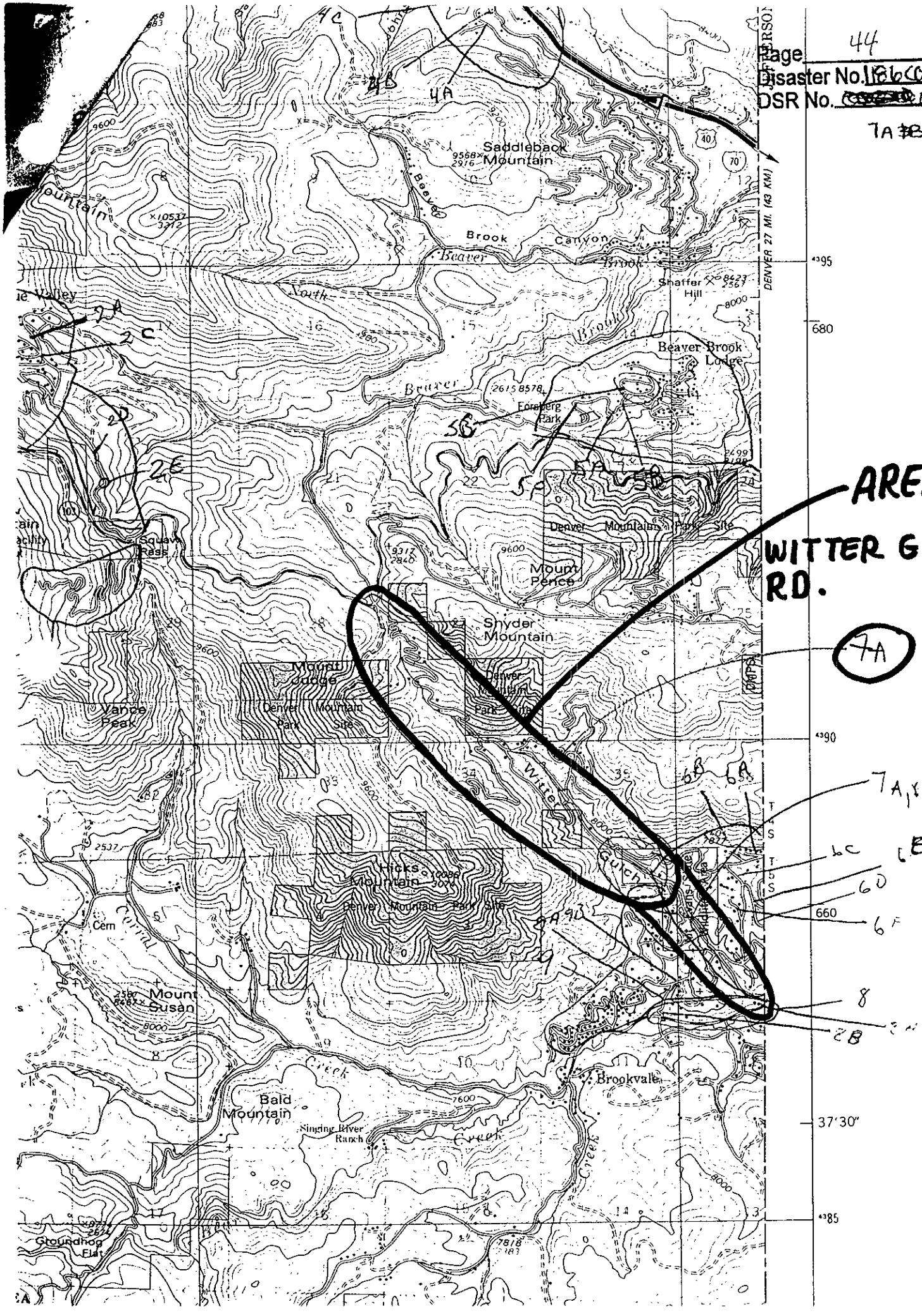
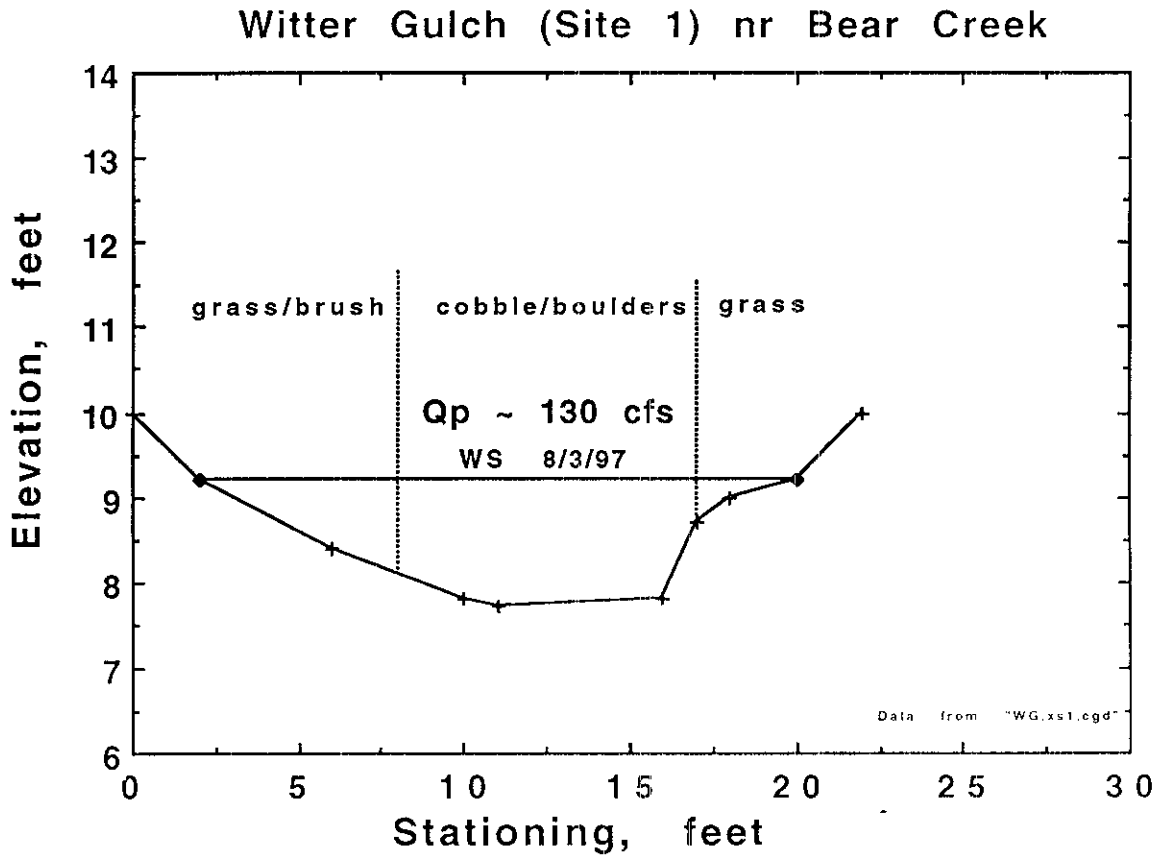

WITTER G/
BASIN
Forsberg Park
Squaw Pass
Mount
Snyder Mountain
Denver Mountain Park
Witter
Gulch
Vance Peak
Cem
Corral
Mount Susan
Bald Mountain
Brookvale
Groundhog Flat
1
2
3
4
5
6
7
8
9
10
11
→ EVERGREEN
#3 PSI-HWW site
BEAR CR
1 MILE
ARAPAHO
NATIONAL
FOREST
JEFFERSON CO
SOURCE: CLEAR CR COUNTY 1:50K SCALE
4390
660
37'30"
4383
640

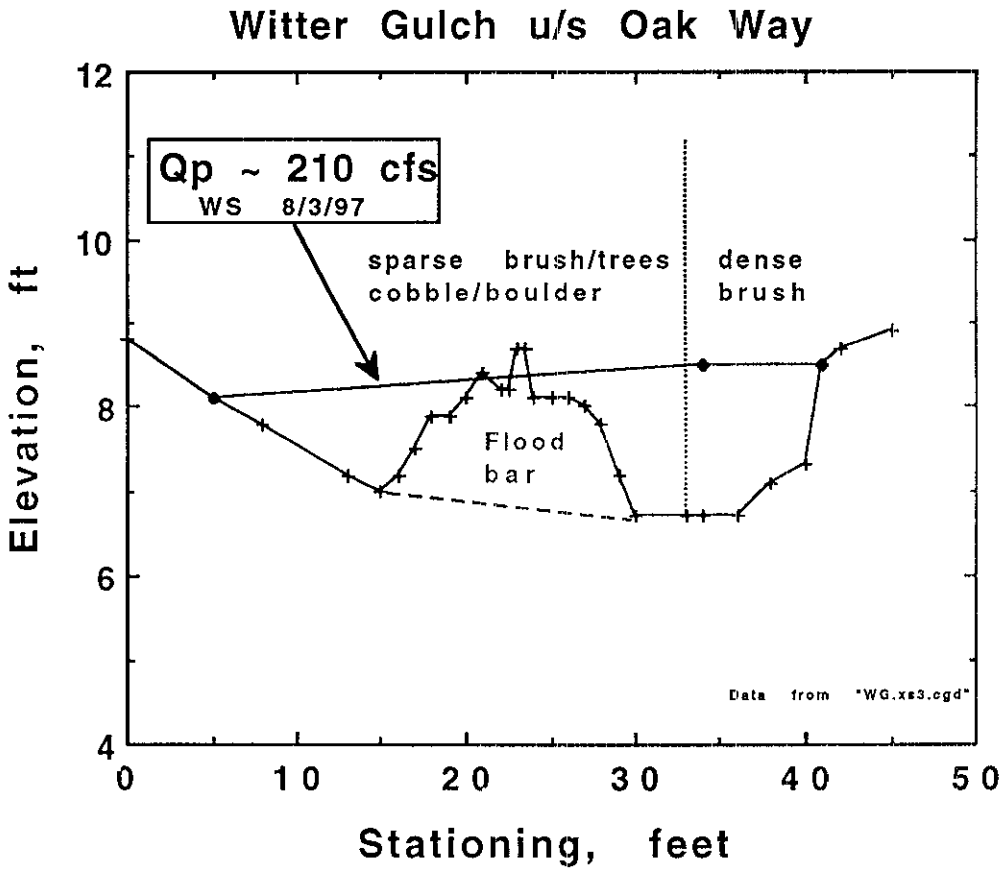
FIG 1

Clear Creek County




Saddleback Mountain
Beaver Brook Canyon
Beaver Brook Lodge
Foreberg Park
Denver Mountain Park Site
Mount Pence
Snyder Mountain
Mount Judge
Vance Peak
Witter Gulch
Hicks Mountain
Mount Susan
Bald Mountain
Brookvale
Singing River Ranch
Groundhog Flat
Shaffer Hill
Squaw Pass
DENVER 27 MI. (43 KM.)
AREA 7
WITTER GULCH RD.
7A
7A,B
7C
7E
7D
7F
8
8B
680
660
37°30"


Witter Gulch (Site 1) nr Bear Creek
Elevation, feet
Stationing, feet
grass/brush
cobble/boulders
grass
Qp ~ 130 cfs
WS 8/3/97
Data from "WG.xs1.cgd"
14
13
12
11
10
9
8
7
6
0
5
10
15
20
25
30


Witter Gulch u/s Oak Way
Elevation, ft
Stationing, feet
Qp ~ 210 cfs
WS 8/3/97
sparse brush/trees
cobble/boulder
dense
brush
Flood
bar
Data from "WG.xs3.cgd"
12
10
8
6
4
0
10
20
30
40
50

	Sta, ft	GR el, ft	HWM el, ft
1	0	10.0	
2	2	9.2	9.2
3	6	8.4	
4	10	7.8	
5	11	7.7	
6	16	7.8	
7	17	8.7	
8	18	9.0	
9	20	9.2	9.2
10	22	10.0	

	Sta, ft	GR el, ft	HWM el, ft
1	0	8.8	
2	5	8.1	8.1
3	8	7.8	
4	13	7.2	
5	15	7.0	
6	16	7.2	
7	17	7.5	
8	18	7.9	
9	19	7.9	
10	20	8.1	
11	21	8.4	
12	22	8.2	
13	22	8.2	
14	23	8.7	
15	24	8.7	
16	24	8.1	
17	25	8.1	
18	26	8.1	
19	27	8.0	
20	28	7.8	
21	29	7.2	
22	30	6.7	
23	33	6.7	
24	34	6.7	8.5
25	36	6.7	
26	38	7.1	
27	40	7.3	
28	41	8.5	8.5
29	42	8.7	
30	45	8.9	

3. State Data

Bob Jarrett, 02:29 PM 10/6/97, Witter Gulch flash flood, even

To: Bob Jarrett
From: Kevin Stewart <kstewart@udfcd.org>
Subject: Witter Gulch flash flood, evening of 97-Aug-3
Cc: Jack Henz, Tom Browning
Bcc:
X-Attachments:

Laura Oman
534-5777
x282

Bob,

Have you conducted any paleo investigations for this event? I just learned last week that this T-storm resulted in a presidential disaster declaration for Clear Creek County. Watershed elevs. range from 7400-10,000' plus. Unconfirmed reports of rainfall exceeding 10-inches. I'm not sure I believe these numbers. Storm duration was about 1-hour. We have hydrographs at Rosedale and Evergreen Dam for this event. We have also archived the radar data. ALERT rainfalll at Rosedale was 0.59". Large hail also reported. Lightning was continuous. I remember this Sunday boomer vividly. Henz and I were both concerned about it's possible impacts. District was not affected.

Kevin

Call back from Brian Hyde

{ 18" Two Unconfirmed reports
11.25"
3" + Also: along Squaw Pass Rd. reported

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 5/12/98

To: MARCUS RITSCH

Fax #: (970) 484-7593

Agency: RTI

From: TOM BROWNING

Fax#: (303) 866-4474
Phone: (303) 866-3441

(5) Pages transmitted, including this cover sheet

Clear Creek County Flood Doc.
Water Outlet Cross-Sections
In order from u/s to d/s #1 through #4

TOM

Sending Operator

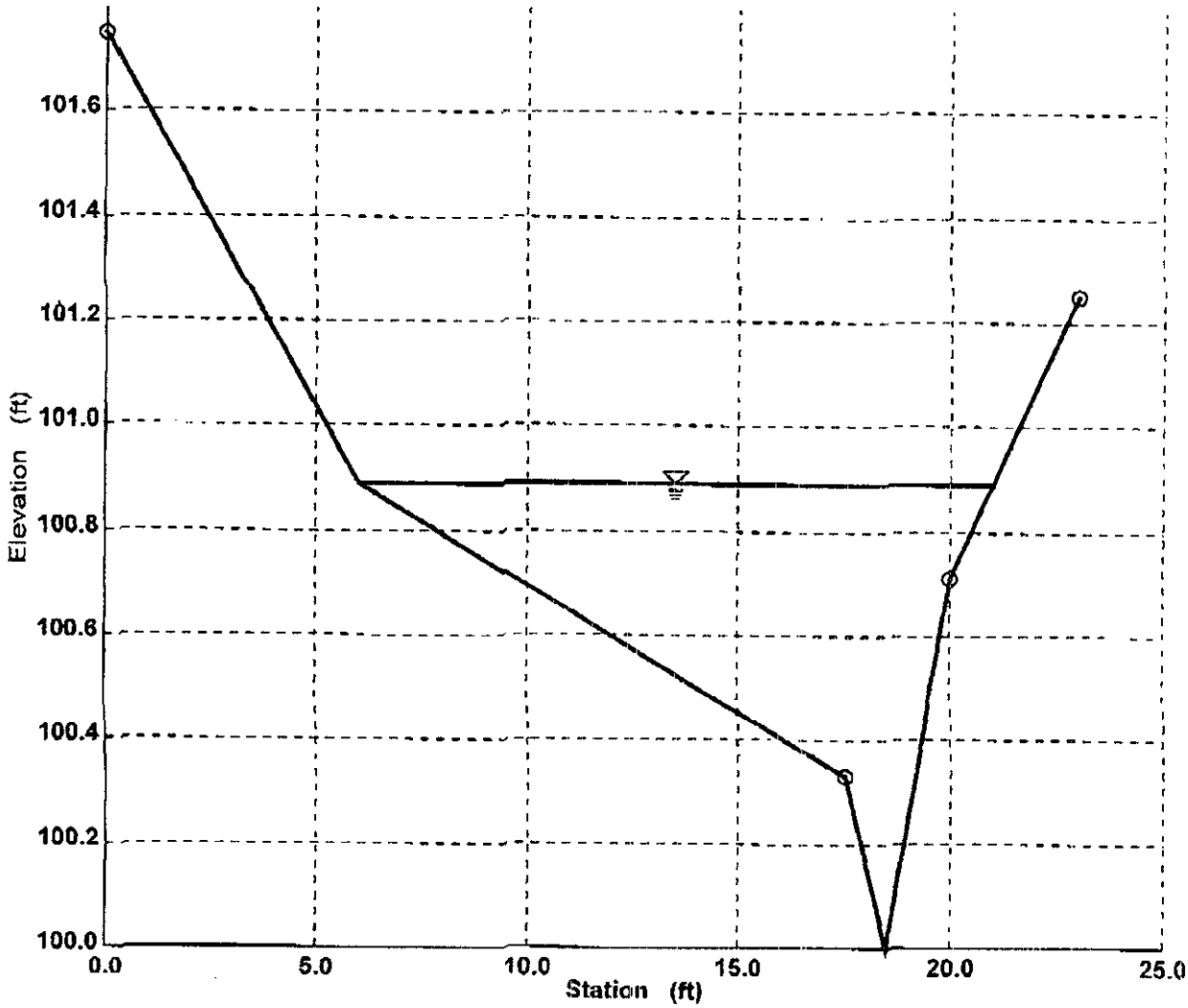
* Are these for peak discharge on 8/3/97 ?

Witter Gulch near Switchback
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\witter-1.fm2
Worksheet	Witter Gulch near Switchback
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

#1

Section Data		
Wtd. Mannings Coefficient	0.037	
Channel Slope	0.100000	ft/ft
Water Surface Elevation	100.89	ft
Discharge	28.65	cfs

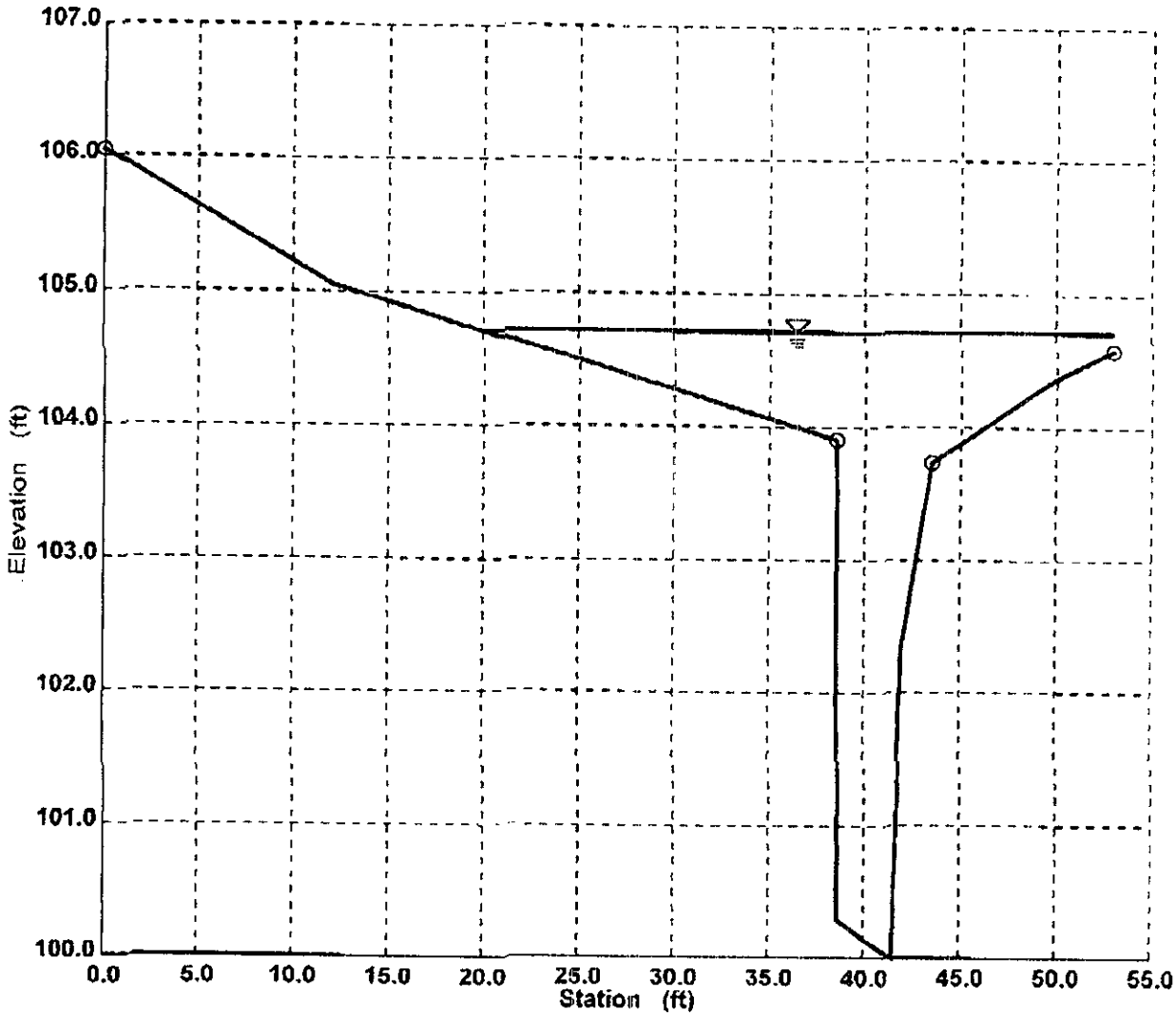


Witter Gulch nr Snyder Mtn Road
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\witter-1.fm2
Worksheet	Witter Gulch at Snyder Mtn Road
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

#2

Section Data		
Wtd. Mannings Coefficient	0.044	
Channel Slope	0.074000	ft/ft
Water Surface Elevation	104.70	ft
Discharge	233.24	cfs

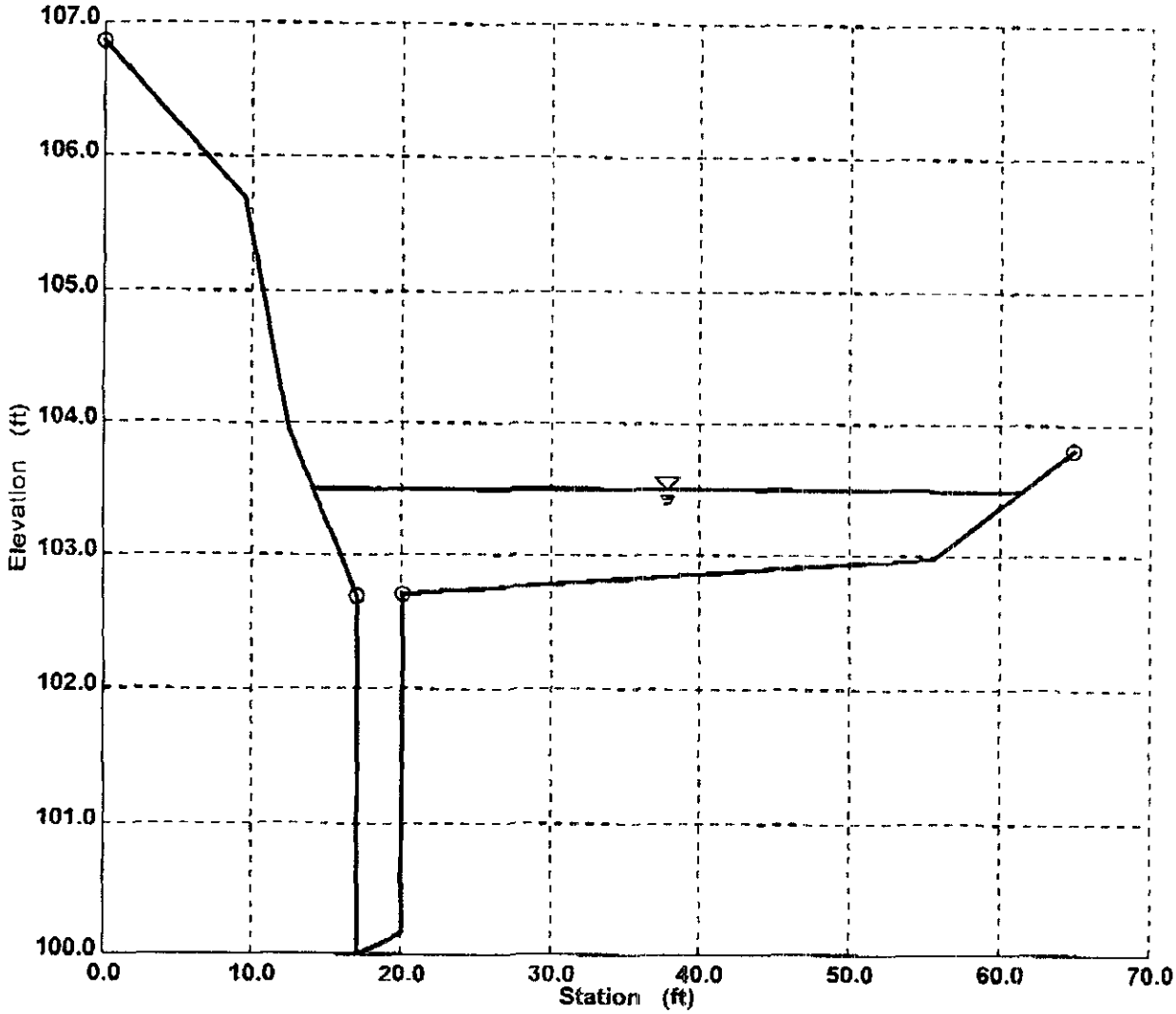


Witter Gulch, Upper X-Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\witter-1.fm2
Worksheet	Witter Gulch ab Bear Crk, Upper X-Sect
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

#3

Section Data		
Wtd. Mannings Coefficient	0.036	
Channel Slope	0.080000	ft/ft
Water Surface Elevation	103.50	ft
Discharge	332.04	cfs

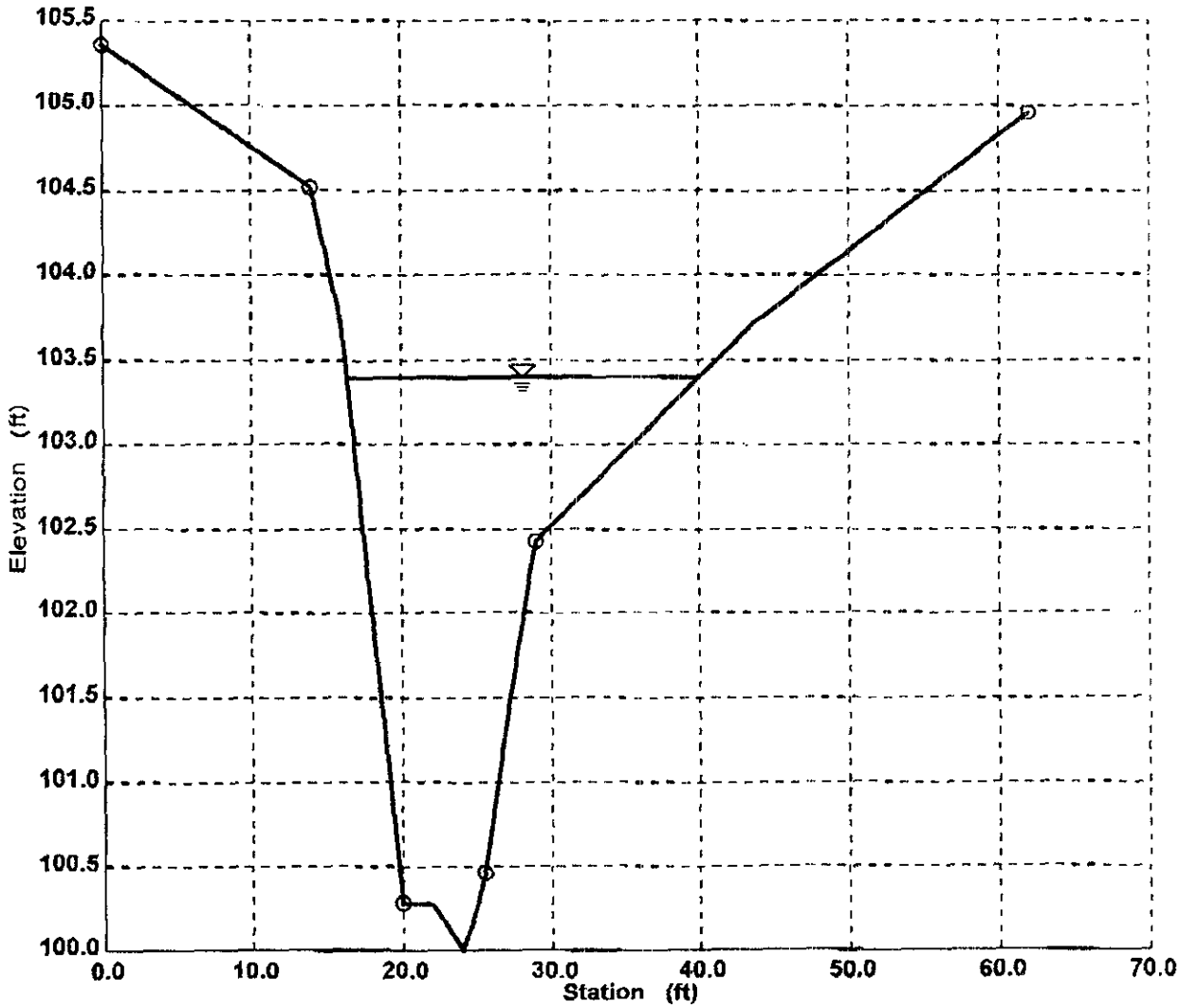


Witter Gulch Middle X-Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\witter-1.fm2
Worksheet	Witter Gulch ab Bear Crk, middle x-sect
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

#4

Section Data		
Wtd. Mannings Coefficient	0.041	
Channel Slope	0.060000	ft/ft
Water Surface Elevation	103.39	ft
Discharge	393.38	cfs



4. Local Data

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
2480 W. 26th Avenue, Suite 156B, Denver, CO 80211
Tel: (303) 455-6277 • FAX: (303) 455-7880

FAX TRANSMITTAL/LETTER

Date: 10-17-97

To: Bob Jarrett

Company: USGS

FAX Number: 236-5034 Telephone Number: 6447

From: Kevin Stewart

Re: Upper Bear

Number of pages transmitted 12 (not including this sheet)

To be followed by original in the mail: ☐ Yes ☒ No

13/13 OK @ 9:47

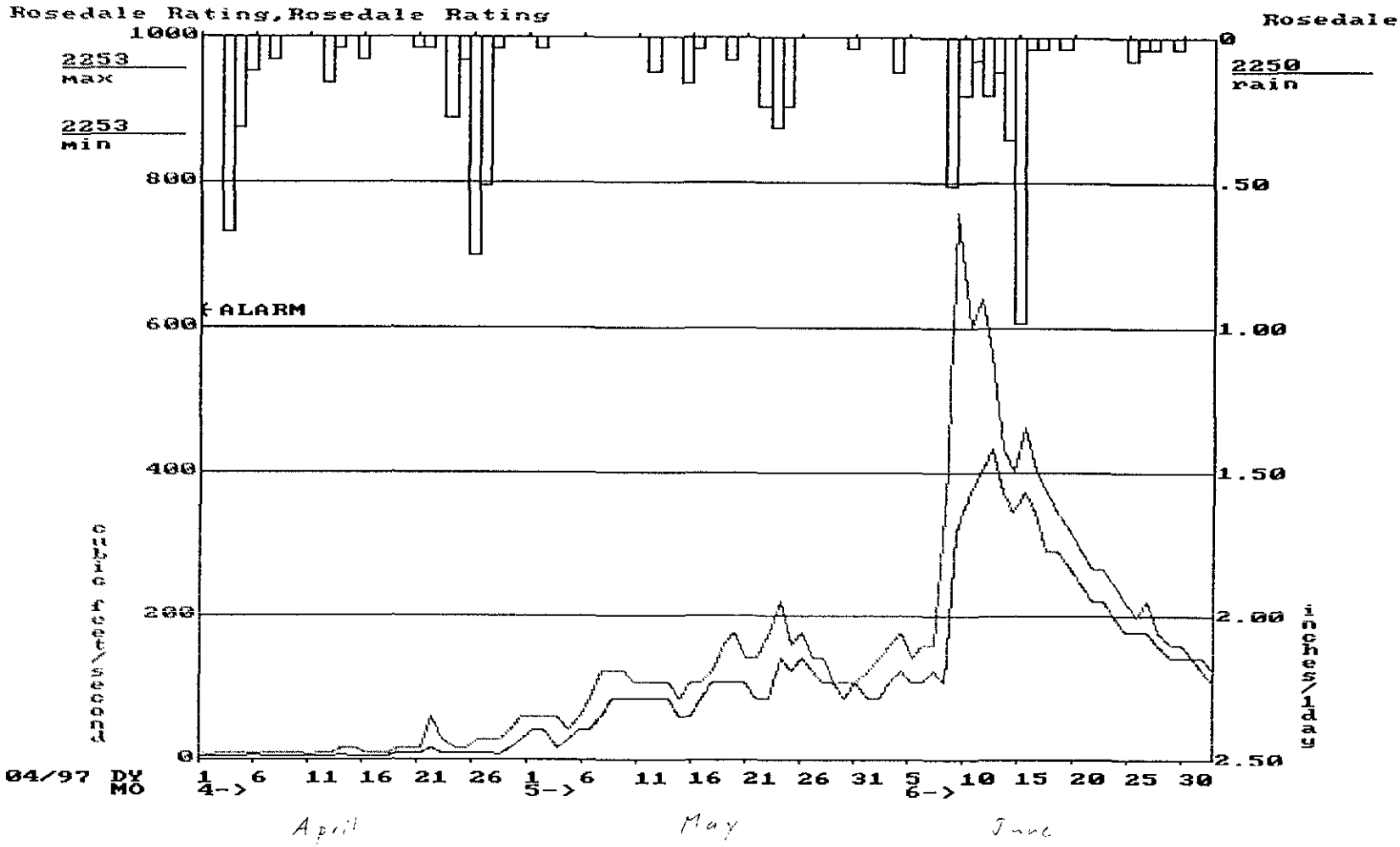
MESSAGE: ALERT Data for Upper Bear Creek - 1997

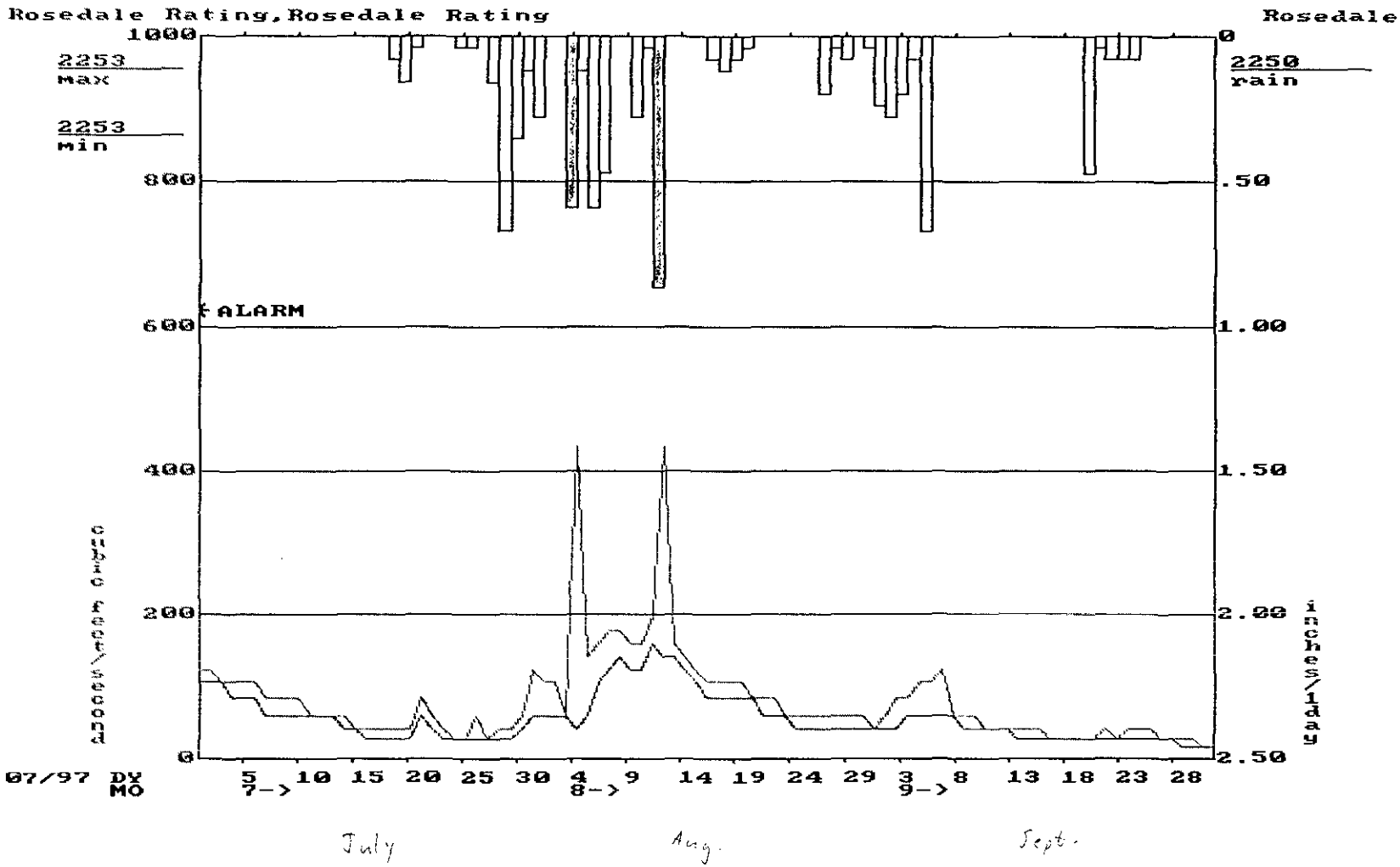
For your files:

1) Seasmal plots for Rosedale Gage #2253 Daily Max/Min Qs. + Rain (2 pages)
2) Aug 3 Hyds + Rain + statreport (3 pages)
3) Aug 11 Hyds + Rain + statreport (4 pages)
↑ A day similar to Aug 3. I believe the peak was higher.
4) Seasm plots for Evergreen Lake + Rain (2 pages)
5) Rating table for Rosedale, based on FIS ↑ "best guess" @ low end. (1 page)

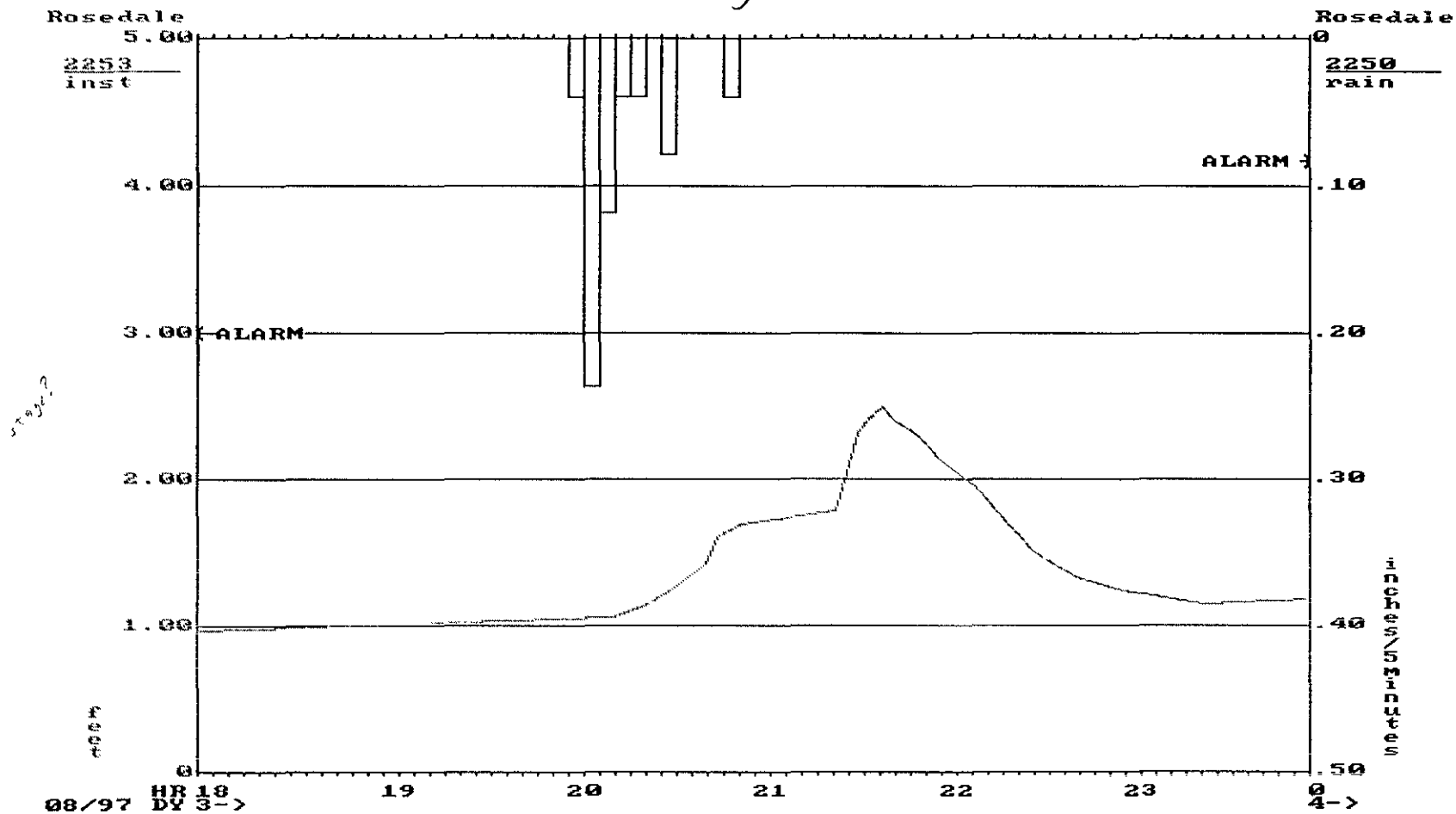
Thanks for your help!

FAXLTR.DOC

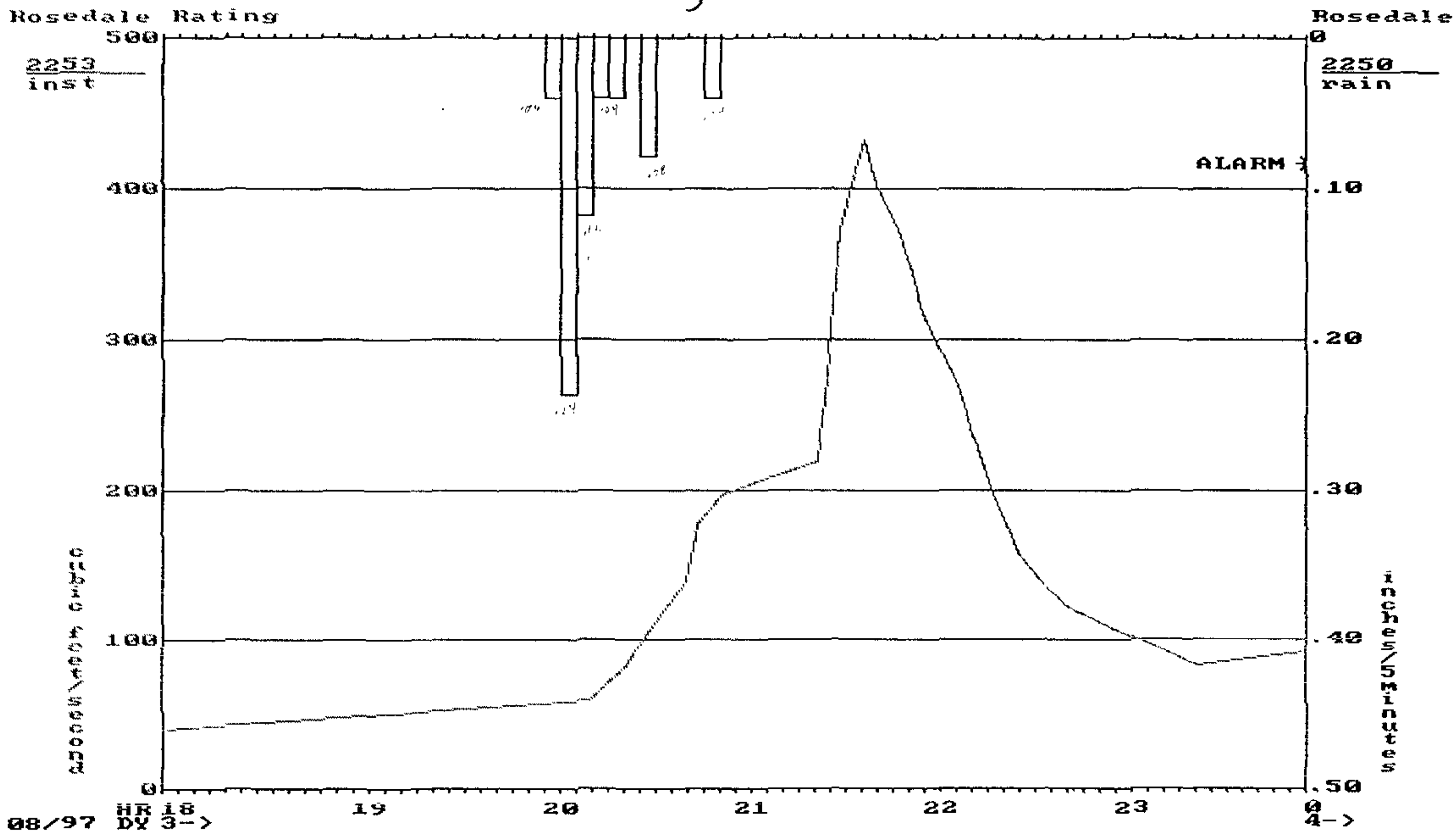

Rosedale Rating,Rosedale Rating
Rosedale
1000
2253
max
2253
min
800
ALARM
600
400
200
0
0
2250
rain
.50
1.00
1.50
2.00
2.50
cubic feet/second
inches/1day
04/97 DY
MO
1
4->
6
11
16
21
26
1
5->
6
11
16
21
26
31
5
6->
10
15
20
25
30
April
May
June


Rosedale Rating,Rosedale Rating
Rosedale
1000
2253
max
2253
min
800
600
ALARM
400
200
0
0
2250
rain
.50
1.00
1.50
2.00
2.50
cubic feet/second
inches/1day
07/97 DY
MO
5
7->
10
15
20
25
30
4
8->
9
14
19
24
29
3
9->
8
13
18
23
28
July
Aug.
Sept.

Aug 3, 1997


Rosedale
2253
inst
Rosedale
2250
rain
5.00
4.00
3.00
2.00
1.00
0
.10
.20
.30
.40
.50
ALARM
ALARM
feet
inches\5minutes
08/97 DY 3->
HR 18
19
20
21
22
23
0
4->
stage?

Aug. 3, 1997


Rosedale Rating
Rosedale
2253
inst
2250
rain
ALARM
500
400
300
200
100
0
0
.10
.20
.30
.40
.50
cubic feet/second
inches/5minutes
HR 18
08/97 DY 3->
19
20
21
22
23
0
4->

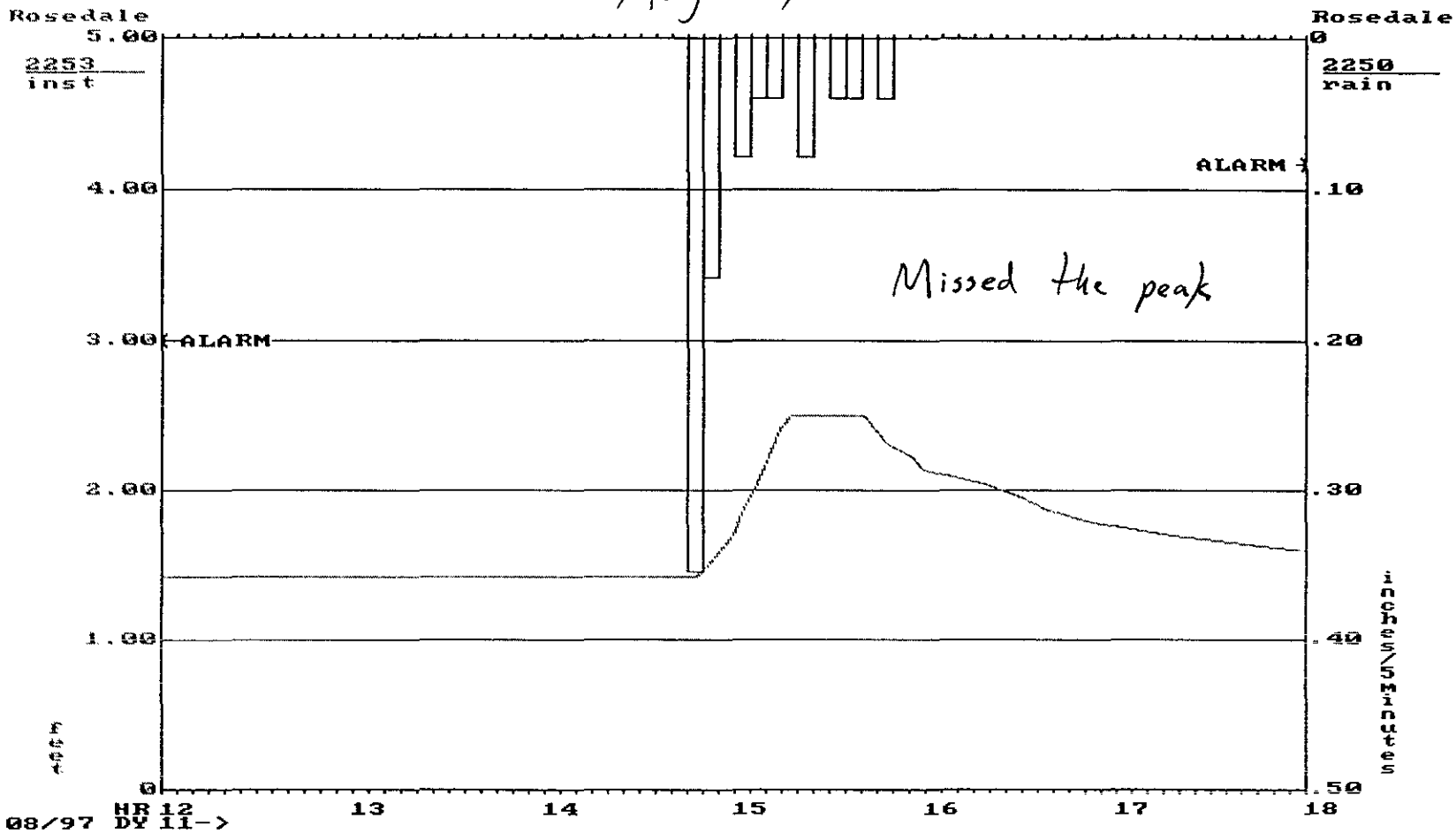
UDFCD ALERT Base Station...NovaStar Node 2

Date Time

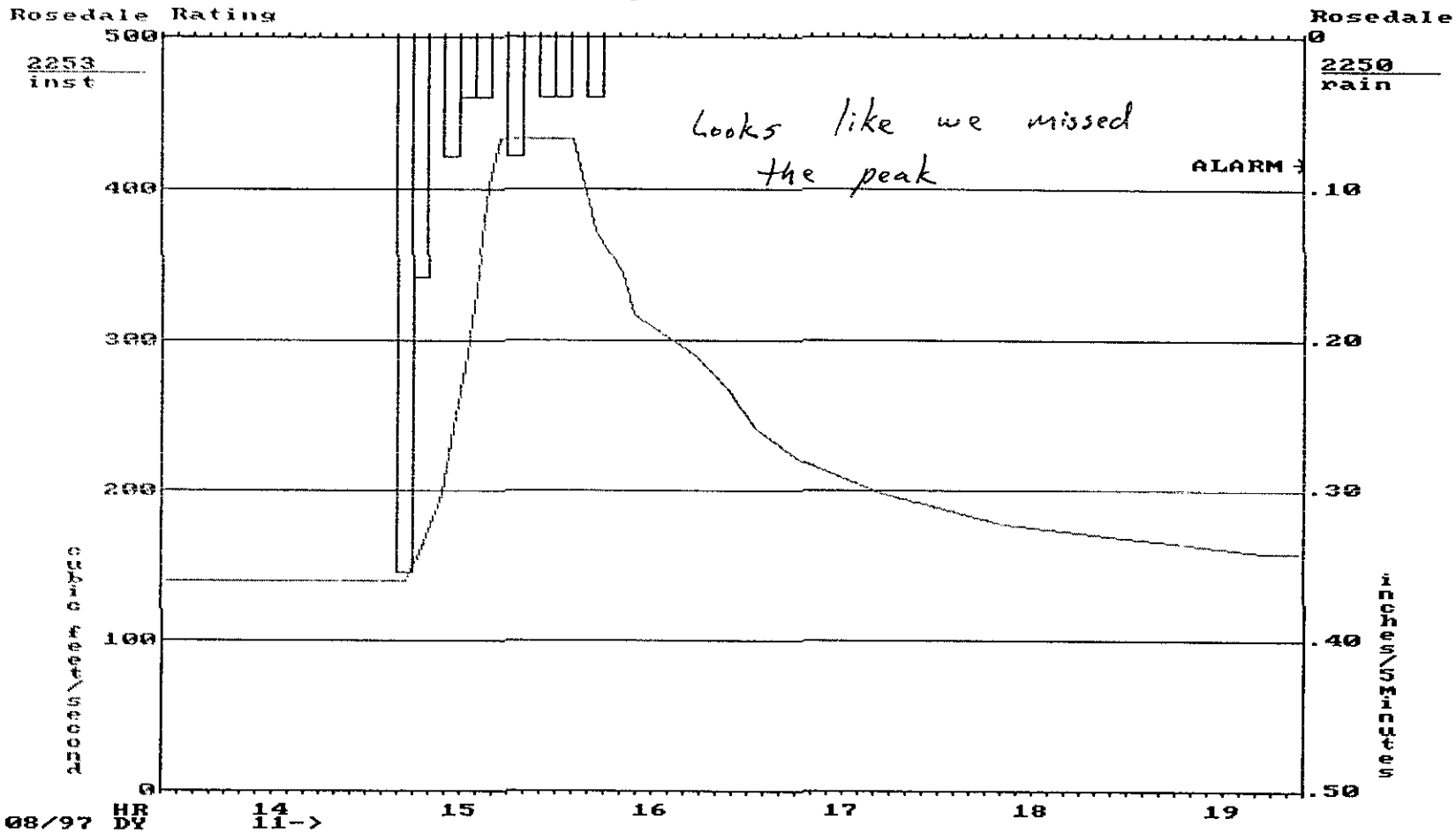
10/16/1997-17:20:35

DeviceID	2253	2253	2253	2253	2253	2253	2253	2253	2253	2250
StatType	max	max	tmax	min	tmin	dif	vols	cnt	inst	rain
DataType	level	rated	level	rated	level	level	rated	level	level	precip
Units	ft	cfs	time	cfs	time	ft	AF	#	ft	in
08/03/97										
2400	1.15	83	23:25	83	23:25	0.00	2	_____	1.15	0.00
2345	1.15	83	23:25	83	23:25	0.00	2	_____	1.15	0.00
2330	1.15	83	23:25	83	23:25	-0.09	2	1	1.15	0.00
2315	1.24	107	22:59	107	22:59	0.00	2	_____	1.24	0.00
2300	1.24	107	22:59	107	22:59	-0.09	3	1	1.24	0.00
2245	1.42	140	22:36	123	22:44	-0.18	3	2	1.33	0.00
2230	1.78	220	22:17	158	22:29	-0.36	4	4	1.51	0.00
2215	1.96	266	22:10	243	22:14	-0.27	6	2	1.87	0.00
2200	2.32	373	21:51	317	21:59	-0.27	8	3	2.14	0.00
2145	2.50	433	21:40	373	21:32	0.36	8	4	2.41	0.00
2130	2.05	291	21:29	220	21:25	0.36	4	2	2.05	0.00
2115	1.69	198	20:55	198	20:55	0.00	4	_____	1.69	0.00
2100	1.69	198	20:55	178	20:47	0.27	4	2	1.69	0.04
2045	1.42	140	20:44	107	20:32	0.27	2	2	1.42	0.08
2030	1.15	83	20:25	83	20:25	0.09	1	1	1.15	0.08
2015	1.06	59	20:14	59	20:14	0.09	1	1	1.06	0.39
2000	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1945	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1930	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1915	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1900	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1845	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1830	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1815	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1800	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1745	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1730	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1715	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1700	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1645	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1630	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1615	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1600	0.97	40	15:40	40	15:40	0.00	1	_____	0.97	0.00
1545	0.97	40	15:40	40	15:40	-0.09	1	1	0.97	0.00
1530	1.06	59	14:47	59	14:47	0.00	1	_____	1.06	0.00
1515	1.06	59	14:47	59	14:47	0.00	1	_____	1.06	0.00
TOTALS:	2.50	433	21:40	40	15:40	0.09	73	26	43.84	0.59

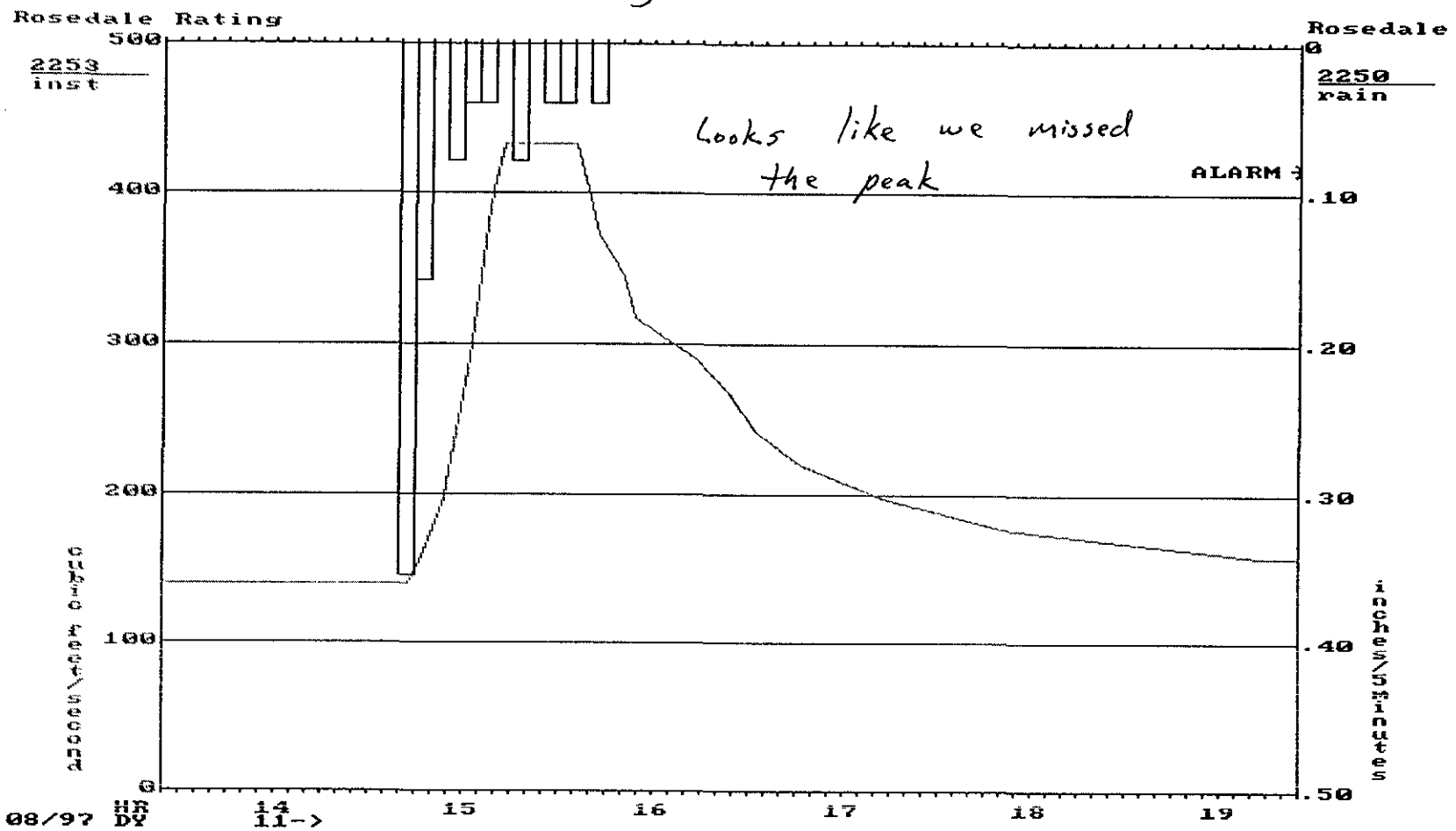
Aug. 11, 1997


Rosedale
5.00
2253
inst
4.00
3.00
ALARM
2.00
1.00
0
feet
Rosedale
0
2250
rain
ALARM
.10
.20
.30
.40
.50
inches/5Minutes
Missed the peak
HR 12
13
14
15
16
17
18
08/97 DY 11->
1997

Aug 11, 1997 Denver Hail Storm Day



Aug 11, 1997 Denver Hail Storm



NS: NovaStar Help Options Display Quit Oct 17 97 8:57:04 0

Data Display

2253 Rosedale

Water Level PT

Enter Device ID: 2253

Date	Time	feet	cubic feet/second	Raw	Alarm
08/11/1997	16:29:26	1.96	266	25	
08/11/1997	16:18:11	2.05	291	26	
08/11/1997	15:59:26	2.14	317	27	
08/11/1997	15:55:42	2.23	345	28	
08/11/1997	15:48:11	2.32	373	29	
08/11/1997	15:44:26	2.41	402	30	
08/11/1997	15:40:41	2.50	433	31	
08/11/1997	15:18:11	2.50	433	31	alarm
08/11/1997	15:14:27	2.41	402	30	
08/11/1997	15:10:41	2.23	345	28	
08/11/1997	15:06:56	2.05	291	26	
08/11/1997	15:03:11	1.87	243	24	
08/11/1997	14:59:26	1.69	198	22	
08/11/1997	14:55:41	1.60	178	21	
08/11/1997	14:51:56	1.51	158	20	

← Missing Data 20 min +

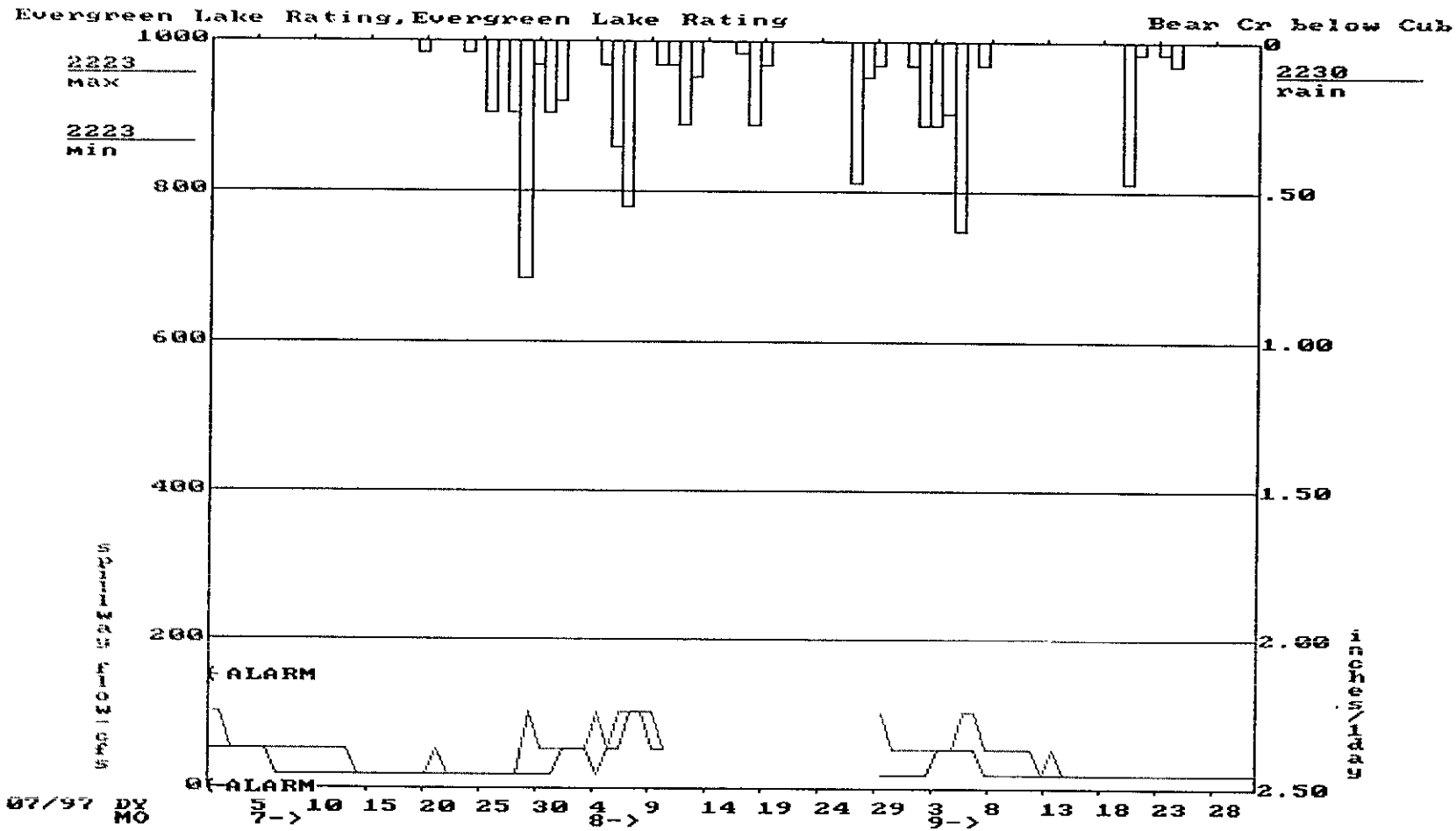
Press [F1] for Help

UDFCD ALERT Base Station...NovaStar Node 2

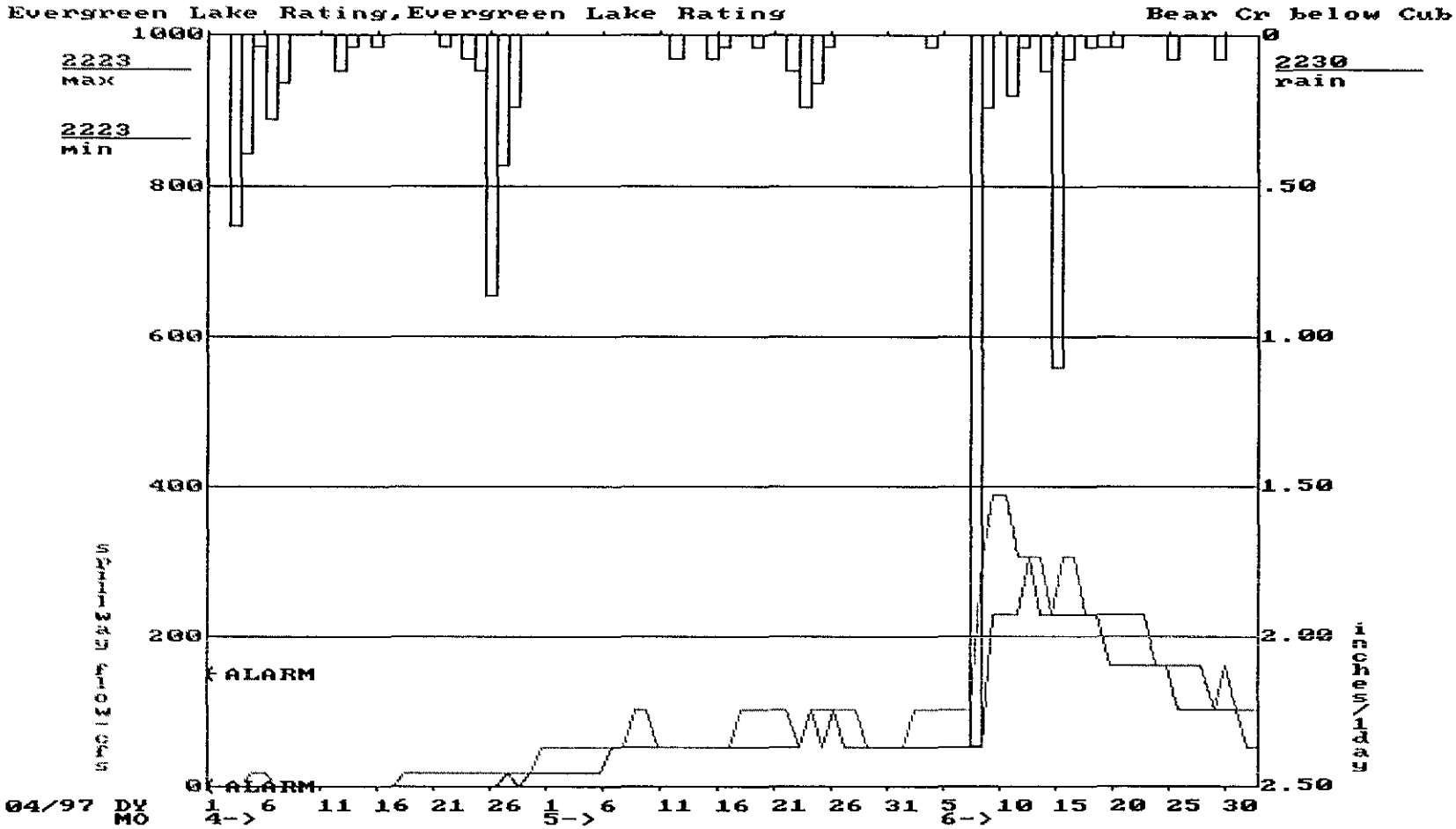
Date Time

10/17/1997-09:01:15

DeviceID	2253	2253	2253	2253	2253	2253	2253	2253	2253	2250
StatType	max	max	tmax	min	tmin	dif	vols	cnt	inst	rain
DataType	level	rated	level	rated	level	level	rated	level	level	precip
Units	ft	cfs	time	cfs	time	ft	AF	#	ft	in
08/11/97										
2000	1.51	158	19:18	158	19:18	0.00	3	_____	1.51	0.00
1945	1.51	158	19:18	158	19:18	0.00	3	_____	1.51	0.00
1930	1.51	158	19:18	158	19:18	-0.09	3	1	1.51	0.00
1915	1.60	178	17:55	178	17:55	0.00	4	_____	1.60	0.00
1900	1.60	178	17:55	178	17:55	0.00	4	_____	1.60	0.00
1845	1.60	178	17:55	178	17:55	0.00	4	_____	1.60	0.00
1830	1.60	178	17:55	178	17:55	0.00	4	_____	1.60	0.00
1815	1.60	178	17:55	178	17:55	0.00	4	_____	1.60	0.00
1800	1.60	178	17:55	178	17:55	-0.09	4	1	1.60	0.00
1745	1.69	198	17:18	198	17:18	0.00	4	_____	1.69	0.00
1730	1.69	198	17:18	198	17:18	-0.09	4	1	1.69	0.00
1715	1.78	220	16:51	220	16:51	0.00	5	_____	1.78	0.00
1700	1.78	220	16:51	220	16:51	-0.09	5	1	1.78	0.00
1645	1.87	243	16:36	243	16:36	-0.09	5	1	1.87	0.00
1630	2.05	291	16:18	266	16:29	-0.18	6	2	1.96	0.00
1615	2.14	317	15:59	317	15:59	0.00	7	_____	2.14	0.00
1600	2.32	373	15:48	317	15:59	-0.27	8	3	2.14	0.04
1545	2.50	433	15:40	402	15:44	-0.09	9	2	2.41	0.08
1530	2.50	433	15:18	433	15:18	0.09	9	1	2.50	0.08
1515	2.41	402	15:14	243	15:03	0.72	6	4	2.41	0.16
1500	1.69	198	14:59	140	14:48	0.27	3	4	1.69	0.51
1445	1.42	140	09:55	140	09:55	0.00	3	_____	1.42	0.00
1430	1.42	140	09:55	140	09:55	0.00	3	_____	1.42	0.00
1415	1.42	140	09:55	140	09:55	0.00	3	_____	1.42	0.00
TOTALS:	2.50	433	15:18	140	09:55	0.09	111	21	42.45	0.87



Gage Maint 8/28



Maint 5/16

6/27

Oct 16 97 17:13:58 2

NS: NovaStar Help Assign Setup Test Quit

Rev.

Setup tables — NovaLynx Systems, Inc.

Table number : 58

Name : Upper Bear Creek at Rosed
Interpolate : LogLog
Extrapolate : Yes

	Index	Tabl
Units	feet	cubi
Abbreviated	ft	cfs
Precision	1	0
Offset	0.0	
Opening	0.0	<- Press [Ente

Index (ft)	Table (cfs)	
0.0	0	
0.7	10	← Forced
1.2	100	
3.4	800	From FIS
5.2	2250	
6.2	3250	
8.2	7050	

→ St. line intercept

Press [F1] for Help

Oct 16 97 17:14:36 E

NS: NovaStar Help Options Display Quit

Enter Device ID: 2253

Data Display
'53 Rosedale
ater Level PT

Date	Time	feet	cubic feet/second	Raw	Alarm
10/16/1997	14:50:57	0.70	10	11	Forced low
10/16/1997	09:50:56	0.70	10	11	
10/16/1997	09:47:11	0.79	17	12	flow to Q
10/16/1997	09:24:41	0.70	10	11	
10/16/1997	09:17:12	0.79	17	12	
10/16/1997	09:13:27	0.70	10	11	Q @ Evergreen
10/16/1997	09:05:56	0.79	17	12	
10/16/1997	09:02:11	0.70	10	11	Lake spillway
10/16/1997	08:54:41	0.79	17	12	
10/16/1997	08:47:11	0.70	10	11	
10/16/1997	02:50:57	0.79	17	12	
10/15/1997	19:28:26	0.79	17	12	
10/15/1997	14:50:59	0.70	10	11	
10/15/1997	14:24:41	0.70	10	11	
10/15/1997	14:20:56	0.79	17	12	

Press [F1] for Help

Need X-Sectn & Qu/Qc calcs to further support this rating.

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
2480 W. 26th Avenue, Suite 156B, Denver, CO 80211
Tel: (303) 455-6277 • FAX: (303) 455-7880

FAX TRANSMITTAL/LETTER

Date: 10-10-97

To: Bob Jarrett "capt'n flood"

Company: USGS

FAX Number: 236-5034 Telephone Number: _____

From: Kevin

Number of pages transmitted 1 (not including this sheet) 2/2 OK @ 11:29

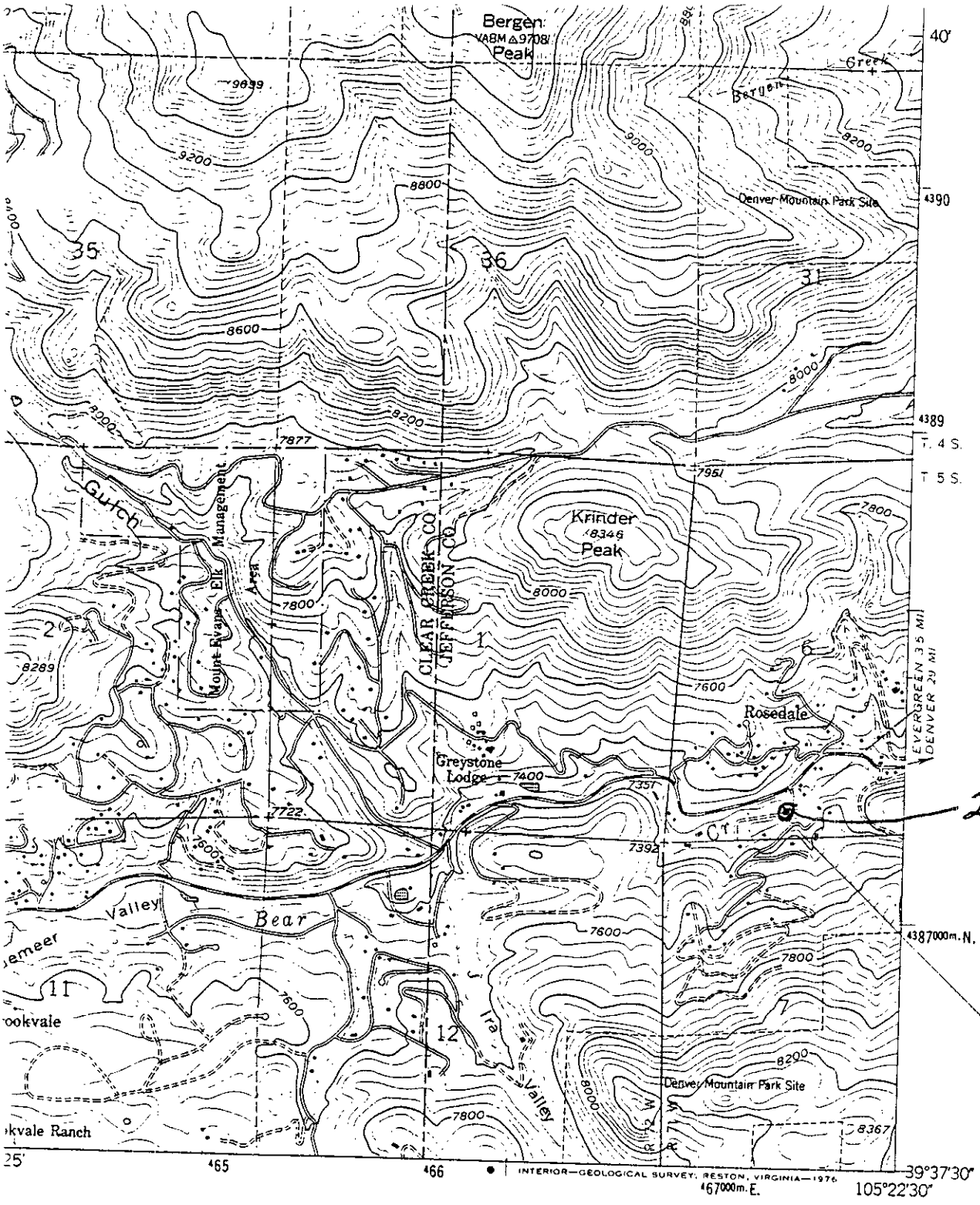
To be followed by original in the mail: ☐ Yes ☒ No

MESSAGE: Your offer is most appreciated.

Thanks!

R. "col. flood"

Caution: This gage is on private property.



ROAD CLASSIFICATION

Primary highway, hard surface

Secondary highway, hard surface

Light-duty road, hard or improved surface

Unimproved road

Interstate Route U. S. Route State Route

COLORADO

QUADRANGLE LOCATION

(CONIFER) 4963 III SE

SQUAW PASS, COLO.

N3937.5--W10522.5/7.5

1957

PHOTOREVISED 1974

AMS 4963 III NW-SERIES V877

5. Calculations and Estimates

Riverside Technology, inc.
5840 Banneker Road, Suite 170 • Columbia, MD 21044
410/740-8220 • FAX 410/740-8221

CWCB

Subject: 100 yr pt. PPt
Computed: wjc Date: June 18, 1998
Checked: _____ Date: _____

Project/Proposal Name: D479 -5
Project/Proposal No.: _____ Task: _____
Page _____ of _____

Values for the 100-year point precipitation, 6 hour duration and 24 hour duration events were taken from Precipitation-Frequency contours in the NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III - Colorado, 1973. The value for the 12 hour duration event was found using a nomagram provided in the Precipitation-Frequency Atlas. The following precipitation values for [redacted] Clear Creek County were obtained in the manner described above:

100-year Pt. PPT Totals for Various Durations

Storm Duration	PPT (inches)
6 hrs	2.9
12 hrs	3.7
24 hrs	4.4

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: CW CB 100yr discharge
Computed: wjc Date: 6/24/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: 8R004 Task: 54
Page 1 of 1

Clear Creek County, Witter Gulch 100-yr Peak Discharge Estimate.

Using CW CB regression method, subregion 5PL-5

$$Q = 39.4 (A)^{0.776}$$

A = drainage area in mi^2
$(2 < A < 480)$

Q = 100 yr peak flow, cfs

Area $\simeq$ 4.9 mi^2 (digital planimeter)

$$Q = 39.4 (4.9)^{0.776} = 135 \text{ cfs}$$

Return Interval for Rainfall Estimates in Clear Creek County

Purpose:

The purpose of this calculation file is to determine the return interval of 0.6 inches and 2.0 inches of precipitation in one hour in the Witter Gulch area of Clear Creek County, Colorado. 0.6 inches of rain was recorded by the Urban Drainage and Flood Control District's Rosedale gauge during a one hour interval on August 3, 1997. Bob Jarrett of the USGS estimated that the flood damage in Witter Gulch was caused by 1 to 2 inches of rain in a short duration - probably less than one hour. Therefore, it is of interest to calculate the return interval of 0.6 inches and 2.0 inches of rainfall in one hour in the Witter Gulch area.

Method:

Equations and nomograms from the NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III - Colorado [1973] (hereafter referred to as the *Atlas*) were used to calculate the return interval of 0.6 and 2.0 inch 1-hour events in the Witter Gulch area of Clear Creek County. The basic method requires the calculation of the 2-year and 100-year 1-hour events and then plotting these values on a nomogram and picking the return frequency for 0.6 inches and 2.0 inches. The equations used are:

$$Y_2 = 0.218 + 0.709\left(x_1 \, {}^{x_1}\!/_{x_2}\right)$$

where, Y_2 = 2-year, 1-hour event in inches
x_1 = 2-year, 6-hour event from the Atlas
x_2 = 2-year, 24-hour event from the Atlas

and,

$$Y_{100} = 1.897 + 0.439\left(x_3 \, {}^{x_3}\!/_{x_4}\right) - 0.008z$$

where, Y_{100} = 100-year, 1-hour event in inches
x_3 = 100-year, 6-hour event from the Atlas
x_4 = 100-year, 24-hour event from the Atlas
z = Elevation above sea-level in hundreds of feet

The elevation of Witter Gulch is approximately 8,000 feet above sea-level. From the Atlas, the following values for the above variables were found:

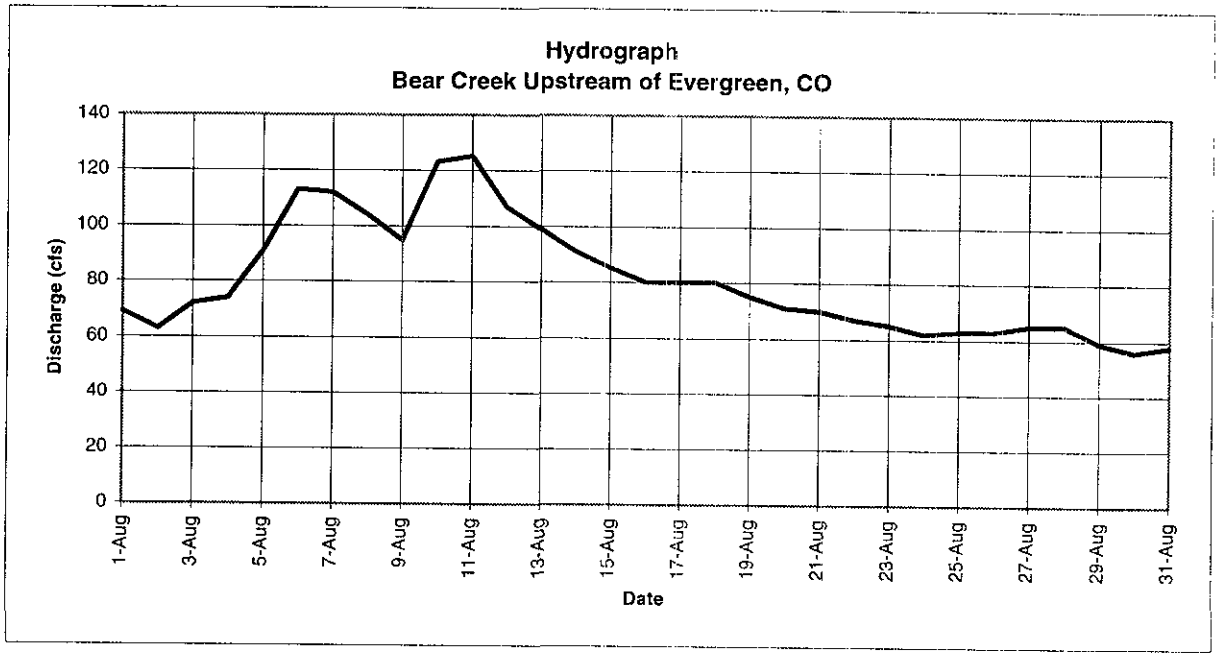
x_1 = 1.2 inches
x_2 = 1.9 inches
x_3 = 2.9 inches
x_4 = 4.4 inches
z = 80

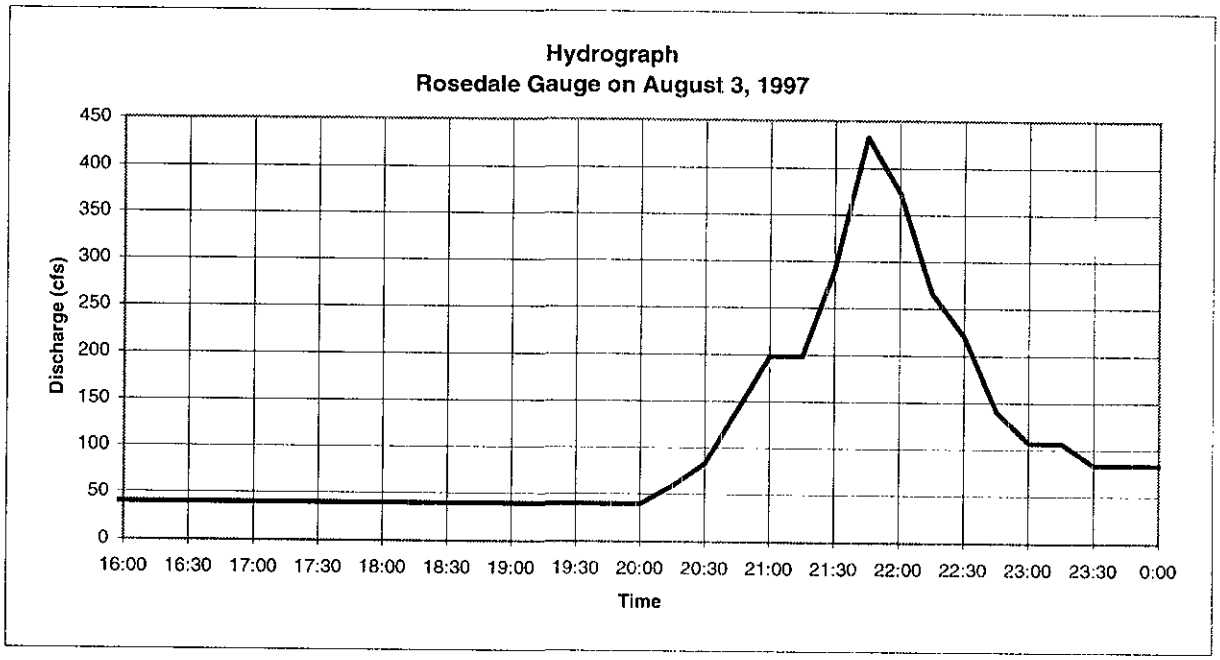
Results:

Using the above equations and variables, the 2-year and 100-year, 1-hour events are:

$$Y_2 \approx 0.75 \text{ inches}, \qquad \text{and} \qquad Y_{100} \approx 2.1 \text{ inches}$$

Therefore, 0.6 inches is less than a 2-year, 1-hour event. Plotting the above values (Y_2 and Y_{100}) on the Figure 6 nomogram of the Atlas, and drawing a straight line between them allows the return period of a 2.0 inch event to be picked. This value is between 50 and 100 years - or about 80 years.


Hydrograph
Bear Creek Upstream of Evergreen, CO
Discharge (cfs)
140
120
100
80
60
40
20
0
1-Aug
3-Aug
5-Aug
7-Aug
9-Aug
11-Aug
13-Aug
15-Aug
17-Aug
19-Aug
21-Aug
23-Aug
25-Aug
27-Aug
29-Aug
31-Aug
Date


Hydrograph
Rosedale Gauge on August 3, 1997
Discharge (cfs)
450
400
350
300
250
200
150
100
50
0
16:00
16:30
17:00
17:30
18:00
18:30
19:00
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
0:00
Time

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/10/98
Call Placed/Received by: Bill Owen
Spoke With: Anthony Gutierrez
Company/Affiliation: CO DWR, Division 2
Phone no.: (719) 542-3368 x 115
Project No.: D479

Comments:

- Anthony will send daily discharge records for the Horse Creek gage at Hwy 194 (only preliminary values!)
- typical channel characteristics include sand channels with mildly sloping banks (but well-defined)
- Joe Flory will send some photos that Don Taylor took during floods of Aug 1997

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/1/98
Call Placed/Received by: Bill Owen
Spoke With: Carol Mumm
Company/Affiliation: Crowley County Administrator
Phone no.: 719-267-3248 x221
Project No.: D479-56

Comments:

- "North County" experiences most flooding in the County
- County has an extensive drainage system in the south, primarily used for agriculture → flows eventually make into Lake Meredith
- County Road + Bridge Dept. put up detour signs around impassable roads that were damaged
- Hwy 96 between Olney Springs and Crowley temporarily flooded; CO DOT flagging people through inundated areas
- Culverts were plugged up due to ~~poor~~ neglecting maintenance (some land sold to irrigation district → lack of use + flood debris
- Flood mitigation: rebuild damaged roads + enlarged some drainage systems to allow more water to pass; County is primarily in a reactive mode
- For city of Olney Springs info, call Barbara Miller (Mayor)
- For city of Crowley info, call Norine Aydelotte (Mayor) (→ only experienced basement flooding from high ground water table)

Signature Bill Owen

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Bill Owen
DATE: 4/2/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Carol Mumm
AFFILIATION: Crowley County Administrator
PHONE #: (719) 267-3248 x221

---

1. *Affected streams and local drainages?*

2. *Geographic extent of flooding?*

   Entire northern portion of the county; no flooding in Ordway, but some in Olney Springs; Rains mostly fell on ranch land

3. *Storm duration? Starting time and ending time of major storm event?*

4. *Rainfall amounts? Extent of rainfall?*

   Northern 1/2 of county got approximately 12 inches
   Southern 1/2 of county got approximatley 6 inches

5. *Rainfall bucket surveys?*

   No

6. *Precipitation gauging network?*

   No

7. *Documentation of high water marks?*

   State OEM did (970-207-4572) site studies and assessments

   Remaining information could be pulled from these assessments

8. *Estimated peak discharges?*

9. *Estimated flood damages?*

10. *Costs associated with the clean-up effort? Differentiate between local, state, and federal.*

11. *Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.*

12. *Types and amounts of repair work after flooding?*

13. *Any previous/recent flood mitigation efforts that reduced damages?*

14. *Any future mitigation needs as a result of the flooding?*

15. *Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?*

16. *Do you have any photos and/or video available? Are the photos in digital format?*

17. *Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.*

18. *Are maps in hardcopy or digital format? (GIS, Autocad, etc.)*

19. *Is there any existing documentation regarding the flooding?*

20. *Name of local newspaper? Do they have a web site?*

    Ordway New Era (719-267-3576); do not know if they have a web site

21. *Do you have an internet site? Do you know of any related local sites?*

2. Federal Data

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

--- PROCESSING DATE/TIME ---

1998 JUN 14 22:37:33

--- PROCESSING OPTIONS ---

Plot option	= None
Basin char output	= None
Print option	= Yes
Debug print	= No
Input peaks listing	= Long
Input peaks format	= WATSTORE peak file

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

Station - 07123675 HORSE CREEK NEAR LAS ANIMAS, CO.
1998 JUN 14 22:37:33

I N P U T D A T A S U M M A R Y

Number of peaks in record	=	13
Peaks not used in analysis	=	1
Systematic peaks in analysis	=	12
Historic peaks in analysis	=	0
Years of historic record	=	0
Generalized skew	=	-0.099
Standard error of generalized skew	=	0.550
Skew option	=	WEIGHTED
Gage base discharge	=	0.0
User supplied high outlier threshold	=	--
User supplied low outlier criterion	=	--
Plotting position parameter	=	0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

**WCF109W-PEAKS WITH MINUS-FLAGGED DISCHARGES WERE BYPASSED. 1
**WCF113W-NUMBER OF SYSTEMATIC PEAKS HAS BEEN REDUCED TO NSYS = 12
WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION. 10.6
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 1631.1
**WCF233W-EXPECTED PROB OUT OF RANGE AT TAB PROB. 0.00008 0.00200
WCF002J-CALCS COMPLETED. RETURN CODE = 2

1

Station - 07123675 HORSE CREEK NEAR LAS ANIMAS, CO.
1998 JUN 14 22:37:33

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.1188	0.5125	-0.473
BULL.17B ESTIMATE	0.0	1.0000	2.1188	0.5125	-0.251

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	4.8	3.7	1.8	0.7	12.8
0.9900	6.8	5.7	3.3	1.2	16.9
0.9500	17.4	16.3	12.8	4.8	35.9
0.9000	28.2	27.6	23.5	9.6	53.6
0.8000	49.5	50.5	45.3	21.1	88.3
0.5000	138.1	144.2	138.1	76.4	253.1
0.2000	359.1	361.1	386.9	201.1	850.2
0.1000	575.8	554.9	664.3	305.5	1642.0
0.0400	933.7	846.1	1207.0	458.4	3296.0
0.0200	1262.0	1090.0	1802.0	585.9	5128.0
0.0100	1643.0	1352.0	2627.0	723.8	7575.0
0.0050	2079.0	1629.0	3765.0	872.3	10760.0
0.0020	2745.0	2018.0	--	1085.0	16300.0

1

Station - 07123675 HORSE CREEK NEAR LAS ANIMAS, CO.
1998 JUN 14 22:37:33

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1980	176.0		1987	293.0	
1981	17.0		1989	1030.0	
1982	149.0		1990	165.0	
1983	345.0		1991	18.0	
1984	169.0		1992	118.0	
1985	198.0		1993	49.0	
1986	-239.0	K			

Explanation of peak discharge qualification codes

PEAKFQ CODE	WATSTORE CODE	DEFINITION

D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above
L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

1

Station - 07123675 HORSE CREEK NEAR LAS ANIMAS, CO.
1998 JUN 14 22:37:33

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1989	1030.0	0.0769	0.0769
1983	345.0	0.1538	0.1538
1987	293.0	0.2308	0.2308
1985	198.0	0.3077	0.3077
1980	176.0	0.3846	0.3846
1984	169.0	0.4615	0.4615
1990	165.0	0.5385	0.5385
1982	149.0	0.6154	0.6154
1992	118.0	0.6923	0.6923
1993	49.0	0.7692	0.7692
1991	18.0	0.8462	0.8462
1981	17.0	0.9231	0.9231
1986	-239.0	--	--

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

End PEAKFQ analysis.

Stations processed	:	1
Number of errors	:	0
Stations skipped	:	0
Station years	:	13

Unrecognized CARD type. Must be Y,Z,N,H,I,2,3,4, or *.

```
# US GEOLOGICAL SURVEY
# DAILY MEAN DISCHARGE DATA
# HORSUGCO
# Station name  :  HORSE CREEK NEAR SUGAR CITY, CO.
# Station number:  07123500
# latitude (degrees, minutes, and seconds)..... 381421
# longitude (degrees, minutes, and seconds)..... 1033804
# state code..................................... 08
# county code.................................... 025
# hydrologic unit code........................... 11020008
# drainage area (square miles).................   1080.00
# contributing drainage area (square miles).....  1026.00
# gage datum (feet above NGVD).................   4271.40
# WATSTORE parameter code........................ 00060
# WATSTORE statistic code........................ 00003
# Discharge is listed in the table in cubic feet per second.
#
# Daily mean discharge data were retrieved from the
# National Water Information System files called ADAPS.
# processed into RDB table Tue Jan 24 10:10:28 EST 1995
# filter version 6
#
# Format of table is as follows.
# Lines starting with the # character are comment lines describing the data
# included in this file.  The next line is a row of tab-delimited column
# names that are Date and Discharge.  The next line is a row of tab-delimited
# data type codes that describe a 10-character-wide date (10d) and an
# 8-character-wide numeric value for discharge (8n).  All following lines are
# rows of tab-delimited data values of date (year.month.day) and discharge.
#
# ----Periods of Record----
#  1 1940.04.13-1947.09.30
#
```

```
# US GEOLOGICAL SURVEY
# DAILY MEAN DISCHARGE DATA
# HORLASCO
# Station name  :  HORSE CREEK NEAR LAS ANIMAS, CO.
# Station number:  07123675
# latitude (degrees, minutes, and seconds)..... 380507
# longitude (degrees, minutes, and seconds)..... 1032110
# state code..................................... 08
# county code.................................... 011
# hydrologic unit code........................... 11020008
# drainage area (square miles).................
# contributing drainage area (square miles).....
# gage datum (feet above NGVD).................
# WATSTORE parameter code........................ 00060
# WATSTORE statistic code........................ 00003
# Discharge is listed in the table in cubic feet per second.
#
# Daily mean discharge data were retrieved from the
# National Water Information System files called ADAPS.
# processed into RDB table Tue Jan 24 10:10:28 EST 1995
# filter version 6
#
# Format of table is as follows.
# Lines starting with the # character are comment lines describing the data
# included in this file.  The next line is a row of tab-delimited column
# names that are Date and Discharge.  The next line is a row of tab-delimited
# data type codes that describe a 10-character-wide date (10d) and an
# 8-character-wide numeric value for discharge (8n).  All following lines are
# rows of tab-delimited data values of date (year.month.day) and discharge.
#
# ----Periods of Record----
#  1 1979.10.01-1993.09.30
#
```

STATION (Climatological) Ordway | (River Station, if different) | MONTH May | 19 97

STATE | COUNTY | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7:00 AM | PRECIPITATION 7:00 AM | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (tns. and hundredths)	Snow, ice pellets (tns. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (in.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	67	38	40																
2	M	M	M																
3	—	—	37																
4	74	37	46																
5	85	45	50																
6	77	48	48																
7	89	44	47																
8	89	45	50																
9	58	39	45																
10	77	40	46																
11	83	40	55																
12	74	40	41	.01															
13	73	41	46																
14	83	42	42																
15	82	42	45																
16	82	44	52																
17	89	52	55	T															
18	94	52	62																
19	89	42	45	.20															
20	63	41	44																
21	79	44	55																
22	82	45	55																
23	76	51	55	T															
24	77	44	53																
25	83	49	55																
26	83	48	52	T															
27	75	41	43																
28	77	41	48																
29	81	48	55																
30	77	54	55	.19															
31	79	51	57																
SUM			SUM	.40															

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge ___.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

	Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds

OBSERVER Robert Petty

SUPERVISING OFFICE DSFO DEN

STATION INDEX NO. 05-6131-1

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): Ordway | (River Station, if different): — | MONTH: June | 19 97

STATE: Colo | COUNTY: Crowley | RIVER: —

TIME (local) OF OBSERVATION RIVER | TEMP.: 7:00 AM | PRECIPITATION: 7 AM | STANDARD TIME IN USE: M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO: Ft. | FLOOD STAGE: Ft. | NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)
1	91	54	61			
2	97	61	64			
3	80	57	62			
4	83	52	57			
5	82	56	58			
6	92	56	59			
7	85	58	58	.70		
8	M	M	59			
9	78	54	54	.29		
10	71	53	55	.06		
11	82	50	59			
12	89	58	63			
13	69	53	58	T		
14	82	59	62			
15	86	56	64			
16	84	52	59			
17	72	48	55			
18	55	54	58			
19	M	M	M			
20	100	54	68			
21	101	54	65			
22	93	58	62			
23	90	60	61			
24	96	58	64			
25	M	M	M	.21		
26	89	53	58			
27	92	52	64			
28	98	55	61			
29	100	61	106			
30	96	56	62			
31						
SUM			SUM	1.25		

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

DATE	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above
8							

RIVER STAGE

DATE	CONDITION	GAGE READING AT ___ A.M.	TENDENCY

REMARKS (Special observations, etc.)

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER: Robert Petty

SUPERVISING OFFICE: SFO DeN

STATION INDEX NO.: 05-6131-1

STATION (Climatological): Ordway | (River Station, if different): — | MONTH: July | 19: 97

STATE: Colo | COUNTY: Crowley | RIVER: —

TIME (local) OF OBSERVATION: RIVER — | TEMP. 7 AM | PRECIPITATION 7 AM | STANDARD TIME IN USE: M

TYPE OF RIVER GAGE: | ELEVATION OF RIVER GAGE ZERO: Ft. | FLOOD STAGE: Ft. | NORMAL POOL STAGE: Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 / 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	102	62	72														
2	100	52	67														
3	90	61	60														
4	84	50	63														
5	M	M	M														
6	94	52	73														
7	93	53	62														
8	101	57	59														
9	97	56	59	.12													
10	M	M	M														
11	84	55	67														
12	M	M	M	T													
13	M	M	M														
14	95	61	68														
15	97	61	63														
16	102	61	62														
17	107	59	62														
18	106	61	66														
19	99	65	66														
20	96	59	60														
21	91	60	62	.04													
22	96	60	62														
23	100	63	76													9	
24	104	63	90													11	
25	103	61	[illegible]	[illegible]													
26	M	M	M	T													
27	100	66	69														
28	100	65	67	.09													
29	92	63	63	.54													
30	89	62	64	.02													
31	92	63	85													11	
SUM			SUM	.81													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

Fog | Ice Pel. | Glaze | Thund. | Hail | Dam. Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge a[illegible]
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Robert Petty

SUPERVISING OFFICE: SFO DeN

STATION INDEX NO.: 05-6131-1

STATION (Climatological): Ordway | (River Station if different): — | MONTH: Aug | 19 97

STATE: Colo | COUNTY: Crowley | RIVER: —

TIME (local) OF OBSERVATION: RIVER — | TEMP 7 AM | PRECIPITATION 7 AM | STANDARD TIME IN USE: M

TYPE OF RIVER GAGE: | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE °F: 24 HRS. ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION: 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER (Calendar Day): Time of observation if different from above	RIVER STAGE: CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	98	64	78				9				
2	96	64	64								
3	M	M	M	.43							
4	91	62	65								
5	94	62	64	1.55							
6	73	61	61	.34							
7	66	56	59	.16							
8	82	56	59								
9	92	59	62								
10	85	60	60	.18							
11	73	58	60	.61							
12	80	56	57	.06							
13	84	56	63								
14	92	56	58	.14							
15	93	55	58								
16	95	57	57								
17	M	M	M								
18	M	M	M								
19	87	54	63								
20	96	59	66								
21	96	53	59								
22	M	M	M	T							
23	97	58	60	T							
24	98	57	64								
25	99	61	62								
26	99	62	66								
27	98	61	66								
28	96	63	65								
29	99	64	65								
30	93	56	58								
31	57	57	57	.03							
SUM			SUM	3.50							

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. 1 2 3 4 5 6 7 8 9 10 11 | NOON | P.M 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day): Mark 'X' for all types occurring each day — Fog, Ice Pellets, Glaze, Thunder, Hail, Damaging Winds

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel | Glaze | Thund. | Hail | Dam. Winds

OBSERVER Robert Kelly

SIGNING OFFICE WSFO Den

STATION INDEX NO 05-6131-1

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open [illegible].
C. Upper surface [illegible] ice.
D. Ice gorge abo[illegible]
E. Ice gorge below gage
F. Shore Ice.
G. Floating Ice.
H. Pool stage.

STATION (Climatological) Ordway | (River Station, if different) — | MONTH Sept | 19 97

STATE Colo | COUNTY Crowley | RIVER —

TIME (local) OF OBSERVATION RIVER | TEMP 7 AM | PRECIPITATION 7 AM | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	88	56	59	.02													
2	92	56	64														
3	M	M	63														
4	M	M	M														
5	89	57	61														
6	94	58	62														
7	94	55	56														
8	91	55	57														
9	94	58	60														
10	M	50	51														
11	89	51	52														
12	81	54	57	.57													
13	90	54	54														
14	93	54	58														
15	93	54	57														
16	M	M	45														
17	89	52	56														
18	76	55	56														
19	M	M	M														
20	82	48	48	T													
21	52	46	46	.20													
22	62	45	51	.01													
23	71.9	45.5	52	.17													
24	64	49	50														
25	73	40	40														
26	85	40	48														
27	M	M	M														
28	M	M	M														
29	71	43	44														
30	86	49	50														
31																	
SUM			SUM	.97													

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam. Winds

OBSERVER Robert Petty

SUPERVISING OFFICE SFO DEN

STATION INDEX NO 05-6131-1

STATION (Climatological) ORDWAY 2ENE (River Station if different) | MONTH Oct | 19 97

STATE CO | COUNTY Crowley | RIVER —

TIME (local) OF OBSERVATION RIVER | TEMP 7 AM | PRECIPITATION 7 AM | STANDARD TIME IN USE M

TYPE OF RIVER GAGE — | ELEVATION OF RIVER GAGE ZERO — Ft. | FLOOD STAGE — Ft. | NORMAL POOL STAGE — Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)
1	M	M	M			
2	91	47	48			
3	90	46	58			
4	90	44	45			
5	M	M	M			
6	92	44	48			
7	80	45	54			
8	85	45	50	.03		
9	72	36	37			
10	74	36	57			
11	85	56	65			
12	82	45	45	.00		
13	49	28	28	.13		
14	M	M	M			
15	76	28	36			
16	75	34	34			
17	69	34	35			
18	77	33	39			
19	82	38	45			
20	57	38	43			
21	57	42	42			
22	M	M	M			
23	75	31	39			
24	73	38	42			
25	M	M	M	M: .50		
26	M	M	M			18
27	M	M	M	M:		
28	36	14	20			
29	51	17	20			
30	53	23	40			
31						
SUM			SUM			

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

DATE	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12						X					
13						X					
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											SNOW
28											
29											
30						9					
31											
	Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds					

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER Robert Kelly

SUPERVISING OFFICE BFO : Den

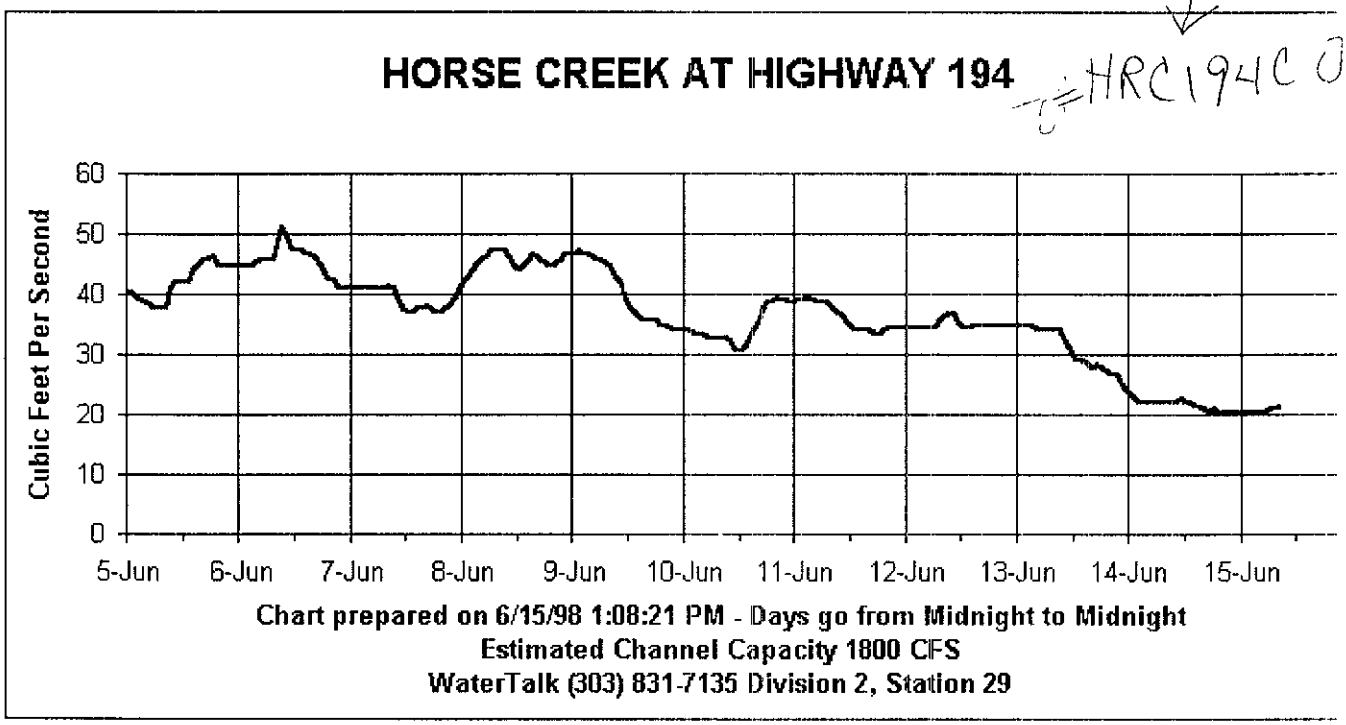
STATION INDEX NO. 05-6131-1

3. State Data

COLORADO'S Streamflow

Colorado Streamflow Information

Here's the streamflow information you requested:



[Another Stream]

Natural Resources | Parks | Wildlife | Water | Geology | Oil & Gas | Mining | Land | Overview

STATE OF COLORADO

WATER DIVISION 2
OFFICE OF THE STATE ENGINEER

310 East Abriendo, Suite B
Pueblo, CO 81004
Phone (719) 542-3368
FAX (719) 544-0800

FAX COVER PAGE

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FROM: ANTHONY GUTIERREZ

DATE: 11 JUNE 98

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Division 2 Telephone: (719) 542-3368 (Anthony's x 115)

Division 2 Fax #: (719) 544-0800

MESSAGE:

HERE IS THE PRELIMINARY DATA FOR THE HORSE CREEK GAGING STATION 1/Y 1997

wb/2fax

PRELIMINARY

SUBJECT TO REVISION

STATE OF COLORADO
DIVISION OF WATER RESOURCES
OFFICE OF STATE ENGINEER

PRELIMINARY

STA NO. 00000000 NORSE CREEK AT HIGHWAY 194 PROCESS DATE: 10-JUN-1998 15:00
RATING TABLE HRC194C004 USED FROM 01-OCT-1996 TO 30-SEP-1997

SUBJECT TO REVISION

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1996 TO SEPTEMBER 1997
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	20	12	13	15	19	19	16	34	53	32	39	26
2	20	12	13	14	20	19	17	25	45	37	30	25
3	19	12	13	14	20	18	29	32	52	35	53	29
4	16	13	13	14	19	16	29	40	44	44	57	38
5	14	13	12	13	18	15	16	38	36	94	28	31
6	14	12	12	12	18	15	19	33	44	51	104	29
7	13	12	12	12	18	27	16	27	55	49	1290	43
8	14	12	12	11	19	32	15	21	59	51	557	42
9	13	12	12	12	20	19	16	19	65	63	199	33
10	13	12	13	12	20	19	17	20	56	27	127	12
11	13	12	13	11	21	17	18	20	51	19	72	31
12	12	12	12	6.0	19	15	18	18	40	19	75	34
13	12	12	12	7.6	13	15	18	19	40	20	51	40
14	12	13	12	6.9	13	18	16	27	43	26	42	49
15	11	13	12	9.3	12	32	17	22	40	16	109	41
16	11	13	11	7.0	12	38	16	32	41	16	171	37
17	11	12	11	6.1	11	24	17	36	42	14	82	31
18	11	13	6.1	9.1	11	18	30	26	39	13	52	47
19	11	14	5.9	10	11	14	18	30	29	14	46	52
20	11	13	6.0	11	9.8	14	16	38	33	16	43	50
21	11	12	8.5	12	11	11	16	39	33	16	42	46
22	11	12	9.4	15	12	9.9	19	41	32	15	41	60
23	11	12	10	16	12	10	18	33	33	20	39	52
24	11	12	9.6	17	11	10	26	42	34	20	37	52
25	12	12	11	16	14	10	31	52	27	20	33	59
26	11	12	9.9	16	15	14	26	72	29	21	28	62
27	12	12	11	16	14	17	20	66	29	33	26	50
28	14	12	12	15	17	14	27	46	38	32	28	44
29	13	12	14	16	---	15	28	49	40	45	29	51
30	12	13	15	17	---	22	35	49	31	33	34	45
31	12	---	15	18	---	23	---	54	---	27	29	---
TOTAL	400	370	351.4	387.0	429.8	560.9	618	1102	1220	892	3593	1261
MEAN	12.9	12.3	11.3	12.5	15.3	18.1	20.6	35.5	40.7	28.8	116	42.0
AC-FT	793	734	697	768	853	1110	1230	2190	2420	1770	7130	2500
MAX	20	14	15	18	21	38	35	72	65	63	1290	62
MIN	11	12	5.9	6.0	9.8	9.9	15	18	27	13	26	25

CAL YR 1996 TOTAL 6788.8 MEAN 18.5 MAX 99 MIN 5.9 AC-FT 13470
WTR YR 1997 TOTAL 11185.1 MEAN 30.6 MAX 1290 MIN 5.9 AC-FT 22190

MAX DISCH 2236 CFS AT 1430 07-AUG-1997 GH 8.15 FT. SHIFT -0.47 FT. MAX GH 8.15 FT. AT 1430 07-AUG-1997
FOR MORE COMPLETE OR DETAILED INFORMATION SEE DAILY OR MONTHLY RECORD.
$

STATE OF COLORADO

Division of Water Resources

OFFICE OF STATE ENGINEER

07123675
STATION NO.

Discharge measurements of HORSE **Creek**

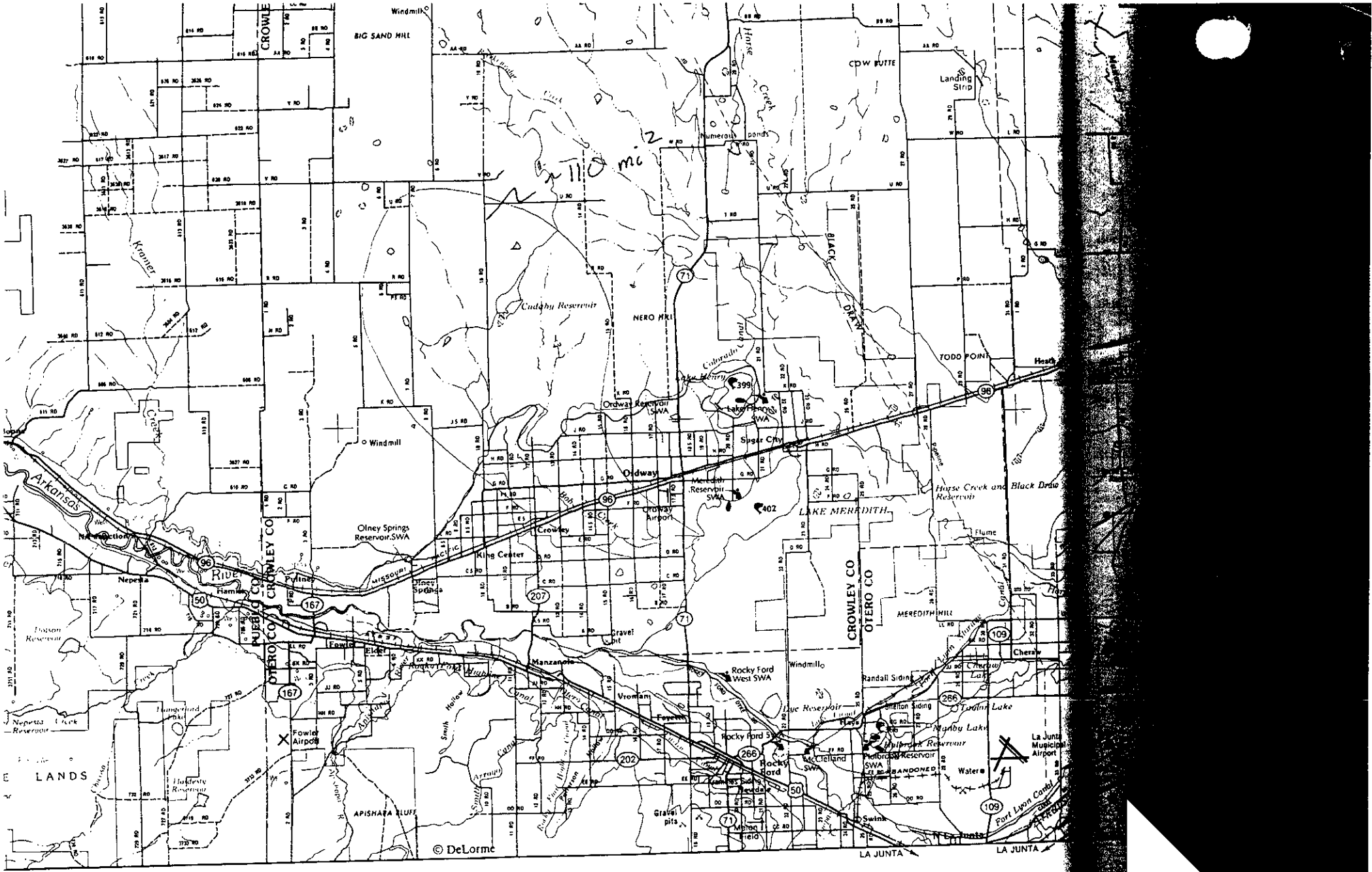
at HIGHWAY 190

PRELIMINARY SUBJECT TO REVISION

No.	Date	Made by	Width Feet	Area of Section Sq. Ft.	Mean Velocity Ft. Per Sec.	Gage Height Feet	Discharge Sec. Ft.	Rating 04 Shift Adj. Feet	Rating 04 Percent Diff.	Method 0.1, 0.6, 0.1, 0.8	No. Meas. Sect.	G.H. Change Feet	Time in Hrs.	Water Temp. °C	REMARKS
					WATER YEAR 1997										
101	1997 JAN 22	A. ADAME	13.3	10.4	1.88	2.05	19.6	+.13		.6	22	.06	.57		
102	FEB 12	A.D. GUTIERREZ	15.0	10.5	1.44	1.81	15.1	+.25		6	19	0	.30		
103	21	A.D. GUTIERREZ, ADAME	12.8	9.08	1.61	1.97	13.7	+.03		6	27	0	.45		
104	MAR 12	A.D. GUTIERREZ	15.1	10.9	1.32	1.96	14.4	+.08		6	21	0	.37		
105	APR 2	A ADAME	12.0	11.5	1.32	2.04	15.2	e		6	25	+.01	.42		
106	23	A.D. GUTIERREZ	18.3	12.5	1.50	2.12	18.7	+.04		6	20	0	.30		
107	MAY 12	A ADAME	12.5	11.8	1.47	2.04	17.4	+.09		6	26	0	.50		
108	29	A.D. GUTIERREZ	18.4	25.9	1.96	3.55	50.7	+.19		6	23	0	.45		
109	JUN 12	A ADAME	13.0	21.2	1.89	2.33	40.0	+.25		6	27	0	.48		
110	27	do	12.0	15.0	1.84	2.18	27.6	+.18		6	25	0	.43		
111	JUL 23	do	11.5	13.4	1.60	2.15	21.5	+.08		6	24	+.01	.62		
112	AUG 8	A.D. GUTIERREZ	–	–	–	5.54	44.6	-.47		5, 6 2+8	48	-.08	1.34		2 CHANNELS WATER AROUND GAGE OVER ROAD
113	21	do	16.6	31.0	1.40	3.39	43.3	+.24		6	18	0	.32		
114	SEP 11	do	16.0	20.5	1.55	2.10	31.7	+.39		6	18	0	.32		
115	29	do	17.3	26.9	2.08	2.49	53.8	+.29		6	22	0	.35		
					BEGIN WATER YEAR 1998										
116	OCT 16	A.D. GUTIERREZ	16.6	18.9	1.21	2.08	22.8	+.20		6	18	0	.35		TORNADO 10-11-97

PRELIMINARY SUBJECT TO REVISION

4. General Maps and Information



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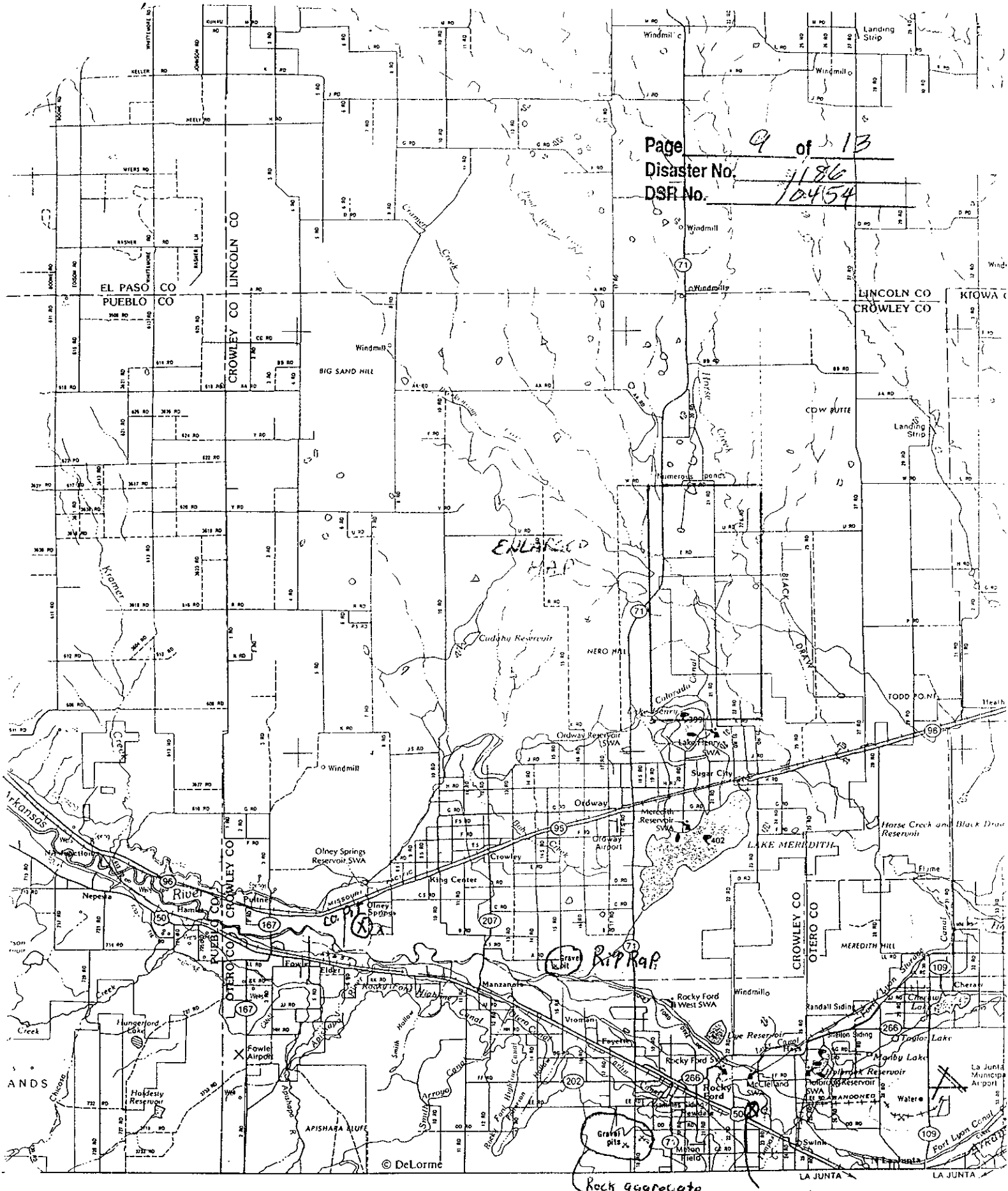

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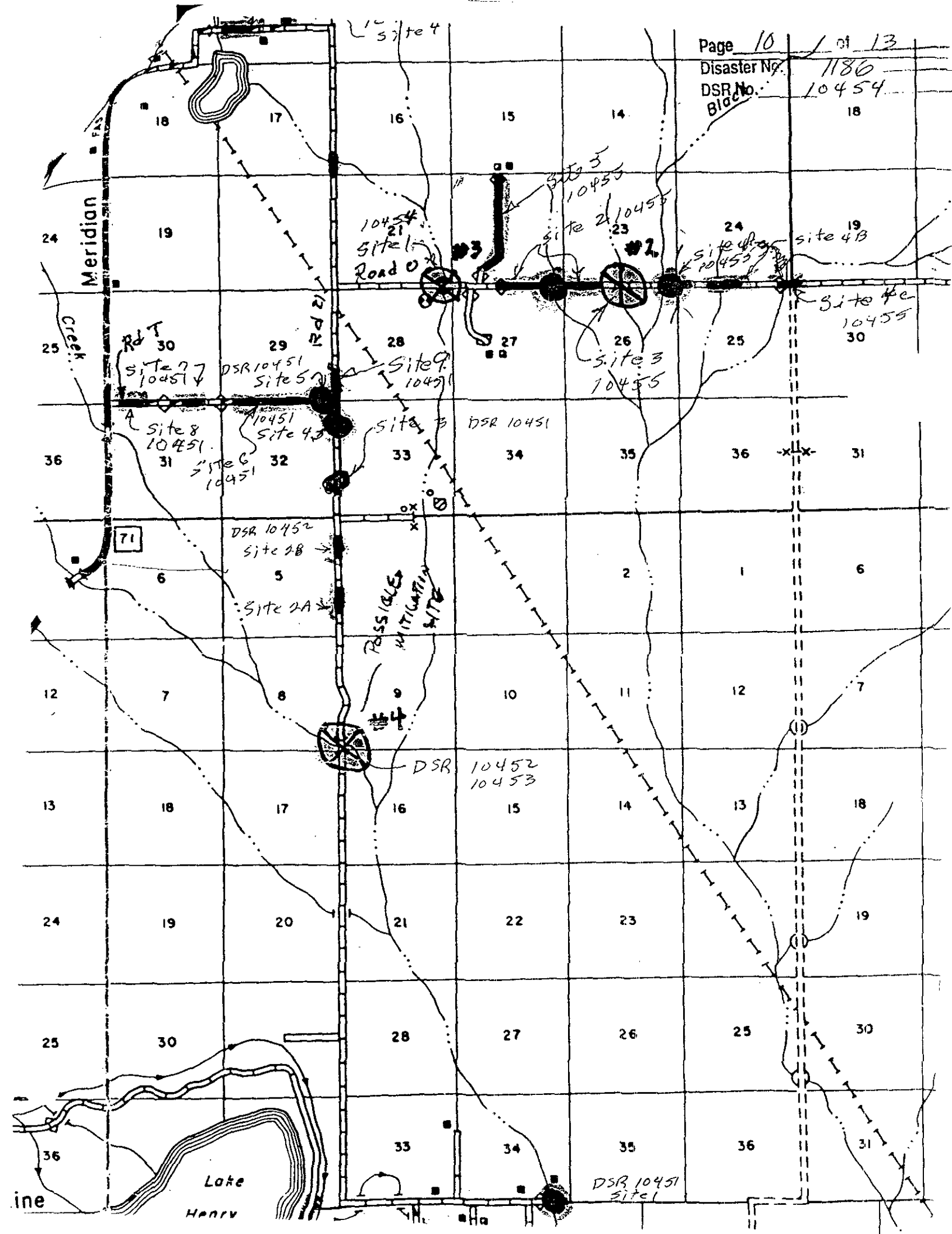
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#3
Site 5
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Site 2
10455
#2
Site 4B
Site 4C
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Site 7
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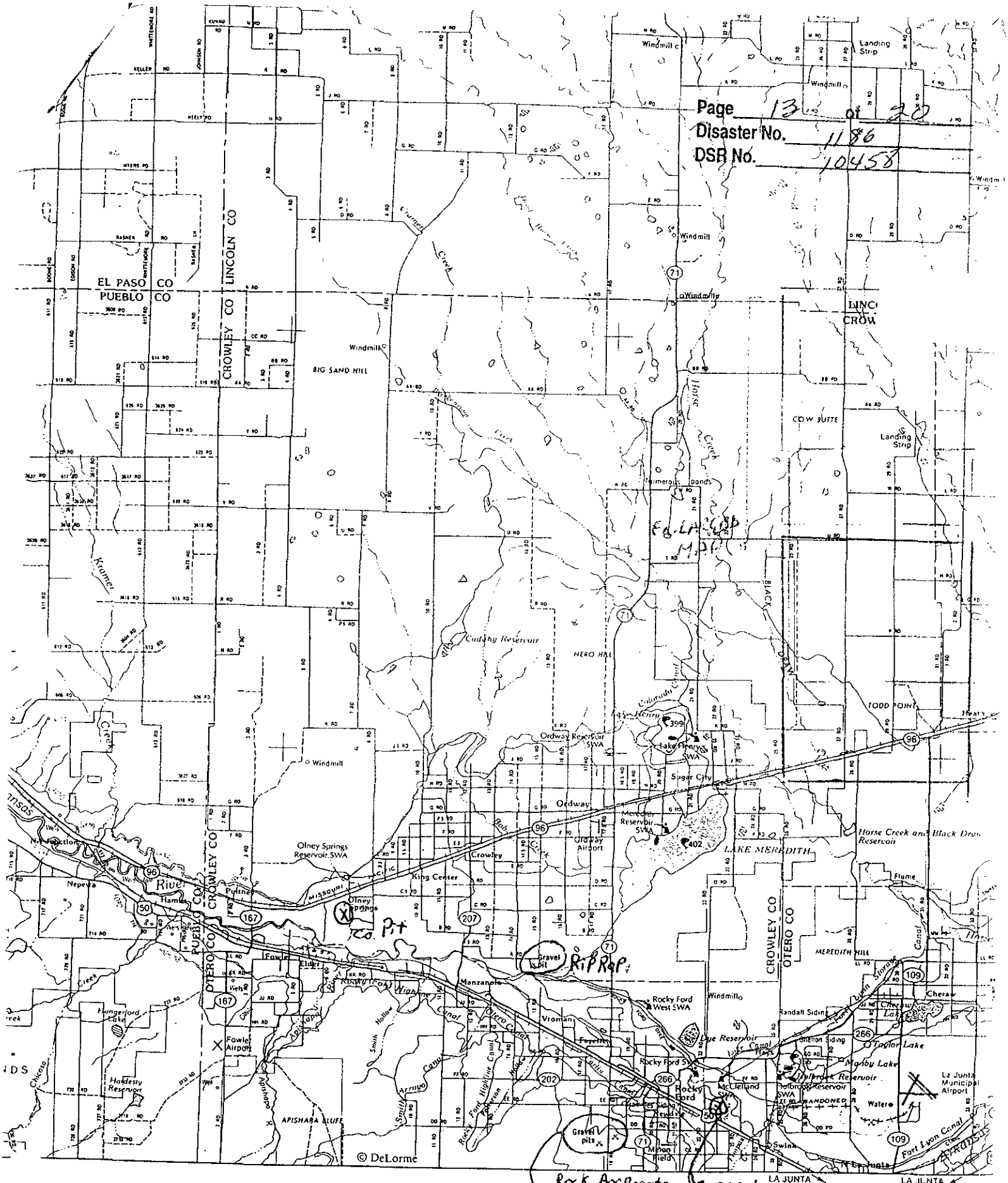
DSR 10451
Site 5
Site 9
10451
Site 3
10455
Site 8
10451
Site 4A
10451
Site 6
10451
Site B
DSR 10451
71
DSR 10452
Site 2B
Site 2A
POSSIBLE MITIGATION SITE
#4
DSR 10452
10453
Lake
Henry
DSR 10451
Site 1



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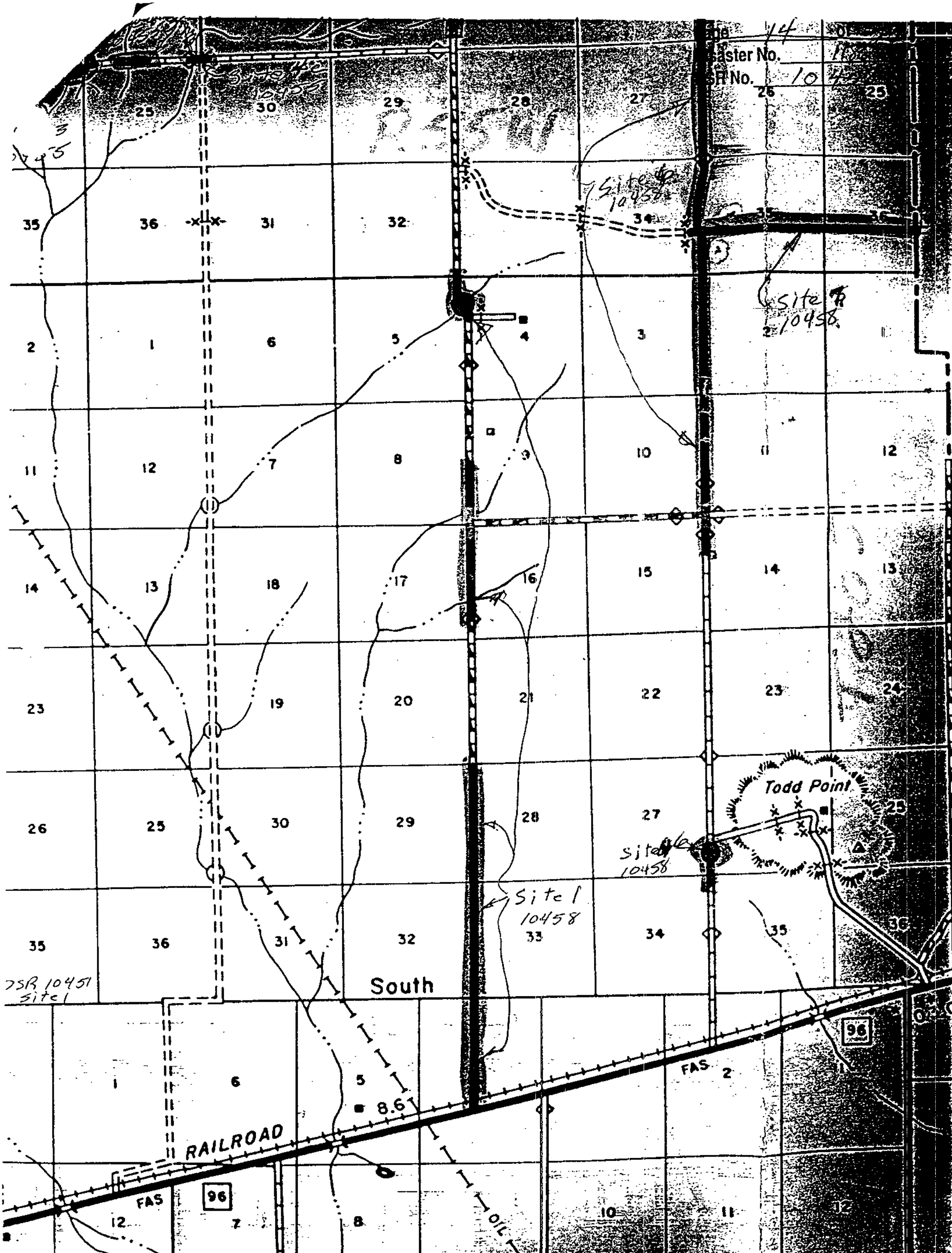
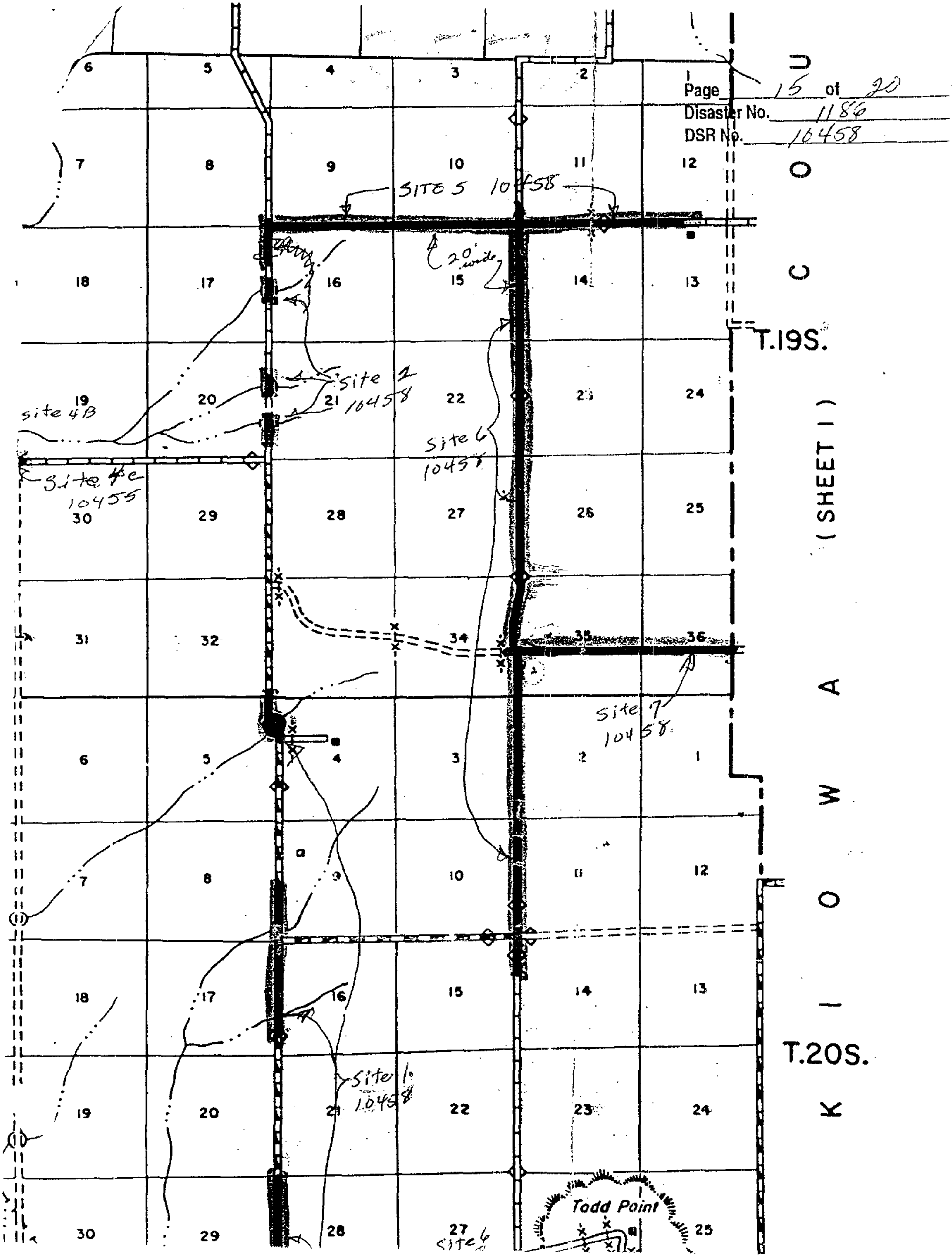


Page 14
Master No.
SR No.
Site 1
10458
Site
10458
TSR 10451
Site 1
South
Todd Point
RAILROAD
FAS
96
8.6
OIL

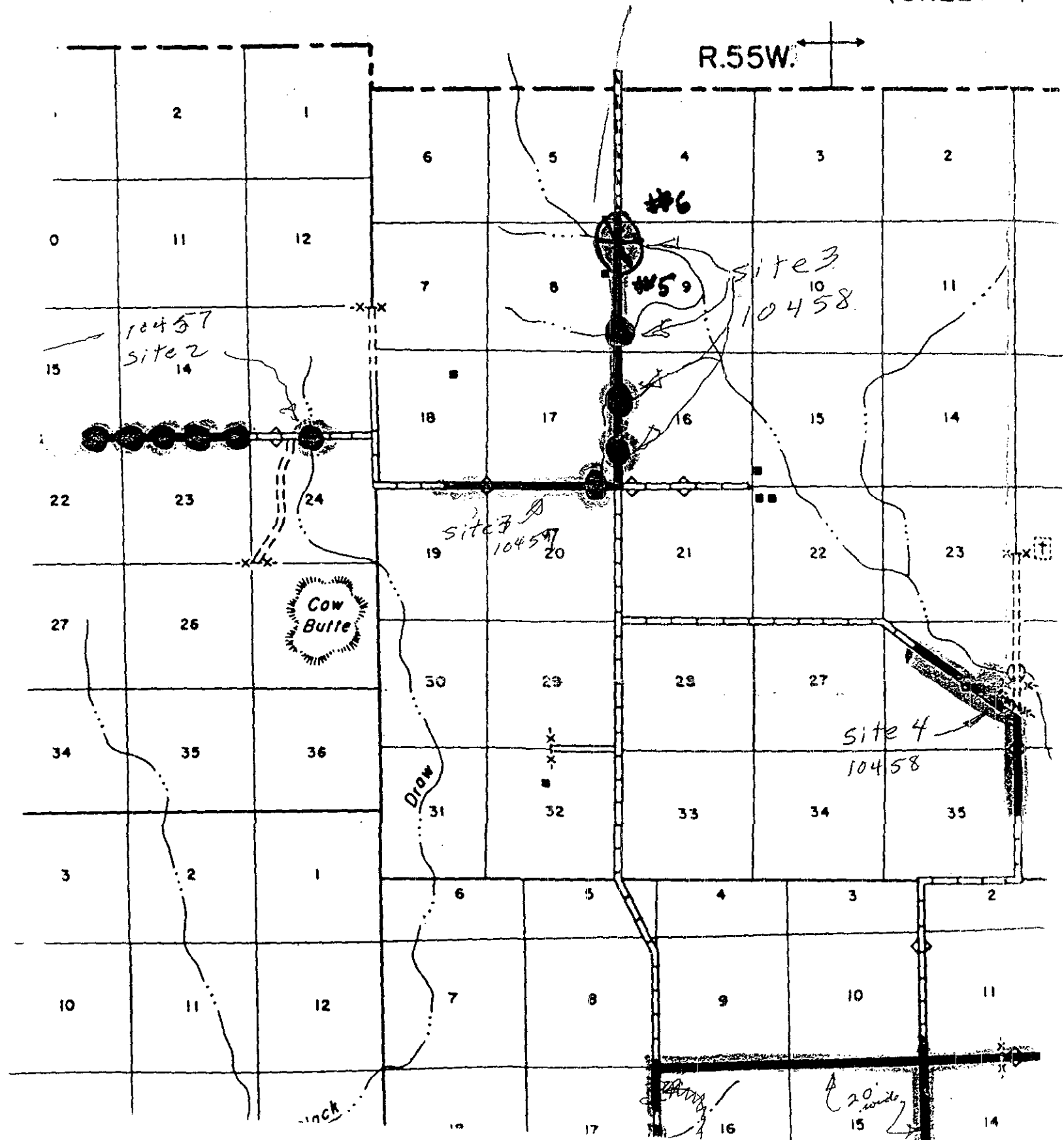
Page 15 of 20
Disaster No. 1186
DSR No. 10458

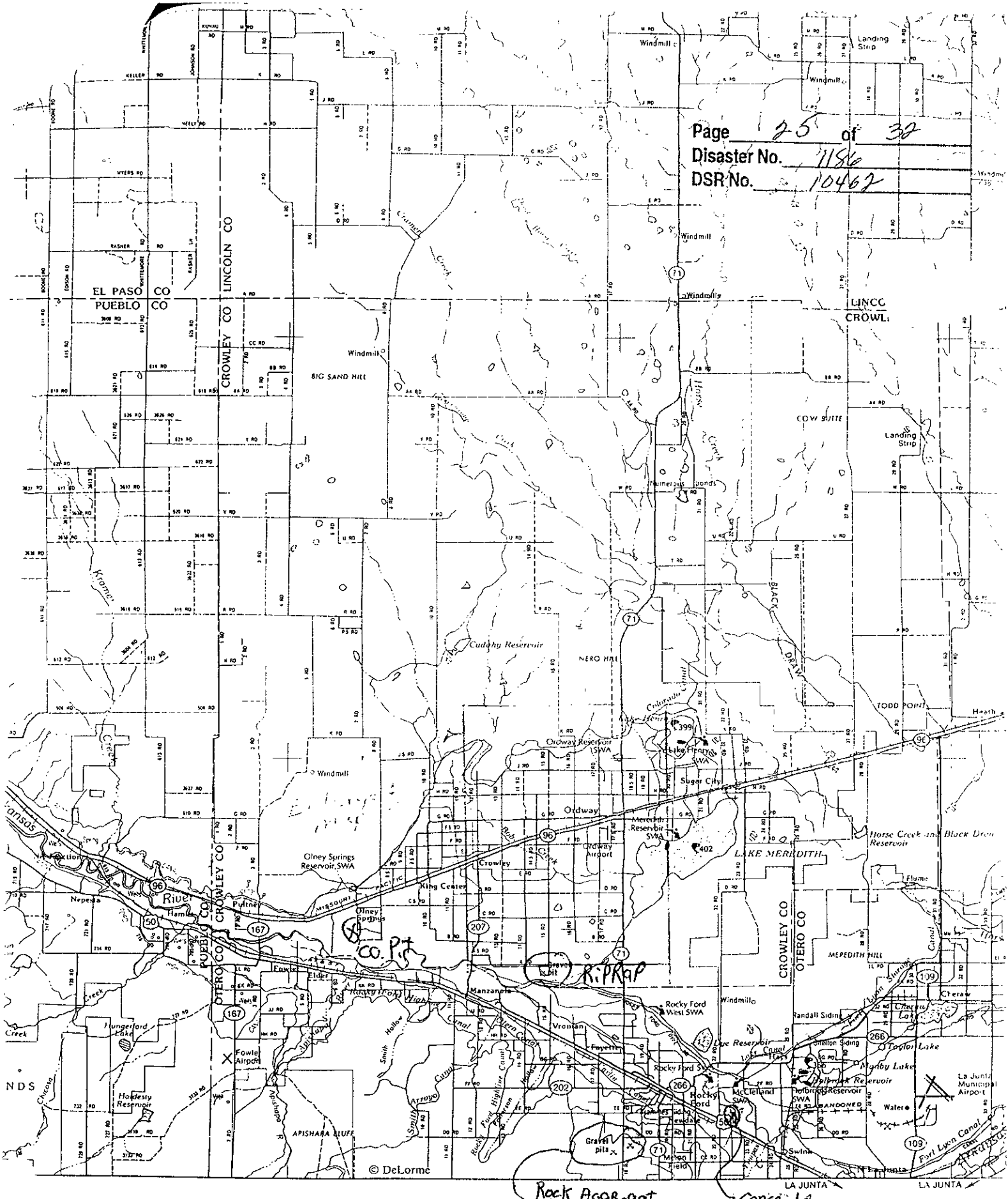


POSSIBLE MITIGATION SITE

; O U N T Y

(SHEET 3)





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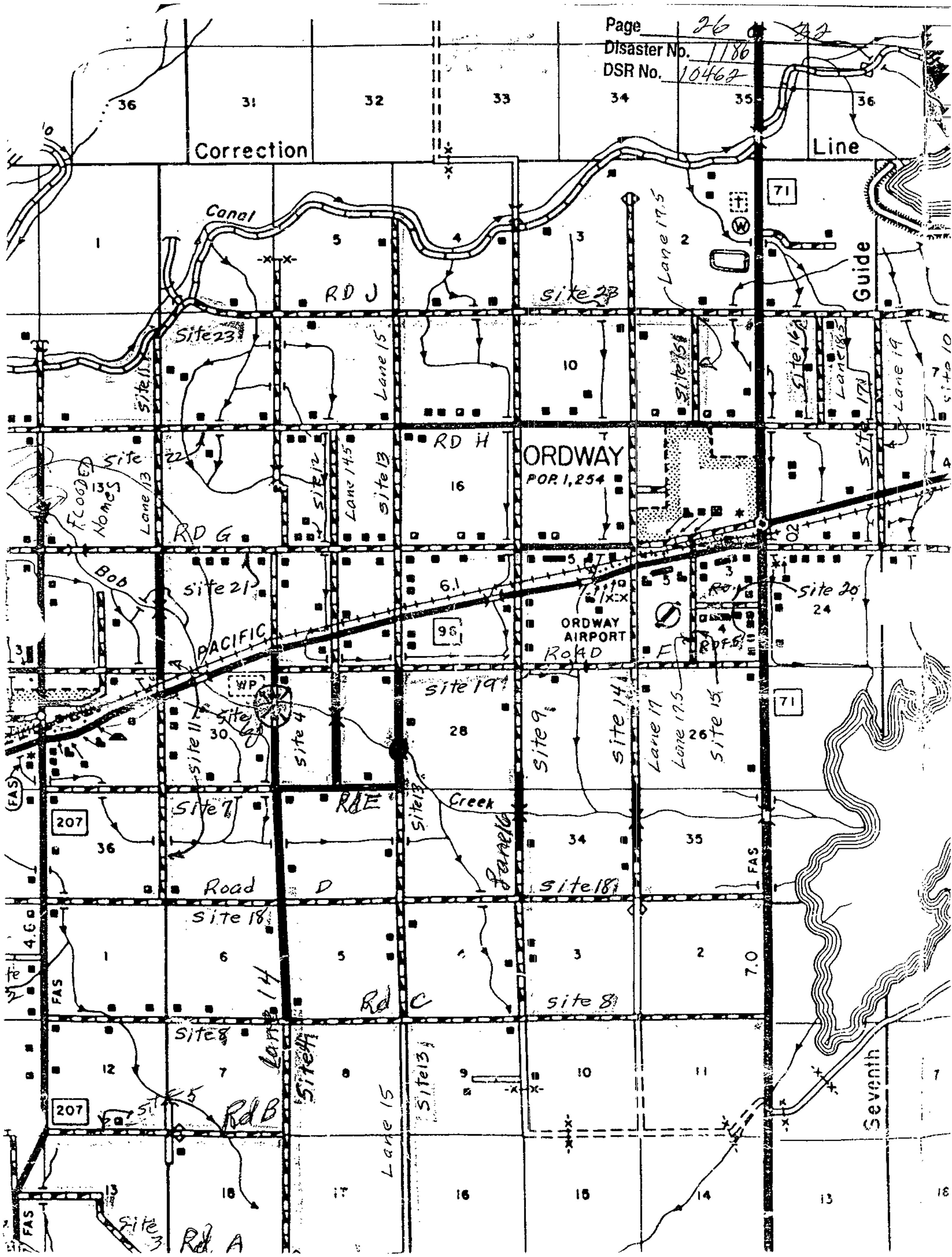
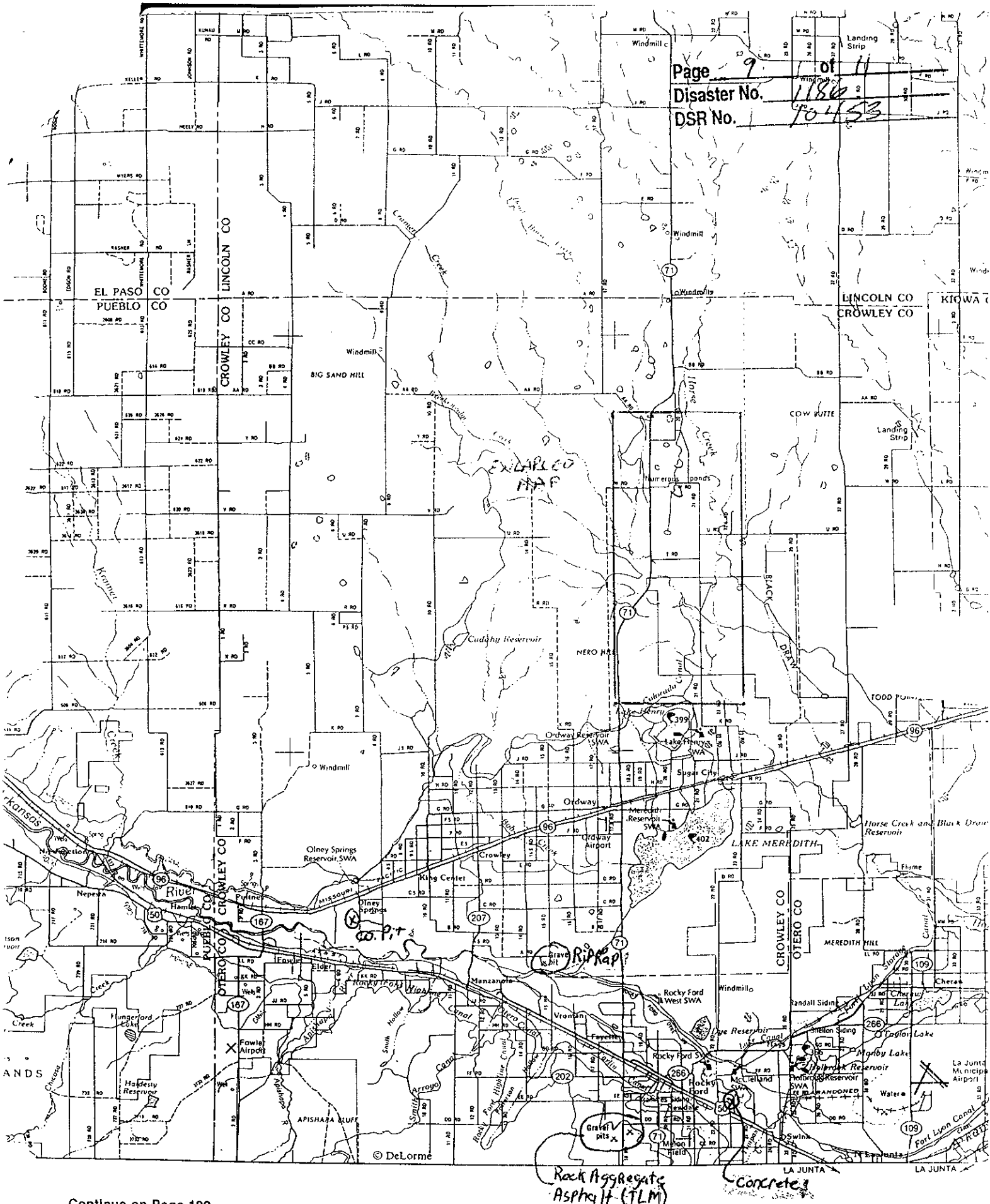
KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12

Page 26 of 32
Disaster No. 1186
DSR No. 10462





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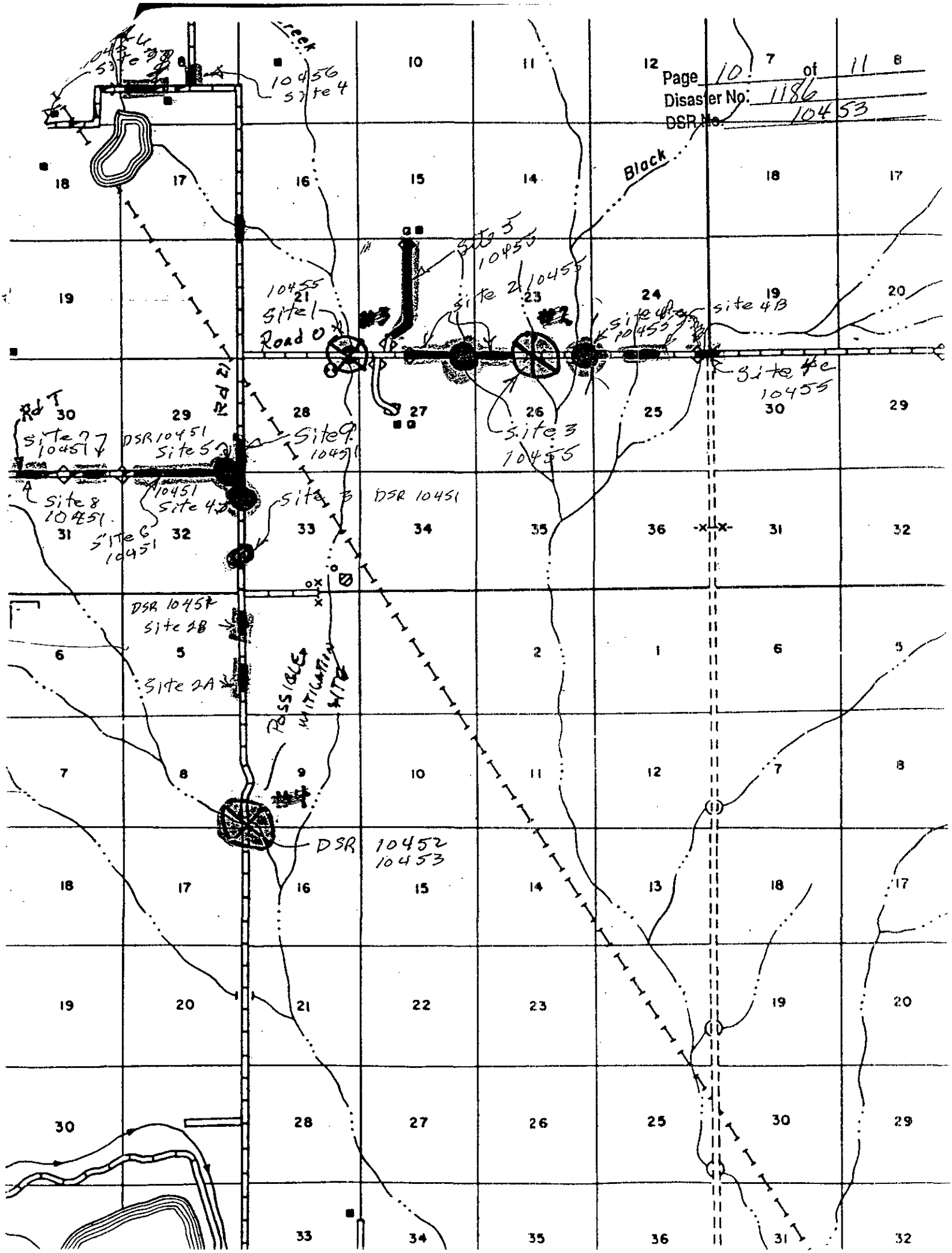
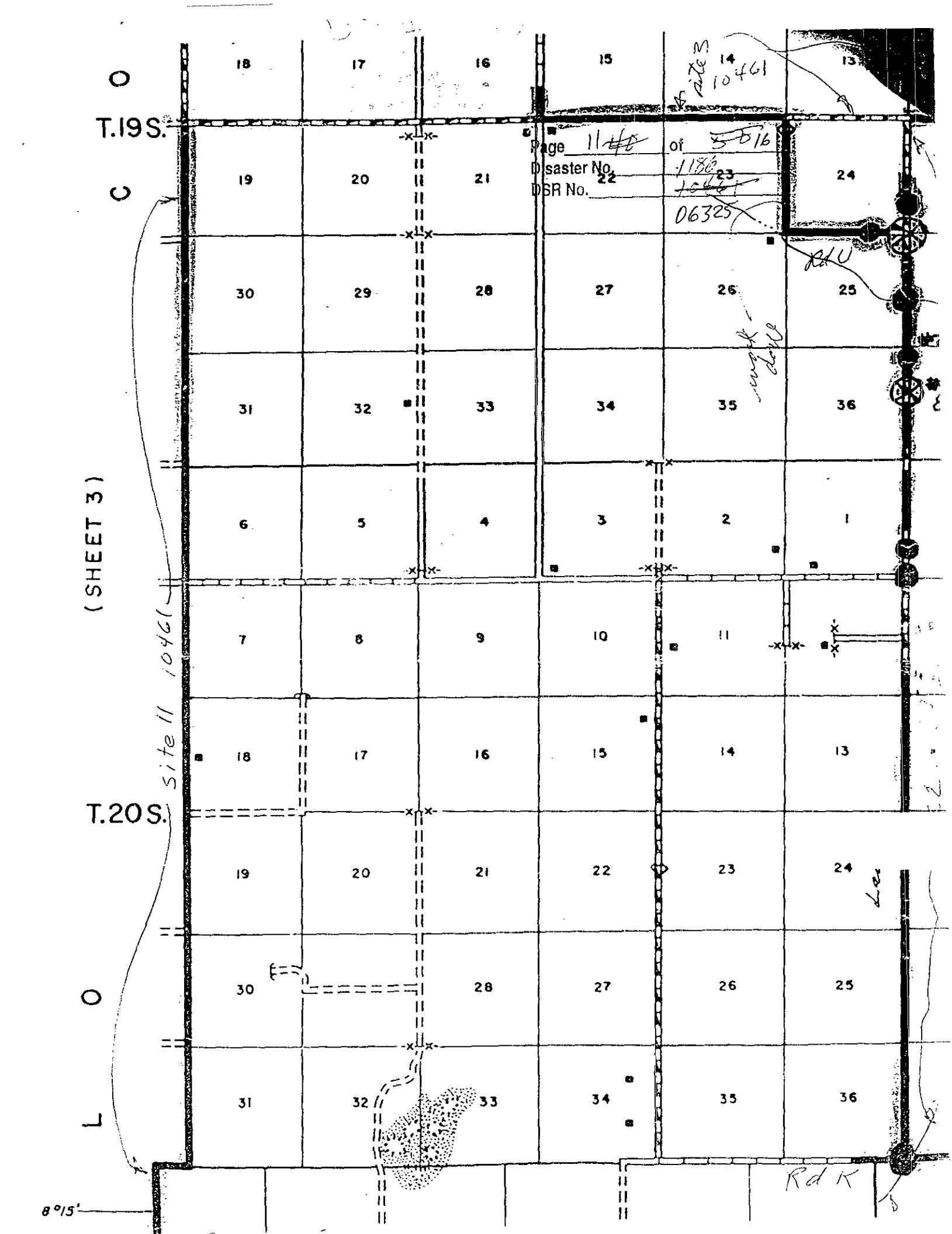
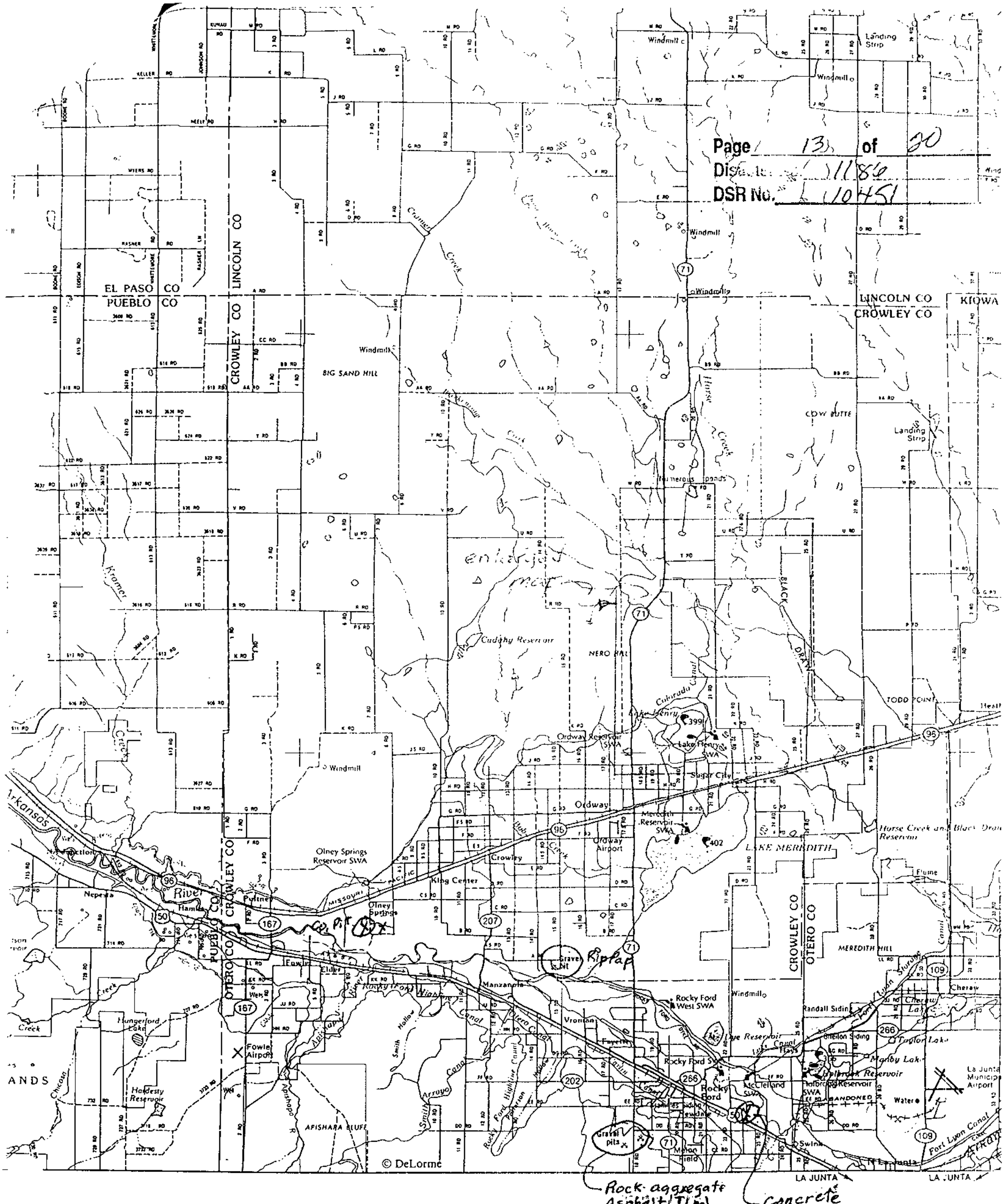
KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12


Creek
10456 Site 4
Black
Site 5 10455
Site 2 10455
10455 Site 1
Road O
Site 4B
Site 4C 10455
Site 4A 10455
Rd 21
Rd T
Site 7 10451
DSR 10451 Site 5
Site 9 10451
Site 3 10455
Site 8 10451
10451 Site 4
Site 6 10451
Site B
DSR 10451
DSR 10451 Site 2B
Site 2A
POSSIBLE MITIGATION SITE
DSR 10452 10453


C O L O
T.19S.
T.20S.
(SHEET 3)
Site 11 10461
Site 11 10461
Page 11 of 5016
Disaster No. 1186
DSR No. 06325
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
6 5 4 3 2 1
7 8 9 10 11
18 17 16 15 14 13
19 20 21 22 23 24
30 28 27 26 25
31 32 33 34 35 36
Rd K
Rd U
8°15'



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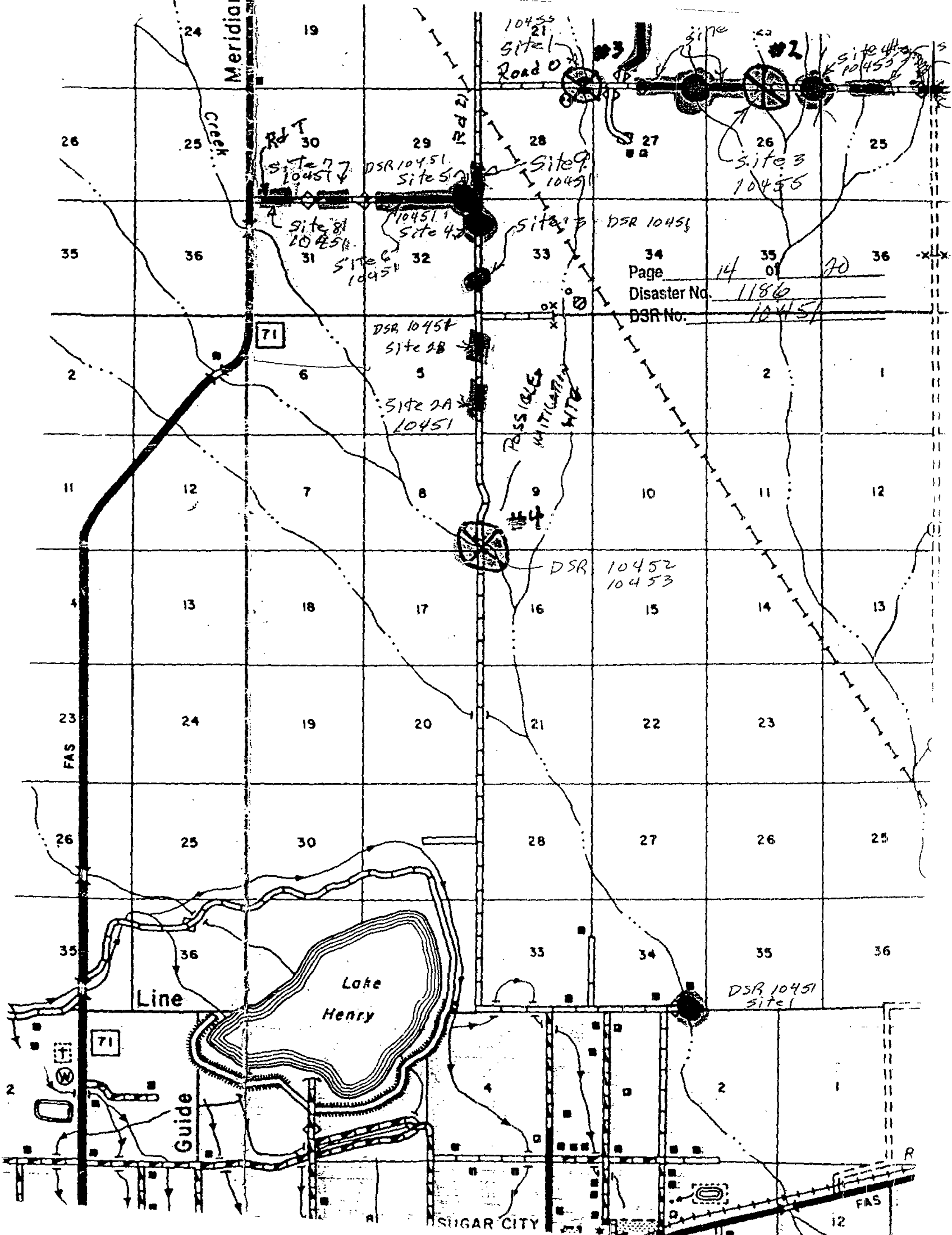
KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12


Meridian
Creek
Rd T
Road O
Rd 21
Site 7 10451
DSR 10451 Site 5
Site 9 10451
Site 8 10451
10451 Site 4
Site 3 DSR 10451
Site 6 10451
Site 1 10455
#3
#2
Site 3 10455
Site 4 10455
Page 14 of 20
Disaster No. 1186
DSR No. 10451
DSR 10451 Site 2B
Site 2A 10451
POSSIBLE MITIGATION WTR
#4
DSR 10452 10453
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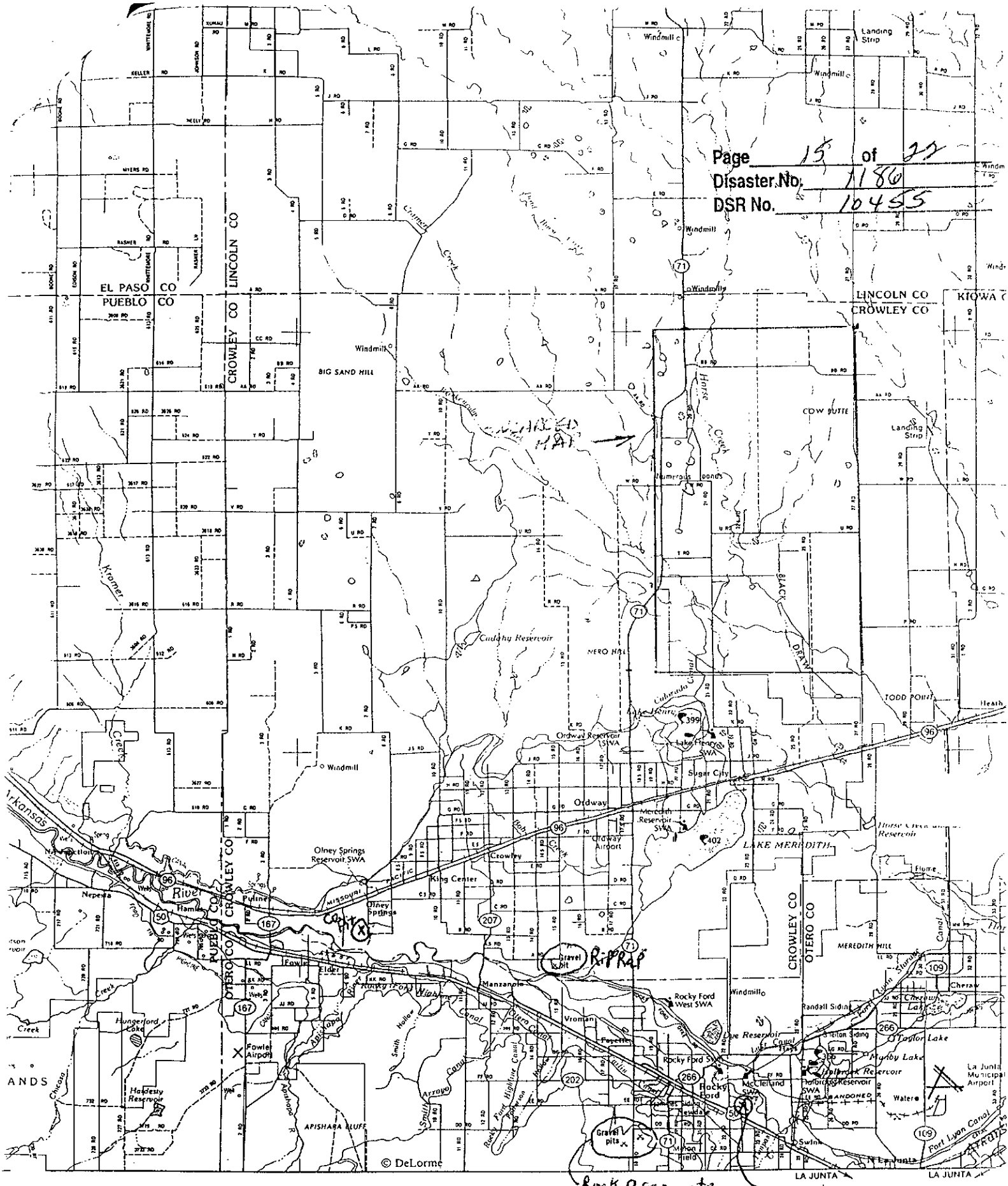
FAS
Lake Henry
Line
Guide
DSR 10451 Site 1
SUGAR CITY
FAS



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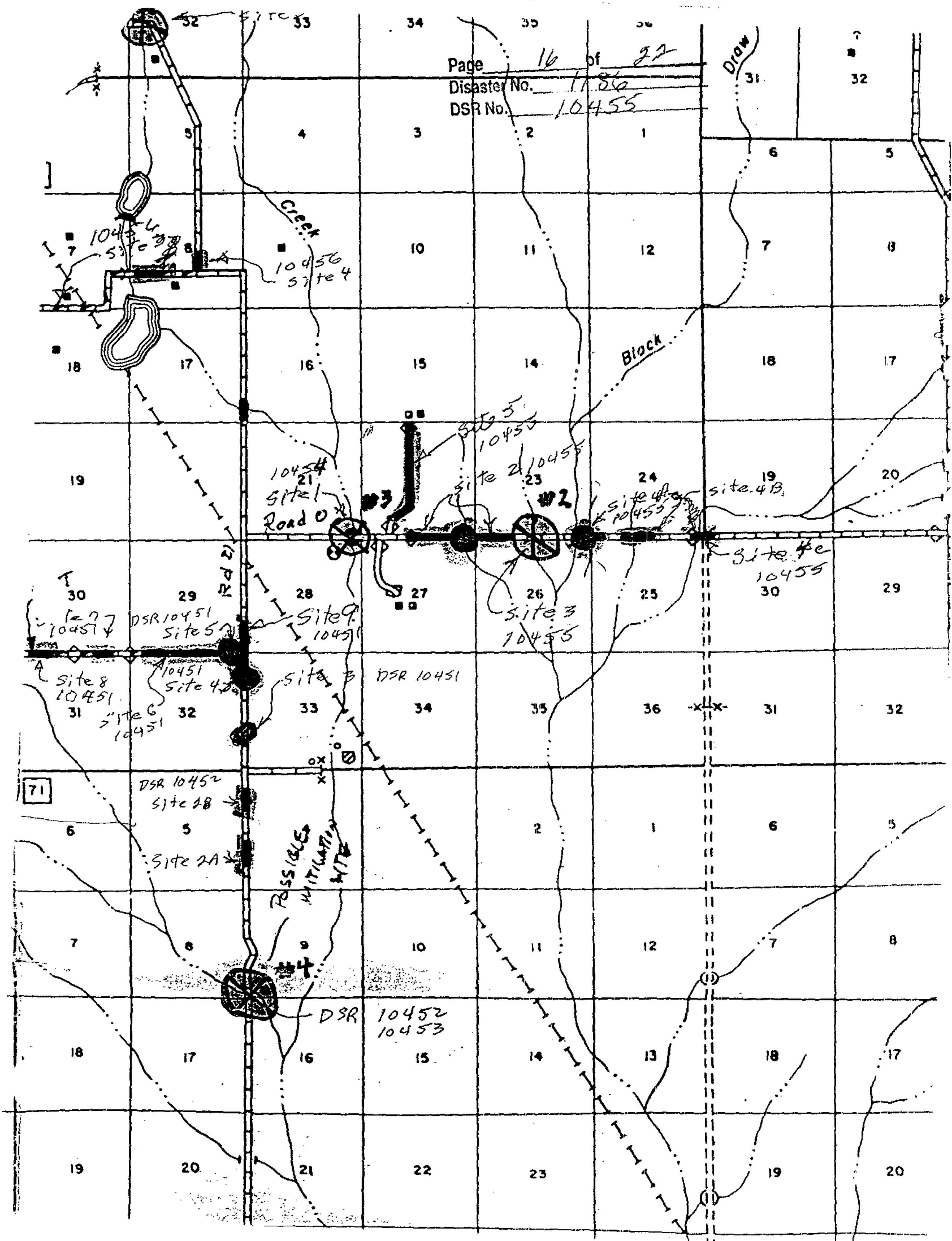
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Creek
Black
Road O
Rd 21
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#3
Site 5
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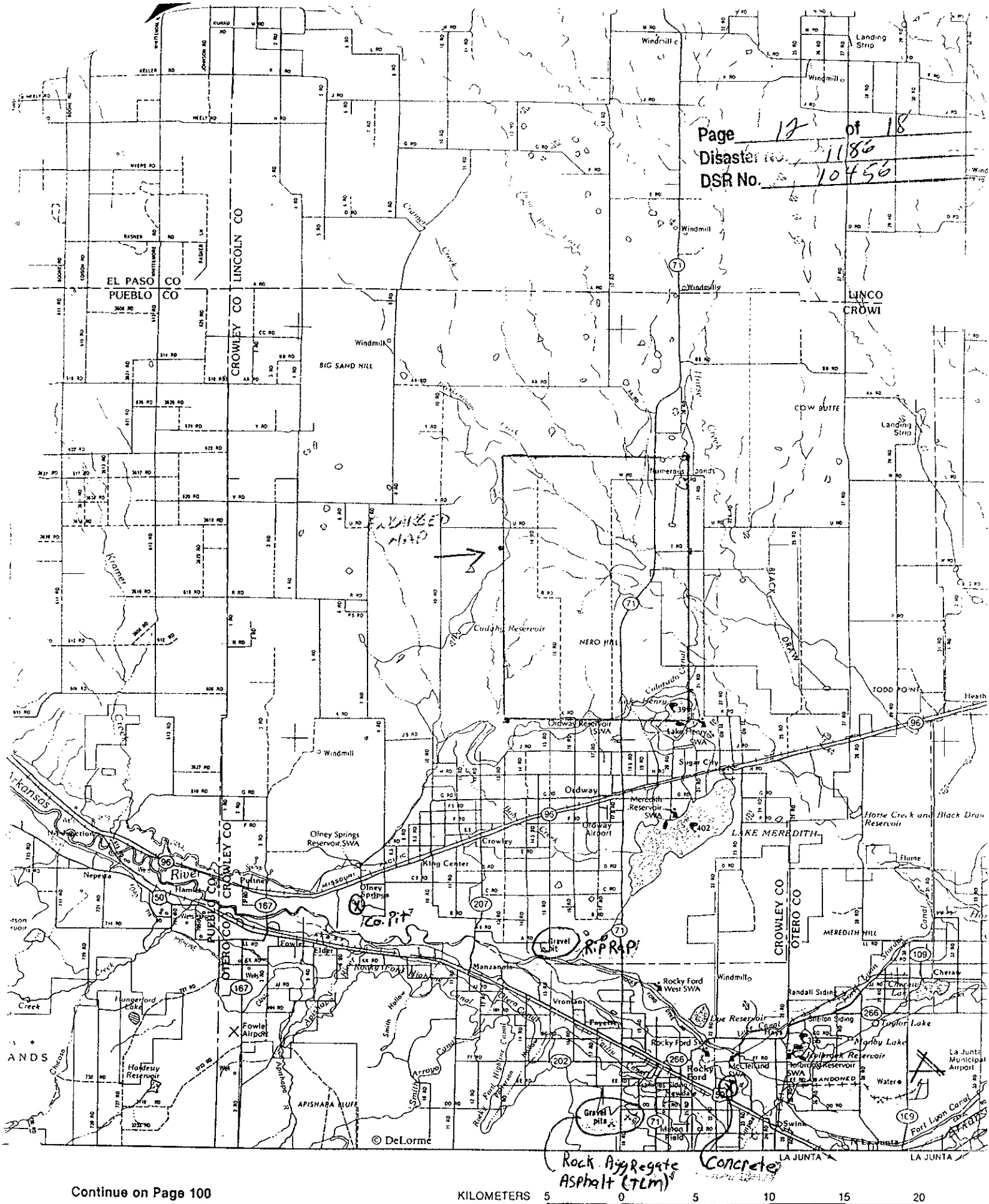
Site 2 10455
#2
Site 4B
Site 4C
10455
Site 3
10455
DSR 10451
Site 5
Site 9
10451
Site 8
10451
Site 6
10451
Site 4
Site 3
DSR 10451
DSR 10452
Site 2B
Site 2A
POSSIBLE MITIGATION SITE
#4
DSR 10452
10453
71



Continue on Page 100

KILOMETERS 5 0 5 10 15 20

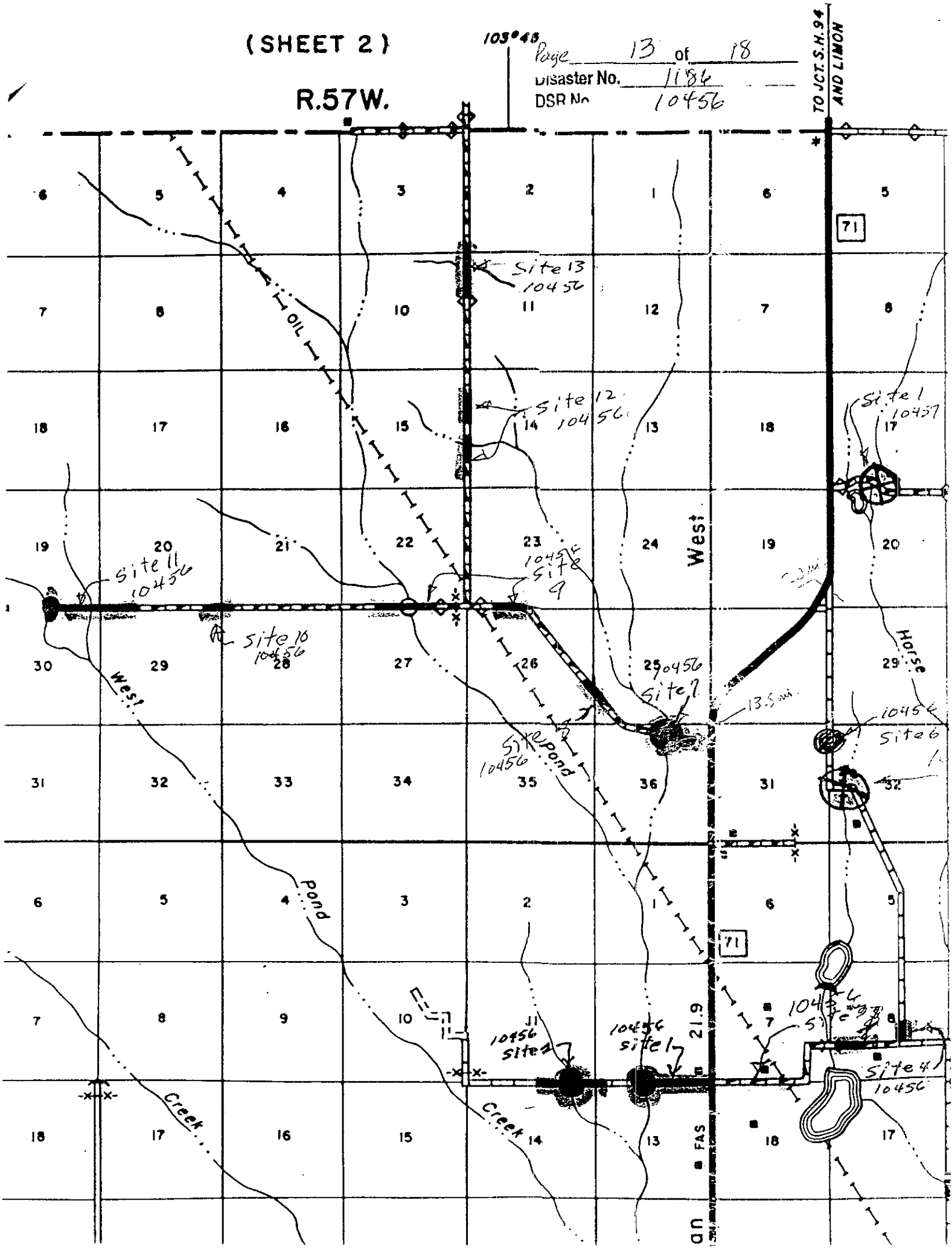
MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12

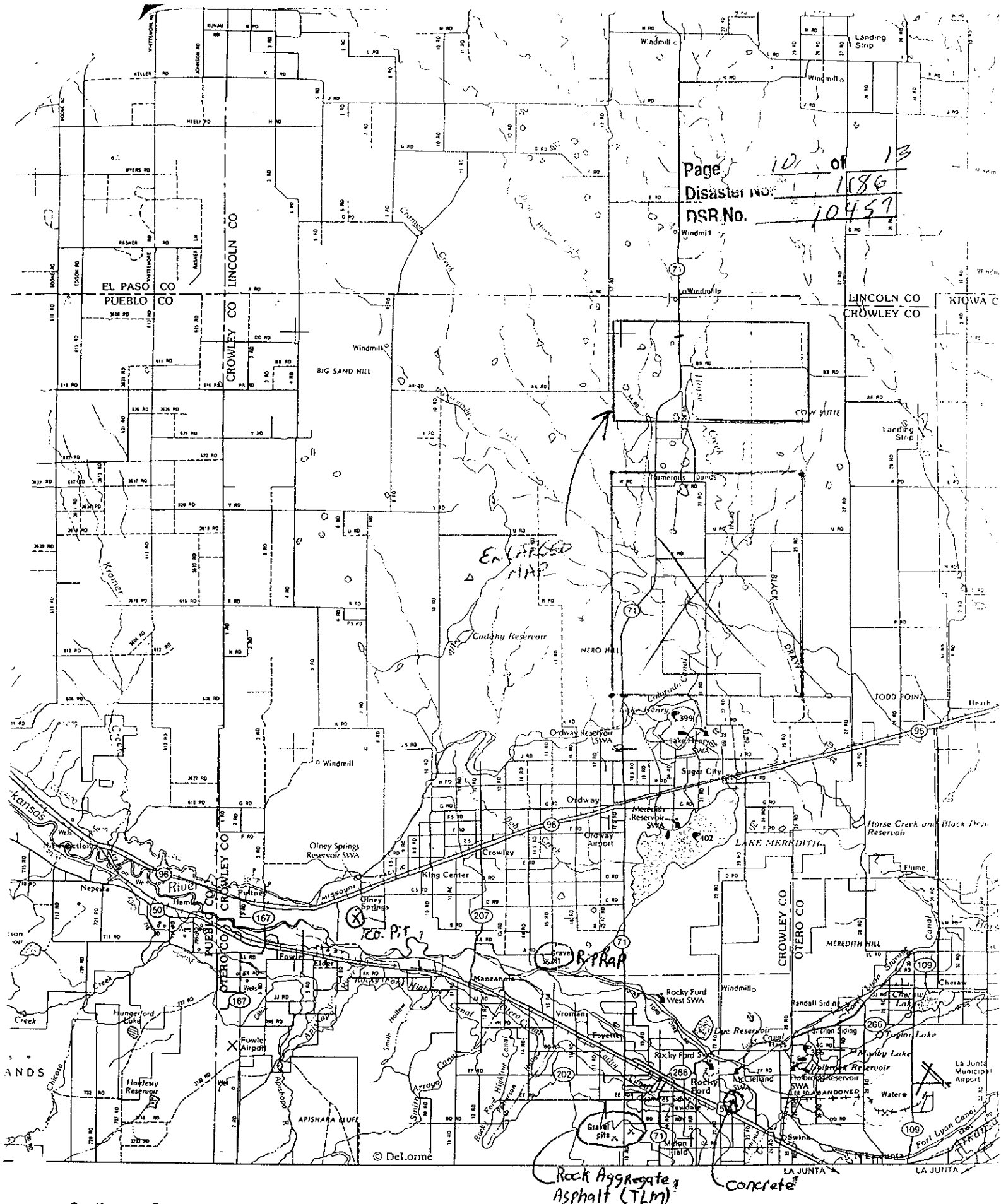
(SHEET 2)

R.57W.

103°45

TO JCT. S.H. 94 AND LIMON





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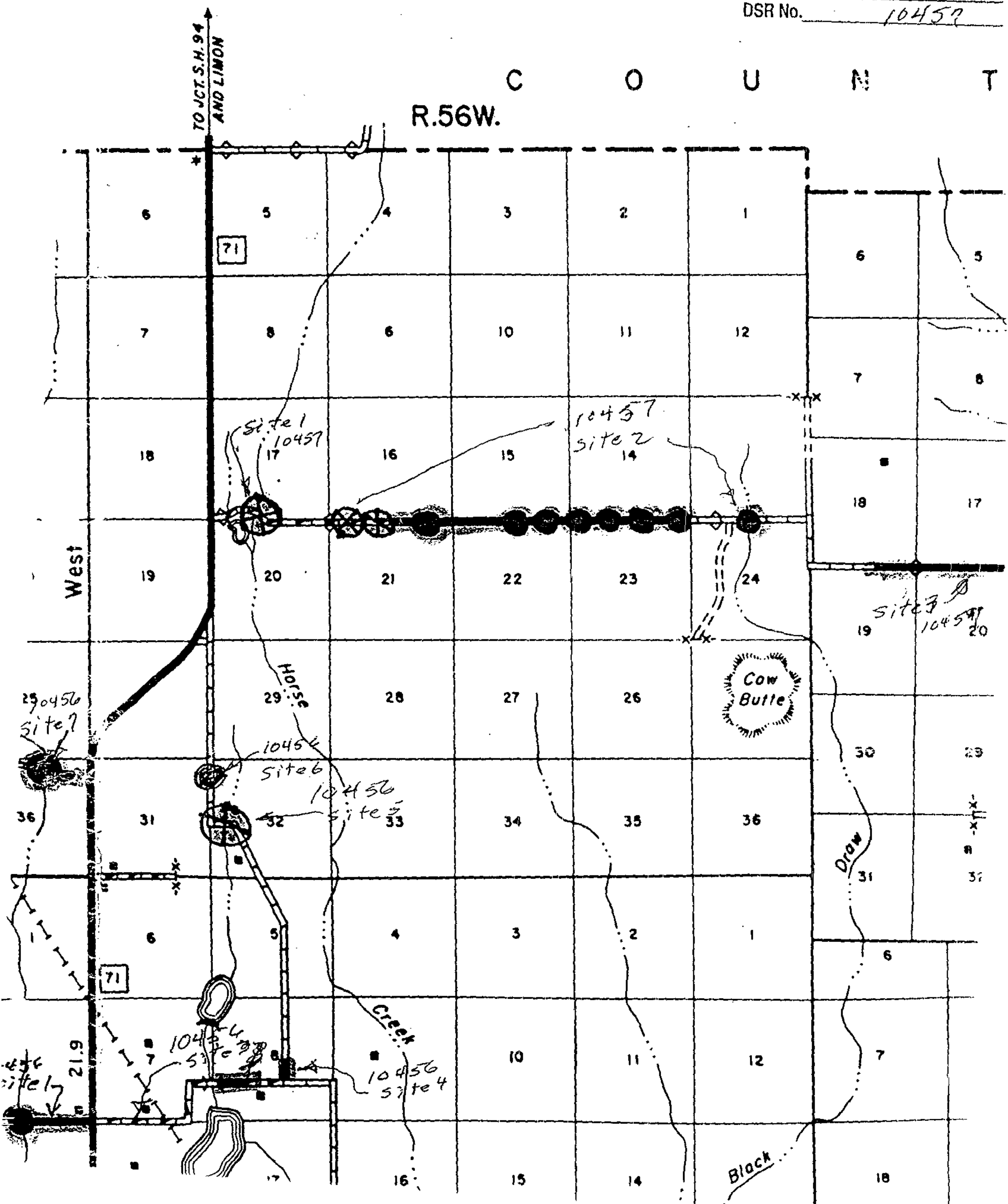
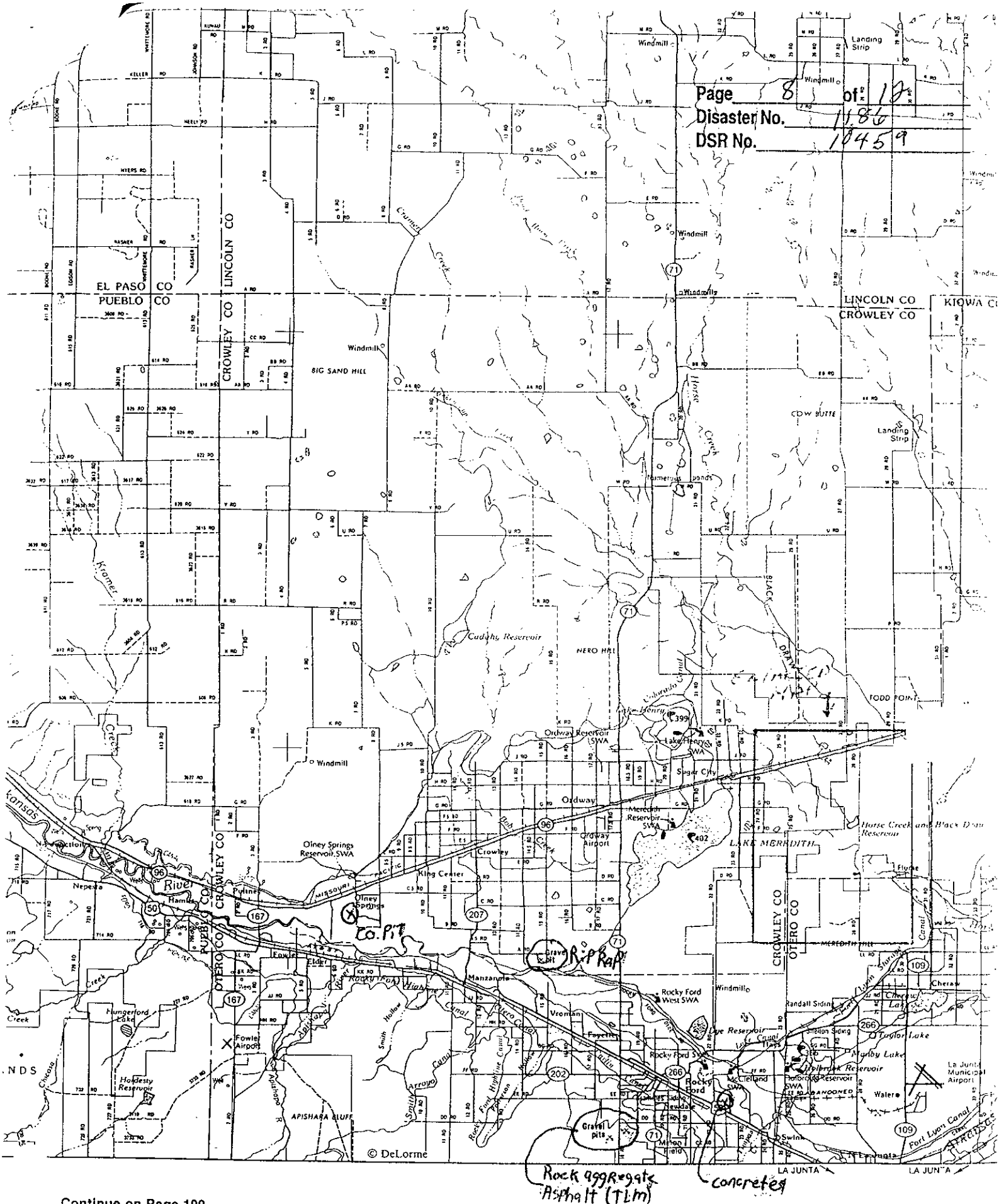

C O U N T
R.56W.
TO JCT. S.H. 94 AND LIMON
71
West
Horse
Creek
Cow Butte
Draw
Black
21.9
Site 1 10457
10457 site 2
site 3 10458
10456 site 7
10456 site 6
10456 site 5
10456 site 4



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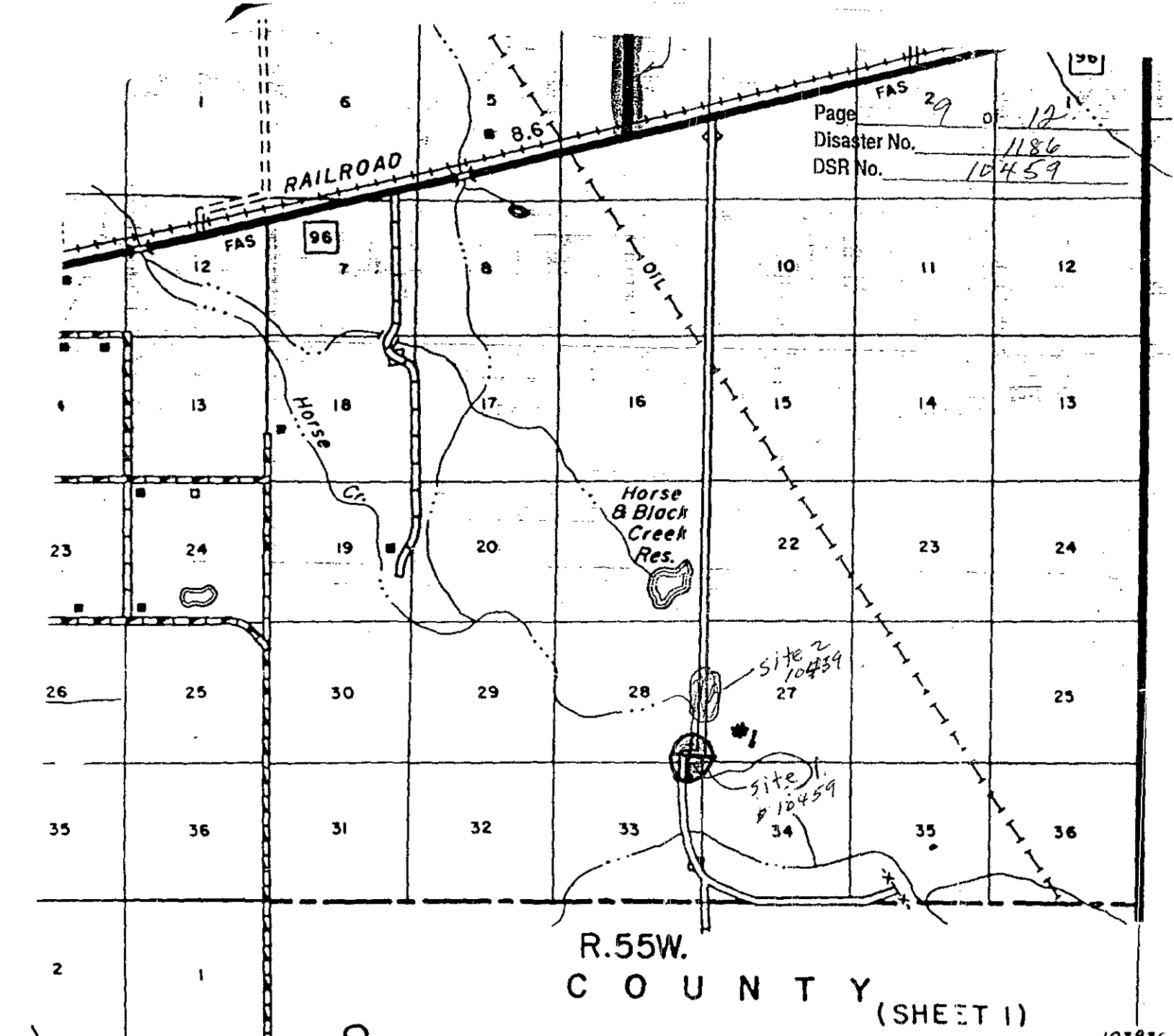
KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12



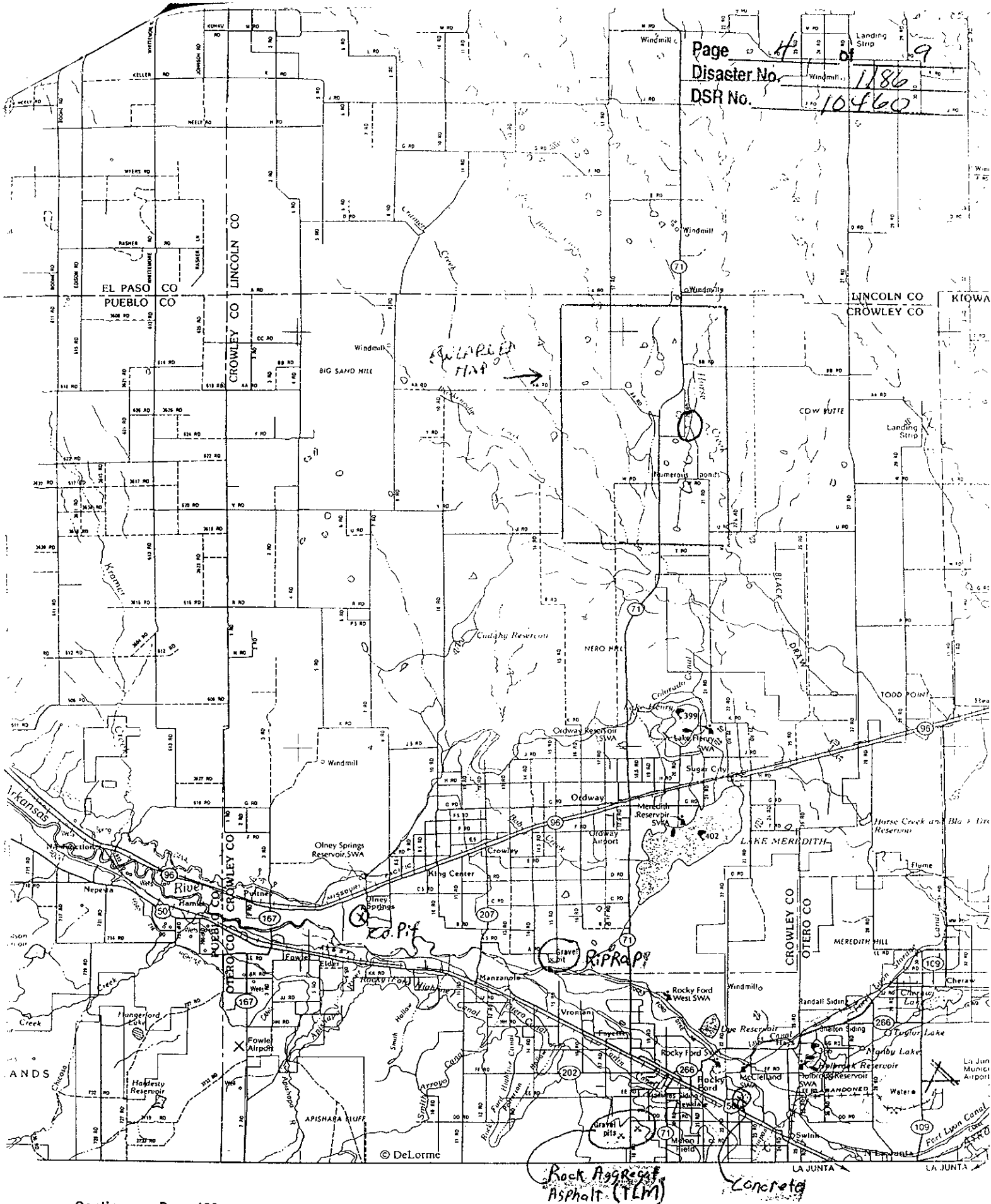
LEGEND

Minor Road Damage 0%-25% (Road material displa

Minor /Major Road Damage 25%-70% (Heavy deg
(Trenches

Major Road Damage 70%-100% (Road dangerous

Storm Structure Damage



Continue on Page 100

KILOMETERS 5 0 5 10 15 20

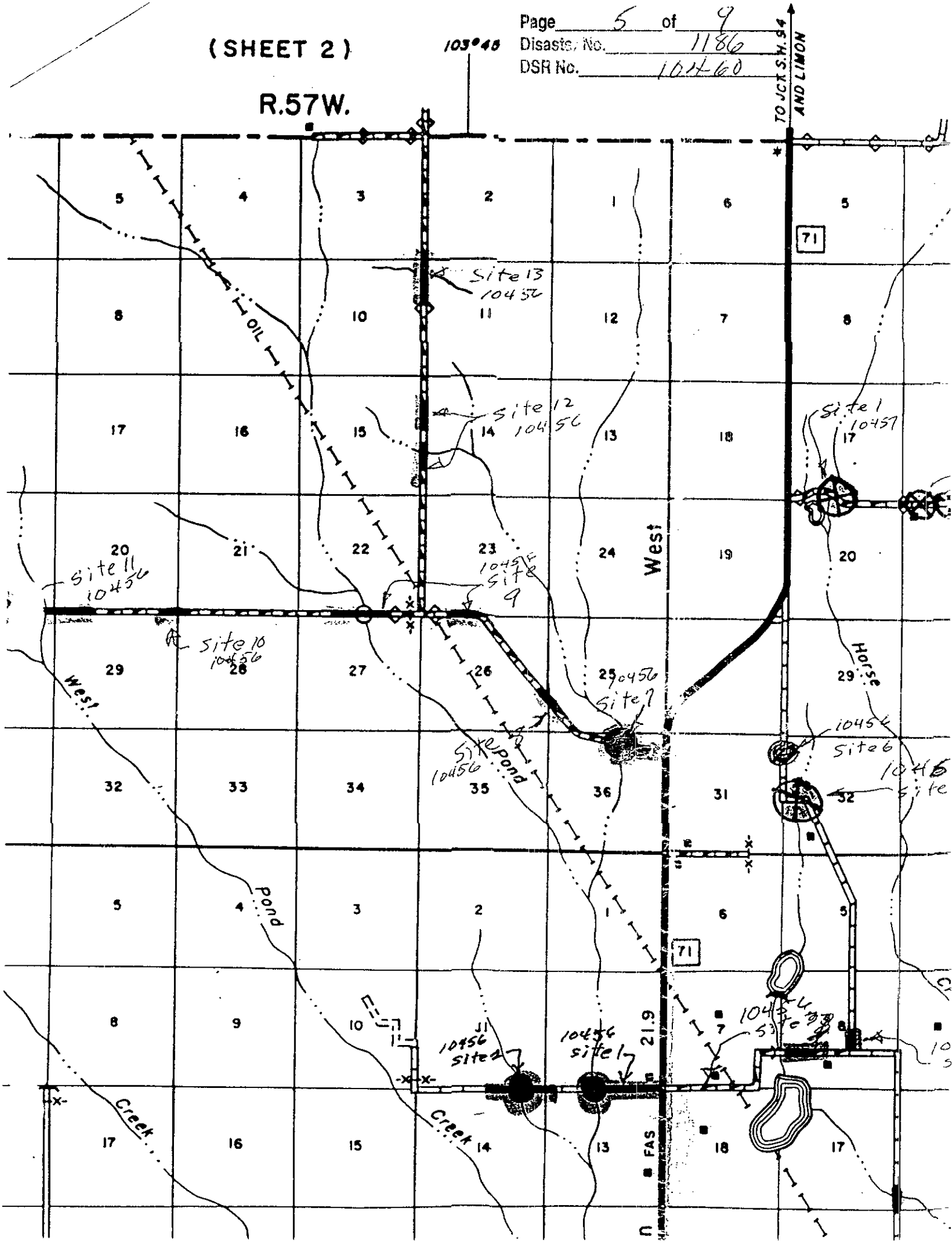
MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12

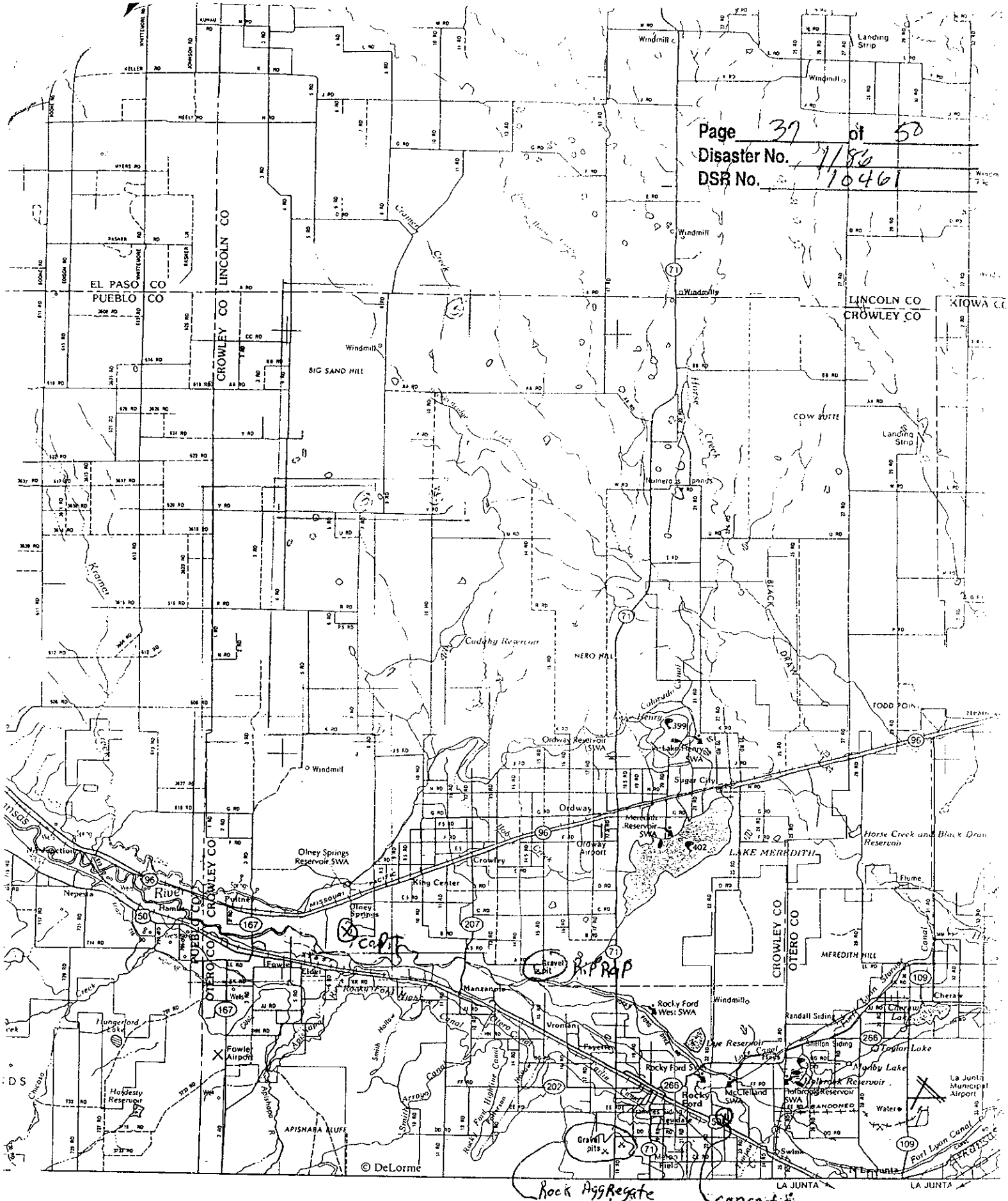
(SHEET 2)

R.57W.

103°45

TO JCT S.H. 94 AND LIMON





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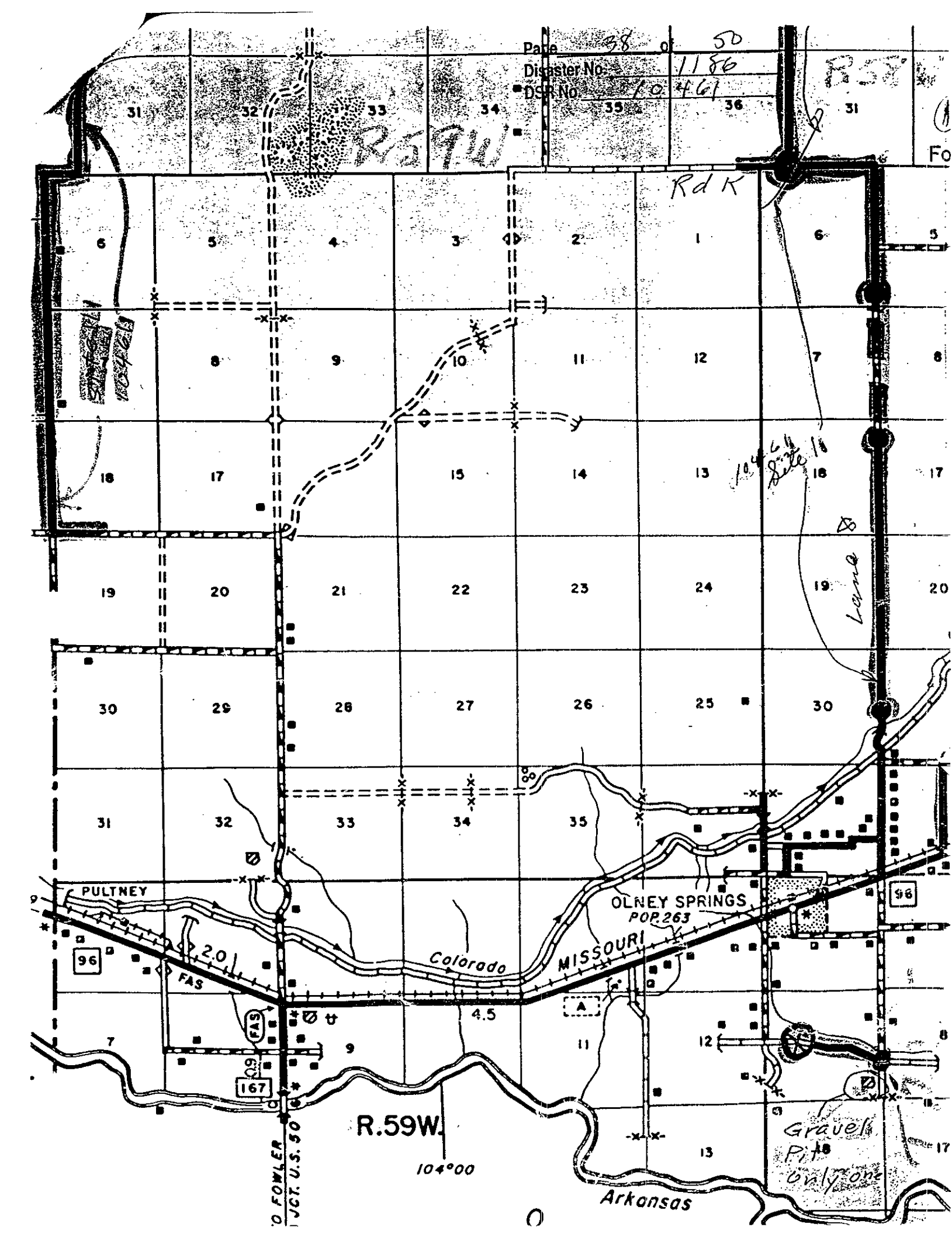
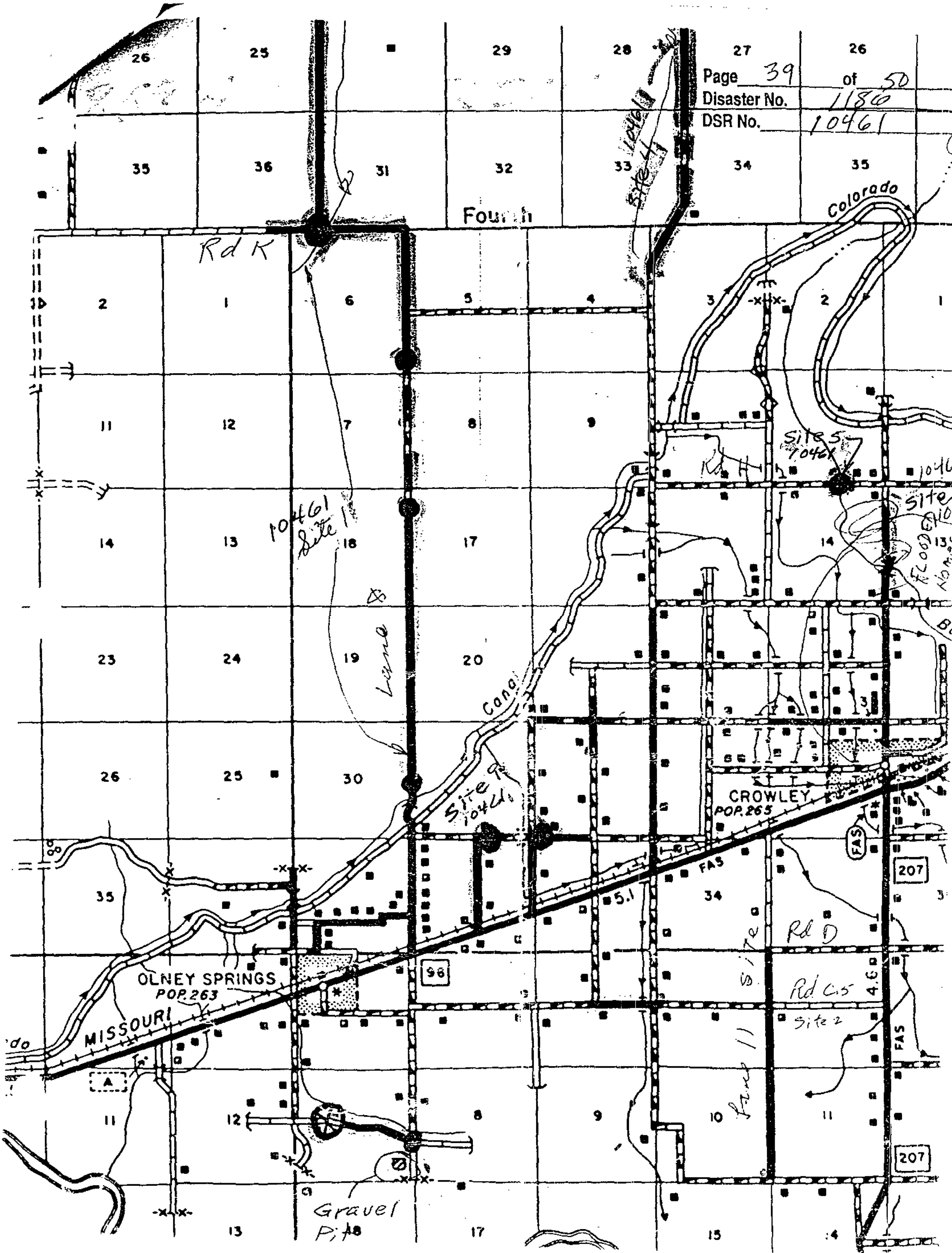
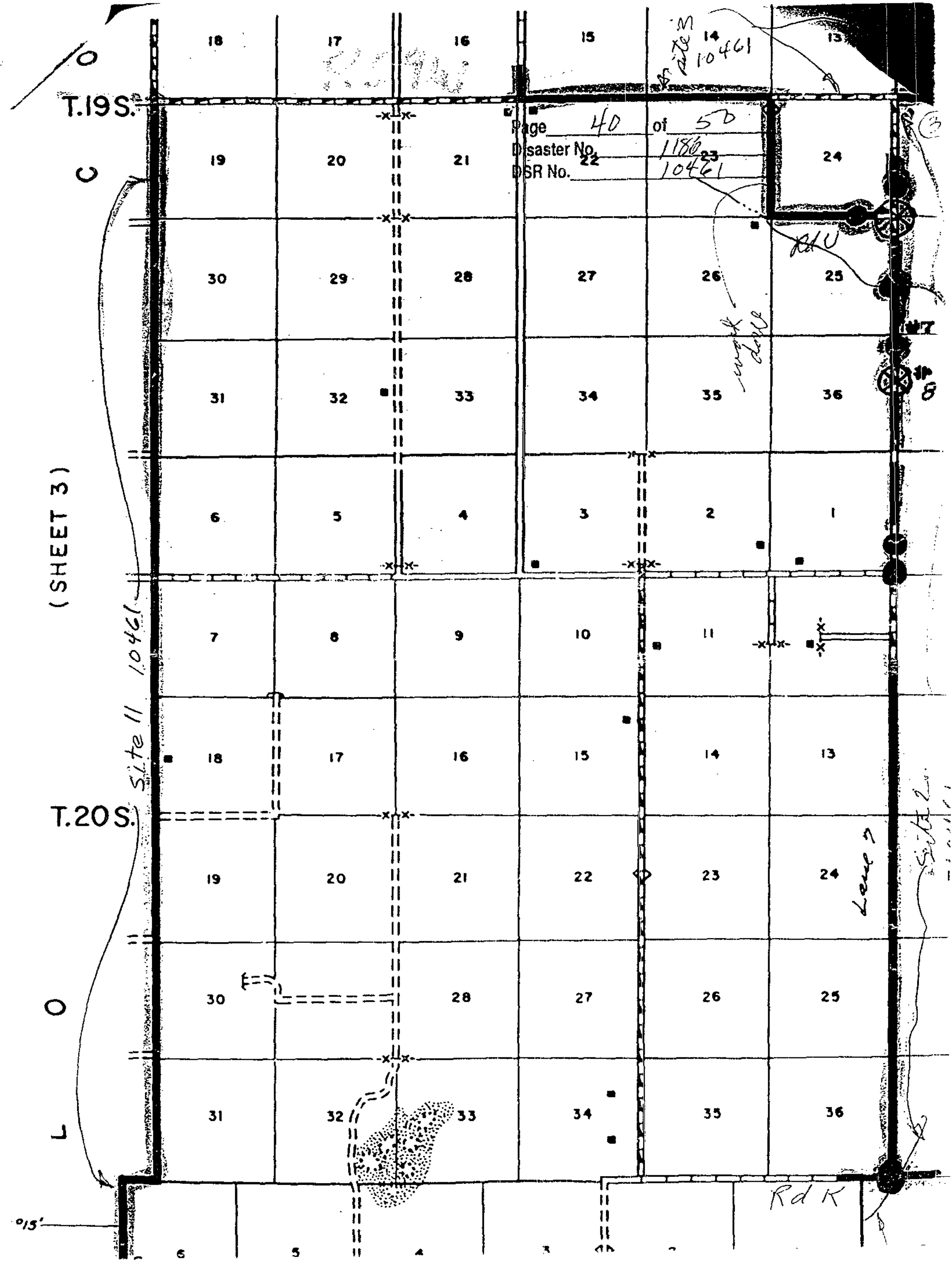
KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12


Page 38 of 50
Disaster No. 1186
DSR No. 710 461
R59W
Rd K
PULTNEY
OLNEY SPRINGS
POP. 263
Colorado
MISSOURI
Arkansas
FAS
2.0
4.5
96
167
R.59W.
104°00
Gravel Pit
Only one


Page 39 of 50
Disaster No. 1180
DSR No. 10461
Fourth
Rd K
Colorado
10461 Site 4
10461 Site 1
Site 5 10461
Rd H
Site
Flood
Lane
Canal
Site 9 10461
CROWLEY
POP. 265
FAS
207
5.1
Rd D
Rd C.5
4.6
Site 2
Lane 11
Site
96
OLNEY SPRINGS
POP. 263
MISSOURI
A
Gravel Pit


T.19S.
T.20S.
COLO
(SHEET 3)
Page 40 of 50
Disaster No. 1186
DSR No. 10461
Site 11 10461
Site 13 10461
Rd K
18
17
16
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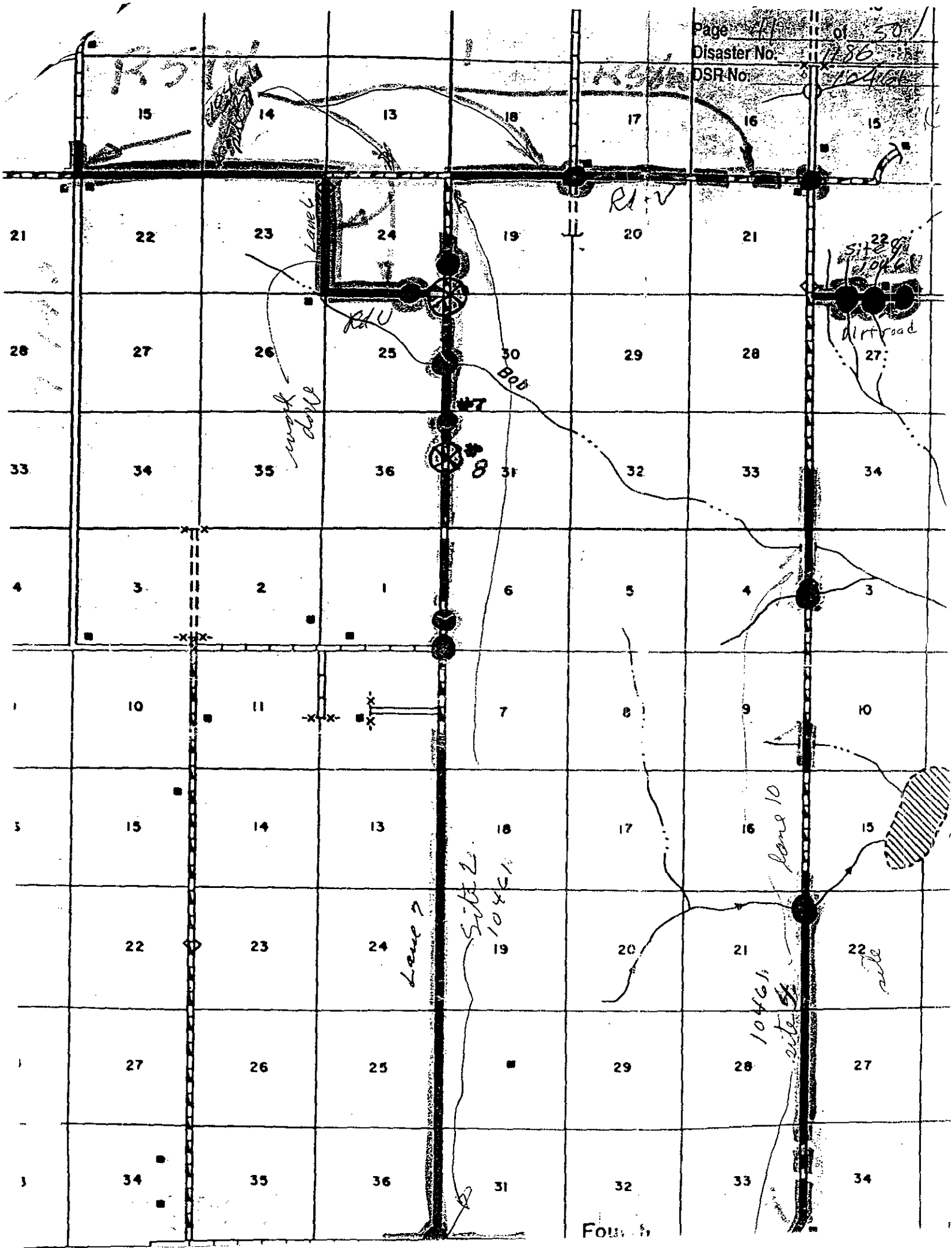
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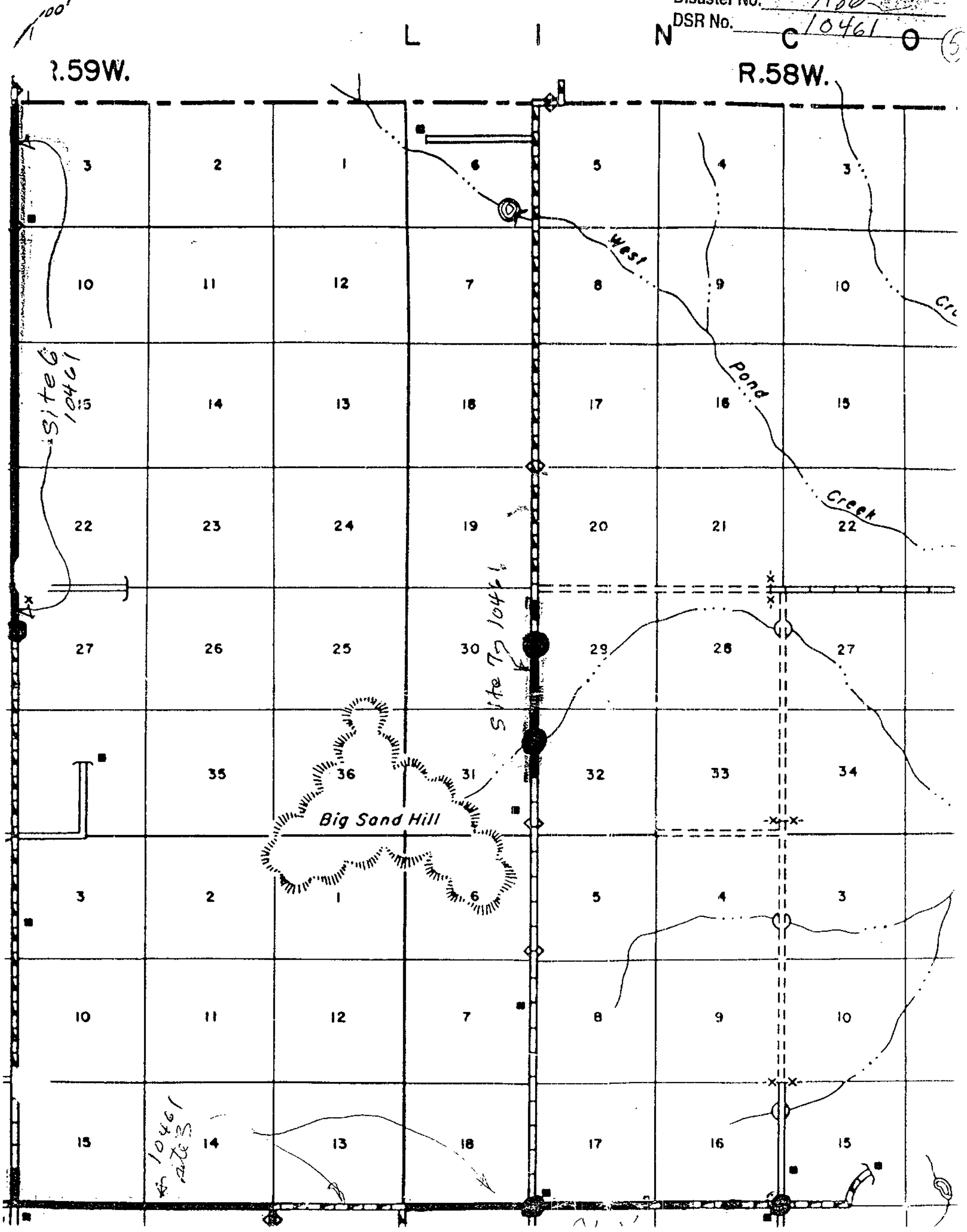
100'
L I N C O
R.59W.
R.58W.
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10
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14
13
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6
5
4
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10
11
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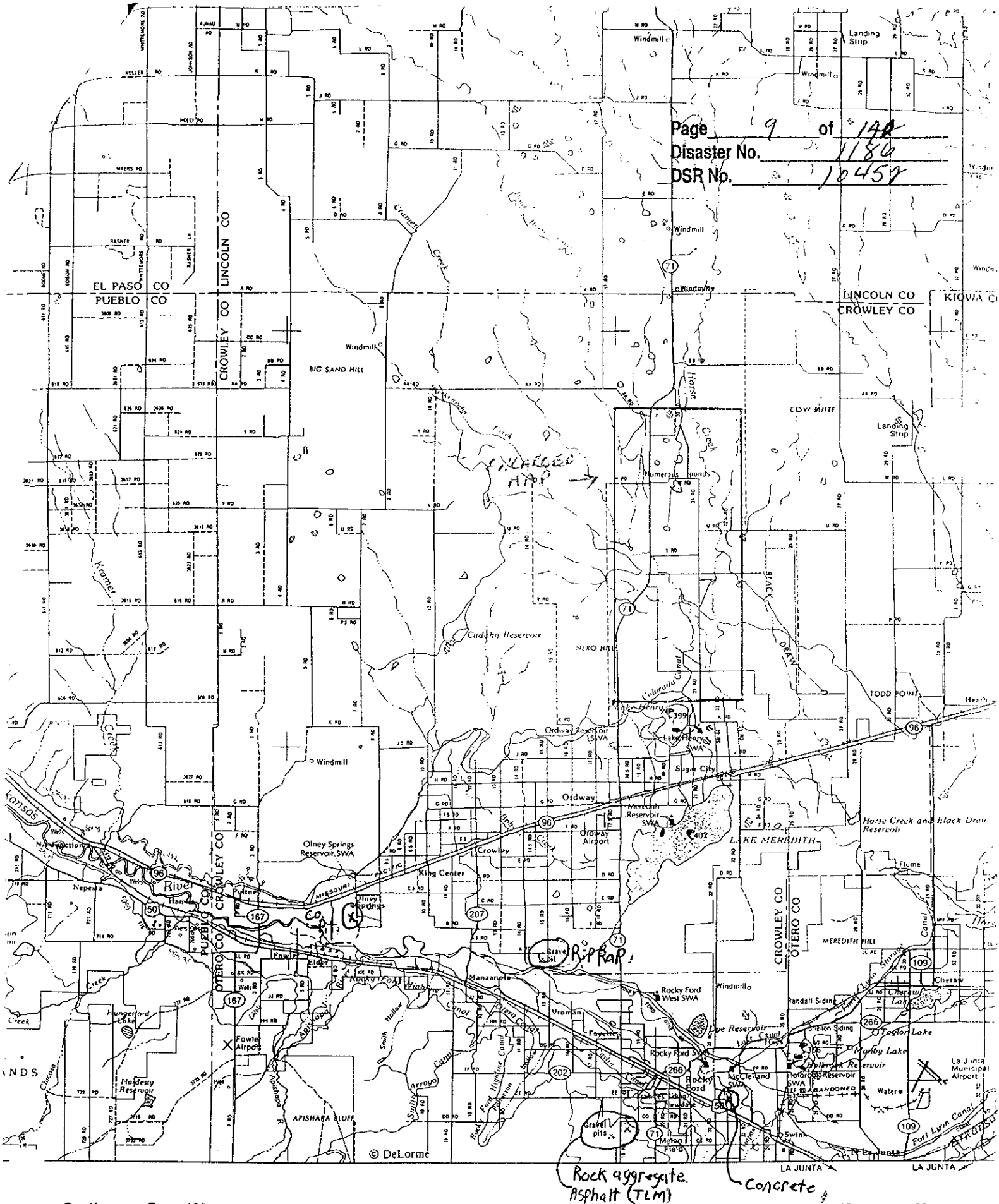
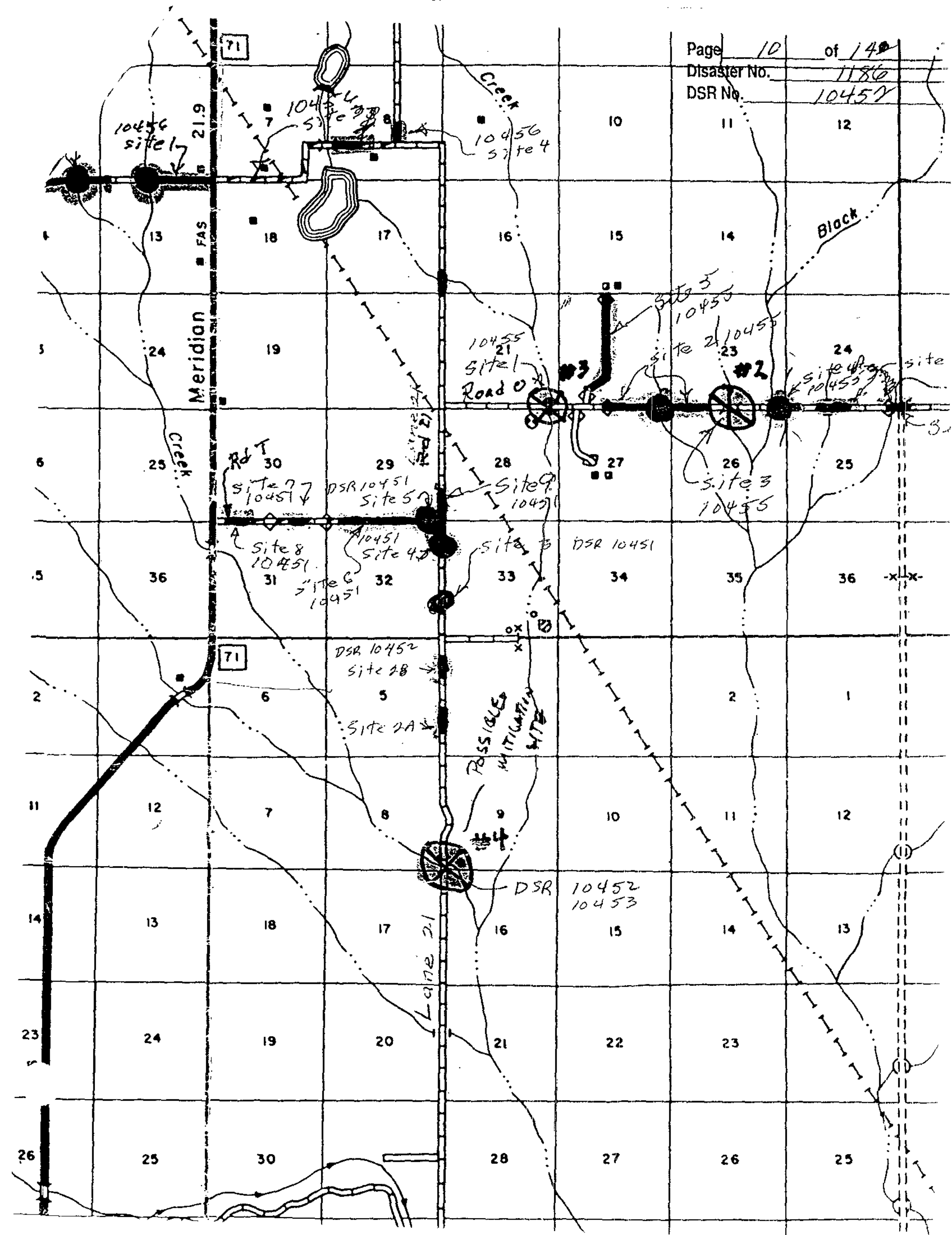
16
15
West Pond Creek
Big Sand Hill
Site 6 10461
Site 7 10461
10461 site 3


EL PASO CO
PUEBLO CO
CROWLEY CO
LINCOLN CO
OTERO CO
Windmill
Landing Strip
BIG SAND HILL
COW BUTTE
NERO HILL
TODD POINT
LAKE MERRIDITH
MEREDITH HILL
Cudahy Reservoir
Ordway Reservoir SWA
Lake Henry SWA
Meredith Reservoir SWA
Ordway Airport
Olney Springs Reservoir SWA
Rocky Ford West SWA
Rocky Ford SWA
McClelland SWA
Horse Creek and Black Draw Reservoir
Holbrook Reservoir
Manby Lake
Taylor Lake
Horsethief Reservoir
Hungerford Lake
Holdeay Reservoir
APISHAPA BLUFF
Fowler Airport
La Junta Municipal Airport
Kansas River
Arkansas River
Crooked Creek
Horse Creek
Black Draw
Timberus ponds
Rip Rap
Gravel pits
Rock aggregate. Asphalt (TLM)
Concrete
LA JUNTA
Continue on Page 100
KILOMETERS 5 0 5 10 15 20
MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12
© DeLorme



Page 10 of 140
Disaster No. 1186
DSR No. 10457
71
21.9
FAS
Meridian
Creek
Black
10456 site 1
10456 site 4
10455 21 site 1
Road O
#3
#2
#4
Site 5 10455
site 2 10455
site 4 10455
site 3 10455
Rd T
site 7 10451
DSR 10451 Site 5
Site 9 10451
site 8 10451
10451 Site 4
site 6 10451
site 3 DSR 10451
DSR 10452 site 2B
site 2A
POSSIBLE MITIGATION SITE
DSR 10452 10453
Lane 21
Road 21

1. Contacts

ELBERT CO.

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

Kiowa Zoning — Sherman Feher (303) 621-3135

BY: JBurrell
DATE: 4/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: S. Feher
AFFILIATION: Kiowa Zoning/Planning
PHONE #: (303) 621-3135

---

1. Affected streams and local drainages? Best to talk to road crews.

2. Geographic extent of flooding? Storms washed out bridges & roads in northern Elbert County

3. Storm duration? Starting time and ending time of major storm event?
   Not specifically other than July

4. Rainfall amounts? Extent of rainfall?

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

County Road crews - Simla - Joe Craven - covers Agate area, too
- Kiowa - western part of the county - Bill Casey

phn_log.doc

ELBERT

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Jim Burrell
DATE: 4/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Joe Craven - Simla
AFFILIATION: Elbert County Roads
PHONE #: (719) 541-2268

---

1. Affected streams and local drainages?
   - North of Calhan, West Bijou Creek, 8 miles north - where creek starts.
   - Fondis area
   - next night, S of Simla - Middle Rush Cr, some on N & S Rush Cr.
   - Big Sandy around River Bend 7/27-28
2. Geographic extent of flooding?
   - has some FEMA DSR's for roads & culverts
3. Storm duration? Starting time and ending time of major storm event?
   Last week in July, couple before - check June (1st week)
4. Rainfall amounts? Extent of rainfall?
   10" 7/28 N. of Calhan 5" 7/27-28
   7/29 South of Simla
5. Rainfall bucket surveys?
   Robert Alexander, north of Calhan, rain gage over flowed > 10"
   ↳ call him
6. Precipitation gauging network?
7. Documentation of high water marks?
   - has photos, come to the field, esp. bad along Middle Rush Cr
   - Rob't Norris - 541-2456 on Middle Rush Cr.

8. Estimated peak discharges? NOT YET

9. Estimated flood damages?
$300K + rec'd from FEMA

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.

12. Types and amounts of repair work after flooding?
Culverts blown out } extensive
Road embankments }
Bridge lost on W. Bijou

13. Any previous/recent flood mitigation efforts that reduced damages?
NO

14. Any future mitigation needs as a result of the flooding?

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?
Lots of culverts, embankments failed

16. Do you have any photos and/or video available? Are the photos in digital format?

Thinks one of his maintenance guys has some photos he could send

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

Will send map

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

hardcopy

19. Is there any existing documentation regarding the flooding?

20. Name of local newspaper? Do they have a web site?

Ranchland News - Simla

- Tini Taylor

21. Do you have an internet site? Do you know of any related local sites?

ELBERT

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Jini Burrell * (719) 541-2268 Joe Cosuen
DATE: 4/23/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Bill Cosey
AFFILIATION: Elbert Co. Road Dept
PHONE #: (303) 621-2366

---

1. Affected streams and local drainages?

Didn't get hit too bad in Kiowa - talk to Joe Cosuen - he got hit hard & has a lot of projects as a result (719) 541-2268

2. Geographic extent of flooding?

3. Storm duration? Starting time and ending time of major storm event?

4. Rainfall amounts? Extent of rainfall?

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

16. Do you have any photos and/or video available? Are the photos in digital format?

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

19. Is there any existing documentation regarding the flooding?

20. Name of local newspaper? Do they have a web site?

check Elbert County paper (303) 646-2711

also - Ranchland News - Simla

21. Do you have an internet site? Do you know of any related local sites?

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: J. Burrell
DATE: 6/5/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Dale Ashcraft
AFFILIATION: Rancher
PHONE #: (719) 54-2851

---

1. Affected streams and local drainages? South Rush. His place is located where a county road dead ends. The road goes on down to Kutch (Halls Station (north-south), on Hwy 96 going E-W.

2. Geographic extent of flooding?

3. Storm duration? Starting time and ending time of major storm event?

4. Rainfall amounts? Extent of rainfall? had 6+" on the 29 (July). 3.5" the night before. Got 3.5" rain + 8" hail on 6/13/97.

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: JBurrell
DATE: 6/5/98
SUBJECT: 1997 Flooding

INDIVIDUAL: John Atwater
AFFILIATION: Rancher
PHONE #: (719) 541-2858

---

1. Affected streams and local drainages? South Rush Creek, July 29, 1997, 4.5". Also got 2" on 6/13/97 and 4" further to west then.

2. Geographic extent of flooding?

(Re: 29 July 97)

3. Storm duration? Starting time and ending time of major storm event? Saw big storm coming up - got on Internet - radar at around 6:30 p.m. Rain started at ≈ 7:30 p.m. Went to bed around 10:30. still running. Got up around 11:15 & looked outside - lots of water!! creek about 120 ft wide. Basement flooded because water couldn't run off the lawn fast enough. Window wells filled up. 12:30 p.m >> creek is 100 yds wide!!

4. Rainfall amounts? Extent of rainfall?

5. Rainfall bucket surveys?
Flowing approx 4 ft above pilings on irrigation works, which is normally 2 ft above water. 1:00 a.m - creek has peaked and is dropping.

6. Precipitation gauging network?
4:30 a.m - creek "slacked off a bunch" only 4 ft deep or so. still running at a good rate a week or so later. Lots of sand transported. Spent most of the night moving

7. Documentation of high water marks?
furniture & stuff out of basement, and running around on county roads marking washouts. Ran out of markers & flags. Had lots of damage to pasture & irrigation take-out down near creek. Got 4.45" in a good Gov't gage - parents were NWS observers. Gordon Bros 1/2 mi N & W got 5.25"!

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: JKB
DATE: 6/5/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Dennis Stone
AFFILIATION: Rancher
PHONE #: (719) 446-5452

---

1. Affected streams and local drainages? South Rush Cr. was up out of its banks one night only. Ran 5-6 days before got back to normal.

2. Geographic extent of flooding? Had a lot on Middle Rush, too. Jay Jolle had to replace culverts all summer up there (4-5 mi N of Stone)

3. Storm duration? Starting time and ending time of major storm event?
Lasted 3-4 hrs., just steady rain, no big bursts. Got 4".

4. Rainfall amounts? Extent of rainfall?
4"

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: J. Burrell
DATE: 6/
SUBJECT: 1997 Flooding

INDIVIDUAL: Joe Craven
AFFILIATION: Elbert roads
PHONE #: (719) 541-2268

---

1. Affected streams and local drainages? Have most trouble on Big Sandy & South Rush/Middle Rush. Big Sandy washes out the I-70 exit at Agate this happened 3-4 times last summer

2. Geographic extent of flooding? Big Sandy Creek - washed out road at River Bend & Matheson on 30 July. Matteson is not a big culvert - flows over the road there often. West Bijou was only high for a day or so Saw it at a road crossing downstream of CR 112 - it was more or less normal.

3. Storm duration? Starting time and ending time of major storm event?

4. ~~Rainfall amounts? Extent of rainfall?~~ FLOOD CONTROLS - RAMAH RESERVOIR had flow over the spillway for a month after July event. Also, SCS flood control dams along Big Sandy helped a bunch.

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

People we were unable to reach in Elbert Co.

Harold Eldrich	347-2212
Leonard Volosin	347-2305
Greg Olayier	347-2295
Alan Moore	541-2337 (fax machine)
Hugh Scherrer	541-2801

2. Federal Data

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE / TIME
Colorado	Elbert	**DISASTER DATE:** 6-14-97 **DISASTER TIME:** ≈ 1:00 Am

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain X	Excessive Snow	Flash Flooding X	Flooding
Freeze	Frost	Hail X	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: Large Thunderstorm with heavy hail ... Area of the map that are indicated by H reflect damage ranging from 40 to 100% loss. "L" reflects areas that show light to 40% loss. Time of hail ≈ 1:00 am 6-14-97

POTENTIAL USDA ASSISTANCE:

APHIS, Animal Disease & Plant Pest Control		FCS, Disaster Food Assistance		CSRE & ES, Technical Advice	
FSA, Emergency Conservation Program		FCS, Food Stamps		NRCS, Earthmoving Equipment	
FSA, Livestock Feed Programs		FSIS, Meat & Poultry Safety		NRCS, Technical & Financial Assistance	
FSA, Emergency Loans		RUS, Technical & Loans Assistance		FS, Fire Protection	
FSA, Noninsured Assistance Program (NAP)	Y	CSRE & ES, Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: Number of Farms:

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Wheat	≈ 40,000	18000	50%	3 wks to harvest
Alfalfa / hay mix	≈ 5000	2500	50%	1st cutting ready, grass ≈ 1 wk to har[illegible]

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. NA

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount. NA

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON: NA

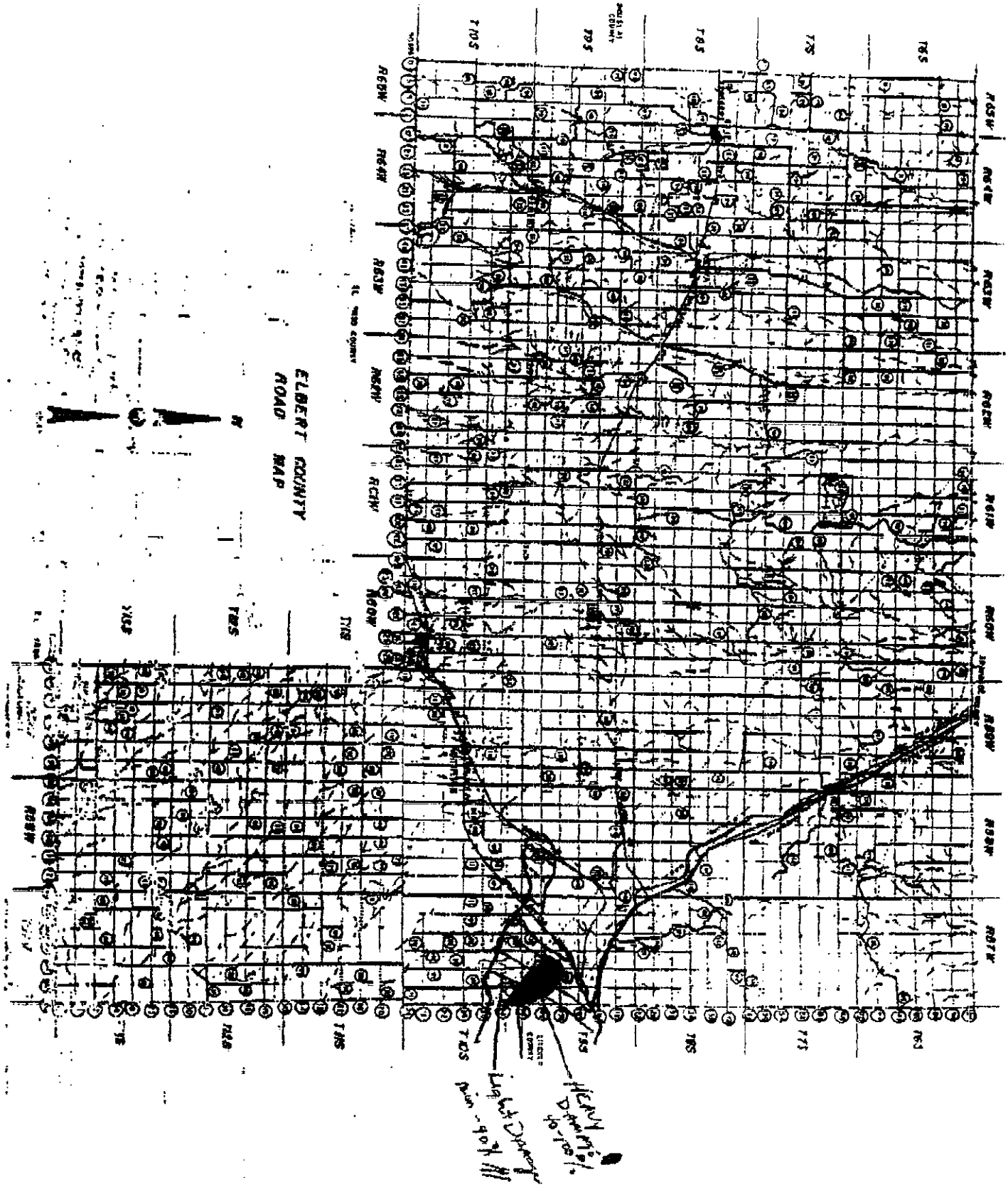
USDA Office Buildings:

Office Equipment and Records:

Employees, Employee Families & Homes:

REPORTED BY: Michael Meyer **TO:** Ed Buck **DATE:** 6-19-97

ote: This is a preliminary disaster report. DO NOT use this data as official USDA data.


ELBERT COUNTY
ROAD MAP

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 6.24.97
Colorado	Elbert	DISASTER TIME: 6:00pm

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain	Excessive Snow	Flash Flooding	Flooding
Freeze	Frost	Hail X	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: wind driven hail 4"-6" deep in some areas Lined area represents light to up to 40% losses, Blackened area represents 40-100% losses

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: ≃15000 acres Number of Farms: ≃25

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
wheat	≃ 8000	3500	40%	starting to turn

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. NA

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount. NA

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON: NA

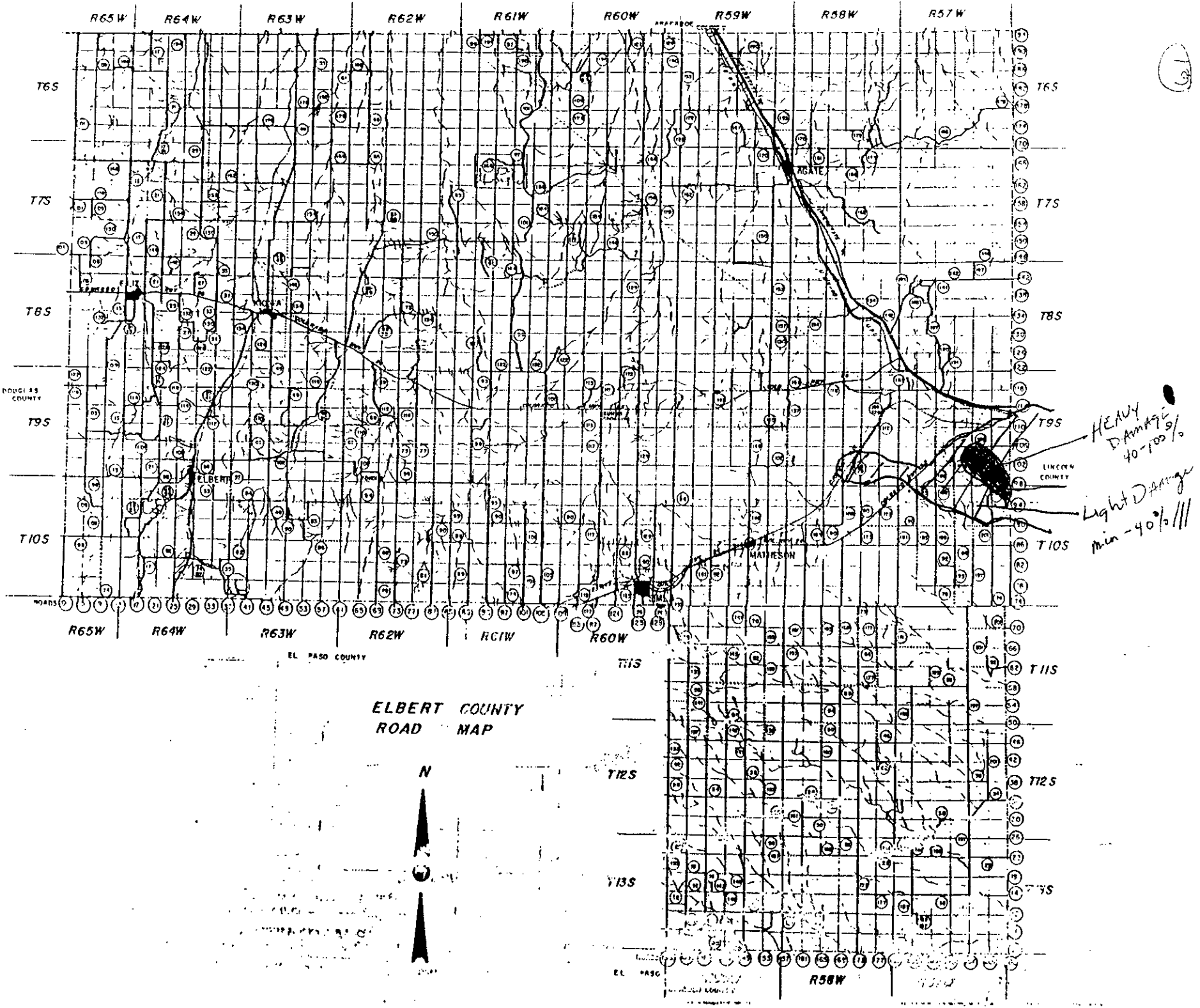
USDA Office Buildings:

Office Equipment and Records:

Employees, Employee Families & Homes:

REPORTED BY: Montgomery Meyer TO: Ed Buck DATE: 6.25.97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.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T6S
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T8S
T9S
T10S
T11S
T12S
T13S
AGATE
MATHESON
ELBERT
MOSSA
DOUGLAS COUNTY
LINCOLN COUNTY
EL PASO COUNTY
ROADS
HEAVY DAMAGE 40-100%
Light Damage min-40%
ELBERT COUNTY
ROAD MAP
N

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 6-24 & 6-25
Colorado	Elbert / Douglas	DISASTER TIME: pm.

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain	Excessive Snow	Flash Flooding	Flooding
Freeze	Frost	Hail X	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: SSW of Kiowa beginning 2 miles from city limit. Heavy area ≈ 4" of hail pea to marble shipped alfalfa leaves and flattened hay/wk to town. Douglas hail is SW Franktown ≈ 4 miles, Heavy are 4"-6" of hail pea to marble flattened wheat full broken heads ≈ 1 wk to harvest

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Nonunsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: Number of Farms:

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Forage hay	400 ac/1000 native mx	1980	≈50%	1st cut ready to clip
Wheat	1200	600	≈50%	1wk to harvest
ts	40	40	≈ 80%	2wk to harvest

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. NA

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount. NA

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON: NA

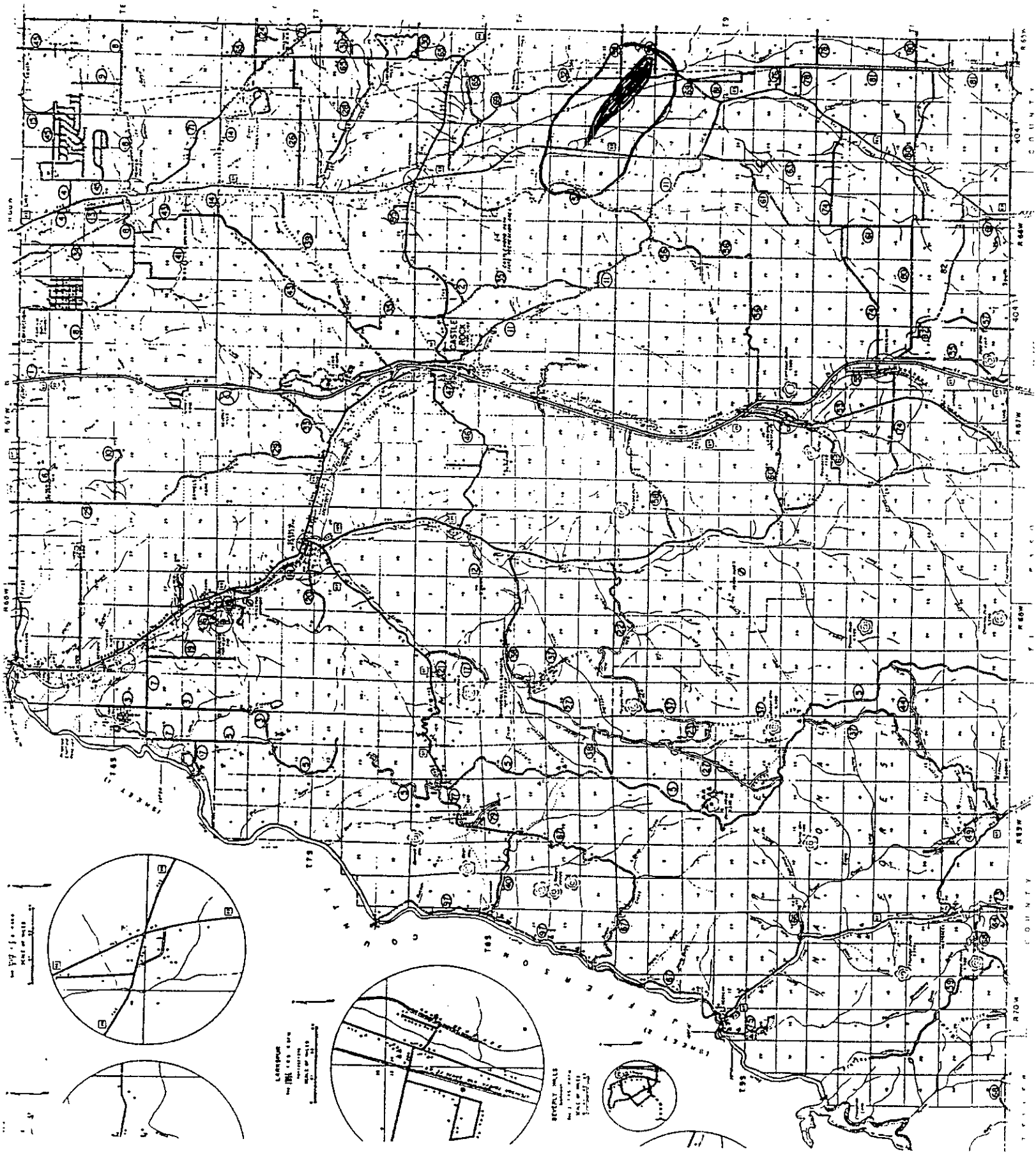
USDA Office Buildings:

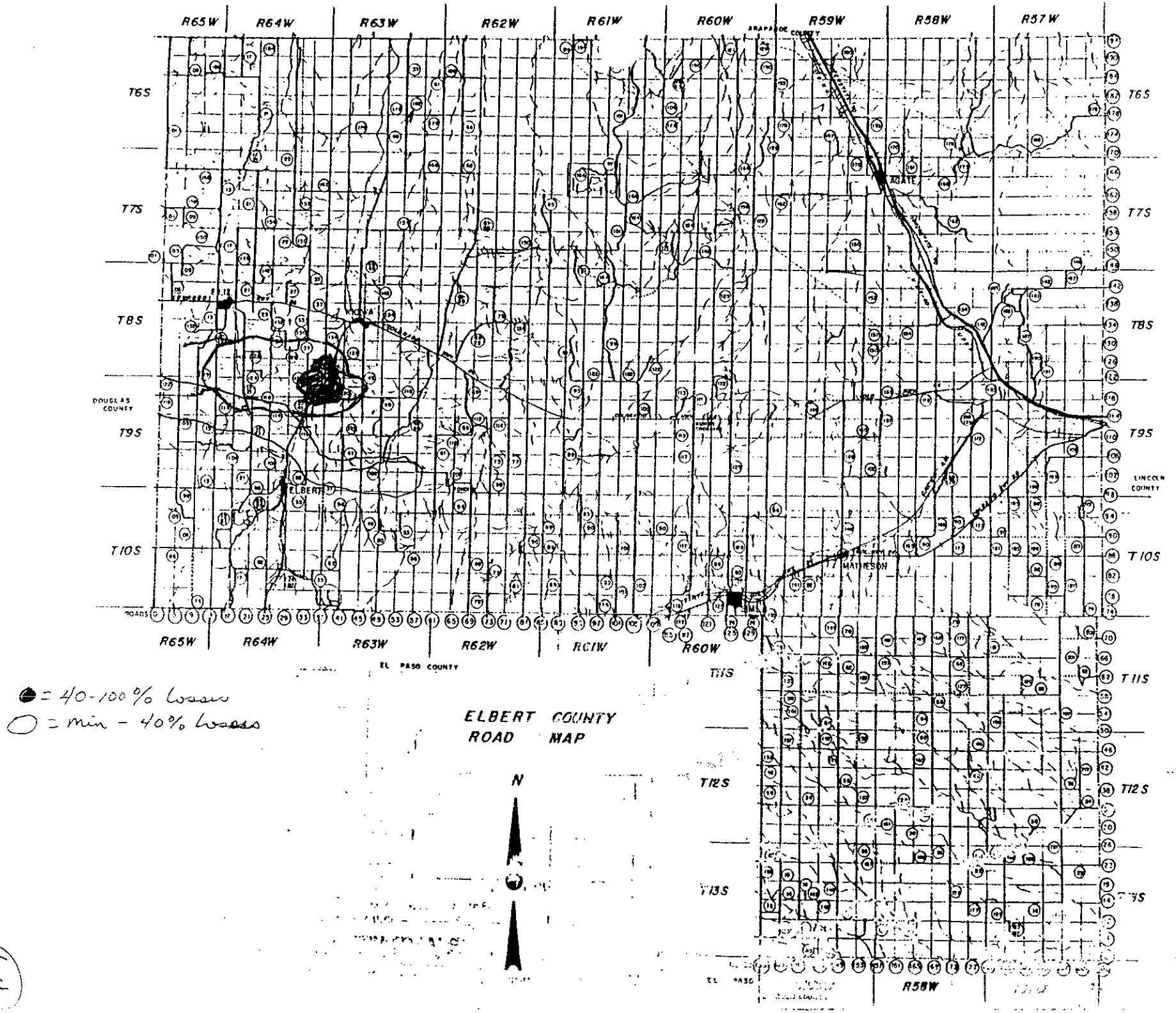
Office Equipment and Records:

Employees, Employee Families & Homes:

REPORTED BY: Michael Meyer TO: Ed Zuck DATE: 6-30-97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.


CASTLE ROCK
LARKSPUR
BEVERLY HILLS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R64W
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T10S
T11S
T12S
T13S
ARAPAHOE COUNTY
AGATE
DOUGLAS COUNTY
ELBERT
MATHESON
LINCOLN COUNTY
EL PASO COUNTY
= 40-100% Losses
= min - 40% Losses
ELBERT COUNTY
ROAD MAP
N

(4)

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 7-29/30-97
Colorado	Elbert	DISASTER TIME: pm

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain X	Excessive Snow	Flash Flooding X	Flooding X
Freeze	Frost	Hail	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: Heavy rains (up to 7 inches in some areas) Field erosion, some dam, terrace & diversion damage, cross fences & parameter fences destroyed in drainage areas

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	✓	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: Number of Farms:

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Alfalfa-Hay mx	≈ 600	≈ 1300	min	pic-second cutting
millet/Prozo	≈ 1500	≈ 1000	20%	4-6" stage predominately

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. NA

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount.

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.) 10-12 dams, ≈ 5mi diversion & terraces	Land Damages (erosion, gullying, etc.) ≈ 600
Other Agricultural Losses/or Damages:	

AFFECTS OF THE DISASTER ON: NA

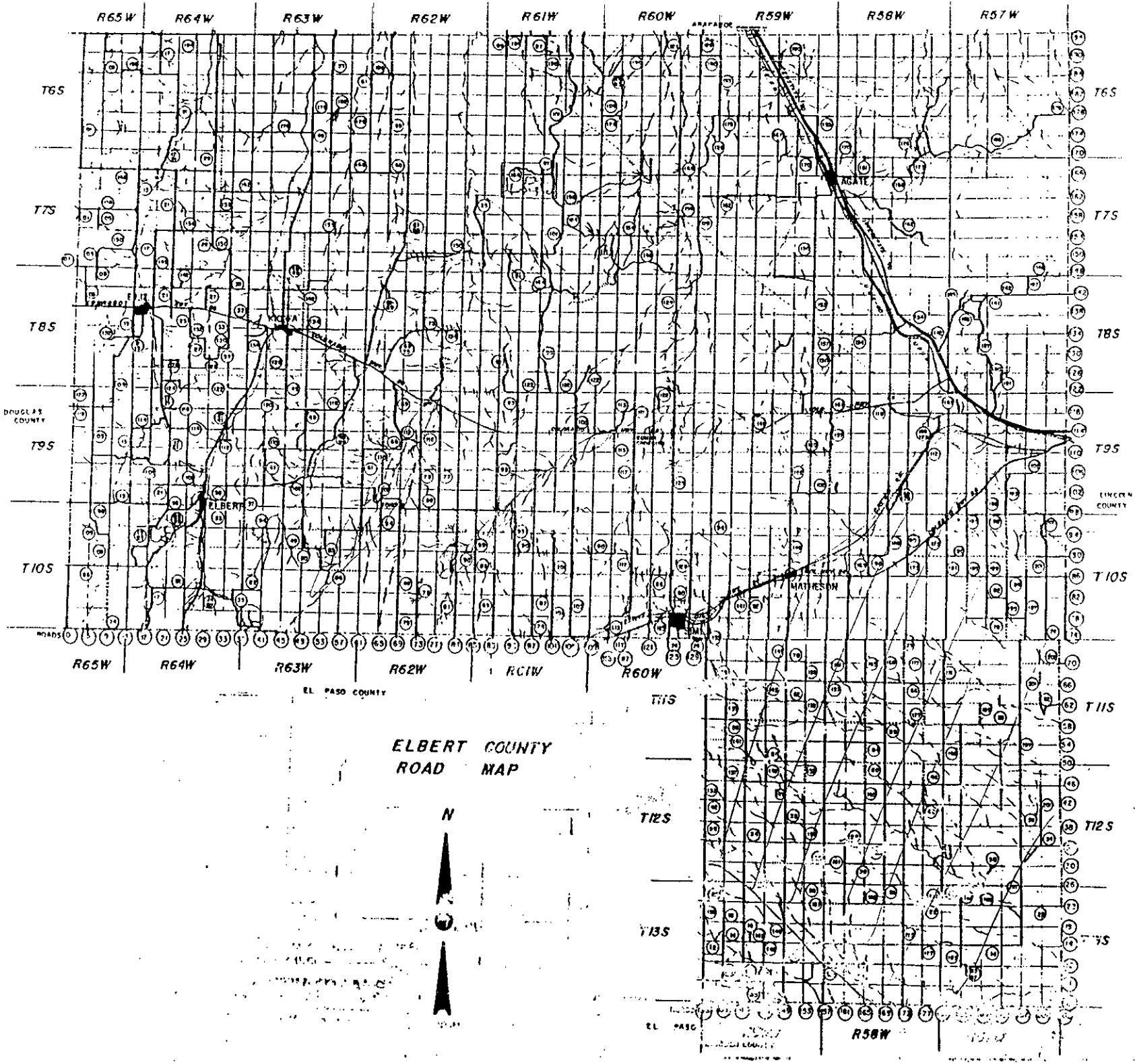
USDA Office Buildings:

Office Equipment and Records:

Employees, Employee Families & Homes:

REPORTED BY: Michael Meyer TO: Ron Koberstein DATE: 8-1-97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.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T10S
T11S
T12S
T13S
ARAPAHOE
AGATE
MATHESON
ELBERT
KIOWA
DOUGLAS COUNTY
LINCOLN COUNTY
EL PASO COUNTY
ROADS
ELBERT COUNTY
ROAD MAP
N

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 7-28-97
Colorado	Elbert	DISASTER TIME: 5 PM to 10 PM

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain X	Excessive Snow	Flash Flooding X	Flooding
Freeze	Frost	Hail	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: Small heavy rain cell located at the headwaters of East Bijou Creek. East Bijou drainage exhibited boundary fences and county road damage 1 old (32 years) dam washed out contributed to the flash flood.

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: approx 400 Number of Farms: 15

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
alf/alf mix	approx 100	approx 100	80	ready to harvest

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. NA

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount. NA

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.) 1	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON: NA

USDA Office Buildings:

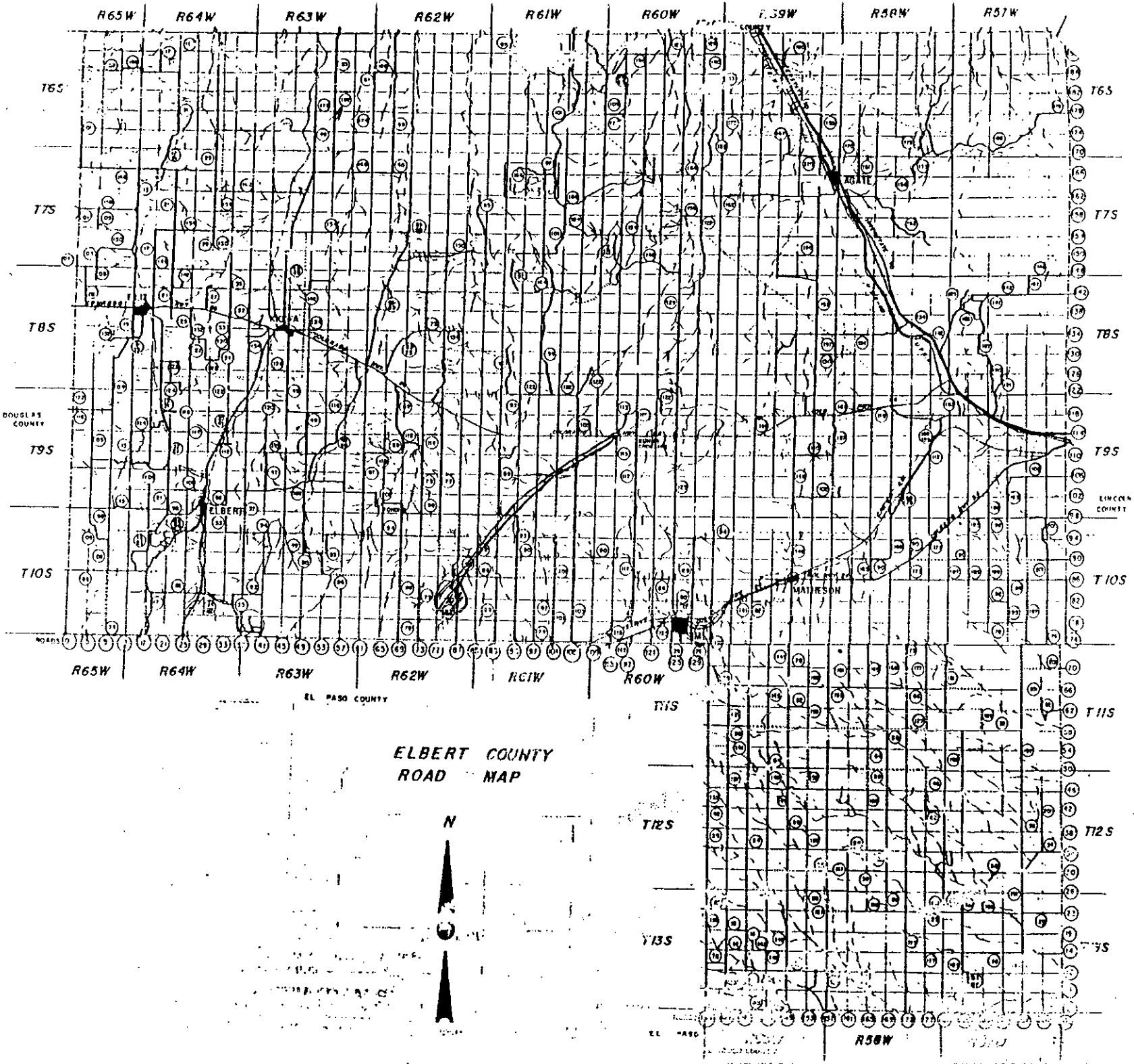
Office Equipment and Records:

Employees, Employee Families & Homes:

REPORTED BY: Michael J Myers TO: Rob Robertson DATE: 7-29-97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.

(6)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T11S
T12S
T13S
DOUGLAS COUNTY
EL PASO COUNTY
LINCOLN COUNTY
ELBERT
MATHESON
ELBERT COUNTY
ROAD MAP
N

14/0447

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COZ046-047-141200-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
440 AM MDT SAT JUN 14 1997

...SMALL STREAM FLOOD ADVISORY REMAINS IN EFFECT UNTIL 6 AM MDT FOR SOUTHEASTERN ELBERT COUNTY...

NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED THAT THE THUNDERSTORMS WITH HEAVY RAIN HAD MOVED OUT OF THE AREA. HOWEVER...RADAR ESTIMATED UP TO 2 INCHES OF RAINFALL WITH THE STORMS EARLY THIS MORNING IN THE MATHESON AND SIMLA AREAS. THIS COMBINED WITH LAST EVENINGS RAINFALL OF ANOTHER 2 TO 3 INCHES TO PRODUCE SOME FLOODING.

THE LINCOLN COUNTY SHERIFF HAD REPORTED THAT WATER HAD COVERED SOME ROADWAYS...BUT CONDITIONS WERE NOW IMPROVING AS THE RAIN HAD COME TO AN END. PERSONS LIVING NEAR SMALL STREAMS AND CREEKS SHOULD STILL CONTINUE TO MONITOR WATER LEVELS OVER THE NEXT COUPLE HOURS AS RUNOFF GATHERS IN THE STREAMS. MOVE TO HIGHER GROUND IF FLOODING IS OBSERVED.

BARJENBRUCH

DEN 3

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMMCOZ046-300030-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
503 PM MDT TUE JUL 29 1997

...FLASH FLOOD WARNING FOR WESTERN ELBERT COUNTY UNTIL 630 PM MDT...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS
KIOWA...ELBERT...AND ELIZABETH

AT 500 PM MDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED THUNDERSTORMS WITH TORRENTIAL RAIN FROM KIOWA TO JUST WEST OF ELBERT.

AT 450 PM MDT...THE KIOWA FIRE DEPARTMENT REPORTED THAT KIOWA CREEK WAS ALREADY OVERFLOWING. WATER COVERED THE ROAD TO A DEPTH OF 2 FEET 2 MILES NORTH OF KIOWA.

THE STORMS PRODUCING THE FLASH FLOODING WERE MOVING VERY SLOWLY EAST AT 5 MPH. RAINFALL AMOUNTS OF 2 TO 3 INCHES WILL FALL WITHIN AN HOUR. STORM TOTALS MAY APPROACH 5 INCHES IN AND NEAR KIOWA.

PERSONS LIVING ALONG KIOWA CREEK...GOPHER CREEK...DRY CREEK... AND RUNNING CREEK SHOULD MOVE TO HIGHER GROUND IMMEDIATELY!
DO NOT ATTEMPT TO CROSS SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY AUTOMOBILE. IF YOUR VEHICLE STALLS...ABANDON IT IMMEDIATELY AND SEEK HIGHER GROUND.

BARJENBRUCH

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COZ046-300200-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
658 PM MDT TUE JUL 29 1997

...FLASH FLOOD WARNING CONTINUES FOR EASTERN ELBERT COUNTY UNTIL 800 PM MDT...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS
AGATE...MATHESON...CEDAR POINT...AND SIMLA

AT 655 PM MDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED THUNDERSTORMS WITH TORRENTIAL RAIN FROM 5 MILES NORTH OF MATHESON TO 6 MILES SOUTHWEST OF MATHESON. THESE STORMS WERE PRODUCING BETWEEN 2 AND 3 INCHES OF RAIN IN AN HOUR OR LESS. THEY WERE MOVING SLOWLY SOUTHEAST AT 10 MPH.

PEOPLE ALONG SMALL CREEKS AND STREAMS...INCLUDING BIJOU CREEK AND BIG SANDY CREEK...SHOULD MOVE TO HIGHER GROUND IMMEDIATELY!

RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS TO PROTECT LIFE AND PROPERTY. DO NOT ATTEMPT TO CROSS SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY AUTOMOBILE. IF YOUR VEHICLE STALLS, ABANDON IT IMMEDIATELY AND SEEK HIGHER GROUND.

BARJENBRUCH

658 Den #5

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMMC0Z046-300200-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
745 PM MDT TUE JUL 29 1997

...FLASH FLOOD WARNING CONTINUES FOR EASTERN ELBERT COUNTY UNTIL
800 PM MDT...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS
AGATE...MATHESON...CEDAR POINT...AND SIMLA

AT 738 PM MDT...WEATHER SERVICE DOPPLER RADAR INDICATED THAT THE
THUNDERSTORMS WITH TORRENTIAL RAIN WERE MOVING SOUTH OF THE SIMLA
AREA AND SLOWLY WEAKENING. THESE STORMS HAD PRODUCED AT LEAST 3
INCHES OF RAIN BETWEEN AGATE AND SIMLA IN AN HOUR OR LESS.

PEOPLE ALONG SMALL CREEKS AND STREAMS...INCLUDING BIJOU CREEK AND
BIG SANDY CREEK...SHOULD MOVE TO HIGHER GROUND IMMEDIATELY!

HIGHWAY 86 WAS CLOSED FROM KIOWA EAST TO MILE MARKER 42 IN ELBERT
COUNTY DUE TO WATER COVERING THE ROAD.

RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE
PRECAUTIONS TO PROTECT LIFE AND PROPERTY. DO NOT ATTEMPT TO CROSS
SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY
AUTOMOBILE. IF YOUR VEHICLE STALLS, ABANDON IT IMMEDIATELY AND SEEK
HIGHER GROUND.

BARJENBRUCH

751
Den
#5

ZCZC DENFFWDEN DEF
TTAA00 KDEN DDHHMM
COC039-073-300600-

BULLETIN - EAS ACTIVATION REQUESTED
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE DENVER CO
955 PM MDT TUE JUL 29 1997

THE NATIONAL WEATHER SERVICE IN DENVER HAS EXTENDED THE FLASH FLOOD WARNING UNTIL MIDNIGHT FOR EASTERN ELBERT AND CENTRAL LINCOLN COUNTIES.

THE WARNING INCLUDES THE FOLLOWING LOCATIONS...
HUGO...KUTCH...LIMON...MATHESON...SIMLA...AND PUNKIN CENTER

AT 950 PM MDT...WEATHER SERVICE DOPPLER RADAR INDICATED THUNDERSTORMS WITH VERY HEAVY RAIN CONTINUING OVER EXTREME SOUTHEAST ELBERT AND CENTRAL LINCOLN COUNTIES. THE STRONGEST STORMS WERE LOCATED FROM 8 MILES SOUTH OF LIMON THROUGH THE KUTCH AREA. THESE STORMS WERE PRODUCING BETWEEN 2 AND 2.5 INCHES OF RAIN IN AN HOUR.

THE LINCOLN COUNTY SHERIFF REPORTED THAT INTERSTATE 70 WAS CLOSED JUST WEST OF LIMON. WATER AND MUD WAS FLOWING ACROSS THE ROAD AND STREAMS WERE OVERFLOWING THEIR BANKS.

THE STORMS WERE SHOWING LITTLE MOVEMENT...BUT A SLOW DECREASE IN INTENSITY. THIS TREND IS EXPECTED TO CONTINUE THROUGH MIDNIGHT. HOWEVER...STORM TOTAL RAINFALL OF 5 INCHES OR MORE CAN BE EXPECTED IN AREAS BETWEEN KUTCH AND HUGO.

PERSONS LIVING NEAR SMALL CREEKS AND STREAMS...INCLUDING BIG SANDY...LONG BRANCH...AND RUSH CREEKS...IN SOUTHEASTERN ELBERT AND CENTRAL LINCOLN COUNTIES SHOULD MOVE TO HIGHER GROUND IMMEDIATELY!

A FLASH FLOOD WARNING MEANS THAT FLOODING IS IMMINENT OR OCCURRING. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS TO PROTECT LIFE AND PROPERTY. DO NOT ATTEMPT TO CROSS SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY AUTOMOBILE.

BARJENBRUCH

959 1,13#5

ZCZC-WAR-FFW-008039+0200-211053-KDEN/NWS-

ZCZC DENFFWDEN DEF
TTAA00 KDEN DDHHMM
COC039-073-300730-

BULLETIN - EAS ACTIVATION REQUESTED
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE DENVER CO
1126 PM MDT TUE JUL 29 1997

THE NATIONAL WEATHER SERVICE IN DENVER HAS ISSUED A FLASH FLOOD WARNING EFFECTIVE UNTIL 130 AM MDT FOR PEOPLE IN THE FOLLOWING COUNTIES

IN EAST CENTRAL COLORADO
SOUTHEASTERN ELBERT AND CENTRAL LINCOLN

INCLUDING THE FOLLOWING LOCATIONS
HUGO...KUTCH AND PUNKIN CENTER

AT 1126 PM MDT WEATHER SERVICE DOPPLER RADAR INDICATED VERY HEAVY RAIN OVER SOUTHEAST ELBERT AND CENTRAL LINCOLN COUNTIES. RADAR ESTIMATES SHOW THAT RAINFALL OF 1 TO 2 INCHES PER HOUR HAS BEEN OCCURRING IN THIS AREA WITH AS MUCH AS 5 INCHES IN SOME LOCATIONS.

THE THUNDERSTORMS PRODUCING THIS RAIN HAVE BEEN NEARLY STATIONARY AND ARE SHOWING FEW SIGNS OF WEAKENING. THEY COULD DUMP ANOTHER 2 TO 4 INCHES OF RAIN BY 130 AM MDT PARTICULARLY IN THE AREAS NEAR KUTCH...HUGO AND PUNKIN CENTER.

EXCESSIVE RUNOFF FROM THIS STORM WILL CAUSE FLASH FLOODING OF SMALL CREEKS AND STREAMS...COUNTRY ROADS...NORMALLY DRY WASHES AND ARROYOS...AS WELL AS FARMLAND ALONG THE BANKS OF CREEKS AND STREAMS. PERSONS LIVING NEAR SMALL CREEKS AND STREAMS...INCLUDING BIG SANDY...LONG BRANCH...AND RUSH CREEKS...IN SOUTHEASTERN ELBERT AND CENTRAL LINCOLN COUNTIES SHOULD MOVE TO HIGHER GROUND IMMEDIATELY!

BE ESPECIALLY CAUTIOUS AT NIGHT WHEN IT IS HARDER TO RECOGNIZE THE DANGERS OF FLOODS AND FLASH FLOODS. IF FLASH FLOODING IS OBSERVED ACT QUICKLY. MOVE UP TO HIGHER GROUND TO ESCAPE FLOOD WATERS. DO NOT STAY IN AREAS SUBJECT TO FLOODING WHEN WATER BEGINS RISING.

DO NOT DRIVE YOUR VEHICLE INTO AREAS WHERE THE WATER COVERS THE ROADWAY. THE WATER DEPTH MAY BE TOO GREAT TO ALLOW YOUR CAR TO CROSS SAFELY. VEHICLES CAUGHT IN RISING WATER SHOULD BE ABANDONED QUICKLY. MOVE TO HIGHER GROUND.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS IMMINENT OR OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS TO PROTECT LIFE AND PROPERTY. DO NOT ATTEMPT TO CROSS SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY AUTOMOBILE. IF YOUR VEHICLE STALLS, ABANDON IT IMMEDIATELY AND SEEK HIGHER GROUND.

TO REPORT SEVERE WEATHER HAVE THE NEAREST LAW ENFORCEMENT AGENCY RELAY YOUR REPORT TO THE NATIONAL WEATHER SERVICE FORECAST OFFICE IN DENVER.

LAT...LON 3925 10344 3872 10327 3876 10362 3860 10405
3915 10405

#5

2220-WRK-FFW-008039+0200-2110358-KDEN/NWS-

ON 30/0137

RWUS32 KDEN 300734
FFSDEN
COC039-073-300830-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
130 AM MDT WED JUL 30 1997

...FLASH FLOOD WARNING IN SOUTHEAST ELBERT AND CENTRAL LINCOLN
COUNTY EXPIRES...

A 120 AM...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED THAT THUNDERSTORMS ON THE EASTERN PALMER DIVIDE WERE MOVING FROM SOUTHERN LINCOLN COUNTY INTO KIOWA AND CHEYENNE COUNTIES. SCATTERED RAINSHOWERS WERE CONTINUING OVER SOUTHEAST ELBERT AND CENTRAL LINCOLN COUNTIES...BUT RAINFALL INTENSITIES IN THE FLASH FLOOD WARNING AREA HAD DIMINISHED.

RADAR ESTIMATED THAT TWO AND A HALF TO FOUR INCHES OF RAIN HAD FALLEN OVER SOUTHEAST ELBERT AND CENTRAL LINCOLN COUNTIES. EXCESSIVE RUNOFF FROM THESE RAINS WILL CONTINUE TO KEEP CREEKS AND STREAMS RUNNING QUITE HIGH THROUGH SUNRISE. RESIDENTS AND MOTORISTS IN SOUTHERN LINCOLN COUNTY SHOULD REMAIN ON THE LOOKOUT FOR DANGER FROM HIGH WATER...AND MOVE TO SAFETY IF WATER LEVELS RISE.

DO NOT DRIVE VEHICLES INTO AREAS WHERE WATER COVERS THE ROADWAY. THE WATER DEPTH MAY BE TOO GREAT TO ALLOW YOUR CAR TO CROSS SAFELY. VEHICLES CAUGHT IN RISING WATER SHOULD BE ABANDONED QUICKLY. MOVE TO HIGHER GROUND.

DANKERS

30/0533

WWUS35 KDEN 301113
SPSDEN
COZ035>50-310000-

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
512 AM MDT WED JUL 30 1997

...LOCAL FLOODING PROBLEMS IN EXTREME NORTHEAST COLORADO...
...MORE HEAVY RAINS EXPECTED THIS AFTERNOON...

SLOW MOVING THUNDERSTORMS CONTINUE PRODUCING HEAVY RAIN IN LOGAN... SEDGWICK AND PHILLIPS COUNTIES THIS MORNING. MOST OTHER SHOWER ACTIVITY OVER NORTHEAST COLORADO HAS BEEN COMING TO AN END. THE STATE PATROL IN STERLING REPORTED THAT SEVERAL ROADS IN LOGAN AND MORGAN COUNTIES ARE CLOSED THIS MORNING...INCLUDING HIGHWAYS 14 AND 61 IN LOGAN COUNTY AND HIGHWAYS 71 AND 144 IN NORTHERN MORGAN COUNTY.

RADAR HAS ESTIMATED THAT MUCH OF WESTERN AND SOUTHERN LOGAN COUNTY HAS RECEIVED FROM TWO TO FIVE INCHES OF RAIN OVERNIGHT. SINCE 430 AM...RAIN HAD MOSTLY ENDED OVER THESE AREAS AND THE HEAVY RAINFALL HAD MOVED INTO NORTHEAST LOGAN COUNTY. ROADWAYS...FIELDS...CREEKS AND IRRIGATION DITCHES WILL CONTINE TO EXPERIENCE THE EXCESSIVE RUNOFF FROM THE HEAVY RAINS FOR THE NEXT SEVERAL HOURS.

NORTHERN MORGAN COUNTY HAS ALSO HAD PROBLEMS WITH FLOODING SINCE AN EARTHEN DAM ON THE RIVERSIDE IRRIGATION DITCH COLLAPSED DURING LAST EVENING'S HEAVY RAINS. EVACUATIONS HAVE BEEN TAKING PLACE IN WELDONA THIS MORNING.

ALTHOUGH SHOWER ACTIVITY IS ON THE WANE THIS MORNING...A VERY MOIST AIRMASS REMAINS IN PLACE OVER ALL OF COLORADO. MONSOON MOISTURE CONTINUES TO MOVE OVER THE STATE FROM THE SOUTH WHILE UPPER LEVEL WINDS REMAIN LIGHT. ANOTHER ROUND OF SLOW MOVING RAIN SHOWERS AND THUNDERSTORMS IS EXPECTED TO DEVELOP ACROSS NORTHEASTERN COLORADO THIS AFTERNOON AND EVENING. MORE FLASH FLOODING PROBLEMS WILL BE POSSIBLE SINCE SOILS ACROSS THE NORTHEAST HAVE BECOME SATURATED BY RAIN STORMS OVER THE PAST SEVERAL DAYS. EXCESSIVE RUNOFF FROM RAIN SHOWERS WILL BEGIN VERY QUICKLY AFTER RAIN SHOWERS DEVELOP.

PEOPLE ACROSS NORTHEAST COLORADO SHOULD KEEP AN EYE ON THE WEATHER TODAY AND BE PREPARED TO DEAL WITH FLOODING PROBLEMS IF THUNDERSTORMS DEVELOP IN THEIR AREA. STAY TUNED TO NOAA WEATHER RADIO AND OTHER BROADCAST AND CABLE MEDIA OUTLETS FOR POSSIBLE FLASH FLOOD WATCHES OR WARNINGS WHICH MAY BE ISSUED.

DANKERS

Bolk 5
@ 10:49 AM

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COC001-005-013-031-035-039-047-059-069-073-075-087-095-115-121-
123-310600-

FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
1040 AM MDT WED JUL 30 1997

A FLASH FLOOD WATCH IS IN EFFECT FOR MOST OF NORTHEASTERN COLORADO UNTIL MIDNIGHT TONIGHT.

24 HOUR RAINFALL AMOUNTS IN NORTHEASTERN COLORADO TUESDAY MORNING INCLUDED 5.03 INCHES NEAR LEROY...3.51 INCHES AT PADRONI...3.48 INCHES 15 MILES WNW OF STERLING...3.39 INCHES 8 MILES SE OF MATHESON...AND 4.60 INCHES AT FLEMING. SOME PEOPLE HAVE BEEN EVACUATED FROM THEIR HOMES AND SEVERAL ROADS AND RAILROAD TRACKS ARE UNDER WATER IN THE NORTHEASTERN CORNER OF THE STATE.

ALL OF THIS IS IN ADDITION TO HEAVY RAIN EVENTS EARLIER... PARTICULARLY IN THE FORT COLLINS AREA. THE POINT IS THAT THE ENTIRE AREA IS MORE OR LESS SATURATED AND IT WILL NOT REQUIRE MUCH IN THE WAY OF ADDITIONAL RAINFALL TO PRODUCE SIGNIFICANT FLOODOING.

MOISTURE FROM THE GULF OF MEXICO CONTINUES TO STREAM OVER THE AREA AND LOCALLY HEAVY RAINS WILL OCCUR TODAY AND TONIGHT. THE EXACT LOCATION OF THESE HEAVY RAINS CANNOT BE PINPOINTED THIS EARLY...BUT THEY WILL OCCUR.

THIS IS A POTENTIALLY DANGEROUS SITUATION AND YOU SHOULD BEGIN TO MAKE PLANS NOW TO DEAL WITH POSSIBLE HEAVY RAIN AND FLOODING THIS AFTERNOON AND EVENING.

FURTHER STATEMENTS OR WARNINGS WILL BE ISSUED AS REQUIRED.

TUNNELL

DLN 5
@ 1409 PM

ZCZC DENSPSDEN DEF
TTAA00 KDEN DDHHMM
COZ041-312045-

SPECIAL WEATHER STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
200 PM MDT THU JUL 31 1997

...THUNDERSTORMS WITH HEAVY RAIN IN WESTERN ELBERT COUNTY...

AT 155 PM MDT NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED THUNDERSTORMS WITH HEAVY RAIN OVER WESTERN ELBERT COUNTY. SMALL HAIL IS ALSO POSSIBLE WITH THE STORMS.

THE STORMS WERE MOVING NORTHEAST AT 20 MILES PER HOUR.

DOPPLER RADAR ESTIMATED UP TO AN INCH AN HOUR HAD FALLEN SOUTHWEST OF KIOWA.

PERSONS IN OR NEAR ELIZABETH AND KIOWA SHOULD BE ON THE LOOKOUT FOR THREATENING WEATHER AND MOVE TO A PLACE OF SAFETY IF BAD WEATHER APPROACHES.

SOME ROADS MAY BE COVERED WITH WATER. DO NOT ATTEMPT TO DRIVE THROUGH WATER OF UNKNOWN DEPTH.

A FLASH FLOOD WATCH IS IN EFFECT FOR MUCH OF NORTHEAST COLORADO UNTIL MIDNIGHT TONIGHT.

LESZCYNSKI

3. Local Data

Elbert County Rainfall Amounts for the Week of July 27, 1997

Name	S	T	R	Date	Rainfall	Phone
John Atwater	3	12S	57W	7/29/97	4.45"	719-541-2858
Joe Frasier	6	9S	57W	7/27/97 7/28/97	3.5" 1.66"	719-775-2790
Dick Young	5	9S	59W	7/27/97	0"	719-541-2310
Joe Dickens	1	9S	57W	7/28/97	~8"	719-775-2437
Rob Alexander	27	10S	62W	7/28/97 7/29/97	9.73" 7.7"	719-347-2979
Jack Swennes	26	11S	58W	7/29/97	~1.5"	719-541-2810

date: 6/22/98

to: Jim Burrell

970-484-7593

from:

B. Kitten

NATURAL RESOURCES CONSERVATION SERVICE
P.O. Box 188 Simla, CO 80835

SUBJECT: 'Ramah Dam Storage

RE: Your request to Double E1 SCD.

Late July '97 - Flowing approx. 34" above principal spillway. If more info needed contact Cheryl @ 719 541 2358 Double E1 SCD

OF PAGES 5

FAX REPLY: 719-541-3061

PERTINENT DATA

A. GENERAL

Name	Ramah
State	Colorado
Inventory of dams I.D. Number	CO 1347
Hazard Potential Classification	High
Owner	Double L Soils Conservation District

B. EMBANKMENT

Type	Zoned earthfill
Crest Length	6000 Feet
Crest Width	17 Feet
Crest Elevation	104.5 feet (Local Datum)
Height	60 Feet (Structural) 49 Feet (Hydraulic)

C. SPILLWAY (EMERGENCY)

Type	Uncontrolled Grasslined Earth
Location	Beyond Left Abutment
Sideslopes	2(H):1(V)
Crest Elevation	99.5 Feet (Local Datum)
Bottom Width	850 Feet
Length	2200 Feet (270' Level Section)
Discharge Capacity @ Dam Crest	19130 cfs

D. OUTLET WORKS & PRINCIPLE SPILLWAY

1. Principle Spillway

Type	11'-9" x 4'-6" Concrete Vertical Drop Inlet with Baffle & Trashrack
Location	900 Feet from Left Abutment
Invert Elevation	84.7 Feet (Local Datum)
Size	6'x6' Concrete Box Culvert
Length	281 Feet
Outlet Invert Elevation	56.3 Feet (Local Datum)
Outlet Type	Stilling Basin
Discharge Capacity at Dam Crest	1050 cfs

2. Drawdown

Inlet Type	Concrete Drop Inlet With Slide Gate & Trashrack
Inlet Invert Elevation	62.21 Feet (Local Datum)
Pipe Type	Reinforced Concrete Pipe
Pipe Length	70' to Spillway Drop Structure
Pipe Dimensions	30" diameter

MAIN

E. RESERVOIR

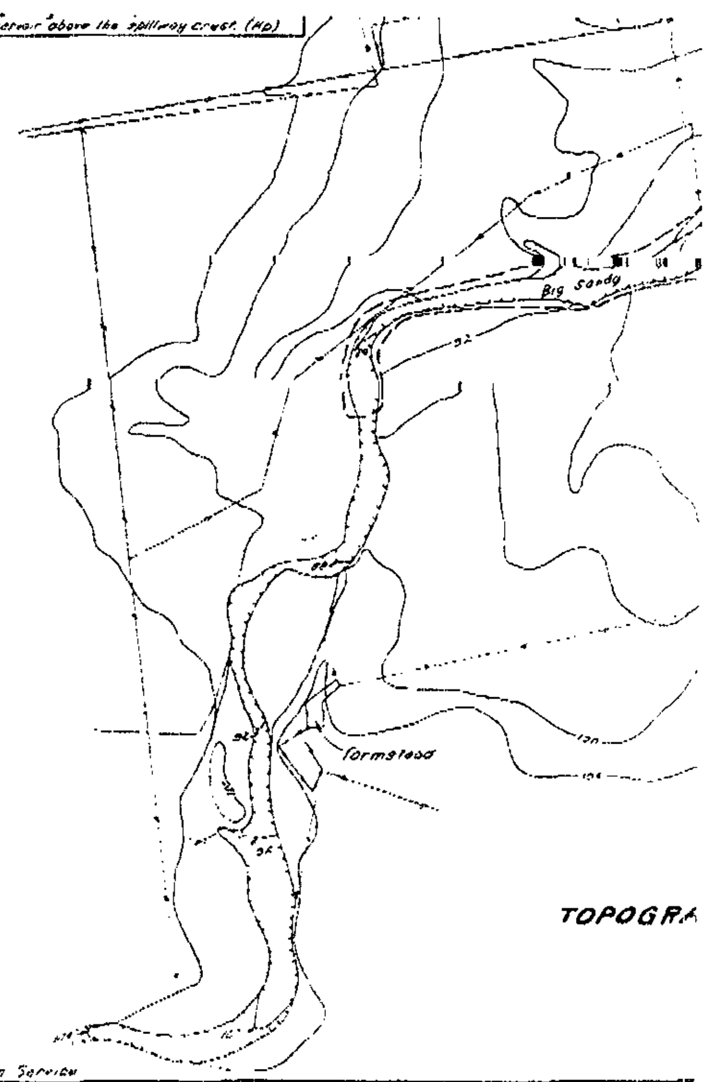
TYPE OF STORAGE	STORAGE VOLUME (ACRE-FEET)	ELEVATION	SURFACE AREA (ACRES)
Recreation Pool	500	77.5 (Local Datum)	78.5
Principle Spillway Crest	1400	84.7 (Local Datum)	167.0
Emergency Spillway Crest	5388	99.5 (Local Datum)	403.3
Dam Crest	7641	104.5 (Local Datum)	495.6

F. DRAINAGE AREA 50.4 Sq. Mi.

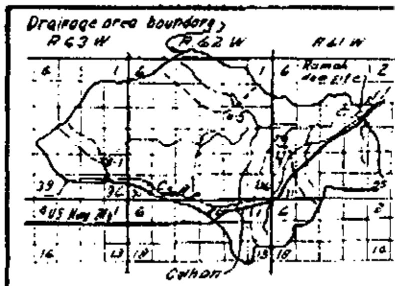
MAIN

Crest prin splwy	84.7	120.42	27.7	1460.12
	88	199.54	31.0	2068.91
	92	250.69	35.0	2967.38
	96	323.43	39.0	4116.01
Crest emer splwy	99.5	403.30	42.6	5388.12
	100	414.69	43.0	5592.62
	104	486.68	47.0	7395.36
Top of dam at ℄	104.5	495.68	47.6	7640.95

reservoir above the spillway crest. (Hp)



Approved [signature] , [illegible] 5-4-62
Head, E & W-P Unit, S.C.S.
Approved [signature] 5-[illegible]-62
State Conservation Engineer, S.C.S.
U.S. Department of Agriculture, Soil Conservation Service



LOCATION MAP

Approx. scale: 1" = 4 mi.

Drainage area ________ 69.0 sq mi

Maximum expected run-off 1.25 × 3.21 storm ________ 27,300 c.f.s.

Approximate elevation ________ 6,150 ft.

Surface area of reservoir at crest of spillway ________ 403.3 acres

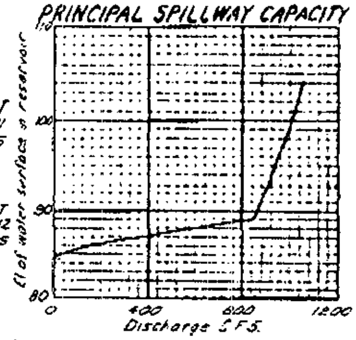
Capacity of reservoir at crest of spillway ________ 5388.12 ac. ft.

"Q" considering spillway storage routing 1.25 × 3.21 storm ________ 19,500 c.f.s.

STORAGE CAPACITY TABLE

	Water surface El.	Surface area in acres	Depth in feet	Capacity in acre-feet
	57	0	0	0
	60	1.76	3.0	2.62
	62	3.32	5.0	7.70
Drawdown	62.2	3.48	5.2	8.38
	64	4.88	7.0	15.90
	68	10.66	11.0	46.96
	72	35.27	15.0	153.75
	76	76.03	19.0	378.88
	80	121.07	23.0	774.94
	84	164.46	27.0	1342.91
Crest prin. splwy	84.7	170.42	27.7	1460.12
	88	198.54	31.0	2068.91
	92	250.69	35.0	2947.38
	96	329.69	39.0	4116.01
Crest emer. splwy	99.5	403.30	42.5	5388.12
	100	414.69	43.0	5592.62
	104	486.68	47.0	7395.36
Top of dam at ℄	104.5	495.66	47.5	7640.95

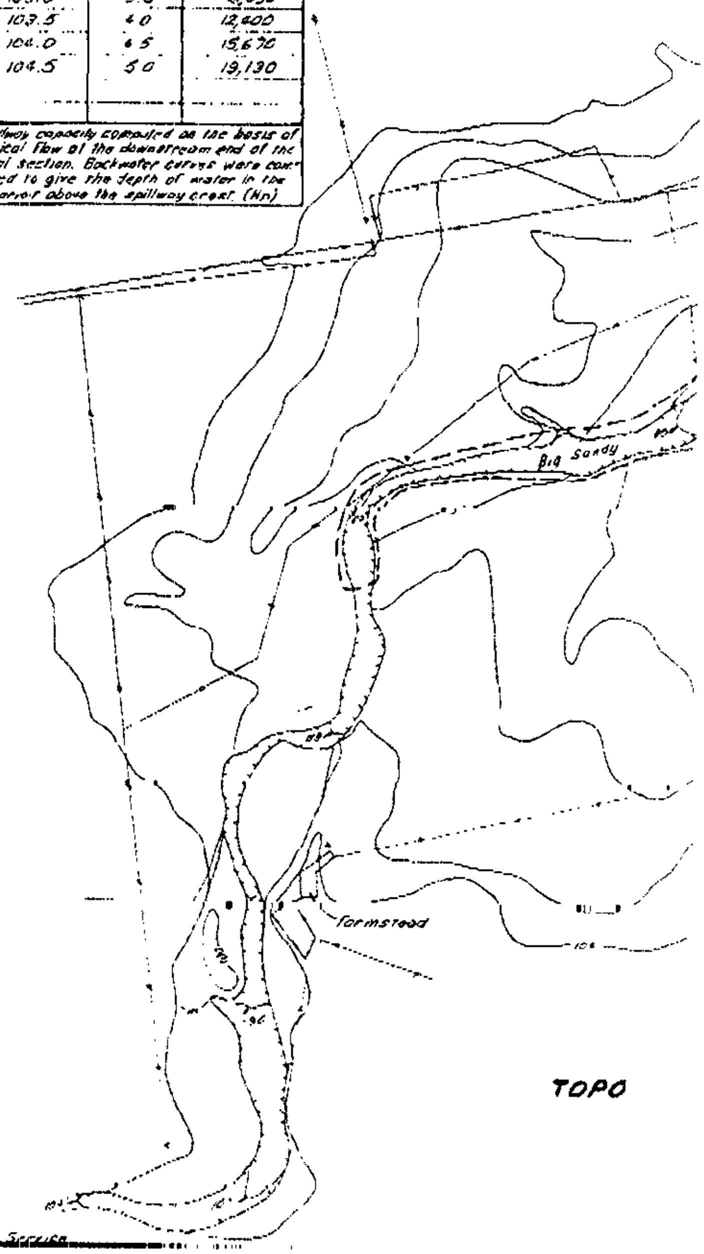
PRINCIPAL SPILLWAY CAPACITY



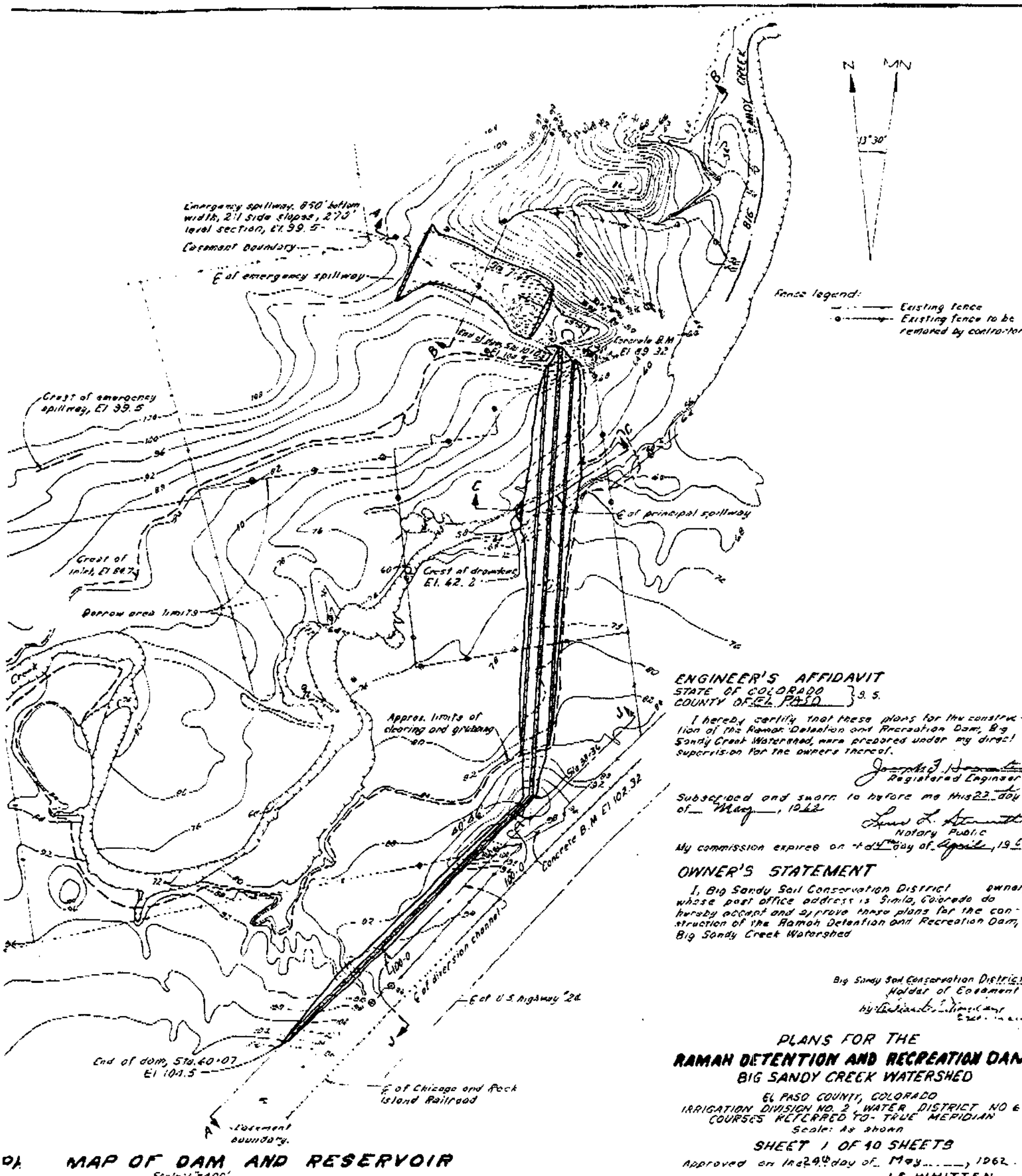
EMERGENCY SPILLWAY CAPACITY

Water surface El. in reservoir	Hp	Quantity, C.F.S.
99.5	0	0
100.0	0.5	190
100.5	1.0	730
101.0	1.5	1,702
101.5	2.0	3,140
102.0	2.5	5,040
102.5	3.0	7,120
103.0	3.5	9,450
103.5	4.0	12,400
104.0	4.5	15,670
104.5	5.0	19,130

Spillway capacity computed on the basis of critical flow at the downstream end of the level section. Backwater curves were computed to give the depth of water in the reservoir above the spillway crest. (Hp)



Approved Eldon ... 5-4-62
Head, E. & WP Unit, SCS
Approved ... 5-...
State Conservation Engineer, S.C.S.
U.S. Department of Agriculture Soil Conservation Service



MAP OF DAM AND RESERVOIR

Scale 1" = 400'

ENGINEER'S AFFIDAVIT

STATE OF COLORADO } S. S.
COUNTY OF EL PASO }

I hereby certify that these plans for the construction of the Ramah Detention and Recreation Dam, Big Sandy Creek Watershed, were prepared under my direct supervision for the owners thereof.

Joseph J. [signature]
Registered Engineer

Subscribed and sworn to before me this 23 day of May, 1962

[signature]
Notary Public

My commission expires on the 4th day of April, 1963

OWNER'S STATEMENT

I, Big Sandy Soil Conservation District, owner, whose post office address is Simla, Colorado do hereby accept and approve these plans for the construction of the Ramah Detention and Recreation Dam, Big Sandy Creek Watershed

Big Sandy Soil Conservation District
Holder of Easement
by [signature]

PLANS FOR THE
RAMAH DETENTION AND RECREATION DAM
BIG SANDY CREEK WATERSHED

EL PASO COUNTY, COLORADO
IRRIGATION DIVISION NO. 2, WATER DISTRICT NO 67
COURSES REFERRED TO TRUE MERIDIAN
Scale: As shown

SHEET 1 OF 10 SHEETS

Approved on the 29th day of May, 1962.
J.E. WHITTEN
State Engineer
by: [signature]
Deputy

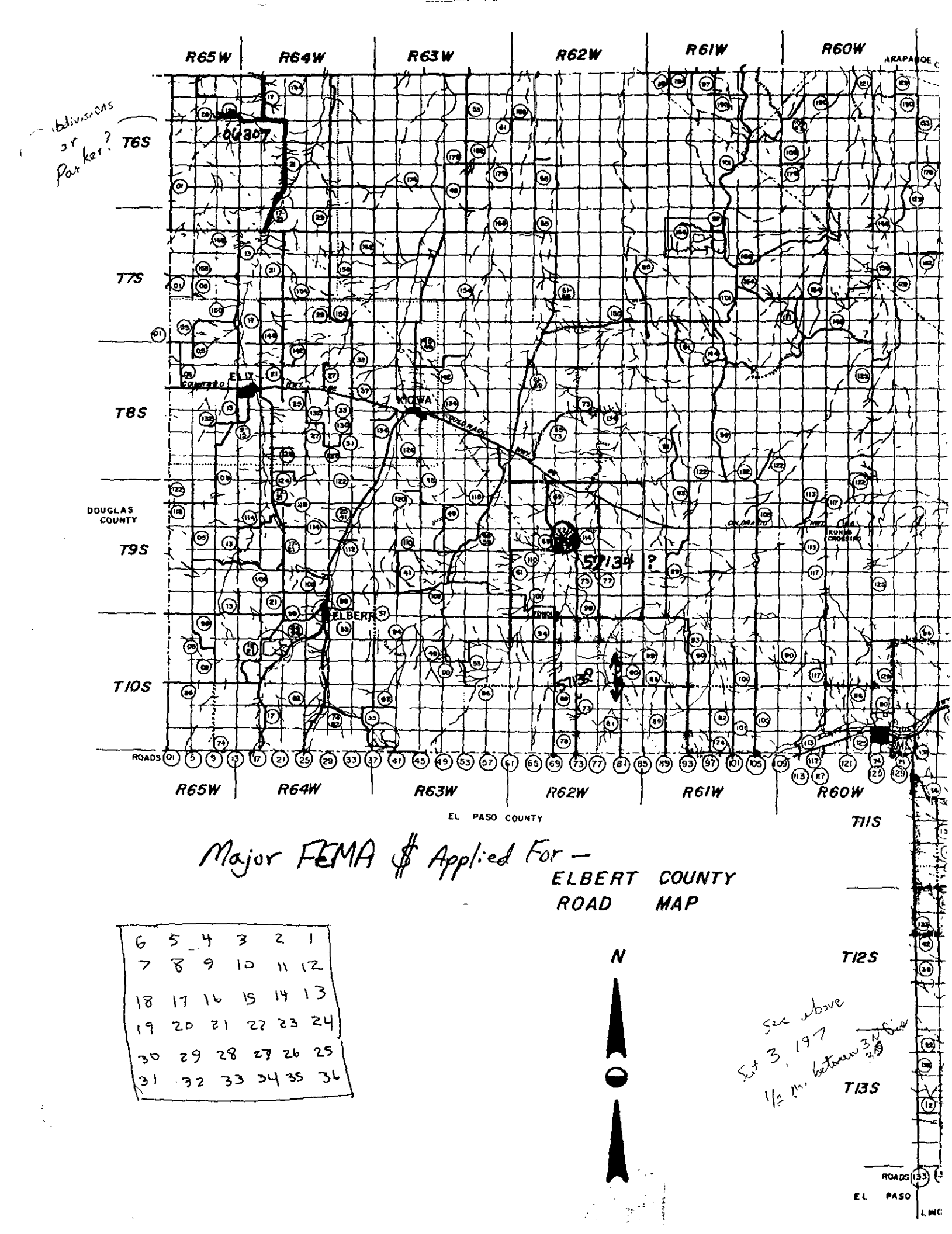
COPY OF ORIGINAL

These plans consist of 10 sheets including Sheets 1,3,5,6,7,8,12,13,14 & 15

Designed	Drawn	Checked	Date
C.H.	L.B.	K.D.M.	6-62

C-1022

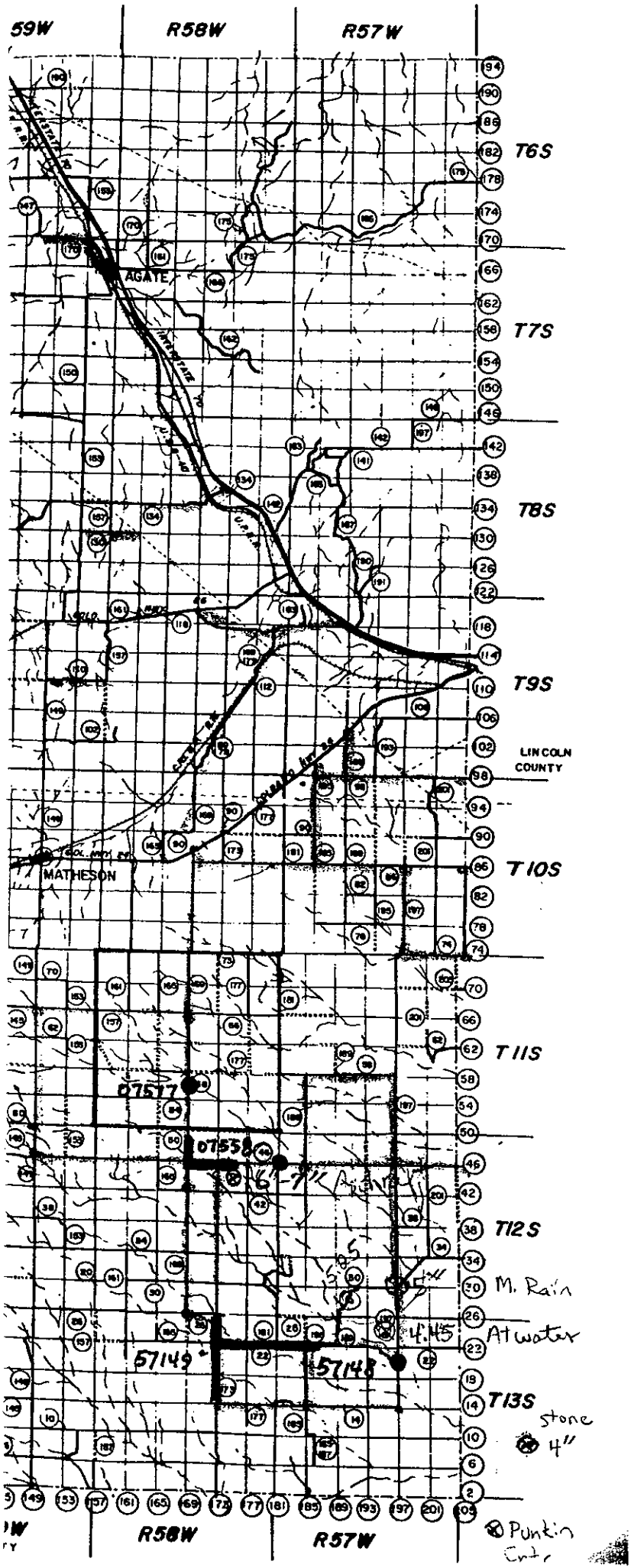
5, E-18, 374

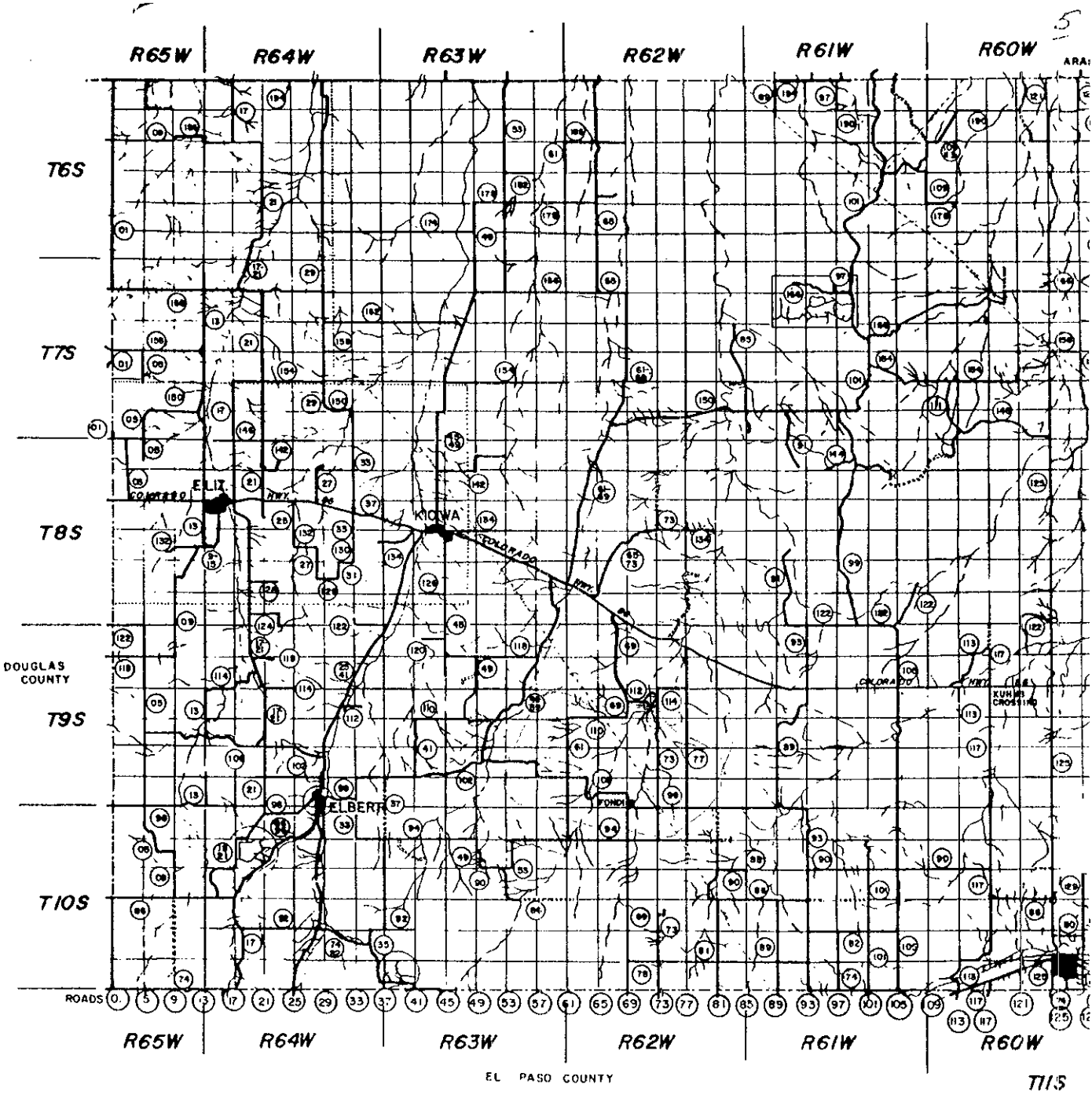


Major FEMA $ Applied For —

ELBERT COUNTY
ROAD MAP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

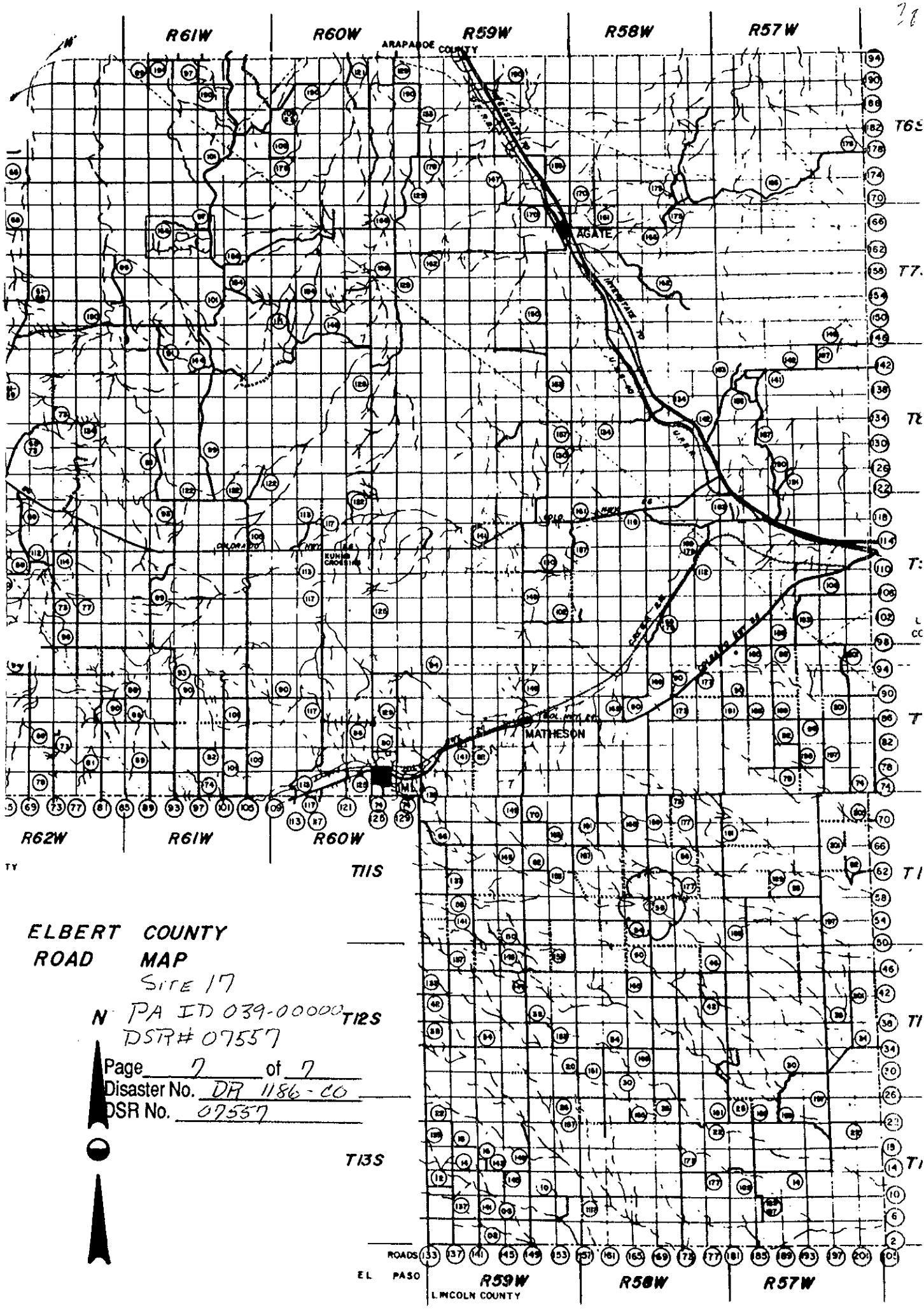

59W
R58W
R57W
T6S
T7S
T8S
T9S
T10S
T11S
T12S
T13S
AGATE
MATHESON
LINCOLN COUNTY
07557
07558
6-7" Rain
M. Rain
4.45
Atwater
57149
57148
stone
4"
Punkin Cntr
R58W
R57W



SITE 3

DAMAGE TO STRUCTURE ON CR 112 BETWEEN CR 69 & CR 73

ELBERT COUNTY ROAD MAP



ELBERT COUNTY
ROAD MAP
SITE 17
PA ID 039-00000
DSR# 07557

Page 7 of 7
Disaster No. DR 1186-CO
DSR No. 07557

4. Calculations and Estimates

Assumptions Used in the Hydraulic Computations

In order to estimate peak discharges, the CWCB flood documentation team employed Manning's equation. The application of Manning's equation to open channel flow problems requires that several generalizing assumptions be made.

Flow in open channels typically occurs as turbulent flow over rough surfaces. Open channel flow is also seldom either steady or uniform. (Steady flow has characteristics that do not vary with time while uniform flow implies that a constant cross sectional area and velocity occur at each section within a reach.) Steady, uniform flow almost never occurs in open channels (Morris and Wiggert, Applied Hydraulics in Engineering, 2nd edition, 1972).

In engineering applications, the Manning's equation has been used extensively and has been shown to be quite reliable even though it is an empirical approach derived for application to the following conditions:

- uniform flow in which the rate of head loss is equal to the bed slope
- steady flow

The open channel flow computations contained herein are treated as approximate solutions based on the assumptions of both steady and uniform flow. In actuality, the floods investigated in this study generally exhibited rapidly-rising and receding floodwave conditions that occurred in highly variable natural channels and adjacent floodplains. Flow characteristics under these circumstances were unlikely to be either steady or uniform.

Approaches are available for estimating floodwave flows, but they require substantial amounts of time and data that were not practical for these investigations. Manning's equation was used due to its general acceptance in the engineering community, and because of its relative ease of application. The Manning "n" values used in the calculations were based on engineering judgement, the reasonableness of results, and the understanding that the "n" term represented energy loss factors not typically found in steady, uniform flows.

CALCULATION FILE: WEST BIJOU CR. IN ELBERT COUNTY (ONE SITE).

Purpose: The purpose of the calculations is to estimate flood discharge at a bridge crossing of West Bijou Creek on County Road 112 in south-central Elbert County Colorado.

Background: A rapidly rising floodwave moved through the channel during the late evening and early morning of July 29 and 30, 1997 as a result of localized extreme precipitation in the headwaters immediately upstream of the Elbert County site. The central bridge pier was severely damaged by flow and debris impact, with corresponding damage to the integrity of the bridge deck.

The site was selected for a field visit to estimate the magnitude of flood discharge on the basis of the severity of damages and the availability of related storm information. A field visit to survey the channel were conducted on June 4, 1998 by RTi personnel.

File Organization: The following materials are presented in this calc file:

1. West Bijou Creek bridge site

- Discharge calculations using the slope-area method and a range of Manning's "n" values.
- Appendix A containing
  - -- Surveying field notes
  - -- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.
  - -- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.
  - -- Watershed map
  - -- Site Photographs

Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: WEST BIJOU DISCHARGE
Computed: TKB Date: 6/9/08
Checked: _____ Date: _____

Project/Proposal Name: CWCB FLOOD STUDY
Project/Proposal No.: D479 Task: 54
Page 1 of 1

GIVEN:

1. FLOW AREA BY SURVEY DATA & AUTOCAD = 927.63 ft²
2. WETTED PERIMETER = 117.23 ft (per spreadsheet - Append. A)
3. SLOPE = 0.0035 (per previous calc's - Append A)
4. MANNING's n = 0.028 (field estimate)

FIND: PEAK FLOOD DISCHARGE

SOLUTION:

1. $Q_p = \frac{1.49}{n} A R^{2/3} S^{1/2}$ where $R = A/P = 7.913$ ft

$$\Rightarrow \frac{1.49}{0.028} (927.63)(7.913)^{0.6667}(0.0035)^{0.5}$$

$\Rightarrow$ 11,596.6 cfs REALITY CHECK: $V = Q/A = 12.50$ fps

2. ALTERNATIVES: if $n = 0.025 \Rightarrow Q = 12,988$ cfs, $V = Q/A = 14.0$ fps
   if $n = 0.030 \Rightarrow Q = 10,823$ cfs, $V = 11.67$ fps
   if $n = 0.035 \Rightarrow Q = 9,277$ cfs, $V = 10.00$ fps
   if $n = 0.040 \Rightarrow Q = 8,118$ cfs, $V = 8.75$ fps

NOTE: DARYL SIMONS SAYS V IN NATURAL SAND-BED OR FINE GRAVEL CHANNELS RARELY GETS OVER 10 fps BECAUSE THE KINETIC ENERGY WILL RE-FORM THE CHANNEL, DROPPING V. USING THIS AS A GENERAL GUIDE, Q HERE SHOULD BE 8,000 TO 10,000 cfs AT THE UPPER LIMIT OF V. NEW SAND BARS AND SCOUR WERE OBSERVED IN THE FIELD - SEDIMENT TRANSPORT AND BEDFORMS COULD RAISE n TO THE HIGHER VALUES ABOVE.

ANSWER: Q = 8,000 TO 10,000 cfs.

Appendix A:

-- Surveying field notes
-- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.
-- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.
-- Watershed map
-- Site Photographs

EST. BIJOU CREEK ELBERT CO.

		T	M	B	EL.
T1	HI =	4.79, ARB. LAT W/ 500			504.79
∡ = 90°	A0	5.37	5.28	5.20	499.51
(CHAINING)	A1	8.49	8.35	8.21	496.30
	(RIGHT DEBRIS LINE)				
	A2	17.95	17.70	17.44	487.09
	A3	18.98	18.56	18.15	486.23
	A4	20.07	19.64	19.20	485.15
	A5	20.98	20.46	19.93	484.33
		(channel bottom = A5)			
	A6	19.20	18.68	18.15	486.11
	A7	14.13	13.48	12.82	491.31
	A8	2.26	1.52	0.79	503.27
		(A8 = TOP OPP. BANK – V. STEEP)			
	D1 =	DEBRIS LINE SHOT ON OPP. BANK			
D1	∡L =	42.5° (READING)			
D1		8.59	7.61	6.62	497.18
		UPSTREAM THALWEG SHOT			
T1		20.91	19.56	18.21	485.23
T1	∡L = 19° (reading)				
(∡'s ARE READINGS NOT REDUCED FROM 90°)					
S1	∡R [illegible]°	1.31	0.73	0.15	504.06
S2	∡R 139°	1.30	0.89	0.47	503.90

pier shots on low steel = S1, S2

JUNE 4, 1998, 1500 HR — 50°F, RAIN, WINDY

JIM BURNELL [illegible]

BILL ELLETT

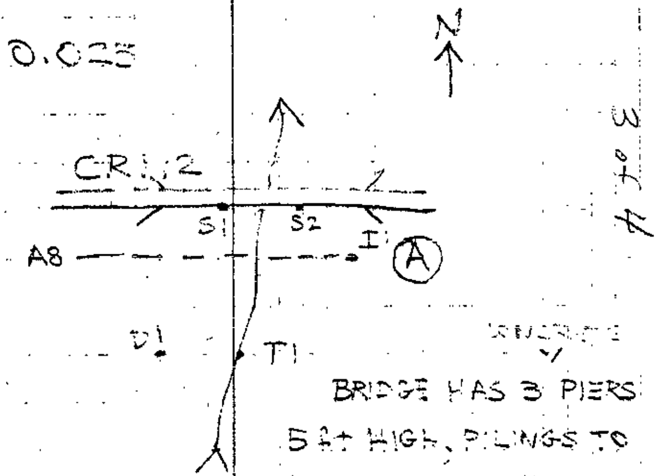
LOW CLOUDS (100% CLOUD COVER)

LEVEL: LEICA WILD NA20

NOTE: A0 & A8 ARE TOP OF BANK
A5 & T1 ARE THALWEG

D1 IS ~100 ft UPSTR OF SURVEY LINE

n = 0.025



H of W

BRIDGE HAS 3 PIERS 5 ft HIGH, PILINGS TO DECK ~15 FT HIGHER

WERE ALL PILINGS DURING STORM 7/97 — JOE CRAVEN SAYS CONCRETE ADDED LATER

NOTE: 0.0 IS AT LOW STEEL ELEV ON THESE SHOTS. S1 = 503.33, S2 = 503.01 FOR LOW CHORD ELEVS.

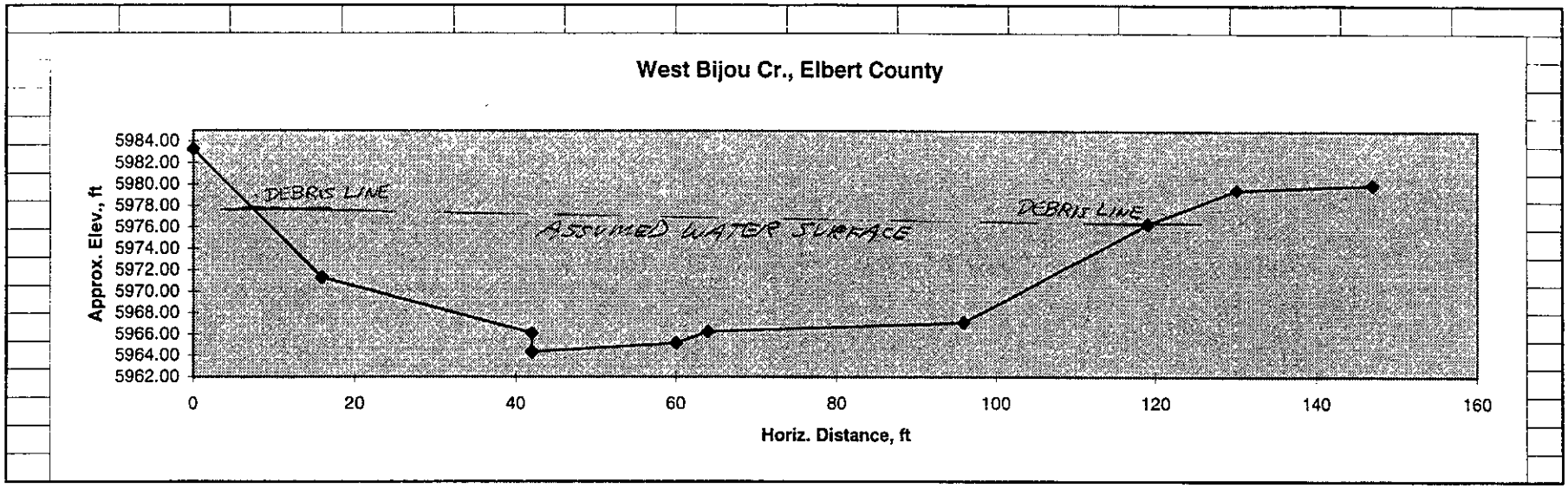
1 of 4

WEST BIJOU CR., ELBERT CO.										
Arbitrary Datum = 500 ft at I1				Horiz.		Re-order	Re-calc	Arbitrary	Actual (a)	Wetted
				Distance		From Left	Horiz.	Datum	Approx	Perimeter
Transect	Point	High	low	ft		Bank	Coord, ft	Elevation	Elev., ft	ft
A	A0	5.37	5.20	17		A8	0	503.27	5983.27	0
	A1(debris)	8.49	8.21	28		A7	16	491.31	5971.31	19.97603
	A2	17.95	17.44	51		A6	42	486.11	5966.11	26.5149
	A3	18.98	18.15	83		A5	42	484.33	5964.33	1.78
	A4	20.07	19.20	87		A4	60	485.15	5965.15	18.01867
	A5	20.98	19.93	105		A3	64	486.23	5966.23	4.143235
	A6	19.20	18.15	105		A2	96	487.09	5967.09	32.01155
	A7	14.13	12.82	131		A1(debris)	119	496.30	5976.30	24.77547
	A8	2.26	0.79	147		A0	130	499.51	5979.51	
						I1	147	500.00	5980.00	
(a) based on USGS topographic quad.						TOTAL Wetted Perimeter below Points A1				117.2318 *
						and D1 (interpolated latter-used half of A8 to A7 value)				
	D1	8.59	6.62	197		debris line - oppos. bank		497.18	5977.18	
	T1	20.91	18.21	270		thalweg upstr		485.23	5965.23	
	S1	1.31	0.15	116		low chord	on bridge	504.06	5984.06	
	S2	1.30	0.47	83		low chord	on bridge	503.90	5983.90	

NOTE: per ANA, using Autocad, area below debris lines = 92763 ft²

P = 117.23 per above.

⇒ A/P = 7.9134'


West Bijou Cr., Elbert County
Approx. Elev., ft
5984.00
5982.00
5980.00
5978.00
5976.00
5974.00
5972.00
5970.00
5968.00
5966.00
5964.00
5962.00
0
20
40
60
80
100
120
140
160
Horiz. Distance, ft
DEBRIS LINE
ASSUMED WATER SURFACE
DEBRIS LINE

Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: WEST BIJOU CHANNEL SLOPE
Computed: JKB Date: 6/5/98
Checked: _____ Date: _____

Project/Proposal Name: CWCB FLOOD STUDY
Project/Proposal No.: D1479 Task: 54
Page 4 of 4

GIVEN:

THALWEG ELEVS AND RELATIVE POSITIONS AS FOLLOW:

POINT	DISTANCE, ft	ELEVATION, ft	INTERNAL ∠ (PER FIELD NOTES)
T1	270	5965.23	90 - 19 = 71°
A5	42	5964.33	

FIND:

CHANNEL SLOPE

SOLUTION: USING COSINE LAW

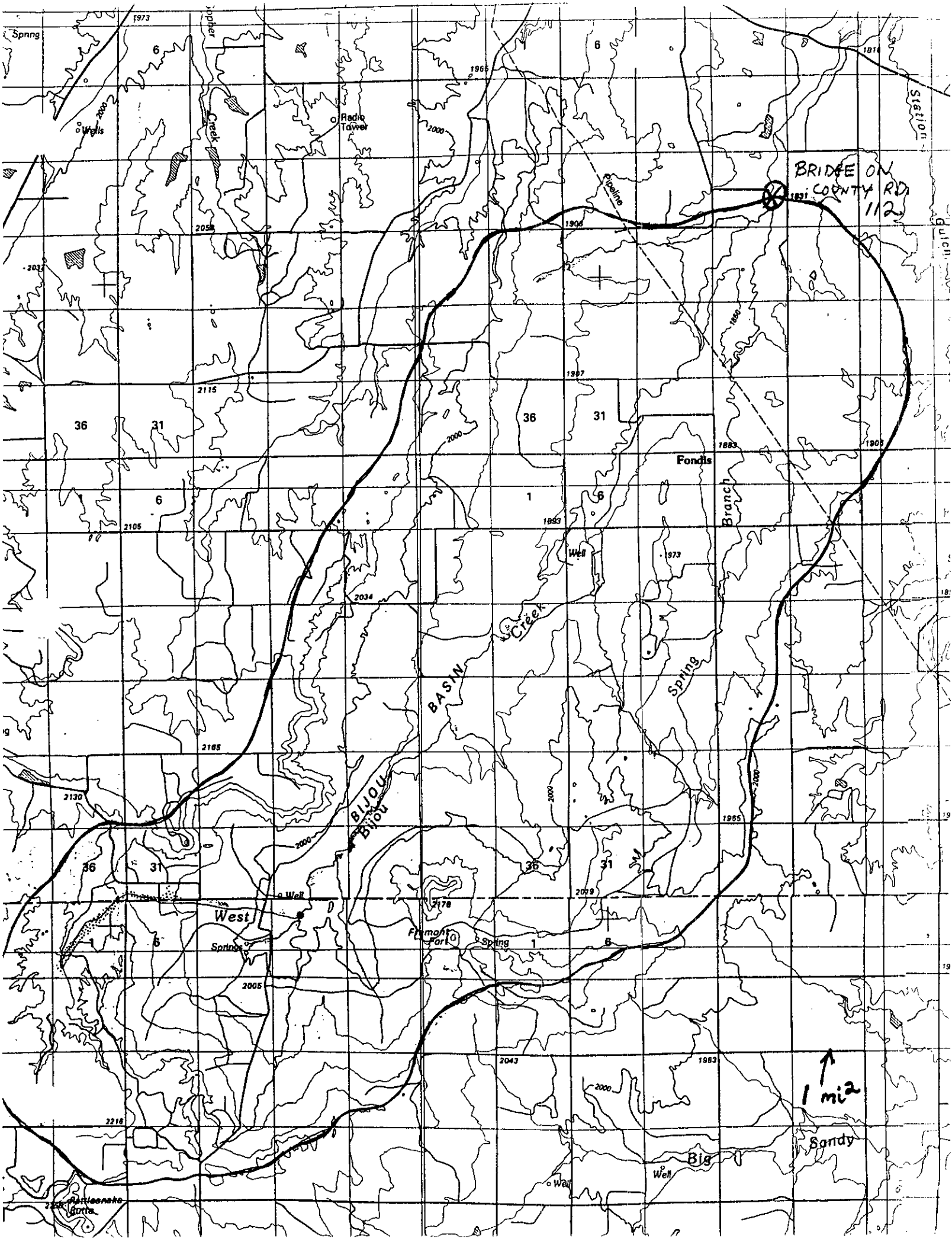
1. $\text{DISTANCE}_{T1 \to A5} = [270^2 + 42^2 - 2(270)(42)\cos 71°]^{1/2}$

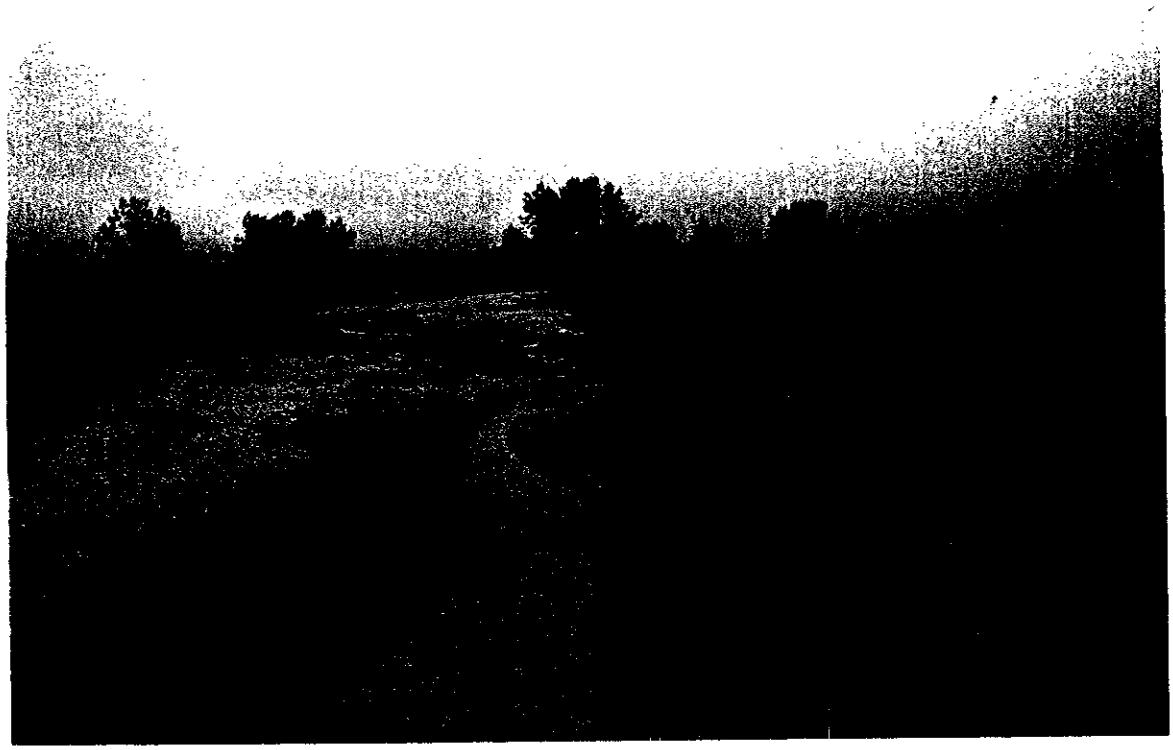
$= 259.4$ ft

2. $\text{SLOPE} = \frac{(5965.23 - 5964.33)}{259.4} = 0.0035$

ANSWER:

$S = 0.0035$


BRIDGE ON COUNTY RD 112
Fondis
Branch
Creek
BASIN
Spring
BIJOU
Bijou
West
Springs
Fremont Fort
Spring
Well
Radio Tower
Wells
Pipeline
Station
Sandy
Big
Well
Rattlesnake Butte
1 mi



West Bijou Creek just upstream of County Rd. 112 (Elbert County). Flow extended about 2/3 of the way up on the steep bank at right. Flow is toward viewer. Note sand bars. Flow width is on the order of 5 or 6 at the time of the picture (6 AM).

View downstream of Elbert County Rd 112 bridge over West Bijou Creek. Bridge is about 20 ft above the channel.

CALCULATION FILE: SOUTH RUSH CR. IN ELBERT AND LINCOLN COUNTIES (TWO SITES).

Purpose: The purpose of the calculations is to estimate flood discharges at a road crossing of South Rush Creek in southeastern Elbert County Colorado, and at a second location on the same stream approximately 8.5 miles downstream in Lincoln County, Colorado.

Background: A rapidly rising floodwave moved through the channel during the late evening and early morning of July 29 and 30, 1997 as a result of localized heavy precipitation in the headwaters immediately upstream of the Elbert County site. A 6-ft diameter culvert and associated roadfill were completely washed away in Elbert County, and a bridge approach was destroyed in Lincoln County.

These sites were selected for field visits to estimate the magnitude of flood discharges on the basis of the severity of damages and the availability of related storm information. Field visits to survey the channel were conducted on June 3 and 4, 1998 by Rti personnel.

File Organization: The following materials are presented in this calc file:

1. Elbert County Site
- Discharge calculations using the slope-area method and a range of Manning's "n" values.
- Appendix A containing
  - -- Surveying field notes
  - -- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.
  - -- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.
  - -- Watershed map
  - -- Site Photographs

2. Lincoln County Site
- Discharge calculations using the slope-area method and a range of Manning's "n" values.
- Appendix B containing
  - -- Surveying field notes
  - -- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.
  - -- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.
  - -- Watershed map
  - -- Site Photographs

3. A summary discussion of the discharge estimates for the two sites, dealing with how and why the two estimates relate to each other and the hydrologic/hydraulic factors involved.

SOUTH RUSH CR. ELBERT COUNTY

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970/484-7573 • FAX 970/484-7593

Subject: SOUTH RUSH CR. FLOW, ELBERT CO. | Project/Proposal Name: CWCB FLOOD STUDY
Computed: JKB Date: 6/8/98 | Project/Proposal No.: 0477 Task: 04
Checked: _____ Date: _____ | Page 1 of 1

GIVEN:

1. FLOW AREA BY SURVEY DATA = 2,859.82 ft² (APPENDIX A)
2. WETTED PERIMETER BY SURVEY DATA = 361.3 ft (APPENDIX A)
3. SLOPE BY SURVEY DATA = 0.00144 (APPENDIX A)
4. MANNING'S n = 0.035

FIND: PEAK FLOOD DISCHARGE

SOLUTION:

$$Q_p = \frac{1.49}{n} A R^{2/3} S^{1/2} \quad \text{where} \quad R = \frac{A}{P} = \frac{2859.82}{361.3}$$

$$= 7.9154 \text{ ft}$$

$$\Rightarrow Q_p = \frac{1.49}{0.035}(2,859.82)(7.9154)^{2/3}(0.00144)^{1/2}$$

$$= \underline{18,349.3 \text{ cfs}}$$

COMMENTS: Channel lined w/ old cottonwoods; depth ≈ 20 ft max, debris on trees up to 10 ft high; 6 ft dia. culvert and all road fill, blown out in flood.

- If $n = 0.050 \Rightarrow Q = 12,844.5$ cfs and $V = Q/A = 4.5$ fps
- If $n = 0.045 \Rightarrow Q = 14,271.7$ cfs, $V = 5.0$ fps
- If $n = 0.040 \Rightarrow Q = 16,055.6$ cfs, $V = 5.6$ fps
- If $n = 0.035 \Rightarrow$ per solution, $Q = 18,350$ cfs, $V = 6.5$ fps
- If $n = 0.030 \Rightarrow Q = 21,407.5$ cfs, $V = 7.5$ fps
- If $n = 0.028 \Rightarrow Q = 22,936.6$ cfs, $V = 8.0$ fps

ANSWER:

ANY Q_p BETWEEN 14,000 TO 18,000 SEEMS REASONABLE, YIELDS V = 5.0 TO 6.5 fps AT PEAK. CALL IT 16,000, $n = 0.040$.

Appendix A (Elbert County):

-- Surveying field notes
-- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.
-- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.
-- Watershed map
-- Site Photographs

1 of 2

RUSH CR. @ CR 197, ELBERT CO.

INTERSECTION W/ CR 22

E.H., 1995 1030 HR

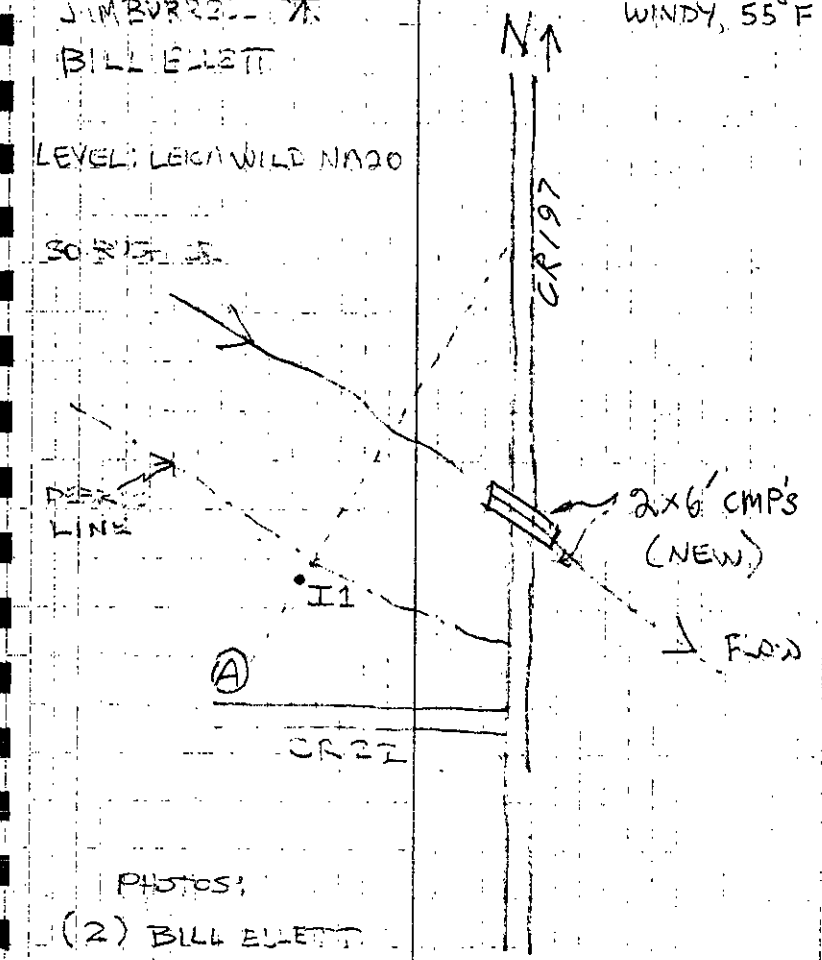
J. IMBURGIA

BILL ELLETT

CLOUDY, WINDY, 55°F

LEVEL: LEICA WILD NA20

	TOP	MIDDLE	LOW	ELEV
I 1	HI = 4.70 ft, HA 207°, DATUM 500'			
504.70				504.70
	(at south debris line)			
A1	5.21	5.19	5.16	499.51
A2	9.65	9.32	9.00	495.38
A3	15.13	14.59	14.06	490.11
	(at toe of bank)			
A4	16.51	15.36	14.21	489.34
	on terrace			
A5	20.63	19.45	18.26	485.25
"channel bottom"	~~(thalweg, right edge water)~~			
A6	20.05	18.72	17.40	485.98
"channel bottom"	~~left edge water (thalweg)~~			
A7	18.11	16.74	15.38	487.96
A8	16.91	15.39	13.88	489.31
A9	15.56	14.02	12.49	490.68
A10	14.60	12.95	11.30	491.75
A11	9.16	7.40	5.65	497.30
A12	6.18	4.34	2.50	500.36
	(left debris line)			



PHOTOS:

(2) BILL ELLETT AT SO. RUSH CR. CULVERTS. DEBRIS IN TREE 10 FT HIGH

2 of 2

TO RUSH CR.

CHANNEL SLOPE BY EDGE OF WATER

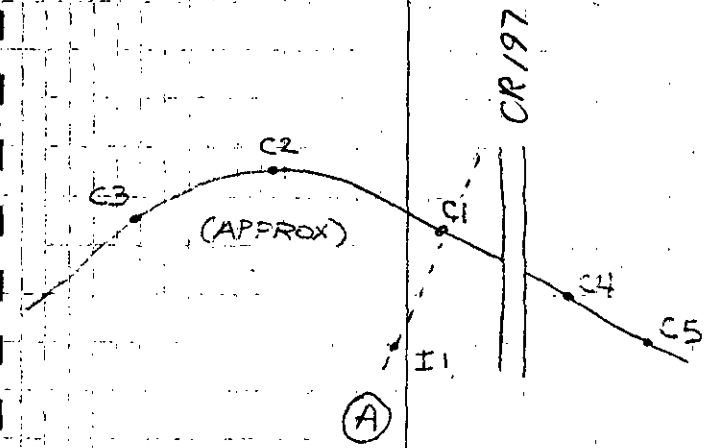
I1 DEGREE READING = 207° BASE ∠

FROM TO	∠ reading	T	M	B	EL.
C1	on Line	18.94	17.77	16.60	486.93
C2	182°	19.25	17.73	16.20	486.97
C3	157°	20.12	17.70	15.28	487.00
C4	∠R 279°	21.26	19.98	18.69	489.72
C5	∠R 293°	22.53	20.28	18.04	484.42
C6	TOO FAR OR TOO MANY TREES				
C7					

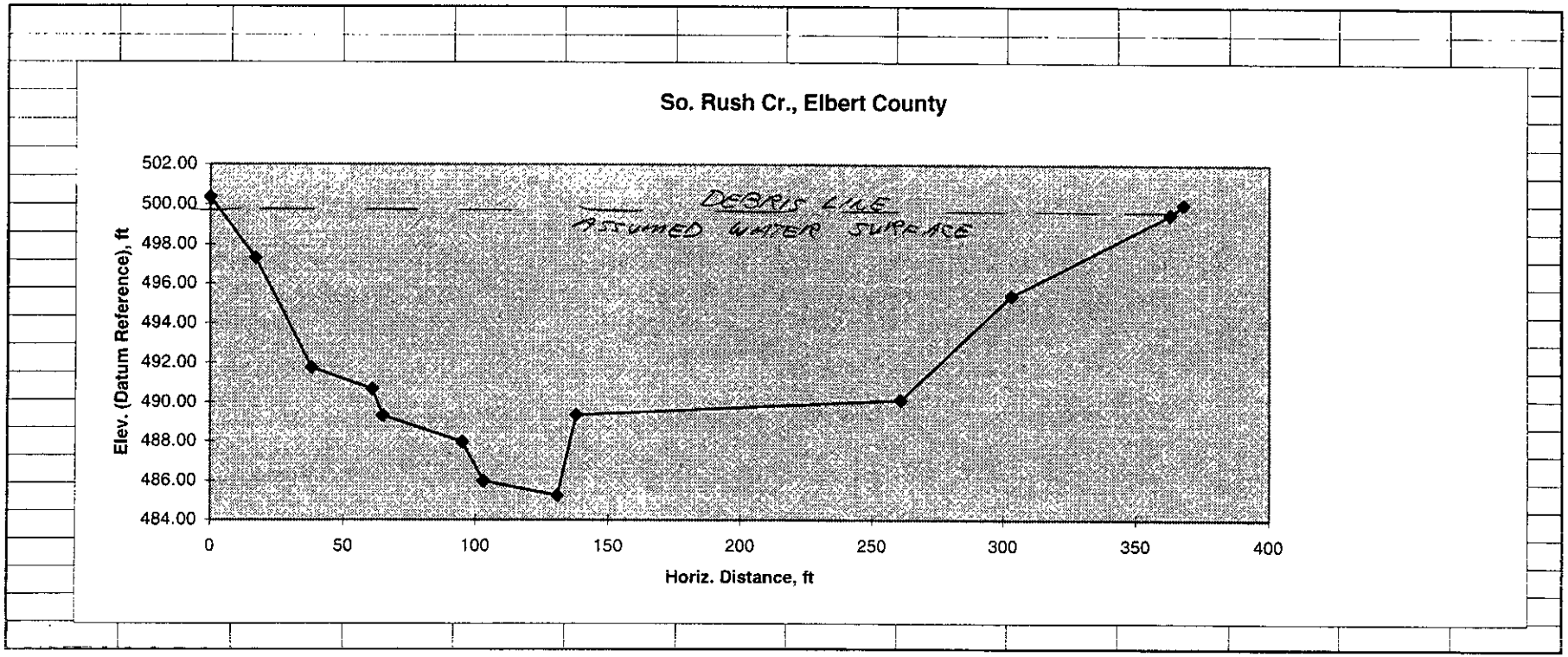
NOT REDUCED (READINGS ONLY)

∠ = EXCEPT AS NOTED. C4, C5 ARE DOWNSTREAM OF CULVERT, OTHERS UPSTR

NOTE: CHANNEL CONSISTS OF DEEP POOLS HAVING UNDULATING BOTTOM, 10 TO 15 FT WIDE.



S. RUSH CR., ELBERT CO.										
						Elevation		Re-order	Re-calc	Arbitrary
Arbitrary Datum = 500.00 ft at I1					Horiz	Per		From Left	Horiz	Datum
Transect	Point	High	low	Dist., ft	Coord	Datum, ft		Bank	Coord, ft	Elevation
A										
	I1			0				A12	0	500.36
	A1	5.21	5.16	5				A11	17	497.30
	A2	9.65	9.00	65				A10	38	491.75
	A3	15.13	14.06	107				A9	61	490.68
	A4	16.51	14.21	230				A8	65	489.31
	A5	20.63	18.26	237				A7	95	487.96
	A6	20.05	17.40	265				A6	103	485.98
	A7	18.11	15.38	273				A5	131	485.25
	A8	16.91	13.88	303				A4	138	489.34
	A9	15.56	12.49	307				A3	261	490.11
	A10	14.60	11.30	330				A2	303	495.38
	A11	9.16	5.65	351				A1	363	499.51 ← WATER SURFACE & HIGHEST DEBRIS
	A12	6.18	2.50	368				I1	368	500.00
								Re-order		Arbitrary
	Slope Measurement							Upstr to		Datum
								Dnstr		Elevation
	C1	18.94	16.60	234		486.93		C3		487.00
	C2	19.25	16.20	305		486.97		C2		486.97
	C3	20.12	15.28	484		487.00		C1		486.93
	C4	21.26	18.69	257		484.72		C4		484.72
	C5	22.53	18.04	449		484.42		C5		484.42
	NOTE: C4 and C5 are below (downstream of) the culvert - channel drops at road.									


So. Rush Cr., Elbert County
DEBRIS LINE
ASSUMED WATER SURFACE
Elev. (Datum Reference), ft
502.00
500.00
498.00
496.00
494.00
492.00
490.00
488.00
486.00
484.00
0
50
100
150
200
250
300
350
400
Horiz. Distance, ft

Riverside Technology, c.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: SLOPE, SOUTH RUSH, N. ELBERT CO. | Project/Proposal Name: CWCB FLOOD STUDY
Computed: GKB Date: 6/8/98 | Project/Proposal No.: D479 Task: 54
Checked: _____ Date: _____ | Page 1 of 1

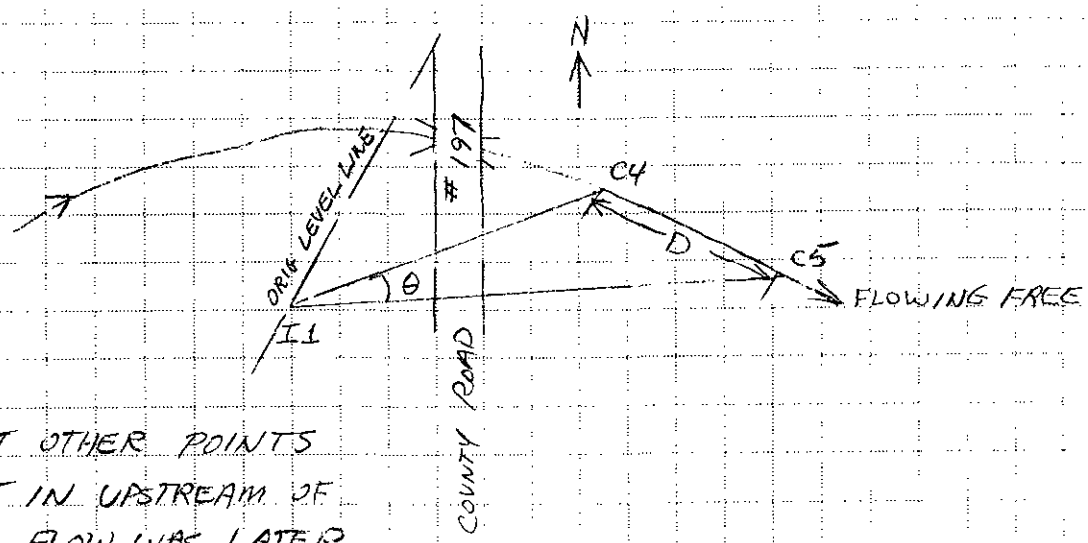
GIVEN:

1. BASE ∠ READING = 207°

2. ANGLE READINGS, ETC., AS FOLLOW, TO THE EDGE OF WATER.

POINT	∠ READ	ELEV., FT.	DISTANCE, FT.
C4	∠R 279°	484.72	257
C5	∠R 293°	484.42	449

3.



4. NOTE THAT OTHER POINTS WERE SHOT IN UPSTREAM OF ROAD, BUT FLOW WAS LATER FOUND TO BE OBSTRUCTED BY CONSTRUCTION ACTIVITIES AT ROAD, CAUSING "DEAD" POOLS UPSTREAM OF ROAD. THESE WERE THEREFORE NOT USED.

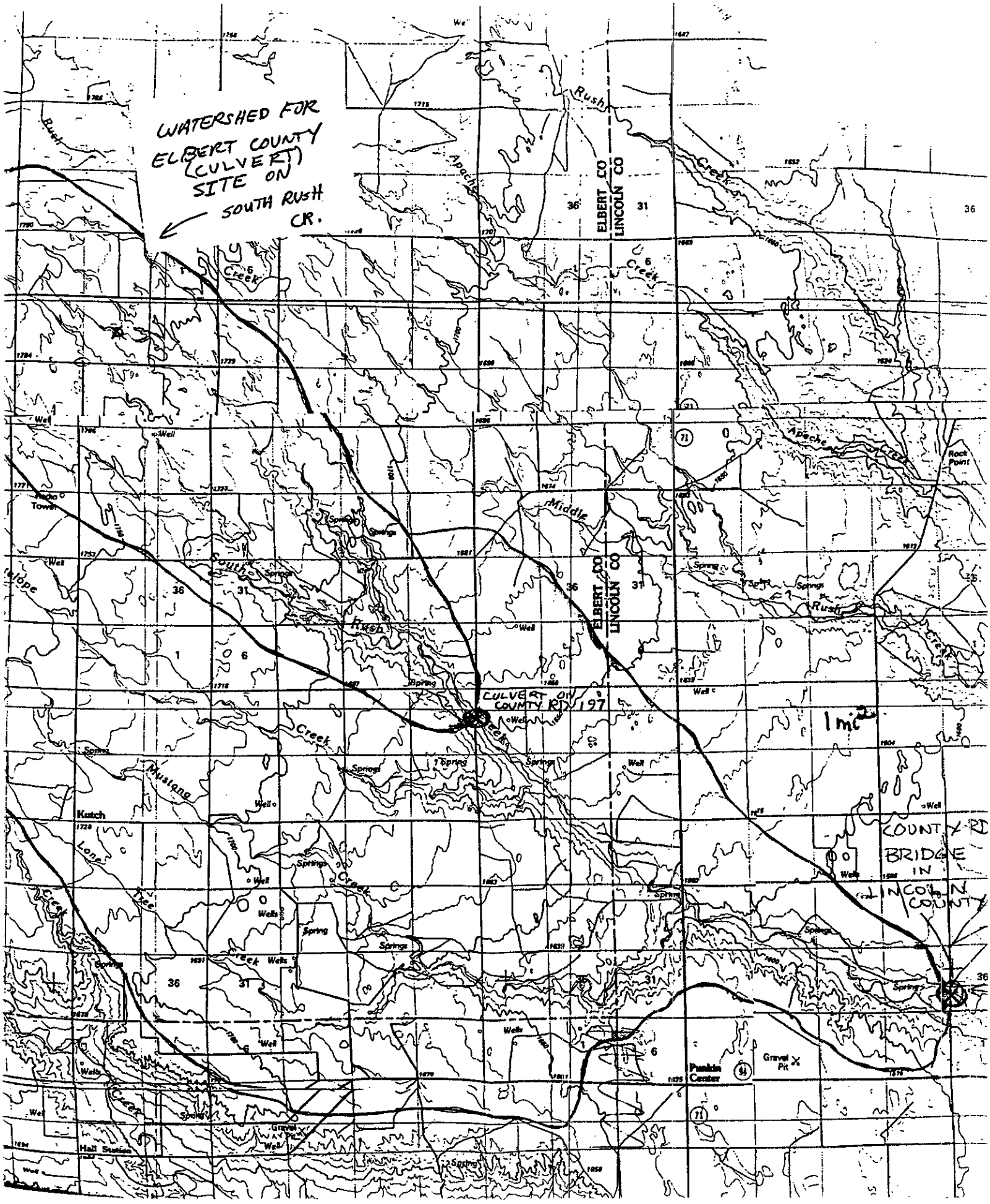
FIND: CHANNEL SLOPE

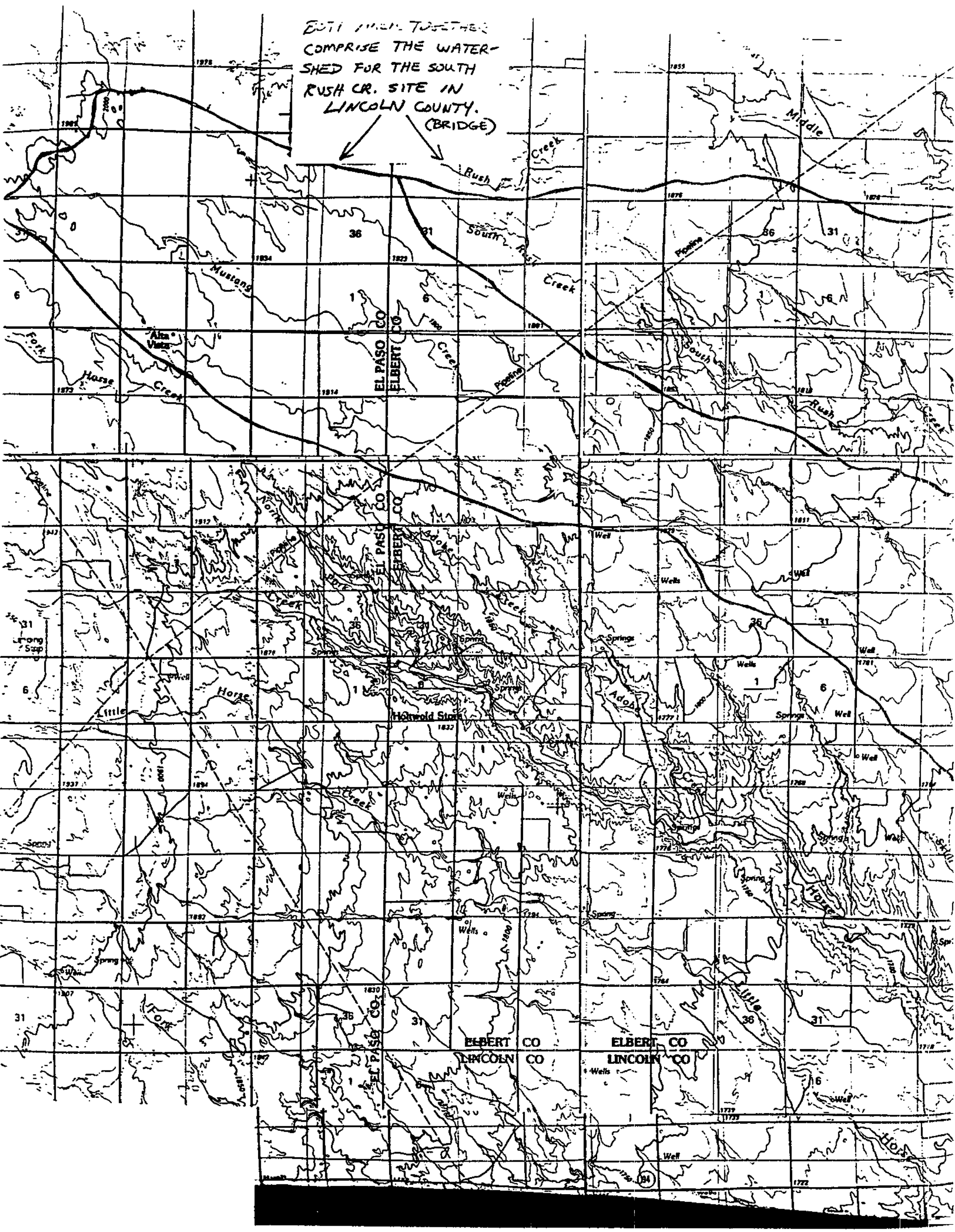
SOLUTION: BY COSINE LAW

1. $D_{C4-C5}^2 = 257^2 + 449^2 - 2(257)(449)\cos(293-279)^\circ \Rightarrow D = 209.09\text{ft}$

2. SLOPE = (484.72 − 484.42) / 209.09 = 0.00144

ANSWER: SLOPE = 0.00144


WATERSHED FOR ELBERT COUNTY (CULVERT) SITE ON SOUTH RUSH CR.
CULVERT ON COUNTY RD 197
1 mi²
COUNTY RD BRIDGE IN LINCOLN COUNTY
ELBERT CO
LINCOLN CO
Rush Creek
Apache Creek
Middle Rush Creek
South Rush Creek
Mustang Creek
Lone Tree Creek
Kutch Creek
Rock Point
Franktown
Hall Station
Gravel Pit


COMPRISE THE WATER-
SHED FOR THE SOUTH
RUSH CR. SITE IN
LINCOLN COUNTY.
(BRIDGE)
Middle
Rush
Creek
South
Rush
Creek
Mustang
Fork
Horse
Creek
Alta Vista
Pipeline
EL PASO CO
ELBERT CO
North
Adobe
Creek
Springs
Wells
Well
Holtwold Store
Little
Horse
ELBERT CO
LINCOLN CO
ELBERT CO
LINCOLN CO
Fork

← So. Rush Cr. the day after the flood. Flow from right to left. Trees extend about ¼ mile upstream.

← Note 6-ft culvert sections lying along banks downstream. Flow from right to left.

- Upstream View on South Rush Creek, [illegible] County. Note [illegible] trees at right. Flow was approximately 50% higher than [illegible] are covering the grassy areas in the foreground & beyond the trees.

- Cottonwood [illegible] trees [illegible] stream for ± 1/4 mi. No trees occur downstream of the [illegible], roots [illegible] to the right of the picture. Top of the [illegible], the trees [illegible] off the [illegible]. Note logs lying in the trees. Logs like these were carried by flow, and clogged the [illegible] culvert.

6-ft culverts being replaced at [illegible] Creek in Elbert County. Flow was from left to right. Note sand [illegible] above the crest on the right.

Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: SOUTH RUSH CR. DISCHARGE SUMMARY
Computed: JKB Date: 6/11/98
Checked: _____ Date: _____

Project/Proposal Name: CWCB FLOOD STUDY
Project/Proposal No.: D479 Task: 54
Page 1 of 2

GIVEN: South Rush Cr. calculations for Elbert County site (upstr.) and Lincoln County site (8.3 mi. dnstr.), as follows:

1. FLOW GEOMETRY

COUNTY	FLOW AREA, ft^2	WETTED PERIMETER, ft	HYDRAULIC RADIUS, ft	SLOPE ft/ft	T ft	Y_{max}, ft
ELBERT	2,860	361	7.9	0.00144	350	~15
LINCOLN (at bridge)	~1,930	218	~8.8	0.00186	218 +	~13

2. ROUGHNESS CONDITIONS - RAPIDLY RISING FLOOD WAVE, WITH:

ELBERT - COTTONWOODS, CULVERT & ROAD FILL IN A V-SHAPED VALLEY W/ GRASSY SLOPES. MUCH VEGETAL DEBRIS, SAND TRANSPORT, ROAD REMOVED & CULVERT DESTROYED.

LINCOLN - GRASSLANDS W/ SHORT REEDS IN A WIDE VALLEY, SCOUR & FILL FORMING HOLES & BARS, BRIDGE SECTION FLOWING (JUST) FULL, SOUTH APPROACH TO BRIDGE WASHED OUT, MUCH VEGETAL DEBRIS AT EDGES OF FLOW.

3. FLOW CALCULATIONS - PEAK DISCHARGE

	ELBERT		LINCOLN	
n	Q, cfs	V, fps	Q, cfs	V fps
0.040	16,055	5.6	11,151	5.58
0.035	18,350	6.5	12,744	6.38
0.030	21,408	7.5	14,868	7.44
0.028	22,937	8.0	15,930	7.98

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2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: SO. RUSH DISCHARGES.
Computed: JKB Date: 6/11/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: _____ Task: _____

FIND: REASONABLE DISCHARGES AND RELATIONSHIP BETWEEN THE 2 SITES.

DISCUSSION: AT ANY GIVEN n VALUE, THE LINCOLN COUNTY SITE HAS SIGNIFICANTLY LESS DISCHARGE AND APPROXIMATELY THE SAME VELOCITY AS THE ELBERT COUNTY SITE. RAINFALL IN THE WATERSHED WAS DISTRIBUTED HEAVILY OVER THE ELBERT COUNTY AREA, TAPERING OFF SIGNIFICANTLY OVER THE REST OF THE WATERSHED. THUS, THE LINCOLN COUNTY SITE DIDN'T HAVE MUCH MORE CONTRIBUTING PRECIPITATION IN SPITE OF A LARGER WATERSHED AREA.

THE SLOPE IS SLIGHTLY FLATTER UPSTREAM IN ELBERT COUNTY (INTERESTING...). THE WETTED PERIMETER IS SLIGHTLY HIGHER IN PROPORTION TO AREA IN ELBERT COUNTY VS. LINCOLN. ALSO, THE LINCOLN SITE IS PROBABLY A BIT SMOOTHER HYDRAULICALLY; VEGETATION (ESPECIALLY COTTONWOODS) PROBABLY INCREASES THE n VALUE FOR ELBERT COUNTY. THE SLOPES ARE VERY CLOSE, AND PROBABLY WITHIN ERROR TOLERANCES, ESPECIALLY FOR DISTURBED SITES HAVING A LOT OF NATURAL VARIATION FROM SECTION TO SECTION.

CONCLUSION: GO WITH $n = 0.040$ FOR A RAPIDLY RISING FLOOD CREST IN THE COTTONWOODS AT THE ELBERT SITE. THIS GIVES $Q = 16,000$ cfs AND $V = 5.6$ fps. DOWNSTREAM, THE RISE WAS ATTENUATED, BUT BRIDGE EFFECTS AND DEBRIS STILL PERTAINED. GO WITH $n = 0.032$; THIS GIVES $Q = 14,000$ cfs AND $V = 7.0$ fps. ADD/SUBTRACT 1,000 cfs TO EITHER VALUE FOR A RANGE OF Q AT EACH SITE.

ANSWER: $Q_{ELBERT} = 15,000$ TO $17,000$ cfs.

$Q_{LINCOLN} = 13,000$ TO $15,000$ cfs.

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/8/98
Call Placed/Received by: Bill Owen
Spoke With: Dan Neuhold
Company/Affiliation: CO Dept. of Nat'l Resources Water Commissioner, Dist. 66 + 67
Phone no.: (719) 336-5364
Project No.: D479-56

Comments:

District 67 - Big Sandy Creek
↳ no significant diversions on this creek

District 66 - Carrizo Creek + Cimarron River
↳ one significant water right
John B. Moya Ditch ⇒ located West Carrizo Creek
headgate @ Section 27, T32S, R53W
↳ irrigates approx. 20 acres of alphalfa
water right of 7.5 cfs (creek normally runs @ 3 cfs on average)

Don Taylor is Water Commissioner in District 17 (in La Junta)

Signature Bill Owen

→ (719) 384-1000 (W)
384-5103 (H)
250-1655 (cell)

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/1/98
Call Placed/Received by: Bill Owen
Spoke With: Donna Peck
Company/Affiliation: Town Clerk, City of Eads, CO
Phone no.: 719-438-5590
Project No.: D479-56

Comments:

- town population approximately 820
- east side of town has poor drainage, mainly because all water flows SE to one culvert that passes water under the railroad tracks
- east side is lower in elevation than the central section of Eads
- this area typically is flooded, with yards inundated & basements flooded
  → however home owners are aware of this & many have own pumps
- 1997 floods, Eads street department cut a trench across the road to divert water (East 13th Street)
- The City plans to construct a dip in this road to facilitate drainage for future storms
- The street department did close the road (using a backhoe) & cleaned the drains
- Kathy Eikenberg, Town Clerk in Hasuell (719) 436-2324

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/1/98
Call Placed/Received by: Bill Owen
Spoke With: Janet Frederick
Company/Affiliation: Kiowa County Commissioners office / Admin. Assist. Aide
Phone no.: 719-438-5810
Project No.: 0479-56

Comments:

- Some flooding occured in Eads and Haswell
  ↳ speak with Donna Peck in Eads

- frequent flooding typically occurs in the central + western part of the county
  ↳ however, substanial flooding only occurs every 5-10 years

- warning signs + road closures were put up the night + day after the floods

Signature Bill Owen

Kiowa County Commissioners

Commissioners
J.D. Wilson
Sheridan Lake, Colorado
Dutch Eikenberg
Haswell, Colorado
Cardon Berry
Lads, Colorado

1305 GOFF
P.O. BOX 591
EADS, COLORADO 81036
(719) 438-5810
(719) 438-5615
FAX (719) 438-5327

Commissioners Meet
Twice Monthly

May 12, 1998

Colorado Water Conservation Board
Bill Owen
721 State Centennial Building
1313 Sherman Street
Denver, CO 80203

Dear Bill,

Enclosed please find the 1997 flood documentation survey you requested. Our Road Commissioner filled out most of it. As I told you, we probably did not have a lot of useful information for you as our circumstances were a little different from those in the northeastern part of the state. Most of our work involved repairing damaged county roads.

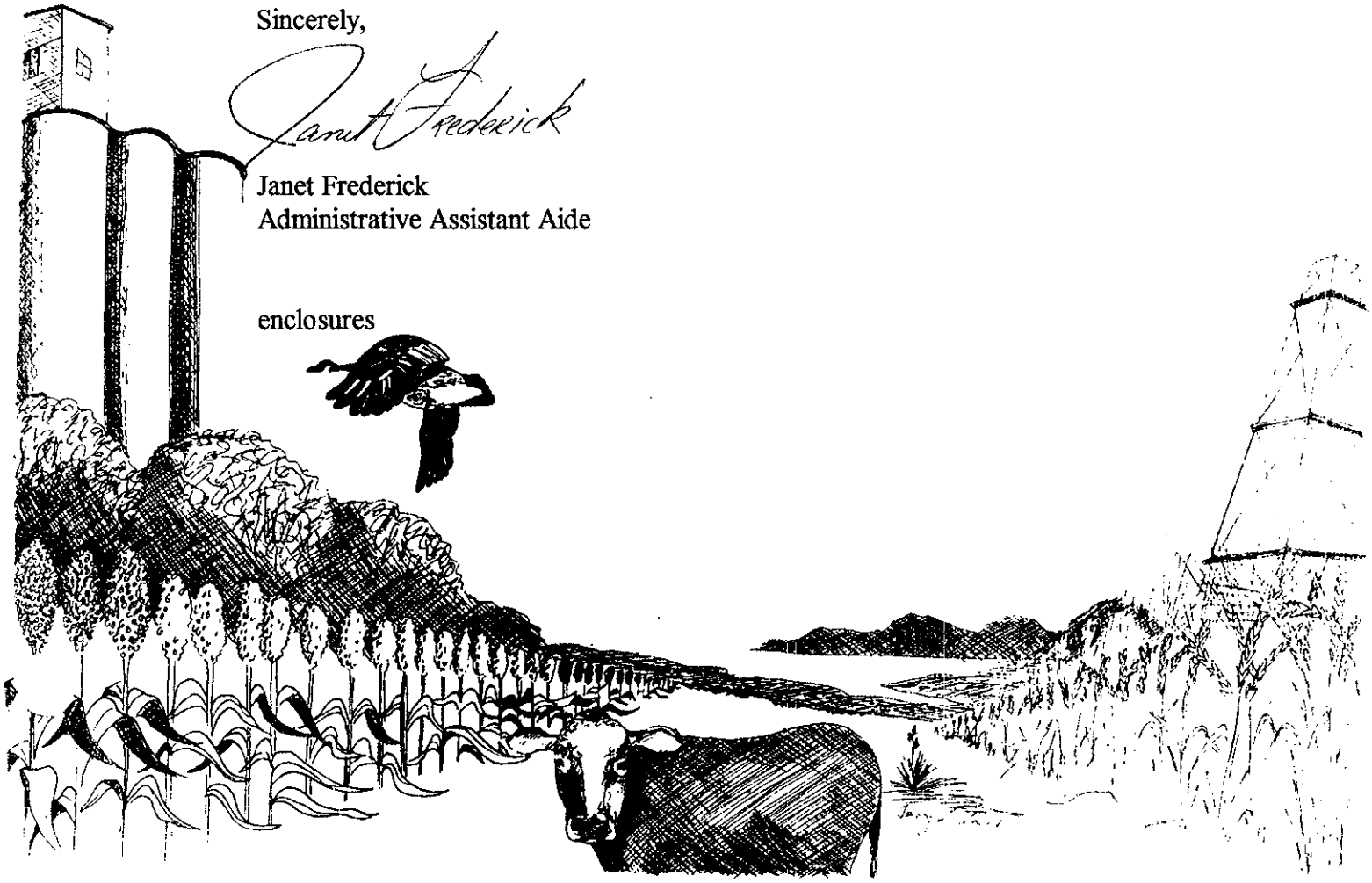
If you have any questions, or I can be of further assistance, please let me know.

Sincerely,

Janet Frederick

Janet Frederick
Administrative Assistant Aide

enclosures



COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY:
DATE:
SUBJECT: 1997 Flooding

INDIVIDUAL: Dutch Eikenberg
AFFILIATION:
PHONE #:

---

1. Affected streams and local drainages? (Eads area Dist 2) Sand Creek, [illegible] (Haswell Area Dist. 3) Adobee Creek, Mustang Creek, North Fork [illegible], Middle Fork Mustang Creek, South Fork Mustang Creek, Lara Arroyo, & John's Creek
2. Geographic extent of flooding? most all of the flooding occurred from [illegible] of range lands, some of problems started in [illegible] & Crowley Counties where these Creeks & Arroyos start.
3. Storm duration?
4. Rainfall amounts? Most all of the rainfall in this area fell in one week period. 3 rain gauges they had from [illegible] inches of rain.
5. Rainfall bucket surveys?

   None
6. Precipitation gauging network?

   None
7. Documentation of high water marks? The only documentation we have is bridges built in the early 1990's to the 100 year flood plans had debris stuck on top of the guard rails.

8. Estimated peak discharges? The Fort Lyon canal people claims that Adobe creek ran 17,000 acre feet of water into Adobe creek reservoir.

9. Estimated flood damages? $108,000.00

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.
Local (FEMA Grant) 15,[illegible] Labor
23,[illegible]
30,614
69,[illegible]

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.

12. Types and amounts of repair work after flooding? (Repairing) washed out) roads) and) installing) bridges) and) new) culverts.

13. Any previous/recent flood mitigation efforts that reduced damages?

None

14. Any future mitigation needs as a result of the flooding? We inserted Culverts where bridges should have went. Without sufficient funds what is one to do.

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

N/A

16. Do you have any photos and/or video available? Are the photos in digital format?

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.
We have maps pertaining to flood damage.

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)
NO

19. Is there any existing documentation regarding the flooding? just the maps and photos

20. Name of local newspaper? Do they have a web site?
Kiowa County [illegible] - www.ruralnet.net/[illegible]

21. Do you have an internet site? Do you know of any related local sites?
www.kiowacty.ruralnet.[illegible]

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Janet Frederick/Dutch Eikenberg

FAX NO.: (719) 438-5327

FROM: Bill Owen

DATE: April 2, 1998

NO. OF PAGES: We are sending 4 Page(s) (Including this Page)

SUBJECT: Questions concerning Kiowa Country 1997 flood

COMMENTS:

Janet:

I've attached a blank copy of the form I'm using to elicit information from county and city personnel in your area about the 1997 floods. I would appreciate any time you and Mr. Eikenberg might have to review and answer these questions. I look forward to hearing from you two soon.

Thanks again for your help in documenting the flooding events in Kiowa County.

Sincerely,

Bill Owen

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	4/2/98
Call Placed/Received by:	Bill Owen
Spoke With:	Janet Frederick
Company/Affiliation:	Kiowa County Commissioners office
Phone no.:	(719) 438-5810
Project No.:	D479 - 51

Comments:

Dutch Eikenberg, Kiowa County Commissioner, was in, but she accepted our offer to send her a fax of the questions we will be asking about the 1997 flooding in Kiowa County (fax number; 719-438-5327).

Ms. Frederick suggested that I contact other potential sources of flood information in the county:

1. Chris Sorenson ,editor of Kiowa County Press, at (719) 438-5800
2. Dean Loukonen, director of the NRCS in Kiowa County, at (719) 438-5414
3. Rod Johnson, office manager of the U.S. Farm Service Agency, at (719) 438-5851

Ms. Frederick said Dutch Eikenberg would call us back.

Signature Bill Owen

2. Federal Data

STATION (Climatological) HASWELL (River Station, if different) MONTH May 19 97

STATE COLORADO COUNTY KIOWA RIVER

TIME (local) OF OBSERVATION RIVER TEMP PRECIPITATION 7AM STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. 1 2 3 4 5 6 7 8 9 10 11 NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				0													
9				.02													
10				0													
11				0													
12				.12													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				.78													
20				0													
21				0													
22				T				X									
23				0													
24				0				X									
25				0													
26				.06													
27				T													
28				.03													
29				.07													
30				.01													
31				.02													
SUM			SUM	1.11		X											

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge at ___.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

	Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds
	X	X	X			

OBSERVER Frankie E. Stoker

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-3828-

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) HASWELL (River Station if different) | MONTH JUNE | 19 97

STATE | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 7 AM. | STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				00													
3				49													
4				0													
5				00													
6				0													
7				41				X									
8				17													
9				0				X									
10				22				X									
11				00													
12				0													
13				09													
14				00													
15				0													
16				73													
17				0													
18				00													
19				00													
20				00													
21				00													
22				00													
23				00													
24				00													
25				49													
26				0													
27				00													
28				00													
29				00													
30				00				X									
31																	
SUM			SUM	2.58													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Frankie E. Stokes

SUPERVISING OFFICE WSO PUEBLO; COLORADO

STATION INDEX NO 05-3828-1

STATION (Climatological) HASWELL (River Station, if different) MONTH July 19 97

STATE COLORADO COUNTY KIOWA RIVER

TIME (local) OF OBSERVATION RIVER TEMP. PRECIPITATION 7 A.M. STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0														
2				0														
3				0														
4				0														
5				0														
6				.03														
7				0														
8				0														
9				0														
10				0														
11				0														
12				.18														
13				0														
14				0														
15				0														
16				0														
17				0														
18				0				X										
19				0				X										
20				.16														
21				0														
22				0														
23				0														
24				0														
25				0														
26				0														
27				T														
28				T														
29				1.24				X										
30				.15				X										
31				0														
SUM			SUM	1.76														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge a
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Frankie E. Stoker

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-3828

STATION (Climatological) HASWELL (River Station if different)

MONTH August YR 97

STATE COLORADO COUNTY KIOWA RIVER

TIME (local) OF OBSERVATION RIVER TEMP PRECIPITATION 7AM STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0													
2				.10													
3				2.51													
4				0													
5				.75													
6				1.30			X										
7				.27			X										
8				0			X										
9				0													
10				0			X										
11				.17			X										
12				.09			X										
13				.15													
14				T			X										
15				0													
16				T			X										
17				0			X										
18				T			X										
19				0			X										
20				0													
21				0			X										
22				.04													
23				0													
24				0													
25				0													
26				0													
27				0													
28				0													
29				.13													
30				1.42													
31				.17													
SUM			SUM	7.10													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but o[illegible]ge.
C. Upper surf[illegible]th ice.
D. Ice gorge a[illegible].
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Frankie E Stoker

ISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-3828-1

STATION (Climatological) HASWELL (River Station, if different) | MONTH SEPT | 19 97

STATE COLORADO | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 7AM | STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				.03				X										
2				0				X										
3				T				X										
4				0				X										
5				0				X										
6				0														
7				0														
8				0														
9				0														
10				0				X										
11				0				X										
12				.02														
13				0														
14				0														
15				0														
16				0														
17				0														
18				0														
19				0														
20				.07														Mist (fine)
21				.14														
22				.23														
23				0														
24				0														
25				0														
26				0														
27				0														
28				0														
29				0														
30				0														
31																		
SUM			SUM	.32														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface [illegible] ooth ice.
D. Ice gorge at
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Frankie E. Stoker

SUPERVISING OFFICE WSO PUEBLO; COLORADO

STATION INDEX NO. 05-3828-[illegible]

STATION (Climatological) HASWELL (River Station, if different) | MONTH OCT | 19 97

STATE COLORADO | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 7AM | STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0														
2				0														
3				0														
4				0														
5				0														
6				0														
7				0														
8				.22														
9				0														
10				0														
11				0														
12				.68														
13				0														
14				0														
15				0														
16				0														
17				0														
18				0														
19				0														
20				0														
21				0														
22				0														
23				0														
24				0														
25				1.00	10	10												light rain then snow
26				.90	12	22												WIND ~5mph
27				0		17												5ft+ drifts
28				0		15												
29				0		10												
30				0		5												
31				0		T												
Sum			SUM	3.280														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of [illegible]
D. Ice gorge above
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Frankie E. Stoker

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-3828-1

STATION (Climatological) BRANDON (River Station, if different) | MONTH MAY | 19 97

STATE CO | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 07:00 | STANDARD TIME IN USE MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A M NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0														
2				0														
3				0														
4				0														
5				0														
6				0														
7				0														
8				0														
9				0														
10				0														
11				0														
12				.24														
13				0														
14				0														
15				0														
16				0														
17				0														
18				0														
19				.19														
20				0														
21				0														
22				0														
23				.14														
24				0														
25				0														
26				0														
27				0														
28				.10														
29				.08														
30				0														
31				0														
SUM			SUM	.76	✓													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel. | Glaze | Thund | Hail | Dam. Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge ab
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER GARY HEDKE

SUPERVISING OFFICE WSFO DENVER

STATION INDEX NO 05-0895-1

STATION (Climatological) BRANDON (River Station, If different)

MONTH JUNE 19 97

STATE CO

COUNTY KIOWA

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP.

PRECIPITATION 07:00

STANDARD TIME IN USE M

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)
1				0		
2				0		
3				.23		
4				0		
5				0		
6				0		
7			0	~~1.46~~		
8				1.86		
9				.04		
10				.01		
11				0		
12				0		
13				.21		
14				0		
15				0		
16				.21		
17				0		
18				0		
19				.07		
20				0		
21				0		
22				0		
23				0		
24				0		
25				.48		
26				0		
27				0		
28				0		
29				0		
30				0		
31						
SUM			SUM	3.11		

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above

RIVER STAGE

CONDITION	GAGE READING AT ___ A.M.	TENDENCY

REMARKS (Special observations, etc.)

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge abov
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds

OBSERVER GARY HEDKE

SUPERVISING OFFICE USFO DENVER

STATION INDEX NO. 05-0895-1

STATION (Climatological)	BRANDON (River Station, if different)	MONTH	JULY	19	97
STATE	CO.	COUNTY	KIOWA	RIVER	
TIME (local) OF OBSERVATION		TEMP.	PRECIPITATION 07:00	STANDARD TIME IN USE	M
TYPE OF RIVER GAGE		ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.	

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0													
2				0													
3				0													
4				0													
5				0													
6				1.14													
7				0													
8				0													
9				0													
10				0													
11				0													
12				0													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				0													
20				1.37													
21				0													
22				0													
23				0													
24				0													
25				0													
26				0													
27				0													
28				.68													
29				1.12													
30				1.04													
31				0													
SUM			SUM	4.35													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge abc
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER GARY HEDKE

SUPERVISING OFFICE WSFO DENVER

STATION INDEX NO. 05-0895-1

STATION (Climatological) BRANDON (River Station, if different) | MONTH AUG | 19 97

STATE CO. | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP | PRECIPITATION 0700 | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0														
2				0														
3				.65														
4				0														
5				.72														
6				2.74														
7				0														
8				0														
9				0														
10				0														
11				.24														
12				.10														
13				.05														
14				0														
15				0														
16				0														
17				0														
18				0														
19				0														
20				0														
21				0														
22				0														
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30				.29														
31				.69														
SUM			SUM	5.48														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund.	Hail	Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface [illegible]th ice.
D. Ice gorge ab[illegible]
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER GARY HEDKE

SUPERVISING OFFICE NSFO DENVER

STATION INDEX NO 05-0895-1

STATION (Climatological) BRANDON (River Station, if different) | MONTH SEPT 19 97

STATE CO. | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 07:00 | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (∿∿∿) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0														
2				0														
3				0														
4				0														
5				0														
6				0														
7				0														
8				0														
9				0														
10				0														
11				0														
12				.07														
13				0														
14				0														
15				0														
16				0														
17				0														
18				0														
19				0														
20				0														
21				0														
22				.88														
23				0														
24				0														
25				0														
26				0														
27				0														
28				0														
29				0														
30				0														
31																		
SUM			SUM	1.95														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge ab
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds

OBSERVER GARY HEDRE

SUPERVISING OFFICE USFO DENVER

STATION INDEX NO. 05-0895-1

STATION (Climatological) BRANDON (River Station, if different) | MONTH OCT | 19 97

STATE CO. | COUNTY KIOWA | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 07:00 | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc..)
1				0														
2				0														
3				0														
4				0														
5				0														
6				0														
7				0														
8				.10														
9				0														
10				0														
11				0														
12				1.13														
13				0														
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26				1.18														
27																		GAUGE UNDER 12 FOOT DRIFT
28																		
29																		
30																		
31																		
SUM			SUM	2.41														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER GARY HEDKE

SUPERVISING OFFICE SFO DENVER

STATION INDEX NO. 05-0895-1

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

--- PROCESSING DATE/TIME ---

1998 JUN 12 13:10:07

--- PROCESSING OPTIONS ---

Plot option	= None
Basin char output	= WATSTORE
Print option	= Yes
Debug print	= No
Input peaks listing	= Long
Input peaks format	= WATSTORE peak file

1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

Station - 07134100 BIG SANDY CREEK NEAR LAMAR, CO.
1998 JUN 12 13:10:07

I N P U T D A T A S U M M A R Y

Number of peaks in record	=	16
Peaks not used in analysis	=	0
Systematic peaks in analysis	=	16
Historic peaks in analysis	=	0
Years of historic record	=	0
Generalized skew	=	-0.097
Standard error of generalized skew	=	0.550
Skew option	=	WEIGHTED
Gage base discharge	=	0.0
User supplied high outlier threshold	=	--
User supplied low outlier criterion	=	--
Plotting position parameter	=	0.00

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE.		0.0
WCF195I-NO LOW OUTLIERS WERE DETECTED BELOW CRITERION.		35.0
WCF162I-SYSTEMATIC PEAKS EXCEEDED HIGH-OUTLIER CRITERION.	1	2471.8

1

Station - 07134100 BIG SANDY CREEK NEAR LAMAR, CO.
1998 JUN 12 13:10:07

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	2.4685	0.4057	0.091
BULL.17B ESTIMATE	0.0	1.0000	2.4685	0.4057	-0.004

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	'EXPECTED PROBABILITY' ESTIMATE	95-PCT CONFIDENCE LIMITS FOR BULL. 17B ESTIMATES LOWER	UPPER
0.9950	26.4	28.7	17.1	8.5	50.8
0.9900	33.4	35.7	23.9	11.8	61.3
0.9500	63.2	64.9	54.3	28.4	103.8
0.9000	88.8	89.7	80.8	44.9	138.7
0.8000	134.0	133.5	127.8	76.8	200.2
0.5000	294.3	290.0	294.3	196.7	440.3
0.2000	645.7	642.7	677.1	432.3	1127.0
0.1000	973.2	982.2	1069.0	623.3	1927.0
0.0400	1507.0	1553.0	1792.0	903.9	3475.0
0.0200	1999.0	2096.0	2558.0	1142.0	5118.0
0.0100	2577.0	2750.0	3593.0	1405.0	7269.0
0.0050	3250.0	3533.0	4998.0	1695.0	10040.0
0.0020	4307.0	4799.0	7679.0	2123.0	14870.0

1

Station - 07134100 BIG SANDY CREEK NEAR LAMAR, CO.
1998 JUN 12 13:10:07

I N P U T D A T A L I S T I N G

WATER YEAR	DISCHARGE	CODES	WATER YEAR	DISCHARGE	CODES
1968	227.0		1976	2520.0	
1969	330.0		1977	720.0	
1970	209.0		1978	355.0	
1971	568.0		1979	317.0	
1972	205.0		1980	304.0	
1973	254.0		1981	43.0	
1974	73.0		1982	138.0	
1975	601.0		1996	419.0	

Explanation of peak discharge qualification codes

PEAKFQ CODE	WATSTORE CODE	DEFINITION
D	3	Dam failure, non-recurrent flow anomaly
G	8	Discharge greater than stated value
X	3+8	Both of the above

L	4	Discharge less than stated value
K	6 OR C	Known effect of regulation or urbanization
H	7	Historic peak

1

Station - 07134100 BIG SANDY CREEK NEAR LAMAR, CO.
1998 JUN 12 13:10:07

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

WATER YEAR	RANKED DISCHARGE	SYSTEMATIC RECORD	BULL.17B ESTIMATE
1976	2520.0	0.0588	0.0588
1977	720.0	0.1176	0.1176
1975	601.0	0.1765	0.1765
1971	568.0	0.2353	0.2353
1996	419.0	0.2941	0.2941
1978	355.0	0.3529	0.3529
1969	330.0	0.4118	0.4118
1979	317.0	0.4706	0.4706
1980	304.0	0.5294	0.5294
1973	254.0	0.5882	0.5882
1968	227.0	0.6471	0.6471
1970	209.0	0.7059	0.7059
1972	205.0	0.7647	0.7647
1982	138.0	0.8235	0.8235
1974	73.0	0.8824	0.8824
1981	43.0	0.9412	0.9412

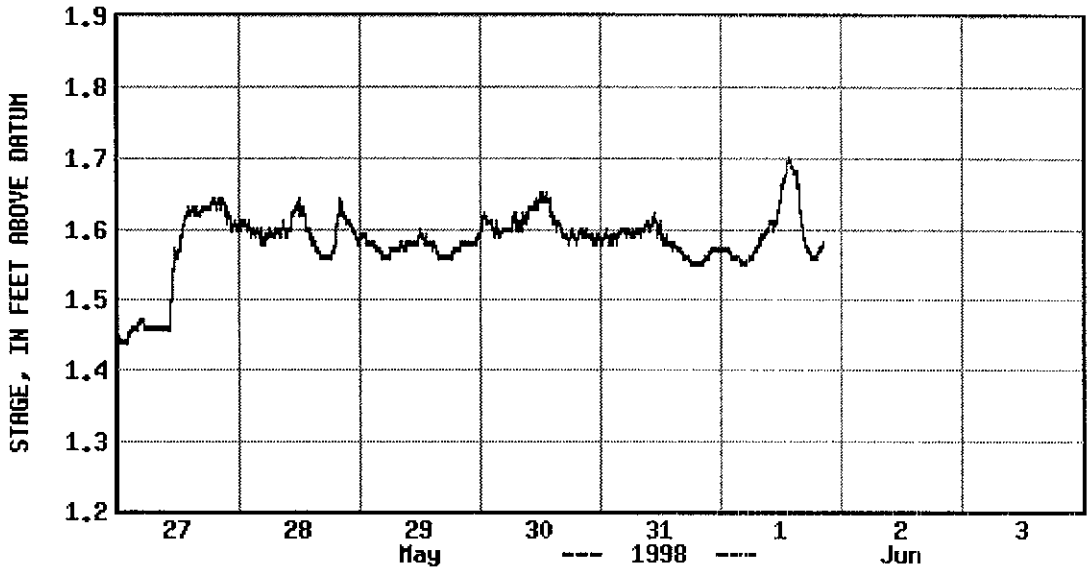
1

U. S. GEOLOGICAL SURVEY
ANNUAL PEAK FLOW FREQUENCY ANALYSIS
Following Bulletin 17-B Guidelines
Program peakfq
(Version 2.4, Apr, 1998)

End PEAKFQ analysis.

Stations processed	:	1
Number of errors	:	0
Stations skipped	:	0
Station years	:	16

Unrecognized CARD type. Must be Y,Z,N,H,I,2,3,4, or *.



- Data used in graphs
- Historical daily mean data for this station
- Complete station data for previous water year
- Map of region surrounding station
- Return to Current Streamflow Conditions table

Station Description

STATION.--07134100 BIG SANDY CREEK NEAR LAMAR, CO.

LOCATION.--Lat 38°06'51", long 102°29'00", in SW1/4SW1/4 sec. 21, T.22 S., R.45 W., Prowers County, Hydrologic Unit 11020011, on right bank 35 ft upstream from State Highway 196, 950 ft upstream from mouth, and 7.5 mi east of Lamar.

DRAINAGE AREA.--3,248 mi2.

PERIOD OF RECORD.-- February 1968 to September 1982, July 1995 to current year.

REVISED RECORDS.--WDR CO-71-1: Drainage area.

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 3,545 ft above sea level, from topographic map.

REMARKS.--Records good except for estimated daily discharges and those above 100 ft3/s, which are poor. Natural flow of stream affected by diversions above station for irrigation and return flow from irrigated areas. Several measurements of specific conductance and water temperature were obtained and published in the "Supplemental Water-Quality Data For Gaging Stations" sectic this report.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Aug. 21, 1965, reached a stage of 9.93 ft from floodmarks, discharge not determined.

Daily Mean Flow Statistics for 06/01 based on 16 years of record, in ft^3/s

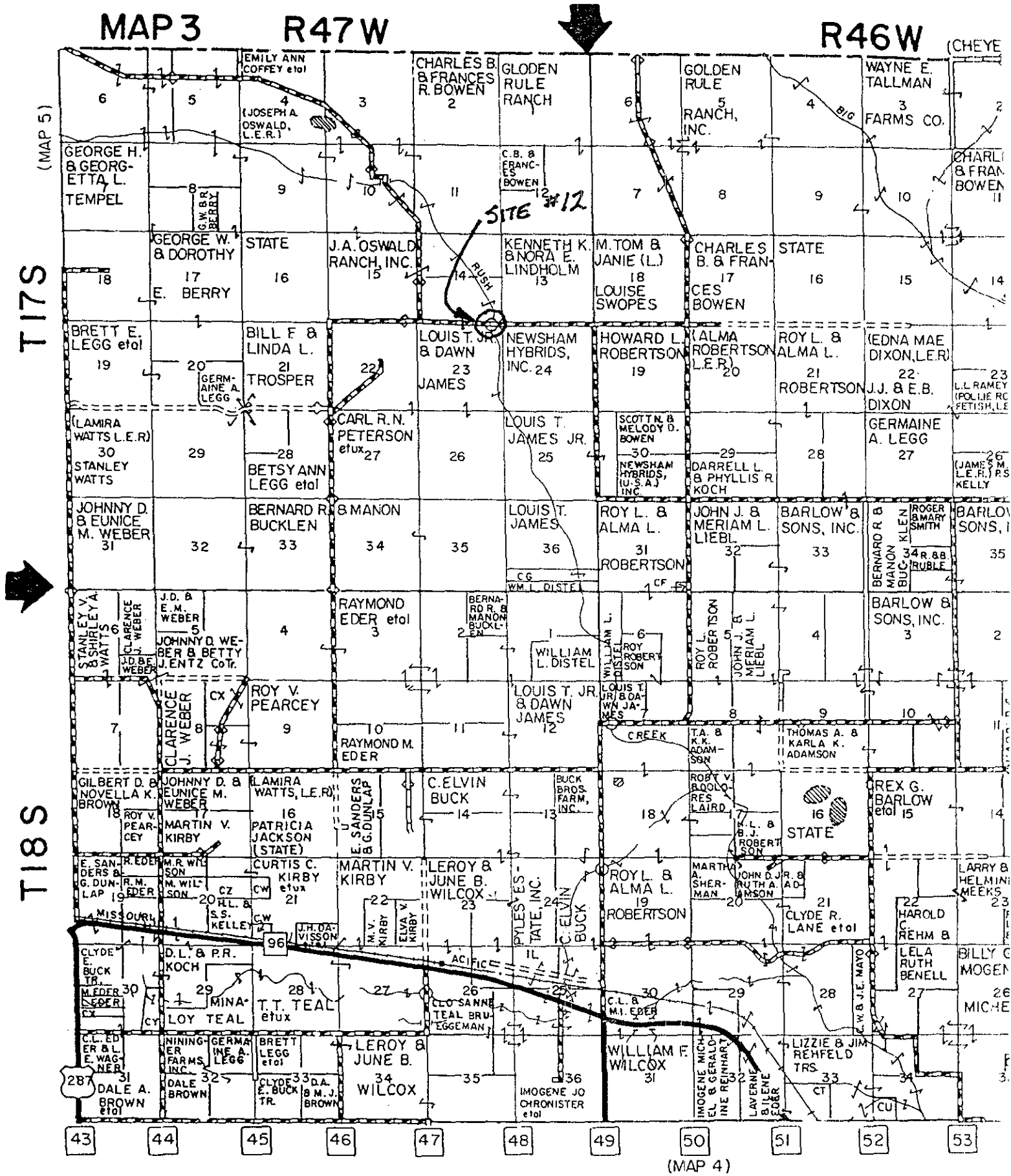
Latest flow 06/01 12:30	Minimum	Mean	Maximum	80 percent exceedance	50 percent exceedance	20 percent exceedance
19	.75	14	56	4.56	8.85	17.2
Percent exceedance means that 80, 50, or 20 percent of all daily mean flows for 06/01 have been greater than the value shown.						

Maintained by: WebMaster@maildcolka.cr.usgs.gov
Hydrologic Information: co.data@maildcolka.cr.usgs.gov
Realtime Water Data page URL: http://nwis-colo.cr.usgs.gov/
Colorado District Home page URL: http://webserver.cr.usgs.gov/

Please direct questions or comments to:

District Chief
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225
Telephone: (303) 236-4882, ext. 258
Fax: (303) 236-4912
Office hours: 8:00 a.m. to 4:30 p.m. Mountain Time

3. General Maps and Information


MAP 3
R47W
R46W
T17S
T18S
(MAP 5)
(MAP 4)
SITE #12
RUSH
BIG
CREEK
MISSOURI PACIFIC
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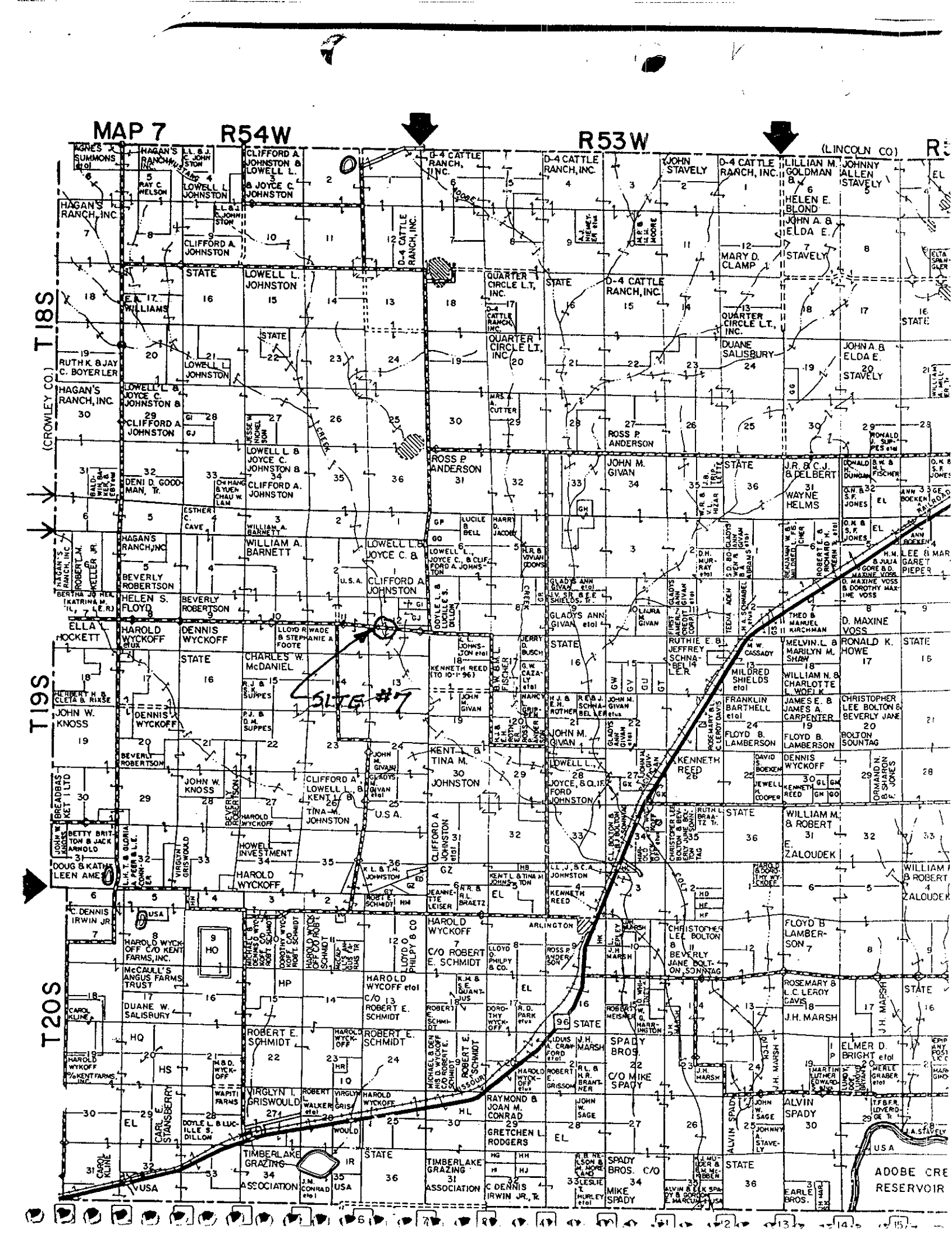
MAP 7
R54W
R53W
(LINCOLN CO)
(CROWLEY CO.)
T18S
T19S
T20S
SLTG #7
HAGAN'S RANCH, INC.
D-4 CATTLE RANCH, INC.
QUARTER CIRCLE L.T., INC.
JOHN STAVELY
LILLIAN M. GOLDMAN & HELEN E. BLOND
JOHNNY ALLEN STAVELY
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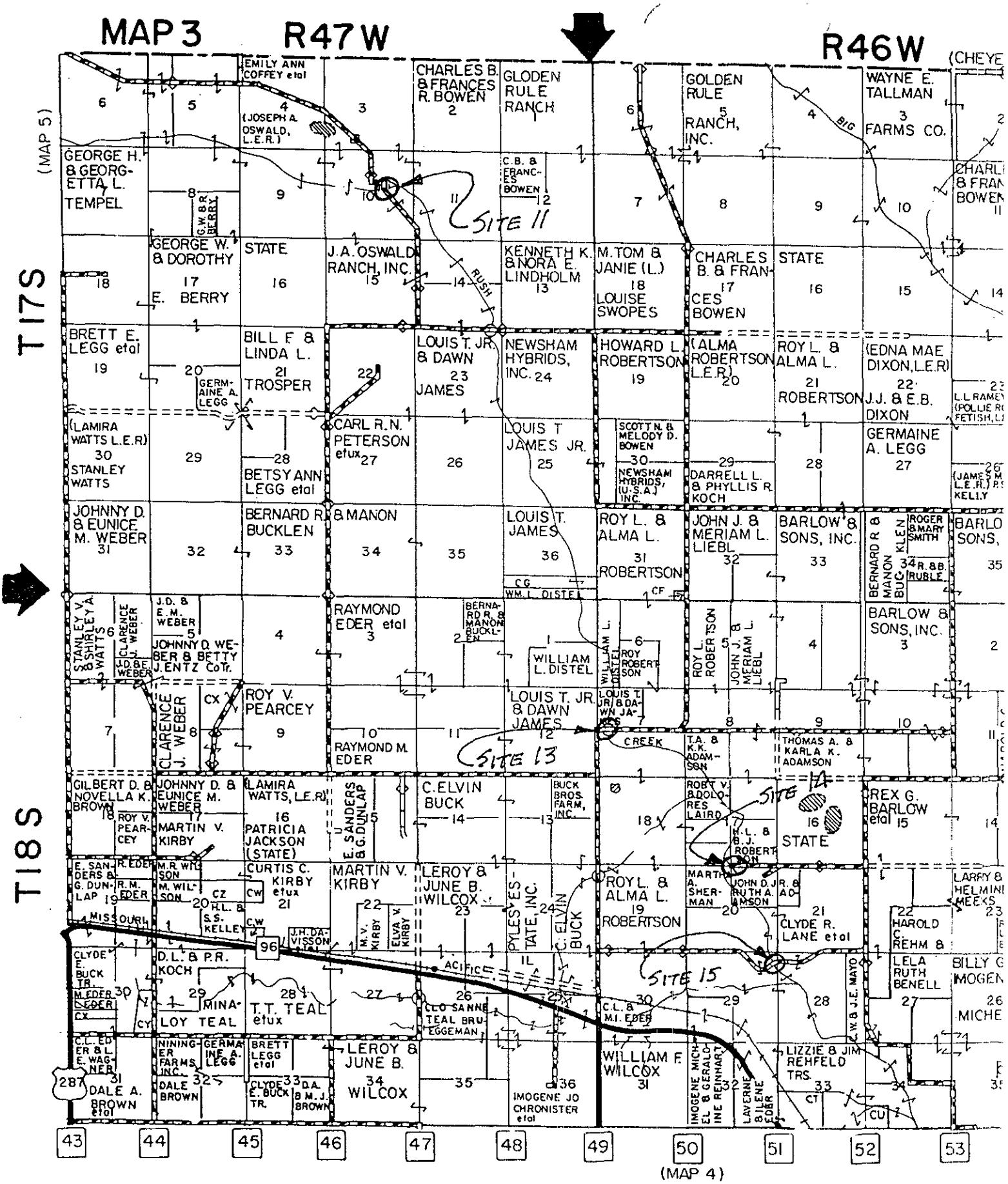
RAYMOND & JOAN M. CONRAD
GRETCHEN L. RODGERS
C. DENNIS IRWIN JR.
SPADY BROS. C/O MIKE SPADY
ALVIN SPADY
ELMER D. BRIGHT et al
ADOBE CRE
RESERVOIR
STATE
USA


MAP 3
R47W
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T17S
T18S
(MAP 5)
(MAP 4)
SITE 11
SITE 13
SITE 15
SITE
EMILY ANN COFFEY etal
(JOSEPH A. OSWALD, L.E.R.)
CHARLES B. & FRANCES R. BOWEN
GLODEN RULE RANCH
GOLDEN RULE RANCH, INC.
WAYNE E. TALLMAN FARMS CO.
GEORGE H. & GEORGETTA L. TEMPEL
GEORGE W. & DOROTHY E. BERRY
STATE
J.A. OSWALD RANCH, INC.
KENNETH K. & NORA E. LINDHOLM
M.TOM & JANIE (L.) LOUISE SWOPES
CHARLES B. & FRANCES BOWEN
BRETT E. LEGG etal
BILL F. & LINDA L. TROSPER
GERMAINE A. LEGG
LOUIS T. JR. & DAWN JAMES
NEWSHAM HYBRIDS, INC.
HOWARD L. ROBERTSON
(ALMA ROBERTSON L.E.R.)
ROY L. & ALMA L. ROBERTSON
(EDNA MAE DIXON, L.E.R.)
J.J. & E.B. DIXON
(LAMIRA WATTS L.E.R.) STANLEY WATTS
CARL R.N. PETERSON etux
BETSY ANN LEGG etal
LOUIS T. JAMES JR.
SCOTT N. & MELODY D. BOWEN
NEWSHAM HYBRIDS, (U.S.A.) INC.
DARRELL L. & PHYLLIS R. KOCH
GERMAINE A. LEGG
JOHNNY D. & EUNICE M. WEBER
BERNARD R. & MANON BUCKLEN
LOUIS T. JAMES
ROY L. & ALMA L. ROBERTSON
JOHN J. & MERIAM L. LIEBL
BARLOW & SONS, INC.
ROGER & MARY SMITH
R. & B. RUBLE
STANLEY V. & SHIRLEY A. WATTS
CLARENCE J. WEBER
J.D. & E.M. WEBER
JOHNNY D. WEBER & BETTY J. ENTZ CoTr.
J.D. & E. WEBER
RAYMOND EDER etal
WILLIAM L. DISTEL
ROY L. ROBERTSON
JOHN J. & MERIAM L. LIEBL
BARLOW & SONS, INC.
ROY V. PEARCEY
LOUIS T. JR. & DAWN JAMES
RAYMOND M. EDER
CREEK
T.A. & K.K. ADAMSON
THOMAS A. & KARLA K. ADAMSON
GILBERT D. & NOVELLA K. BROWN
ROY V. PEARCEY
JOHNNY D. & EUNICE M. WEBER
MARTIN V. KIRBY
LAMIRA WATTS, L.E.R.
PATRICIA JACKSON (STATE)
E. SANDERS & G. DUNLAP
C. ELVIN BUCK
BUCK BROS. FARM, INC.
ROBT V. & DOLORES LAIRD
H.L. & B.J. ROBERTSON
STATE
REX G. BARLOW etal
E. SANDERS & G. DUNLAP
R. EDER
R.M. EDER
M.R. WILSON
M. WILSON
CURTIS C. KIRBY etux
MARTIN V. KIRBY
LEROY & JUNE B. WILCOX
PYLES-TATE, INC.
ROY L. & ALMA L. ROBERTSON
MARTHA A. SHERMAN
JOHN D. JR. & RUTH A. AMSON
CLYDE R. LANE etal
HAROLD C. REHM &
LARRY & HELMINI MEEKS
R.L. & S.S. KELLEY
J.H. DAVISSON
M.V. KIRBY
ELVA V. KIRBY
MISSOURI
96
ACIFIC
CLYDE E. BUCK TR.
D.L. & P.R. KOCH
MINA-LOY TEAL
T.T. TEAL etux
LEO SANNE TEAL BRUEGGEMAN
C.L. & M.I. EDER
LELA RUTH BENELL
BILLY G. IMOGEN
MICHE
C.L. EDER & L. WAGNER
287
DALE A. BROWN etal
NINNIGER FARMS, INC.
GERMAINE A. LEGG
BRETT LEGG etal
DALE BROWN
CLYDE E. BUCK TR.
D.A. & M.J. BROWN
LEROY & JUNE B. WILCOX
IMOGENE JO CHRONISTER etal
WILLIAM F. WILCOX
IMOGENE MICHEL & GERALDINE REINHART
LAVERNE & ILENE EDER
LIZZIE & JIM REHFELD TRS.
C.W. & J.E. MAYO
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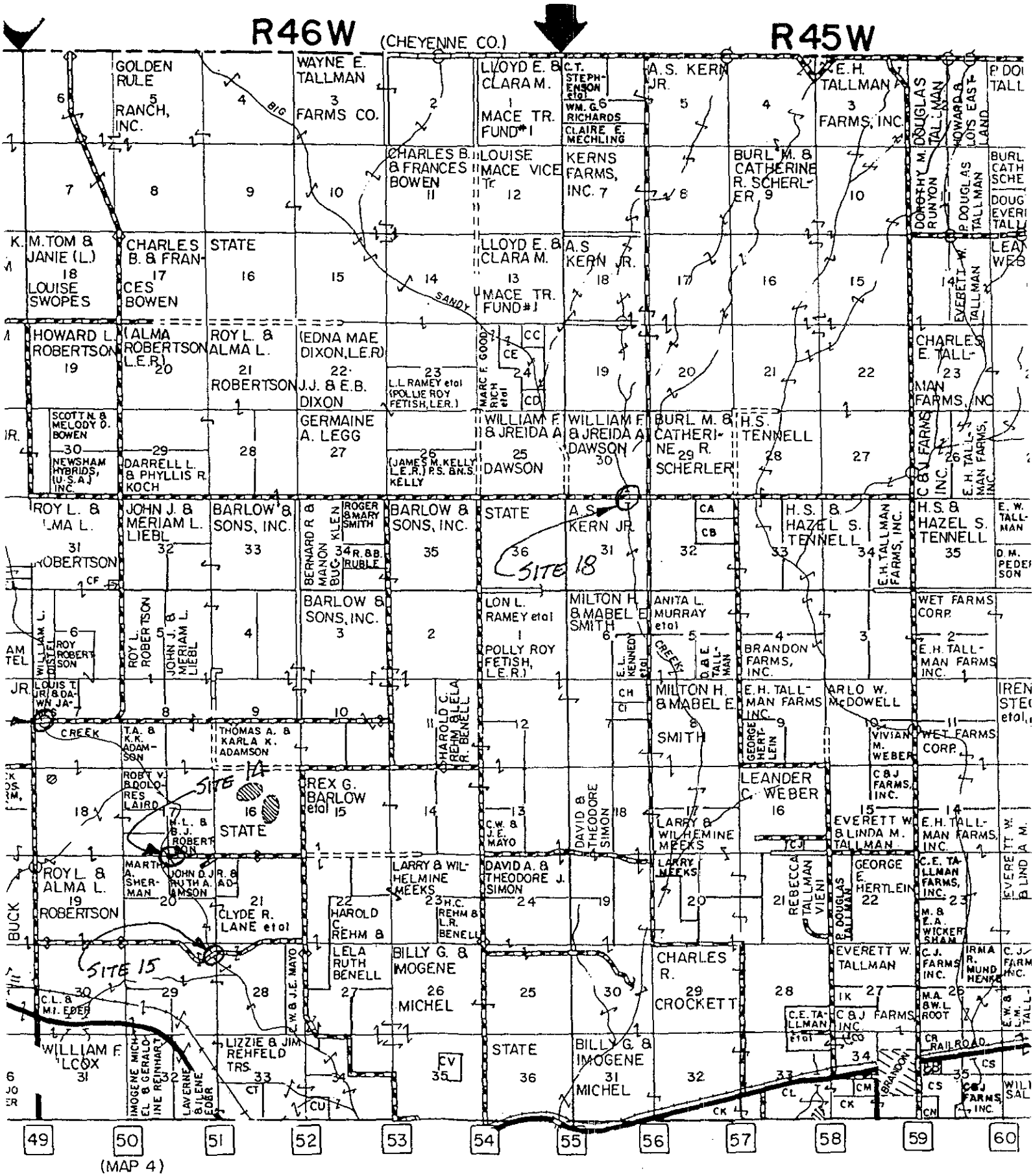
R46W
(CHEYENNE CO.)
R45W
GOLDEN RULE RANCH, INC.
WAYNE E. TALLMAN FARMS CO.
LLOYD E. & CLARA M. MACE TR. FUND #1
C.T. STEPHENSON etal
WM. G. RICHARDS
CLAIRE E. MECHLING
A.S. KERN JR.
E.H. TALLMAN FARMS, INC.
DOUGLAS TALLMAN
HOWARD & LOIS EAST LAND
CHARLES B. & FRANCES BOWEN
LOUISE MACE VICE Tr
KERNS FARMS, INC.
BURL M. & CATHERINE R. SCHERLER
DOROTHY M. RUNYON
P. DOUGLAS TALLMAN
K.M. TOM & JANIE (L.) LOUISE SWOPES
CHARLES B. & FRANCES BOWEN
STATE
LLOYD E. & CLARA M. MACE TR. FUND #1
A.S. KERN JR.
EVERETT W. TALLMAN
HOWARD L. ROBERTSON
(ALMA ROBERTSON L.E.R.)
ROY L. & ALMA L. ROBERTSON
(EDNA MAE DIXON, L.E.R.)
J.J. & E.B. DIXON
L.L. RAMEY etal (POLLIE ROY FETISH, L.E.R.)
MARC F. GOOD RICH etal
CHARLES E. TALLMAN FARMS, INC.
SCOTT N. & MELODY D. BOWEN
NEWSHAM HYBRIDS, (U.S.A.) INC.
DARRELL L. & PHYLLIS R. KOCH
GERMAINE A. LEGG
(JAMES M. KELLY L.E.R.) P.S. & N.S. KELLY
WILLIAM F. & JREIDA A. DAWSON
BURL M. & CATHERINE R. SCHERLER
H.S. TENNELL
C & J FARMS INC.
E.H. TALLMAN FARMS, INC.
ROY L. & ALMA L. ROBERTSON
JOHN J. & MERIAM L. LIEBL
BARLOW & SONS, INC.
ROGER & MARY SMITH
BERNARD R. & MANON BUCKLEN
R.B.B. RUBLE
BARLOW & SONS, INC.
STATE
A.S. KERN JR.
SITE 18
H.S. & HAZEL S. TENNELL
E.H. TALLMAN FARMS, INC.
D.M. PEDERSON
BARLOW & SONS, INC.
LON L. RAMEY etal
POLLY ROY FETISH, L.E.R.
MILTON H. & MABEL E. SMITH
ANITA L. MURRAY etal
BRANDON FARMS, INC.
E.H. TALLMAN FARMS INC.
WET FARMS CORP.
WILLIAM L. DISTEL
ROY L. ROBERTSON
JOHN J. & MERIAM L. LIEBL
LOUIS T. JR. & DAWN JAMES
E.L. KENNEDY etal
D & E TALLMAN
CREEK
MILTON H. & MABEL E. SMITH
E.H. TALLMAN FARMS INC.
CARLO W. McDOWELL
WET FARMS CORP.
T.A. & K.K. ADAMSON
THOMAS A. & KARLA K. ADAMSON
HAROLD C. REHM & LELA R. BENELL
GEORGE HERTLEIN
VIVIAN M. WEBER
ROBT V. & DOLORES LAIRD
SITE 14
REX G. BARLOW etal
STATE
C.W. & J.E. MAYO
DAVID & THEODORE SIMON
LEANDER C. WEBER
C & J FARMS, INC.
M.L. & B.J. ROBERTSON
LARRY & WILHEMINE MEEKS
EVERETT W. & LINDA M. TALLMAN
E.H. TALLMAN FARMS, INC.
ROY L. & ALMA L. ROBERTSON
MARTHA A. SHERMAN
JOHN D. JR. & RUTH A. ADAMSON
CLYDE R. LANE etal
HAROLD C. REHM & H.C. REHM & L.R. BENELL
LARRY & WILHELMINE MEEKS
DAVID A. & THEODORE J. SIMON
LARRY MEEKS
REBECCA TALLMAN VIENI
DOUGLAS TALLMAN
GEORGE E. HERTLEIN
C.E. TALLMAN FARMS, INC.
M. & E.A. WICKERSHAM
SITE 15
LELA RUTH BENELL
BILLY G. & IMOGENE MICHEL
CHARLES R. CROCKETT
EVERETT W. TALLMAN
C.J. FARMS INC.
IRMA R. MUNDHENKE
C.L. & M.I. EDER
C.E. TALLMAN etal
C & J FARMS INC.
M.A. & W.L. ROOT
WILLIAM F. LCOX
LIZZIE & JIM REHFELD TRS.
STATE
BILLY G. & IMOGENE MICHEL
CR RAILROAD
C & J FARMS, INC.
IMOGENE MICH EL & GERALDINE REINHART
LAVERNE & ILENE EDER
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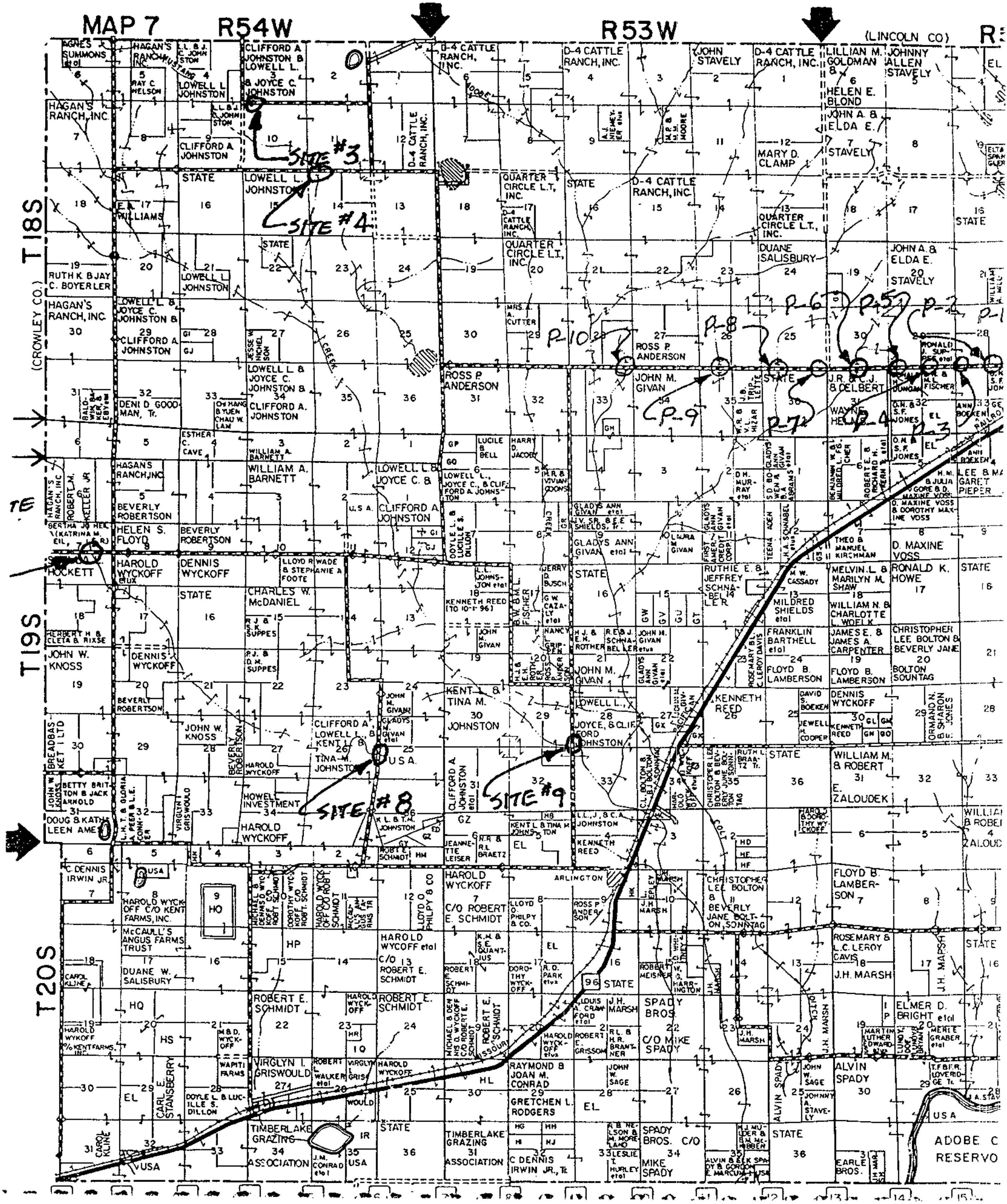
(MAP 4)


MAP 7
R54W
R53W
(LINCOLN CO)
(CROWLEY CO.)
T18S
T19S
T20S
SITE #3
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SITE #9
P-1
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HAGAN'S RANCH, INC.
CLIFFORD A. JOHNSTON
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MILDRED SHIELDS
FRANKLIN BARTHELL
FLOYD B. LAMBERSON
JAMES E. & JAMES A. CARPENTER
CHRISTOPHER LEE BOLTON & BEVERLY JANE
BOLTON SOUNTAG
D. MAXINE VOSS
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WILLIAM N. & CHARLOTTE L. WOELK
WILLIAM M. & ROBERT E. ZALOUDEK
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GRETCHEN L. RODGERS
SPADY BROS.
C/O MIKE SPADY
J.H. MARSH
ROSEMARY & C. LEROY CAVIS
ELMER D. BRIGHT etal
ALVIN SPADY
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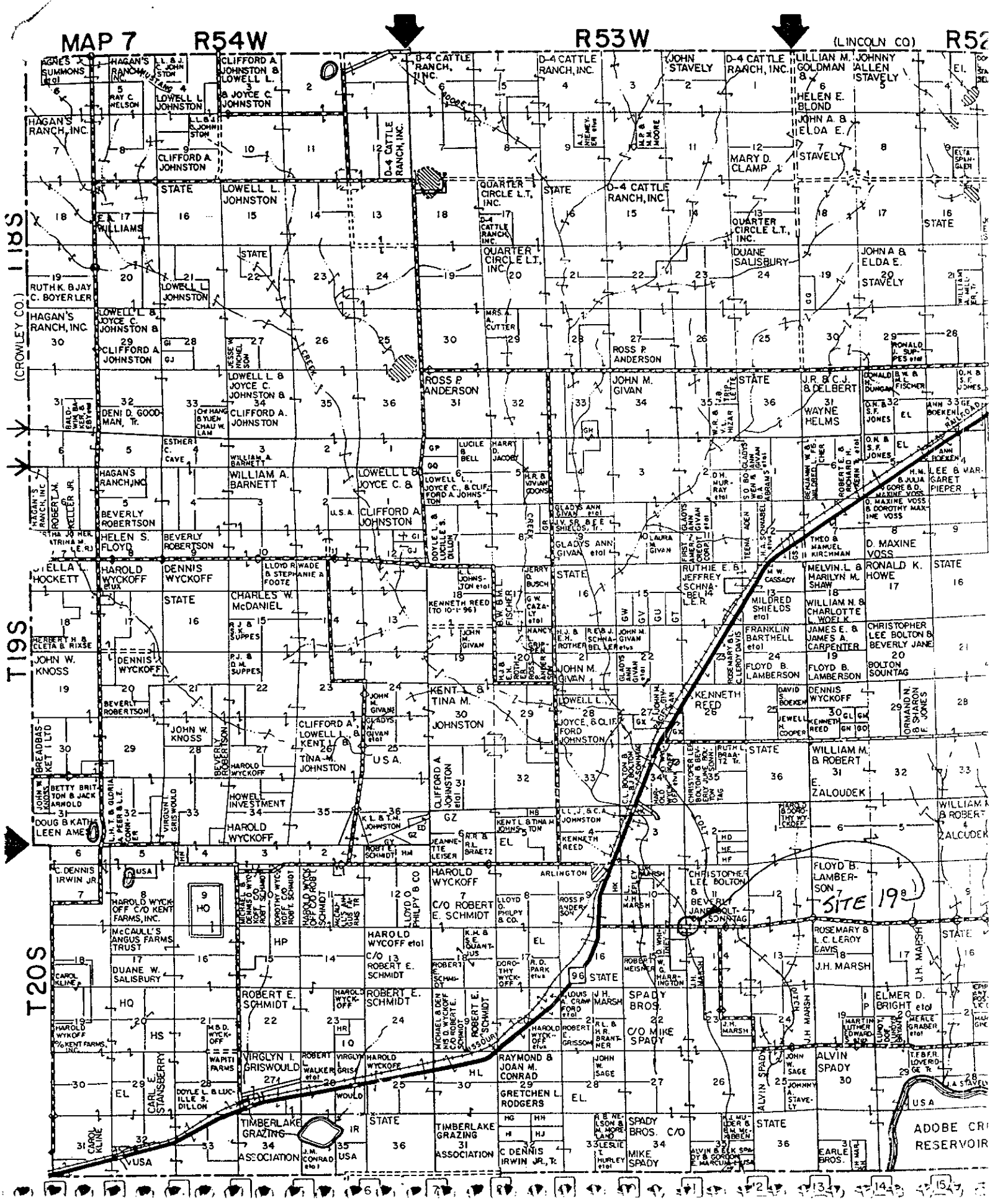
CAROL KLINE
CARL E. STANSBERRY
ARLINGTON
ADOBE C
RESERVO
STATE
USA
96


MAP 7
R54W
R53W
(LINCOLN CO)
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T19S
T20S
(CROWLEY CO.) 115
HAGAN'S RANCH, INC.
D-4 CATTLE RANCH, INC.
QUARTER CIRCLE L.T., INC.
CLIFFORD A. JOHNSTON & LOWELL L. & JOYCE C. JOHNSTON
LOWELL L. JOHNSTON
LOWELL L. & JOYCE C. JOHNSTON
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HAROLD WYCKOFF etal C/O 13 ROBERT E. SCHMIDT
VIRGLYN I. GRISWOULD
TIMBERLAKE GRAZING ASSOCIATION
RAYMOND & JOAN M. CONRAD
GRETCHEN L. RODGERS
C DENNIS IRWIN JR., Tr.
SPADY BROS.
C/O MIKE SPADY
ALVIN SPADY
ELMER D. BRIGHT etal
ROSEMARY & L.C. LEROY DAVIS
J.H. MARSH
CHRISTOPHER LEE BOLTON & BEVERLY JANE SONNTAG
FLOYD B. LAMBERSON
WILLIAM M. & ROBERT E. ZALOUDEK
KENNETH REED
JAMES E. & JAMES A. CARPENTER
FRANKLIN BARTHELL etal
MILDRED SHIELDS etal
MELVIN L. & MARILYN M. SHAW
WILLIAM N. & CHARLOTTE L. WOELK
RONALD K. & HOWE
D. MAXINE VOSS
LEE & MARGARET PIEPER
BOLTON SOUNTAG
ORMAND N. & SHARON JONES
DENNIS WYCKOFF
JEWELL COOPER
GLADYS ANN GIVAN etal
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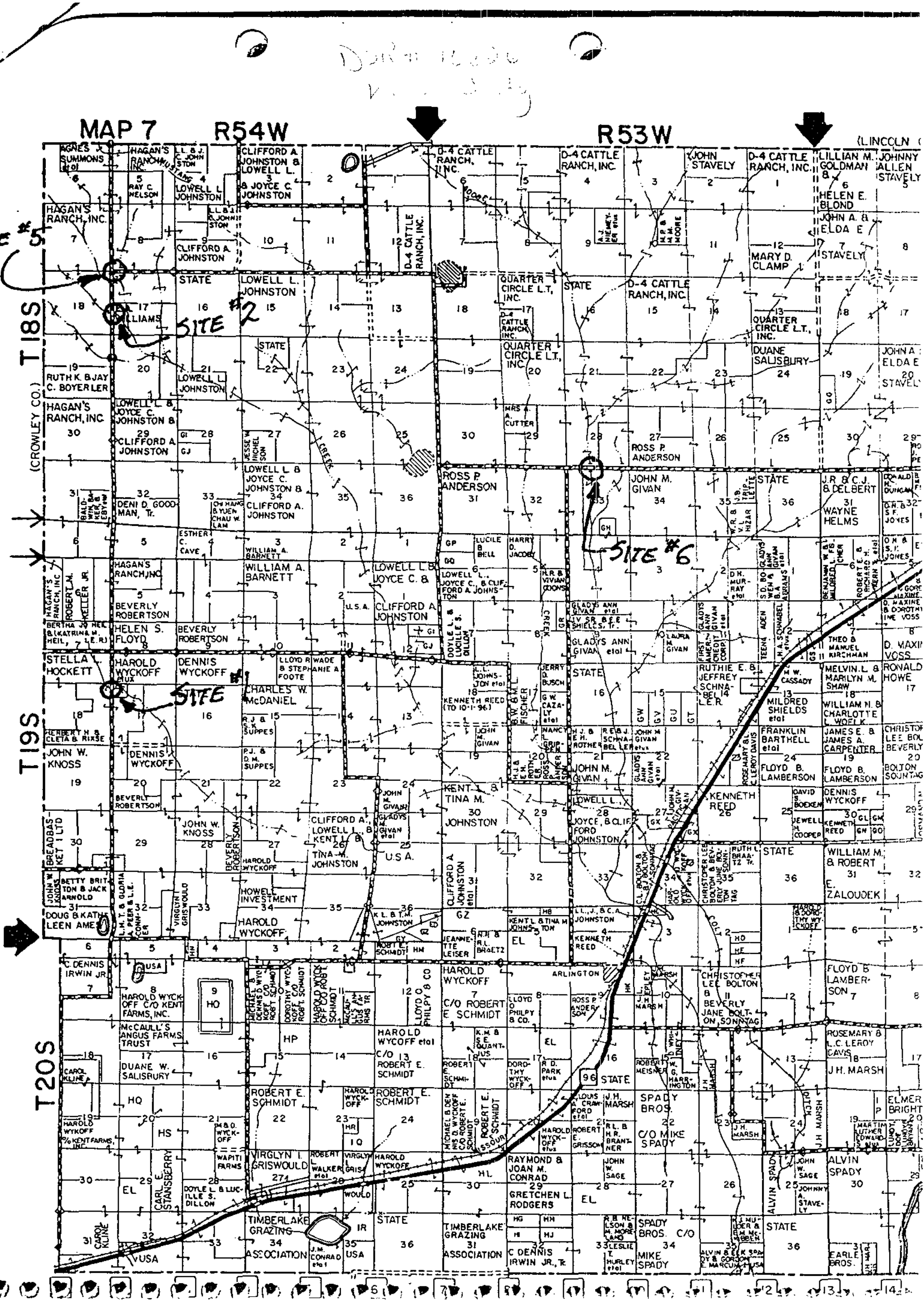
THEO & MANUEL KIRCHMAN
ADOBE CR
RESERVOIR
SITE 19
USA


MAP 7
R54W
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T18S
T19S
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SITE #5
SITE #2
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ALVIN SPADY
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WILLIAM M. & ROBERT E. ZALOUDEK
CARL E. STANSBERRY
CAROL KLINE
VIRGLYN I. GRISWOULD
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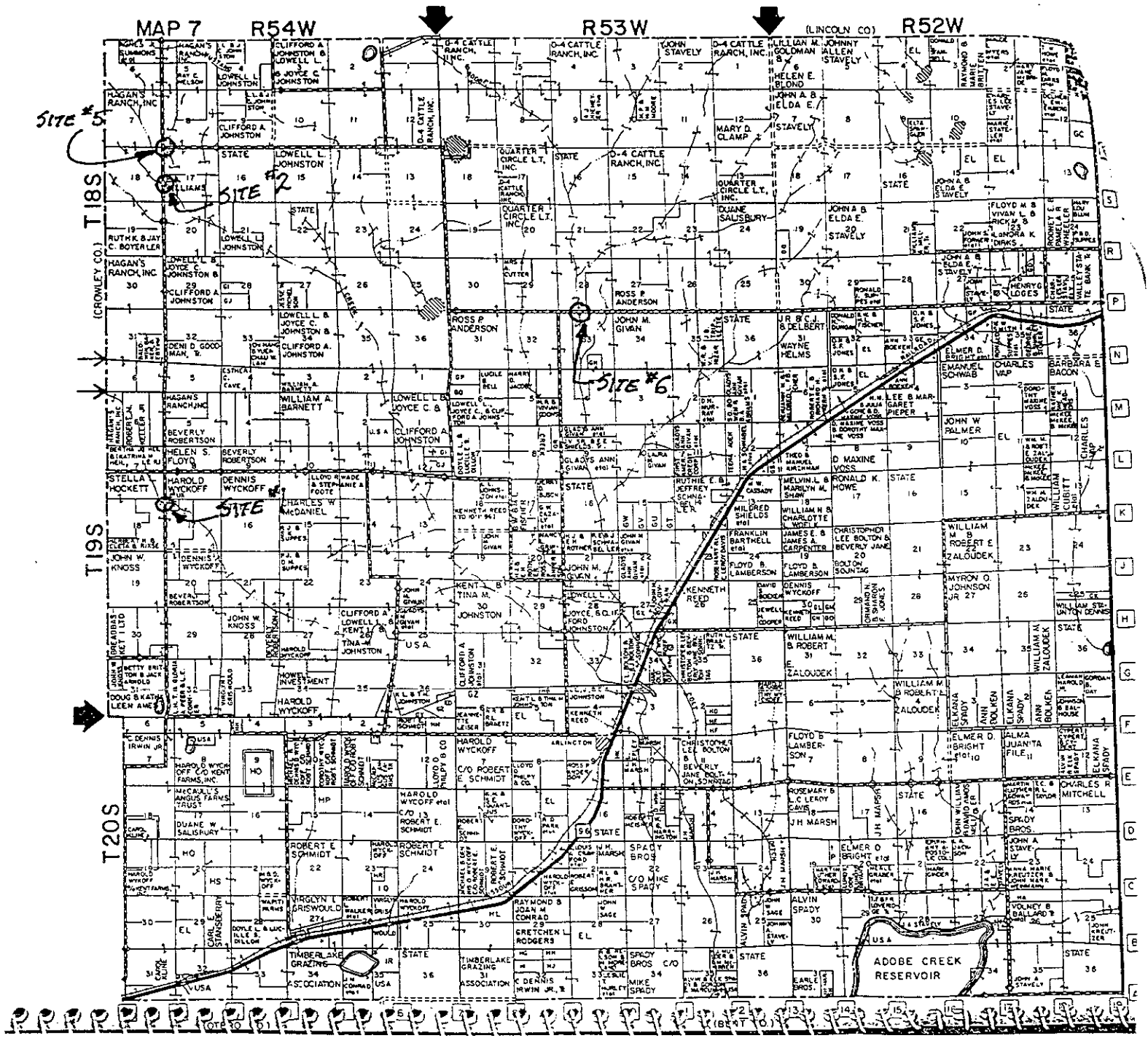
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SITE #5
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ADOBE CREEK RESERVOIR
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0-4 CATTLE RANCH, INC
QUARTER CIRCLE L.T., INC.
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ROBERT E. SCHMIDT
VIRGLYN L. GRISWOULD
CARL E. STANSBERRY
TIMBERLAKE GRAZING ASSOCIATION
RAYMOND & JOAN M. CONRAD
GRETCHEN L. RODGERS
C. DENNIS IRWIN JR.
MIKE SPADY
SPADY BROS C/O MIKE SPADY
ALVIN SPADY
JOHN A. & ELDA E. STAVELY
MARY D. CLAMP
DUANE SALISBURY
HELEN E. BLOND
WILLIAM M. & ROBERT E. ZALOUDEK
ELMER D. BRIGHT et al
J.H. MARSH
ROSEMARY & L.C. LEROY CAVIS
CHARLES R. MITCHELL
ELKANA SPADY
ALMA JUANITA FILE, II
MYRON O. JOHNSON JR.
KENNETH REED
FLOYD B. LAMBERSON
CHRISTOPHER LEE BOLTON & BEVERLY JANE BOLTON SOUNTAG
RONALD K. & D MAXINE HOWE
WAYNE HELMS
JR B & C J DELBERT
JOHN W. PALMER
EMANUEL SCHWAB
CHARLES VAP
BARBARA BACON
LEE B & MARGARET PIEPER
HENRY G LOGES
FLOYD M & VIVIAN L & RICKY & LENORA K. DIRKS
RONNEY E & PAMELA R WHEELER
VALLEY STATE BANK
JOHNNY ALLEN STAVELY
WILLIAM M. GOLDMAN
JOHN STAVELY
STATE
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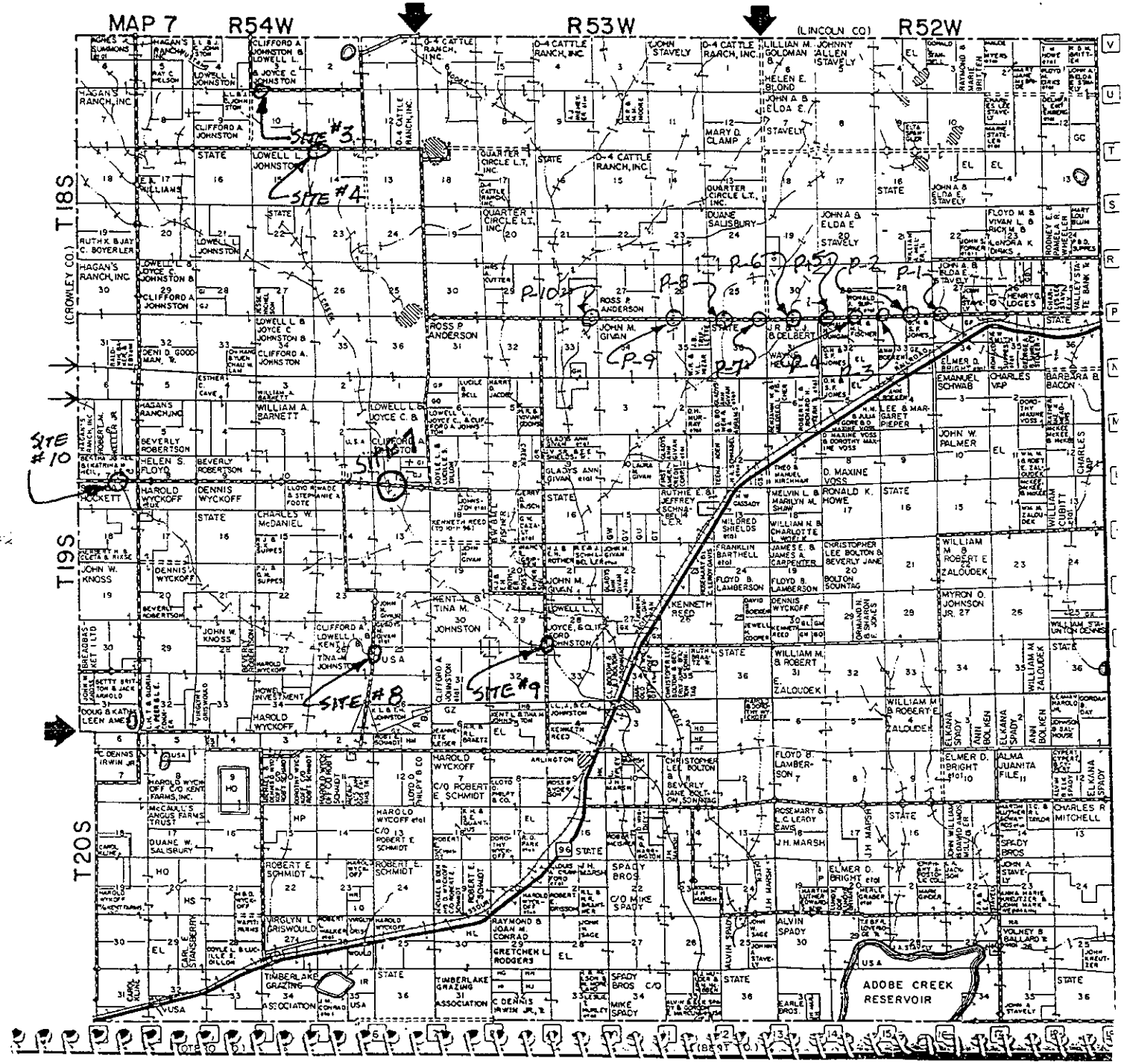
GY
USA


MAP 7
R54W
R53W
R52W
(LINCOLN CO.)
T18S
T19S
T20S
(CROWLEY CO.)
SITE #3
SITE #4
SITE #5
SITE #6
SITE #7
SITE #8
SITE #9
SITE #10
P-1
P-2
P-3
P-4
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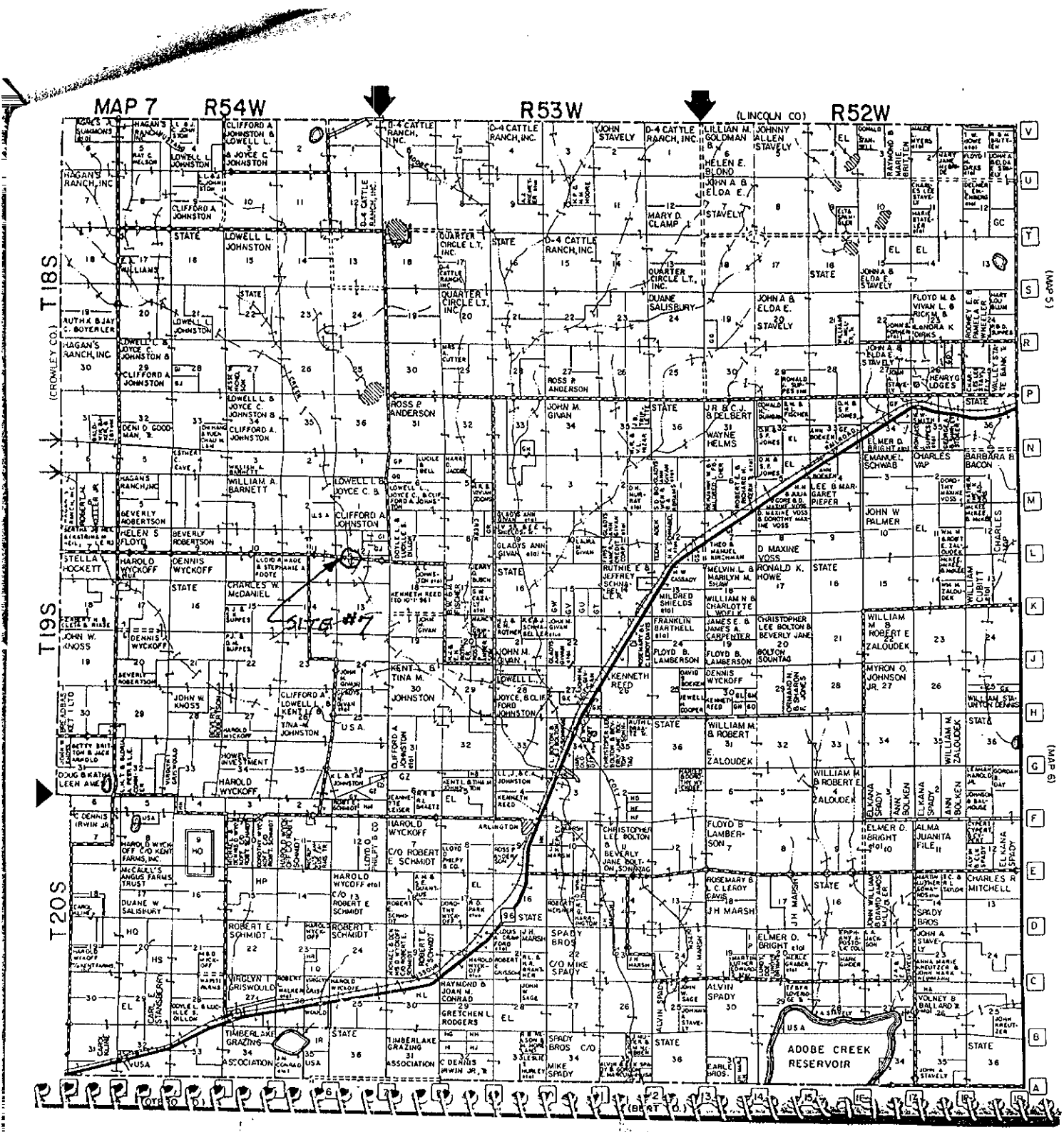
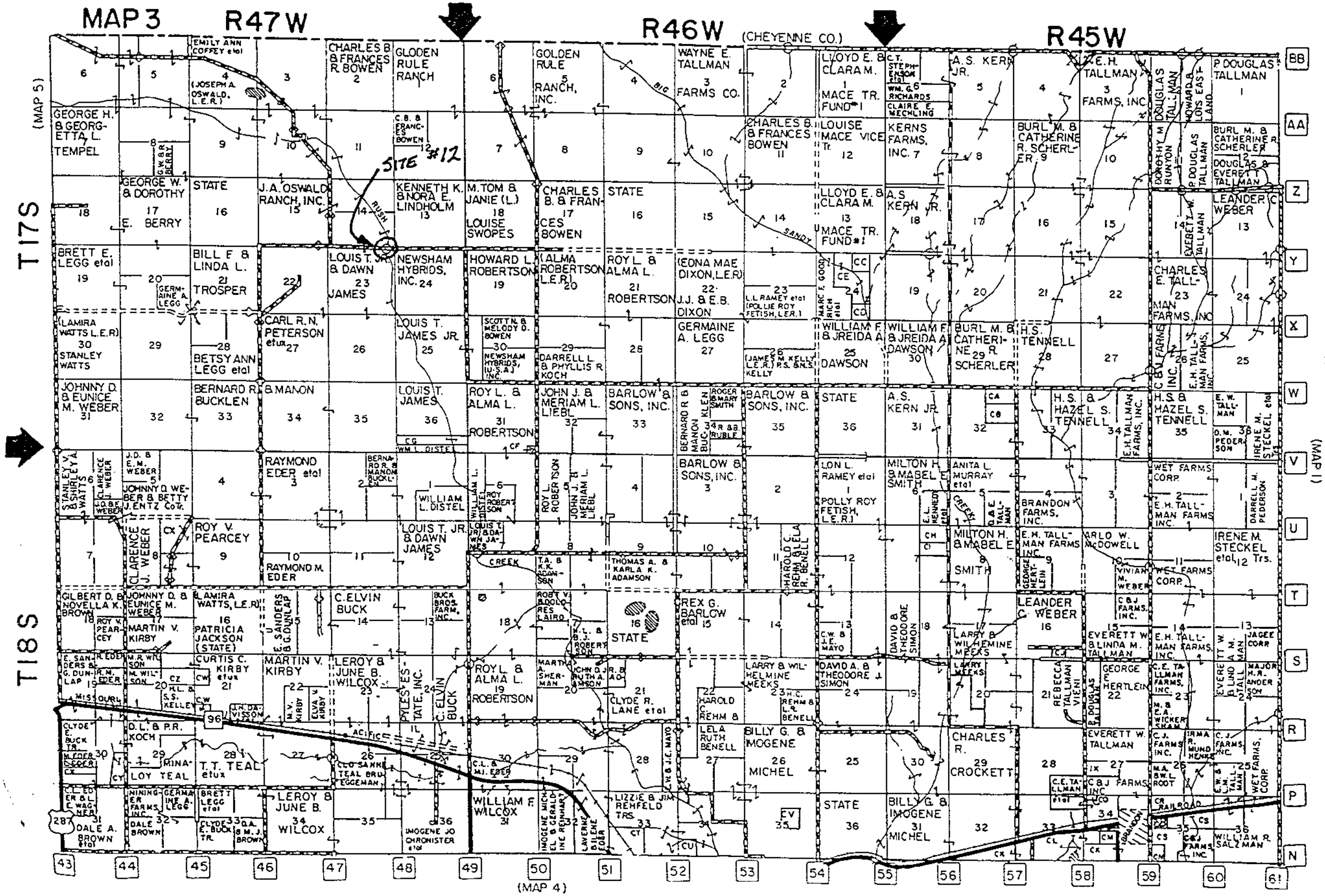
P-6
P-7
P-8
P-9
P-10
ADOBE CREEK RESERVOIR


MAP 7
R54W
R53W
R52W
(LINCOLN CO)
T18S
T19S
T20S
(CROWLEY CO.)
(MAP 5)
(MAP 9)
ADOBE CREEK RESERVOIR
(BENT CO.)



MAP 3
R47W
R46W
(CHEYENNE CO.)
R45W
T17S
T18S
(MAP 5)
(MAP 1)
(MAP 4)
SITE #12
RUSH
BIG
SANDY
CREEK
MISSOURI
PACIFIC
RAILROAD
96
287
GEORGE H. & GEORGETTA L. TEMPEL
EMILY ANN COFFEY etal
JOSEPH A. OSWALD, L.E.R.
CHARLES B & FRANCES R. BOWEN
GLODEN RULE RANCH
GOLDEN RULE RANCH, INC.
WAYNE E. TALLMAN FARMS CO.
LLOYD E. & CLARA M. MACE TR. FUND #1
A.S. KERN JR.
E.H. TALLMAN FARMS, INC.
P. DOUGLAS TALLMAN
GEORGE W. & DOROTHY E. BERRY
STATE
J.A. OSWALD RANCH, INC.
KENNETH K. & NORA E. LINDHOLM
M. TOM & JANIE (L.) LOUISE SWOPES
CHARLES B. & FRANCES BOWEN
LOUISE MACE VICE Tr.
KERNS FARMS, INC.
BURL M. & CATHERINE R. SCHERLER
LEANDER C. WEBER
BRETT E. LEGG etal
BILL F. & LINDA L. TROSPER
LOUIS T. JR. & DAWN JAMES
NEWSHAM HYBRIDS, INC.
HOWARD L. ROBERTSON
ALMA ROBERTSON L.E.R.
ROY L. & ALMA L. ROBERTSON
EDNA MAE DIXON, L.E.R.
J.J. & E.B. DIXON
CHARLES E. TALLMAN FARMS, INC
LAMIRA WATTS L.E.R.
STANLEY WATTS
BETSY ANN LEGG etal
CARL R.N. PETERSON etux
LOUIS T. JAMES JR.
DARRELL L. & PHYLLIS R. KOCH
GERMAINE A. LEGG
WILLIAM F. & JREIDA A. DAWSON
H.S. TENNELL
JOHNNY D. & EUNICE M. WEBER
BERNARD R. BUCKLEN
B. MANON
LOUIS T. JAMES
ROY L. & ALMA L. ROBERTSON
JOHN J. & MERIAM L. LIEBL
BARLOW & SONS, INC.
H.S. & HAZEL S. TENNELL
RAYMOND EDER etal
WILLIAM L. DISTEL
LON L. RAMEY etal
POLLY ROY FETISH, L.E.R.
MILTON H. & MABEL E. SMITH
ANITA L. MURRAY etal
BRANDON FARMS, INC.
WET FARMS CORP.
E.H. TALLMAN FARMS INC.
ROY V. PEARCEY
RAYMOND M. EDER
LOUIS T. JR. & DAWN JAMES
THOMAS A. & KARLA K. ADAMSON
ARLO W. McDOWELL
IRENE M. STECKEL etal Trs.
GILBERT D. & NOVELLA K. BROWN
JOHNNY D. & EUNICE M. WEBER
LAMIRA WATTS, L.E.R.
PATRICIA JACKSON (STATE)
C. ELVIN BUCK
REX G. BARLOW etal
LEANDER C. WEBER
EVERETT W. & LINDA M. TALLMAN
MARTIN V. KIRBY
CURTIS C. KIRBY etux
LEROY & JUNE B. WILCOX
ROY L. & ALMA L. ROBERTSON
CLYDE R. LANE etal
LARRY & WILHELMINE MEEKS
DAVID A. & THEODORE J. SIMON
GEORGE E. HERTLEIN
D.L. & P.R. KOCH
LOY TEAL
T.T. TEAL etux
LELA RUTH BENELL
BILLY G. & IMOGENE MICHEL
CHARLES R. CROCKETT
EVERETT W. TALLMAN
WILLIAM F. WILCOX
LIZZIE & JIM REHFELD TRS.
DALE A. BROWN etal
IMOGENE JO CHRONISTER etal
WILLIAM R. SALZMAN
BB
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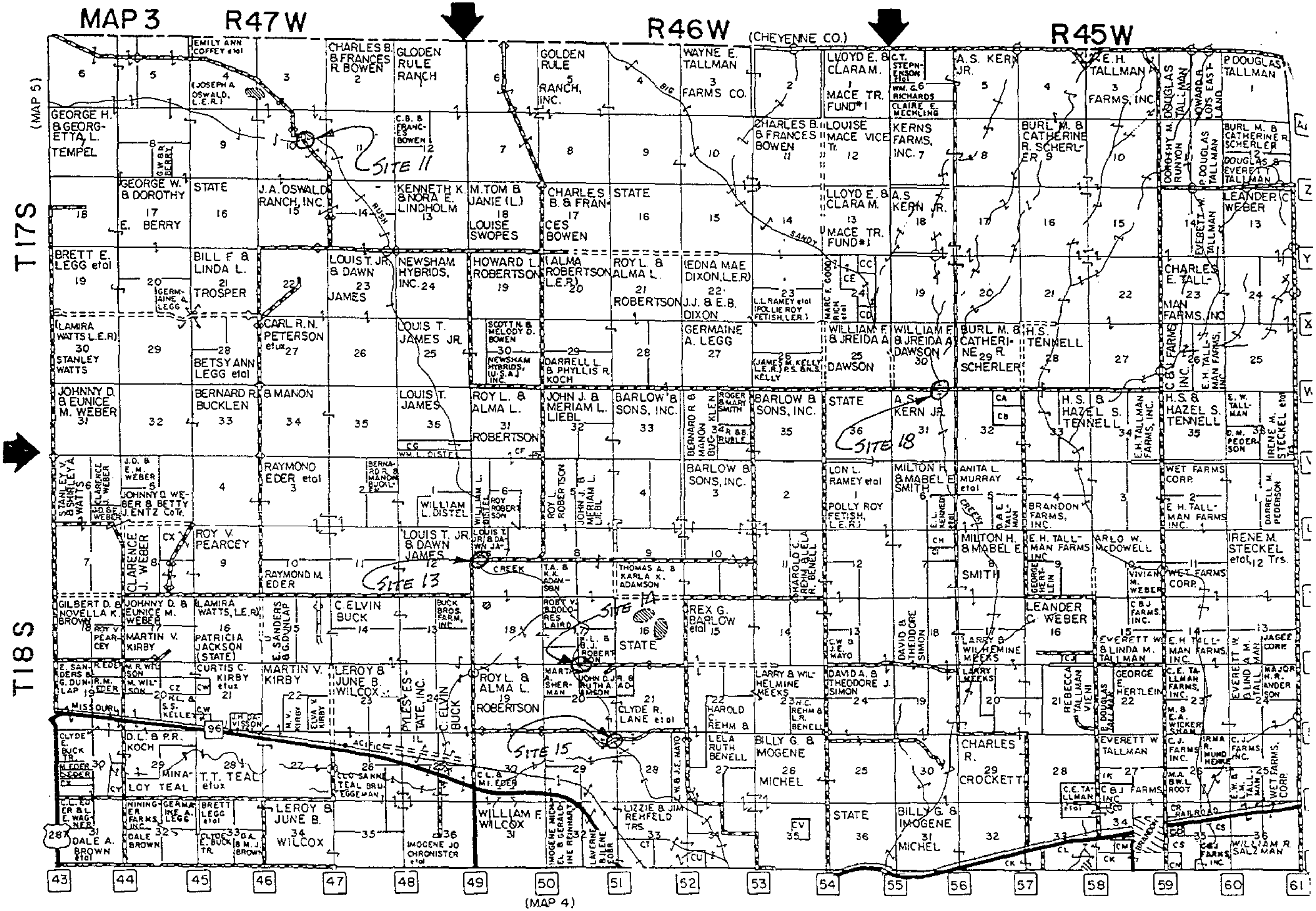
MAP 3
R47W
R46W
(CHEYENNE CO.)
R45W
(MAP 5)
T17S
T18S
(MAP 4)
SITE 11
SITE 13
SITE 14
SITE 15
SITE 18
GOLDEN RULE RANCH
GOLDEN RULE RANCH, INC.
WAYNE E. TALLMAN FARMS CO.
CHARLES B. & FRANCES R. BOWEN
EMILY ANN COFFEY etal
GEORGE H. & GEORGETTA L. TEMPEL
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M. TOM & JANIE (L.) LOUISE SWOPES
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J.J. & E.B. DIXON
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STANLEY WATTS
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H.S. TENNELL
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BERNARD R. & MANON BUCKLEN
JOHN J. & MERIAM L. LIEBL
BARLOW & SONS, INC.
STATE
H.S. & HAZEL S. TENNELL
RAYMOND EDER etal
WILLIAM L. DISTEL
LON L. RAMEY etal
POLLY ROY FETISH, L.E.R.
MILTON H. & MABEL E. SMITH
ANITA L. MURRAY etal
BRANDON FARMS, INC.
WET FARMS CORP.
E.H. TALLMAN FARMS INC.
ROY V. PEARCEY
CLARENCE J. WEBER
RAYMOND M. EDER
E.H. TALLMAN FARMS
ARLO W. McDOWELL
IRENE M. STECKEL etal Trs.
GILBERT D. & NOVELLA K. BROWN
MARTIN V. KIRBY
PATRICIA JACKSON (STATE)
C. ELVIN BUCK
BUCK BROS. FARM, INC.
THOMAS A. & KARLA K. ADAMSON
REX G. BARLOW etal
LEANDER C. WEBER
EVERETT W. & LINDA M. TALLMAN
CURTIS C. KIRBY etux
MARTIN V. KIRBY
LEROY & JUNE B. WILCOX
PYLES ESTATE, INC.
ROY L. & ALMA L. ROBERTSON
CLYDE R. LANE etal
HAROLD C. REHM &
LARRY & WILHELMINE MEEKS
DAVID A. & THEODORE J. SIMON
GEORGE F. HERTLEIN
MISSOURI PACIFIC
96
D.L. & P.R. KOCH
MINA LOY TEAL
T.T. TEAL etux
LELA RUTH BENELL
BILLY G. & MOGENE MICHEL
CHARLES R. CROCKETT
EVERETT W. TALLMAN
WET FARMS CORP.
287
DALE A. BROWN etal
LEROY & JUNE B. WILCOX
IMOGENE JO CHRONISTER etal
WILLIAM F. WILCOX
LIZZIE & JIM REHFELD TRS.
STATE
BILLY G. & IMOGENE MICHEL
RAILROAD
WILLIAM R. SALZMAN
BIG SANDY
RUSH CREEK
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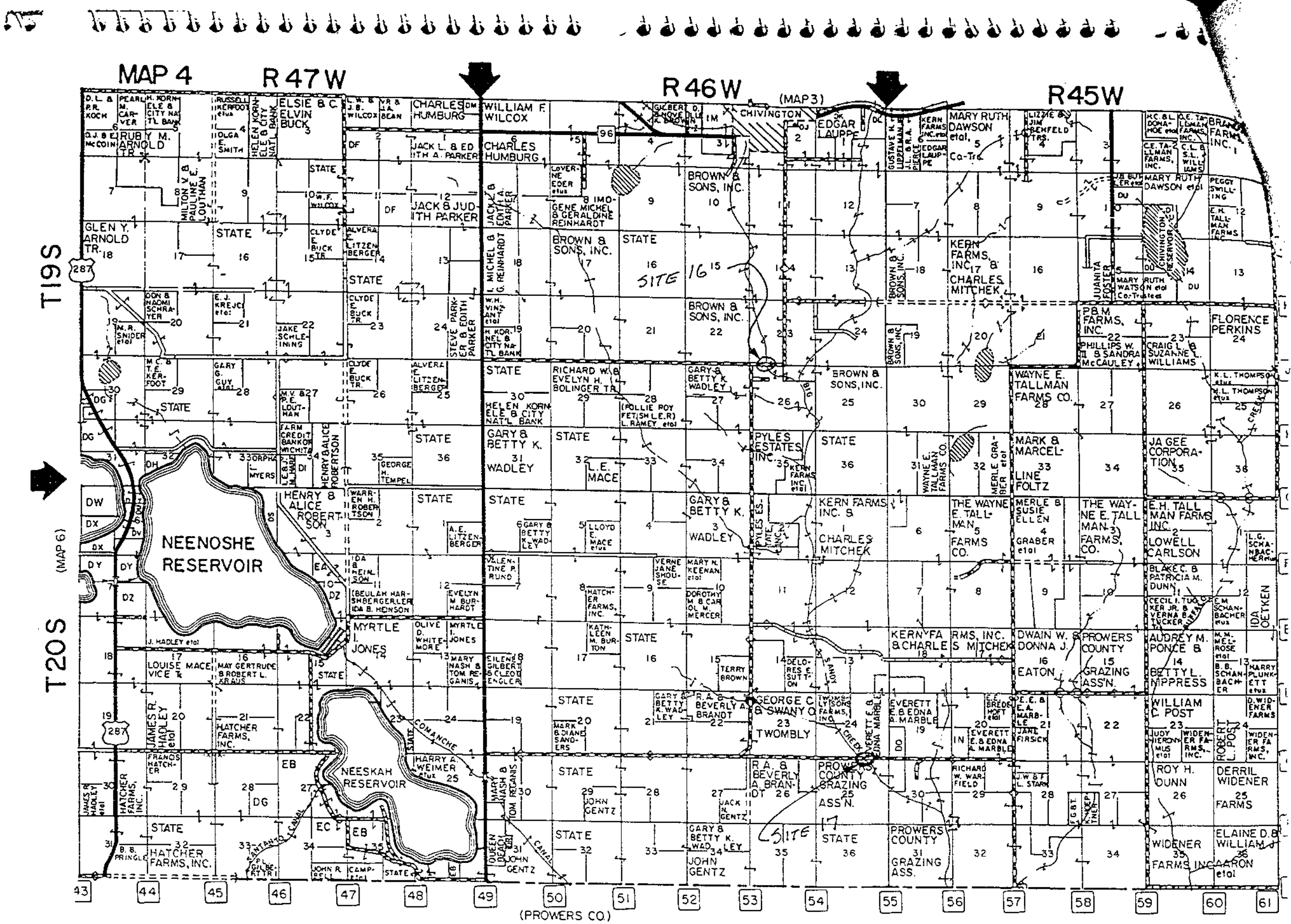
MAP 4
R47W
R46W
R45W
(MAP 3)
T19S
T20S
(MAP 6)
NEENOSHE RESERVOIR
NEESKAH RESERVOIR
CHIVINGTON
CHIVINGTON RESERVOIR
SITE 16
SITE 17
BIG SANDY CREEK
COMANCHE CANAL
(PROWERS CO.)
CHARLES HUMBURG
WILLIAM F. WILCOX
ELSIE & C. ELVIN BUCK
RUBY M. ARNOLD TR.
GLEN Y. ARNOLD TR.
JACK & JUDITH PARKER
BROWN & SONS, INC.
EDGAR LAUPPE
MARY RUTH DAWSON etal
KERN FARMS, INC. & CHARLES MITCHEK
WAYNE E. TALLMAN FARMS CO.
MARK & MARCEL-LINE FOLTZ
GARY & BETTY K. WADLEY
HELEN KORNELE & CITY NAT'L BANK
RICHARD W. & EVELYN H. BOLINGER TR.
PYLES ESTATES INC.
HENRY & ALICE ROBERTSON
MYRTLE I. JONES
LOUISE MACE VICE
HATCHER FARMS, INC.
GEORGE C. & SWANY O. TWOMBLY
PROWERS COUNTY GRAZING ASS'N.
DWAIN W. & DONNA J. EATON
WILLIAM C. POST
ROY H. DUNN
DERRIL WIDENER FARMS
ELAINE D. & WILLIAM AARON etal
JOHN GENTZ
FLORENCE PERKINS
JA GEE CORPORATION
E.H. TALLMAN FARMS INC.
LOWELL CARLSON
AUDREY M. PONCE & BETTY L. NIPPRESS
STATE
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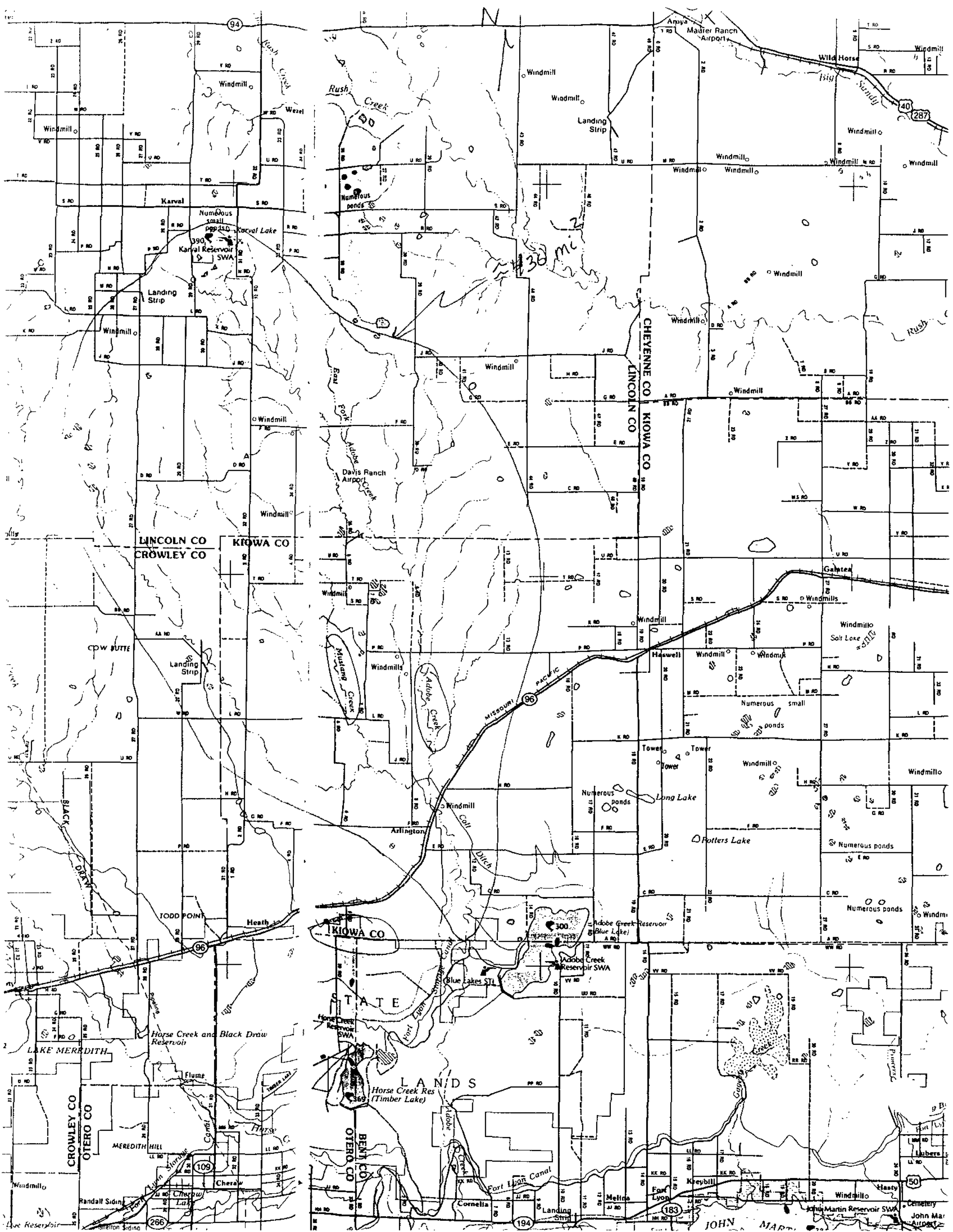
Karval
Karval Lake
Karval Reservoir SWA
Landing Strip
Windmill
Rush Creek
Wezel
Numerous ponds
Maurer Ranch Airport
Wild Horse
Big Sandy
CHEYENNE CO
LINCOLN CO
KIOWA CO
CROWLEY CO
East Fork
Adobe Creek
Davis Ranch Airport
Cow Butte
Mustang Creek
Missouri Pacific
Galatea
Haswell
Salt Lake
Numerous small ponds
Tower
Long Lake
Potters Lake
Arlington
Colt Ditch
Black Draw
Todd Point
Heath
Adobe Creek Reservoir (Blue Lake)
Adobe Creek Reservoir SWA
Blue Lakes STL
State Lands
Fort Lyon Storage Canal
Horse Creek Reservoir SWA
Horse Creek Res (Timber Lake)
Horse Creek and Black Draw Reservoir
Lake Meredith
Flume
Timber Lake
Meredith Hill
OTERO CO
BENT CO
Cheraw
Cheraw Lake
Randall Siding
Fort Lyon Canal
Cornelia
Melina
Fort Lyon
Kreybill
Hasty
Lubers
Cemetery
John Martin Reservoir SWA
John Martin Airport
Numerous ponds
Gageby Creek
Numerous ponds
30 mi

1. Contacts

Author: www@taz.noaa.gov at EXTERNAL
Date: 6/13/97 7:31 PM
Priority: Normal
TO: Kristine Herrald at W-CR-DEN
Subject: Severe Weather Report
---------- Message Contents ----------

Name = Bill Eckrich
email = bill.eckrich@MCI2000.com
area = 970
prefix = 663
phone = 4978
city = Loveland (North side)
county = Larimer
day = 13
month = June
hour = 2
minute1 = 2
minute2 = 5
ampm = pm
report = I am a trained spotter as well as a deputy sheriff with Larimer County. I submitted this report by phone at the time, but wanted to give a full report here. I received 1.83 inches of rain between 1325 and 1425. Rain ended by 1500 giving a storm total of 1.88. There was a brief period of 1/4" hail at 1350 and a wind gust of 37 mph from 360 degrees at 1341. Another brief shower passed 1630-1640 giving only another .01 inch. I use an official NWS 8" rain gauge. I also have an old Frieze(sp?) recording rain gauge I got from your office years ago that was working in case you would like a copy of the graph. I had street flooding and flooding in the yard. I also got some water in the basement due to water overflowing from the yard into a window well and hence, into my basement.

Hope this is of use. I had earlier sent an email to your WCM about my status as a spotter and storm chaser and reporting protocols, but never received any answer so I was unsure about making reports.

Thank you!

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Markus Ritsch
DATE: 3/19/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Marsha Hilmes
AFFILIATION: City of Fort Collins
PHONE #: 224-6036

---

1. Affected streams and local drainages?
   see HMGP application for the flood warning system

2. Geographic extent of flooding?
   see HMGP application for the flood warning system

3. Storm duration?
   see HMGP application for the flood warning system
   see An analysis of rainfall for the July28, 1997 flood in Fort Collins, Colorado (Doesken and Mckee)

4. Rainfall amounts?
   see HMGP application for the flood warning system
   see An analysis of rainfall for the July28, 1997 flood in Fort Collins, Colorado (Doesken and Mckee)

5. Rainfall bucket surveys?
   see HMGP application for the flood warning system
   see An analysis of rainfall for the July28, 1997 flood in Fort Collins, Colorado (Doesken and Mckee)

6. Precipitation gauging network?
   see HMGP application for the flood warning system
   see An analysis of rainfall for the July28, 1997 flood in Fort Collins, Colorado (Doesken and Mckee)

7. Recurrance intervals of point rainfall amounts?
   see HMGP application for the flood warning system
   see An analysis of rainfall for the July28, 1997 flood in Fort Collins, Colorado (Doesken and Mckee)

8. Documentation of high water marks?
   see HMGP application for the flood warning system
   see USGS Summary of discharge measurements flood of July 28, 1997 in Fort Collins, Colorado

9. Streamflow gauge data?
   see HMGP application for the flood warning system
   see USGS Summary of discharge measurements flood of July 28, 1997 in Fort Collins, Colorado

10. Estimated peak discharges?
    see HMGP application for the flood warning system
    see USGS Summary of discharge measurements flood of July 28, 1997 in Fort Collins, Colorado

11. Recurrance interval of peak discharge?
    see HMGP application for the flood warning system
    see USGS Summary of discharge measurements flood of July 28, 1997 in Fort Collins, Colorado

12. Estimated flood damages?
    see HMGP application for the flood warning system

13. Costs associated with the clean-up effort? Differentiate between local, state, and federal.
    see HMGP application for the flood warning system

14. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.
    see HMGP application for the flood warning system

15. Types and amounts of repair work after flooding?
    see HMGP application for the flood warning system

16. Any previous/recent flood mitigation efforts that reduced damages?
    see HMGP application for the flood warning system

17. Any future mitigation needs as a result of the flooding?
    see HMGP application for the flood warning system
    see HMGP application for Larimer County, Vine Street Project

18. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?
    see HMGP application for the flood warning system
    see HMGP application for Larimer County, Vine Street Project

19. Do you have any photos and/or video available?
    yes, CSU Alumni Association, home videos, Glen Levy's video

20. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.
    see HMGP application for the flood warning system
    see HMGP application for Larimer County, Vine Street Project

21. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)
    GIS

22. Is there any existing documentation regarding the flooding?
see HMGP application for the flood warning system
see HMGP application for Larimer County, Vine Street Project

23. Name of local newspaper?
Coloradoan

24. Do you have an internet site?
http://www.ci.fort-collins.co.us/c_safety/oem/index.htm

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:
Call Placed/Received by: Markus Ritsch
Spoke With: Marsha Hilmes
Company/Affiliation: Fort Collins SW Utility
Phone no.: 224-6036
Project No.: D479

Comments:

Can we get a copy the NWS report? yes
- report team inchdine Eric Grumfest, Matt Kelsch, etc.

can we get a look at the CD of digital photos? yes

picked up on 3/25/98.

must return to Marsha

was returned on July 1, 1998

Signature Markus Ritsch

10:30 9am on the 24th

15 min Total

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

218 W. Mountain across crt. house.

BY: Markus Ritsch
DATE: 3/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Lisa Dunn
AFFILIATION: Larimer Cnty
PHONE #: 970-498-5703

---

1. Affected streams and local drainages?
   - no Streams, sheet flow due to rain, Irrigation Ditches Poudre valley & Lake New Mercier

2. Geographic extent of flooding?
   - West Vine Drainage Basin
   - Cotton willow Subdivision in LaPorte
   - Fairview Subdivision

3. Storm duration?
   - Nolan's Document
   - HMGP application

4. Rainfall amounts?
   - Nolan's Document
   - HMGP application

5. Rainfall bucket surveys?
   - Nolan's Document
   - HMGP application

6. Precipitation gauging network?
   - none, see CSU & City of Fort Collins

7. Documentation of high water marks?
   - Pictures of high water marks.
   - Field note book

#

8. Estimated peak discharges?
- Lisa did a few measurements, see HMGP App

9. Estimated flood damages?
- See HMGP Application
- see DSR

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.
- Have not totaled these numbers.
* - Has a DSR for pumping on Holiwood - $2,400

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.
- See DSR for additional info not in Application.

12. Types and amounts of repair work after flooding?
- See DSR

13. Any previous/recent flood mitigation efforts that reduced damages?
- NO

14. Any future mitigation needs as a result of the flooding?
- west Vine project - HMGP app.

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?
- irrigation ditches_ *Woodward clyde doc. Report Documented where it spilled.
- Development along natural flow path.
-

16. Do you have any photos and/or video available? Are the photos in digital format?
– No video, Photos in hardcopy format.

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.
– Damage Area map – in HMGP Application
CAD map

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)
CAD map

19. Is there any existing documentation regarding the flooding?
– Lisa's Field notes
– DSR
– Woodward Clyde report

20. Name of local newspaper? Do they have a web site?
–

21. Do you have an internet site? Do you know of any related local sites?
– yes but it Contains no flood info.

Action Items:
Visit with Lisa to borrow three reports:
– Lisa's field note book
– Lisa's personal photo album
– The County's DSR
– The Woodward Clyde report

State Code	County Code	Site Name	HQ State	HQ County
8	69	LARIMER COUNTY FSA OFFICE	8	69

CED	Contact Name
Lynn Higley	Lynn Higley

Area Name	State Name	Site Type Name	Site District	Transmission ID	Time Zone
Southwest	Colorado	FSA County Office	3	AHV	Mountain

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Phone #	(970)223-0969	ext.	
Fax #	(970)225-2156	ext.	

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	MAIL ADDRESS		STREET ADDRESS
Address	2850 MCCLELLAND DRIVE	Address	2850 MCCLELLAND DRIVE
Address	SUITE 3400	Address	SUITE 3400
City	FT COLLINS	City	FT COLLINS
State	CO	State	CO
Zip	80525	Zip	80525

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Send a question, idea or comment to the County Office via the State Office.

If any of the information on this page is incorrect, please notify us.

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State Code	County Code	Site Name	HQ State	HQ County
8	61	KIOWA COUNTY FSA OFFICE	8	61

CED	Contact Name
ROD JOHNSON	ROD JOHNSON

will call early next week (5/11)

Area Name	State Name	Site Type Name	Site District	Transmission ID	Time Zone
Southwest	Colorado	FSA County Office	1	AHS	Mountain

Top of Page

Phone #	(719)438-5851	ext.	
Fax #	(719)438-5410	ext.	

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	MAIL ADDRESS		STREET ADDRESS
Address	910 WANSTED STREET	Address	910 WANSTED STREET
Address		Address	
City	EADS	City	EADS
State	CO	State	CO
Zip	81036	Zip	81036

Top of Page

Send a question, idea or comment to the County Office via the State Office.

If any of the information on this page is incorrect, please notify us.

Top of Page

From:	**"Markus Ritsch" <HORSETOOTH/MLR>**
To:	**wje, wjo**
Date sent:	**Wed, 20 May 1998 15:53:52 MDT-0600**
Subject:	**Fort Collins Storm Data**
Copies to:	**mlr**

Bill and Bill,

I was able to ascertain the cloud top elevations from Matt Kelsch yesterday for the Fort Collins storm of July 28.

The Fort Collins storm was associated with warmer cloud-top temperatures and less lightning strike activity than is typical. Most of the precipitation growth was occurring in a 4-km deep layer between cloud base (around 500 m above ground level to 15,000 ft above ground level). This means that cloud-top elevations were about 15,000 feet above ground level or about 20,000 feet above mean sea level.

This is typical of a tropical storm and is not characteristic for Colorado.

Bill O. these points should come out in your text.

Later
Markus

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: FSA contacts + ag'damages
Computed: wjo Date: 5/11/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: 0479 Task: 52
Page _____ of _____

Rod Johnson (Kiowa FSA)

- Rangeland area got hit hard
  - ↳ actually good ~~information~~ conditions → moisture good for fields
- winter wheat, grain/sorgum
  - ↳ Oct. blizzard hit this

Aug 2 – Aug 6
↳ ~5+ inches

NW corner of county ~~light~~ got hit the hardest

Lynn Higley – Larimer FSA
hay ground + pasture land
↳ due to ag canals

- hay in balles or stacked
  - ↳ tons of hay affected
- 500+ tonage lost
- debris washed up over pasture land
  - ↳ use equipment + delaying

2. Federal Data

Fort Co	llins	Weath	er Sta	tion Au	tomated	Hour	ly Obs	ervati	ons
Date	Time	Temp	RH	DewPt	WS	WD	Gust	Dir	Press
		degF	%	degF	mph	deg	mph	deg	in Hg
6/2/97	0	65	59.8	50.6	4.8	354	13.5	1	24.97
6/2/97	100	63.5	65.1	51.5	4.6	6	11.9	354	24.977
6/2/97	200	63	69.5	52.9	6.7	11	14.3	13	24.993
6/2/97	300	62.1	76.5	54.6	4.6	8	13.1	354	25.001
6/2/97	400	60.9	86.9	57	3.3	63	7.3	14	25.007
6/2/97	500	60	93.2	58	2.9	81	5.6	62	25.014
6/2/97	600	59.8	93.5	57.9	2.4	77	5.9	111	25.017
6/2/97	700	59.8	92.7	57.7	2.7	90	5.6	71	25.025
6/2/97	800	59.7	93.2	57.8	1.4	349	4.1	0	25.032
6/2/97	900	59.2	98.1	58.7	3.4	143	8	166	25.032
6/2/97	1000	62.4	91.5	59.9	5.4	208	10.6	205	25.014
6/2/97	1100	66.7	78.3	59.7	4.3	151	12.7	90	24.989
6/2/97	1200	69.4	70.5	59.4	6	143	15	151	24.968
6/2/97	1300	71	67.1	59.5	8.7	156	15.6	179	24.939
6/2/97	1400	73.1	60.9	58.8	7.4	149	18.4	177	24.923
6/2/97	1500	69.2	68.3	58.3	4.5	300	16.4	336	24.934
6/2/97	1600	60.7	96.2	59.6	5.6	309	15	217	24.931
6/2/97	1700	60.3	99	60	4.4	49	12.5	84	24.953
6/2/97	1800	57.9	99.3	57.7	3.1	312	12.1	69	24.972
6/2/97	1900	59.3	100.1	59.3	2.1	311	6.2	16	24.999
6/2/97	2000	60	86.4	56	6.6	1	17.2	20	25.045
6/2/97	2100	59.5	71.5	50.3	4.4	10	15.3	342	25.062
6/2/97	2200	57.2	76.9	50.1	2.3	143	10.1	348	25.026
6/2/97	2300	57.7	71.9	48.7	4.1	35	10.2	13	25.024
6/2/97	**Min**	**57.2**	**81.9**	**56.4**	**4.4**	**144**	**11.5**	**141**	**24.99**
	Max	**73.1**							
	Avg	**62.4**							

CSU Station

Fort C	ollins	Weat	her St	ation A	utomated	Hou	rly Ob	servat	ions
Date	Time	Temp	RH	DewPt	WS	WD	Gust	Dir	Press
		degF	%	degF	mph	deg	mph	deg	in Hg
7/27/97	0	68.6	63.3	55.6	1.3	270	3.8	304	25.141
7/27/97	100	67.6	65.4	55.6	1	352	3.5	7	25.128
7/27/97	200	66.2	69.6	56	1.8	358	5.2	14	25.128
7/27/97	300	64.5	74.3	56.1	1.3	323	3.6	0	25.127
7/27/97	400	64.3	72	55.1	1.2	349	4.5	17	25.114
7/27/97	500	64.7	71.1	55.1	1.5	348	5	16	25.12
7/27/97	600	64.7	72.2	55.6	1.4	337	4	95	25.127
7/27/97	700	66.7	68.5	56	1.6	134	4	116	25.135
7/27/97	800	73	56.2	56.5	1.1	177	3.5	179	25.14
7/27/97	900	75.2	49.9	55.3	1.5	55	5.1	24	25.139
7/27/97	1000	75.3	50.8	55.9	3.2	88	6.4	92	25.137
7/27/97	1100	74.4	55.2	57.3	3.9	91	7	81	25.156
7/27/97	1200	75.4	52.2	56.6	4.1	49	12.3	16	25.176
7/27/97	1300	77.5	44.5	54.2	5.6	2	16.1	354	25.178
7/27/97	1400	80.7	37.4	52.3	6.9	31	14.6	7	25.162
7/27/97	1500	82.3	34.6	51.7	5.8	10	14.2	354	25.15
7/27/97	1600	81	40.9	55	6	24	17.1	91	25.153
7/27/97	1700	68.9	75.4	60.8	7	317	16.9	285	25.187
7/27/97	1800	64	88	60.4	3.7	275	9.3	255	25.211
7/27/97	1900	64.4	87.6	60.6	2.9	242	7.9	311	25.211
7/27/97	2000	64.7	84.3	59.8	4	233	8.2	259	25.226
7/27/97	2100	64.4	83.5	59.3	2.7	29	6.1	10	25.234
7/27/97	2200	64.5	83.6	59.4	3	130	9.2	138	25.245
7/27/97	2300	63.3	91.2	60.6	1.9	270	5.8	254	25.237
	Average	69.8	65.5	56.7	3.1	187	8.1	137	25.17

Min 63.3

Max 82.3

Fort Coll	ins W	eather	Stati	on Auto	mated H	ourly	Obser	vation	s
Date	Time	Temp	RH	DewPt	WS	WD	Gust	Dir	Press
		degF	%	degF	mph	deg	mph	deg	in Hg
7/28/97	0	62.8	95.1	61.4	2.6	18	6.5	32	25.248
7/28/97	100	63.7	93.5	61.8	2.3	35	5	12	25.255
7/28/97	200	62.2	98.8	61.9	1.9	311	5.9	301	25.259
7/28/97	300	61.9	100.8	62.2	1.7	350	6.3	96	25.258
7/28/97	400	62.5	101.1	62.8	2.4	38	4.9	36	25.263
7/28/97	500	62.1	100.6	62.3	3.4	44	10.5	75	25.274
7/28/97	600	61.1	99.6	61	3.1	24	9.6	48	25.286
7/28/97	700	61.2	99.9	61.2	2.2	349	8.9	108	25.291
7/28/97	800	61.8	99.1	61.6	6.7	78	14.7	84	25.287
7/28/97	900	62.5	96.4	61.5	6.3	103	12.3	100	25.296
7/28/97	1000	63.4	94.8	61.9	7.9	101	15.2	111	25.298
7/28/97	1100	65.4	92.3	63.1	7.3	109	14.1	92	25.294
7/28/97	1200	66.6	88.4	63	7.2	112	13.1	88	25.289
7/28/97	1300	68.2	83.6	63.1	6.7	112	12.8	115	25.282
7/28/97	1400	68.2	82.4	62.6	8	102	13.9	103	25.268
7/28/97	1500	68.4	83.9	63.3	6	107	11.8	123	25.246
7/28/97	1600	69.4	80.6	63.2	4.6	99	11.9	106	25.232
7/28/97	1700	69.4	80.8	63.3	2.5	111	8.7	75	25.224
7/28/97	1800	67.1	93.5	65.1	3.9	158	11.3	234	25.224
7/28/97	1900	64.8	100.6	65	1.9	224	9.7	235	25.229
7/28/97	2000	65.2	101.4	65.5	4.5	84	13.2	61	25.232
7/28/97	2100	64.5	101.3	64.8	7.5	25	22.9	20	25.255
7/28/97	2200	60.9	101.1	61.2	7.1	117	18.6	127	25.263
7/28/97	2300	61	102	61.6	3	125	9.2	108	25.253
7/28/97	**Min**	**60.9**	**94.7**	**62.7**	**4.6**	**122**	**11.3**	**104**	**25.26**
	Max	**69.4**							
	Avg	**64.3**							

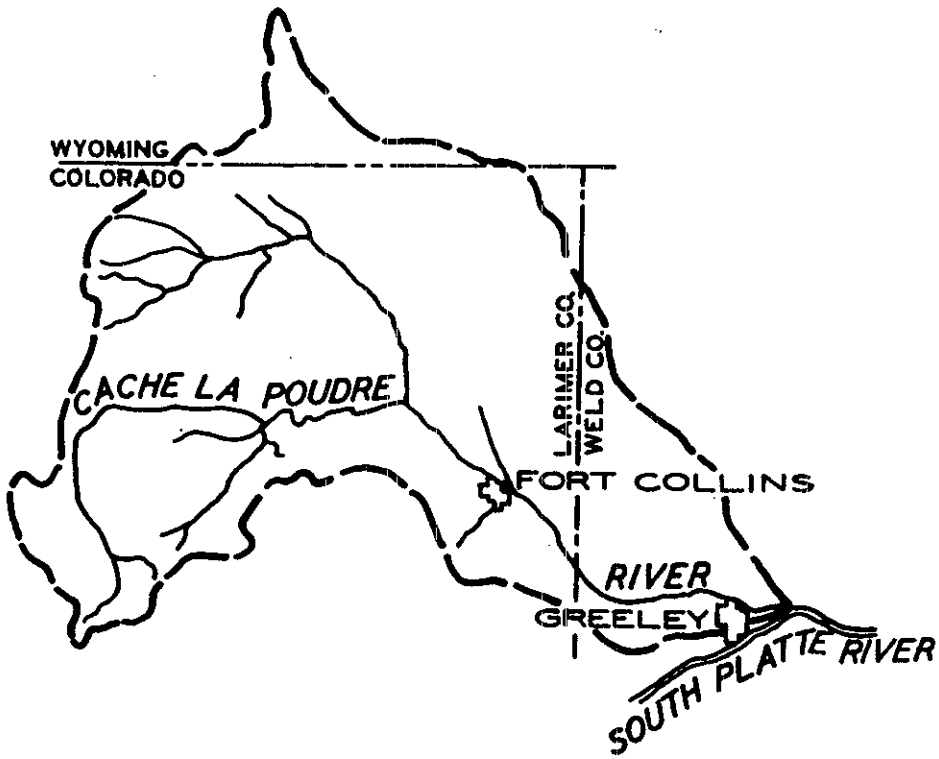
Fort Col	lins	Weather	Stat	ion Au	tomated	Hourl	y Obse	rvatio	ns
Date	Time	Temp	RH	DewPt	WS	WD	Gust	Dir	Press
		degF	%	degF	mph	deg	mph	deg	in Hg
8/4/97	0	67	68.9	56.5	4.3	328	14.6	1	25.385
8/4/97	100	67.1	63.4	54.3	3.2	340	9.4	0	25.381
8/4/97	200	66.4	64.6	54.1	2	354	5.6	13	25.377
8/4/97	300	65	71	55.3	1.2	352	3.2	338	25.373
8/4/97	400	64	76.4	56.5	1	313	3.7	75	25.374
8/4/97	500	63.5	79.6	57.1	0.8	317	2	295	25.376
8/4/97	600	63.6	81	57.7	1.1	349	3.1	0	25.385
8/4/97	700	65.9	77.5	58.7	1.2	314	4.4	278	25.398
8/4/97	800	69.5	69.8	59.2	1.8	360	5.8	35	25.396
8/4/97	900	70.4	70.3	60.3	3.7	96	8.4	104	25.394
8/4/97	1000	72	70.9	62	3.5	171	9.2	199	25.387
8/4/97	1100	74.8	62.4	61.1	4	210	10.3	166	25.376
8/4/97	1200	78	53.9	60	6.8	157	13.9	176	25.367
8/4/97	1300	79.5	51.7	60.2	6.2	153	12.6	191	25.358
8/4/97	1400	81	47.4	59.2	5.2	129	13.2	111	25.342
8/4/97	1500	82	43.1	57.4	7.9	111	17.1	117	25.326
8/4/97	1600	80.7	43.9	56.7	7.9	100	13.5	84	25.314
8/4/97	1700	78.7	46.6	56.5	7.1	113	20	179	25.326
8/4/97	1800	71.2	64	58.4	10.7	207	22	199	25.342
8/4/97	1900	67.6	74.5	59.2	7.8	201	19.6	197	25.358
8/4/97	2000	67.5	74.1	58.9	3.5	145	10.1	103	25.356
8/4/97	2100	67.2	77.3	59.9	3.8	105	8	150	25.364
8/4/97	2200	66.7	77.3	59.4	4.8	92	10.1	121	25.375
8/4/97	2300	65.1	85	60.5	2.9	171	8.5	123	25.39
	min	**63.5**	**66.4**	**58.3**	**4.3**	**216**	**10.3**	**136**	**25.37**
	max	**82**							
	avg	**70.6**							
8/5/97	0	64.6	88	61	6	189	13.7	205	25.398
8/5/97	100	63.3	96.1	62.1	2.7	175	7.1	183	25.39
8/5/97	200	62.8	98.3	62.3	3.7	196	7.1	205	25.378
8/5/97	300	62.3	98.9	62	2.6	196	6.2	181	25.364
8/5/97	400	62.6	98.1	62	5.6	178	10.9	147	25.356
8/5/97	500	61.8	96.5	60.8	4.4	193	11.4	168	25.345
8/5/97	600	61.5	96.6	60.5	2.3	207	6.6	199	25.333
8/5/97	700	62.8	94.5	61.2	2.4	212	6	203	25.325
8/5/97	800	66.1	85.1	61.5	4.2	198	9.3	197	25.313
8/5/97	900	67.3	79.1	60.6	5	146	10.4	105	25.306
8/5/97	1000	68.1	77.1	60.6	4.9	126	10.9	150	25.299
8/5/97	1100	68.7	73.9	60.1	4.5	88	9.4	83	25.295
8/5/97	1200	68.7	75.7	60.8	3.6	104	9.3	65	25.284
8/5/97	1300	66.8	90.7	64	2.9	75	7.9	120	25.276
8/5/97	1400	67.9	86.9	63.8	1.8	25	5.5	336	25.265
8/5/97	1500	67.8	91.3	65.2	3.5	342	9.6	325	25.259
8/5/97	1600	67.2	89.6	64.1	4.7	11	9.4	27	25.251
8/5/97	1700	67.9	85.4	63.3	4.9	54	8.9	83	25.245
8/5/97	1800	66.5	90.2	63.6	5	86	9.3	103	25.241
8/5/97	1900	64	98.1	63.5	5.3	108	10	137	25.246
8/5/97	2000	62.0 1	1.3	62.4	5.2	72	12.1	75	25.253
8/5/97	2100	59.4 1	1.6	59.8	7.2	28	14.4	30	25.282
8/5/97	2200	58.3 1	2.1	58.9	4.1	360	9.5	24	25.299
8/5/97	2300	58.4 1	2.2	59	4.2	4	10.9	0	25.308
	min	**61.5**	**74.9**	**61.8**	**4.2**	**141**	**9.4**	**140**	**25.30**
	max	**68.7**							
	avg	**65.4**							
8/6/97	0	58.4 1	2.2	59.1	3.8	352	9.6	0	25.312
8/6/97	100	58.1 1	2.3	58.7	3.4	340	9.6	5	25.31
8/6/97	200	57.8 1	2.3	58.4	2.8	321	8.1	311	25.31
8/6/97	300	57.5 1	2.2	58.1	4	331	10.9	0	25.318
8/6/97	400	57.0 1	1.2	57.3	3.6	310	10.4	309	25.318
8/6/97	500	56.7	96.1	55.6	3.2	312	8.9	305	25.32
8/6/97	600	57.6	89.7	54.6	3.2	314	10.3	316	25.337
8/6/97	700	60.2	78.7	53.6	2.5	331	15	342	25.344
8/6/97	800	62.4	75.7	54.6	3	243	6.4	235	25.348
8/6/97	900	62.5	76.6	55	2.2	226	5.8	219	25.355
8/6/97	1000	62.9	72.6	53.9	4.6	161	11.3	190	25.364
8/6/97	1100	63.2	71.2	53.8	6.3	197	11.4	177	25.363
8/6/97	1200	65.2	70.8	55.5	6.2	185	10.6	196	25.356
8/6/97	1300	67.9	68.1	57	5.5	175	9.3	198	25.35
8/6/97	1400	71.2	57.4	55.3	3.8	195	7.5	204	25.343
8/6/97	1500	73.3	46.9	51.9	3.8	148	9.7	87	25.331
8/6/97	1600	72.2	50.6	52.9	6.2	139	14.2	88	25.327
8/6/97	1700	66.6	56.9	50.9	4.6	355	11.6	39	25.335
8/6/97	1800	65.3	66.8	54	2.5	324	6.8	311	25.337
8/6/97	1900	63.5	73	54.8	1.4	308	5.6	297	25.338
8/6/97	2000	61	81.9	55.4	1.4	319	5.2	0	25.345
8/6/97	2100	59.7	85	55.2	1.4	318	4.3	292	25.355
8/6/97	2200	58.9	85.9	54.7	0.6	341	2.2	354	25.357
8/6/97	2300	59.4	84.4	54.7	1.1	325	4.3	353	25.352
	min	**56.7**	**58.3**	**55.2**	**3.4**	**274**	**8.7**	**201**	**25.34**
	max	**73.3**							
	avg	**63.7**							

SPECIAL STUDY

OCTOBER 1981

CACHE LA POUDRE RIVER BASIN
LARIMER - WELD COUNTIES, COLORADO

VOLUME I
FLOOD HAZARD, DAM SAFETY AND FLOOD WARNING



US Army Corps Engineers
aha District

801

PRIOR STUDIES

A number of flood control and flood plain management studies of various kinds have been published by different agencies for the Cache la Poudre River basin. Table 3 lists these studies in brief summary form.

In addition to the Corps of Engineers other Federal agencies involved in flood plain management activities include the Federal Insurance Administration, under the Federal Emergency Management Agency, and the Soil Conservation Service.

Survey reports study a wide range of water resources problems. Section 205 and Section 14 reports involve small projects for flood control or streambank protection. The special studies are flood plain information studies done under the Corps' Technical Assistance Program.

Other reports have been prepared by private consultants, local governments, or universities.

FLOOD DAMAGE REDUCTION MEASURES

PHYSICAL IMPROVEMENTS

The Cache la Poudre River basin is laced with a complex system of diversions, canals, and reservoirs. There are about 70 reservoirs of varying sizes, most in the plains region. Except for two large reservoirs on the North Fork Cache la Poudre River, storage reservoirs are generally located on small tributaries or offstream and have little individual effect on decreasing floodflows. Almost all reservoirs in the basin are for irrigation or water supply; the exceptions are the SCS dams on Boxelder Creek which were designed for flood control. The operation of the reservoirs results in their being nearly full about June, and there is little extra storage available during the flood season.

Halligan Reservoir, built on the North Fork Cache la Poudre River, has attenuation effects downstream. Although the reservoir does not have specific flood control storage, floodflows are delayed by their passage through the reservoir spillway and are, thus, reduced.

On the plains, the cumulative incidental flood control effects of reservoirs can be significant as water is diverted from streams to fill storage in the reservoirs. Peak discharges on the Cache la Poudre River are attenuated considerably by these diversions. Peak discharges are also attenuated by valley storage. Discharges are reduced as floods spread out to fill the broad Cache la Poudre River Valley. On the smaller tributaries, diversion dams or canals may absorb normal high flows and result in complacency about flooding.

Under the provisions of the Watershed Protection and Flood Prevention Act, Public Law 566, a Soil Conservation Service watershed project for Boxelder Creek is under construction. The project includes land treatment measures together with construction of five single-purpose floodwater-retarding structures and one grade-stabilization structure. The Soil Conservation Service estimates that the project may reduce floodwater damages in the watershed by $171,310 annually.

REGULATION

Flood plain land use within the city limits of Greeley and Fort Collins is regulated by the respective city. All other flood plain land use is regulated by Larimer or Weld County.

The city of Greeley adopted a zoning ordinance in July 1976 which requires construction of detention ponds in new subdivisions designed to assure that development of the subdivision will not increase runoff. The city, however, has not enacted flood plain ordinances sufficient to be included in the National Flood Insurance Program as of this report.

1. Contacts

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: _____ Project/Proposal Name: _____
Computed: _____ Date: _____ Project/Proposal No.: _____ Task: _____
Checked: _____ Date: _____ Page _____ of _____

Calhan – Town Hall

(719) 347-2586 Marian – Utilities Foreman
Todd

Rain amounts in July 22, 1997

Elizabeth – Elbert County Assessor – Dave Munns
(303) 646-2710

Limon/Hugo County Roads – Chris Banks – shop? 719 743-2411 Limon
Hugo – shop? (719) 743-2411

County Clerk – Roxy Devers – FEMA applications, maps
(719) 743-2444 in Hugo

Limon Leader – (719) 775-2264

Karval/Punkin Center

Shaw

Arriba – (719) 768-3381 Clerk

Punkin Center – Tobe Riemenschneider

Karval – (719) 446-5341 Community Bldg.

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: JBurrell
DATE: 4/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Ms. Roxy Devers
AFFILIATION: Lincoln County Clerk
PHONE #: (719) 743-2444 (Hm)

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1. Affected streams and local drainages? don't know off-hand

2. Geographic extent of flooding? will send map. No damage around Sharon. Light damage W of Punkin Center. Most occurred E of Hwy 71 and in an area W of Hwy 109 and N of I-70. Isolated scattered damage S of I-70.

3. Storm duration? Starting time and ending time of major storm event?
don't know exactly - around July 28
- also possibly in early August had more rain

4. Rainfall amounts? Extent of rainfall?
—

5. Rainfall bucket surveys?
—

6. Precipitation gauging network?
—

7. Documentation of high water marks?
—

8. Estimated peak discharges?

9. Estimated flood damages?

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.

12. Types and amounts of repair work after flooding?

13. Any previous/recent flood mitigation efforts that reduced damages?

14. Any future mitigation needs as a result of the flooding?

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

16. Do you have any photos and/or video available? Are the photos in digital format?

will send photos.

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc. yes - will send flood damage maps

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

19. Is there any existing documentation regarding the flooding?

sent to FEMA in Ft. Collins

20. Name of local newspaper? Do they have a web site?

will talk to newspaper personnel later this.

21. Do you have an internet site? Do you know of any related local sites?

LINCOLN CO.

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: JBurrell
DATE: 4/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Receptionist/Reporters
AFFILIATION: Limon Leader (newspaper)
PHONE #: (719) 775-2264

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1. Affected streams and local drainages?

   Neither the receptionist or staff she talked to recall any newspaper coverage of July storms.

2. Geographic extent of flooding?

3. Storm duration? Starting time and ending time of major storm event?

4. Rainfall amounts? Extent of rainfall?

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

LINCOLN

Town of Limon Public Works - Dave Stone

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Jim Burrell
DATE: 4/24/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Dave Stone
AFFILIATION: Limon Publ. Works
PHONE #: 719-775-2346

---

1. Affected streams and local drainages? Big Sandy

2. Geographic extent of flooding? Not much - flood control dam held everything - they were at spill level. A little basement flooding here & there. More rain W of town washed out a road & water main - approx. 6 m. to W.

3. Storm duration? Starting time and ending time of major storm event?

4. Rainfall amounts? Extent of rainfall?
late july - early august 7/27 - had 4" in town
10-11" in that week
had snowstorm in late October

5. Rainfall bucket surveys?

6. Precipitation gauging network?

7. Documentation of high water marks?

8. Estimated peak discharges?

9. Estimated flood damages? Little damage in flood retention dam - corroded pipe on W dam eroded. No homes seriously damaged Water main washed out to W; had more rain approx 6 miles to W of town

10. Costs associated with the clean-up effort? Differentiate between local, state, and federal.

11. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.

12. Types and amounts of repair work after flooding?

13. Any previous/recent flood mitigation efforts that reduced damages?
Flood control dams on N side of town were at capacity, as were waterways through Limon.

14. Any future mitigation needs as a result of the flooding?

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

16. Do you have any photos and/or video available? Are the photos in digital format?

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

19. Is there any existing documentation regarding the flooding?

20. Name of local newspaper? Do they have a web site?

775 - 2064
Limon Leader

21. Do you have an internet site? Do you know of any related local sites?

Karval - dryer

Puntin Center -
Tobe Riemenschneider

2. Federal Data

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 6/13/97
Co.	Lincoln	DISASTER TIME: 9-10 PM

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain	Excessive Snow	Flash Flooding	Flooding
Freeze	Frost	Hail X	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA:

Hard wind with hail and rain (See Map attached)

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: 2668 Number of Farms: 11

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Wheat	2668	2668	85%	Headed
(Est. 75-85%	Insured)			

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. N/A

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount.

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON:

USDA Office Buildings: N/A

Office Equipment and Records: N/A

Employees, Employee Families & Homes: N/A

REPORTED BY: Jim Stone & Penny Wilkins TO: W. E. Fitzler CED DATE: 6/16/97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.

BACA COUNTY DISTRICT NO. 3

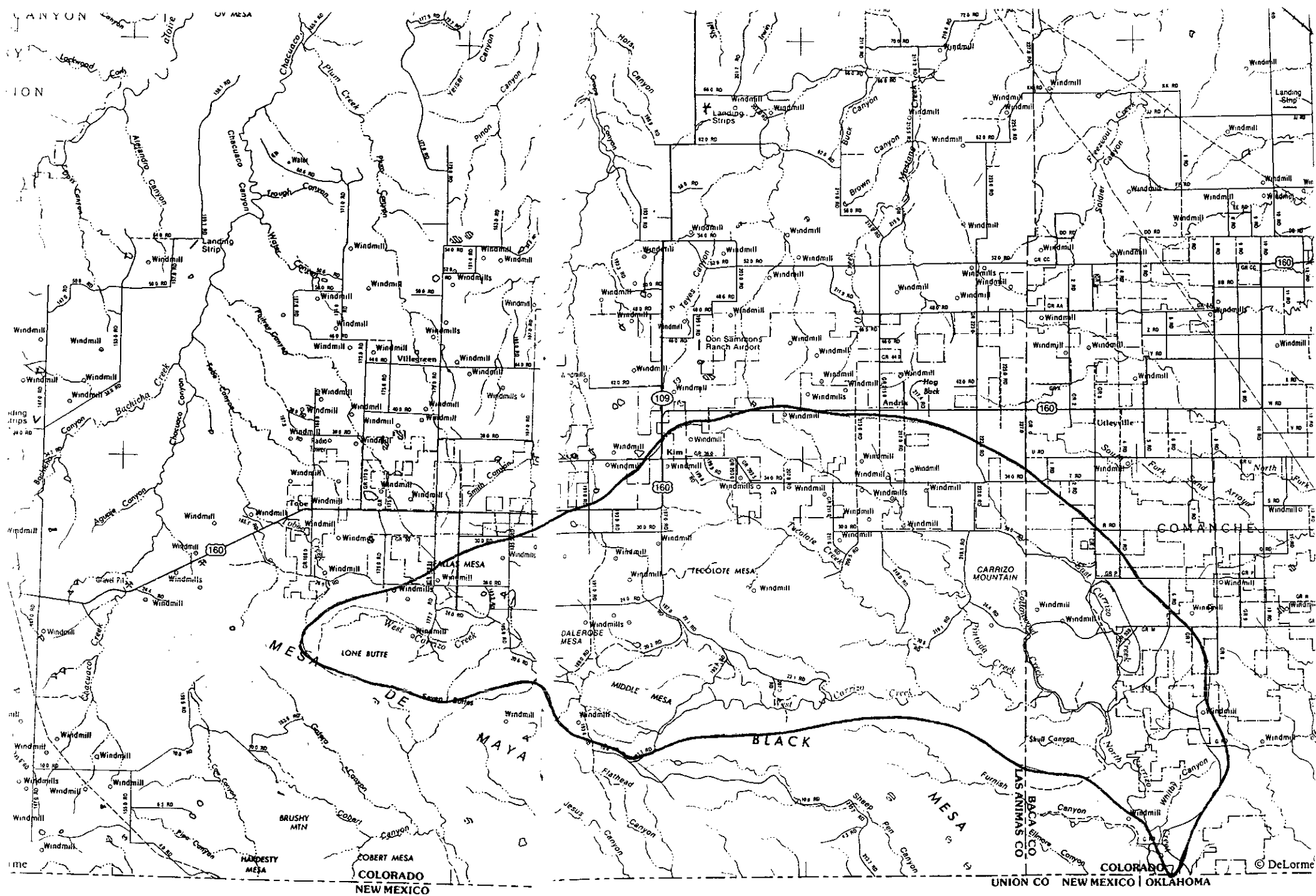
For Month of Slab on Rd 14

Item South of Rd FF

DATE	OPERATOR'S NAME	UNIT NO.	QUANTITY	PART NUMBER	PART NAME	PRICE EACH	MACHINE NAME
7/31/97	Clinton - Robert - Byron - James & Jemox						55 hrs
8/1/97				11	11	11	30 hrs
8/4/97				11	11	11	18 hrs
	Backhoe		15 hrs		#1,125	00	
	950F		10 hrs		A/200	00	
	Cement				1,834	00	

STANFIELD-GUYMON FORM BC-11

4. General Maps and Information



5 0 5 10 15 20

1 0 1 2 3 4 5 6 7 8 9 10 11 12

Scale 1:320,000

1 inch represents 5 miles

Contour interval

600 feet (182.9 meters)

SE Corner of Las Animas County, CO

SW Corner of Baca County, CO

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	August 10, 1998
Call Placed/Received by:	Bill Ellett
Spoke With:	Laura Oman
Company/Affiliation:	Clear Creek County
Phone no.:	(303) 569-3251 ex 382
Project No.:	D479, Task 51

Comments:

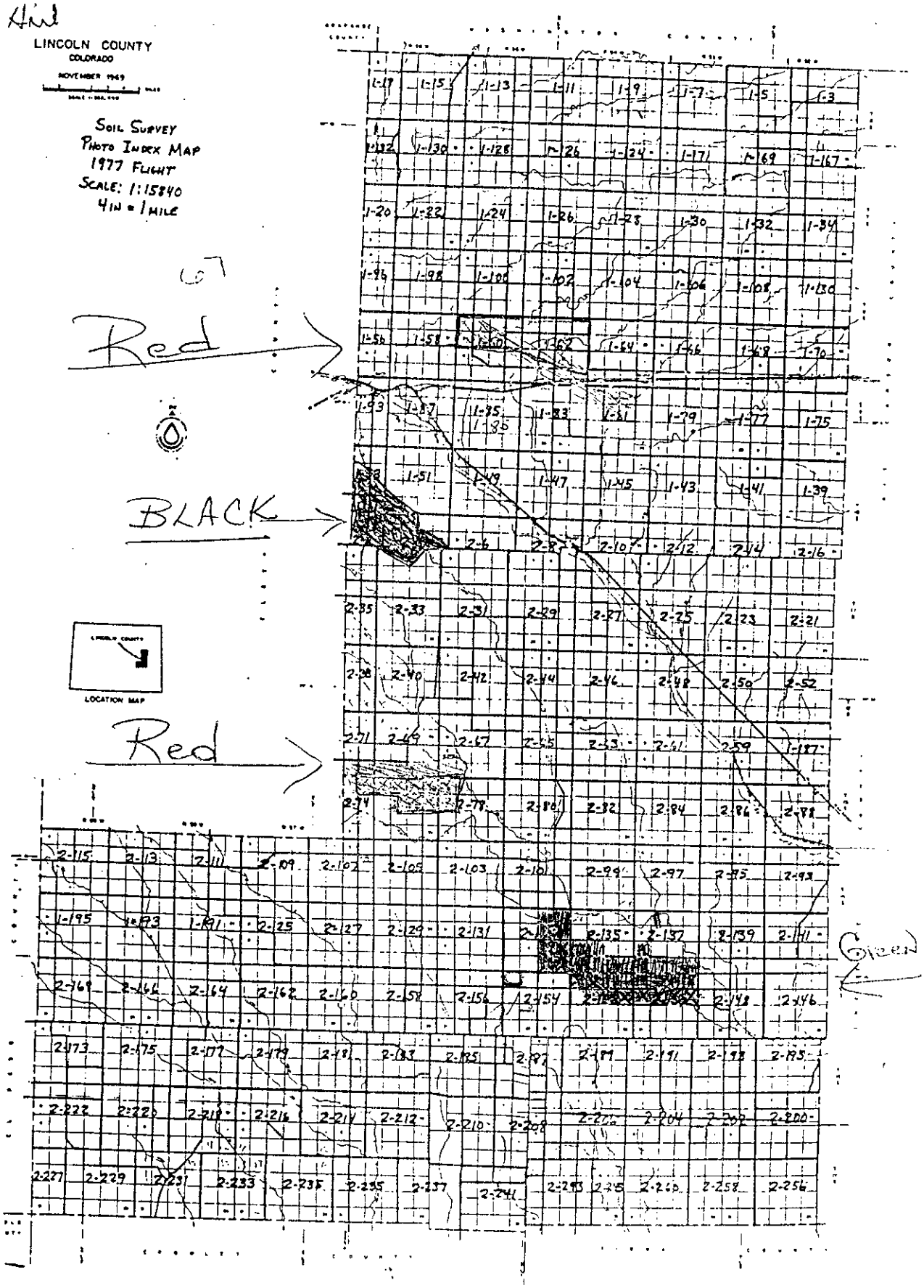
Laura called back and left a message that there was approximately $100,000 worth of damage to private property from the flooding in August of 1997. She also said that the pictures she spoke of last time we talked were now at FEMA and she wasn't sure how or if we could get copies. However, she said if I could meet with her she could give me some pictures that show flood damage immediately after the storm.

Signature W. J. Ellett

5/25/97 - Green Hail
6/13/97 - Red Hail
6/24/97 - Black Hail

LINCOLN COUNTY
COLORADO
NOVEMBER 1949

SOIL SURVEY
PHOTO INDEX MAP
1977 FLIGHT
SCALE: 1:15840
4 IN = 1 MILE



USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 6/24/97
CO	LINCOLN	DISASTER TIME: 6-6:30 PM

TYPE OF DISASTER:

Blizzard	Drought	Excessive Rain	Excessive Snow	Flash Flooding	Flooding
Freeze	Frost	Hail X	High Winds	Hurricane	Lightning
Tornado	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA:

Hard Wind with Hail + Rain

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: 4500 | Number of Farms: 10

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Wheat	4000	4000	60 %	HEADED
Millet	500	500	75 %	EMERGED
(Est. 100% Insured - Wheat)				

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. N/A

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount. N/A

Farm Dwellings & Service Buildings	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.)

Other Agricultural Losses/or Damages:

AFFECTS OF THE DISASTER ON:

USDA Office Buildings: N/A

Office Equipment and Records: N/A

Employees, Employee Families & Homes: N/A

REPORTED BY: WEFitzler, CED TO: ED Buck - FSA STO DATE: 6/25/97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.

USDA FLASH SITUATION REPORT

STATE	COUNTY	DISASTER DATE: 7/26-29/97
Colorado	Lincoln	DISASTER TIME: 5:00 PM

TYPE OF DISASTER:

Hazard	Drought	Excessive Rain X	Excessive Snow	Flash Flooding X	Flooding
Freeze	Frost	Hail	High Winds X	Hurricane	Lightning X
Tornado X	Other (Identify)				

DESCRIPTION OF DISASTER AND AFFECTED AREA: (See Map attached).

POTENTIAL USDA ASSISTANCE:

APHIS. Animal Disease & Plant Pest Control		FCS. Disaster Food Assistance		CSRE & ES. Technical Advice	
FSA. Emergency Conservation Program		FCS. Food Stamps		NRCS. Earthmoving Equipment	
FSA. Livestock Feed Programs		FSIS. Meat & Poultry Safety		NRCS. Technical & Financial Assistance	
FSA. Emergency Loans		RUS. Technical & Loans Assistance		FS. Fire Protection	
FSA. Noninsured Assistance Program (NAP)	X	CSRE & ES. Information Material			

ESTIMATED CROP LOSSES: Total Acres Affected: 2060 | Number of Farms: 20

Crops Affected	Acres Planted	Acres Affected	Percent of Loss	Stage of Growth
Millet	~~500~~ 625	400	50	4 to 5 Leaf stage
Proso	~~500~~ 625	400	50	" "
Sunflowers	280	160	80	2 foot tall
Grass for Grazing (Native)	—	1000	60	Growing stage
Hay	200	100	40	" "

ESTIMATED NUMBER OF LIVESTOCK AND POULTRY, ETC. LOST: Numbers only-no dollar amount. N/A

Cattle (Beef)	Poultry (Layers)	Swine
Cattle (Dairy)	Poultry (Broilers)	Aquaculture
Sheep	Turkeys	Other (Identify)

ESTIMATED LOSSES TO FARM FACILITIES AND LAND, ETC.: Numbers & Acres Only - No Dollar Amount.

Farm Dwellings & Service Buildings 2	Farm Machinery & Equipment
Farm Structures (dam, silo, etc.)	Land Damages (erosion, gullying, etc.) 2060 acres
Other Agricultural Losses/or Damages:	

AFFECTS OF THE DISASTER ON:

USDA Office Buildings: N/A

Office Equipment and Records: N/A

Employees, Employee Families & Homes: N/A

RTED BY: WEFritzler, CED TO: Ed Buck - FSA-STC DATE: 7/30/97

Note: This is a preliminary disaster report. DO NOT use this data as official USDA data.

5/25/97 - ~~Access~~ Haul Green
6/13/97 - Red Haul
6/24/97 - Black Haul
7/26-29/97 - Blue Haul & Excavation

LINCOLN COUNTY
COLORADO

SOIL SURVEY
PHOTO INDEX MAP
1977 FLIGHT
SCALE: 1:15840
4 IN = 1 MILE

Blue

Red

BLACK

Red

LOCATION MAP

Green

361-0661

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COC073-020335-

SMALL STREAM FLOOD ADVISORY STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
905 PM MDT FRI AUG 1 1997

...SMALL STREAM FLOOD ADVISORY CANCELLED FOR LINCOLN COUNTY...

THE NATIONAL WEATHER SERVICE IN DENVER HAS CANCELLED THE SMALL STREAM FLOOD ADVISORY FOR PEOPLE IN CENTRAL AND SOUTHERN LINCOLN COUNTY IN EAST CENTRAL COLORADO.

AS OF 900 PM MDT NATIONAL WEATHER SERVICE DOPPLER RADAR NO LONGER INDICATES ANY THUNDERSTORM ACTIVITY OVER LINCOLN COUNTY.

EARLIER THIS EVENING...SLOW MOVING THUNDERSTORMS WERE PRODUCING VERY HEAVY RAIN OVER CENTRAL LINCOLN COUNTY...WITH RADAR DETECTING FROM 3 TO 4 INCHES OF RAIN IN OPEN RANGELAND SOUTHWEST OF THE TOWN OF HUGO.

THE LINCOLN COUNTY SHERIFF HAS RECEIVED NO REPORTS OF ANY FLOODING AS A RESULT OF THIS HEAVY RAINFALL.

EXCESSIVE RUNOFF FROM THIS STORM MAY STILL CAUSE MINOR FLOODING OF SMALL CREEKS AND STREAMS...NORMALLY DRY WASHES AND ARROYOS...AS WELL AS RANGELAND ALONG THE BANKS OF CREEKS AND STREAMS FOR THE NEXT HOUR.

BAKER

FORM B-91 (-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Local) Hasse Ranch (River Station, if different) | MONTH May | 19 97

STATE Colo | COUNTY Elbert | RIVER

TIME (local) OF OBSERVATION | TEMP. | PRECIPITATION | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				0													
9				0													
10				0													
11				0													
12				.06													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				.56													
20				0													
21				0													
22				.66													
23				.13													
24				0													
25				0													
26				0													
27				0													
28				0													
29				.04													
30				.03													
31				0													
SUM			SUM	1.48													

56
-6C
-26
1,48

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds

OBSERVER Burton Hasse

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO. 05-5020-1

STATION (Climato[illegible]) 2[illegible] - Hays Ranch (River Station, if different) | MONTH June | 19 97

STATE Colo | COUNTY Elbert | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 7A | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91)

U.S. DEPARTM[illegible] COMMERCE
NATIONAL OCEANIC AND ATMOSPHE[illegible] NISTRATION
NATIONAL [illegible]ER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc..)
1				0													
2				.07													
3				.08													
4				0													
5				0													
6				0													
7				.17													
8				0													
9				.36													
10				.40													
11				.25													
12				.0													
13				.68													
14				.42													
15				.08													
16				.04													
17				0													
18				0													
19				0													
20				.04													
21				0													
22				0													
23				0													
24				0													
25				.04													
26				0													
27				.25													
28				0													
29				0													
30				0													
31																	
SUM			SOM	2.88													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Burton Hays

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO 05-5020-1

STATION (Climatological): [illegible], Hass Ranch (River Station, if different) | MONTH: July | 19 97

STATE: Colo | COUNTY: Elbert | RIVER:

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION: 7 A | STANDARD TIME IN USE: M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91 (93)

U.S. DEPAR[TMENT OF COMMERCE]
NATIONAL OCEANIC AND ATMOSP[HERIC ADMINISTRATION]
NATIO[NAL WEATHER SERVICE]

(719) 775-2539

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATI[ONS]

< 3 mi S. of Limon

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	REMARKS (Special observations, etc.)
1				0			
2				0			
3				0			
4				0			
5				.01			
6				0			
7				0			
8				0			
9				0			
10				0			
11				0			
12				0			
13				0			
14				0			
15				0			
16				0			
17				0			
18				0			
19				0			
20				.18			
21				0			
22				0			
23				0			
24				0			
25				0			
26				10			
27				.24			
28	pros wet		.41	[illegible]			
29				.37			
30				4.40			
31				0			
SUM			SUM	5.73			

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved. A.M. 1 2 3 4 5 6 7 8 9 10 11 NOON P.M. 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog, Ice Pellets, Glaze, Thunder, Hail, Damaging Winds | Time of observation if different from above | RIVER STAGE: CONDITION, GAGE READING AT ___ A.M., TENDENCY

Much damage from 4.40 rain to field roads & fences

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Burton Hass

SUPERVISING OFFICE: NATIONAL WEATHER SERVICE, 10230 SMITH ROAD, DENVER, CO 80239-2238

STATION INDEX NO: 05-5020-1

ORM B-91
j)

U.S. DEPARTM
NATIONAL OCEANIC AND ATMOSPHE
NATIONAL

OMMERCE
NISTRATION
HER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Clim: Simon Hass Ranch (River Station if different)		MONTH Aug	19 97
STATE Colo	COUNTY Elbert	RIVER	
TIME (local) OF OBSERVATION RIVER	TEMP.	PRECIPITATION 7 A	STANDARD TIME IN USE M
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0														
2				0														
3				T														
4				.04														
5				.01														
6				.17														
7				.16														
8				.08			shower											
9				0														
10				.01														
11				0														
12				.24														
13				.06														
14				0														
15				0														
16				0														
17				0														
18				.05														
19				.29														
20				0														
21				0														
22				.03														
23				.23														
24				0														
25				0														
26				0														
27				.06														
28				0														
29				.19														
30				0														
31				.10														
SUM			SUM	2.73														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Buton Hass

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO 05-5020-1

FORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climate) on Hass Ranch (River Station, if different) | MONTH Sept | 19 97

STATE Colo. | COUNTY Elbert | RIVER

TIME (local) OF OBSERVATION | TEMP. | PRECIPITATION | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				.05				✓									
2				.05													
3				0				✓									
4				0													
5				0													
6				0													
7				1.47													
8				0													
9				0													
10				0													
11				0													
12				0													
13				0													
14				.13				✓									
15				0													
16				0													
17				0													
18				0													
19				0													
20				0													
21				0													
22				0													
23				0													
24				0													
25				0													
26				0													
27				0													
28				0													
29				0													
30				0													
31				0													
SUM			SUM	1.70													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Burton Hass

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO 05-5020-1

STAT (Climatological) Lyman Hass Ranch (River Station, if different) MONTH Oct 19 9

STATE Colo COUNTY Elbert RIVER

TIME (local) OF OBSERVATION RIVER TEMP. PRECIPITATION 7A STANDARD TIME IN USE M

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				0													
9				0													
10				0													
11				0													
12				.74													
13				.05													
14				0													
15				0													
16				0													
17				0													
18				0													
19				0													
20				0													
21				0													
22				0													
23				0													
24		R 3 C		0													
25				.50	6 1	6											
26				.17	2 1	7											
27						5											
28				0		5											
29				0		4											
30				0		4											
31				0		3											
SUM			SUM	1.46													

Very bad blizzard the 26th
many cattle lost
very large drifts

Snow'd in late

'79

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel. | Glaze | Thund. | Hail | Dam. Winds

OBSERVER Burton Hass

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO 05-5020-1146

STATION (Climatological) Hugo (River Station, if different) | MONTH June | 19 97

STATE CO | COUNTY Lincoln | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 6:45 | PRECIPITATION 6:45 | STANDARD TIME IN USE

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

NWS FORM B-91 (9)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	87	46	46															
2	90	48	57															
3	94	51	55	.22							X							
4	96	47	49															
5	96	49	53															
6	83	53	56															
7	77	53	57	.23														
8	72	53	54	.43														
9	70	52	52	.99	(.99)													
10	59	49	50	1.23														
11	70	50	55															
12	85	54	56															
13	80	51	52	.38														
14	74	52	58	.06														
15	74	54	62															
16	81	51	55															
17	78	48	52															
18	81	52	55															
19	87	55	60															
20																		
21																		
22																		
23	94	54	58															
24	84	54	57															
25	86	51	54	.65							X							
26	87	49	51	.09														
27	82	50	53															
28	89	51	55															
29	91	53	57								X							
30	89	51	55															
31																		
SUM			SUM	3.73														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Marvin L Stroble

SUPERVISING OFFICE WFO Denver

STATION INDEX NO 05-4172-01

STATION (Climatological) Hugo (River Station, if different) MONTH July 1977
STATE Co COUNTY Lincoln RIVER
TIME (local) OF OBSERVATION RIVER TEMP. 6:45 PRECIPITATION 6:45 STANDARD TIME IN USE M
TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

FORM B-91 (89) U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	Temperature F. 24 hrs. ending at observation MAX.	MIN.	AT OBSN.	Precipitation 24-hr amounts: Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	River Stage: Condition	Gage reading at ___ A.M.	Tendency	Remarks (Special observations, etc.)
1	94	55	59														
2	93	45	48														
3	82	45	51														
4																	
5	81	46	60														
6	84	47	52	.05						X							
7	87	48	49				X										
8	92	49	58	.10						X							
9	89	51	52	.10						X							
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21	85	58	55														
22	89	55	57														
23	91	57	60														
24	95	59	65														
25	93	60	62														
26	96	59	60	.20					X	X							
27	94	60	64	.40					X	X							Wind
28	92	63	63	.95						X							Wind
29	80	59	60	.85						X							Wind
30	80	60	60	1.15						X							Wind
31	83	60	63				X										
SUM			SUM	3.80													

Dac.

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING | DATE

OBSERVER Marvin L. Thalla

SUPERVISING OFFICE WFO Denver

STATION INDEX NO. 05-4172-01

FORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): 1 - W-Hugo | (River Station, if different) | MONTH: Aug | 1997
STATE: C | COUNTY: Lincoln | RIVER:
TIME (local) OF OBSERVATION RIVER | TEMP. 6:45 | PRECIPITATION 6:45 | STANDARD TIME IN USE
TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	REMARKS (Special observations, etc.)
1	88	60	64										
2													
3	90	58	58	1.35						X			Wind
4	85	58	61										
5	85	61	62	1.20						X			Hard Rain at 12:30 AM
6	68	56	56	.11						X			Drizzle all afternoon & night
7	73	42	42	.13									Drizzle
8	76	47	49				X						
9	89	49	68										
10	77	56	56										
11	60	56	58	.09			X						Drizzle all day 8-10 & 8-11 morning
12	73	52	52	.25						X			
13	80	52	58	.43						X			
14	84	53	54	T									
15	85	52	57										
16	89	57	58										
17	84	55	56				X						
18	75	54	60	.27						X			
19	79	51	55	.25						X			
20	85	53	53										
21	86	53	58				X						
22	92	56	56										
23	87	54	55	.10						X			Hard Wind with Rain.
24	90	55	55	.07						X			
25	90	55	61										
26	92	61	64							X			
27	90	60	61							X			
28	89	57	58										
29	87	58	61	.25						X			
30	89	58	60										
31	83	57	58										
SUM			SUM	4.50									

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day): Mark 'X' for all types occurring each day.

RIVER STAGE: Time of observation if different from above | CONDITION | GAGE READING AT ___ A.M. | TENDENCY

CHECK BAR (For wire-weight) NORMAL CK. BAR: READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Marvin L. [illegible]

SUPERVISING OFFICE: WFO Denver

STATION INDEX NO. 05-4172-01

ORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): Hugo
(River Station, if different)
MONTH: Sept 1997
STATE: Co.
COUNTY: Lincoln
RIVER
TIME (local) OF OBSERVATION RIVER
TEMP: 6:45 AM
PRECIPITATION: 6:45 AM
STANDARD TIME IN USE
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	83	55	55	.60						X							Rain 830 PM on 8-31-97.
2	87	54	59	0													
3	72	57	59	0			X										
4	76	58	58	0			X										
5	83	57	57	.05						X							
6	76	53	54	0						X							
7	87	52	53	.17						X							
8	87	53	53	0													
9	88	53	54	0						X							
10	73	50	54	0			X										
11	82	47	49	0			X										
12	84	49	55	0													
13	87	50	50	0													
14	88	50	57	0			X										
15	89	52	53	0													
16	90	53	57	0													
17	80	50	51	0													
18	83	46	47	0													
19	89	46	50	0													
20	75	42	43	T						X							
21	49	40	40	T			X										Fog all day
22	54	39	52	.05			X										Ready at 630 AM.
23	65	46	46	.05													
24	58	44	45	0													
25	71	39	41	0													
26	82	37	43	0													
27	87	43	52	0													
28	87	37	38	0													
29	75	38	41	0													
30	83	41	42	0													
31	—	—															
SUM			SUM	.42													

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING | DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Marvin L. [illegible]
SUPERVISING OFFICE: WFO Denver
STATION INDEX NO. 05-4172-01

NWS FORM B-91 (39)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE: NW-#460 | COUNTY: Lincoln | ~~OCT~~ | 19 97 | RIVER:

TIME (loc.) | OBSERVATION | RIVER | TEMP. 6:45 | PRECIPITATION 6:45 | STANDARD TIME IN USE

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	83	47	47														
2	86	49	46														
3	87	52	56														
4	79	41	42														
5	81	42	46														
6	85	44	54														
7	75	46	54														
8	82	49	49														
9	63	29	30														
10	66	31	37														
11	83	35	54														
12	80	40	41	1.20						X	X						Hard Rain + pea size hail
13	45	25	27	.30	T												Snow & Rain
14	59	26	27														
15	66	21	40														
16																	
17	67	30	30														
18	76	30	39														
19	78	38	41														
20	59	39	39														
21	49	39	40														
22	59	28	29														
23	70	28	31														
24	68	36	36														
25	39	13	13	.60	6in	6in											snow had 4in 6in
26	17	7	10	.20	6in	6in											
27	32	9	13			6in											
28	51	12	32			4											
29	32	24	25			2											
30	58	25	34														
31	63	30	37														time 535 AM,
SUM			SUM	2.80													

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER: Marie L Stalls

SUPERVISING OFFICE: WFO Dawn

STATION INDEX NO.: 05-4172-01

STATION (Climate) Kit Carson (River Station, if different) | MONTH May | 19 97

STATE Colorado | COUNTY Lincoln | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7AM. | PRECIPITATION 7AM. | STANDARD TIME IN USE ~~MD~~ M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	74	30	35	0	0	0												
2	70	29	35	0	0	0												
3	56	28	38	0	0	0												
4	M	M	56	0	0	0												
5	77	44	52	0	0	0												
6	70	42	56	0	0	0												
7	M	M	54	0	0	0												
8	60	26	44	T	0	0												
9	53	31	38	0	0	0												
10	67	35	52	0	0	0												
11	77	47	50	0	0	0												
12	69	36	40	.13	0	0												
13	69	40	47	0	0	0												
14	80	40	46	0	0	0												
15	73	39	46	.02	0	0												
16	73	42	54	0	0	0												
17	87	51	60	0	0	0												
18	88	53	60	0	0	0												
19	83	40	41	.40	0	0												
20	56	37	39	0	0	0												
21	71	39	51	0	0	0												
22	74	49	49	0	0	0												
23	69	47	50	.05	0	0												
24	72	44	51	0	0	0		X										
25	78	45	59	0	0	0												
26	71	44	51	.06	0	0						X						
27	66	39	47	0	0	0												
28	70	38	45	0	0	0												
29	74	40	50	0	0	0		X										
30	70	46	54	T	0	0												
31	75	46	57	.09	0	0												
SUM			SUM	.75				Fog	Ice Pel.	Glaze	Thund.	Hail	Dam Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage
E. Ice gorge below gage
F. Shore Ice.
G. Floating Ice.
H. Pool stage.

OBSERVER Cynthia Leonard

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO 05-4444-1

FORM B-91

U S DEPARTMEN OMMERCE
NATIONAL OCEANIC AND ATMOSPHERI STRATION
NATIONAL V SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climato) Karval (River Station if different) | MONTH June | 19 97

STATE Colorado | COUNTY Lincoln | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 7AM | PRECIPITATION 7AM | STANDARD TIME IN USE MD

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft | FLOOD STAGE Ft | NORMAL POOL STAGE Ft

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A.M. NOON P.M	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT A.M	TENDENCY	REMARKS (Special observations, etc.)
1	84	49	57	0	0	0											
2	87	55	55	.04	0	0		X			X						
3	73	51	58	.06	0	0											
4	75	46	47	0	0	0		X									
5	75	47	57	0	0	0											
6	82	54	54	0	0	0		X									
7	77	52	59	.64	0	0					X						
8	74	53	56	.64	0	0					X						
9	69	51	51	.24	0	0					X						
10	62	48	49	.62	0	0		X									
11	M	M	58	.26	0	0											
12	82	53	61	0	0	0											
13	78	50	56	.34	0	0					X						
14	71	54	58	0	0	0											
15	77	50	55	0	0	0											
16	80	49	55	.31	0	0					X	X					
17	74	50	65	0	0	0											
18	M	M	M	0	0	0											
19	M	M	M	.11	0	0											
20	M	M	M	0	0	0											
21	M	M	65	0	0	0											
22	82	57	64	0	0	0											
23	90	55	57	0	0	0											
24	84	54	70	0	0	0											
25	85	54	59	.09	0	0					X						
26	M	M	55	.50	0	0					X						
27	82	52	61	0	0	0											
28	88	53	67	0	0	0											
29	90	55	68	0	0	0											
30	89	52	54	0	0	0											
31																	
SUM			SUM	3.85				Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds				

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER Cynthia Leonard

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER

STATION INDEX NO 05-4444-1

STATION (local): Ka[illegible] (River Station, if different) MONTH: July 1997

S FORM B-91 (7-89)

U.S. DEPA[illegible] OF COMMERCE
NATIONAL OCEANIC AND ATMOSP[illegible] ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE: Colorado COUNTY: Lincoln RIVER:

TIME (local) OF OBSERVATION RIVER: TEMP.: 7 AM PRECIPITATION: 7 AM STANDARD TIME IN USE: MD

TYPE OF RIVER GAGE: ELEVATION OF RIVER GAGE ZERO: Ft. FLOOD STAGE: Ft. NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	95	52	67	0	0	0											
2	93	47	58	0	0	0											
3	81	51	53	0	0	0											
4	76	46	56	0	0	0											
5	75	49	57	0	0	0											
6	89	47	55	0	0	0											
7	84	50	60	0	0	0											
8	M	M	64	.03	0	0				X							
9	89	53	60	.05	0	0				X							
10	87	55	66	0	0	0											
11	93	59	64	0	0	0											
12	93	58	64	.01	0	0				X							
13	93	54	59	0	0	0											
14	87	58	61	0	0	0											
15	88	55	64	0	0	0											
16	97	55	64	0	0	0											
17	98	59	69	0	0	0											
18	97	56	65	0	0	0											
19	92	58	65	0	0	0											
20	M	M	62	.10	0	0				X							
21	M	M	68	T	0	0											
22	90	56	67	0	0	0											
23	90	59	68	0	0	0											
24	94	62	70	0	0	0											
25	95	61	70	0	0	0											
26	93	58	64	.08	0	0											
27	94	61	68	0	0	0											
28	92	63	64	.02	0	0											
29	83	58	59	1.10	0	0				X							
30	M	M	61	.79	0	0	X			X							
31	84	61	62	0	0	0											
SUM			SUM	2.18			Fog	Ice Pel	Glaze	Thund.	Hail	Dam. Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING / DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Cynthia Leonard

SUPERVISING OFFICE: NATIONAL WEATHER SERVICE 10[illegible] SMITH ROAD

STATION INDEX NO: 05-4444-1

U.S. DEPARTMENT [of Co]MMERCE
NATIONAL OCEANIC AND ATMOSPHERIC [ADMINIS]TRATION
NATIONAL WE[ATHE]R SERVICE

[FOR]M B-91

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): Karv
(River Station, if different):
MONTH: Aug 19 97
STATE: Colorado
COUNTY: Lincoln
RIVER:
TIME (local) OF OBSERVATION RIVER:
TEMP.: 7 AM.
PRECIPITATION: 7 AM.
STANDARD TIME IN USE: MD
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	88	62	69	0	0	0											
2	88	61	66	.08	0	0											
3	M	M	66	.25	0	0				X							
4	83	60	62	0	0	0											
5	84	59	60	.37	0	0											
6	64	55	55	1.23	0	0											
7	67	54	63	.16	0	0											
8	74	53	55	0	0	0	X										
9	84	53	65	0	0	0											
10	77	55	56	.10	0	0	X										
11	63	55	58	.16	0	0	X										
12	73	51	57	.04	0	0	X										
13	78	56	59	.01	0	0	X										
14	86	55	59	.05	0	0											
15	86	54	60	0	0	0											
16	88	55	63	0	0	0											
17	85	54	56	0	0	0											
18	M	M	60	.05	0	0	X			X							
19	81	53	57	0	0	0											
20	88	54	57	0	0	0											
21	88	53	57	0	0	0											
22	95	57	57	0	0	0											
23	M	M	64	.10	0	0											
24	87	55	66	0	0	0											
25	89	58	62	0	0	0											
26	91	60	60	0	0	0											
27	89	60	67	0	0	0											
28	91	62	62	0	0	0											
29	89	61	61	0	0	0				X							
30	M	M	64	.71	0	0				X	X						
31	M	M	61	.02	0	0											
SUM			SUM	3.33													

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Cynthia Leonard

SUPERVISING OFFICE: NATIONAL WEATHER SERVICE 10230 SMITH ROAD

STATION INDEX NO: 05-4444-1

FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION: Karval	(River Station, if different)	MONTH: Sept.	19 97
STATE: Colorado	COUNTY: Lincoln	RIVER	
TIME (local) OF OBSERVATION RIVER	TEMP. 7 AM.	PRECIPITATION 7 AM.	STANDARD TIME IN USE: MD
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	M	M	64	.13	0	0				X							
2	87	M	58	.07	0	0											
3	75	58	58	0	0	0	X										
4	74	56	57	0	0	0	X										
5	80	56	58	0	0	0											
6	81	M	65	0	0	0											
7	M	M	64	.28	0	0				X							
8	86	54	56	0	0	0											
9	88	54	54	0	0	0											
10	67	50	53	0	0	0	X										
11	80	49	49	0	0	0	X										
12	83	49	57	0	0	0											
13	83	M	63	0	0	0											
14	85	56	62	0	0	0											
15	90	57	62	0	0	0											
16	90	58	58	0	0	0											
17	81	50	50	0	0	0											
18	82	50	55	0	0	0											
19	90	53	53	0	0	0											
20	76	42	43	0	0	0											
21	47	40	40	.08	0	0	X										
22	53	40	53	.01	0	0	X										
23	69	46	47	0	0	0											
24	64	43	46	0	0	0											
25	73	41	44	0	0	0											
26	80	42	45	0	0	0											
27	90	45	58	0	0	0											
28	85	44	52	0	0	0											
29	83	47	48	0	0	0											
30	81	46	48	0	0	0											
31																	
SUM			SUM	.57			Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice
D. Ice gorge above gage
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage

OBSERVER: Cynthia Leonard

SUPERVISING OFFICE: NATIONAL WEATHER SERVICE 10230 ...

STATION INDEX NO. 05-4444-1

STATION (Clima) Kacv (River Station, if different) MONTH Oct 19 97

STATE Colorado COUNTY Lincoln RIVER

TIME (local) OF OBSERVATION RIVER TEMP. 7A.M. PRECIPITATION 7A.M. STANDARD TIME IN USE MD

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

FORM B-91

U.S. DEPARTME
NATIONAL OCEANIC AND ATMOSPHER
NATIONAL

OMMERCE
IISTRATION
ER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11
1	80	47	51	0	0	0		
2	84	45	46	0	0	0		
3	87	45	55	0	0	0		
4	78	44	45	0	0	0		
5	80	45	59	0	0	0		
6	84	48	52	0	0	0		
7	M	M	M	0	0	0		
8	M	M	M	0	0	0		
9	M	M	29	0	0	0		
10	65	29	49	0	0	0		
11	82	49	61	0	0	0		
12	80	36	36	.46	0	0		
13	M	M	33	.05	0	0		
14	58	33	34	0	0	0		
15	64	31	39	0	0	0		
16	71	34	37	0	0	0		
17	64	32	32	0	0	0		
18	73	31	42	0	0	0		
19	80	39	41	0	0	0		
20	55	38	38	0	0	0		
21	48	38	38	0	0	0		
22	54	31	37	0	0	0		
23	68	37	43	0	0	0		
24	71	38	38	0	0	0		
25	44	13	13	.44	10	10		
26	M	M	18	.75	8	18		
27	35	18	31	0	0	12		
28	54	30	37	0	0	8		
29	55	26	29	0	0	4		
30	66	28	37	0	0	2		
31	67	35	42	0	0	1		
SUM			SUM	1.70				

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above

RIVER STAGE

CONDITION	GAGE READING AT ___ A.M.	TENDENCY

REMARKS (Special observations, etc.)

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating Ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds

OBSERVER Cynthia Leonard

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER CO 80239-3238

STATION INDEX NO 05-4444-1

STATION (Climatological) R... L IN (River Station, if different) | MONTH MAY | 19 97

STATE Co | COUNTY EL PASO | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE MDT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91 3)

U.S. DEPARTM... NATIONAL OCEANIC AND ATMOSPHE... NATIONAL ... COMMERCE ... INISTRATION ... HER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	53	29	33	0													
2	60	25	30	T													Very windy N (Hard)
3	50	24	32	T													
4	59	32	48	0													
5	71	37	40	0													
6	63	40	60	0													
7	75	44	52	0													
8	69	37	39	T													
9	49	29	37	0													
10	62	29	47	0													
11	72	42	44	0													
12	59	31	35	.12													
13	63	35	59	0													
14	74	33	48	0													
15	66	35	42	.02													
16	68	42	56	.04													
17	74	45	56	0													
18	80	46	58	T													
19	73	35	36	.97							X						
20	50	35	46	T													
21	64	46	46	0				X									
22	68	45	46	.08				X									
23	51	43	48	.17				X									
24	65	40	47	0				X									
25	70	44	49	0													
26	63	38	46	.07													
27	60	34	41	0													
28	58	34	45	0													
29	65	43	43	T													
30	67	43	50	T													
31	63	45	56	.14													
SUM			SUM	1.61													

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

OBSERVER THOMAS H. HOOVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7287-1

STATION (City) R 4 IN (River Station, if different) | MONTH JUNE | 19 97

STATE Colo | COUNTY EL PASO | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE M.D.T.

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

ORM B-91
3)

U.S. DEPARTM COMMERCE
NATIONAL OCEANIC AND ATMOSPHE INISTRATION
NATIONAL THER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc..)
1	79	45	59	0													
2	78	45	51	T				X									
3	66	45	53	0				X									
4	72	43	55	0				X									
5	71	47	47	0				X			X						
6	75	48	51	0				X									
7	71	49	50	.26				X									
8	65	47	49	.05				X									
9	65	47	49	.13				X									
10	52	45	47	.18				X			X						
11	69	46	53	1.40													
12	77	48	57	0							X						
13	77	43	49	.67				X									
14	64	50	51	2				X			X						
15	72	48	55	0													
16	70	43	52	.05													
17	66	47	55	0													
18	77	50	61	0													
19	79	50	63	.03							X						
20	84	50	71	0													
21	86	53	64	0													
22	78	52	62	0				X									
23	84	50	54	0													
24	82	50	55	T							X						
25	78	45	52	.03							X						
26	75	46	52	.14													
27	77	49	52	0													
28	83	47	63	0							X						
29	55	50	64	0													
30	82	47	67	0													
31																	
SUM			SUM	3.54													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER THOMAS H. HOOVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-7287-1

STATION (Cli[illegible]al) F H IN (River Station, if different) | MONTH July | 19 97

STATE Colo. | COUNTY El Paso | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 0700 | PRECIPITATION 0700 | STANDARD TIME IN USE M.D.T.

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91 (93)

U.S. DEPART[illegible] OF COMMERCE
NATIONAL OCEANIC AND ATMOSP[illegible] ADMINISTRATION
NATION[illegible] WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	88	53	67	0													
2	27	42	55	0													HIGH WIND S.SE
3	76	45	50	0													HIGH WIND N.
4	71	40	52	0													
5	74	48	58	0						X							
6	82	44	54	T													
7	80	47	56	0						X							
8	86	50	60	.02													
9	82	49	62	0													
10	82	48	59	0													
11	86	53	56	0													
12	93	50	60	T													
13	85	51	60	0													
14	82	54	60	0													
15	81	50	62	0													
16	93	60	75	0													
17	92	55	65	0													
18	89	51	64	0													
19	87	54	62	0						X							
20	80	50	58	.23						X							
21	77	50	62	T						X							
22	82	52	63	0													
23	93	56	68	0						X							
24	88	58	70	0													
25	88	59	73	0						X							
26	87	55	62	T						X							
27	86	55	65	.05						X							
28	84	55	58	.16						X							
29	75	54	56	.13						X							
30	76	52	56	2.63													
31	77	54	62	0													
SUM			SUM	3.22													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice
H. Pool stage.

OBSERVER THOMAS H. HOOVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7287-1

FORM B-91
(3)

U.S. DEPART
NATIONAL OCEANIC AND ATMOSPH
NATIONAL

COMMERCE
MINISTRATION
THER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) FT H IN (River Station, if different)
MONTH AUG 19 97
STATE COLO.
COUNTY EL PASO
RIVER
TIME (local) OF OBSERVATION RIVER
TEMP. 0700
PRECIPITATION 0700
STANDARD TIME IN USE M.D.T.
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO Ft.
FLOOD STAGE Ft.
NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	81	58	64	0														
2	80	56	62	0							X							
3	80	54	64	.65														
4	78	55	00	0														
5	77	54	54	.29														
6	58	51	51	.20														
7	60	47	50	.19														
8	69	49	58	0														
9	82	54	64	0				X			X							
10	70	56	50	.18				X										
11	59	50	52	.04				X			X							
12	69	49	53	.13							X							
13	71	50	56	.09							X							
14	77	48	60	.04														
15	79	51	62	0				X			X							
16	93	48	51	.11				X			X							
17	67	52	55	.05				X										
18	73	51	56	.04							X							
19	81	50	58	T							X							
20	80	51	58	0														
21	85	51	61	T							X							
22	79	52	63	.11														
23	82	53	68	0							X							
24	83	57	63	.03							X							
25	83	58	68	T							X							
26	82	57	65	T							X							
27	76	56	67	0							X	X						
28	83	54	64	.42							X							
29	82	52	57	.42							X							
30	82	53	53	T							X							
31	71	51	59	.05							X							
SUM			SUM	3.04														

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel | Glaze | Thund | Hail | Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER THOMAS H. HOOVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7287-1

FORM B-91
93)

U.S. DEPAR
NATIONAL OCEANIC AND ATMOSPI
NATIONAL ...EATHER SERVICE

F COMMERCE
...MINISTRATION

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Cl ...rical) SH IV (River Station, if different)
MONTH SEPT 19 97
STATE COLO
COUNTY EL PASO
RIVER
TIME (local) OF OBSERVATION RIVER
TEMP 0700
PRECIPITATION 0700
STANDARD TIME IN USE MDT
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO Ft.
FLOOD STAGE Ft.
NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)
1	77	51	53	.07		
2	68	54	54	.03		
3	69	50	53	.02		
4	75	52	56	.09		
5	78	52	60	0		
6	79	48	61	.05		
7	78	49	68	0		
8	80	47	49	.02		
9	63	45	53	0		
10	77	47	60	0		
11	72	52	59	T		
12	77	49	65	0		
13	80	48	57	0		
14	81	50	65	0		
15	84	50	54	.02		
16	73	45	48	0		
17	76	48	61	0		
18	84	47	47	0		
19	84	37	38	.08		
20	70	37	38	.20		
21	51	38	48	.01		
22	60	41	42	.05		
23	57	40	43	0		
24	66	38	40	0		
25	73	41	46	0		
26	83	47	50	0		
27	83	36	43	0		
28	69	41	48	0		
29	79	43	44	0		
30	75	45	50	0		
31						
SUM			SUM	0.65		

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day

DATE	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above
1	X						
2	X						
3	X			X			
4				X			
5				X			
6							
7							
8							
9							
10							
11				X			
12							
13							
14							
15							
16							
17							
18	X						
19	X						
20	X						
21	X						
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

RIVER STAGE

DATE	CONDITION	GAGE READING AT ___ A.M.	TENDENCY
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
SUM	X	X	X

REMARKS (Special observations, etc.,)

DISREGRD LINE RK
CLOUDY

0900 Time

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore Ice.
G. Floating ice
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds
X	X	X	X	X	X

OBSERVER THOMAS H. HOOVER

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-7287-1

FORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): …SH IN (River Station, if different)

MONTH: OCT 19 97

STATE: Curo

COUNTY: EL PASO

RIVER:

TIME (local) OF OBSERVATION RIVER: — TEMP. 0700 — PRECIPITATION 0700

STANDARD TIME IN USE: MDT

TYPE OF RIVER GAGE: — ELEVATION OF RIVER GAGE ZERO: Ft. — FLOOD STAGE: Ft. — NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	79	42	54	0													
2	79	49	57	0													
3	70	41	55	0													
4	75	43	52	0													
5	77	43	49	0													
6	65	38	42	0													
7	75	41	41	0													
8	61	28	32	0													
9	60	39	42	0													
10	75	41	50	0						X	X						
11	74	30	31	.45	T					X							
12	42	19	22	.04													
13	53	25	32	0													
14	58	32	57	0									08				
15	62	29	38	0													
16	60	29	38	0													
17	69	36	43	0													
18	71	34	45	0			X						08				
19	49	32	32	.01			X										
20	45	32	33	0			X										
21	51	31	40	0													
22	62	34	36	0			X										
23	59	32	33	.02			X										Check at 4:40PM Snow & Blizzard
24	38	10	14	?													Snow Blizzard Don't Know How much 28" 1.85 Guest
25	21	11	21	?													
26	37	14	24	0													
27	47	24	31	0													
28	45	24	35	0													
29	55	30	37	0													
30	57	30	41	0													
31	57	25	33	0													
SUM			SUM	.52 (4			Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds					

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day): Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

2.37"

OBSERVER: THOMAS H. HOOVER

SUPERVISING OFFICE: WSO PUEBLO, COLORADO

STATION INDEX NO: 05-7287-1

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

WB-91

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): Genoa (River Station, if different):
MONTH: May 19 97
STATE: Colo. COUNTY: Lincoln RIVER:
TIME (local) OF OBSERVATION RIVER: 7 TEMP.: 7AM PRECIPITATION: 7AM STANDARD TIME IN USE: MT
TYPE OF RIVER GAGE: ELEVATION OF RIVER GAGE ZERO: Ft. FLOOD STAGE: Ft. NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	REMARKS (Special observations, etc.)
1	58	34	45										
2	60	31	31	.12	2.25	2.25						X	SNOW
3	49	28	36										High wind 65+
4	59	36	49										
5	75	40	47										
6	69	45	55										
7	81	48	63										
8	84	42	42										
9	54	36	47										
10	M	M	M										
11	77	40	51										
12	59	35	43	T									
13	65	43	39										
14	75	43	56										
15	67	46	55										
16	82	51	69										
17	86	—	—										
18	86	51	66										
19	75	36	40	T	T								
20	54	38	40				X						Fog
21	71	39	49										
22	72	48	49	.35									
23	M	M	M										VAC.
24	M	M	M										
25	M	M	M										SORRY But was Far
26	M	M	M										
27	M	M	M										
28	63	42	44				X						
29	71	44	53										
30	71	44	55										
31	70	49	63										
SUM	1639	991	SUM	1.47	2.25								

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day): Mark 'X' for all types occurring each day.

RIVER STAGE: Time of observation if different from above; CONDITION; GAGE READING AT ___ A.M.; TENDENCY

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER [signature]

NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO. 05-3258-3

FORM B-91 (9)

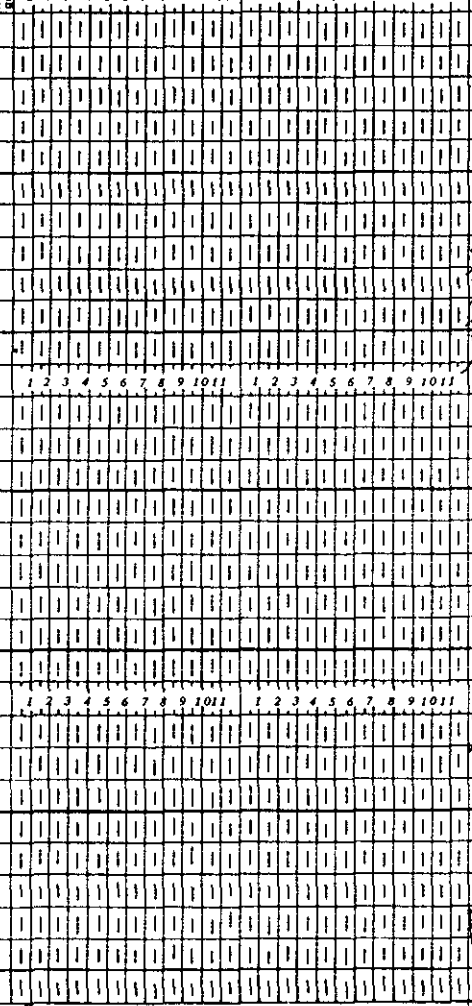
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) Vaughn (River Station, if different)
MONTH June 19 97
STATE Mont.
COUNTY Lincoln
RIVER
TIME (local) OF OBSERVATION RIVER
TEMP. 7:00AM PRECIPITATION 7:00PM
STANDARD TIME IN USE MT
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO Ft.
FLOOD STAGE Ft.
NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)
1	82	51	58			
2	87	54	56			
3	87	52	56	.48		
4	71	43	50			
5	73	50	53			
6	79	53	55			
7	74	52	55	.15		
8	74	52	56	.21		
9	67	51	51	1.71		
10	67	47	49	1.13		
11	65	49	56			
12	81	55	63			
13	77	49	55	.54		
14	66	51	55	.22		
15	75	51	70			
16	74	52	60			
17	75	55	70			
18	M	M	M			
19	84	65	72			
20	90	65	76			
21	91	57	65			
22	92	59	71			
23	90	56	59			
24	82	58	63	.19		
25	80	55	62	.21		
26	79	51	63			
27	80	56	68			
28	M	M	M			
29						
30	91	63	77			
31						
SUM	2123	1454	SUM	4.89		

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.



WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

DATE	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above
7	X						
8	X						
9	X						
10	X						
11	X						
14					X		
23	X						
29	X						

RIVER STAGE — CONDITION | GAGE READING AT ___ A.M. | TENDENCY

REMARKS (Special observations, etc.,)

Ingleworth 4:06 Hail Quarter Size in about 10 min

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds

OBSERVER Carl Dunn

NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO. 05-3258-3

STAT: natological) (River Station, if different) | MONTH: July | 19 9

STATE: Colo. | COUNTY: Lincoln | RIVER:

TIME (local) OF OBSERVATION RIVER | TEMP. 7:00 AM | PRECIPITATION 7:00 AM | STANDARD TIME IN USE: MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

NS FORM B-91 (7-89)

U.S. DEP NATIONAL OCEANIC AND ATMOSI NATIC

T OF COMMERCE ADMINISTRATION EATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	92	45	67																
2	79	48	55																
3	72	48	53																
4	77	54	68																
5	83	50	67																
6	84	53	76																
7	88	60	73	T	T														
8	86	56	69	.07															
9	86	60	74																
10	M	M	M																
11																			
12	90	58	80	T	T														
13	91	52	69																
14	84	66	77																
15	92	58	70																
16	95	59	80																
17	98	68	80																
18	96	63	72																
19	92	60	79																
20	90	56	65	.57															
21	74	62	74																
22																			
23	88	60	85																
24	92	64	79																
25	90	64	81																
26	92	61	77	.32	(.32)														
27	90	63	76	.17															
28	87	60	62	1.36															
29	71	58	60	.68	(.65)														
30	M	M	M																
31	81	59	59																
SUM	2327	1557	SUM	3.11															

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

Fog | Ice Pel. | Glaze | Thund | Hail | Dam. Winds

OBSERVER

SUPERVISING OFFICER

NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER CO 80239-3238

STATION INDEX NO 05-3258-3

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

3.14

STATION (Climatological) Geneva | (River Station, if different) | MONTH Aug 19 97

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

STATE C | COUNTY Lincoln | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7am | PRECIPITATION 7AM | STANDARD TIME IN USE MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

Dreier

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	M	M	M	0													
2	M	M	M	0													
3	87	62	77	.52													
4	83	59	70	T	T												
5	81	59	59	.43													
6	65	54	55	.31													
7	62	54	61	.25													
8	73	53	58	0													
9	57	58	60	0													
10	71	53	55	0			X										
11	60	56	58	.11			X										
12	71	53	58	.52													
13	74	55	62	.30													
14	82	57		0													
15	87	56	59	0													
16	M	M	M	0													
17	79	53	54	0			X										
18	71	54	59	.56			X										
19	76	55	68	.07													
20	79	57	64	0													
21	80	57	67	0													
22	87	59	68	0													
23	83	61	75	0													
24	82	65	76	.04													
25	84	68	80	0													
26	89	65	73	T													
27	M	M	M	0													
28	M	M	M	0													
29	88	57	76	T													
30	87	56	62	0													
31	92	57	63	0													
SUM	2060	1434	SUM	3.11													

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11

Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR | READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER [signature]

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO. 05-3258-3

STATION (City) C 29 (River Station, if different) MONTH Sept 19 97

STATE COLO COUNTY LINCOLN RIVER

TIME (local) OF OBSERVATION RIVER TEMP 0700 PRECIPITATION 0700 STANDARD TIME IN USE MT

TYPE OF RIVER GAGE ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

ORM B-91
3)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	76	57	73														
2	93	56	58					X									
3	M	M	M					X									
4	77	56	56					X									
5	61	56	65	.10													
6	61	56	72														
7	56	54	69	.31													
8	82	53	64														
9	85	51	52														
10	80	52	54					X									
11	80	54	68					X									
12	83	57	80														
13	65	24	57														
14	87	55	57														
15	87	55	57														
16	76	50	57														
17	M	M	M														
18	83	53	77														
19	88	47	51														
20	71	41	41														
21	46	38	40					X									
22	53	39	50					X									
23	55	44	45	T				X									
24	54	43	47					X									
25	65	46	55														
26	78	53	70														
27	85	54	64														
28	82	45	66														
29	72	54	63														
30	60	56	60														
31																	
SUM	2046	1404	SUM	1.41			CHECK BAR (For wire-weight) NORMAL CK. BAR	Fog	Ice Pel	Glaze	Thund.	Hail	Dam. Winds				

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

READING	DATE

OBSERVER

SUPERVISOR'S OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239

STATION INDEX NO. 05 3258-3

NWS FORM B-91 (2-93) — U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): [illegible]oa (River Station, if different):
MONTH: Oct 19 97
STATE: Colo
COUNTY: Lincoln
RIVER:
TIME (local) OF OBSERVATION RIVER: TEMP 0700 PRECIPITATION 0700
STANDARD TIME IN USE: MT
TYPE OF RIVER GAGE: ELEVATION OF RIVER GAGE ZERO Ft. FLOOD STAGE Ft. NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Hourly (A.M. / NOON / P.M.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	CONDITION	GAGE READING AT __ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	80	53	65															
2	M	M	M															VAC.
3	M	M	M															
4	M	M	M															
5	M	M	M															
6	M	M	M															
7	68	50	57					X										
8	80	45	53															
9	80	32	37															
10	63	37	48															
11																		
12	68	30	30	1.2	.50													Started Snow 5:30 AM.
13	41	26	31	.05	1.20													
14	53	30	43															
15	61	43	48															
16	61	36																
17	62	38																
18	72	38	54.1															
19	[illegible]	M	M															
20	73	37																
21	M	M	M															
22	M	M	M															
23	66	41	43				[illegible] 1.24											
24	M	M	M															Could not get here
25	M	M	M	~~[illegible]~~														to Read
26	M	M	M	.28	14.5													6 to 8' Foot Snow Drifts
27	M	M	M															
28	57	32	39															
29	45	31	44															
30	VAC																	
31																		
SUM	1030	599	SUM	1.53	16.2													

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER: [signature]

NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239

STATION INDEX NO. 05 3258-3

FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (City) (River Station, if different): Ellicott ville 2 WNW
MONTH: May 19 97
STATE: CO
COUNTY: El Paso
RIVER: W Kiowa Creek
TIME (local) OF OBSERVATION RIVER:
TEMP:
PRECIPITATION: 6.00 Am
STANDARD TIME IN USE: MOST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft
FLOOD STAGE: Ft
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (Ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0		T											
2				0		T											
3				0													
4				0													
5				0													
6				0													
7				T													
8				.04													
9				0													
10				0													
11				0						X							
12				.25	1.8	1.0				X							
13				T													
14				0						X							
15				.04													
16				.05													
17				.06													
18				T													
19				.43			X			X							
20				T			X										
21				0			X			X							
22				.08			X										
23				.52						X							
24				T						X							
25				.01						X							
26				T						X							Cool Day
27	24			T						X							
28				.02						X							Month
29				.03						X							Hard freeze on 27th
30				.02			X			X							24°
31				.03													
SUM			SUM	1.58	1.8												

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: C Robert Guy

SUPERVISING OFFICE:

STATION INDEX NO: 05-2494 [illegible]

STATION (climatological): Eastonville 2NNW (River Station, if different)
MONTH: June 19 4'1
STATE: CL
COUNTY: EL Peso
RIVER: West Kiowa Cr.
TIME (local) OF OBSERVATION RIVER: 6:00
TEMP.:
PRECIPITATION: 6:00 AM
STANDARD TIME IN USE: MBST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

WS FORM B-91 (2-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				T						X	X						
2				.32	T	T	X			X							
3				.06													
4				0													
5				0						X							
6				.22			X			X							
7				1.21			X			X							
8				.08						X							
9				.19			X										
10				.35			X			X							
11				.19													
12				0						X							
13				.26						X							
14				.12						X							
15				T						X							
16				T						X							
17				0													
18				0						X							
19				.05						X							
20				0													
21				0													
22				0													
23				0						X							
24				1.00						X	X						
25				.11													
26				.17													
27				0													Hot last week
28				0						X							
29				T													Black Forest had
30				0													from 7-9" of moisture
31																	for [illegible]
SUM			SUM	4.33			Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: C. Robert Grey

SUPERVISING OFFICE:

STATION INDEX NO: 05-2494 4

FORM B-91
(-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (City, town, etc.): E?st …ille 2 NNW (River Station, if different)
MONTH: July 19 97
STATE: CO
COUNTY: El Paso
RIVER: W Kiowa Creek
TIME (local) OF OBSERVATION RIVER: • TEMP: PRECIPITATION: 6:00 AM
STANDARD TIME IN USE: M DST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0						X							
2				T													
3		37		0						X							
4				T						X							
5				.01						X							
6				0													
7				0													
8				0						X							
9				T						X							
10				0						X							
11				T						X							
12				.09													
13				0													
14				0													
15				0													
16				0													
17	91			0													
18				0						X							
19				0						X							
20				.42						X							
21				.10						X							
22				T													
23				0													
24				0													
25				0						X							
26				.19						X							
27				T						X							
28				.35						X							
29				.43						X							
30				1.05						X							
31				.05						X							.95 fell late this day
SUM			SUM	2.69													

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING | DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Robert [illegible]
SUPERVISING OFFICE:
STATION INDEX NO. 05-2494 4

STATION (Climatological)	(River Station, if different)	MONTH	19
Eastonville 2NNW		Aug	97

STATE	COUNTY	RIVER
Co	El Paso	West Kiowa Creek

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION | STANDARD TIME IN USE

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

TEMPERATURE F. — 24 HRS. ENDING AT OBSERVATION

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (〰) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

DATE	MAX	MIN	AT OBSN	Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets, (Ins. and tenths)	At Ob.: Snow, ice pellets, hail, ice on ground (Ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE: CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				.95						X							
2				T						X							
3				.04						X							
4	62			T						X							
5	54			1.24			X			X							Cold daytime temps on
6				.55			X										5th and 6th.
7				.89													
8				T													
9				0						X							
10				.13			X			X							
11				.77			X			X							
12				.04						X							
13				.25													
14				T													
15				0						X							
16				0						X							
17				.05						X							
18				.27						X							
19				.10						X							
20				.26						X							
21				.04						X							
22				.26						X							
23				.08													
24				0						X							
25				.11						X							
26				.12						X							
27				.64						X							
28				.25						X							
29				.03						X							
30				T													
31				0													
SUM			SUM	6.77													

67

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage

OBSERVER: Robert Guy

SUPERVISING OFFICE

STATION INDEX NO. 05-2494 4

FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Local): Eas Nville 2NNW (River Station, if different)
MONTH: Sept 1997
STATE: CO.
COUNTY: El Paso
RIVER: West Kiowa Creek
TIME (local) OF OBSERVATION RIVER:
TEMP.:
PRECIPITATION: 6:00 AM
STANDARD TIME IN USE: MDST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft

DATE	Temp. Max.	Temp. Min.	Temp. At Obsn.	Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Fog	Thunder	Remarks (Special observations, etc.)
1				T				X	
2				.25				X	
3				T					
4				0				X	
5				.61					
6				0				X	
7				.31					
8				T					
9				0					
10				0					
11				0					
12				0					
13				0					
14				0					
15				0				X	
16				.12					
17				0					
18				0					
19				0					
20				.09			X	X	
21				.08			X	X	
22				.07			X	X	
23				.39					
24		29		.04					1st frost
25				0					
26				0					
27				0					
28				0					
29				0					
30				0				X	
31									
SUM				1.96					

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING / DATE

CONDITION OF RIVER AT GAGE
A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice
G. Floating ice.
H. Pool stage

OBSERVER: Robert Grey
SUPERVISING OFFICE:
STATION INDEX NO. 05-2494 4

FORM B-91 (-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological)	EGS[illegible] ville 2 NNW
(River Station, if different)	
MONTH	OCT
19	97
STATE	Co
COUNTY	EL Paso
RIVER	West Houa Creek
TIME (local) OF OBSERVATION RIVER	
TEMP.	
PRECIPITATION	6:00 AM
STANDARD TIME IN USE	M DST
TYPE OF RIVER GAGE	
ELEVATION OF RIVER GAGE ZERO	Ft.
FLOOD STAGE	Ft.
NORMAL POOL STAGE	Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	CONDITION	GAGE READING AT ___ A.M.	TENDENCY
1				.18												
2				0												
3				0												
4				0												
5				0												
6				0												
7				0												
8				0												
9				0												
10				0												
11				0												
12				.18	2.0	1.0										
13				.25	3.0	3.0										
14				0												
15				0												
16				0												
17				0												
18				0												
19				0												
20				0												
21				0												
22				0												
23				0												
24				0												
25				0								X				
26	14	6		2.60	.26.0	22.0						X				
27				1.10	19.0	34.0										
28				0		30.0										
29				0		24.0										
30				0		19.0										
31				0		16.0										
SUM			SUM	4.31	.50.0											

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved.
A.M. NOON P.M.
1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day): Mark 'X' for all types occurring each day.

RIVER STAGE

REMARKS (Special observations, etc.,)

Great Oct Blezard began on Oct 25th - 5 pm heavy snow and strong wind began 40 to 50 mph 0-0 visability temp at 7:00 AM on 26th was 6° stay at 10°-12° all day till rising to 14° at 8:00 pm 8 - 12' drifts every where Main roads blocked till 28th, last secondary roads opened on 30th Due to wind only 50 moisture in rain gage I snowshoed to timber and found a protected area where the wind didn't drift snow on 27th snow depth average 36" took 8" gage with me and cut a 8" biscuit of snow and took it home and melted the water content of the 34.0 of snow 3.70 due to settling and compression of snow figured the storm total of 45.0 from 5 pm the 25th till 5 pm the 26th was the greatest 24 hr snow fall amount of 40.0 inches since April 1921

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: C Robert [illegible]

SUPERVISING OFFICE:

STATION INDEX NO. 05-2494 4

STATION (Local) TACONY (River Station, if different) 105c

MONTH MAY 19 97

STATE COLO

COUNTY PUEBLO

RIVER ARKANSAS

TIME (local) OF OBSERVATION RIVER

TEMP 5PM

PRECIPITATION 5PM

STANDARD TIME IN USE MST

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MIN.	TEMPERATURE F. AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (ins. and hundredths)	PRECIPITATION 24-HR AMOUNTS Snow, ice pellets (ins and tenths)	PRECIPITATION At Ob Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	RIVER STAGE GAGE READING AT ___ A M	RIVER STAGE TENDENCY	REMARKS (Special observations, etc.,)
1	71	37	60	0													
2	62	33	55	0													
3	68	28	65	0													
4	79	36	78	0													
5	78	49	69	0													
6	86	44	72	.01						X							
7	78	42	67	0													
8	67	45	52	T													
9	71	35	68	0													
10	79	39	75	0													
11	75	46	60	0													
12	70	39	69	.03													
13	82	38	75	0													
14	75	38	70	0													
15	75	41	73	0						X							
16	86	43	80	0													
17	90	45	78	0									400				400 CM Reading
18	83	48	70	0													
19	70	42	57	.18													
20	75	39	70	0													
21	78	53	60	.16			X			X							Light fog.
22	69	51	60	0			X			X							Light fog
23	75	47	70	.03													Have no idea what time it rained
24	80	47	76	.05			X										
25	77	47	65	T													
26	72	43	57	0													
27	72	37	68	0													
28	76	42	72	0													
29	74	47	58	.04						X							
30	73	52	72	.11													
31	86	48	83	0													
SUM			SUM 1.67														

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. Mark 'X' for all types occurring each day.

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage
E. Ice gorge below gage
F. Shore ice
G. Floating ice
H. Pool stage

CHECK BAR (For wire weight) NORMAL CK. BAR

READING	DATE

OBSERVER John M. Haza

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-8157-1

'S FORM B-91
2-93)

U.S. DEPA. OF COMMERCE
NATIONAL OCEANIC AND ATMOSI ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) TACONY 10SE	(River Station, if different)	MONTH JUNE	19 92
STATE Colo.	COUNTY PUEBLO	RIVER ARKANSAS	
TIME (local) OF OBSERVATION RIVER	TEMP. 5PM	PRECIPITATION 5PM	STANDARD TIME IN USE MST
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	90	52	86	0							X							
2	86	58	72	0				X										
3	81	53	78	0														
4	78	49	74	0														
5	86	51	85	0														
6	85	57	73	0				X			X							
7	73	53		1.80														
8	74	53	67	.04				X										
9	69	53	60	.53														
10	75	51	74	.25				X			X							
11	86	57	85	0				X										
12	85	53	77	0														Light Fog.
13	77	52	74	.06							X							
14	82	55	79	0														
15	80	52	70	.63				X			X							
16	75	56	73	0														
17	82	48	77	0														
18	89	54	86	.02				X										
19	96	57	89	.17				X										
20	98	55	96	0				X										
21	96	58	85	0														
22	94	57	84	0														
23	90	56	88	0														
24	88	55	85	0				X										
25	85	52	78	0				X										
26	87	50	86	.01				X										
27	92	49	79	0														
28	96	52	80	0														
29	92	57	89	0											6.47			6.45 PM Reading
30	101	51	98	0														
31																		
SUM			SUM	2.92														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating Ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

OBSERVER John M. Hajia

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-8157-1

FORM B-91
93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (City or local) TACONY (River Station, if different) JOSE | MONTH July | 19 87
STATE Colo. | COUNTY PUEBLO | RIVER ARKANSAS
TIME (local) OF OBSERVATION RIVER | TEMP. 5PM | PRECIPITATION 5PM | STANDARD TIME IN USE MST
TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	98	55	94	0															
2	94	46	85	0															
3	94	54	77	0															
4	85	47	78	0								X			5:30				5:30 PM Reading was in Hospital
5		50	89	.01															
6			79	0															
7	96	50	74	0															
8	93	57	84	0															
9	91	53	89	0															
10	96	53	89	0															
11	97	62	77	0															
12	97	54	94	0															
13	94	55	85	0											6:30				6:30 PM Reading
14	91	61	90	0															
15	102	59	99	0															
16	103	58	93	0															
17	100	56	96	0															
18	96	57	79	0								X			9:00				9:00 PM Reading
19	96	65	68	0															
20	88	58	78	.11								X							
21	91	58	88	0															
22	93	61	89	0															
23	100	61	93	0								X							
24	100	63	95	0															
25	100	63	82	0								X							
26	98	61	81	0															
27	95	61	89	0															
28	89	62	80	0								X							
29	86	61	80	.17						X		X							
30	87	60	84	.29						X		X							Light Fog.
31	92	62	89	0															
SUM			SUM	1.08															

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

OBSERVER John M. Heza

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO.
05-8157-1

STATION (Local) TACONY (River Station, if different) 10SE | MONTH AUG. | 19 92

STATE COLO | COUNTY PUEBLO | RIVER ARKANSAS

TIME (local) OF OBSERVATION RIVER | TEMP. 5PM | PRECIPITATION 5PM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

S FORM B-91 (2-93)

U.S. DEPA OF COMMERCE
NATIONAL OCEANIC AND ATMOSP DMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	90	64	75	0						X							
2	90	62	82	0						X							
3	86	60	83	.06													
4	86	63	78	0						X							
5	78	61	66	1.54			X			X							
6	66	57	63	.51			X										Intermittent rain & mist.
7	76	55	75	0													
8	85	53	85	0													
9	85	54	74	0						X							
10	74	54	64	.39			X			X							.25" rain
11	76	58	70	0						X							.03 rain
12	78	53	77	.03													
13	86	60	71	.01						X							
14	90	54	83	0													
15	91	53	85	0													
16	89	58	75	.02						X							
17	75	57	73	0													
18	82	61	80	.05			X			X							
19	90	52	74	0						X							
20	88	57	82	0						X							.38 rain
21	91	55	87	.38						X							
22	87	57	67	.69									10 PM				10 PM Reading
23	89	57	86	0													
24	90	56	88	0													
25	91	62	84	0													
26	91	61	87	0													
27	91	62	88	0						X							
28	91	62	89	0													
29	91	63	66	.27						X			6 PM				6 PM Reading
30	81	60	75	T													
31	83	57	65	.01						X							.48 rain
SUM			SUM	3.96													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11

Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER John M. Higa

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO. 05-8157-1

STATION (Climatological) PUEBLO 105E (River Station, if different) | MONTH SEPT | 19 92

STATE COLO. | COUNTY PUEBLO | RIVER ARKANSAS

TIME (local) OF OBSERVATION RIVER 3:00 PM | TEMP 5:00 PM | PRECIPITATION | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

FORM B-91 (-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins. and hundredths)	Snow, ice pellets (Ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	85	56	81	.48													
2	81	60	70	0													
3	78	60	75	6			X										
4	84	56	80	0			X			X							
5	85	57	83	0													
6	89	57	76	0													
7	87	71	74	0									6PM				6PM P.M. Reading
8	89	53	84	0													
9	84	57	64	0													
10	82	48	80	0			X										
11	86	56	80	6						X							
12	87	51	81	0													
13	89	53	84	0													
14	90	52	85	0													
15	93	52	86	0						X							
16	86	60	80	0													
17	87	55	80	0													
18	95	51	81	0									6PM				6PM P.M. Reading
19	81	53	74	0													
20	74	43	46	.09			X										
21	56	47	48	.11			X										
22	71	51	62	0			X										
23	62	47	57	.12													
24	71	47	66	0													
25	81	40	75	0													Left to Glenwood Spgs FRI
26															→		" " " "
27																	
28	92	44	59	0									9PM				9PM P.M Reading
29	84	41	78	0													
30	82	47	74	0									5PM				5.3PM P.M Reading
31																	
SUM				.80													

CHECK BAR (For wire-weight) NORMAL CK. BAR

	READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage
C. Upper surface of smooth ice
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER John M. Hoza

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-8157-1

ORM B-91
3)

U.S. DEPARTM COMMERCE
NATIONAL OCEANIC AND ATMOSPHER. MINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climat) TACONY 1C5Z (River Station, if different) | MONTH OCT | 19 97
STATE COLO | COUNTY PUEBLO | RIVER ARKANSAS
TIME (local) OF OBSERVATION RIVER | TEMP 5 PM | PRECIPITATION 5 PM | STANDARD TIME IN USE MST
TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN.	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	87	51	83	0									4:30				4:30 P.M. Reading
2	90	44	81	6													
3	88	48	74	0													
4	84	43	79	0													
5	85	44	79	0													
6	79	46	70	0													
7	85	43	74	0													
8	74	47	63	.01													
9	71	32	63	0													
10	84	48	77	0													
11	83	62	75	0						X	X						
12	75	33	40	1.40	T	0											1.4" rain 1/2" hail almost covered the lawn Rain & rain mixed with snow.
13	54	26	32	0													
14	65	30	54	0													
15	71	36	60	0													
16	65	33	54	0													
17	73	32	64	0													
18	78	37	65	0													
19	62	42	48	0													
20	54	38	46	0			X										Light fog.
21	56	39	52	0			X										
22	72	32	61	0			X										Light fog.
23	64	40	54	0													
24	54	32	32	.06	T	0											Rain changing to snow
25				1.8					Didn't get cont to measure								Estimated Snowfall 12" or more
26	35	10	27	0	T	1M			Zero to 7ft Drifts								Moisture reading taken this morn.
27	31	15	40	0		3M											
28	57	24	46	0		1M											
29	58	24	45	0		1M											
30	67	31	47	0		1M											
31	70	32	48	0		1M											Snow mostly in drifts
SUM			SUM	1.96													Impossible to measure

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

Mark 'X' for all types occurring each day.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice
H. Pool stage.

OBSERVER John M. Hazle

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-8157-1

STATION (Climatological): ST[illegible] YENE (River Station, if different) — MONTH: May 19 97

STATE: Colorado — COUNTY: Washington — RIVER:

TIME (local) OF OBSERVATION RIVER — TEMP. 07 — PRECIPITATION 07 — STANDARD TIME IN USE: M

TYPE OF RIVER GAGE — ELEVATION OF RIVER GAGE ZERO Ft. — FLOOD STAGE Ft. — NORMAL POOL STAGE Ft.

[illegible]S FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

TEMPERATURE F. — 24 HRS. ENDING AT OBSERVATION 35

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

Date	Max.	Min.	At Obsn.	Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	Snow, ice pellets, hail, ice on ground (ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	Condition	Gage Reading at ___ A.M.	Tendency	Remarks (Special observations, etc.)
1	60	35	41	0													
2	67	32	32	.13	1.3	1											awoke to snow
3	53	28	35	.01	.2	0											
4	65	35	47	0													
5	79	40	46	0													
6	73	44	46	0													
7	84	46	55	0													
8	80	42	44	0													
9	61	28	40	0													
10	69	39	48	0													
11	81	44	45	0													
12	64	28	42	0													
13	69	35	52	0													
14	81	37	45	0													
15	71	36	46	0													
16	78	44	60	0													
17	88	49	58	0													
18	88	47	59	0													
19	80	40	40	.04													Southerly 15-30 MPH wind
20	62	40	44	.02													S-SE wind " " allday
21	75	43	52	0													SSE wind 15-30 allday
22	74	50	50	T													SE wind.
23	64	49	50	.38													
24	68	45	49	.01													Slight Drizzle Fr. AM
25	79	49	49	T													
26	68	46	49	.22			X			X	X						
27	63	38	47	.17						X	X						
28	68	38	43	.01													
29	72	44	51	.14			X			X							
30	64	44	49	.01													
31	72	49	54	0													
Sum			Sum	1.14			Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds					

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING — DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239-3238

STATION INDEX NO. 05 7560-3

ORM B-91 (1)

U.S. DEPARTME
NATIONAL OCEANIC AND ATMOSPHEF
NATIONAL

COMMERCE
NISTRATION
ER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climat) SHAi ENE (River Station, if different) | MONTH June | 19 97

STATE Colorado | COUNTY | RIVER

TIME (local) OF OBSERVATION | RIVER | TEMP. 07 | PRECIPITATION 07 | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN. 57	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	89	51	52	0															
2	83	55	56	0															
3	74	51	56	.39															
4	75	46	47	T				X											
5	74	46	56	T				X											
6	81	56	58	0				X											
7	75	55	57	.01															
8	80	53	56	.01															
9	74	55	55	.46				X			X								
10	58	50	51	.71															
11	67	51	60	.01															
12	83	51	58	0															
13	77	49	53	.65															Rain off + on from 8:00 Monday
14	68	53	56	.10							X								
15	76	54	57	T							X								
16	79	49	54	.01							X								
17	74	48	57	0															
18	79	52	65	0															
19	89	56	66	.07							X								
20	93	58	70	T							X								
21	93	55	63	.29							X								slight hail
22	84	56	67	0															SSE. wind all day
23	92	58	62	0															
24	87	54	64	.06							X								
25	83	54	56	.95							X	X							Power failure / Max Temp
26	81	50	58	0															
27	85	54	66	0															
28	89	52	60	.08							X								
29	91	54	59	.29							X								Power failure during Max Temps
30	88	56	62	.14							X								
31																			
SUM			SUM	4.23			CHECK BAR (For wire-weight) NORMAL CK. BAR		Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds					

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

READING	DATE

OBSERVER

SUPERVISING OFFICE
NATIONAL WEATHER SERVICE
10230 SMITH ROAD
DENVER, CO 80239 3238

STATION INDEX NO. 05 7560-3

STATION (Climatological)	(River Station if different)	MONTH	YEAR
Shaw 4 ENE		07	1997

STATION INDEX NUMBER	STATE	COUNTY	RIVER
05-7560-03	CO	Washington	Kansas-4

TIME (local) OF OBSERVATION RIVER	TEMP.	PRECIP.	STANDARD TIME USED
	0700	0700	MOUNTAIN

TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO	FLOOD STAGE	NORMAL POOL STAGE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

U.S. DEPARTMENT OF COMMERCE
NOAA WS FORM CB-91
NATIONAL WEATHER SERVICE

DATE	TEMPERATURE (°F) 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	Precipitation (in.) 24 HR AMOUNTS PRECIP. (nn.nn)	SNOW (nn.n)	AT OB. SNOW on ground (inch)	Time of Precipitation — Draw - through hours precip was observed. = through hours precip probably occurred. A.M. 1 2 3 4 5 6 7 8 9 10 11 12 P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER for the Calendar Day Mark all "X" Fog	Ice Pellets	Glaze	Thunder	Hail	Dmgng Winds	When if diff Obs. Time	RIVER STAGE Condition	Reading at __AM	TENDENCY	REMARKS (Special observations, etc.)
01	93	55	66	0.00	0.0	0												
02	90	44	52	0.00	0.0	0												
03	82	49	51	0.00	0.0	0												
04	75	49	54	0.00	0.0	0												
05	80	54	60	T	0.0	0	=											trace rain about 20:00 Friday
06	84	53	61	0.00	0.0	0	= =											.18 rain afternoon on the 6th.
07	89	55	63	0.18	0.0	0												.18 rain 1600 previous afterno
08	90	58	63	0.23	0.0	0	= =			X								
09	89	53	62	0.22	0.0	0				X								
10	87	55	64	0.00	0.0	0												
11	93	62	64	0.00	0.0	0	= =											shower this afternoon
12	83	55	67	T	0.0	0												
13	94	52	60	0.00	0.0	0												
14	87	53	60	T	0.0	0	=											
15	86	55	65	0.00	0.0	0												
16	97	57	70	0.00	0.0	0												
17	99	60	72	0.00	0.0	0												
18	101	61	69	0.00	0.0	0												
19	96	58	67	0.00	0.0	0	= = = = = =											
20	83	56	58	0.51	0.0	0		X										Power failure /time of max tem
21	83	56	62	0.00	0.0	0												
22	87	56	64	0.00	0.0	0												
23	90	59	68	0.00	0.0	0												
24	94	63	67	0.00	0.0	0												
25	95	64	67	0.00	0.0	0	= = =											
26	95	60	63	0.08	0.0	0				X								
27	94	61	67	0.00	0.0	0	= = = = = = = = = = = =			X								
28	91	62	62	1.31	0.0	0	= = = = = = = = = = = =	X		X								
29	75	60	60	0.56	0.0	0	= = = = = = = = = = = =			X								
30	79	60	62	0.41	0.0	0	= = = = = = = = = = = =			X								
31	83	61	67	0.00	0.0	0	=			X								.35 rain at 5:00 PM
SUM	2744	1756	1957.0	3.50	0.0	XXXXXX												
AVR	88.5	56.6	63.1	XXXXXXX	XXXXXX	XXXXXX												

OBSERVER : Homer R. Hill

Condition of River at Gage Codes:
A.Obstructed by rough ice
B.Frozen but open at gage
C.Upper surface of smooth ice
D.Ice gorge above gage
F.Shore ice
G.Floating ice
H.Pool stage

STATION (Climat.): SH… YENE (River Station, if different) MONTH: Aug 19 97

FORM B-91

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE: Colorado | COUNTY: Washington | RIVER:

TIME (local) OF OBSERVATION: RIVER | TEMP. 07 | PRECIPITATION 07 | STANDARD TIME IN USE: M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

TEMPERATURE F. — 24 HRS. ENDING AT OBSERVATION; AT OBSN. 67

DATE	MAX.	MIN.	AT OBSN.	Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	Snow, ice pellets, hail, ice on ground (ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	REMARKS
1	85	62	64	.34									
2	85	60	65	0									
3	86	61	63	.16						X			
4	86	59	62	0									
5	83	61	61	.12									
6	67	55	56	.32			X						
7	71	53	55	.41									
8	77	55	56	0									
9	87	53	54	0									
10	74	55	59	.07									
11	63	50	59	0			X						
12	71	51	54	.12									
13	81	55	59	.02									
14	85	54	60	0									
15	83	53	60	0									
16	88	57	57	0			X						
17	80	53	54	.20			X			X			
18	75	53	56	1.69						X			
19	80	53	58	.85						X			
20	81	53	56	0									
21	80	56	63	0									
22	89	53	56	0									
23	85	54	62	0									
24	90	57	63	0									
25	91	57	62	0									
26	90	62	65	0									
27	89	60	63	.29									
28	87	60	62	0									
29	88	57	58	.60									strong wind & lighting / night
30	88	56	59										
31	82	55	57										
SUM			SUM	5.19	0								

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice
H. Pool stage.

OBSERVER

SUPERVISING OFFICE: NATIONAL WEATHER SERVICE, 10230 SMITH ROAD, DENVER, CO 80239-3238

STATION INDEX NO. 05 7560-3

STATION (Climatological)	(River Station if different)	MONTH	YEAR
Shaw 4 ENE		09	1997

STATION INDEX NUMBER	STATE	COUNTY	RIVER
05-7560-03	CO	Washington	Kansas-4

TIME (local) OF OBSERVATION	TEMP.	PRECIP.	STANDARD TIME USED
RIVER	0700	0700	MOUNTAIN

TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO	FLOOD STAGE	NORMAL POOL STAGE
-			

DATE	TEMPERATURE (°F) 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	Precipitation (in.) 24 HR AMOUNTS PRECIP. (nn.nn)	SNOW (nn.n)	AT OB. SNOW on ground (inch)	Time of Precipitation — Dash (-) through hours precip was observed. Asterisk (*) through hours precip probably occurred. A.M. 1 2 3 4 5 6 7 8 9 10 11 12	P.M. 1 2 3 4 5 6 7 8 9 10 11 12	WEATHER for the Calendar Day Mark all "X" Fog	Ice Pellets	Glaze	Thunder	Hail	Dmgng Winds	When if diff Obs. Time	RIVER STAGE Condition	Reading at __AM	TENDENCY	RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS U.S. DEPARTMENT OF COMMERCE NOAA WS FORM CB-91 NATIONAL WEATHER SERVICE REMARKS (Special observations, etc.)
01	82	57	60	0.00	0.0	0													
02	87	57	59	T	0.0	0	= = = = = =		X										
03	67	56	60	T	0.0	0	= = =		X										
04	78	58	58	T	0.0	0	= = =		X										
05	85	56	58	0.03	0.0	0	= = = = =												
06	83	56	60	0.00	0.0	0		= = = = =											
07	89	55	58	0.05	0.0	0													
08	85	50	55	0.00	0.0	0													Power failure during Max temp
09	87	52	52	0.01	0.0	0	= = = = =												
10	74	52	55	0.00	0.0	0			X										
11	84	53	57	0.00	0.0	0													
12	87	53	60	0.00	0.0	0													
13	85	52	58	0.00	0.0	0													Observed lighting in NE 9/12 A
14	89	58	61	0.00	0.0	0													saw light showers N few miles
15	89	56	58	0.00	0.0	0													
16	91	51	51	0.00	0.0	0		= =											
17	78	48	49	T	0.0	0					X								
18	83	49	58	0.00	0.0	0													
19	91	48	49	0.00	0.0	0													
20	71	41	42	0.05	0.0	0	= = = = = = = =	= = = = = = = =	X										some fog & light drizzle
21	46	40	40	0.01	0.0	0	= =		X										light drizzle & fog most of d
22	53	40	51	0.04	0.0	0	= =		X										fog & drizzle all day
23	57	45	47	T	0.0	0													
24	56	44	45	0.00	0.0	0													
25	68	38	42	0.00	0.0	0													
26	68	38	42	0.00	0.0	0													
27	88	43	45	0.00	0.0	0													
28	86	35	38	0.00	0.0	0													
29	76	41	41	0.00	0.0	0													
30	82	41	48	0.00	0.0	0													
SUM	2345	1463	1557.0	0.19	0.0	XXXXXX													
AVE	78.2	48.8	51.9	XXXXXXX	XXXXXX	XXXXXX													

OBSERVER : Homer B. Hill
NWS OFFICE : DENVER FORECAST OFFICE

Condition of River at Gage Codes:
A.Obstructed by rough ice
B.Frozen but open at gage
C.Upper surface of smooth ice
D.Ice gorge above gage
E.Ice gorge below gage
F.Shore ice
G.Floating ice
H.Pool stage

STATION (Climatological)	(River Station if different)	MONTH	YEAR
Shaw 4 ENE		10	1997

STATION INDEX NUMBER	STATE	COUNTY	RIVER
05-7560-03	CO	Washington	Kansas-4

TIME (local) OF OBSERVATION	TEMP.	PRECIP.	STANDARD TIME USED
RIVER	0700	0700	MOUNTAIN

TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO	FLOOD STAGE	NORMAL POOL STAGE

WEATHER for the Calendar Day Mark all "X"

RIVER STAGE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

U.S. DEPARTMENT OF COMMERCE
NOAA NS FORM CB-91
NATIONAL WEATHER SERVICE

DATE	TEMPERATURE (°F) 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	Precipitation (in.) 24 HR AMOUNTS PRECIP. (nn.hh)	SNOW (nn.h)	AT OB, SNOW on ground (inch)	Time of Precipitation. Draw - through hours precip was observed. * through hours precip probably occurred. A.M. 1 2 3 4 5 6 7 8 9 10 11 12 P.M. 1 2 3 4 5 6 7 8 9 10 11 12	Fog	Ice pellets	Glaze	Thunder	Hail	Dmgng Winds	When if diff Obs. Time	RIVER STAGE Condition	Reading at __AM	TENDENCY	REMARKS (Special observations, etc.)
01	84	48	51	0.00	0.0	0											
02	88	49	52	0.00	0.0	0											
03	86	48	48	0.00	0.0	0											
04	77	44	47	0.00	0.0	0											
05	82	42	42	0.00	0.0	0											
06	84	41	47	0.00	0.0	0											Low about 7:05 yesterday AM
07	71	43	55	0.00	0.0	0											
08	82	49	49	0.00	0.0	0	= =										
09	60	29	32	T	0.0	0											First freeze this fall
10	65	32	44	0.00	0.0	0											low at 7:00 the 9th
11	82	44	58	0.00	0.0	0	= = ∓										low at 7:00 morning before
12	79	40	40	0.72	0.0	0	= = = ∓ = = = ∓ = = = ∓ =			X							very strong south wind all day
13	41	25	25	0.14	2.0	0											strong NW wind morning of 12th
14	53	25	34	0.00	0.0	0											low at 7:00 the 13th
15	65	34	36	0.00	0.0	0											
16	65	34	35	0.00	0.0	0											
17	66	35	37	0.00	0.0	0											
18	75	36	42	0.00	0.0	0											
19	75	39	40	0.00	0.0	0											
20	52	40	40	0.00	0.0	0											
21	51	39	40	0.00	0.0	0											
22	58	33	37	0.00	0.0	0											
23	68	33	40	0.00	0.0	0											
24	66	36	36	0.12	0.0	0	= = = ∓ = = = = ∓ = = = ∓ = = = ∓ = = = = ∓										
25	37	13	13	0.99	9.5	9	= = = ∓ = = = ∓ = = = ∓ = = = ∓ = = = = ∓										strong blizzard
26	17	3	5	0.63	6.5	14											Bad blizzard all day yesterday
27	32	4	21	0.00	0.0	12											low was yesterday morning
28	45	21	32	0.00	0.0	9											
29	44	27	33	0.00	0.0	7											
30	54	33	36	0.00	0.0	5											
31	53	34	42	0.00	0.0	3	= = = ∓ = = = ∓										
SUM	1957	1053	1189.0	2.60	18.0	XXXXX											
AVE	63.1	34.0	38.4	XXXXXX	XXXXX	XXXXX											

Condition of River at Gage Codes:
A. Obstructed by rough ice
B. Frozen but open at gage
C. Upper surface of smooth ice
D. Ice gorge above gage
F. Shore ice
G. Floating ice
H. Pool stage

OBSERVER : Homer E. Hill

3. Local Data

LINCOLN COUNTY
CLERK AND RECORDER
ROXANA DEVERS
P.O. BOX 67
HUGO, CO 80821-0067
Phone: 719-743-2444
Fax: 719-743-2838

May 4, 1998

Mr. Jim Burrell
Riverside Technology
2290 E. Prospect Rd. #1
Ft. Collins, CO 80525

RE: Rainfall Information

Dear Mr. Burrell:

I hope that the information I have provided will be helpful to you. I was not able to obtain any photos. Personnel with Road & Bridge believe that they were given to the people from FEMA who visited the county. I have included the following:

1. A map of Lincoln County showing where the damage occurred
2. A list of the creeks that caused damage
3. The costs by site to repair the damage
4. Rainfall amounts kept by several residents of the county
5. Two issues of the Eastern Colorado Plainsman with articles about the flooding

Please contact me if you need anything further.

Sincerely,

Roxana Devers
Lincoln County Clerk

rd

Enclosures

Lincoln County Creeks

Apache Creek/North Rush Creek
Middle Rush Creek
South Rush Creek
Long Branch
Coon Creek
Big Sandy Creek
Adobe Creek
East Fork Adobe Creek

Lincoln County Site # Narrative

#1 - 6ft culvert washed out. County will put in the 6ft culvert and add a 5ft culvert

#2 - Rip-rap washed away from bridge

#3 - Culvert washed out

#4 - Culvert washed out

#5 - Approach to bridge washed out

#6 - Culvert washed out

#7 - Culvert washed out

#8 - Culvert washed out

#9 - Culvert washed out

#10 - 3 four ft. culverts washed out.

St. 1 Hugo

Dist. 1
Chris

Bridge Lin 47-96.8

Semi + End dump	90.55	40 hrs.	3,622.—
Semi + lowboy	73.25	10 hrs.	732.50
Loader	69.38	40 hrs.	2,775.20
Dozer	82.50	25 hrs.	2,062.50
Loader	69.38	25 hrs.	1,734.50
Tandem	73.25	40 hrs.	2,930.—
4 dump trucks	61.75 ea. per hour	150 hrs.	9,262.50
5 men	7.64	190 hrs.	1,451.60
2 foreman	9.58	80 hrs.	766.40
pick-up	10.10	40 hrs.	404.—
			25,741.20
Materials			
Rip rap	1.00 ea.	192.—	192.—
Gravel	1.00 ea.	50	50.—
			25,983.20 total

Site 5?

Road 27

Dozer	82.50	4 hrs.	330.—
Loader	69.38	24 hrs.	1665.12
Lowboy	73.25	4 hrs.	293.—
tandem	73.25	15 hrs.	1098.75
maintainer	70.63	12 hrs.	847.56
2 foreman	9.58	20 hrs.	191.60
3 dump trucks	61.75 ea. per hr.	35 hrs.	2,161.25
pickup	10.10	20 hrs.	202.00
5 men	7.64	74 hrs.	565.36
			7,354.83
Materials			
Gravel	1.00 per load	40 loads	40.—
Tube	72" x 40'	1	1280.—

Site 2 or 3

Site #1? NO 6 ft culvert

P.o Rap	1.00	25. loads	25.00
			8,826.83 total

Rd. 2F+25

maintainer	20.63	13 hrs.	918.19
4 dumptrucks	61.75	40 hrs.	2,470.—
loader	69.38	10 hrs	693.80
pick up	10.10	10 hrs.	101.—
4 men	7.89	63 hrs.	497.07
foreman	8.94	10 hrs.	89.40
			4,769.46
Materials			
Gravel	1.00	54 loads	54.—
			4,823.46 total

Dist Grand total: 39,570.49

Dist. 2 Canoa

Rd 3J

shoe	28.15	10 hrs.	231.50
Cain	30.25	6 hrs.	181.50
2 dump Trucks	61.75	20 hrs.	1235.—
2 semi/belly	90.55	20 hrs.	1811.—
maintainer	70.63	12 hrs.	847.56
loader	69.38	10 hrs.	693.80
pick-up	10.10	16 hrs.	161.60
6 men	8.37	96 hrs.	803.52
foreman	10.68	16 hrs.	170.88
			6,136.34
Materials			
tube	5' x 42'	1	1552.32
clay	1.00	89 loads	89.00
			7,777.68

Wash out Various roads

loader	69.38	32 hrs.	2,220.16
semi/belly (2)	90.55	64 hrs.	5,795.20
Dozer	82.50	6 hrs.	495.—
3 men	8.86	96 hrs.	850.56
			9,360.92
Materials			
clay	1.00	110 loads	110.—
			9,470.92 total

Dist. 2 Grand total 17,248.60

List 3 Kawad

Road J+71

	cost		Totals
maintainer	70.63 per hr.	16 hrs.	1,130.08
loader	69.38 per hr.	16 hrs.	1,110.08
6 men	8.69 per hr.	120 hrs.	1,042.80
1 foreman	10.68 per hr.	20 hrs.	213.60
1 truck	61.75 per hr.	16 hrs.	988.00
2 tandems	73.25 per hr.	32 hrs.	2,344.00
1 pick-up	10.10 per hr.	8 hrs.	80.80
			6,909.36
Materials			
Rip Rap	1.00 ea.	21 loads	21.-
fill dirt	1.00 ea.	96 loads	96.-
gravel	1.00 ea.	20 loads	20.-
			7,046.36 total

Road M+71

maintainer	70.63 per hr.	8 hrs.	565.04
loader	69.38 per hr.	8 hrs.	555.04
1 truck	61.75 per hr.	8 hrs	494.-
2 tandem	73.25 per hr.	16 hrs.	1,172.-
6 men	8.69 per hr.	48 hrs.	417.12
1 foreman	10.68 per hr.	8 hrs.	85.44
1 pick-up	10.10 per hr.	8 hrs.	80.80
			3,369.44
Materials			
fill dirt	1.00 ea.	30 loads	30.-
gravel	1.00 ea.	15 loads	15.-
			3414.44 total

Road 29

1 truck	61.75	12 hrs.	741.-
2 tandems	73.25	24 hrs.	1758.-
loader	19.38	[illegible]	429.54

			3,331.54
' ·ck hoe	23.15	12 hrs.	277.80
le men	8.49 per hr.	72 hrs.	625.68
Inrman	10.68 per hr.	12 hrs.	128.16
Dickins	10.10 per hr.	12 hrs.	121.20
			4,484.40
Materials			
fill dirt	1.00	10 loads	10.—
Rip Rap	1.00	15 loads	15.—
			4,509.40 total

Road 34

loader	69.38	48 hrs.	3,330.24
4 trucks	61.75	160 hrs.	9,880.—
2 tandems	73.25	80 hrs.	5,860.—
r ·tainer	70.43	48 hrs.	3,390.24
6 men	8.49 per hr.	240 hrs.	2,085.40
foreman	10.68 per hr.	40 hrs	427.20
pick up	10.10 per hr.	40 hrs.	404.—
			25,377.28
Materials			
filldirt	1.00	400 loads	400.—
gravel	1.00	70 gravel	70.—
tube 48"x50'	22.82	50 ft.	1,141.—
			26,988.28 total

Road F

2 tandems	73.25	80 hrs.	5,860.—
loadee	69.38	40 hrs.	2,775.20
r ·tainer	70.43	40 hrs.	2,825.20
4 men	8.49	160 hrs.	1,390.40
foreman	10.68	40 hrs.	427.20
pickups	10.10	40 hrs	404.—

Materials

0 sand 1.00

50 loads

13,682.00
50.00
13,732.00 total

Grand total 55,690.48

LINCOLN COUNTY

James Mathis
16105 Page St. Kenwal

April - 23+24 - 1½"
May - 12 - 1/10"
25 - 1/10"
June 2 - 1/10"
~~6~~ - 6/10"
7 - 1"
8 - 1"
11 - 2/10"
13 - 3/10"
15 - 3/10"
16 - 4/10"
18 - 8/10"
25 - ½"
July 19 - 1/10"
25 - 1/10"
28 thru Aug 1 - 2 1/10"
Aug. 3 - 3/10"
5 - 1"
6 - 8/10"
9 - 1/10"
10 - 2/10"
12 - 1/10"
Aug. 14 - 1/10"
16 - shower
18 - 1/10"
22 - 1/10"
Sept. 6 - 3/10"
Oct. 11 - 4/10"

12 7/10

Where Service Quality is the Difference.

RSC

Rental Service Corporation

Rainfall - 1997

Joe Buckhaults
10010 Co. Rd 27

Jan. - .12
Feb. - .53
March - .71
April - 2.22
May - .72
June - 1.87
July - 2.26
Aug. - 5.37
Sept. - .78
Oct. - .40

14 inch 98 hundreds

Bill Patton
17½"
21068 Co. Rd X

Bob Elliott 15460 Co Hwy 63

April 1 in 2 tenths
May 1 in. 1 tenths
June 1½ inches
July 2 inches
Aug. 6 inches 8 tenths
11½ inches

1997
LINCOLN COUNTY
RAINFALL RECORDED AT 11840 STATE ROAD 71
(13 MILES SOUTHWEST OF KARVAL, COLORADO)

MAY 19----.2"

JUNE 7-----.4"
JUNE 9-----.7"
JUNE 10----.3"
JUNE 12----.2"
JUNE 15----.5"
JUNE 24----.1"
JUNE 25----.15"

JULY 27----- NOTHING HERE, MICROBURST WINDS AT LIMON
JULY 28----.75"
JULY 29---1.1" HORSE CREEK RUNNING BANK FULL PAST HERE
HEAVIER RAINS NORTH OF HERE BELOW HIGHWAY 94

AUG. 2----1.4" DRENCHING RAIN CAME IN ABOUT 1 HR, FILLED
CANAL SOUTH OF OUR DRIVEWAY

AUG.4 &5-2.5" SLOW RAIN ALL NIGHT UNTIL ABOUT NOON
SECOND DAY - HORSE CREEK RUNNING AGAIN
AUG. 6-----.3"
AUG. 9-----.1"
AUG. 10----.2"
AUG. 29----.8"
AUG. 30----.1"
AUG. 31----.7"

SEPT. 1-----.1"
SEPT. 6-----.1"

OCT. 11----.4"

OCT. 24 & 25----BLIZZARD!

Recorded by
Cherry Stogsdill

4. Calculations and Estimates

Assumptions Used in the Hydraulic Computations

In order to estimate peak discharges, the CWCB flood documentation team employed Manning's equation. The application of Manning's equation to open channel flow problems requires that several generalizing assumptions be made.

Flow in open channels typically occurs as turbulent flow over rough surfaces. Open channel flow is also seldom either steady or uniform. (Steady flow has characteristics that do not vary with time while uniform flow implies that a constant cross sectional area and velocity occur at each section within a reach.) Steady, uniform flow almost never occurs in open channels (Morris and Wiggert, Applied Hydraulics in Engineering, 2nd edition, 1972).

In engineering applications, the Manning's equation has been used extensively and has been shown to be quite reliable even though it is an empirical approach derived for application to the following conditions:

- uniform flow in which the rate of head loss is equal to the bed slope
- steady flow

The open channel flow computations contained herein are treated as approximate solutions based on the assumptions of both steady and uniform flow. In actuality, the floods investigated in this study generally exhibited rapidly-rising and receding floodwave conditions that occurred in highly variable natural channels and adjacent floodplains. Flow characteristics under these circumstances were unlikely to be either steady or uniform.

Approaches are available for estimating floodwave flows, but they require substantial amounts of time and data that were not practical for these investigations. Manning's equation was used due to its general acceptance in the engineering community, and because of its relative ease of application. The Manning "n" values used in the calculations were based on engineering judgement, the reasonableness of results, and the understanding that the "n" term represented energy loss factors not typically found in steady, uniform flows.

SOUTH RUSH CR. - LINCOLN COUNTY

Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: S. RUSH CR. Q, LINCOLN COUNTY | Project/Proposal Name: CWCB FLOOD STUDY
Computed: JKB Date: 6/10/98 | Project/Proposal No.: D479 Task: 54
Checked: ____ Date: ____ | Page 1 of 2

GIVEN:

1. SLOPE = 0.00186 per previous calc's (Appendix B)

2. ACTIVE FLOW AREA ESTIMATES - (APPENDIX B)
   SECT. A = 1,997 ft² (approx. active flow area)
   SECT. C = 1,931 ft² (approx. active flow area)
   BRIDGE SECT. = 1,921 ft² (flowing to low steel in open channel conditions - negligible pressure)
   $\bar{x}$ = 1,950 ft²

3. HYDRAULIC RADII AT - SEE APPENDIX B
   SECT. A = 6.484 ft
   SECT. C = 3.76 ft
   BRIDGE SECT = 8.80 ft
   $\bar{x}$ = 6.35 ft

FIND: PEAK FLOOD DISCHARGE AT THE LOCATION.

SOLUTION:

NOTE: 3 CROSS-SECTIONS AND THE BRIDGE SECTION WERE MEASURED AT THIS LOCATION. 2 SECTIONS (A, B) ARE 99 ft AND 231 ft RESP. UPSTREAM OF THE BRIDGE, AND SECT. C IS ABOUT 100 ft DOWNSTR.

FLOW WAS VERY WIDE (100's of feet) AND SHALLOW (0.5 TO 1.5 ft) TO THE SOUTH OF THE MAIN CHANNEL. MOST OF THIS HAS BEEN DISCOUNTED AS INACTIVE FLOW AREA.

THE ACTIVE FLOW AREA AND CORRESPONDING HYDRAULIC RADIUS ESTIMATED FOR SECT. A WILL BE USED TO ESTIMATE Q. THIS SEEMS TO FIT REASONABLY WELL WITH THE BRIDGE FLOW AREA IN PARTICULAR, AS WELL AS WITH JKB'S ACTIVE FLOW ESTIMATE FOR SECT. C, AND THE AVERAGE HYDRAULIC RADIUS.

Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: SO. RUSH CR. DISCHARGE, LINCOLN CO. | Project/Proposal Name: _____
Computed: JKB Date: 6/10/98 | Project/Proposal No.: _____ Task: _____
Checked: _____ Date: _____ | Page 2 of 2

SOLUTION (CONT.)

THE n VALUE USED WILL BE THAT ESTIMATED IN THE FIELD FOR SECTION A. BY USING ONLY SECTION A, BRIDGE LOSSES AND THEIR EFFECT ON FLOW GEOMETRY AT SECTION C CAN BE IGNORED, AND THE DISCHARGE ESTIMATE SIMPLIFIED.

1. $Q_p = \frac{1.49}{n} A R^{0.6667} S^{0.5}$ where $n = 0.025$ initially

$$\Rightarrow Q_p = \frac{1.49}{0.025} (1,997)(6.48)^{0.6667} (0.00186)^{0.5}$$

$\Rightarrow Q_p = \underline{17,841.5}$ cfs CHECK: $V = Q/A = 17,841/1997 = 8.93$ fps

2. ALTERNATIVES:
$n = 0.040 \Rightarrow Q = 11,151$ cfs, $V = 5.58$ fps
$n = 0.035 \Rightarrow Q = 12,744$ cfs, $V = 6.38$ fps
$n = 0.030 \Rightarrow Q = 14,868$ cfs, $V = 7.44$ fps
$n = 0.028 \Rightarrow Q = 15,930$ cfs, $V = 7.98$ fps
$n = 0.023 \Rightarrow Q = 19,393$ cfs, $V = 9.71$ fps

ANSWER: $Q_p = 13,000$ to $15,000$ cfs seems reasonable, with about 15,000 ($n = 0.030$) judged the "best" answer. $V \doteq 6.5$ to 7.5 fps.

Appendix B (Lincoln County):

-- Surveying field notes

-- Survey data reduction (distances, angles, and cross-sections) primarily using an Excel spreadsheet.

-- Supplemental calculations (based on surveying data) for channel slope, flow area, wetted perimeter, etc.

-- Watershed map

-- Site Photographs

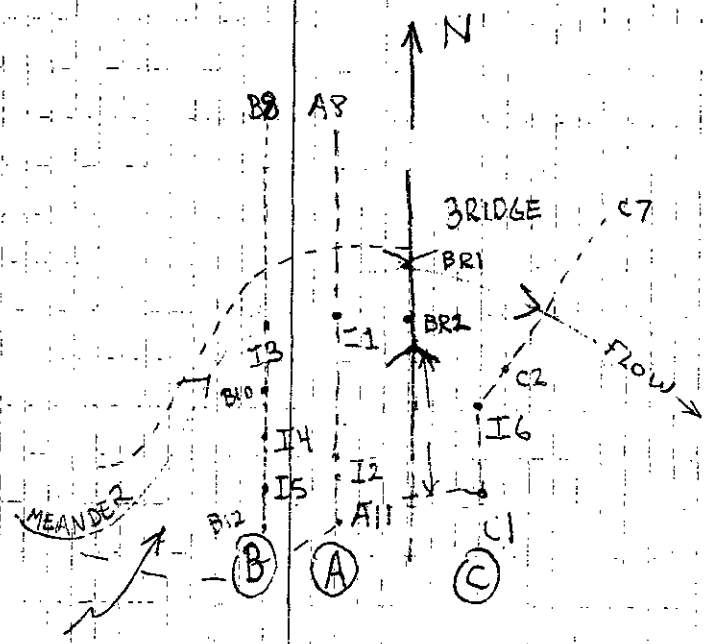
1 of 4 RUSH CR., LINCOLN CO.

Jim Burrell
Bill Ellett
LEVEL: LEICA WILD NA20

June 3, 1998 1500 HR
Partly Cloudy, 60°F
Gusty Winds, Temp. Dropping to 40°

Channel has deep wide pools separated by narrow, shallow riffles.

		ARBITRARY DATUM I1 = 4000 ft			
		TOP	MIDDLE	BOTTOM	EL
I-1	(HI = 4.82)				4004.82
	A1	5.25	5.19	5.10	3999.63
	A2	9.35	9.06	8.78	3995.76
	A3	9.99	9.29	8.59	3995.53
EDGE WATER	A4	11.74	11.98	10.20	3992.84
EDGE WATER	A5	11.88	11.97	10.09	3992.85
	A6	8.94	7.91	6.88	3996.91
	A7	7.08	6.00	4.94	3998.82
	A8	3.24	2.01	0.79	4002.81
	slope from A7 to A8 continues uphill				
BRIDGE	BR1	5.72	4.68	3.63	4000.74
∠R 31°	LOW STEEL	3.96 ab grnd (measured)			
				LS =	4004.1
∠R 90°	BR2	9.99	9.49	9.00	3995.33
	LOW STEEL	7.16 ab grnd (measured)			
				LS =	4002.49
∠R 180°	A9	6.72	5.81	4.90	3999.01
	A10	5.03	3.20	1.37	4001.62
I2 at	A10	HI = 4.84			4006.46
	BSI1	8.32	6.50	4.66	3999.96
RT. EDGE OF DEBRIS	A11	4.42	2.68	0.92	4003.78



APPROX AREA OF FLOW - - - -
VERY WIDE - BROKE OUT AT MEANDER.

SO. RUSH CR. - LINCOLN CO.

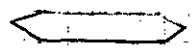
I1 = 4000.00 ft DATUM

		TOP	MIDDLE	BOTTOM	I3 INST.
I3	BSI1	6.01	5.07	4.13	4005.07
HI 5.12		∠R = 102.5°,		I3 GRND	3999.95
	B1	5.04	4.87	4.71	4000.20
	B2	8.21	7.93	7.65	3997.14
	B3	9.13	8.55	7.98	3996.52
	B4	11.66	11.04	10.46	3994.03
	B5	11.95	11.21	10.46	3993.86
PER BILL -	CHANNEL	POOL	1.0 ft DEEP	AT	B5
	B6	10.74	9.98	9.24	3995.09
	B7	10.63	9.73	8.83	3995.34
	B8	2.57	1.57	0.57	4003.50
	CHANNEL BOTTOM (THALWEG)				
T1	∠R 331.5°	12.09	11.06	10.03	3994.01
T2	∠R 59°	12.77	11.62	10.48	3993.45
	S9	6.98	5.50	4.03	3999.57
I4 at	B9	HI =	5.16,	I4 INST =	4004.73
	BSI3	6.21	4.73	3.26	4000.00
	B10	4.00	2.96	1.92	4001.77
∠R 117°	BSI2	3.25	3.01	1.77	4001.72
	B11	2.51	1.65	0.79	4003.08
I5 at	B11	HI =	5.05,	I5 INST =	4008.13
	BSI4	9.33	8.45	7.61	3999.65
	B12	2.90	1.72	0.53	4006.41
∠R 255°	BSI2	7.55	6.39	5.25	4001.74

NOTE: FLOW OCCURRED BEYOND B12 TO CURVE OF MEANDER.

PHOTOS 1. DEBRIS LINE IN TREE NR BRIDGE

2. BILL ELLETT AT BRIDGE

NOTE: BRIDGE HAS 2 CONCRETE PIERS, EACH 1.50 ft WIDE. SHARP NOSED ON BOTH ENDS 

CHRIS MENK SAYS SO. BRIDGE APPROACH WAS WASHED OUT, GUARD RAIL IN AIR. PRESSURE FLOW AT BRIDGE, BASED ON WATER LEVEL DURING HIS VISIT IN 7/97.

NOTE: 0.05 TO 0.12 ft ERRORS AT I4, I5. THESE ARE LONG SHOTS, GETTING DARK, COLD, AND WINDY.

DOWNSTREAM OF BRIDGE — ELEVATION I2=4001.62

4 SO. RUSH CR - LINCOLN CO.

		TOP	MIDDLE	BOTTOM	ELEV.
I6	HI=7.89				
	BS-I2	2.77	1.14	—	4001.62
≈	∠R I2 to I1	= 112	-40.5	= 71.5°	
	C1	5.43	3.12	0.82	(3999.64)
	(at outer edge of debris to South)				
C1-C2	∠R =	349°	to 212°	= 223°	
	C2	5.23	4.88	4.54	(3997.88)
	C3	8.67	8.24	7.81	(3994.52)
	C4	10.44	9.46	8.48	(3993.30)
	(right edge of water)				
	C5	10.98	9.46	7.95	(3993.30)
	C6	8.47	6.82	5.18	(3995.94)
	C7	5.12	3.21	1.30	(3999.55)
	(left debris line)				

GROUND ELEVATION AT I6 = 4001.62 + 1.14 - 4.89
= 3997.87

INSTR. ELEV. AT I6 = 4001.62 + 1.14 = 4002.76

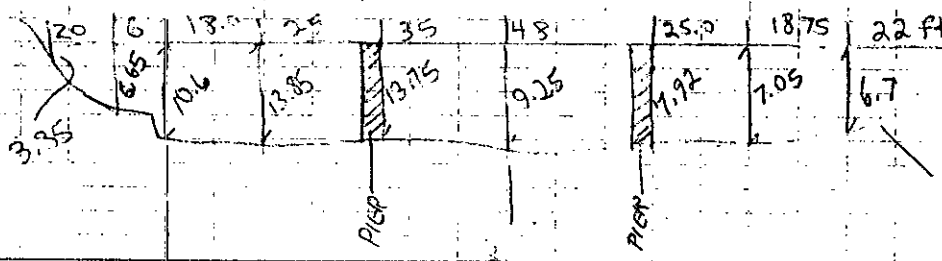
NOTE: CANNOT SEE PAST BRIDGE AND ROAD FILL TO ANY POINTS EXCEPT I2 FROM DN STR. SIDE (I6). 1/2 READING.

BILL PUT ROD ON I1 AFTER SHOT FROM I6 → I2. READ ANGLE I2 - I6 - I1 (APPROX) BY LINING UP X-HAIRS TO TOP OF ROLLOVER ROAD FILL. COULD NOT TAKE READINGS.

GETTING DARK ON C TRANSECT - VERY LOW DENSE CLOUDS & WIND. TOOK SHOTS, WILL REDUCE NOTES LATER.

X 6/4/98 - DATA REDUCTIONS IN PARENS.

BRIDGE; LOW STEEL TO GROUND



GIRDER THICKNESS { + 3.42 ft / 0.09 ft / 3.51 ft

ADD 2"-4" (MAX) FOR GRAVEL, TO TOP OF ROAD

ELEVATION VIEW DOWNSTREAM

NOTE; BRIDGE HAD PRESSURE FLOW NOT REALLY! SEE NOTE, 5 PAGES further on.

47, SO. RUSH-LINCOLN CO.

SOUTH RUSH CR., LINCOLN COUNTY							Re-order	Re-calc	Arbitrary	Actual (a)
Arbitrary Datum = 4000.00 ft at I1					Horiz		From Left	Horiz	Datum	Approx.
Transect	Point	High	Low	Distance	Coord		Bank	Coord, ft	Elevation	Elev., ft
A	I1			0.00			A8	0	4002.81	5112.81
	A1	5.25	5.10	15.00			A7	31	3998.82	5108.82
	A2	9.35	8.78	57.00			A6	39	3996.91	5106.91
	A3	9.99	8.59	140.00			A5	66	3992.85	5102.85
	A4	11.74	10.20	154.00			A4	91	3992.84	5102.84
	A5	11.88	10.09	179.00			A3	105	3995.53	5105.53
	A6	8.94	6.88	206.00			A2	188	3995.76	5105.76
	A7	7.08	4.94	214.00			A1	230	3999.63	5109.63
	A8	3.24	0.79	245.00			I1	245	4000.00	5110.00
	A9	6.72	4.90	182.00	-182		A9	427	3999.01	5109.01
	A10	5.03	1.37	366.00	-366		A10	611	4001.62	5111.62
	A11	4.42	0.92	350.00	-716		A11	961	4003.78	5113.78
	NOTE: A9 through A11 are 180 degr. behind the instrument from A1 through A8.									
	Thus, horizontal coordinate A9 = I1 - 182									
	Thus, horizontal coordinate A10 = I1 - 366									
	A11 is 350 ft beyond a second instrument set-up at A10, so its									
	horizontal coordinate = I1 - 366 - 350									
	(a) based on USGS topographic quad.									

DEBRIS LINE = WSEL (ASSUMED)

PER FIELD NOTES, LOW STEEL ON BRIDGE = 5110 + 4.1 = 5114.10 and = 5110 + 2.49 = 5112.49

Sect. A is split from bridge west.

SOUTH RUSH CR., LINCOLN COUNTY							Re-order	Re-calc	Arbitrary	Actual (a)
Arbitrary Datum = 4000.00 ft at I1					Horiz		From Left	Horiz	Datum	Approx.
Transect	Point	High	Low	Distance	Coord		Bank	Coord, ft	Elevation	Elev., ft
B	I3			0.00			B8	0	4003.50	5113.50
	B1	5.04	4.71	33.00			B7	20	3995.34	5105.34
	B2	8.21	7.65	56.00			B6	50	3995.09	5105.09
	B3	9.13	7.98	115.00			B5	51	3993.86	5103.86
	B4	11.66	10.46	120.00			B4	80	3994.03	5104.03
	B5	11.95	10.46	149.00			B3	85	3996.52	5106.52
	B6	10.74	9.24	150.00			B2	144	3997.14	5107.14
	B7	10.63	8.83	180.00			B1	167	4000.20	5110.20
	B8	2.57	0.57	200.00			I3	200	3999.95	5109.95
	B9	6.98	4.03	295.00	-295		B10	287	4001.77	5111.77
	B10	4.00	1.92	208.00	-87		B9	495	3999.57	5109.57
	B11	2.51	0.79	172.00	-467		B11	667	4003.08	5113.08
	B12	2.90	0.53	237.00	-704		B12	904	4006.41	5116.41
	NOTE: B9, B11, and B12 are 180 degr. behind the instrument (south) from B1 through B8.									
	Thus, horizontal coordinate B9 = I3 - 295. Set up on this spot to extend transect - unfortunately it's too low.									
	B10 is a long shot back towards I3, 208 ft from B9 (I4), so its distance from I3 = -295+-208 = -87 ft from I3									
	We weren't sure whether we could set up at B11 and get back sights, so had Bill stake B10 in case.									
	Instrument positions were dictated by length of shot and topography, trying to minimize set-ups.									
	B11 is 172 ft south beyond the second instrument set-up at B9, so its									
	horizontal coordinate B11 =I3 - 295 - 172 = -467 from I3									
	B12 is 237 ft south beyond a third instrument set-up at B11, so its									
	horizontal coordinate B12 =I3 - 295 - 172 - 237 = -704 ft from I3									

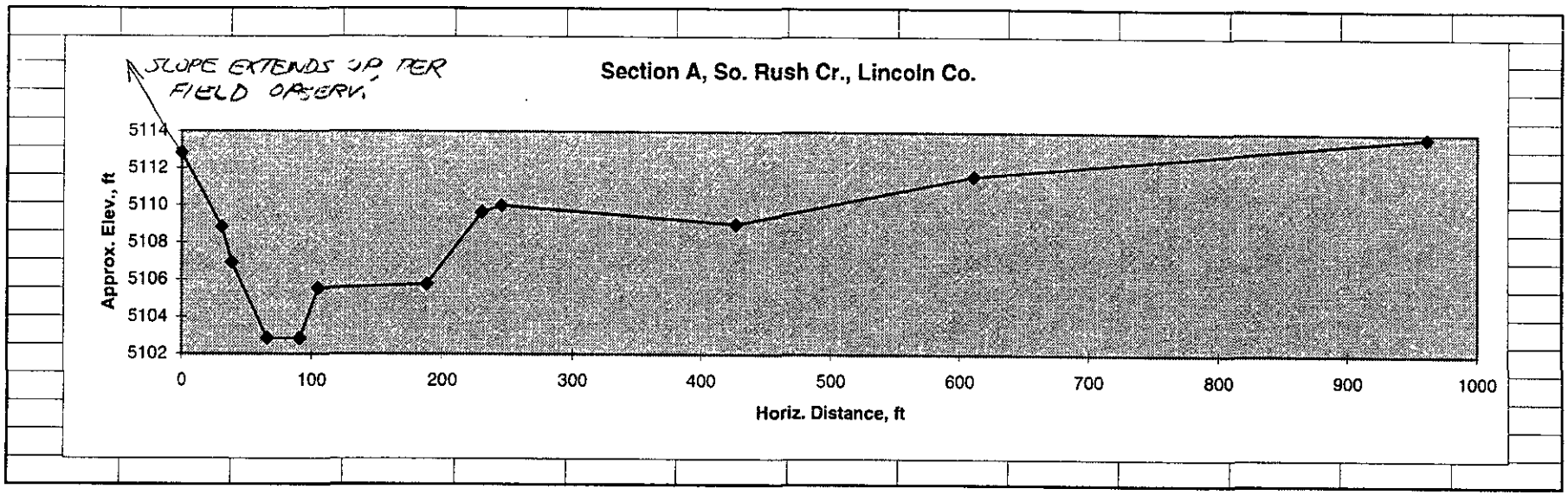
edge of wtr. - road man says channel floor is about 1 ft deeper here.

SOUTH RUSH CR., LINCOLN COUNTY							Re-order	Re-calc	Arbitrary	Actual (a)
Arbitrary Datum = 4000.00 ft at I1					Horiz		From Left	Horiz	Datum	Approx.
Transect	Point	High	Low	Distance	Coord		Bank	Coord, ft	Elevation	Elev., ft
C	I6			0.00	0		C7	0	3999.55	5109.55
	C1	5.43	0.82	461.00	-461		C6	53	3995.94	5105.94
	C2	5.23	4.54	69.00	69		C5	79	3993.30	5103.30
	C3	8.67	7.81	86.00	86		C4	186	3993.30	5103.30
	C4	10.44	8.48	196.00	196		C3	296	3994.52	5104.52
	C5	10.98	7.95	303.00	303		C2	313	3997.88	5107.88
	C6	8.47	5.18	329.00	329		I6	382	3997.87	5107.87
	C7	5.12	1.30	382.00	382		C1	843	3999.64	5109.64
	C1 is behind I6, more or less to south; the rest are in front to the NE, perpend. to channel									

edge of wide pool. Bottom unknown.

water surface elev.

use 5109.60 at Sect. C.



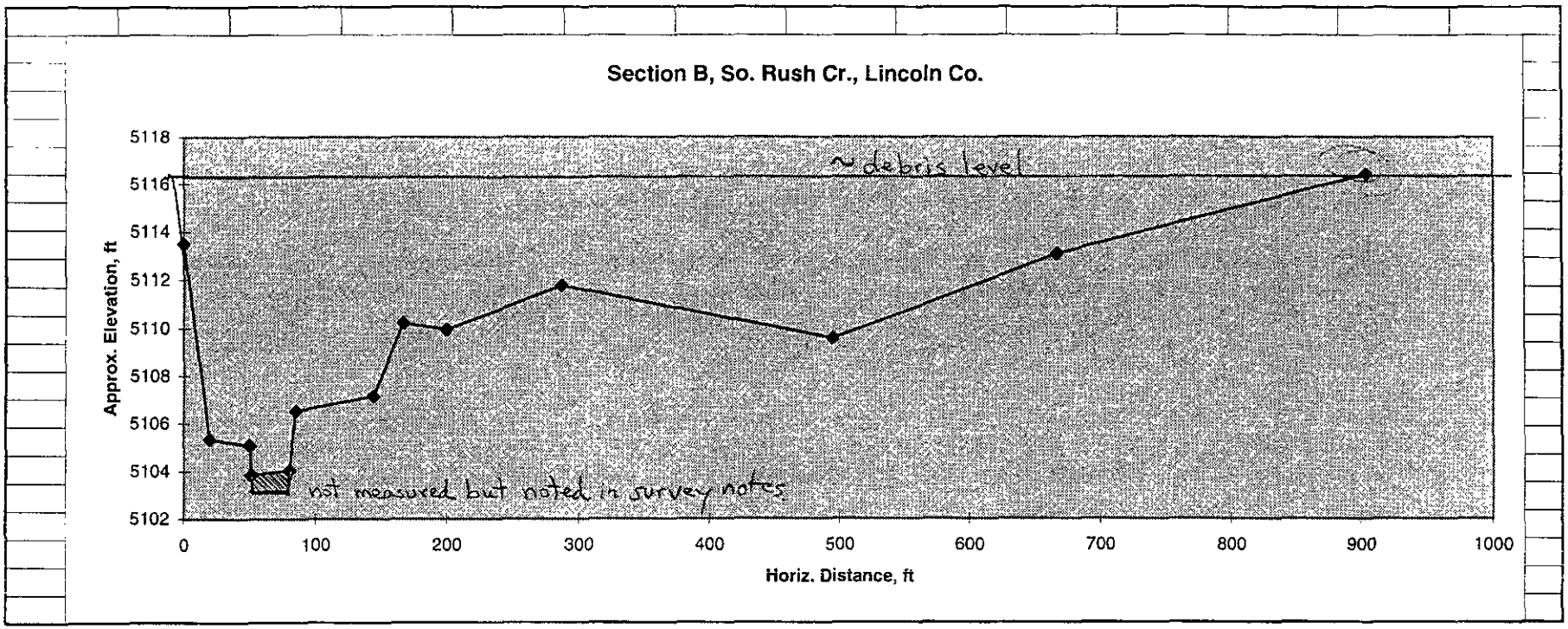
SECT. A FLOW AREA (ACTIVE FLOW)

A. Original Data

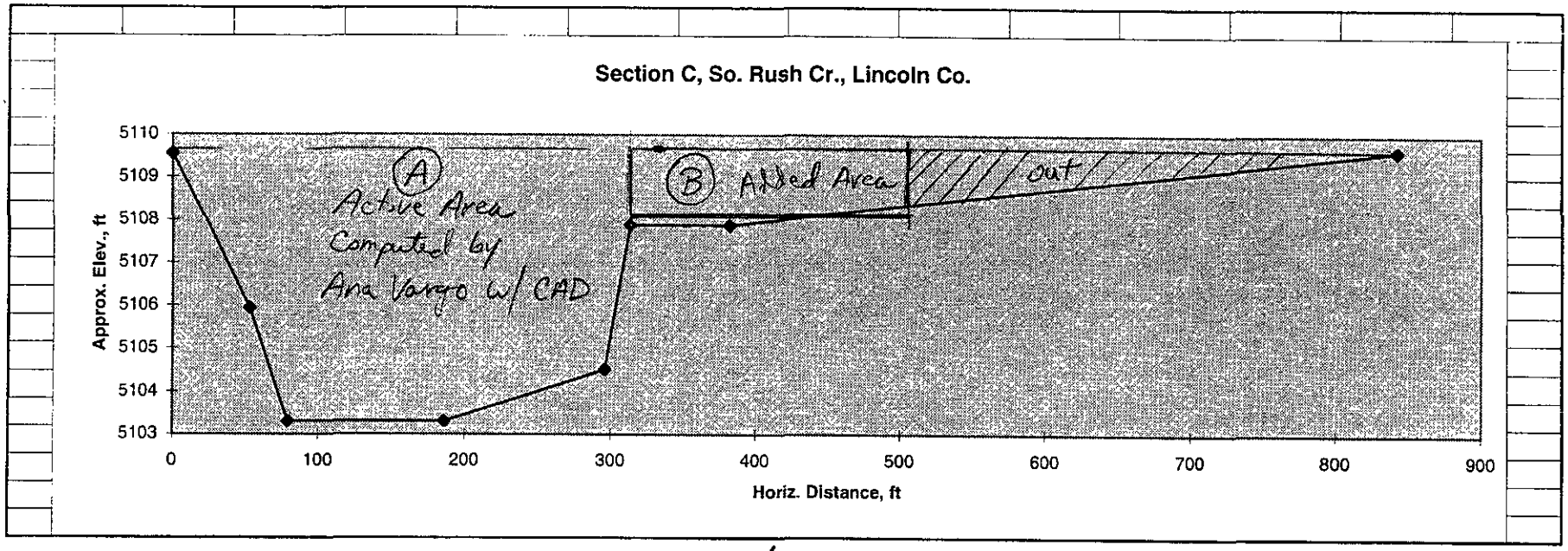
1. Total Area below EL 5113.78 debris line
   = 3,575 ft² per Ana w/ AutoCad.
2. Wetted Perimeter of same = 969.6 ft
3. R = 3.687 ft

B. Revised, per JkB's estimate of Active Flow Area

1. per Ana & AutoCad ⇒ area = 1997 ft²
2. wetted perimeter = 308.5 ft
3. $R_{rev.}$ = 6.484 ft



1. FLOW AREA FROM I ANA, PER AUTO CAD, = 4,513.33 ft²
2. WETTED PERIMETER = 914.72 ft
3. A/P = 5.2621 ft.



SECTION C FLOW GEOMETRY

A. 1. Section C Active Area (initial guess) from Ana = 1585.60 ft²

2. Wetted Perimeter from Ana = 313.6 ft

B. 1. Added Area above = 345 ft²

2. Added Perimeter = 200 ft

3. Revised Active Area = 1586 + 345 = 1931 ft²

4. Revised Wetted Perimeter = 314 + 200 = 514 ft

5. $R_{Revised}$ = 1931/514 = 3.76 ft

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Subject: BRIDGE OPEN AREA S. RUSH CR.
Computed: JKB. Date: 6/2/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: _____ Task: _____
Page 1 of 1

GIVEN: OPEN AREAS BELOW FROM FIELD NOTES, PAGE 4 OF 4, AT BRIDGE

$(22 \times 6.7)\ 0.5 =$	73.7
$18.75 \times [(7.05+6.7)/2] =$	128.91
$25 \times [(7.92+7.05)/2] =$	187.12
$48 \times [(9.25+7.92)/2] =$	412.0
$35 \times [13.75+9.25)/2] =$	402.50
$25 \times [13.8] =$	345
$18 \times [(13.85+10.6)/2] =$	220
$6 \times [(10.6+6.65)/2] =$	52
$20 \times [(6.65+3.35)/2] =$	100

FIND: TOTAL FLOW AREA AT BRIDGE = $\Sigma \Rightarrow$ 1,921.23 ft²

ANSWER: BRIDGE OPEN AREA = 1921.23 ft²

NOTE: ELEVATION CALC'S ON BRIDGE LOW STEEL INDICATE IT WAS ABOVE THE WATER SURFACE ON THE NORTH END OF THE BRIDGE (LOW CHORD = 5114.10 ft, WSEL = 5113.78 max). ON THE SOUTH END, THOUGH, THE LOW STEEL WAS SUBMERGED (LOW CHORD = 5112.49 ft.) DAMAGE TO APPROACH WAS ON SOUTH END.

ADDITIONAL ACTIVE FLOW OCCURRED OVER THE ROAD SOUTH OF THE BRIDGE. THIS AREA IS DIFFICULT TO QUANTIFY, SINCE THE ROAD WAS REPAIRED AND NO WATERMARKS WERE AVAILABLE.

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Subject: SO. RUSH CR. BRIDGE, LINCOLN CO. | Project/Proposal Name: _____
Computed: JKB. Date: 6/10/98 | Project/Proposal No.: _____ Task: _____
Checked: _____ Date: _____ | Page _____ of _____

GIVEN: BRIDGE GEOMETRY FROM FIELD NOTES, PAGE 4 OF 4, AND FLOW AREA = 1,921 ft² (per previous calcs)

FIND: HYDRAULIC RADIUS AT BRIDGE.

SOLUTION:

1. METHOD 1 (R = D for wide channel)

a. have the following heights, low steel to ground, with flow depth basically at low steel.

3.35 + 6.65 + 10.6 + 13.85 + 13.75 + 9.25 + 7.92 + 7.05 + 6.7

Σ = 79.12, $\bar{x}$ = 79.12/9 = 8.79 ft for R

b. $R \approx A/T$, where T = 20+6+18+25+35+48+25+19+22
= 218 ft

R = 1921/218 = 8.81 ft

c. THESE ARE THE SAME THING DUE TO $A = f(T, Y)$. NO POINT IN GOING FURTHER SINCE THIS IS ALL THE DATA THERE IS.

ANSWER: R = 8.80 ft

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Subject: SO. RUSH CR. SLOPE, LINCOLN CO.
Computed: JKB Date: 5 JUN 98
Checked: _____ Date: _____

Project/Proposal Name: CWCB FLOOD STUDY
Project/Proposal No.: D479 Task: 53
Page 1 of 1

GIVEN:

A. HAVE THE FOLLOWING ANGLES RIGHT & ROD READINGS FROM INSTR. POINT

	HIGH	LOW	ELEVATION
T1 = 331.5°	12.09	10.03	3994.01
T2 = 59°	12.77	10.48	3993.45

WHERE T1, T2 ARE POINTS ON THE CHANNEL THALWEG ALONG A FAIRLY STRAIGHT STREAM REACH

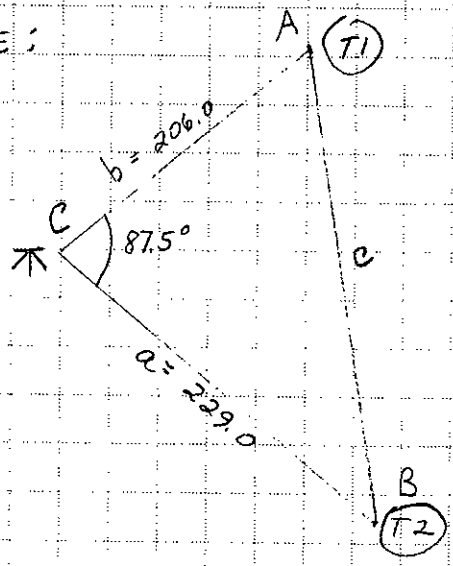
FIND: CHANNEL SLOPE

SOLUTION:

A. ANGLE SUBTENDED = (360 - 331.5) + 59 = 28.5 + 59 = 87.5°

B. DISTANCES: T1 = (12.09 - 10.03) * 100 = 206.0 ft
T2 = (12.77 - 10.48) * 100 = 229.0 ft

C. HAVE:



1. By Cosine Law:

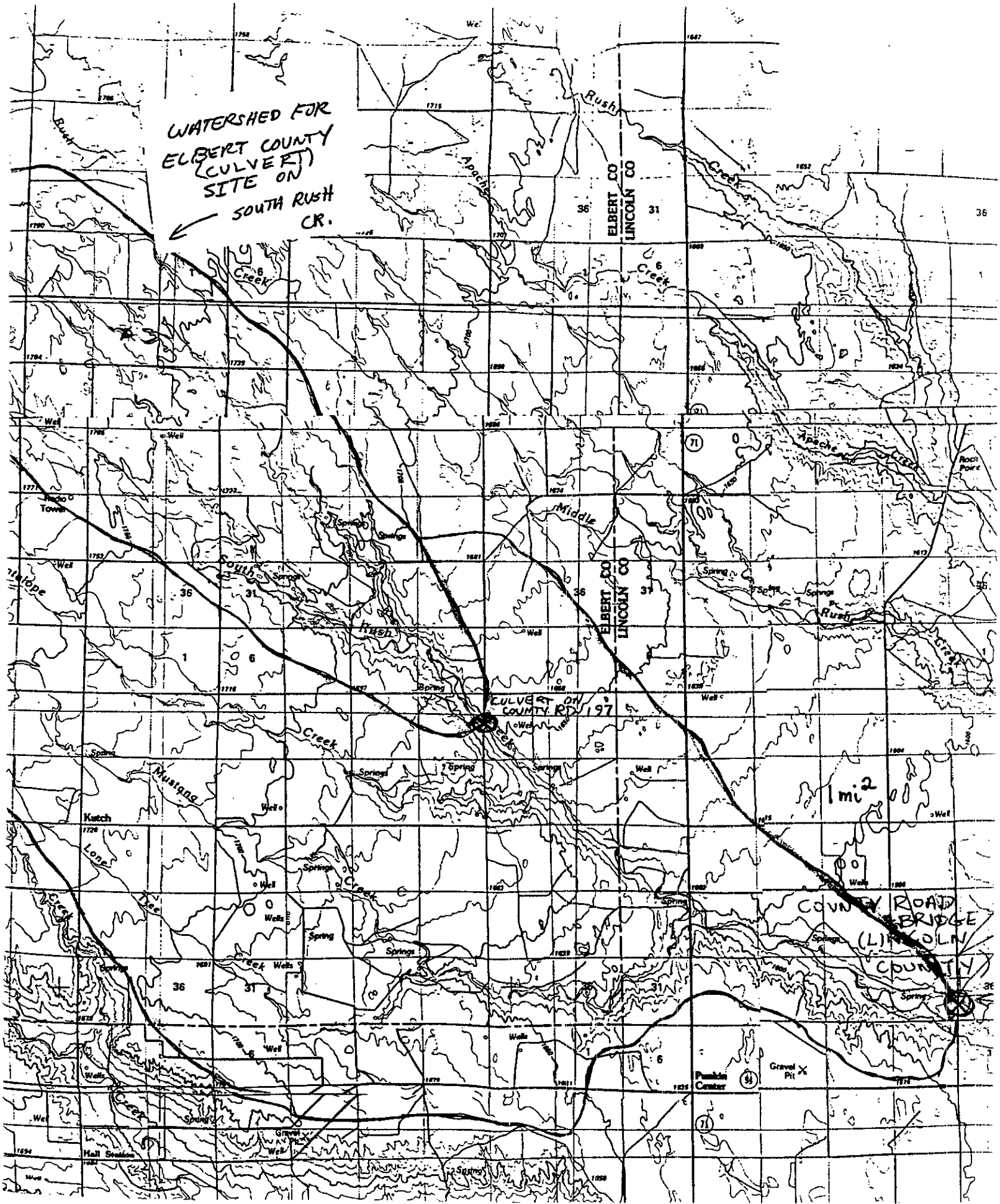
$$c^2 = a^2 + b^2 - 2ab\cos C$$
$$= (229)^2 + (206)^2 - 2(229 \times 206)\cos 87.5°$$
$$= (90{,}761.6)^{1/2}$$
$$= 301 \text{ ft}$$

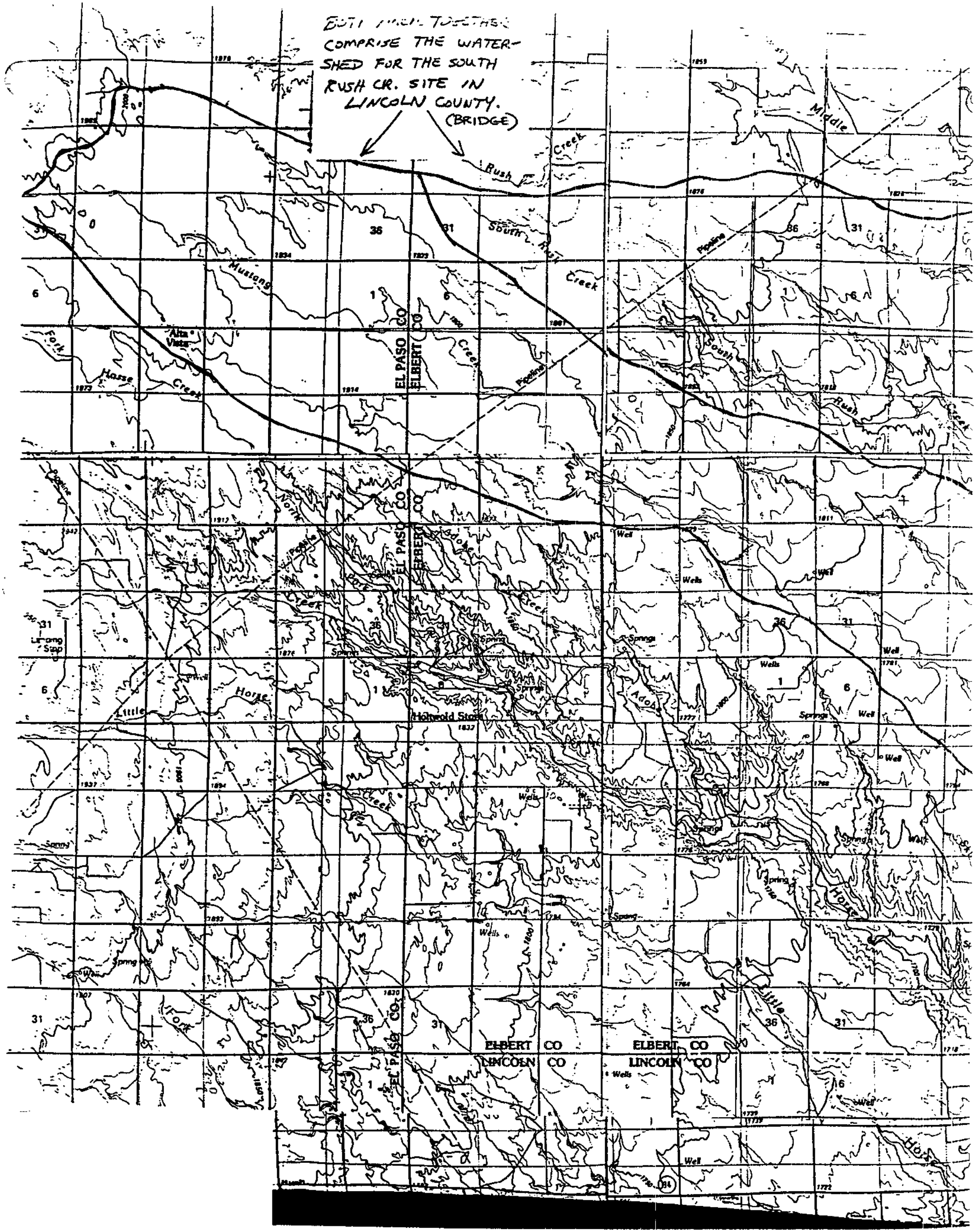
2. $\Delta EL = 3994.01 - 3993.45$
$= 0.56$ ft

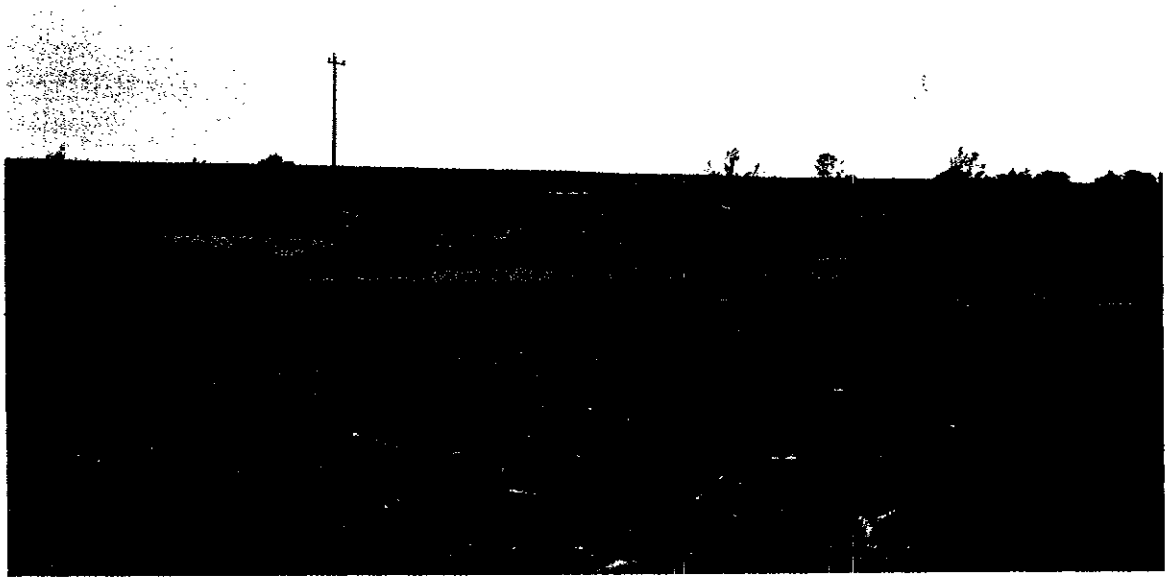
3. SLOPE $= \frac{0.56}{301} = 0.00186$ ft/ft

ANSWER:

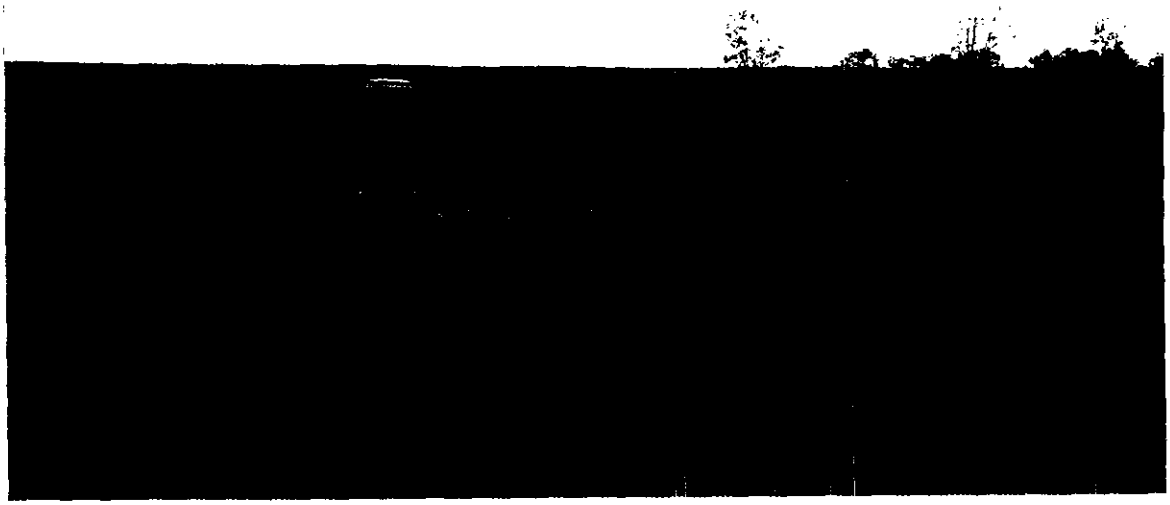
$S = 0.00186$ ft/ft


WATERSHED FOR ELBERT COUNTY (CULVERT) SITE ON SOUTH RUSH CR.
ELBERT CO
LINCOLN CO
CULVERT ON COUNTY RD 197
1 mi²
COUNTY ROAD BRIDGE (LINCOLN COUNTY)
Rush Creek
Middle Rush Creek
South Rush Creek
Apache Creek
Mustang Creek
Long Creek
Kutch
Pumpkin Center
Gravel Pit
Hall Station
Radio Tower

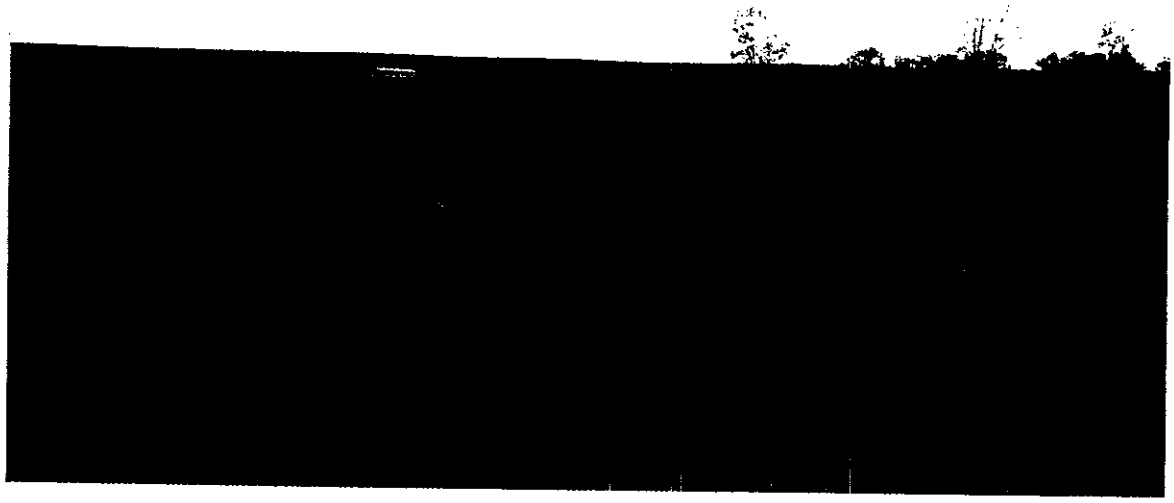

BOTH MAPS TOGETHER COMPRISE THE WATER-SHED FOR THE SOUTH RUSH CR. SITE IN LINCOLN COUNTY.
(BRIDGE)
Middle
Rush
Creek
South Rush Creek
Mustang
Alta Vista
Fork
Hasse
Creek
EL PASO CO
ELBERT CO
Pipeline
North
Adobe
Creek
Holtwold Store
Little
Horse
Adobe
Wells
Springs
Spring
Well
ELBERT CO
LINCOLN CO
ELBERT CO
LINCOLN CO



- So. Fork Cr. in [illegible] County, looking upstream at bridge. Flow is [illegible] measured the lower South approach (on left of picture) was [illegible] on upstream side as flow moved from [illegible] back to the main channel.
- Note scattered flood debris [illegible].



Overbank [illegible] bridge in previous picture. The entire foreground & middle ground of the picture was covered by water 1 to 2 ft deep.



Overhead view of bridge in previous picture. The entire foreground & middle ground of the picture was covered by water 1 to 2 ft deep.

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Subject: SOUTH RUSH CR. DISCHARGE SUMMARY
Computed: JKB Date: 6/11/98
Checked: _____ Date: _____

Project/Proposal Name: CWCB FLOOD STUDY
Project/Proposal No.: D479 Task: 54
Page 1 of 2

GIVEN: South Rush Cr. calculations for Elbert County site (upstr.) and Lincoln County site (8.3 mi. dnstr.), as follows:

1. FLOW GEOMETRY

COUNTY	FLOW AREA, ft^2	WETTED PERIMETER, ft	HYDRAULIC RADIUS, ft	SLOPE ft/ft	T ft	Y_{max}, ft
ELBERT	2,860	361	7.9	0.00144	350	~15
LINCOLN (at bridge)	~1,930	218	~8.8	0.00186	218 +	~13

2. ROUGHNESS CONDITIONS - RAPIDLY RISING FLOOD WAVE, WITH:

ELBERT - COTTONWOODS, CULVERT & ROAD FILL IN A V-SHAPED VALLEY W/ GRASSY SLOPES, MUCH VEGETAL DEBRIS, SAND TRANSPORT, ROAD REMOVED & CULVERT DESTROYED.

LINCOLN - GRASSLANDS W/ SHORT REEDS IN A WIDE VALLEY, SCOUR & FILL FORMING HOLES & BARS, BRIDGE SECTION FLOWING (JUST) FULL, SOUTH APPROACH TO BRIDGE WASHED OUT, MUCH VEGETAL DEBRIS AT EDGES OF FLOW.

3. FLOW CALCULATIONS - PEAK DISCHARGE

	ELBERT		LINCOLN	
n	Q, cfs	V, fps	Q, cfs	V, fps
0.040	16,055	5.6	11,151	5.58
0.035	18,350	6.5	12,744	6.38
0.030	21,408	7.5	14,868	7.44
0.028	22,937	8.0	15,930	7.98

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Subject: SO. RUSH DISCHARGES. | Project/Proposal Name:
Computed: JKB Date: 6/11/98 | Project/Proposal No.: Task:
Checked: Date: | Page 2 of 2

FIND: REASONABLE DISCHARGES AND RELATIONSHIP BETWEEN THE 2 SITES.

DISCUSSION: AT ANY GIVEN n VALUE, THE LINCOLN COUNTY SITE HAS SIGNIFICANTLY LESS DISCHARGE AND APPROXIMATELY THE SAME VELOCITY AS THE ELBERT COUNTY SITE. RAINFALL IN THE WATERSHED WAS DISTRIBUTED HEAVILY OVER THE ELBERT COUNTY AREA, TAPERING OFF SIGNIFICANTLY OVER THE REST OF THE WATERSHED. THUS, THE LINCOLN COUNTY SITE DIDN'T HAVE MUCH MORE CONTRIBUTING PRECIPITATION IN SPITE OF A LARGER WATERSHED AREA.

THE SLOPE IS SLIGHTLY FLATTER UPSTREAM IN ELBERT COUNTY (INTERESTING...). THE WETTED PERIMETER IS SLIGHTLY HIGHER IN PROPORTION TO AREA IN ELBERT COUNTY VS. LINCOLN. ALSO, THE LINCOLN SITE IS PROBABLY A BIT SMOOTHER HYDRAULICALLY; VEGETATION (ESPECIALLY COTTONWOODS) PROBABLY INCREASES THE n VALUE FOR ELBERT COUNTY. THE SLOPES ARE VERY CLOSE, AND PROBABLY WITHIN ERROR TOLERANCES, ESPECIALLY FOR DISTURBED SITES HAVING A LOT OF NATURAL VARIATION FROM SECTION TO SECTION.

CONCLUSION: GO WITH $n = 0.040$ FOR A RAPIDLY RISING FLOOD CREST IN THE COTTONWOODS AT THE ELBERT SITE. THIS GIVES $Q = 16,000$ cfs AND $V = 5.6$ fps. DOWNSTREAM, THE RISE WAS ATTENUATED, BUT BRIDGE EFFECTS AND DEBRIS STILL PERTAINED. GO WITH $n = 0.032$; THIS GIVES $Q = 14,000$ cfs AND $V = 7.0$ fps. ADD/SUBTRACT 1,000 cfs TO EITHER VALUE FOR A RANGE OF Q AT EACH SITE.

ANSWER: $Q_{ELBERT} = 15,000$ TO $17,000$ cfs.

$Q_{LINCOLN} = 13,000$ TO $15,000$ cfs.

Colorado Water Conservation Board
1997 Colorado Flood Documentation
Technical Addendum

Section II, County Specific Information, Subsections H - N

Riverside Technology, inc.
July 1998

PAWNEE CREEK
LOGAN COUNTY, COLORADO

FLOOD OF JULY 1997

DRAFT

Department of Natural Resources
Colorado Water Conservation Board
Flood Control and Floodplain Management Section
1313 Sherman Street, Room 721
Denver, Colorado 80203

August 1997

PAWNEE CREEK
LOGAN COUNTY, COLORADO

FLOOD OF JULY 1997

Prepared by:
Thomas Browning, P.E.
Colorado Water Conservation Board

Department of Natural Resources
Colorado Water Conservation Board
Flood Control and Floodplain Management Section
1313 Sherman Street, Room 721
Denver, Colorado 80203

August 1997

TABLE OF CONTENTS

I. INTRODUCTION

Summary

On the morning of July 30, 1997 the CWCB was advised by Logan County residents that an intense rainstorm had occurred over the Pawnee Creek watershed on July 29, 1997. The resulting flood flow elevations in Pawnee Creek were reported to be "higher than the flood of 1965." State and local officials were immediately concerned for the life and safety of residents, motorists, and visitors in the Pawnee Creek floodplain downstream of the rainstorm area. In particular, the communities of Atwood and Sterling, Colorado were in the direct path of flood flows or flood overflows from Pawnee Creek. This memo summarizes the key elements of the flood event of 1997.

Purpose

The purpose of this report is to document the flooding of July 29-31, 1997 in the Pawnee Creek watershed. The documentation will provide area residents, others affected by the flooding, and agencies and entities involved in post-flood study and mitigation with basic information about the flooding and its impacts. In addition, the report will contribute to preliminary decisions about flood hazard mitigation.

II. STUDY AREA DESCRIPTION

Community Description

The study area for this report includes portions of Logan and Weld Counties, which are located in northeastern Colorado. In addition to the unincorporated county areas, affected communities include Sterling and Atwood. The City of Sterling, the county seat of Logan County, is located approximately 125 miles northeast of Denver. Sterling is the largest community in Logan County, and has a population of about 11,000 (1995 estimate). The total population within Logan County is about 19,000 (1995 estimate).

Watershed Description

Pawnee Creek is a left bank tributary to the South Platte River and drains an area of about 700 square miles. The watershed is located in extreme northeast Colorado mainly within Logan County and Morgan County. The mouth of the creek is located about 5 miles southwest of Sterling and about 1 mile northeast of Atwood in Logan County. The watershed elevation ranges from about 3,980 feet to 5,400 feet. The soils in the basin are mostly loams and clay loams, with sandstone, shale, and siltstone outcroppings. Land use consists of open range land and a significant amount of irrigated cropland in the lower part of the basin. The mean annual precipitation for the basin ranges from 14 to 16 inches.

Although Pawnee Creek itself is not located in or adjacent to Sterling, the U.S. Highway 6 and the Burlington/Union Pacific Railroad embankments are major obstructions which divert flow from the main channel toward the northeast. Figure 1 presents a vicinity map of the Atwood and Sterling area.

Map of Entire Basin, showing Atwood + Sterling

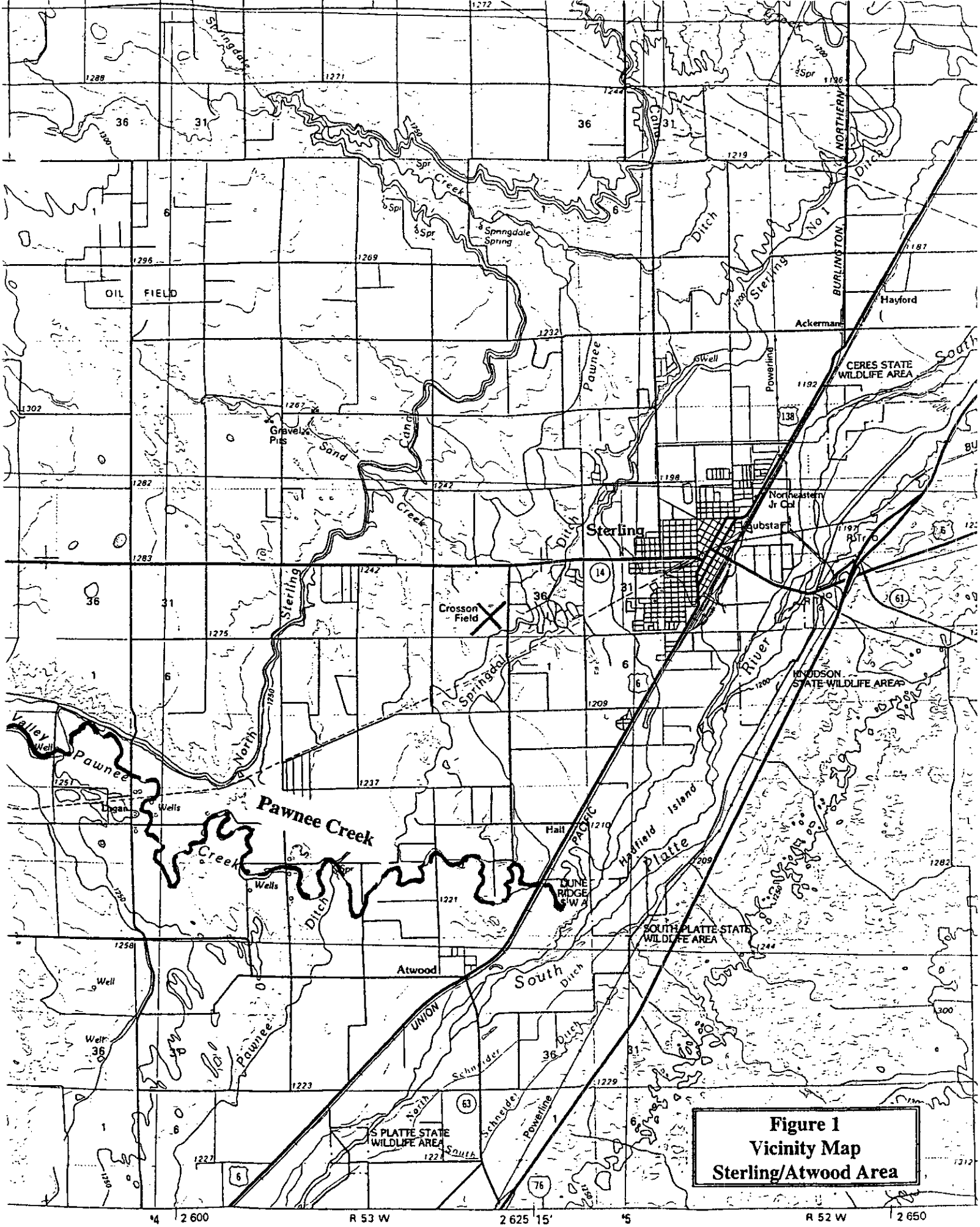


Figure 1
Vicinity Map
Sterling/Atwood Area

Flooding Problems and Flood History

Flooding on Pawnee Creek can occur as a result of general rains over large areas, or from local thunderstorms over smaller areas. A significant flood event on Pawnee Creek occurred on June 14/15, 1965. A peak flow estimate of 35,200 cfs was indirectly measured at the Colorado Highway 14 bridge approximately 10 miles upstream from Atwood. During the 1965 event, overflows from Pawnee Creek flooded areas on the west side of Sterling and did not affect the residential and business (downtown) areas on the east side of the city.

The 1965 flood event was preceded by another large flood event in May of 1935. Discharge estimates for the 1935 event are not readily available.

III. JULY 1997 FLOOD EVENT

Heavy rains in northeast Colorado during the week of July 28, 1997 caused significant flooding in several areas including Fort Collins, Weldona, Atwood, and Sterling. Rainfall over the Pawnee Creek watershed on the evening of July 29 saturated agricultural/range lands and caused major storm runoff in the tributaries and main channel. Flood waters in the Pawnee Creek floodplain crested in Atwood at approximately 3pm on July 30. Flood waters from the Pawnee overflow first reached the south side of Sterling at about 4pm, and then crested in the downtown area around midnight on July 30th.

Flood documentation was performed by the CWCB in cooperation with the Corps of Engineers (Omaha District) and the CSU Extension Office in Logan County. The majority of the field work for the flood documentation occurred on August 5-7, 1997. Team members for the flood documentation efforts are listed in Table 1.

Table 1 - Flood Documentation Team

Name	Affiliation
Larry Lang	Colorado Water Conservation Board
Tom Browning	Colorado Water Conservation Board
Carolyn Adams	Colorado Water Conservation Board
Selma Kessler	Corps of Engineers, Omaha District
Lynn Shaw	Corps of Engineers, Omaha District
Randy Buehler, Wes, and Tracy	CSU Extension Office, Logan County

In addition, CWCB staff assisted the City of Sterling with flood fighting efforts on the night of July 30 and the morning of July 31. A video of the floodwaters in and around Sterling during the actual event was recorded by the CWCB.

Storm Characteristics and Rainfall Information

A severe thunderstorm produced extremely heavy rain in Weld and Logan Counties on the evening of July 29 and into the early morning hours of July 30. Point rainfall amounts of up to 15 inches in a 4 to 8 hour time period were reported in the upper watershed areas of Pawnee

Melvin Rden on July 28 !

Creek. An unusual weather pattern within northeastern Colorado had been producing above average rains and intense thunderstorms since June of this year. The weather pattern seemed to be caused by a combination of the monsoonal moisture from the southwest, the position of the jet stream, and other factors. The weather conditions which produced severe storms and flooding in 1997 were not unlike the conditions that existed in 1965.

A rainfall bucket survey, which included areas within Logan County and eastern Weld County, was performed by the flood documentation team. A map showing the collected rainfall amounts is presented as Figure 2.

Hydrologic and Hydraulic Characteristics

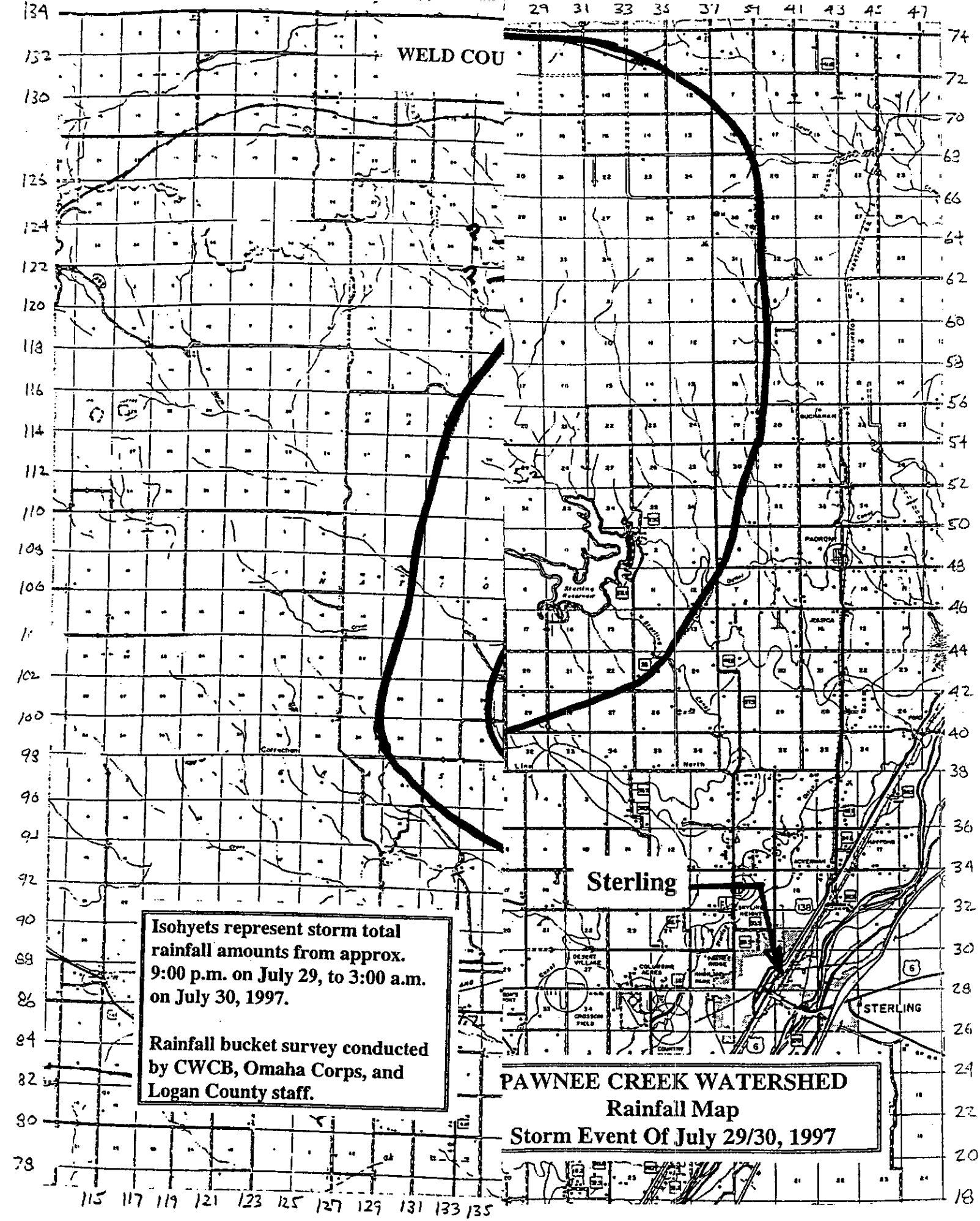
In order to estimate peak discharges at various stream and overlfow locations, the flood documentation team identified cross-section locations, flagged high water marks, and field surveyed channel and overflow cross-sections for the Pawnee Creek flooded areas. A private surveying company, which was under contract with the City of Sterling, surveyed several cross-sections that were located and marked by the flood documentation team. Data from the field surveys was transmitted to the CWCB and forwarded to the Omaha Corps for review and analysis.

In general, this was a very significant flood event. Peak flow estimates on the Pawnee Creek mainstem above Colorado Highway 14 ranged from 40,000 to over 70,000 cfs (These are preliminary estimates that need to be finalized). An eyewitness account from one landowner (located along the left bank of the creek approximately 1,500 feet upstream of Highway 14) pegged the 1997 high water mark at about 5 to 6 feet above the 1965 high water mark. Another landowner downstream of Highway 14 estimated that the 1997 peak flow rate was at least 50% higher than the 1965 peak flow rate.

The Pawnee Creek flows and the overflows into Sterling were estimated by field surveying high water marks, ground slopes, water surfaces slopes, and floodplain cross-sections. The Pawnee overflow into Sterling was based on survey data taken perpendicular to Highway 6 and the railroad embankment near the Riverside Cemetery. The flow estimates were made by using indirect flow measurement techniques. The resulting discharge estimates are presented in the table below:

PRELIMINARY FLOW ESTIMATES

Location	Estimated Peak Flow (cfs)
Pawnee overflow into Sterling near Riverside Cemetery	3,800
Pawnee overflow perpendicular to Highway 6 and railroad at the Riverside Cemetery.	2,500
Pawnee Creek u/s of Highway 14 (section 1)	40,000 to 70,000
Pawnee Creek u/s of Highway 14 (section 2)	40,000 to 70,000
Pawnee Creek (section 3)	No survey data at this time
Pawnee Creek (section 4)	No survey data at this time


WELD COU
Sterling
STERLING
Isohyets represent storm total rainfall amounts from approx. 9:00 p.m. on July 29, to 3:00 a.m. on July 30, 1997.
Rainfall bucket survey conducted by CWCB, Omaha Corps, and Logan County staff.
PAWNEE CREEK WATERSHED
Rainfall Map
Storm Event Of July 29/30, 1997

Add:

1) Existing floodplain information
2) Map of where cross sections were taken
3) Plots of cross-sections
4) Floodplain delineations where possible
   (i.e. @ Atwood + Sterling)

Flow widths for the surveyed cross-sections across the Pawnee Creek floodplain ranged from about 1,600 feet at the upstream end, to several thousand feet at the downstream end. The flow depth in the confined channel at the upstream cross-section was just over 11 feet, while the flow depth closer to Atwood was much more wide and shallow, with depths on the order of 4 feet.

A landowner who witnessed the entire flood flow on Pawnee Creek several mile upstream of Atwood (and downstream of Colorado Highway 14), was able to assist the team in re-creating a flood hydrograph.

IV. FACTORS THAT INFLUENCED THE PAWNEE CREEK OVERFLOW

The City of Sterling lies approximately 4 miles northeast of the confluence of Pawnee Creek and the South Platte River. The community of Atwood lies about 1.5 miles to the southwest of the confluence. The Atwood area is located within the natural floodplain of Pawnee Creek, however Sterling is not. The majority of flood flows from the Pawnee drainage into Sterling are mainly due to man-made obstructions. The U.S. Highway 6 embankment and the Union Pacific Railroad embankment run parallel to each other along the west side of the South Platte River. These two embankments act as diversion structures because flood flows on the Pawnee are not able to pass through the existing bridges and over the embankments directly to the South Platte River. When flow in the Pawnee is high enough, a portion of the flow is diverted to Sterling along the embankments toward the northeast. This was the case in 1935, 1965, and 1997. This situation is known as the "Pawnee Overflow." The estimated overflow in 1965 was 5,000 cfs, while the estimated overflow in 1997 was 3,800 cfs.

Existing floodplain mapping for Sterling indicates that the Pawnee Overflow would travel along the highway and railroad embankments toward Sterling, and would then flow toward the western side of Sterling, rather than the eastern side. The assumption of the westerly flow was based on available documentation for the actual flood event of 1965. During the 1997 flood event, the Pawnee Overflow continued in a northeasterly direction and inundated most of eastern Sterling, including the downtown area and central business district. The flooded portion of Sterling in 1997 was generally mapped in the FEMA 500-year floodplain, while the unflooded portion of Sterling was generally mapped in the FEMA 100-year floodplain. There are some qualitative explanations as to why the 1965 flooded area (and the mapped FEMA floodplain) is different than what actually happened in July of 1997. The explanations are summarized below.

- Development has occurred on the southern end of Sterling that has changed the topography and the drainage patterns.

- The 1965 flood occurred in mid-June when the corn stalks were not very tall. The 1997 flood occurred at the end of July when corn stalks were over 6 feet tall. Hundreds of acres of corn fields south of Sterling diverted water by acting as barriers to the flow. Debris, hay, and other materials were caught in the corn fields, thus diverting water toward the northeast.

Add:

1) Map showing specific hydraulic problems @ Atwood

2) Cross-sections @ Atwood

3) Map showing specific hydraulic problems near Sterling

4) Map of flow path @ South end of Sterling, then through town

- Individual levees along the edges of farm fields may have diverted flow in directions that were different from the 1965 flow path.

- Although the Pawnee Creek peak flow in 1997 was higher than in 1965, the Pawnee Overflow in 1997 was less. The flood hydrograph in 1965 contained a higher volume of water over a longer duration. The 1997 flood waters "ran out of gas" before western Sterling became inundated.

The Colorado Water Conservation Board is considering alternative flood hazard mitigation plans for Sterling. The proposed mitigation plans will be included in a separate document that will be published at a later date.

V. FLOOD DAMAGES

Floodwaters from Pawnee Creek and the Pawnee Overflow damaged or destroyed homes, businesses, utilities, bridges, highway and railroad embankments, county roads, crops and farm land, irrigation facilities, streambanks, vegetation, and vehicles. Very preliminary damage amounts for the Sterling area were estimated to be in the range of 10 million dollars. More detailed damage information will be made available by FEMA for inclusion in this report.

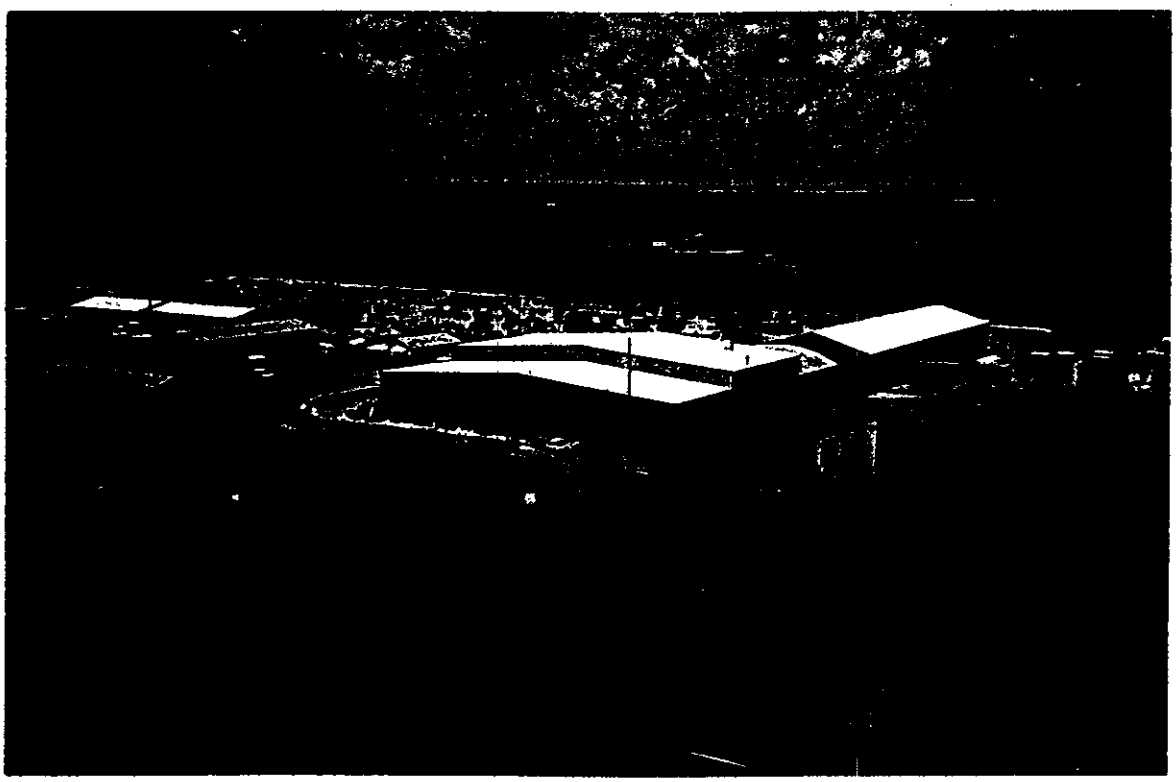
General map showing areas of low, moderate, high damage

1) infrastructure
2) agricultural
3) residential + commercial

APPENDIX A

FLOOD PHOTOGRAPHS

Pawnee Creek at Highway 6 and the UPRR embankment



Pawnee Creek Overflow south of Sterling

APPENDIX B

NEWSPAPER ARTICLES

Colorado & The West

Tonia Twichell, State Editor — 892-5223 • e-mail — state@denver-rmn.com

Floodwaters force evacuations

Residents flee Atwood; patients airlifted from hospital in Sterling

By Ann Imse
Rocky Mountain News Staff Writer

The residents of Sterling and Atwood could see disaster flowing their way.

As much as 15 inches of rain dropped on the Pawnee National Grassland northwest of the two towns overnight Tuesday.

Then the water poured down Pawnee Creek — normally a dry ditch "no wider than your bathtub," as one local described it — and grew into a seven-mile sheet of water that steadily rolled across the flatlands and reached the towns by Wednesday.

The slow-moving flood gave authorities time to warn residents, pluck 40 people from their roofs in Atwood and evacuate all the patients from the Sterling hospital.

"People were just patiently waiting until someone could get them off their rooftops," said National Guard Maj. Gen. William Westerdahl.

But if the devastation took its time, it hit with a vengeance when it arrived.

Atwood was empty by 9 a.m., when the floodwaters completely [illegible]d the town of 70 people.

[illegible]e houses were under 8 feet [illegible]er.

[illegible]came in with a real lot of [illegible]," said Roma Mason, Atwood's postmistress, as she stood at the edge of town watching water pour through her post office.

Raging floodwaters closed half a dozen state highways in a 60-mile swath from Sterling west to Goodrich, shut bridges, damaged roads and covered fields.

The Colorado Army National Guard flew its helicopters to the plains after Gov. Roy Romer ordered them to assist in rescue efforts for the worst flooding in the area in 30 years.

Helicopter pilots reported more than 100 houses and 30 vehicles underwater in Atwood alone, before the flood spread to Sterling.

The hospital evacuation began about 7:30 p.m. as water lapped at the curb, clouds darkened and winds gusted up to 20 mph.

Three helicopters transported the most seriously ill to northern Colorado Medical Center in Greeley.

They closed the hospital for fear rising water could take out the electricity, James Bowey, director of Support Services for the Sterling Regional Medical Center, said.

"We really don't know how high the water will get. So we're not taking chances," he said.

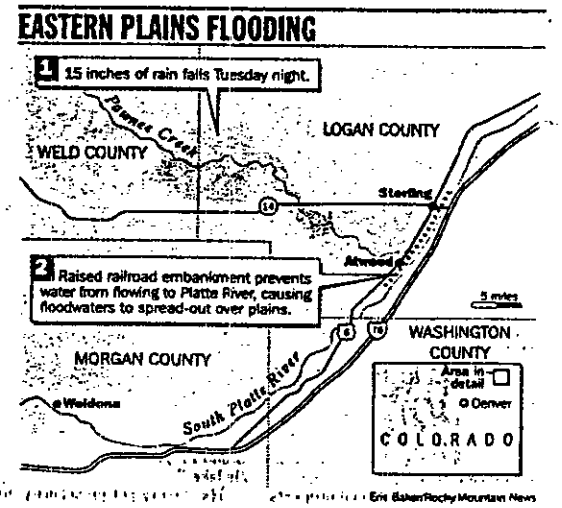
"I hear it's raining like a ban-

See STERLING on 16A

Photos by Patrick Davison/Rocky Mountain News

Lydia Meisner looks skyward as she waits to board a bus for evacuation from the hospital in Sterling. Some patients were airlifted.

Firefighters, from left, Rod McClaren, Steve Vierow and Marv Stanley, stay together in Sterling.



Eric Baker/Rocky Mountain News

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/27/98
Call Placed/Received by: markus Pitsch
Spoke With: C.W. Scott, Morgan County
Company/Affiliation: Natural Resources Conservation Service
Phone no.: (970) 867-8568
Project No.: Cindy Hottle, Farm Service Agency

Comments: Damage Estimates to Crops

acres Affected | % ~~damage~~ loss | hail, rain, flooding

July 19 — no estimates
wheat
corn

June 2
June 10 – wet microburst
June 24 – wheat damage.

July 30
wheat

~~$2,000~~ – 10%
Corn ~~7,000~~ 8,000
Pinto 700 – 7%
Sug. Beats 1000 – 5%
Alfalfa 4000 – 35%
Grain sorgum 200 – 5%
Pasture land 7000 – unknown

July 31 — no estimates

Aug 3-4 — no estimates
wheat

Signature Markus Pitsch

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Joe Baltazar/Darrell Graham

FAX NO.: (970)- 867-5264 970-380-1238 - Cell phone

FROM: Markus Ritsch

DATE: 4/28/98

NO. OF PAGES: We are sending 1 Page(s) (Including this Page)

SUBJECT:

COMMENTS: A few more questions for the CWCB documentation.

Joe and Darrell, I have a couple of additional questions for you regarding the flooding you experienced in 1997.

1. Can you give me a brief description of any past flood mitigation projects that have been completed anywhere in Morgan County?
2. Can you tell me of any mitigation projects that you would like to see built anywhere in Morgan County?
3. Can you give me the damage estimates sustained by County structures (roads/bridges/culverts) during the following storm events:
   - July 19, 1997 storm near Weldona - no damage estimates.
   - July 31, 1997 storm between Fort Morgan and Snyder – to send DSR's
   - August 3-4, 1997 storm near Hillrose and Stoneham

If you did not estimate damage costs for these events that is ok, just let me know that was the case.

I appreciate your effort on these remaining questions.

Thanks

Markus Ritsch, P.E. MLR
Riverside Technology, inc.

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: ~~Joe Baltazar~~ 4/27/98
Call Placed/Received by: markus Ritsch
Spoke With: Joe Baltazar
Company/Affiliation: Morgan County
Phone no.: (970) 867 - 9446
Project No.:

Comments:

What Streams/drainages experienced flooding from the Storm event on July 31, b/w Fort Morgan & Snyder?
- wildcat creek

Aug 3-4 between Stoneham & Hillrose?
- west side of town by Sewer lagoon into platte.
Beaver Creek

Signature Markus Ritsch

From: **tom.browning@state.co.us**
To: **mlr@riverside.com**
Subject: **Schaefer Draw**
Date sent: **Tue, 21 Apr 1998 13:32:42 -0600**

Markus;

Here are the incremental rainfall amounts (cumulative) for the centroid of the Schaefer Draw basin. These are estimated from NWS radar information. Storm began on July 29, 1997.

Time	Rain (in.)
9:46 pm	0.1
10:15	0.7
10:45	1.3
11:15	2.0
11:44	2.5
12:14	3.0
12:44	4.1
1:22	4.2
1:51	4.2
2:21	4.2
2:51	4.2

Storm total precip amounts farther north in the Schaefer Draw basin and outside of Weldona were higher than the numbers I gave you. Let me know if you have any questions.

Tom

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Markus Ritsch

INDIVIDUAL: Joe Baltazar
Kevin Kuretich
Darrel Graham
Dan Royal

DATE: 3/25/98

AFFILIATION: Morgan County

SUBJECT: 1997 Flooding

PHONE #: (970)-867-9446

---

1. **Affected streams and local drainages?** Schaefer Draw and watershed north and west of Schaefer Draw. Two irrigation canals (Riverside Canal and Weldon Valley Canal) transect the Schaefer Draw drainage and so the effective catchment is increased. There is also drainage tile located under the Weldon Valley Canal all the way down to the South Platte River.

2. **Geographic extent of flooding?** The Colorado State Forest Service has a map of the flooded areas. Joe is going to send me the name and phone number of the person to contact to get this map. If we have trouble getting a map, Joe can describe the approximate limits of flooding (County Rd 2, H&H, Highway 52, and Weldona).

   Joe is going to send me the map.

3. **Storm duration?** The primary precipitation event took place from July 29, at 5:30 pm to July 30, at 4:00 am. The county experienced a good bit of precipitation on July 27 and July 28 which saturated the ground prior to the heavy precipitation on the 29 and 30th.

4. **Rainfall amounts? Extent of rainfall?** Bob Glancy is the best source of precipitation information. We should contact him to obtain precipitation maps, isohyetal maps, and areal extent of precipitation. Bob Glancy can be reached at 303-361-0661. In general the period from July 29, at around 12 pm to July 30, at 3 am experienced a maximum point total of approximately 14 inches according to the NWS.

5. **Rainfall bucket surveys?** Tom Browning and Joe (and a third person whom Joe could not remember other than it was a female) conducted house-to-house visits after the storm to inquire about precipitation data. Ask Tom of he has this information.

6. **Precipitation gauging network?** The County operates none, but is interested in installing one if matching funds are available.

7. **Documentation of high water marks?** No documented high water marks are available. There may be a few business in town that could show us how high the water came. The expanse of

water in the Town of Weldona however was large and any discharge estimates would be difficult to make.

8. **Estimated peak discharges?** No peak discharge estimates we developed by the County. Tom Browning did estimate a peak discharge of 1300 cfs (see HMGP application). Since no high water marks were documented, it seems that computation of discharges would be difficult at this time.

9. **Estimated flood damages?** The HMGP application documents the damages associated with the residential and commercial properties in Weldona. Joe is going to supply a number associated with the County clean-up efforts, flood fight efforts, rental of equipment, overhead hours for County personnel, etc. Joe called on 2/26/98 with a total figure of $142,341. Joe is going to send me an itemization of costs associated with this figure.

10. **Costs associated with the clean-up effort? Differentiate between local, state, and federal.**
See HMGP application.

11. **Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.**
See HMGP application.

12. **Types and amounts of repair work after flooding?**
See HMGP application.

13. **Any previous/recent flood mitigation efforts that reduced damages?**
None, other than maintenance of the ditches.

14. **Any future mitigation needs as a result of the flooding?**
Yes, flood protection for Weldona. Both structural and non-structural.
See HMGP application.

15. **Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?**
Two man-made ditches and one railroad embankment affected flooding. See HMGP application for a description of these structures.

16. **Do you have any photos and/or video available?** Are the photos in digital format?
Yes, Joe will send me his photos for us to scan. The County did shoot a video of the flooding. Tom Browning has a copy of the video.

17. **Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.**
Rainfall mapping - Bob Glancy
Inundation maps - Forest Service
Watershed maps - Morgan County, Morgan County will send me their maps.

18. **Are maps in hardcopy or digital format? (GIS, Autocad, etc.)**
All County maps are in hardcopy format. Check with Bob Glancy and the Forest Service.

19. **Is there any existing documentation regarding the flooding?**
    The HMGP application is the most comprehensive documentation regarding the flooding. Joe also the preliminary response reports that he will send me.

20. **Name of local newspaper?** Fort Morgan Times 867-5651
21. **Do you have an internet site?** no
22. **e-mail address**: morganoem@sosinc.net

Morgan County
CONTACT LIST

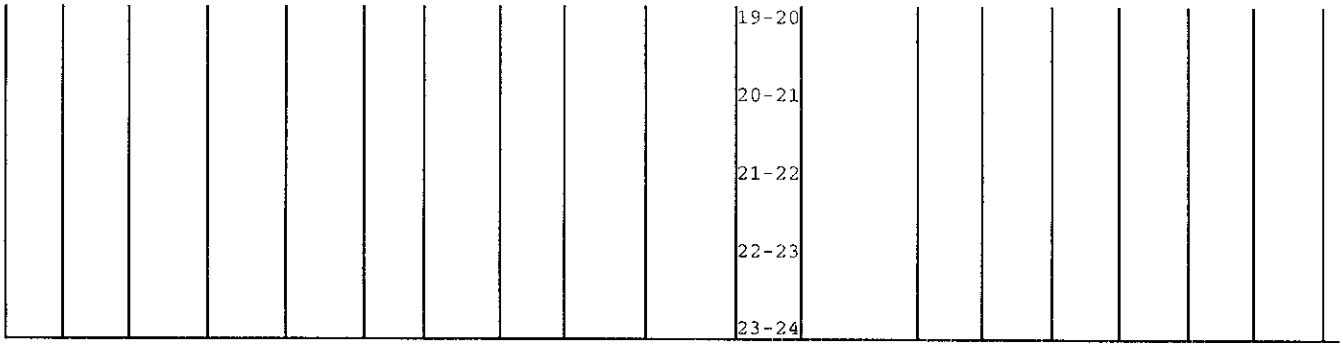
Name	Affiliation	Phone	Fax or Alt. #
Joe Baltazar	Morgan County Public Works	(970) 867-9446	380-1238 (cell)
Kevin Kuretich	Morgan County OEM	(970) 867-8506	380-8506 (cell)
Darrel Graham	Morgan County Bridge Supervisor	(970) 867-9446	(970)380-1233
Bart Woodward	Riverside Irrigation Ditch	(970) 867-6586	768-0541 (cell) 842-2935 (hm)

2. Federal Data

UNEDITED LOCAL CLIMATOLOGICAL DATA [NOAA, National Climatic Data Center] MONTH: 06/1997

Station Location: AKRON, CO (AKO) lat: 40°
Elev(Ground): 4665 FeetTime Zone: Mountain Standard WI

date	Temperature (Fahrenheit)						Deg Days Base 65 Degrees		Significant Weather	Snow/Ice on Gnd(In)		Precipitation (In)		Pressure (inch of Hg)	
	Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling		0600 LST Depth	1200 LST Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	A Se le
01	88	55	72	72	56	62	0	7	TS TSRA HZ	M	-	-	0.17	25.15	29
02	76	55	66	66	57	60	0	1	TS TSRA FG	M	-	-	0.52	25.20	29
03	71	50	61	61	54	56	4	0	-	M	-	-	0.01	25.37	30
04	72	45*	59	59	52	55	6	0	FG+ FG	M	-	-	0.00	25.33	30
05	79	53	66	66	56	60	0	1	FG	M	-	-	0.00	25.15	29
07	80	54	67	67	56	59	0	2	TS	M	-	-	T	25.20	29
08	77	54	66	66	56	59	0	1	TS TSRA FG HZ	M	-	-	0.35	25.20	29
09	59	53	56*	56	54	55	9	0	TS TSRA RA FG	M	-	-	0.29	25.36	30
10	68	51	60	60	54	56	5	0	TS TSRA FG	M	-	-	0.03	25.34	30
11	82	52	67	67	52	58	0	2	FG+ FG	M	-	-	0.01	25.18	29
12	75	50	63	63	54	57	2	0	TS TSRA FG	M	-	-	0.10	25.15	29
13	69	53	61	61	54	56	4	0	FG	M	-	-	0.01	25.19	29
14	79	55	67	67	57	60	0	2	TS TSRA FG	M	-	-	0.29	25.20	29
15	76	53	65	65	54	58	0	0	TS TSRA	M	-	-	0.01	25.17	29
16	75	51	63	63	51	56	2	0	-	M	-	-	0.01	25.20	29
17	78	52	65	65	53	58	0	0	-	M	-	-	0.00	25.24	29
18	89	59	74	74	55	61	0	9	TS TSRA FG	M	-	-	0.06	25.26	29
19	92	60	76	76	55	63	0	11	-	M	-	-	0.00	25.16	29
20	91	58	75	75	56	63	0	10	TS TSRA	M	-	-	0.01	25.08	29
21	86	59	73	73	57	63	0	8	TS	M	-	-	T	25.18	29
22	94*	61	78*	78	56	64	0	13	-	M	-	-	0.00	25.18	29
23	88	59	74	74	59	64	0	9	TS TSRA	M	-	-	T	25.18	29
24	81	55	68	68	56	60	0	3	TS TSRA FG	M	-	-	0.69	25.27	29
25	82	53	68	68	56	59	0	3	TS RA FG	M	-	-	0.07	25.37	30
26	87	53	70	70	56	61	0	5	FG+ FG	M	-	-	0.01	25.35	30
27	92	58	75	75	48	59	0	10	-	M	-	-	0.00	25.27	29
28	91	59	75	75	51	60	0	10	TS TSRA	M	-	-	0.36	25.19	29
29	86	58	72	72	54	61	0	7	TS	M	-	-	T	25.19	29
30	91	61	76	76	57	64	0	11	TS TSRA	M	-	-	0.36	25.13	29



SUMMARY OF THE DAY (MIDNIGHT TO MIDNIGHT)

PEAK WINDS			FASTEST 2-MIN WIND									SKY COVER		
Speed (mph)	Direction	Time (lst)	Speed (mph)	Direction	Time (lst)	Sunrise Time (lst)	Sunset Time (lst)	Total Sunshine (min)	Percent of PSBL Sunshine	Character Sunrise	Character Sunset	Sunrise to Sunset	Midnight to Midnight	24 M Te (0.
43	44	45	46	47	48	49	50	51	52	53	54	55	56	
33	080	1938 1937	28	080		425	1926	M	M					

REMARKS, NOTES AND MISCELLANOUS PHENOMENA 65: Tir

3. State Data

Morgan County Rain-fall Amounts
(July 28th-29th)

Resident	Amount (inches)	S	T(N)	R(W)
Larry Christensen	2.5, 2+	34	5	59
Jim Musser	2.5, 4.5	12	5	60
State Park's Office (Jackson Res.)	3.48	21	5	60
Elmo Hendershot	2.1	6	5	60
Marvin Dahl	4.0	4	5	60
Wickstrom's	2.9	15	6	60
Ed Richardson	2.75	6	6	60
Nola Schauerman	3.6, 0.35	10	6	59
Larry Sharfenberg	2.5	22	6	59
Todd Caster	2.25, 3.5	26	5	59
Linda Shauer	2.5, 0.7	30	5	59

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 30 March 1998

To: Marcus

Fax #: (970) 484-7593

Agency: Riverside Technologies

From: Carolyn Adams

Fax#: (303) 866-4474
Phone: (303) 866-3441

3 Pages transmitted, including this cover sheet

Hope this helps you out - call if you have questions!

Sending Operator

Original Mailed __Yes ✓ No

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 4/1/98

To: MARKUS

Fax #: (970 484 7593

Agency: RTC

From: TOM B

Fax#: (303) 866-4474
Phone: (303) 866-3441

7 Pages transmitted, including this cover sheet

MARKUS:

FLOW ESTIMATE FOR SCHAEFER DRAW ABOVE WELDONA

SECTION 1, 2 → Average

SECTION 3, 4 → Average → Flow Estimate

SECTION 5, 6 → Average

Call if you have questions

Tom

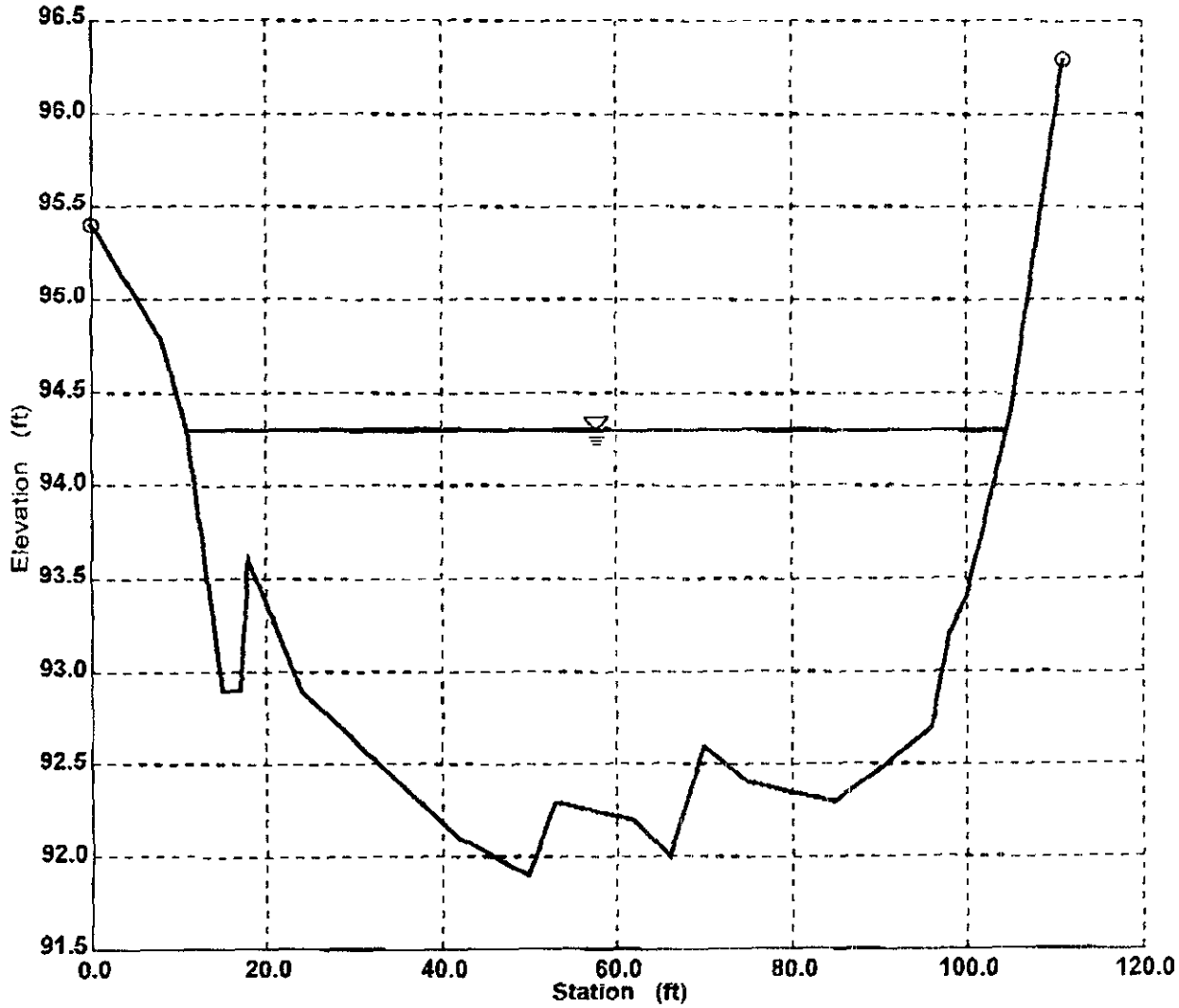
Sending Operator

Original Mailed ___Yes ___No

Schaefer Draw above Weldona, section 1
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer Draw above Weldona, section 1
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

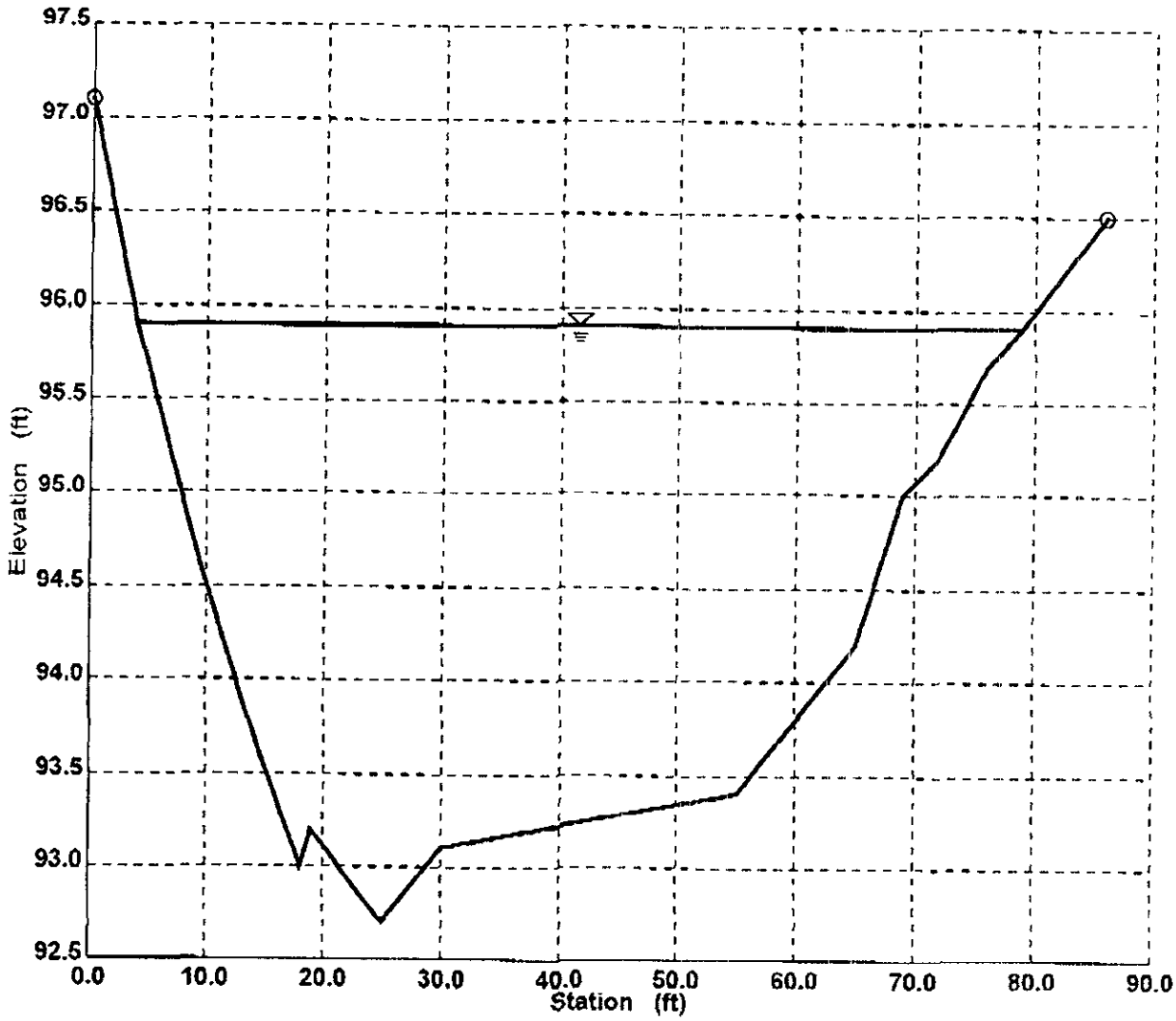
Section Data		
Wtd. Mannings Coefficient	0.032	
Channel Slope	0.003900	ft/ft
Water Surface Elevation	94.30	ft
Discharge	665.18	cfs



Schaefer Draw above Weldona, section 2
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer Draw above Weldona, section 2
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

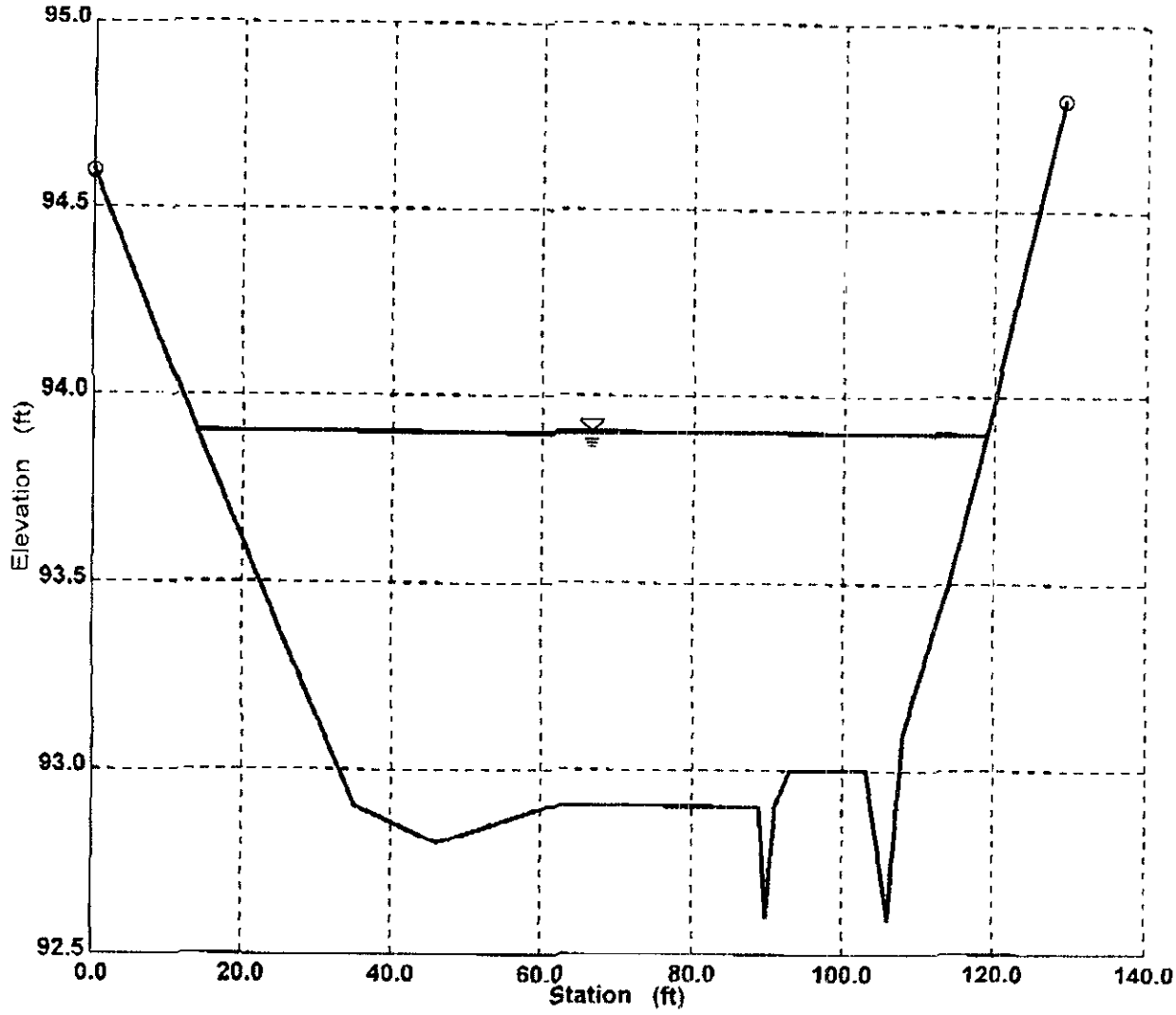
Section Data		
Wtd. Mannings Coefficient	0.032	
Channel Slope	0.003900	ft/ft
Water Surface Elevation	95.90	ft
Discharge	719.32	cfs



Schaefer trib above Weldona, section 3
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer trib above Weldona, section 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

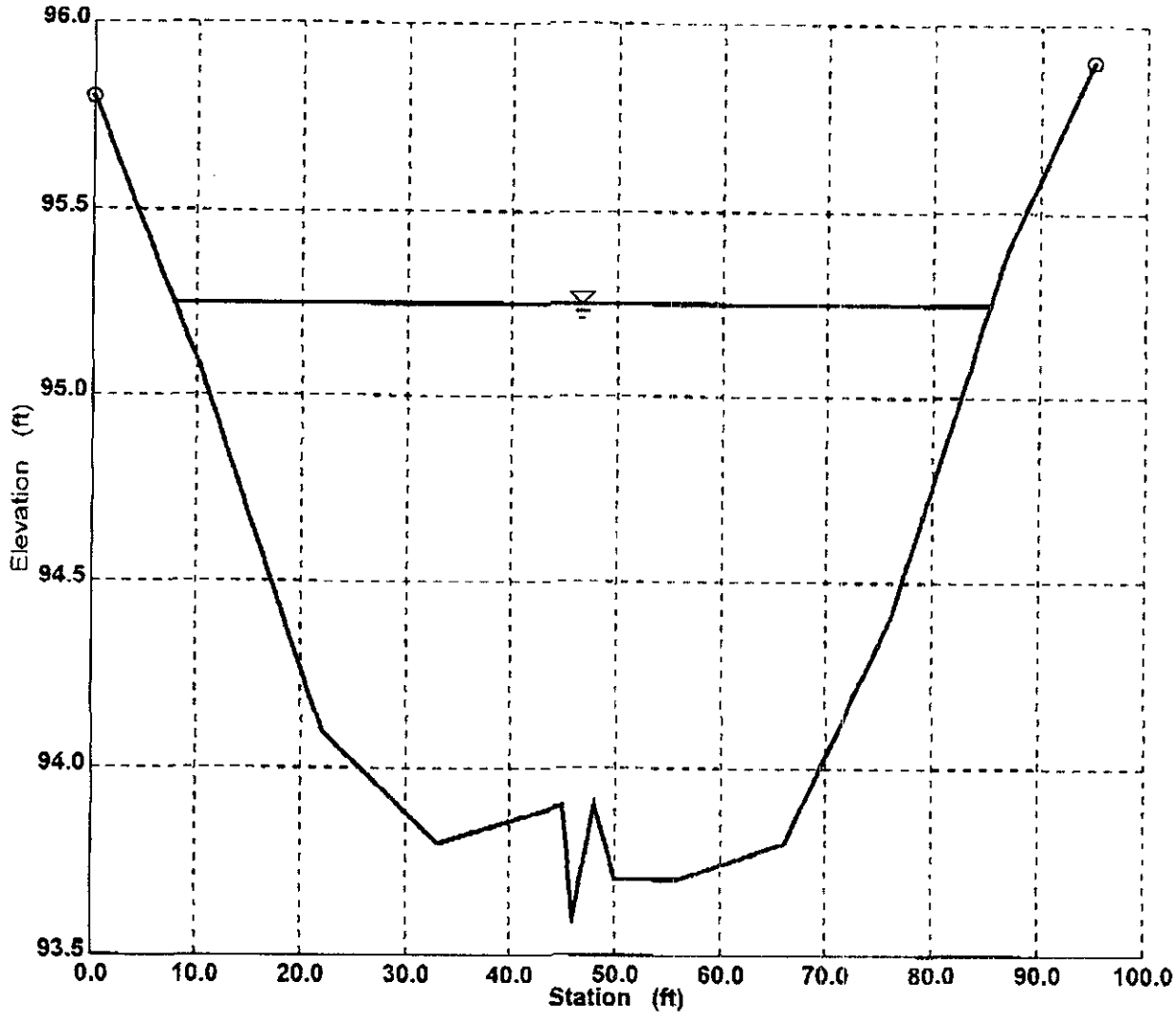
Section Data		
Wtd. Mannings Coefficient	0.038	
Channel Slope	0.007500	ft/ft
Water Surface Elevation	93.90	ft
Discharge	269.54	cfs



Schaefer Draw above Weldona, section 4
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer trib above Weldona, section 4
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

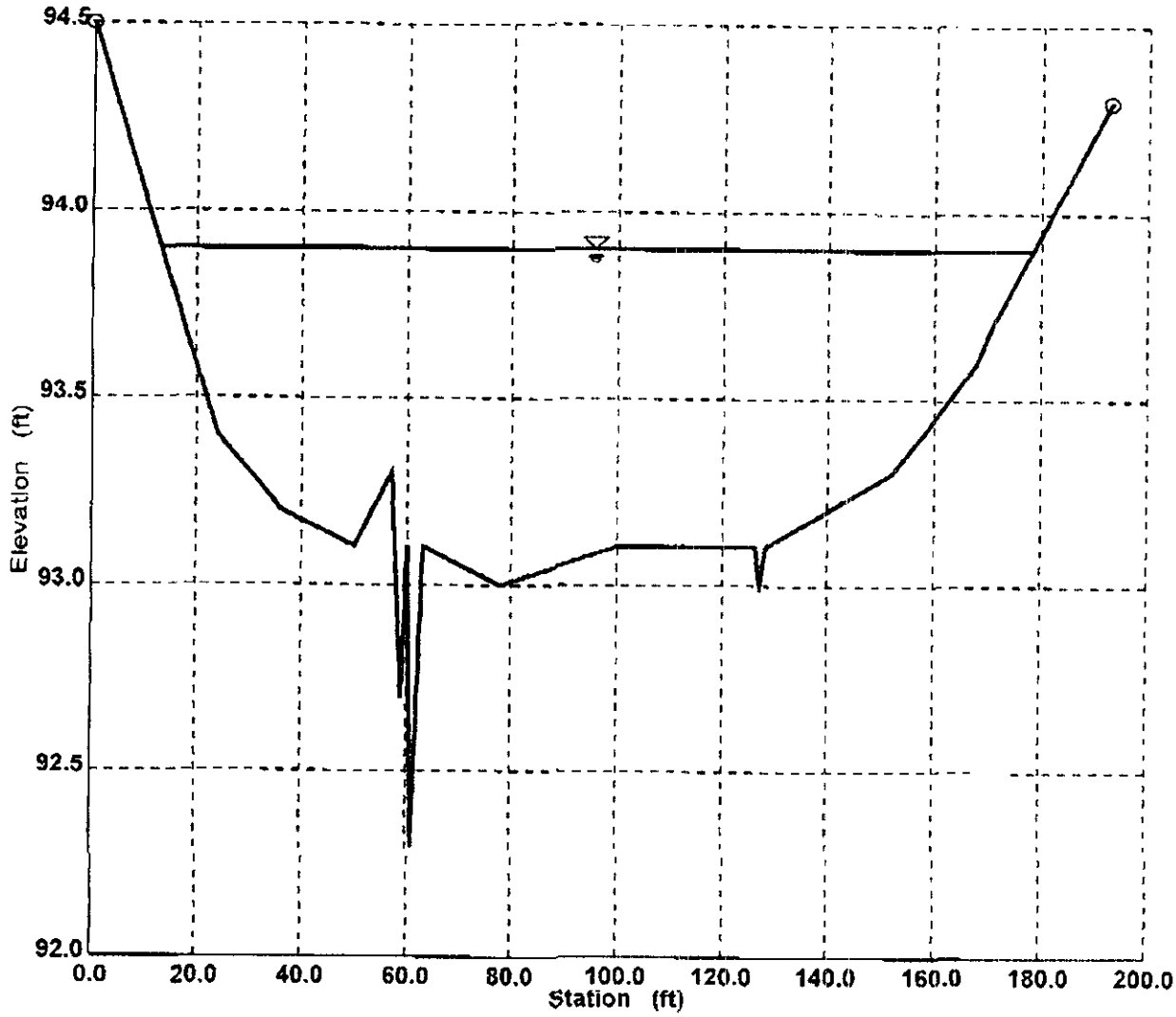
Section Data		
Wtd. Mannings Coefficient	0.038	
Channel Slope	0.007500	ft/ft
Water Surface Elevation	95.25	ft
Discharge	313.10	cfs



Schaefer trib above Weldona, section 5
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer trib above Weldona, section 5
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

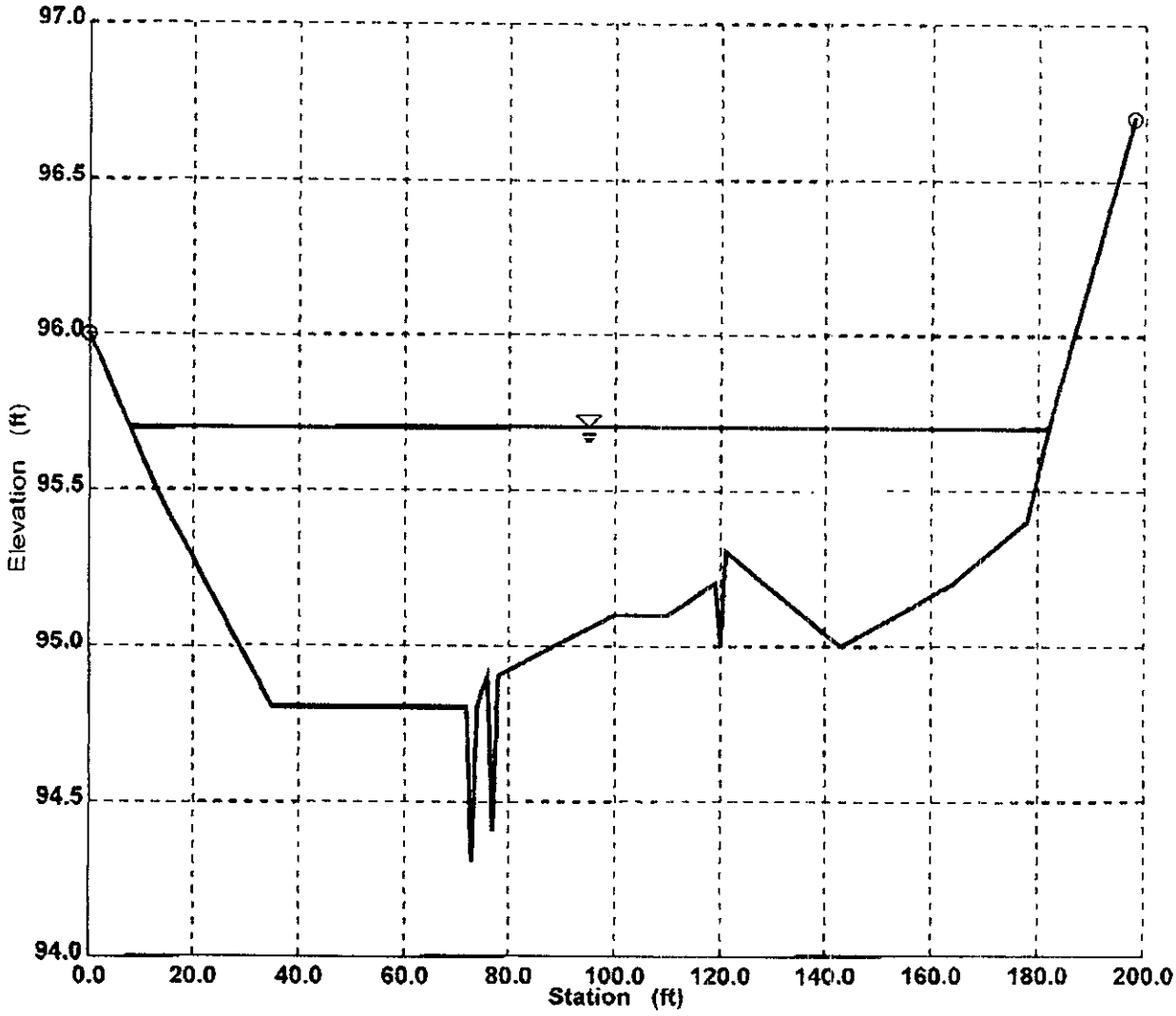
Section Data		
Wtd. Mannings Coefficient	0.038	
Channel Slope	0.011000	ft/ft
Water Surface Elevation	93.90	ft
Discharge	349.13	cfs



Schaefer trib above Weldona, section 6
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\weldona1.fm2
Worksheet	Schaefer trib above Weldona, section 6
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.038	
Channel Slope	0.011000	ft/ft
Water Surface Elevation	95.70	ft
Discharge	333.43	cfs



HAZARD MITIGATION
404 GRANT APPLICATION
COMMUNITY OF WELDONA
MORGAN, COUNTY, COLORADO

PREPARED FOR:

FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION 8

PREPARED BY:

DEPARTMENT OF NATURAL RESOURCES
COLORADO WATER CONSERVATION BOARD
FLOOD CONTROL AND FLOODPLAIN MANAGEMENT SECTION
1313 SHERMAN STREET, ROOM 721
DENVER, COLORADO 80203

MORGAN COUNTY GOVERNMENT
231 ENSIGN STREET
FORT MORGAN, COLORADO 80701

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246

JANUARY 30, 1998

V. DESCRIPTION OF FLOOD HAZARD MITIGATION STUDY

A. PROBLEM DESCRIPTION AND DISCUSSION

Overview

Reports of flooding in Weldona were broadcast by a local television station on the morning of July 30, 1997. On that same morning, CWCB staff performed field investigations in the Weldona area of Morgan County to view the flooded areas and to begin flood documentation efforts. An intense rainstorm had occurred north of Weldona late in the evening of July 29 and into the early morning of July 30. The storm produced flood flows in Schaefer Draw and adjacent tributaries which caused two irrigation ditches to breach. Storm runoff from Schaefer Draw and other adjacent tributaries ,combined with spilled flows from the irrigation ditches, inundated nearly the entire community. Residents were evacuated from their homes due to hazardous conditions and public health issues. The U.S. Army National Guard was called in to assist with the evacuations, perform rescue operations, and secure the area.

Morgan County, among other Colorado Counties, officially received a federal disaster declaration on August 1, 1997 based on severe flooding conditions. The disaster declaration made it possible for Morgan County to be eligible for federal funding for disaster relief which includes individual assistance, public assistance, and mitigation assistance.

Morgan County officials made written and verbal requests to the Colorado Water Conservation Board (CWCB) for technical assistance with developing an engineering feasibility study to address drainage and flooding problems in Weldona. The initial request was made prior to the 1997 declared disaster event due to previous, recurring flooding problems. Subsequent to the July 1997 flood disaster, Morgan County officials renewed their request to the CWCB for technical mitigation assistance.

Authority

According to Section 37-60-106(1)(c) of the Colorado Revised Statutes, the Colorado Water Conservation Board has the power and duty:

> "... to devise and formulate methods, means and plans for bringing about the greater utilization of the waters of the state and the prevention of flood damages therefrom and to designate and approve storm or floodway runoff channels or basins, and to make such designations available to legislative bodies of cities and unincorporated towns; to county planning commissions; and to boards of adjustments of cities; incorporated towns; and counties of this state..."

Community Description

Morgan County is located in eastern Colorado within the South Platte River valley. The community of Weldona is located in the northwest quadrant of the county approximately 12 miles northwest of Fort Morgan. (Fort Morgan is the county seat of Morgan County, and it is located approximately 70 air miles northeast of Denver, and approximately 50 air miles southeast of Greeley). Interstate Highway 76 is the major east-west highway that serves the county, however Weldona is located near Colorado State Highway 144 which is just on the north side of the South Platte River. Elevations in the county range from about 4,000 feet to over 5,000 feet. Weldona sits at an elevation of about 4,350 feet. There are approximately 50 structures in the study areas which include residential, commercial, church, and school uses. The land uses surrounding the community predominantly consist of agricultural, ranching, and open range land. The resident population of Weldona is approximately 150 persons.

Watershed Description

The watersheds of interest include the Schaefer Draw basin and adjacent unnamed tributaries, which are within the South Platte River basin. The South Platte River flows through Morgan County from west to east and has a generally well defined main channel and floodplain. Weldona is located approximately 0.5 miles north of the main channel of the South Platte River. Schaefer Draw, a left bank tributary to the South Platte, has a total drainage area of about 7 square miles at its confluence with the South Platte. Two irrigation canals, the Riverside Canal and the Weldon Valley Ditch, run parallel to the South Platte and are located north of Weldona. These two man-made channels complicate the basin hydrology. Historically, the ditches have spilled or breached only in the more rare flood events.

Flooding Problems and Flooding History

Flooding problems in Weldona are caused by inadequate storm drainage systems, flat topography, and man-made flow obstructions that block the natural drainage courses (i.e. railroad embankment, highway embankment, county roads, etc.). Irrigation ditches complicate the local hydrology, and have the ability to either provide beneficial or detrimental impacts depending on the situation.

According to a floodplain information report produced by the U.S. Army Corps of Engineers, Omaha District, Weldona is located outside of the 100-year floodplain of the South Platte River. Floods on the tributaries in Morgan County, including Schaefer Draw, normally occur during the spring and summer months from May through September as a result of intense thunderstorms or large general rainstorms.

1997 Flood Damages (Declared Event)

Floodwaters from Schaefer Draw, adjacent tributaries, the Riverside Canal, and the Weldon Valley Ditch damaged homes, businesses, utilities, roadways, crops, farm land, irrigation facilities, and vehicles. Preliminary damage estimates for the Weldona area were estimated to be nearly 1 million dollars.

B. PROPOSED SOLUTION

No Action
(ALTERNATIVE 1)
Taking no action (the Do Nothing Alternative) to mitigate the flood hazard to Weldona will leave the community vulnerable to the effects of future large storm runoff events. The costs of this alternative are the health hazards and significant property damage as described in the preceeding section. These costs can exceed the cost of a flood mitigation effort during a single flood event.

Diversion Channel/Ring Levee Without Upstream Detention
(ALTERNATIVE 2)

This alternative consists of construction of a channel and ring levee system on the north side of Weldona to divert the storm flows around the community to the South Platte River. This system would be sized to accommodate a 100-year runoff event. Reinforced concrete box culverts would be constructed to convey the flow under Highway 144 to a new channel constructed south along Grove Street from Highway 144 to the South Platte River. Bank protection would be provided along the South Platte River at the new channel outfall.

The existing ditch and culverts along the south side of Highway 144 would be enlarged to accommodate the road overtopping at the RCBC and the 100-year runoff from the small watershed consisting of Weldona. Bank protection structures would be constructed on Riverside Canal and Weldon Ditch to prevent future bank failures.

The total estimated cost of this alternative is approximately $600,000. This estimate does not include costs for final topographic survey and mapping, final engineering design, legal and administrative costs, and construction management.

Detention Reservoir North of Weldona
(ALTERNATIVE 3)

Alternative 3 consists of building a detention reservoir approximately 1.5 miles due north of the community of Weldona. The main purpose of a detention facility is to store excess storm runoff in order to protect downstream property and public infrastructure. The detention facility would capture stormwater runoff from the Schaefer Draw basin and spilled flows from the Riverside Canal. The Riverside Canal is just to the north (upstream) of the proposed reservoir site. The dam embankment would be of earthen construction with a maximum fill height of about 24 feet. The embankment would be vegetated with grass, and the upstream and downstream side slopes would be no steeper than 3H to 1V. The reservoir would be designed for 100-year capacity and would include an emergency spillway that could pass up to the design 100-year discharge. The emergency spillway is located to act as a side-channel spillway that would not allow flows to pass over the dam embankment. The proposed spillway configuration is generally more cost effective, especially given the terrain of the project area. The estimated storage volume is on the order of 400 acre-feet, and the surface area at maximum capacity is approximately 55 acres. Maximum reservoir outflow would be limited to about 150 cfs. Downstream channel improvements and other facilities are not proposed as part of this alternative. It is assumed that the reservoir outflow would follow natural drainage paths, and the flow would end up as shallow sheet flow across agricultural fields and open space areas.

Any dam constructed for the purpose or storing water where the surface area, volume, or dam height exceed the criteria as specified in the Colorado Revised Statutes 37-87-105, as amended, shall require the approval of the plans by the State Engineer's Office. As such, the proposed reservoir would be subject to the design and construction criteria as set for the by the State of Colorado.

The total estimated construction cost for this alternative is approximately $400,000. This estimate does not include costs for land acquisition, relocation of fences and access roads, construction of spill structures on two irrigation ditches, final topographic mapping and surveys, final engineering design, construction surveys, legal and administrative costs, and construction management.

Elevation of Flood Prone Structures
(ALTERNATIVE 4)

General
Non-structural alternatives to flood hazard mitigation include a number of feasible measures that include floodplain regulations and zoning, flood preparedness and planning, flood proofing, public acquisition of flood prone lands, relocation of flood prone structures, and various other solutions. Non-structural measures are different from structural ones in that the protection device or means is not a physical structure located in a specific place (such as a reservoir, levee, channel, etc.). Non structural solutions often provide protection to individual structures in the floodplain.

The non-structural alternative chosen for this study is elevation of flood prone structures. Elevating structures on fill material is a fairly common practice, especially in new development where site grading combined with a raised foundation can easily elevate a structure above the design flood level. Existing structures may also be elevated, but with more difficulty and usually more expense. Typically, an existing structure can be mechanically lifted in place and supported with temporary shoring while the ground elevation (or the foundation) is elevated to the desired level. This procedure requires disconnecting and reconnecting utility lines as well as repairing any stress cracks or other minor damage to the structure that may have occurred during construction. Disruption to the individual or family residing in the affected house is quite significant.

Methodology
The specific methodology used to estimate costs for elevating flood prone structures was obtained from the U.S. Army Corps of Engineers, Omaha District. An empirical equation was developed based on actual cost data for elevating a number of structures in the Midwest. The equation assumes a wood frame structure with brick veneer and a crawl space. Costs will vary somewhat for other types of foundations, exterior finishes, and building construction.

The empirical equation used for this study is as follows:

Elevation Cost = (K + Ks(Structure Size) + Kh(Raise Height)) X C.F.

Where: K = $11,360
Ks = $12.6
Kh = $970
C.F. = 1.2 (cost factor)

The cost for elevating a mobile home was estimated to be a flat rate of $12,000 per home. There are approximately 50 flood prone structures in Weldona that would require varying amounts of elevation. It was assumed that the school building and church buildings would not be elevated. The total estimated cost for this alternative is approximately $1,200,000. Based on the reduction in flood damages provided by this alternative, it is unlikely that a feasible benefit-cost ratio would be obtained.

C. SELECTED PROJECT DESCRIPTION

Project Location

The Community of Weldona is located in Morgan County in northeastern Colorado approximately 12 miles northwest of Fort Morgan on Colorado Highway 144. The Community is situated at the South end of the watershed and approximately 0.5 miles North of the South Platte River in the north one-half of Section 3, Township 4 North, Range 59 West of the 6th Principal Meridian. A vicinity map of the area is shown in Figure 1 included in Section III of the report.

The watershed draining to Weldona is bounded on the south by Highway 144 and the Union Pacific Railroad embankment. The watershed extends approximately 6 miles north of Weldona, encompasses approximately 13.7 square miles and consists primarily of two sub-watersheds. The eastern sub-watershed is Schaefer Draw Basin. The western sub-watershed drains toward the intersection of Highway 144 and County Road 9 at the western edge of the town. A much smaller sub-watershed consists of Weldona proper. The project area and watershed map are presented in Figures 2 and 3, respectively, attached in Section III.

Project Description

The objectives of the proposed project is to develop a Flood Hazard Mitigation Plan and preliminary design of drainage improvements to reduce the severity of flooding in the Community of Weldona. The intended primary means of achieving these goals is to divert the flood waters around the community and convey the water to the South Platte River. This approach will remove all but local storm runoff from draining through the Town itself. Very little local flooding would be expected even during a major storm event.

The Preliminary Flood Hazard Mitigation Plan showing the proposed drainage improvements is included in a pocket in the back of this report. The storm runoff will be diverted around the town to the west and south by a channel and ring levee system. The Channel is sized for a minimum of a 50-year storm event without overtopping the north and west banks which is essentially existing ground elevation. The levee on the south and east side of the channel will be approximately 5 feet in height above existing ground. The dike will provide 3 feet of freeboard above the 100-year water surface. The overflow on the north and west sides of the channel will inundate farmland a maximum of approximately 300 feet distance from the levee during the 100-year event, primarily on the western end of the alignment.. The elevation of County Road 9.5 will be raised at the northeast corner of the school property approximately 3 feet to match the elevation of the levee at this location.

A 7 barrel RCBC is proposed to convey the runoff under Colorado Highway 144 to a channel to be constructed from the culvert outlet through the Union Pacific Railroad embankment to the South Platte River. Bank protection will be needed at the South Platte River where the channel daylights.

The ditch along the south side of Highway 144 is to be improved to accommodate the flow overtopping the highway at the culvert entrance and from Weldona itself. Existing culverts will need to be replaced to convey this flow easterly to the outfall at the railroad trestle approximately 0.75 miles east of Weldona.

The individual components of the recommended alternative (Alternative 2) are summarized below.

- Construction of a channel and levee along the northern and western edge of Weldona.

- Construction of a reinforced concrete box culvert (RCBC) under Highway 144 near County Road 9 west of Weldona.
- Construction of a channel from Highway 144 to the South Platte River.
- Improvements to the ditch on the south side of Highway 144 from the RCBC to the railroad trestle approximately 0.75 miles east of Weldona including replacement of existing culverts to accommodate the design flow.
- Construction of a small channel just east of Weldona extending north from Highway 144.
- Minor drainage improvements within Weldona including larger culverts under streets and drives and cleaning of the local drainageways and ditches.
- Bank stabilization at critical locations along the Riverside Canal and Weldon Valley Ditch.

It is assumed that the onsite excavated material will be suitable for construction of the levee embankment.

Detailed Project Hydrology

General

The hydrologic analysis for the study area was performed to define the storm runoff peak flows and volumes for the various sub-watersheds of the Community of Weldona Flood Mitigation Project. The runoff information was subsequently used to evaluate the existing drainage facilities, potential drainage problems and alternative drainage improvements for this preliminary design report.

The study area was divided into a total of three sub-watersheds. Peak flows at each watershed outlet point were calculated for the 2-, 5-, 10-, 50-, and 100-year recurrence interval for existing land use conditions.

Design Rainfall

The modified 2-hour design storm distributions recommended by the Urban Storm Drainage Criteria Manual(USDCM) were used to produce runoff hydrographs and peak flow data for the design. The 1-hour design rainfall depth option was used in the Colorado Urban Hydrograph Procedure runoff module. These values were obtained using the procedure described in the NOAA atlas for geographic region 1 and are listed below.

1-HOUR FREQUENCY VALUES	
Recurrence Period	**1-Hour Frequency Values**
2	1.0
5	1.5
10	1.75
50	2.50
100	2.77

Colorado Urban Hydrograph Procedure Parameters

The CUHP computer program was used to compute storm runoff hydrographs for the various sub-watersheds. The version used for the study was CUHPfpc2. The sub-watershed input parameters required for CUHP are: sub-watershed identification number, drainage area, length and centroidal length, drainageway slope, impervious percentage, detention and retention storage losses and infiltration loss rates. The weighted channel slopes were adjusted using Figure 4-1 of the Runoff Chapter of the USDCM of input

method option for drainage sub-watersheds less that 90 acres in size was not used. Sub-watershed geometries were measured directly from the mapping prepared for this study. The impervious percentages used in this study were derived using Table 3-1 of the Runoff chapter of the USDCM.

Detention, retention, and infiltration parameters were assigned to each hydrologic soil group as recommended in Tables 2-1 and 2-2 of the runoff Chapter of the USDCM. These parameters were then adjusted based on calibration to actual rainfall and runoff estimates of the declared event and other field observations. Parameters were then determined for each sub-watershed using a weighted average of the soil zones. A summary of the CUHP parameters used for the analysis are presented below. Referenced Tables and Figures from USDCM are included in the Technical Appendix.

Weldona Hazard Mitigation Project

Basin Number (mi^2)	Basin Area (mi2)	Basin Length (mi)	Distance to Basin Centroid (mi)	Basin Imp (%)	Weighted Basin Slope (ft/ft)	Time of Conc (min)	Pervious Depression Storage (in)	Impervious Depression Storage (in)	Initial Infiltration Rate (in/hr)	Horton's Decay Coefficient (sec^{-1})	Final Infiltration Rate (in/hr)
1	0.08	0.53	0.32	30	0.0025	19.9	0.4	0.1	3	0.0016	0.5
2	7.4	9.5	5.8	2	0.009	NA	0.4	0.1	3	0.0016	0.5
3	6.29	7.0	3.87	2	0.01	NA	0.4	0.1	3	0.0016	0.5

Modeling Results

The results of the hydrologic analysis for each design storm are summarized in the table below of this report. The final alternative was designed for the runoff from Schaefer Draw and the runoff from the unnamed tributary to the north and west of Weldona. For a 100 year recurrence period, the peak flows indicated from the hydrologic analysis are 1100 cfs originating from Schaefer Draw and 1300 cfs originating from the other basin. It was decided that with flows of this size it was feasible to design the flood mitigation system so as to protect the community from a 100 year storm event and remain within the fiscal constraints associated with the project.

Weldona Hazard Mitigation Project
Peak Flows

Basin Number	Q_2	Q_5	Q_{10}	Q_{50}	Q_{100}
1	22	57	75	145	171
2	7	211	352	874	1099
3	8	252	418	1041	1309

Cost Estimate

Estimated costs were calculated using unit costs from FEMA Region 8 Numeric Cost Code Listing, CWCB cost information, and in-house WRC cost data. Following is a list of unit prices and their source used in calculating estimated costs.

Schedule of Unit Prices

ITEM	SOURCE	UNITS	UNIT PRICE
Unclassified Excavation C.I.P.	FEMA	CY	$2.00
7-Barrel 4'x8' RCBC	WRC	CY	$400.00
Wingwalls and Channel Protection at RCBC	WRC	LS	$15,000.00
36" CMP	FEMA	LF	$36.00
12" CMP	FEMA	LF	$15.00
Relocate Weigh Station	CWCB	LS	$5,000.00
Aquire Existing Garage	CWCB	LS	$5,000.00
Hwy 144 Ditch Improvements	WRC	LF	$1.00
Ditch Improvements East of Weldona (North of Highway 144)	FEMA	CY	$2.00
Seeding & Mulching	WRC	Ac	$1,600.00
Land Acquisition	CWCB	Ac	$2,000.00
Farm Inundation/Flood Easements	CWCB	Ac	$300.00
County Road Improvements	FEMA/WRC	LF	$10.00
Outfall Bank Stabilization (Riprap)	FEMA/WRC	CY	$50.00
Irrigation Canal Spill Structure (Weldona Valley)	CWCB	EA	$25,000.00
Irrigation Canal Spill Structure (Riverside)	CWCB	EA	$13,000.00
Remove/Replace Asphalt Pavement	WRC	Ton	$80.00
Traffic Control/Temporary Detour	WRC	LS	$15,000.00
Local Storm Drainage Improvements (In Town)	CWCB	LS	$10,.000.00
Mobilization	WRC	LS	$20,00.00
Construction Survey	WRC	LS	$7,500.00

The following table details the estimated costs for the proposed project.

Cost Estimate
Weldona Flood Hazard Mitigation Plan

DESCRIPTION	UNITS	QTY	UNIT PRICE	ITEM PRICE
Unclassified Excavation C.I.P. (Assumes Wasting 32,600 CY on or near site)	CY	47,000	$2.00	$94,000
7-Barrel 4'x8' RCBC	CY	213	$400.00	$85,200
Wingwalls and Channel Protection at RCBC	LS	--	--	$15,000
36" CMP	LF	525	$36.00	$18,900
12" CMP	LF	130	$15.00	$1,950
Relocate Weigh Station	LS	-	-	$5,000
Aquire Existing Garage	LS	-	-	$5,000
Hwy 144 Ditch Improvements	LF	6,100	$1.00	$6,100
Ditch Improvements East of Weldona (North of Highway 144)	CY	5,000	$2.00	$10,000
Seeding & Mulching	Ac	30	$1,600.00	$48,000
Land Acquisition	Ac	23	$2,000.00	$46,000
Farm Inundation/Flood Easements	Ac	5	$300.00	$1,500
County Road Improvements	LF	1,500	$10.00	$15,000
Outfall Bank Stabilization (Riprap)	CY	180	$35.00	$6,300
Irrigation Canal Spill Structure (Weldona Valley)	EA	1	$25,000.00	$25,000
Irrigation Canal Spill Structure (Riverside)	EA	2	$13,000.00	$26,000
Remove/Replace Asphalt Pavement	Ton	150	$80.00	$12,000
Traffic Control/Temporary Detour	LS	--	--	$15,000
Local Storm Drainage Improvements (In Town)	LS	-	-	$10,000
Mobilization	LS	--	--	$20,000
Construction Survey	LS	--	--	$7,500
			SUB-TOTAL	$473,450
			CONTINGENCY 15%	$71,020
			ADMINISTRATIVE AND LEGAL 5%	$23,670
			ENGINEERING/FINAL DESIGN	$30,000
			TOTAL	$598,140

Cost Effectiveness of Proposed Project

Methodology

The benefit-cost analysis for the proposed flood control project at Weldona was performed using FEMA's economic analysis computer program. The program was developed in-house using the QuatroPro™ spreadsheet software. Several modules for the economic analysis were developed by FEMA in order to handle varying degrees of available input data. The most basic module, known as the "very limited data" module, requires basic information about the flood event such as the estimated damages for the declared event, the estimated frequency of the flood event, and the cost of the proposed mitigation measure. The next level module, known as the "limited data" module, requires annual maintenance costs and more detailed damage-frequency data in addition to the information needed for the basic module. It is the "limited data" module that was used to estimate the benefit-cost (B/C) ratio for the proposed Weldona project.

Project Data

The proposed project features for Weldona are designed to provide protection up to the 100-year event. The channels and levees will be stabilized with grass and other natural vegetation, and all project components will be inspected and maintained on a regular basis to ensure longevity and functionality of the project. For the B/C analysis, the estimated useful life of the project is 50 years. More detailed information on the project description, the cost of the project, and the estimated annual maintenance costs is presented in the previous two sections of the report.

Land Use Characteristics

Land use types in the project area consist of residential, commercial, agricultural, open range, and natural floodplain (South Platte River). Data compiled for the residential and commercial structures included the estimated flood depth at the first floor, the type of structure, the type of foundation (i.e. basement, slab, crawl space, etc.), and the market value of the structure. Average structure values for each type of house were obtained from the Morgan County Assessor's Office.

Flood Damages

Total flood damages determined for this analysis include damages to residential structures, commercial structures, and structure contents. The content value for residential structures was assumed to be 50% of the structure value, while the content value for commercial structures was assumed to be 75% of the structure value. Flood cleanup costs were also included in the analysis. The cost of temporary relocation damages to public facilities such as roadways, bridges, and utilities were not included.

Damages to residential and commercial structures and their contents for various flood frequencies were estimated using flood depth information estimated from the 1997 declared flood event in conjunction with the land use/building data in the project vicinity. Depth-building damage data was based on published tables/curves from the FEMA actuarial information system. Building damage for various flood depths and building types is reported as a percentage of the building value.

The pertinent flood damage information for buildings and contents was entered into a spreadsheet program to asses the damage potential for "without project" conditions. (See technical appendix). Total present worth flood damages were computed for the 2-, 5-, 10-, 50-, and 100-year events. Estimated damages after mitigation were assumed to be $0 up through the 100-year event. The direct and indirect damage estimates are presented in the table below.

Estimated Flood Damages for Proposed Project Area

Flood Frequency (years)	Estimated Direct Damages Before Mitigation	Estimated Indirect Damages Before Mitigation	Estimated Total Damages After Mitigation
2	$122,000	$1,000	$0
5	$122,000	$1,000	$0
10	$221,600	$2,500	$0
50	$775,000	$7,500	$0
100	$902,000	$7,500	$0

The damages for the 2-year and 5-year events are the same because the estimated flood depths for those frequencies are essentially equal. Damages for the remaining frequencies increase due to an increase in the depth of flooding.

Assuming a discount rate of 7%, the FEMA program yields a Benefit-Cost ratio of 1.83 for the proposed project. This value is above the minimum ratio of 1.1 that is required for HMGP projects.

Backup data for the benefit-cost analysis is located in the Technical Appendix of this report.

D. CONCLUSION

The selected alternative is a cost effective flood mitigation project which will protect the Community of Weldona from a 100-year storm runoff event. The proposed project is recommended for construction as the most feasible and politically acceptable of the alternative solutions considered.

MEETING SUMMARY
Weldona Flood Hazard Mitigation

December 29, 1997

Overview:

On Monday, December 29, 1997 a meeting and site visit were held in Weldona to discuss flood hazard mitigation for the community. The CWCB and WRC Engineering met with local officials and a landowner to review alternatives, share ideas, view proposed mitigation areas, and document the 1997 flood characteristics.

Meeting Attendees:

Name	Affiliation
Daryl Graham	Morgan County Road and Bridge (bridge supervisor)
Dick Early	Morgan County Road and Bridge (construction supervisor)
Don Christensen	Landowner (owns land north of Weldona)
Tom Browning	CWCB (flood control and floodplain management section)
Alan Leak	WRC Engineering, Inc.

Key Results:

The following bullet items summarize the key results of the meeting and site visit:

Flood Documentation (Flood event of July 29/30, 1997)

- The three existing reservoirs in the lower Schaefer Draw watershed (located in Section 27 and 22) did not fail during the flood. The reservoirs filled and spilled, but damage to the dams did not occur according to the landowner. The three reservoirs were viewed during the site visit. The uppermost reservoir (just south of the Riverside Canal) is located on State-owned land, while the lower two are located on private property. The upper reservoir had a storage capacity of about 75 acre-feet prior to the flood. That reservoir may have less flood control capacity now due to the sediment loading that was washed into it during the flood. The lower two reservoirs have less capacity than the upper one. The existing dams were privately built (many years ago) for the purpose of flood control and irrigation.

- The CWCB estimated a peak flow of about 1300 cfs on Schaefer Draw above the Riverside Canal. The landowner estimated that the flow was double that amount just below the Weldon Valley Ditch flowing to Weldona.

- Flow from County Road 8 (fairly large watershed to the west of Schaefer Draw) emptied into the Weldon Valley Ditch at the location where the ditch crosses the road. The Weldon Valley Ditch was overtopped by as much as 2 feet between County Road 8 and County Road

9. The spilled water traveled in a southeasterly direction and ended up in Weldona (trapped behind the highway and railroad embankments).

- Flood flows from Schaefer Draw breached through the Riverside Canal and the Weldon Valley Ditch. The flows entered Weldona mainly from the west side of County Road 9.

Proposed Mitigation Alternatives

- Alternative 1: The County staff and the landowner are very interested in building a diversion levee/channel along the north side of Weldona. The levee/channel would direct overland flows to the west and to the east of the community. The high point of the levee/channel system would be located near the high school. Existing drain tiles in the area would need to be preserved if channels are constructed to direct the flows to the south (exact locations and depths of drain tiles are unknown at this time).

- In conjunction with alternative 1, a new channel could be constructed from highway 144 due south to the South Platte River along Grove Road. The County staff estimated that the length of this channel would be 0.3 mile. Existing farm land would need to be purchased in order to gain right-of-way to build the channel. This option appears to be quite viable.

- In conjunction with any alternative, new culverts could be constructed under highway 144 just west of County Road 9. CR 9 could be raised 1 to 2 feet from hwy 144 to the north (approximately 200 feet). This improvement would divert flows from the west of CR 9 and north of hwy 144 to the ditch along the south side of hwy 144. The existing property/abandoned house located on the northwest corner of highway 144 and County Road 9 should be acquired. This property is in a low-lying area and receives frequent nuisance flooding. It is also located in the backwater area for the proposed culverts.

- Alternative 2: A new reservoir could be constructed just downstream of the existing reservoir below the Riverside Canal. The new reservoir would capture the 100-year runoff from Schaefer Draw, and would have a spillway that could pass up to the 100-year flow. If the reservoir outflow was designed to be quite small, then it could drain into the existing downstream flow paths. A large reservoir outflow would require a downstream conveyance system or a levee on the north side of Weldona.

- In conjunction with any alternative, spill structures on the Riverside Canal and the Weldon Valley Ditch need to be constructed to prevent future bank failures.

Miscellaneous

- Acquisition costs for farm land were estimated to be $1,500 to $3,000 per acre.

Action Items:

- CWCB should set up a review meeting for mid-January. The meeting should be held on a Wed., Thurs., or Friday to accommodate the schedules of the County Commissioners and staff. County staff will invite all interested landowners to the meeting.

- County staff will locate and obtain copies of maps that show existing drain tiles in the Weldona area.

- County staff will contact the owner of the old scale (located just south of highway 144 at Weldona) and determine if the scale can be relocated.

- WRC Engineering will analyze the levee alternative (north side of Weldona) for the "with" and "without" reservoir flood flows.

- CWCB staff will investigate a new alternative which includes several small detention reservoirs in the upper part of the watershed.

- The CWCB will ask the Corps of Engineers to investigate a new alternative which may include diversion levees/channels that would direct flood flows away from Weldona.

MEETING SUMMARY
Weldona Flood Hazard Mitigation

January 9, 1998

Overview:

On Friday, January 9, 1998 a meeting and site visit were held in Weldona to discuss flood hazard mitigation alternatives for the community. The CWCB met with interested parties to review alternatives and come up with a recommended mitigation plan.

Meeting Attendees:

Name	Affiliation
Mark Arndt	Morgan County Commissioner
Joe Baltazar	Morgan County Public Works Director
Darrell Graham	Morgan County Road and Bridge (bridge supervisor)
Dick Early	Morgan County Road and Bridge (construction supervisor)
Kevin Kuretich	Morgan County Emergency Management
Tom Browning	CWCB (Flood control and floodplain management section)
Dave Darling	Colorado Department of Transportation (Evans office)
Ella R.	Colorado Department of Transportation (Evans office)
Bart Woodward	Riverside Canal Representative
Rick Lorenzini	Landowner and Weldon Valley Ditch Representative

Key Results:

The following bullet items summarize the key results of the meeting and site visit:

- Based on input from County officials and other meeting attendees, the preferred mitigation alternative consists of the following:

  1. Construct a dike/channel system at the north end of town to protect Weldona from a 100-year flood event. The dike will begin at hwy 144 on the west end of town near CR 9, and will continue east and tie into to CR 9.5 near the high school. CR 9.5 will be elevated from the point of the dike tie-in north to the first bend in the road. The elevated road will act as a north-south levee to keep flows on the west side of the road.
  2. Construct box culverts or a bridge under hwy 144 near CR 9. The opening of the culverts or bridge should be 3 to 4 feet high and as wide as possible. Attempt to construct the largest crossing possible for around $100,000. The 100-year flows from the dike/channel system will likely overtop the highway, and that is acceptable to CDOT and the County.
  3. Construct a 100-year capacity channel downstream of the hwy 144 crossing. The County would like to purchase the farm land south of hwy 144 and west of Grove Street. The flood channel could go directly through this land to the South Platte River. The County recommended that the railroad embankment be open-cut to save the cost of

an additional culvert crossing. Attempt to protect the left bank of the South Platte River in the area where the new flood channel will daylight. The river bank is not stable and tends to migrate during high flows.

4. Increase the capacity of the existing ditch located between the railroad and hwy 144. The reach will start at CR 9 and continue east to the old railroad trestle. Provide large box culverts for the road and driveway crossings of the ditch (4 total?). Protect the drain tiles in the vicinity of the old railroad trestle with riprap or encasements.
5. Construct concrete spill structures on the Riverside Canal and the Weldon Valley Ditch need to be constructed to prevent future bank failures. The ditch companies are agreeable to this.
6. Widen the existing drain ditch that flows from north to south from the intersection of CR Y and CR 10 to hwy 144. Purchase a strip of land on the east side of the power poles to construct a shallow and wide ditch. Possibly increase the size of the existing culvert at hwy 144. Construct a dip (Texas Crossing) on CR Y just to the west of CR 10.

- Acquisition costs for the farm land located to the south of hwy 144 are estimated to be $1,800 per acre.

- Inundation and/or flood easements across farm lands could be estimated as a lump sum payment of $300 per acre.

- There does not seem to be a good source of riprap anywhere in the project area. The ditch company uses broken concrete.

- The County will provide money for some of the necessary land acquisition, and will provide labor and equipment for a majority of the earthwork. The County would also like to trade a piece of land for the small parcel located on the NW corner of CR 9 and hwy 144 so that it does not have to be purchased.

- The Riverside Ditch suffered damages in the amount of $62,000 as a result of the flood. $20,000 of that was not considered to be "eligible damages" according to FEMA.

Action Items:

- CWCB will set up a final review meeting for the end of January. The meeting should be held on a Thursday, if possible, to accommodate the schedules of the County Commissioners and staff.

- CWCB staff and County staff will attempt to contact the UPRR regarding work on the railroad right-of-way.

- CDOT will provide cost information for bridges and culverts for recent highway work.

Morgan Query

MUNICIPAL *Brush*

STREAM	TITLE	AUTHOR	RPT_DATE
Beaver Creek	Flood Insurance Study, City of Brush, Colorado	FEMA	02/77
Beaver Creek	FIS City of Brush, CO		2/1/77
Beaver Creek	Floodplain Information Report, Beaver Creek, Brush, Colorado,	Gingery Associates, Inc., Denver	4/76

MUNICIPAL *Fort Morgan*

STREAM	TITLE	AUTHOR	RPT_DATE
South Platte River	FIR. City of Fort Morgan, Colorado	CWCB	4/97
South Platte River	Special FHIR, South Platte River, Volume II, Morgan County - Washington County, Colorado	US Army Corps of Engineers, O	5/77
South Platte River	Special Flood Hazard Information Report, S. Platte R., Vol. II	USACE, Omaha District	May 1977

MUNICIPAL *Unincorporated*

STREAM	TITLE	AUTHOR	RPT_DATE
Badger Creek	Floodplain Information Report, Beaver Creek, Brush, Colorado,	Gingery Associates, Inc., Denver	4/76
Beaver Creek	FIS, Morgan County, Colorado Unincorporated Areas	FEMA	9/29/89
Beaver Creek	Floodplain Information Report, Beaver Creek, Brush, Colorado.	Gingery Associates, Inc., Denver	4/76
Sand Creek	Floodplain Information Report, Beaver Creek, Brush, Colorado,	Gingery Associates, Inc., Denver	4/76
South Platte River	FIS, Morgan County, Colorado Unincorporated Areas	FEMA	9/29/89
South Platte River	Special Flood Hazard Information Report, South Platte River, Volume I, Weld County, Colorado.	USACE Omaha District	4/77

STREAM	*TITLE*	*AUTHOR*	*RPT_DATE*
Kiowa Creek	Floodplain Information Report Kiowa Creek at Wiggins, Colorado	Colorado Water Conservation Bo	6/90
Kiowa Creek	Flood Insurance Study, City of Wiggins, Colorado	Gingery Associates, Inc. under F	8/78

4. Local Data

STATE OF COLORADO

OFFICE OF EMERGENCY MANAGEMENT
Tommy F. Grier, Jr. - Director

DEPARTMENT OF LOCAL AFFAIRS
Division of Local Government

Roy Romer
Governor

Larry Kallenberger
Executive Director

Harold A. Knoll
Director

OEM Grant Award Letter

INITIAL AWARD X INCREASE ___ DECREASE ___ CHANGE ___

Part 1: Accounting Information

1. Contract Logging Inquiry Number (CLIN): 01146
2. Encumbrance Number: 8OEMMRGN
3. Accounting Line: SD00/395/FD95/3D95 =$19,799.00 SD00/797/FD97/3797 = $123,375.00
4. Vendor Number: 846000788 B

Part 2: Grant Information

5. Master Contract Number: 6OEM31
6. Award Made to Sub-Grantee: MORGAN COUNTY, including award for Riverside Irrigation District
   Box 1399
   Fort Morgan, CO 80701

A - Barricade Rental
B - Damage to a Police Car

7. This Award Amount $143,174 ($118,793 Federal + $4,582 Federal Admin + $19,799 State)

Total Awarded To Date: $143,174

Entity DSR#	Category	Approved DSR Project Amt $	Federal $	Fed Admin $	State Advance $	State Final $	Local $
Morgan County		**$117,007**	**$87,755**	**$3,340**	**$7,314**	**$7,312**	**$14,626**
DSR 56013	A	$8,095	$6,071		$506	$506	$1,012
DSR 56014	B	$13,839	$10,379		$865	$865	$1,730
DSR 56103	C	$5,434	$4,076		$339	$340	$679
DSR 56108	C	$9,578	$7,184		$598	$599	$1,197
DSR 56109	C	$5,256	$3,942		$329	$328	$657
DSR 56115	C	$2,248	$1,686		$141	$140	$281
DSR 56116	C	$5,669	$4,252		$354	$355	$708
DSR 56117	C	$1,660	$1,245		$103	$104	$208
DSR 56121	C	$1,772	$1,328		$111	$111	$222
DSR 56123	C	$1,322	$992		$83	$82	$165
DSR 56126	C	$1,153	$865		$72	$72	$144

15075 South Golden Road, Golden, Colorado 80401-3979 (303) 273-1622 FAX (303) 273-1795 TDD (303) 273-1794

Amendment One DS.

Entity DSR#	Category	Approved DSR Project Amt	(*) Federal $	(*) Subgrantee Fed. Admin $	(*) State Advance $	State Final $	Local $
Morgan County				$1,056			
DSR 56105	C	$21,026	$15,770		$1,314	$1,314	$2,628
DSR 56110	C	$2,252	$1,689		$141	$141	$281
DSR 56111	C	$3,842	$2,882		$240	$240	$480
DSR 56112	C	$12,248	$9,186		$766	$765	$1,531
DSR 56114	C	$4,518	$3,388		$282	$283	$565
DSR 56119	C	$5,247	$3,935		$328	$328	$656
DSR 56124	C	$3,639	$2,729		$227	$228	$455
Total		$52,772	$39,579	$1,056	$3,298	$3,299	$6,596

(*) In table above = Advance Warrant Components (This Amendment)

8. Performance Period: **Category A and B Projects - July 28, 1997- January 30, 1998**
Category C,D,E,F and G Projects - July 28, 1997 - January 30, 1999

9. Purpose: - The Colorado Office of Emergency Management (OEM), through an agreement with the Federal Emergency Management Agency (FEMA) under Presidentially-declared Disaster DR-1186, distributes Public Assistance federal funds to qualified local governments for disaster recovery projects.

10. Scope: - As approved by the Federal Emergency Management Agency and the Colorado Office of Emergency Management, this grant award provides federal project funds, plus federal administrative funds, to complete the approved projects in Attachment B. The remaining twenty five percent (25%) of approved project DSR amounts will be funded equally between the state and the local entity. This project work and special federal requirements are based on FEMA-approved Damage Survey Reports (DSRs) incorporated herein as Attachment B. Subgrantee appeals of the scope of work or funding amount provided in a DSR must be filed in writing to the Office of Emergency Management within forty five (45) days of the approval date of this grant award. **NOTE: DSR project completion and financial reports/certifications must be submitted to the department Field Manager, Kent Gumina at the DoLA office in Sterling within thirty (30) days of project completion.**

11. Grant Considerations: - Attached is a copy of the fiscal terms and conditions entered into by the State and the aforementioned government jurisdiction (Attachment A). All attachments hereto are incorporated by reference. Federal project funds, Federal administrative funds, and one half (50%) of the awarded State funds are being advanced. The second one-half of the awarded state funds shall be paid upon completion of the project work following submission by the Subgrantee and approval by the State of project completion certification and expenditure summary. Any balance (underspending) of funds on this award will be used by the Subgrantee on other projects or on hazard mitigation projects contingent upon written approval by the state designated project monitor/field manager. No amendment letter need be executed to effect the use of these funds. Any deficit of funds (overspending) is strictly the responsibility of the Subgrantee.

12. Reviewed By: Polly White Date: 10/30/97 13. Issued By: Division of Local Government

14. Approved: State Controller, Clifford W. Hall

Harold A. Knott Date: 11/30/97
Harold A. Knott, Director

By: [signature] Date: 12/1/97
Rose Marie Auten, Controller, DoLA

NOTE: Acceptance of the grant implies agreement with the terms and conditions as stated in the master contract and the attachments to this award letter. The state grant funds are provided from state General Funds. You are advised to seek counsel on the receipt and expenditure of these state funds under TABOR, and appropriating the funds in your current budget as necessary.

Entity DSR#	Category	Approved DSR Project Amt.	(*) Federal $	(*) Fed Admin $	(*) State Advance $	State Final $	Local $
Morgan County Continued							
DSR 56102	C	$5,667	$4,250		$355	$354	$708
DSR 56104	C	$5,408	$4,056		$338	$338	$676
DSR 56106	C	$13,509	$10,131		$845	$844	$1,689
DSR 56113	C	$4,448	$3,336		$278	$278	$556
DSR 56116	C	$2,325	$1,743		$145	$146	$291
DSR 56120	C	$1,617	$1,213		$101	$101	$202
DSR 56127	C	$11,625	$8,719		$727	$726	$1,453
DSR 56207	C	$15,882	$11,912		$993	$992	$1,985
DSR 56016	E	$500	$375		$31	$31	$63
Riverside Irrigation Dist.		**$41,384**	**$31,038**	**$1,242**	**$2,586**	**$2,587**	**$5,173**
DSR 56007	D	$41,384	$31,038		$2,586	$2,587	$5,173
Totals		**$158,391**	**$118,793**	**$4,582**	**$9,900**	**$9,899**	**$19,799**

(*) In table above = Initial Warrant Components

8. Performance Period: **Category A and B Projects - July 28, 1997- January 30, 1998**
Category C,D,E,F and G Projects - July 28, 1997 - January 30, 1999

9. Purpose: - The Colorado Office of Emergency Management (OEM), through an agreement with the Federal Emergency Management Agency (FEMA) under Presidentially-declared Disaster DR-1186, distributes Public Assistance federal funds to qualified local governments for disaster recovery projects.

10. Scope: - As approved by the Federal Emergency Management Agency and the Colorado Office of Emergency Management, this grant award provides federal project funds, plus federal administrative funds, to complete the approved projects in Attachment B. The remaining twenty five percent (25%) of approved project DSR amounts will be funded equally between the state and the local entity. This project work and special federal requirements are based on FEMA-approved Damage Survey Reports (DSRs) incorporated herein as Attachment B. Subgrantee appeals of the scope of work or funding amount provided in a DSR must be filed in writing to the Office of Emergency Management within forty five (45) days of the approval date of this grant award. **NOTE: DSR project completion and financial reports/certifications must be submitted to the department Field Manager, Kent Gumina at the DoLA office in Sterling within thirty (30) days of project completion.**

TRX#	DATE	SORT	TYPE	JRNL	DESCRIPTION	REQ/INV	PRD/VDR/EMP	UNIT	QUANTITY	RATE	AMOUNT
97084	WELDONA DRAINANGE FLOOD										
51121189	Salaries--Department Head										
5457	01/02/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	10.00	14.71	147.15
5458	01/09/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	7.00	14.71	103.01
6078	01/30/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	5.00	18.39	91.97
6081	02/06/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	10.00	18.39	183.94
6555	03/06/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	7.00	18.39	128.76
6557	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00116	HRS	13.00	18.39	239.12
2349	08/08/97	FLO	T/C	PAY	P/R TIME CARD		00116	HRS	12.00	14.15	169.80
					---------- DETAIL TOTAL ---------->>				64.00		1,062.75
51131184	Salaries - Permanent										
9657	08/07/97	1FA	T/C	PAY	P/R TIME CARD		00818	HRS	10.00	10.16	101.65
3865	09/15/97	1FA	T/C	PAY	P/R TIME CARD		00821	HRS	8.00	7.94	63.53
3605	09/15/97	1FA	T/C	PAY	P/R TIME CARD		00817	HRS	8.00	7.11	56.90
3974	10/07/97	1FA	T/C	PAY	P/R TIME CARD		00147	HRS	10.00	8.18	81.84
4048	10/07/97	1FA	T/C	PAY	P/R TIME CARD		00803	HRS	7.00	8.59	60.13
5399	01/09/98	1FA	T/C	PAY	P/R TIME CARD		00818	HRS	8.00	10.77	86.16
6019	01/30/98	1FA	T/C	PAY	P/R TIME CARD		00818	HRS	4.00	13.46	53.85
6507	03/06/98	1FA	T/C	PAY	P/R TIME CARD		00818	HRS	12.00	13.46	161.55
6815	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00147	HRS	24.00	10.46	251.07
6708	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00820	HRS	20.00	10.37	207.45
6690	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00806	HRS	16.00	10.03	160.51
6612	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00122	HRS	5.00	13.06	65.31
6652	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00819	HRS	21.00	11.53	242.29
6750	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00821	HRS	8.00	10.36	82.91
6867	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00803	HRS	32.00	11.21	359.00
6511	03/13/98	1FA	T/C	PAY	P/R TIME CARD		00818	HRS	16.00	13.46	215.40
					---------- DETAIL TOTAL ---------->>				209.00		2,249.55
51131185	Salaries - Permanent										
2753	09/03/97	1SA	T/C	PAY	P/R TIME CARD		00816	HRS	4.00	8.18	32.73
2497	09/03/97	1SA	T/C	PAY	P/R TIME CARD		00300	HRS	4.00	12.14	48.58
2498	09/04/97	1SA	T/C	PAY	P/R TIME CARD		00300	HRS	10.00	12.14	121.44
2499	09/08/97	1SA	T/C	PAY	P/R TIME CARD		00300	HRS	10.00	12.14	121.44
2500	09/09/97	1SA	T/C	PAY	P/R TIME CARD		00300	HRS	5.00	12.14	60.72
3747	10/07/97	1SA	T/C	PAY	P/R TIME CARD		00819	HRS	4.00	8.77	35.10
3703	10/07/97	1SA	T/C	PAY	P/R TIME CARD		00814	HRS	5.00	9.62	48.13
3901	10/07/97	1SA	T/C	PAY	P/R TIME CARD		00805	HRS	5.00	8.60	43.03
3658	10/07/97	1SA	T/C	PAY	P/R TIME CARD		00122	HRS	5.00	9.99	49.98

TRX#	DATE	SORT	TYPE	JRNL	DESCRIPTION	REQ/INV	PRD/VDR/EMP	UNIT	QUANTITY	RATE	AMOUNT
					---------- DETAIL TOTAL ---------->>				52.00		561.15
53581184	Other Professional Services										
0000	01/03/98	1SA	INV	PUR	SERVICES	LM9743	53690		1.00	3,460.00	3,460.00
					---------- DETAIL TOTAL ---------->>				1.00		3,460.00
54161184	Cement & Concrete Supplies										
0000	09/25/97	1FA	INV	PUR	GRATE	9200.0	12600		1.00	200.00	200.00
					---------- DETAIL TOTAL ---------->>				1.00		200.00
54521184	Gravel & Sand										
1763	11/04/97	1SA	INV	PUR	DIRT	11631.	25385		42.00	1.25	52.50
					---------- DETAIL TOTAL ---------->>				42.00		52.50
55331184	Fleet - Mach. & Equip. Rental										
2234	08/31/97	1FA	ADJ	GSAJ	AUGUST I/F	MR1			0.00	0.00	8.80
2355	09/30/97	1FA	ADJ	GSAJ	SEPTEMBER I/F	MR1			0.00	0.00	1,019.48
2392	10/31/97	1FA	ADJ	GSAJ	OCTOBER I/F	MR1			0.00	0.00	661.50
2544	01/31/98	1FA	ADJ	GSAJ	JANUARY I/F	MR1			0.00	0.00	17.38
					---------- DETAIL TOTAL ---------->>				0.00		1,707.16
					---------- SUB CODE TOTALS ---------->>				369.00		9,294.11

DETAIL SUBSIDIARY REPORT BY SUB CODE

TRX#	DATE	SORT	TYPE	JRNL	DESCRIPTION	REQ/INV	PRD/VDR/EMP	UNIT	QUANTITY	RATE	AMOUNT
					---------- GRAND TOTALS ---------->>						369.00
					---------- GRAND TOTALS ---------->>						9,294.11

RIVERINE FLOOD: LIMITED DATA MODULE

Version 1.02 *December 31, 1996* Page 1

PROJECT INFORMATION

Disaster Number	FEMA-DR-1186-CO	Project	Weldona
DSR Number	n/a	Address	
DSR Category	n/a	City, State, Zip	Weldona, Colorado
DSR Subject	n/a	County	Morgan
Inspection Date	n/a	Applicant	Morgan County
Application Date	February 1, 1998	Contact Person	Tom Browning-CWCB
Discount Rate (%)	7.00		
Analysis Date	January 29, 1998	Scenario Run ID	1
Analyst	Tom Browning	Save As File Name	LD_EXAMP.WB2

PROJECT DATA

Project Description: New culverts/new ring levee with channel/channel imp./culvert imp.

Project Useful Life (years)	50
Base Year of Costs	1998
Mitigation Project Cost	
Total cost, including mitigation measure	$600,000
Repair cost, to pre-disaster condition only	$0
Net Mitigation Project Cost	$600,000
Annual Maintenance Cost ($/year)	$3,500
Present Value of Annual Maintenance Cost ($)	$48,303
TOTAL NET MITIGATION PROJECT COST	$648,303

FLOOD FREQUENCY AND DAMAGE ESTIMATES

Estimated Frequency of Declared Flood Event (Years): 100

SCENARIO DAMAGES BEFORE & AFTER MITIGATION

Flood Frequency (Years)	Expected Annual Number of Floods	Estimated Damages Before Mitigation (per flood event)		Estimated Damages After Mitigation (per flood event)		Avoided Damages After Mitigation (per flood event)	
		Direct	Other	Direct	Other	Direct	Other
2	3.00E-01	$122,000	$1,000			$122,000	$1,000
5	1.00E-01	$122,000	$1,000			$122,000	$1,000
10	8.00E-02	$221,000	$2,500			$221,000	$2,500
50	1.00E-02	$775,000	$7,500			$775,000	$7,500
100	8.00E-03	$902,000	$7,500			$902,000	$7,500
500	2.00E-03	$1,100,000	$7,500	$1,100,000	$7,500	$0	$0

SUMMARY OF BENEFITS AND COSTS

	Expected Annual	Present Value
Expected Annual Damages Before Mitigation	$84,395	$1,164,712
Expected Annual Damages After Mitigation	$2,214	$30,553
Expected Avoided Damages After Mitigation (BENEFITS)	$82,181	$1,134,159

PROJECT BENEFITS	$1,134,159
PROJECT COSTS	$648,303
BENEFITS MINUS COSTS	$485,857
BENEFIT-COST RATIO	**1.75**

FEMA Disclaimer: The results produced by this analysis are neither conclusive evidence that a proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.

Community of Weldona
Residential and Commercial Building Damages
Caused by July 1997 Declared Flood Event (100-year Event)

Address	Property Type	Structure Type	Actual Value($)	Contents Value($)	Total Value($)	Est. 1st Flr Flood Depth (ft)	Percent Damaged	Total Est. Damage ($)
203 Railroad Ave.	Residential	Single Family	$43,927	$21,964	$65,891	2	22	$14,496
116 Cottage Ave.	Residential	Single Family	$22,402	$11,201	$33,603	2	22	$7,393
111 Cottage Ave.	Residential	Single Family	$15,584	$7,792	$23,376	2	22	$5,143
707 Warren St.	Residential	Single Family	$38,278	$19,139	$57,417	2	22	$12,632
207 Railroad Ave.	Residential	Single Family	$63,018	$31,509	$94,527	2.5	25	$23,632
201 Railroad Ave.	Residential	Single Family	$26,298	$13,149	$39,447	2	22	$8,678
114 Cottage Ave.	Residential	Single Family	$6,623	$3,312	$9,935	2	22	$2,186
205 Railroad Ave.	Residential	Single Family	$75,972	$37,986	$113,958	2	22	$25,071
109 Railroad Ave.	Residential	Single Family	$17,532	$8,766	$26,298	2	22	$5,786
211 Railroad Ave.	Residential	Single Family	$25,129	$12,565	$37,694	3	27	$10,177
705 Warren St.	Residential	Single Family	$39,837	$19,918	$59,755	2	22	$13,146
805 Warren St.	Residential	Single Family	$23,668	$11,834	$35,502	2	22	$7,811
809 Warren St.	Residential	Single Family	$16,363	$8,182	$24,545	2	22	$5,400
813 Warren St.	Residential	Single Family	$6,818	$3,409	$10,227	2	22	$2,250
611 Main St.	Residential	Single Family	$14,513	$7,256	$21,769	0	9	$1,959
702 Warren St.	Residential	Single Family	$19,772	$9,886	$29,658	2	22	$6,525
802 Warren St.	Residential	Single Family	$23,084	$11,542	$34,626	2	22	$7,618
605 Main St.	Residential	Single Family	$26,688	$13,344	$40,031	0	9	$3,603
603 Main St.	Residential	Single Family	$26,006	$13,003	$39,009	0	9	$3,511
609 Main St.	Residential	Single Family	$17,142	$8,571	$25,714	0	9	$2,314
503 Main St.	Residential	Single Family	$25,616	$12,808	$38,424	2	22	$8,453
501 Main St.	Residential	Single Family	$56,979	$28,490	$85,469	2	22	$18,803
509 Main St.	Residential	Single Family	$50,940	$25,470	$76,410	1	14	$10,697
806 Warren St.	Residential	Single Family	$12,662	$6,331	$18,993	2	22	$4,178
309 Railroad Ave.	Residential	Single Family	$20,551	$10,276	$30,827	3	27	$8,323
515 Main St.	Residential	Single Family	$19,870	$9,935	$29,804	0.5	5	$1,490
505 Main St.	Residential	Single Family	$10,032	$5,016	$15,048	1.5	18	$2,709
311 Main St.	Commercial	1 story	$76,368	$57,276	$133,644	3	27	$36,084
PTLot 9 &Triangle	Commercial	1 story	$277,648	$208,236	$485,884	3	27	$131,189

Community of Weldona
Residential and Commercial Flood Damages
Caused by July 1997 Declared Flood Event (100-year Event)

Address	Property Type	Structure Type	Actual Value($)	Contents Value($)	Total Value($)	Est. Flood Depth (ft)	Percent Damaged	Total Est. Damage ($)
Lot0 & W50ft Lot 1	Commercial	1 story	$164,280	$123,210	$287,490	3	27	$77,622
307 Railroad Ave.	Commercial	1 story	$121,064	$90,798	$211,862	3	27	$57,203
303 Railroad Ave.	Commercial	1 story	$34,040	$25,530	$59,570	3	27	$16,084
Lot; 3- Lot; 5	Commercial	1 story	$32,264	$24,198	$56,462	3	27	$15,245
209 Railroad Ave.	Residential	Mobile Home	$8,370	$4,185	$12,555	2	63	$7,910
207 Railroad Ave.	Residential	Mobile Home	$24,750	$12,375	$37,125	1.5	54	$20,048
207 Railroad Ave.	Residential	Mobile Home	$4,800	$2,400	$7,200	1.5	54	$3,888
403 Main St.	Residential	Mobile Home	$7,150	$3,575	$10,725	2	63	$6,757
703 Warren St.	Residential	Mobile Home	$41,710	$20,855	$62,565	1	44	$27,529
701 Warren St.	Residential	Mobile Home	$12,390	$6,195	$18,585	1.5	54	$10,036
507 Main St.	Residential	Mobile Home	$13,180	$6,590	$19,770	0.5	26	$5,140
610 Main St.	Residential	Mobile Home	$26,520	$13,260	$39,780	0	8	$3,182
607 Main St.	Residential	Mobile Home	$17,500	$8,750	$26,250	0.5	26	$6,825
804 Warren St.	Residential	Mobile Home	$12,960	$6,480	$19,440	1	44	$8,554
803 Warren St.	Residential	Mobile Home	$4,890	$2,445	$7,335	1	44	$3,227
High School	Tax Exempt	2 story w/ bsmt	$500,000	$250,000	$750,000	1	15	$112,500
High School Annex	Tax Exempt	1 story w/o bsmt	$150,000	$75,000	$225,000	1	14	$31,500
Catholic Church	Tax Exempt	1 story w/ bsmt	$250,000	$125,000	$375,000	2	20	$75,000
Church Annex	Tax Exempt	1 story w/ bsmt	$75,000	$37,500	$112,500	2	20	$22,500
				Total	**$4,076,699**		**Total**	**$902,004**

Property Values Obtained from the Morgan County Assessor's Office

Percent Damage based on FEMA Actuarial Information System

Residential Contents Value Assumed to be 50% of Structure Value

Commercial Contents Value Assumed to be 75% of Structure Value

5. Calculations and Estimates

Morgan County - Schaefer Draw
Precipitation Frequency Analysis

Purpose:

The purpose of this calculation is to determine the storm precipitation totals for storm durations of 6-hr, 12-hr, and 24-hr, for a return interval of 100-yr. The precipitation quantities represent annual amounts (the seasonal precipitation quantities, May-October are not available for Morgan County).

Methodology:

The information presented in this calculation is developed from the NOAA, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Vol III - Colorado, 1973. Using the figures in the NOAA Atlas, the following information is obtained.

6-hr Precipitation Quantities

Return Interval	Precipitation (inches)
2-yr	1.5
5-yr	2.0
10-yr	2.2
25-yr	2.7
50-yr	3.0
100-yr	3.4

24-hr Precipitation Quantities

Return Interval	Precipitation (inches)
2-yr	1.7
5-yr	2.3
10-yr	2.7
25-yr	3.2
50-yr	3.5
100-yr	4.0

Using procedures outlined in the NOAA, Atlas 2, the 12-hr precipitation quantities were estimated from the 6-hr and 24-hr values and are shown below.

12-hr Precipitation Quantities

Return Interval	Precipitation (inches)
2-yr	1.6
5-yr	2.2
10-yr	2.5
25-yr	3.0
50-yr	3.3
100-yr	3.7

PRELIMINARY

COMMUNITY OF WELDONA
MORGAN COUNTY, COLORADO

Hydrologic Summary for Schaefer Draw near Weldona
1997 Flood Event

Date of Flood: July 29/30, 1997

Duration of Rainstorm: 4 hours

Maximum Rainfall Depth near Basin Centroid: 4.2 inches
Rainfall depths obtained from NWS Radar data. Radar estimates of rainfall amounts were calibrated to ground-truth data from the Fort Collins and Pawnee Creek storms.

Estimated Return Period for Rainfall Event: >100-year

Antecedent Moisture in Basin: Moderate

Estimated Maximum Peak Flow: 1,300 cfs
Peak flow estimated by CWCB staff based on surveyed cross-sections, high water marks, and channel slopes. Several flow estimates were obtained and averaged at locations on the stream above irrigation canals, reservoirs, or any significant man-made features. The drainage basin above the observed location is essentially natural, unregulated, and undeveloped rangeland. Drainage area above flow estimate location is approximately 5 square miles.

Computed Peak Flows for Schaefer Draw
Using Various Hydrologic Methods
(Drainage Area = 5 square miles)

Source of Estimated Flow	100-year Peak Flow (cfs)
CWCB "Guidelines for Determining 100-year Flood Flows for Approximate Floodplains in Colorado" (1997)	2,030
USGS "Analysis of the Magnitude and Frequency of Floods in Colorado" (Vaill, 1996 draft)*	3,060
USGS/CWCB "Manual for Estimating Flood Characteristics of Natural-Flow Streams in Colorado" (1976)	5,460
SCS TR-55 methodology	1,310
UDFCD "Colorado Urban Hydrograph Procedure" **	1,180
Actual Flood Event	1,300***

* Eastern plains regression equations to be revised by USGS
** Simplified single basin CUHP analysis using recommended infiltration parameters
*** Flood-frequency not assigned

Watershed Calculation for Wildcat Creek in Morgan and Weld County, Colorado

Using 1:320,000 Colorado Atlas & Gazetteer (pg 94), the area of the Wildcat Creek watershed was calculated using *Placom* Digital Planimeter. The water shed was roughly estimated on the map (note: only one contour line existed on the map; therefore, the watershed was inexact). Four traces were done for the watershed in acres, this was averaged to determine the area.

86536.4 acres
86283.4
87042.5
87801.5

AVG= 86916.0 acres = 135.8 sq miles

Wildcat Creek watershed equals approximately 136 sq miles.

Attached is the map used to calculate the watershed.

Ana Vargas

Assumptions Used in the Hydraulic Computations

In order to estimate peak discharges, the CWCB flood documentation team employed Manning's equation. The application of Manning's equation to open channel flow problems requires that several generalizing assumptions be made.

Flow in open channels typically occurs as turbulent flow over rough surfaces. Open channel flow is also seldom either steady or uniform. (Steady flow has characteristics that do not vary with time while uniform flow implies that a constant cross sectional area and velocity occur at each section within a reach.) Steady, uniform flow almost never occurs in open channels (Morris and Wiggert, Applied Hydraulics in Engineering, 2nd edition, 1972).

In engineering applications, the Manning's equation has been used extensively and has been shown to be quite reliable even though it is an empirical approach derived for application to the following conditions:

- uniform flow in which the rate of head loss is equal to the bed slope
- steady flow

The open channel flow computations contained herein are treated as approximate solutions based on the assumptions of both steady and uniform flow. In actuality, the floods investigated in this study generally exhibited rapidly-rising and receding floodwave conditions that occurred in highly variable natural channels and adjacent floodplains. Flow characteristics under these circumstances were unlikely to be either steady or uniform.

Approaches are available for estimating floodwave flows, but they require substantial amounts of time and data that were not practical for these investigations. Manning's equation was used due to its general acceptance in the engineering community, and because of its relative ease of application. The Manning "n" values used in the calculations were based on engineering judgement, the reasonableness of results, and the understanding that the "n" term represented energy loss factors not typically found in steady, uniform flows.

Flood Discharge Estimates for Wildcat Creek
Morgan County, Colorado

Purpose:

The purpose of the calculation file is to estimate the peak flood discharge on Wildcat Creek in Morgan County, Colorado. The area around Wildcat Creek experienced flooding on July 28-30, 1997. Although radar data shows the maximum precipitation occurred about 3 miles southwest of Wildcat Creek, no drainages exist in this area that could be surveyed. Wildcat Creek is the closest drainage that has a well defined channel and still had debris lines in June of 1998.

Method:

The slope-area method of estimating stream discharge was used to estimate the peak flood discharge on Wildcat Creek. This method uses the following equation:

$$Q = \frac{1.49}{n} A R^{2/3} s^{1/2}$$

where Q = discharge (cfs)
n = Manning number
A = Cross-sectional area of flow (ft^2)
R = Wetted radius (ft) = A/P
s = gradient of the channel
P = Wetted perimeter (ft)

On June 26, 1998, stream channel cross-sections of Wildcat Creek near the Colorado State Highway 52 bridge (bridge number C21H) were surveyed by Bill Ellett and Bill Owen. Profile number 1 was located approximately 100 feet upstream from the bridge and approximately parallel to the bridge. Profile number 2 was located about 200 feet downstream of the bridge and profile number 3 was about 600 feet downstream. All three profiles were oriented approximately north-south and stretched between high-water marks on either side of the channel. High-water marks were clearly evident in the form of debris lines on each bank. Survey shots were also taken along the bottom of the stream channel to determine the channel slope. The survey equipment used was a Wild NA20 and stadia rod. The wetted perimeter at each profile was measured with a 100 foot tape.

From each profile, the cross-sectional area of flow was calculated. The attached photographs show the condition of the channel. A Manning number for grass-covered channels was estimated to be in the range of 0.029 to 0.035. The channel gradient was calculated from survey data taken along the bottom of the channel. The cross-sectional area of flow, Manning number, channel gradient, and wetted perimeter were input into the above equation to calculate flood discharge. As a reality check, the flow velocity was calculated from the discharge estimate by dividing the discharge by the cross-sectional area of flow.

The channel gradient was taken from the farthest upstream shot on profile number 1 and farthest downstream shot on profile number 2. The two profiles were tied together by shooting the bottom of

the bridge. From the profile number 1 instrument set-up, the level shot on the rod was 15.54 feet and the bottom of the bridge was 12.25 feet. Thus, the bottom of the bridge was 3.29 feet below the horizontal shot. From the profile number 2 instrument set-up, the level shot on the rod was 13.66 feet and the bottom of the bridge was 12.22 feet. Therefore, the bottom of the bridge from this position was 1.44 feet below the horizontal. It was assumed that the bottom of the bridge was horizontal. Therefore, the horizontal shot from profile number 2 set-up was 1.85 feet (3.29 - 1.44) lower than that from the profile number 1 set-up. The instrument at profile number 2 was also 0.10 feet higher off the ground than it was on profile number 1. Therefore, the ground at the profile number 2 set-up was 1.95 feet lower than the ground at the profile number 1 set-up.

The attached Excel spreadsheets and graphs present all of the raw survey data, calculations, and channel cross-sections.

Results:

The relative change in channel elevation from profile number 1 to profile number 2 was 2.20 feet. This change occurred over a distance of 924 feet. Therefore, the gradient of the channel was estimated to be 0.0024 (2.20 feet divided by 924 feet). The area of flow for profile number 1 is estimated to be 1,229 ft^2. The area of flow for profiles 2 and 3 is estimated to be 705 ft^2 and 605 ft^2 respectively. Assuming a Manning number of 0.035, the following discharges and velocities were estimated for each profile:

$n = 0.035$	Discharge (cfs)	Velocity (fps)
Profile Number 1	6,009	4.9
Profile Number 2	2,757	3.9
Profile Number 3	2,271	3.8

If the channel is smoother and a Manning number of 0.029 is used, the following discharges and velocities are estimated for each profile:

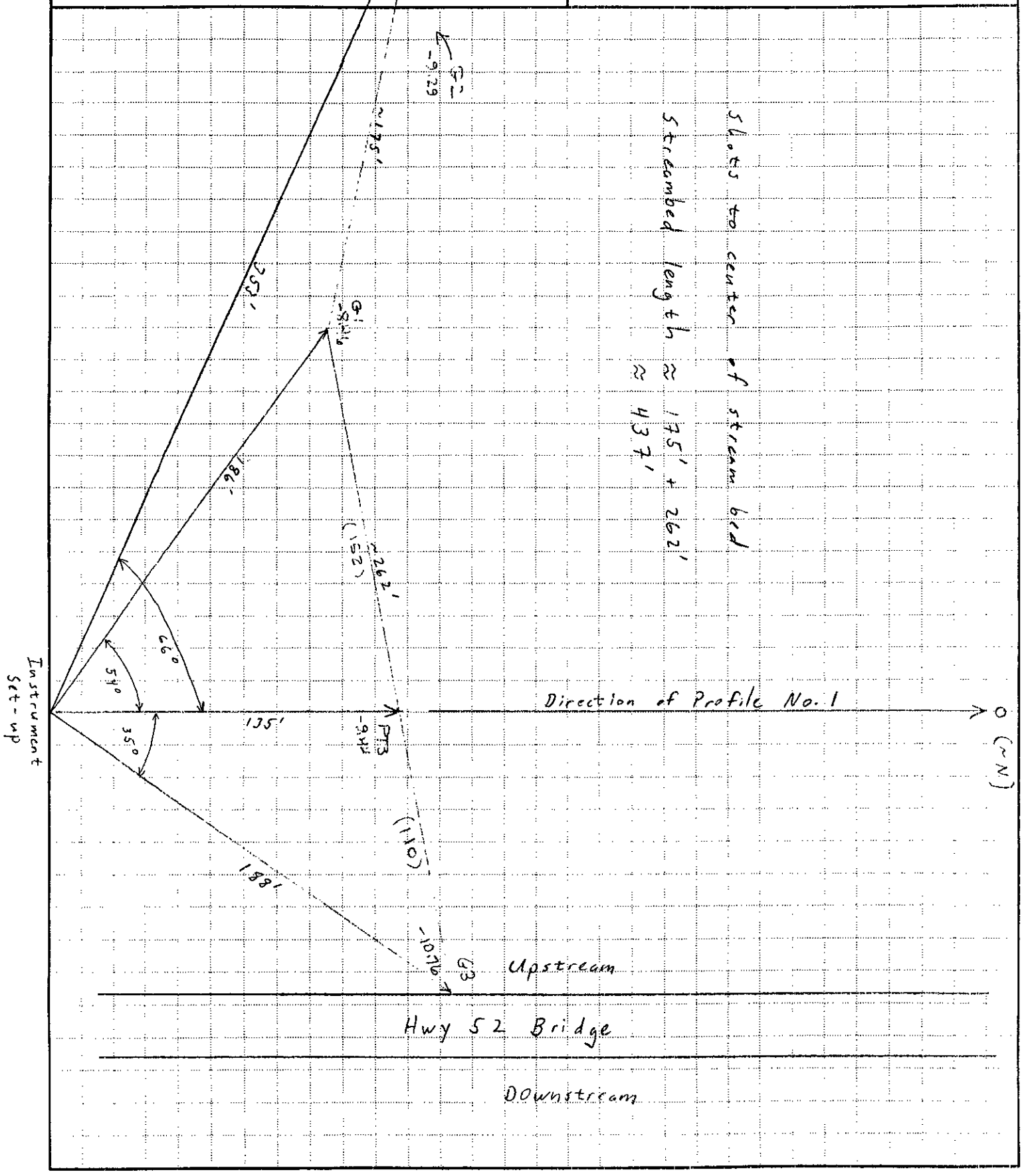
$n = 0.029$	Discharge (cfs)	Velocity (fps)
Profile Number 1	7,252	5.9
Profile Number 2	3,327	4.7
Profile Number 3	2,741	4.5

The stream discharge and velocity estimates for profile number 1 are considered to be too large because the cross-sectional area of flow for this profile probably included some backwater upstream from the bridge. However, profiles 2 and 3 are thought to be good representations of the actual channel flows. Therefore, the average of the discharges estimated from profiles 2 and 3 is thought to be a reasonable peak flood discharge estimate along this reach of Wildcat Creek. This average is between approximately 2,500 cfs and 3,000 cfs, depending on which Manning number is used.

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: Upstream Gradient — Wildcat Ck
Computed: wjc — Date: 7/2/98
Checked: ____ — Date: ____

Project/Proposal Name: CWCB Flood Docu.
Project/Proposal No.: XR004 — Task: 54
Page 1 of 4

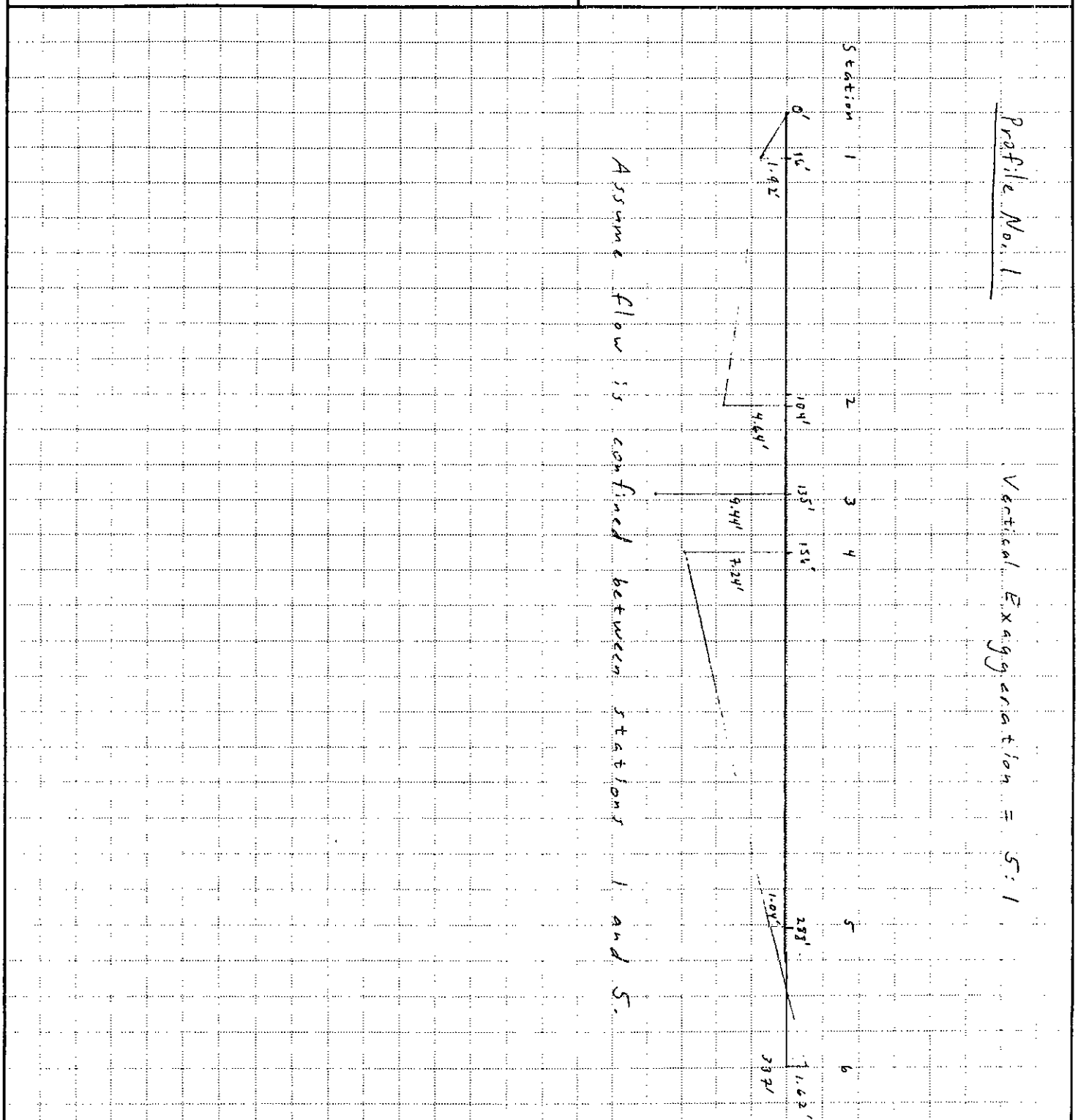


Riverside Technology, Inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: Wildcat Ck X-Sections
Computed: wje Date: 7/2/98
Checked: _____ Date: _____

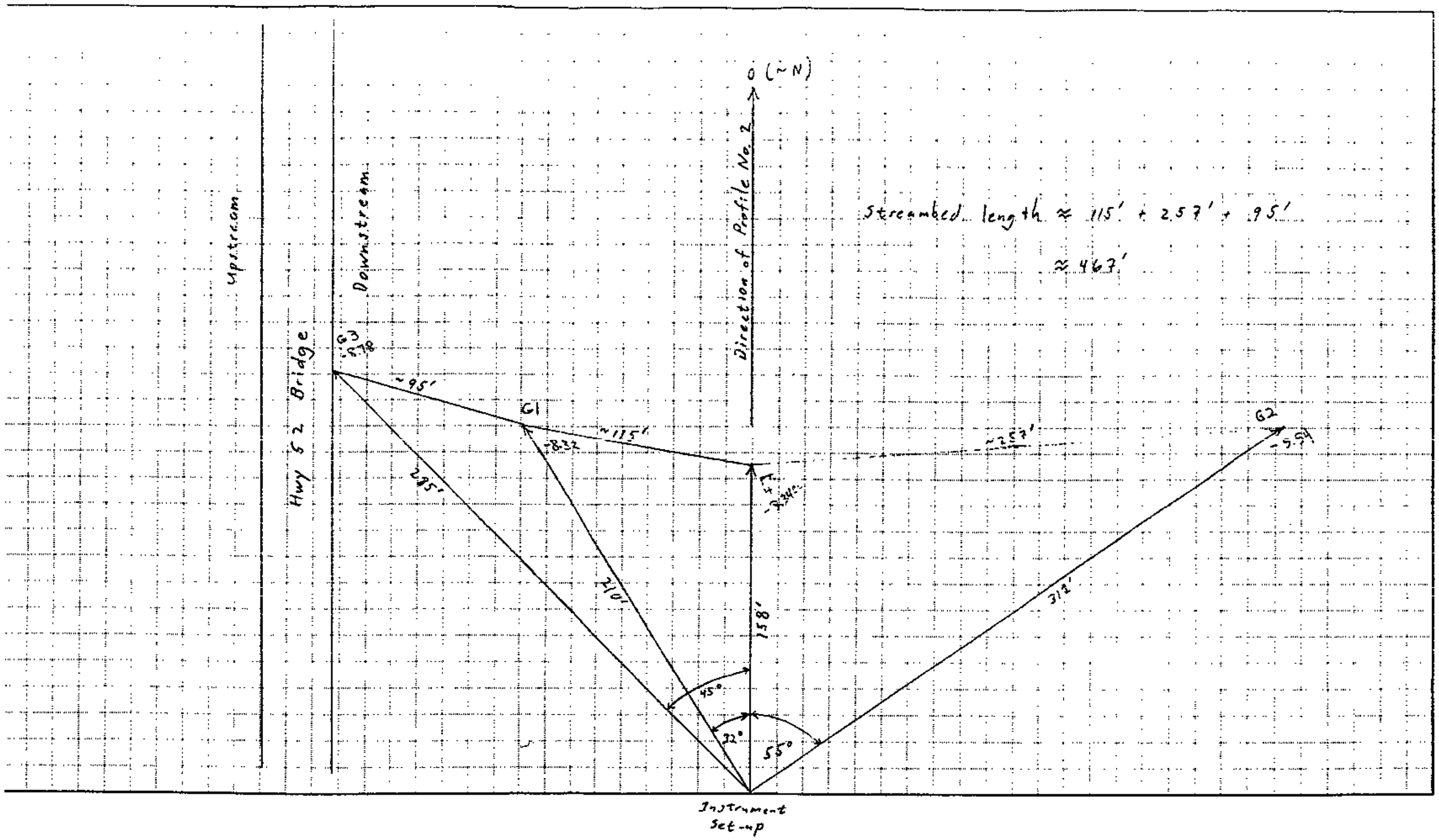
Project/Proposal Name: CWCB Flood Docum...
Project/Proposal No.: XR004 Task: 54
Page 2 of 4

Profile No. 1



Assume flow is confined between stations 1 and 5.

Vertical Exaggeration = 5:1



0 (~N)
Streambed length ≈ 115' + 257' + 95'
≈ 467'
Upstream
Hwy 52 Bridge
Downstream
Direction of Profile No. 2
G3
G1
G2
~95'
~115'
~257'
285'
210'
158'
312'
45°
32°
55°
Instrument Set-up

Morgan County, Colorado
Wildcat Creek Flood Discharge Estimates
Colorado State Highway 52 at Wildcat Creek, Bridge No. C21H

Stream X-Section Survey Data and Calculations

26-Jun-98
Bill Ellett
Bill Owen
Weather is sunny and warm, light breeze
Instrument used: Wild NA20

Profile No. 1
Datum (ft) = 0

Approximately 100 feet upstream of bridge
Bearing = 0 degrees (~N)
Intrument Height (ft) = 4.78

Instrument at south high water mark
Surveyor: Bill Ellett
Rodman: Bill Owen

Readings (ft)					
Station No.	Bearing	Top	Middle	Bottom	Notes
0	0				Instrument set-up
1	0	6.78	6.70	6.62	
2	0	9.94	9.42	8.90	
3	0	14.90	14.22	13.55	Bottom of Creek
4	0	12.80	12.02	11.24	
5	0	7.26	5.82	4.38	
6	0	4.83	3.16	1.46	North high water mark
Gradient 1	306	14.17	13.24	12.31	Creek bottom
Gradient 2	294	15.82	14.07	12.29	Creek bottom, farthest upstream
Gradient 3	35	16.48	15.54	14.60	Creek bottom at bridge
Bridge Bottom	35				Bottom of bridge = 12.25 ft on rod

(Top - Bottom) 100	Calculations
Distance (ft)	Change in Elevation (ft)
0	0
16	-1.92
104	-4.64
135	-9.44
156	-7.24
288	-1.04
337	1.62
186	-8.46
353	-9.29
188	-10.76
188	1.49

Wetted perimeter = 340 ft (slope distance between high water marks)

X-Sectional Area of Flow Calculations (square feet)
(assume flow is confined between stations 1 and 5)

Polygon	Area (ft^2)
Area 1	15.36
Area 2	288.64
Area 3	218.24
Area 4	175.14
Area 5	546.48
Area 6	14.21
TOTAL	**1229**

(Sum of Area 2 - 5)

Gradient

Streambed Length =	924	ft
Elevation Difference =	2.2	ft
Gradient =	0.0024	

Morgan County, Colorado
Wildcat Creek Flood Discharge Estimates
Colorado State Highway 52 at Wildcat Creek, Bridge No. C21H

Stream X-Section Survey Data and Calculations

26-Jun-98
Bill Ellett
Bill Owen
Weather is sunny and warm, light breeze
Instrument used: Wild NA20

Profile No. 2
Datum (ft) = -1.95
(Relative to Profile No. 1)

Approximately 200 feet downstream of bridge
Bearing = 0 degrees (~N)
Intrument Height (ft) = 4.88

Instrument at south high water mark
Surveyor: Bill Ellett
Rodman: Bill Owen

Readings (ft)					
Station No.	Bearing	Top	Middle	Bottom	Notes
0	0				Instrument set-up
1	0	7.96	7.72	6.89	
2	0	9.38	8.81	8.24	
3	0	10.93	10.16	9.42	
4	0	13.78	13.00	12.25	
5	0	14.01	13.22	12.43	Creek bottom
6	0	13.26	12.36	11.46	
7	0	9.03	8.07	7.12	
8	0	8.60	7.38	6.17	
9	0	5.20	3.86	2.51	
Gradient 1	328	14.26	13.20	12.16	Creek bottom
Gradient 2	55	15.98	14.42	12.86	Creek bottom, farthest downstream
Gradient 3	315	15.08	13.66	12.23	Creek bottom at bridge
Bridge Bottom	315				Bottom of bridge = 12.22 ft on rod
Profile 3 Set-up	91	8.28	6.14	4.00	Shot to Profile No. 3 set-up

Calculations		
Distance (ft)	Change in Elevation (ft)	Relative to Profile No. 1
0	0	-1.95
107	-2.84	-4.79
114	-3.93	-5.88
151	-5.28	-7.23
153	-8.12	-10.07
158	-8.34	-10.29
180	-7.48	-9.43
191	-3.19	-5.14
243	-2.50	-4.45
269	1.02	-0.93
210	-8.32	-10.27
312	-9.54	-11.49
285	-8.78	-10.73
285	3.44	1.49
428	-1.26	-3.21

Wetted perimeter = 273 ft (slope distance between high water marks)

X-Sectional Area of Flow Calculations (square feet)
(assume flow is confined between stations 1 and 9 and half of Area 1 flows)

Polygon	Area (ft^2)
Area 1	151.94
Area 2	23.695
Area 3	170.385
Area 4	13.4
Area 5	41.15
Area 6	174.02
Area 7	58.685
Area 8	147.94
Area 9	19.24
TOTAL	**705**

$\frac{1}{2}$ Area 1 + Sum (Area 2 - 8)

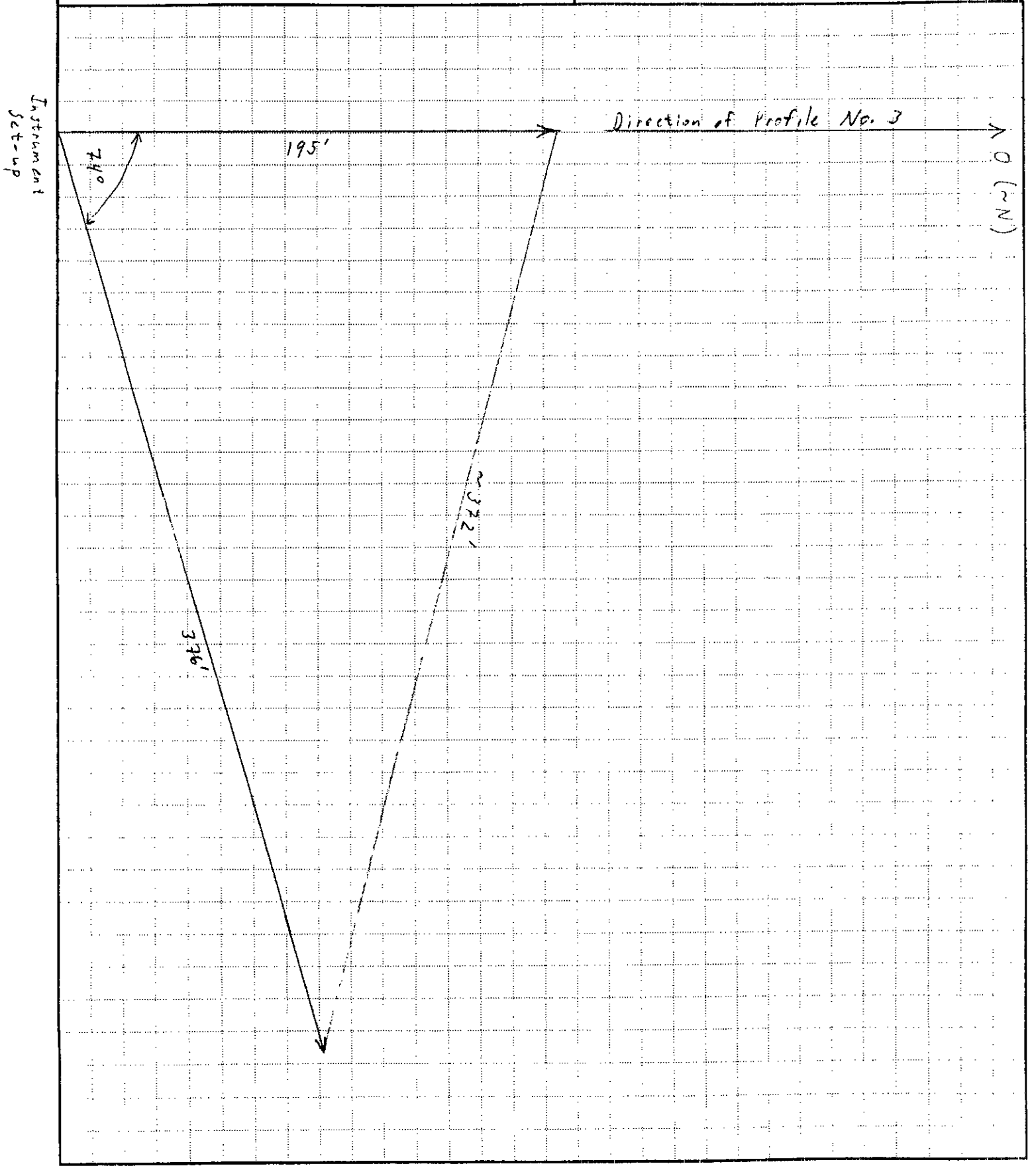
Gradient

Streambed Length =	924	ft
Elevation Difference =	2.2	ft
Gradient =	0.0024	

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: Downstream Gradient, Wildcat Ck
Computed: wje Date: 7/2/98
Checked: _____ Date: _____

Project/Proposal Name: CWCB Flood Docu.
Project/Proposal No.: XR004 Task: 54



Morgan County, Colorado
Wildcat Creek Flood Discharge Estimates
Colorado State Highway 52 at Wildcat Creek, Bridge No. C21H

26-Jun-98
Bill Ellett
Bill Owen
Weather is sunny and warm, light breeze
Instrument used: Wild NA20

Stream X-Section Survey Data and Calculations

Profile No. 1
Datum (ft) = 0

Approximately 100 feet upstream of bridge
Bearing = 0 degrees (~N)
Intrument Height (ft) = 4.78

Instrument at south high water mark
Surveyor: Bill Ellett
Rodman: Bill Owen

Readings (ft)					
Station No.	Bearing	Top	Middle	Bottom	Notes
0	0				Instrument set-up
1	0	6.78	6.70	6.62	
2	0	9.94	9.42	8.90	
3	0	14.90	14.22	13.55	Bottom of Creek
4	0	12.80	12.02	11.24	
5	0	7.26	5.82	4.38	
6	0	4.83	3.16	1.46	North high water mark
Gradient 1	306	14.17	13.24	12.31	Creek bottom
Gradient 2	294	15.82	14.07	12.29	Creek bottom, farthest upstream
Gradient 3	35	16.48	15.54	14.60	Creek bottom at bridge
Bridge Bottom	35				Bottom of bridge = 12.25 ft on rod

(Top - Bottom) 100	Calculations
Distance (ft)	Change in Elevation (ft)
0	0
16	-1.92
104	-4.64
135	-9.44
156	-7.24
288	-1.04
337	1.62
186	-8.46
353	-9.29
188	-10.76
188	1.49

Wetted perimeter = 340 ft (slope distance between high water marks)

X-Sectional Area of Flow Calculations (square feet)
(assume flow is confined between stations 1 and 5)

Polygon	Area (ft^2)
Area 1	15.36
Area 2	288.64
Area 3	218.24
Area 4	175.14
Area 5	546.48
Area 6	14.21
TOTAL	**1229**

(Sum of Area 2 - 5)

Gradient

Streambed Length =	924	ft
Elevation Difference =	2.2	ft
Gradient =	0.0024	

Morgan County, Colorado
Wildcat Creek Flood Discharge Estimates
Colorado State Highway 52 at Wildcat Creek, Bridge No. C21H

Stream X-Section Survey Data and Calculations

26-Jun-98
Bill Ellett
Bill Owen
Weather is sunny and warm, light breeze
Instrument used: Wild NA20

Profile No. 2
Datum (ft) = -1.95
(Relative to Profile No. 1)

Approximately 200 feet downstream of bridge
Bearing = 0 degrees (~N)
Intrument Height (ft) = 4.88

Instrument at south high water mark
Surveyor: Bill Ellett
Rodman: Bill Owen

Readings (ft)					
Station No.	Bearing	Top	Middle	Bottom	Notes
0	0				Instrument set-up
1	0	7.96	7.72	6.89	
2	0	9.38	8.81	8.24	
3	0	10.93	10.16	9.42	
4	0	13.78	13.00	12.25	
5	0	14.01	13.22	12.43	Creek bottom
6	0	13.26	12.36	11.46	
7	0	9.03	8.07	7.12	
8	0	8.60	7.38	6.17	
9	0	5.20	3.86	2.51	
Gradient 1	328	14.26	13.20	12.16	Creek bottom
Gradient 2	55	15.98	14.42	12.86	Creek bottom, farthest downstream
Gradient 3	315	15.08	13.66	12.23	Creek bottom at bridge
Bridge Bottom	315				Bottom of bridge = 12.22 ft on rod
Profile 3 Set-up	91	8.28	6.14	4.00	Shot to Profile No. 3 set-up

Calculations		
Distance (ft)	Change in Elevation (ft)	Relative to Profile No. 1
0	0	-1.95
107	-2.84	-4.79
114	-3.93	-5.88
151	-5.28	-7.23
153	-8.12	-10.07
158	-8.34	-10.29
180	-7.48	-9.43
191	-3.19	-5.14
243	-2.50	-4.45
269	1.02	-0.93
210	-8.32	-10.27
312	-9.54	-11.49
285	-8.78	-10.73
285	3.44	1.49
428	-1.26	-3.21

Wetted perimeter = 273 ft (slope distance between high water marks)

X-Sectional Area of Flow Calculations (square feet)
(assume flow is confined between stations 1 and 9 and half of Area 1 flows)

Polygon	Area (ft^2)
Area 1	151.94
Area 2	23.695
Area 3	170.385
Area 4	13.4
Area 5	41.15
Area 6	174.02
Area 7	58.685
Area 8	147.94
Area 9	19.24
TOTAL	**705**

$\frac{1}{2}$ Area 1 + Sum(Area 2 - 8)

Gradient

Streambed Length =	924	ft
Elevation Difference =	2.2	ft
Gradient =	0.0024	

Morgan County, Colorado
Wildcat Creek Flood Discharge Estimates
Colorado State Highway 52 at Wildcat Creek, Bridge No. C21H

Stream X-Section Survey Data and Calculations

26-Jun-98
Bill Ellett
Bill Owen
Weather is sunny and warm, light breeze
Instrument used: Wild NA20

Profile No. 3

Approximately 600 feet downstream of bridge
Bearing = 0 degrees (~N)
Intrument Height (ft) = 5.00

Instrument at south high water mark
Surveyor: Bill Owen
Rodman: Bill Ellett

Readings (ft)					
Station No.	Bearing	Top	Middle	Bottom	Notes
0	0				Instrument set-up
1	0	9.56	8.82	8.09	
2	0	11.32	10.42	9.57	
3	0	14.42	13.45	12.47	Creek bottom
4	0	13.06	12.01	10.98	
5	0	9.94	8.85	7.78	
6	0	5.57	4.36	3.08	
Gradient 1	74	15.42	13.57	11.66	Creek bottom, farthest downstream

Calculations	
Distance (ft)	Change in Elevation (ft)
0	0
147	-3.82
175	-5.42
195	-8.45
208	-7.01
216	-3.85
249	0.64
376	-8.57

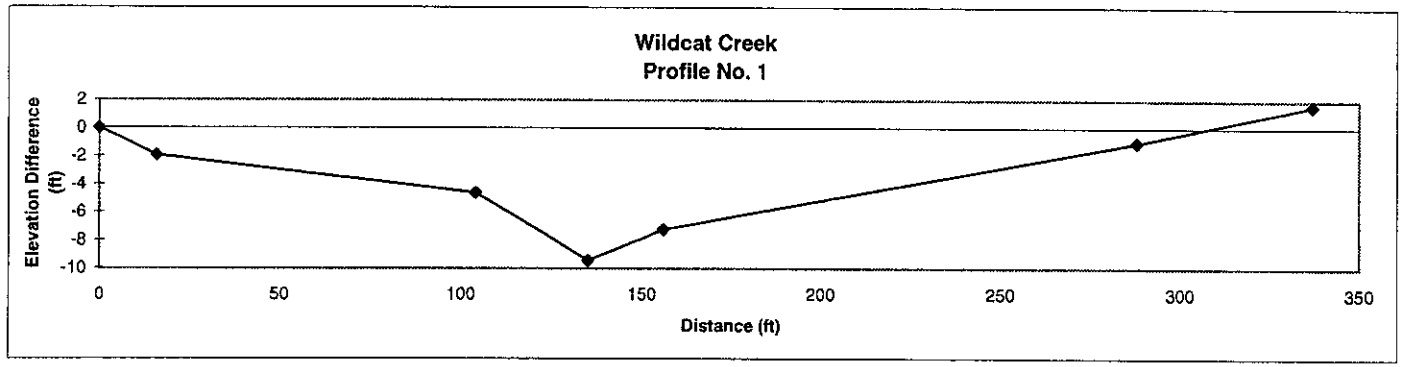
Wetted perimeter = 249 ft (slope distance between high water marks)

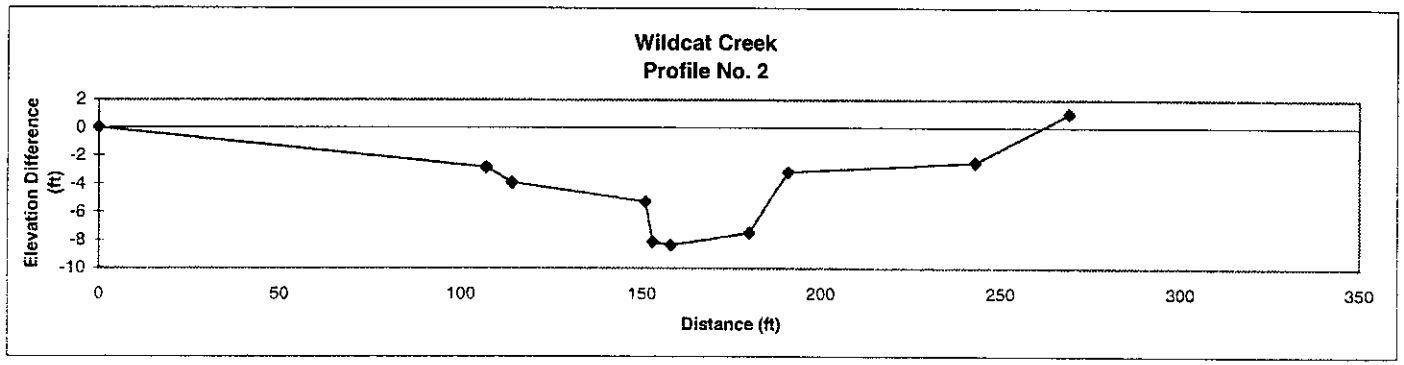
X-Sectional Area of Flow Calculations (square feet)
(assume flow is confined between stations 1 and 6 and half of Area 1 flows)

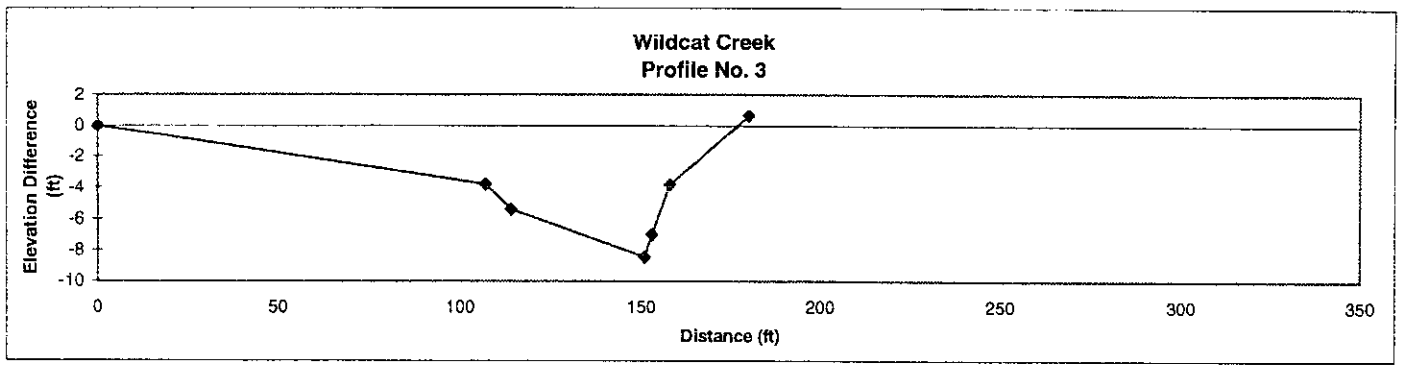
Polygon	Area (ft^2)
Area 1	280.77
Area 2	129.36
Area 3	138.7
Area 4	100.49
Area 5	43.44
Area 6	52.965
TOTAL	**605**

Gradient

Streambed Length =	924	ft
Elevation Difference =	2.2	ft
Gradient =	0.0024	


Wildcat Creek
Profile No. 1
Elevation Difference (ft)
2
0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300
350
Distance (ft)


Wildcat Creek
Profile No. 2
Elevation Difference (ft)
2
0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300
350
Distance (ft)


Wildcat Creek
Profile No. 3
Elevation Difference (ft)
2
0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300
350
Distance (ft)

Discharge Calculations

Manning Equation

$$Q = \frac{1.49}{n} AR^{2/3} s^{1/2}$$

Q = Discharge (cfs)
n = Manning number
A = X-Sectional area of flow (ft^2)
R = Wetted radius (ft) = A/P
s = gradient
P = Wetted perimeter (ft)

Profile No. 1

A = 1229 square feet
P = 340 feet
s = 0.0024

Manning number	Discharge (cfs)	Velocity (fps)
0.029	7,252	5.9
0.030	7,010	5.7
0.031	6,784	5.5
0.032	6,572	5.3
0.033	6,373	5.2
0.034	6,186	5.0
0.035	**6,009**	4.9

Profile No. 2

A = 705 square feet
P = 273 feet
s = 0.0024

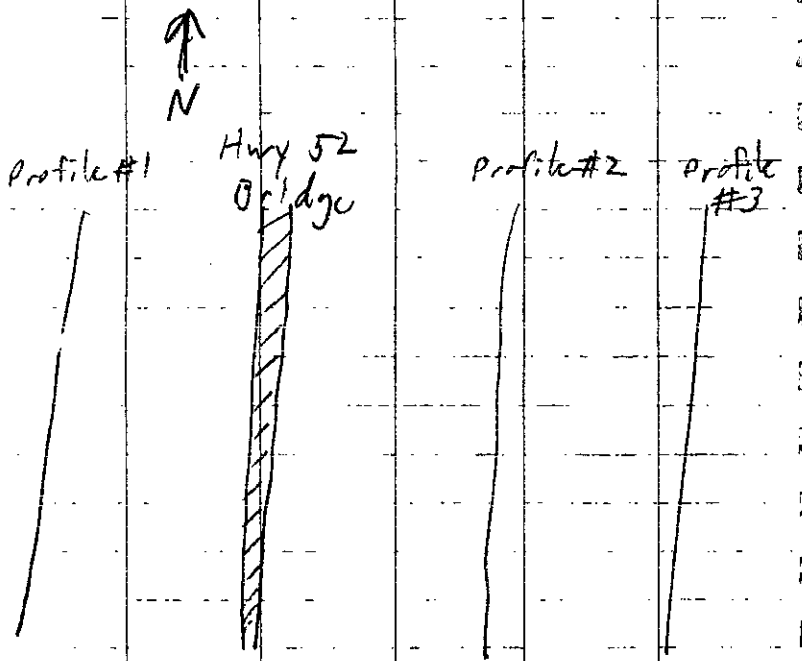
Manning number	Discharge (cfs)	Velocity (fps)
0.029	3,327	4.7
0.030	3,216	4.6
0.031	3,112	4.4
0.032	3,015	4.3
0.033	2,924	4.1
0.034	2,838	4.0
0.035	**2,757**	3.9

Profile No. 3

A = 605 square feet
P = 249 feet
s = 0.0024

Manning number	Discharge (cfs)	Velocity (fps)
0.029	2,741	4.5
0.030	2,650	4.4
0.031	2,564	4.2
0.032	2,484	4.1
0.033	2,409	4.0
0.034	2,338	3.9
0.035	**2,271**	3.8

6/26/98 Wildcat Ck



6/26/98 Bill Elliott - Instrument
Sunny & Warm Bill Owen - Rod
Profile #1, ~100' upstream of Hwy 52 Bridge (C 21 H)
H.I. = 4.78', Bearing = 0° (~N)
Instrument set-up @ south high water mark
Instrument is Wild NA20

Station	Top	Middle	Bottom	
1	6.78	6.70	6.62	
2	9.94	9.42	8.90	
3	14.90	14.22	13.55	Bottom of Ck
4	12.80	12.02	11.24	
5	7.26	5.82	4.38	
6	4.83	3.16	1.46	Hi Water mark

Gradient Shots

Bearing	Top	Middle	Bottom	
306°	14.17	13.24	12.31	
294°	15.82	14.07	12.29	Ck Center
35°	16.48	15.54	14.60	Bridge

Bottom of bridge = 12.25'
Wetted parimeter = 340'

Profile # 2 — 6/26/98

H.I. = 4.88' — sunny, warm

Instrument set-up @ southern Hi water mark

Bearing = 0°

Station	Hi	Mid	Low	Notes
1	7.96	7.42	6.89	
2	9.38	8.81	8.24	
3	10.93	10.16	9.42	
4	13.78	13.03	12.25	
5	14.01	13.22	12.43	ck Bottom
6	13.26	12.36	11.46	
7	9.03	8.07	7.12	
8	8.60	7.38	6.17	
9	5.20	3.86	2.51	

Gradient shots

Bearing	Hi	Mid	Low	Notes
328°	14.26	13.20	12.16	Bottom
55°	15.98	14.42	12.86	Bottom
91°	8.28	6.14	4.00	to Set-up for Profile #3
315° (Bridge)	15.09	13.66	12.23	

Bottom of Bridge = 12.22

Wetted parimeter = 273'

6/26/98

Profile #3

Height = 5.00'

Instrument set up @ southern high watermark (S-WM)

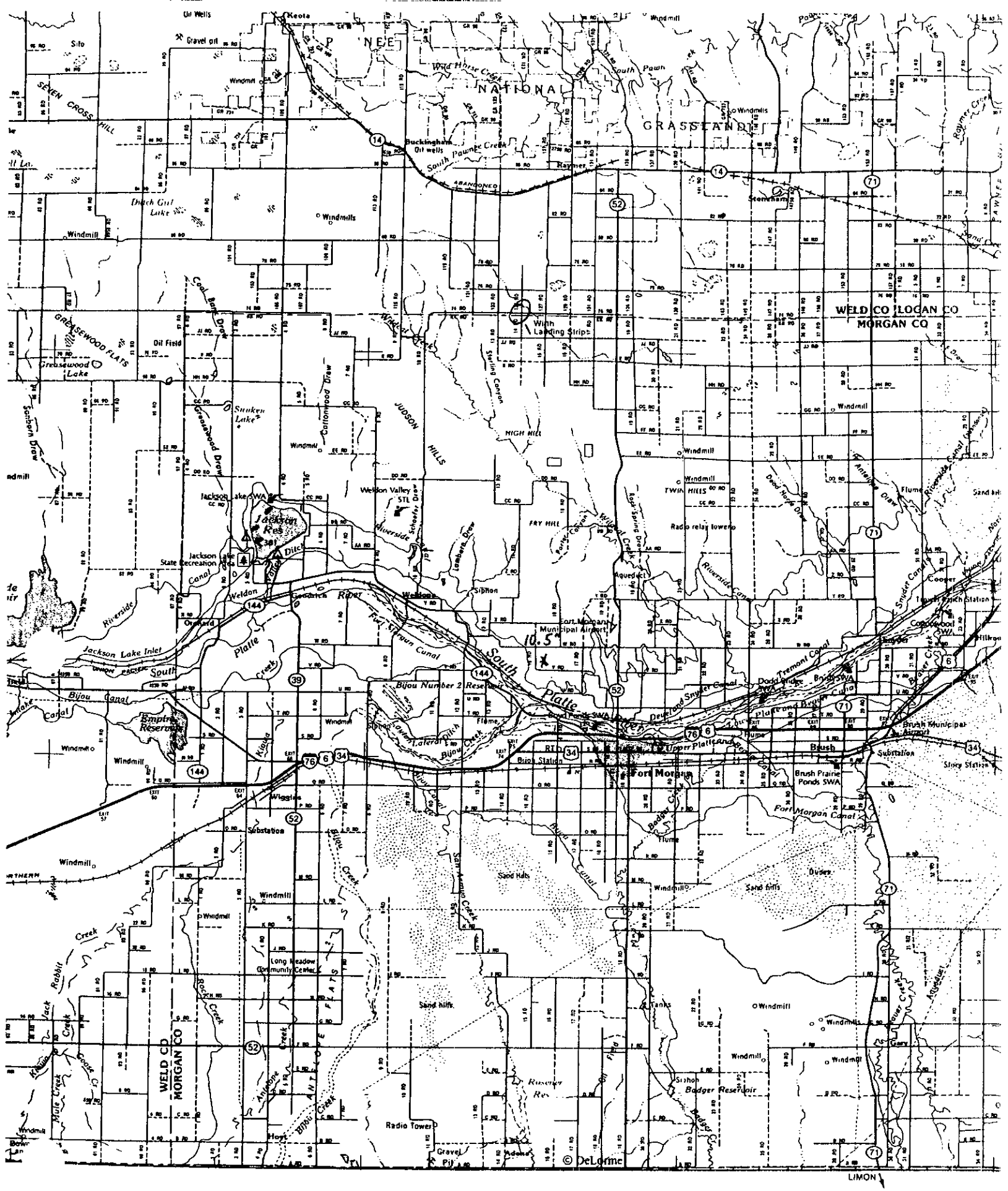
Bearing = 0°

Station	Hi	Med	Low	Notes
1	9.56	8.82	8.09	~~S-H-W-M~~
2	9.57	10.42	11.32	
3	14.42	13.45	12.47	bottom
4	13.06	12.01	10.98	
5	9.94	8.85	7.78	
6	5.57	4.33	3.08	

Gradient shots

Bearing	Hi	Mid	Low	Notes
74	15.42	13.37	11.63	Bottom

Wetted perimeter = 249'



Continue on Page 96

KILOMETERS 5 0 5 10 15 20

MILES 1 0 1 2 3 4 5 6 7 8 9 10 11 12

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/22/98
Call Placed/Received by: Bill Owen
Spoke With: Kathy Ehlrich
Company/Affiliation: Otero County Land Use Coordinator
Phone no.: (719) 383-3035
Project No.: D479

Comments:

- most of the rain fell in dry arroyos which ~~were~~ un-named
- the most significant damage occurred in Horse Creek basin (Fort Lyon Storage Canal breached)
- 4-5 roads in the county were damaged; damage to bridges were minimal
- only mitigation measures currently in use are jetty jacks along the Arkansas River
- the rains that fell ~~were~~ were localized, but heavy
- CR 33 across Horse Creek ~~were~~ was damaged (pipe + 100-feet of roadway)
- the end-wall of a bridge on Timpas Creek was also damaged
- no evacuations were conducted

Signature Bill Owen

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Kathy Ehrlich

FAX NO.: (719) 383-3090

FROM: Bill Owen

DATE: June 18, 1998

NO. OF PAGES: We are sending 2 Page(s) (Including this Page)

SUBJECT: 1997 Flooding in Otero County

COMMENTS:

Ms. Ehlich:

I have attached a summary of the questions I would like to ask you and Ken Parker concerning the floods that occurred in your County during the summer of 1997. I have added a few examples to some questions that may seem a little obscure.

I plan on contacting you at 8:30 Monday morning (June 22). Hopefully, I can catch both of you in the office at that time, and we can go over these questions then.

Thank you for your assistance in completing this flood documentation study.

Sincerely,

Bill Owen

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY:
DATE:
SUBJECT: 1997 Flooding

INDIVIDUAL:
AFFILIATION: Otero County
PHONE #:

---

1. *Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.*

2. *Any previous/recent flood mitigation efforts that reduced damages?*

3. *Any future mitigation needs as a result of the flooding?*

4. *Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments, culverts plugged, etc.)?*

5. *Do you have any photos available? Are the photos in digital format?*

6. *What are typical local flooding problems and their locations?*

7. *Locations or Reaches of Flooded Streams?*

   (I have county damage reports that specify road crossings where damages occur, but no information concerning the extent of the inundated areas or length of the stream channel/canal that overtopped.)

8. *County (or other government agency) emergency response effort as a result of the flooding?*

   (Examples may include road & bridge crew erecting barricades, sheriff's office providing traffic control, citizens volunteering to establish temporary levees, etc.)

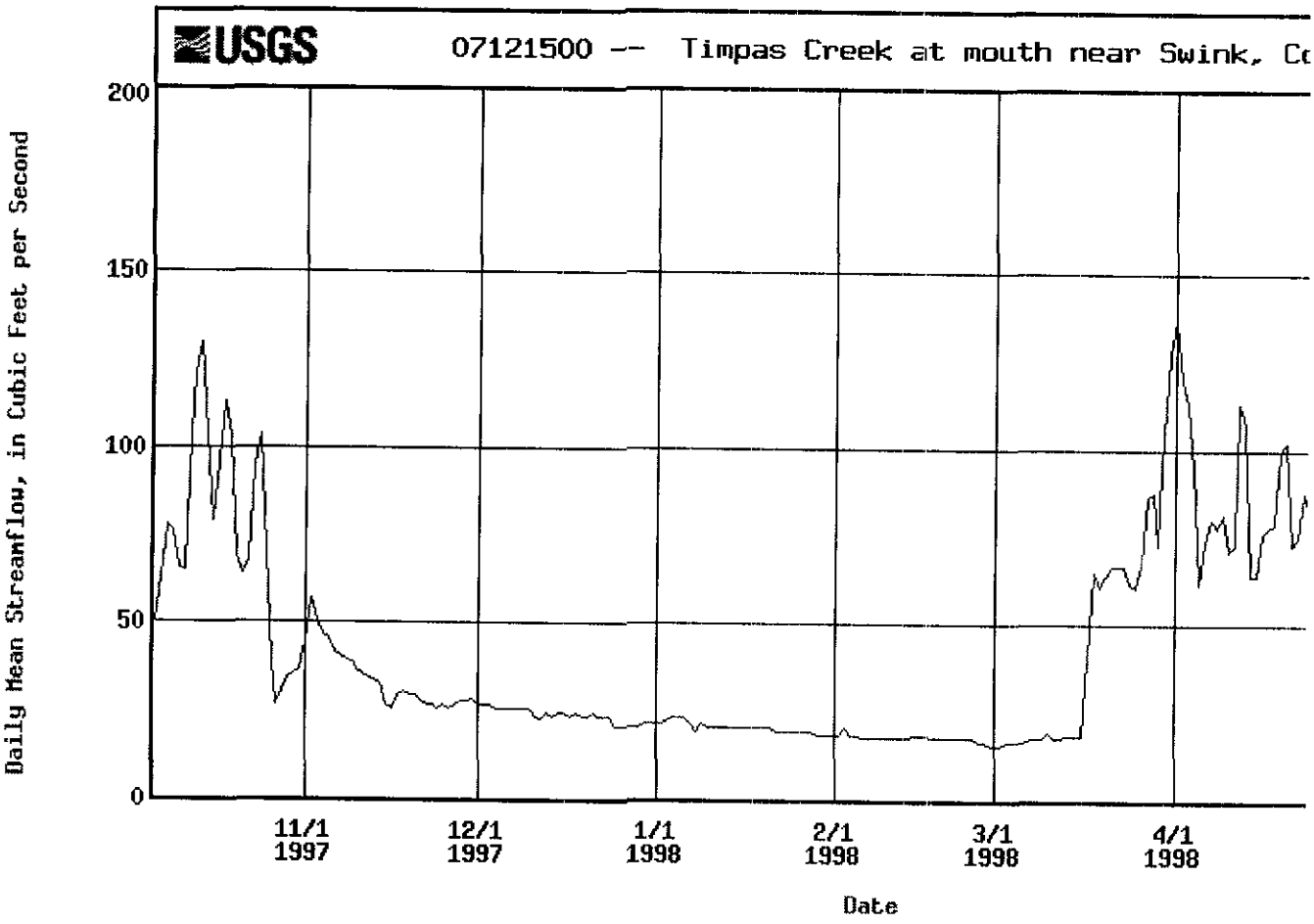
2. Federal Data

USGS

Provisional current year water data

PROVISIONAL DATA SUBJECT TO REVISION

07121500-- Timpas Creek at mouth near Swink, Co.



Retrieve a Text Table of Data

Station Description

STATION.--07121500 TIMPAS CREEK AT MOUTH NEAR SWINK, CO.

LOCATION.--Lat 38°00'11", long 103°39'20", in NW1/4SW1/4 sec.35, T.23 S., R.56 W., Otero County, Hydrologic Unit 11020005, on left bank 40 ft shoreward, 125 ft upstream from left end of 23rd Rd. Bridge, 1.7 mi southwest of Swink, and 2.9 mi upstream from mouth.

DRAINAGE AREA.--496 mi2.

PERIOD OF RECORD.--January 1922 to September 1925, March 1968 to current

year.

REVISED RECORDS.--WDR CO 76-1: 1975.

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 4,120 ft above sea level, from topographic map. Prior to May 29, 1975, at site 140 ft downstream at datum 0.13 ft, lower.

REMARKS.--Records good except for estimated daily discharges, which are poor. Natur flow of stream affected by minor diversions upstream from station for irrigation, water imported from Arkansas River and Crooked Arroyo for irrigat upstream from station, and return flow from irrigated areas. Several measurem of specific conductance and water temperature were obtained and are published in the "Supplemental Water-Quality Data For Gaging Stations" section of this report.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1922, 21,400 ft3/s, June 17, 1965.

Maintained by: WebMaster@maildcolka.cr.usgs.gov
Hydrologic Information: co.data@maildcolka.cr.usgs.gov
Provisional Current Year Water Data page URL: http://nwis-colo.cr.usgs.gov/nwis/currentWY.html
Colorado District Home page URL: http://webserver.cr.usgs.gov/

Please direct questions or comments to:

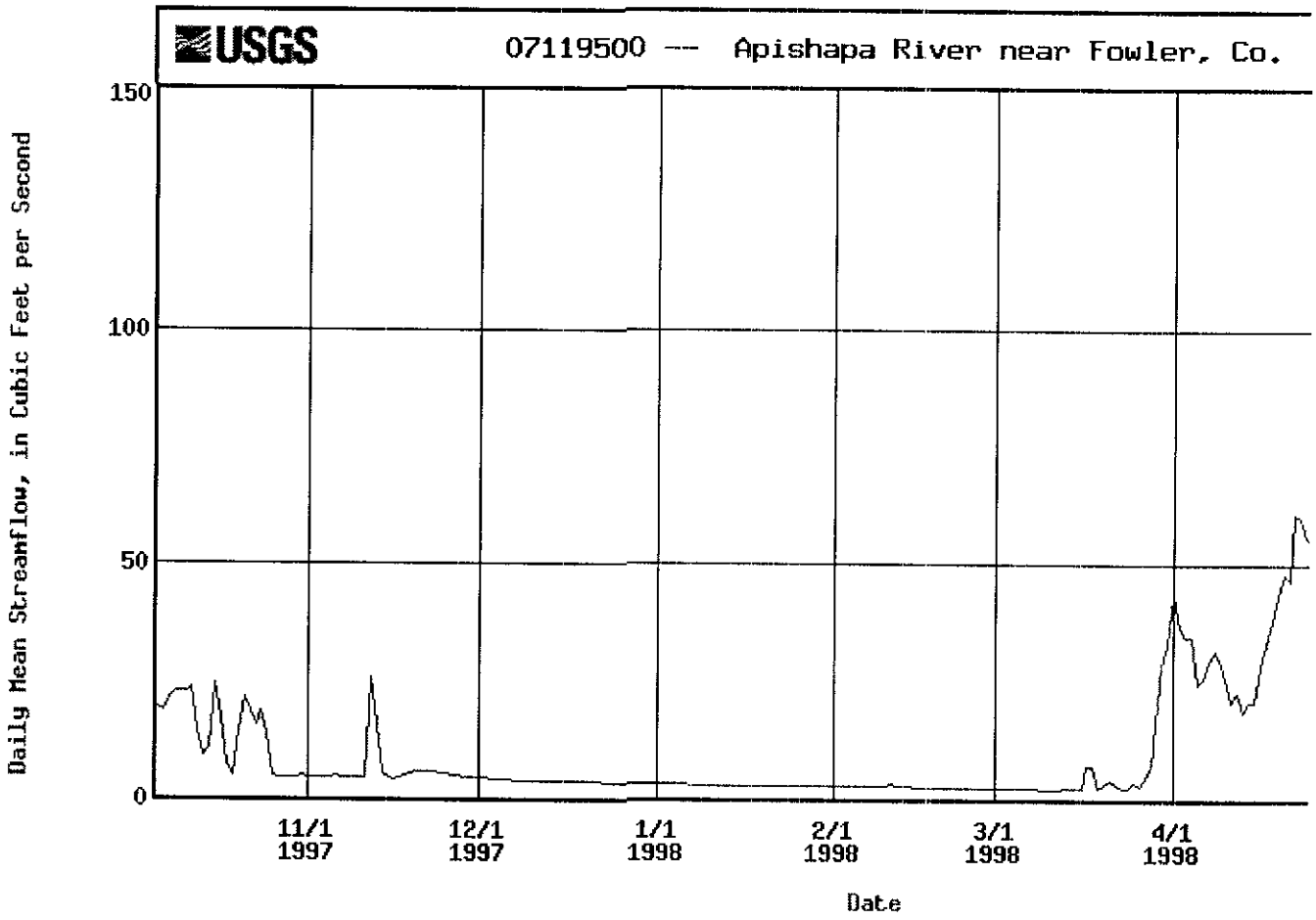
District Chief
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225
Telephone: (303) 236-4882, ext. 258
Fax: (303) 236-4912
Office hours: 8:00 a.m. to 4:30 p.m. Mountain Time

USGS

Provisional current year water data

PROVISIONAL DATA SUBJECT TO REVISION

07119500-- Apishapa River near Fowler, Co.



Retrieve a Text Table of Data

Station Description

STATION.--07119500 APISHAPA RIVER NEAR FOWLER, CO.

LOCATION.--Lat 38°05'28", long 103°58'52", in SE1/4NW1/4 sec.35, T.22 S., R.59 W, Otero Country, Hydrologic Unit 11020007, near right bank on downstream side of county highway bridge, 3.5 mi southeast of Fowler, and 5.4 mi upstream from mouth.

DRAINAGE AREA.--1,125 mi2.

PERIOD OF RECORD.--Streamflow records, April 1922 to September 1925, May 1939

to current year. Monthly discharge only for some periods, published in WSP 1311. Water-quality data available, November 1963 to September 1967, Janu to April 1969.

REVISED RECORDS.--WSP 957: 1939, 1941. WSP 1117: Drainage area. WSP 1241: 1923(M). WRD Colo. 1974: 1973(M).

GAGE.--Water-stage recorder with satellite telemetry and crest-stage gages. Datum c is 4,317.05 ft above sea level. Prior to Aug. 29, 1923, at site 3 mi downstream at different datum. Aug. 29, 1923 to Sept. 30, 1925, at present site at different datum. May 27, 1939 to July 30, 1940, at present site at different datum. July 30, 1940 to Sept. 30, 1985, at datum 2.0 ft, higher.

REMARKS.--Records good except for Oct. 11 to Dec. 13 and Mar. 5-20, which are fair, and estimated daily discharges, which are poor. Waste water from Oxford Farmers Co., and Rocky Ford Highline canals enters river upstream from station. Diversions upstream from station for irri of about 4,700 acres. Several measurements of specific conductance and water temperature were obtained and are published in the "Supplemental Water-Qualit For Gaging Stations" section of this report.

Maintained by: WebMaster@maildcolka.cr.usgs.gov
Hydrologic Information: co.data@maildcolka.cr.usgs.gov
Provisional Current Year Water Data page URL: http://nwis-colo.cr.usgs.gov/nwis/currentWY.html
Colorado District Home page URL: http://webserver.cr.usgs.gov/

Please direct questions or comments to:

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Lakewood, CO 80225
Telephone: (303) 236-4882, ext. 258
Fax: (303) 236-4912
Office hours: 8:00 a.m. to 4:30 p.m. Mountain Time

STATION (Climatological) LA JUNTA | (River Station, if different) 15 | MONTH MAR | 19 97

STATE COLORADO | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 5 A.M. 5 P.M. | PRECIPITATION | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	53	24	25	0														
2	49	22	26	0														
3	67	26	39	0														
4	65	23	23	0														
5	51	15	15	0.09	0.3	.3												
6	56	10	26	0														
7	71	24	32	0														
8	73	28	33	0														
9	81	32	33	0														
10	62	29	29	0														
11	81	28	33	0														
12	82	33	41	0														
13	84	32	33	0														
14	53	24	24	0														
15	46	15	15	0														
16	48	15	27	0														
17	80	26	43	0														
18	78	40	40	0														
19	70	27	28	0														
20	78	27	42	0														
21	86	41	43	0														
22	78	33	33	0														
23	79	32	35	0														
24	73	32	46	0														
25	66	28	29	.21		T												
26	53	27	29	0														
27	75	26	42	0														
28	80	31	32	0														
29	70	28	29	0														
30	CONT			0														
31	76	24	37	0														
SUM			SUM	30														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

	Fog	Ice Pel	Glaze	Thund	Hail	Dam. Winds
OBSERVER						

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO
05-4724-01

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological) LA JUNTA	(River Station if different) LS	MONTH APR	19 97
STATE COLORADO	COUNTY Otero	RIVER	
TIME (local) OF OBSERVATION RIVER	TEMP 5AM	PRECIPITATION 5AM	STANDARD TIME IN USE MST
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A M NOON P M	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc..)
1	77	35	47	0														
2	76	37	38	0														
3	49	34	36	0														
4	60	36	37	0														
5	70	33	34	T		T												
6	55	21	22	.09		.T												
7	62	22	28	0														
8	69	24	25	0														
9	43	21	29	0														
10	67	26	26	0														
11	27	17	17	.21		3												
12	31	11	11	0														
13	37	10	21	0														
14	58	20	28	0														
15	71	25	31	0														
16	76	30	41	0														
17	77	37	39	0														
18	86	37	48	0														
19	87	39	44	0														
20	85	44	46	0														
21	84	46	47	0														
22	76	38	40	T														
23	65	33	33	0														
24	69	32	44	.36														
25	44	37	37	1.07														
26	47	33	33	0														
27	62	32	35	0														
28	77	34	45	0														
29	81	43	44	T														
30	83	43	44	.10														
31																		
SUM			SUM	2.43														

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING 1.83 DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of [illegible]ooth ice.
D. Ice gorge at
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER [signature]

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO
05-4724-01

STATION (Climatological) La Junta 1S (River Station, if different) | MONTH May | 19 97

STATE COLORADO | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 5 AM | PRECIPITATION 5 AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft | FLOOD STAGE Ft | NORMAL POOL STAGE Ft

WS FORM B-91 (12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (∿∿∿) through hours precipitation probably occurred unobserved A.M. 1 2 3 4 5 6 7 8 9 10 11 NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	71	43	43	Ø													
2	77	40	43	Ø													
3	65	35	36	Ø													
4	76	36	41	Ø													
5	90	41	49	Ø													
6	81	48	56	Ø													
7	90	48	49	Ø													
8	84	48	51	Ø													
9	62	44	44	Ø													
10	80	40	42	Ø													
11	86	42	51	Ø													
12	76	43	43	Ø													
13	76	42	45	Ø													
14	89	44	45	Ø													
15	85	44	51	Ø													
16	84	45	52	Ø													
17	92	49	54	Ø													
18	97	54	58	Ø													
19	85	42	43	.18								✓					
20	67	43	45	Ø													
21	88	44	57	Ø													
22	83	55	57	Ø													
23	78	51	52	Ø													
24	82	47	48	Ø													
25	85	47	46	Ø													
26	52	52	52	Ø													
27	79	42	42	Ø													
28	78	43	49	Ø													
29	86	48	54	Ø	R												
30	77	52	54	.15													
31	83	53	55	Ø													
SUM			SUM	1.33													

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open r
C. Upper surface of
D. Ice gorge above s
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER C. Graves

SU | OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-4721-01

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): LA JUNTA 1S (River Station, if different)
MONTH: JUNE 19 97
STATE: COLORADO
COUNTY: Otero
RIVER:
TIME (local) OF OBSERVATION: 5AM
RIVER: 5PM
STANDARD TIME IN USE: MST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	92	52	53	0													
2	98	52	63	0													
3	83	57	62	0													
4	91	55	55	0													
5	85	53	58	0													
6	96	56	58	0						✓							
7	85	57	58	1.97						✓							
8	79	57	58	0						✓							
9	81	54	55	.40						✓							
10	73	54	55	0						✓							
11	86	54	58	.05			✓			✓							
12	92	58	62	0						✓							
13	88	54	55	.40													
14	83	55	60	0													
15	85	56	57	0													
16	84	54	54	0													
17	80	53	55	0													
18	90	52	59	0													
19	98	58	64	0													
20	100	62	67	0													
21	103	64	64	0													
22	94	61	62	0													
23	98	62	63	0													
24	99	61	61	0													
25	98	60	61	0													
26	98	55	55	0													
27	95	59	59	0													
28	99	56	61	0													
29	100	62	63	0													
30	96	59	59	.27													
31																	
SUM			SUM	2.89													

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed and a waved line (~~~) through hours precipitation probably occured unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above.
E. Ice gorge below gage
F. Shore Ice.
G. Floating Ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

OBSERVER: C Stevens

SUPERVISING OFFICE: WSO PUEBLO, COLORADO

STATION INDEX NO: 05-4724-01

STATION (Climatological) LA JUNTA | (River Station, if different) | MONTH JULY | 1997

STATE COLORADO | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 5AM | PRECIPITATION 5AM | STANDARD TIME (LOCAL) MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	103	56	77	Ø														
2	103	54	54	Ø														
3	91	57	62	Ø														
4				Ø														
5	89	58	61	Ø														
6	96	53	58	Ø												✓		HIGH WINDS ABT 6:30 AM AS clouds moved thru
7	95	58	62	Ø														
8	100	60	63	Ø														
9	98	60	60	.01														
10	98	59	63	Ø														
11	97	60	69	Ø														
12	97	58	65	Ø														
13	99	61	61	Ø														
14	97	61	61	Ø														
15	99	60	66	Ø														
16	104	62	69	Ø														
17	106	64	67	Ø														
18	105	63	63	Ø														
19	100	60	62	Ø														
20	97	61	61	Ø														
21	86	63	63	.44														
22	95	63	64	Ø														
23	97	63	72	Ø														
24	103	70	71	Ø														
25	107	68	71	Ø														
26	103	67	67	Ø														
27	103	67	67	Ø														
28	101	67	67	Ø														
29	92	61	64	.49														
30	91	64	66	Ø														
31	91	64	71	Ø														
SUM			SUM	1.93														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of [illegible]oth ice.
D. Ice gorge a[illegible]
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

	Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds
OBSERVER						

C. Graves

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO
05-4724-01

STATION (Climatological) LA JUNTA 1S (River Station, if different) | MONTH AUG | 19 97

STATE COLORADO | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 5A.M | PRECIPITATION 5AM | STANDARD TIME IN USE MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved A.M. NOON P.M	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc..)
1	96	66	67	0														
2	97	66	67	0														
3	96	63	64	T														
4	93	63	66	0														
5	94	63	63	.38														
6	79	63	63	.64														
7	71	57	58	.14														
8	84	58	59	0														
9	94	58	64	0														
10	87	60	60	.20														
11	78	60	61	.32														
12	83	60	60	.88														
13	86	60	65	0														
14	92	60	62	.08														
15	91	60	61	0														
16	97	59	65	0														
17	93	62	62	0														
18	84	62	68	0														
19	88	58	59	0														
20	95	58	65	0														
21	95	61	62	.10														
22	98	59	64	0														
23	93	61	63	0														
24	98	62	62	0														
25	99	61	66	0														
26	97	63	67	0														
27	99	66	66	0														
28	98	65	66	0														
29	101	63	66	0														
30	95	58	59	0														
31	91	58	60	0														
SUM			SUM	2.74														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge abov
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER

SUPERVISING OFFICE
WSO PUEBLO, COLORADO

STATION INDEX NO.
05-4724-01

WS FORM B-91
(12-93)

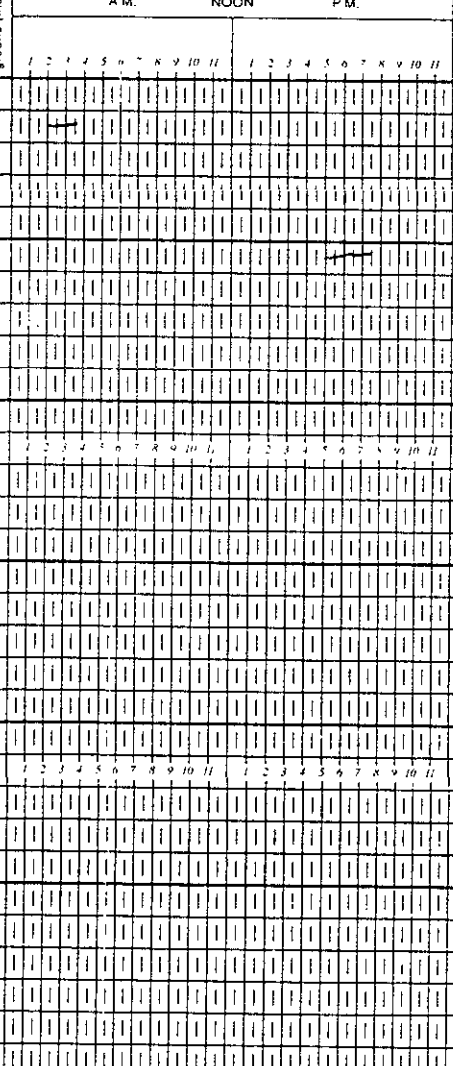
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): LA JUNTA (River Station, if different): 15
MONTH: SEPT 19 97
STATE: COLORADO
COUNTY: Otero
RIVER:
TIME (local) OF OBSERVATION: RIVER: 8AM PRECIPITATION: 8AM
STANDARD TIME IN USE: MST
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snowy, ice pellets, hail, ice on ground (ins.)
1	92	59	64	0		
2	95	64	67	.14		
3	96	65	65	0		
4	86	58	58	0		
5	93	57	65	0		
6	93	60	60	0		
7	95	58	58	.56		
8	93	57	58	0		
9	94	56	60	0		
10	74	53	53	0		
11	90	53	57	0		
12	94	54	63	.27		
13	92	55	55	0		
14	94	55	66	0		
15	95	61	61	0		
16	99	56	72	0		
17	92	56	56	0		
18	92	54	66	0		
19	96	59	60	0		
20	84	49	49	0		
21	51	46	47	.30		
22	66	47	54	0		
23	78	52	53	0		
24	69	46	46	0		
25	75	45	45	0		
26	87	44	53	0		
27	95	51	58	0		
28	91	56	56	0		
29	82	52	52	0		
30	89	48	51	0		
31						
SUM			SUM	1.27		

PRECIPITATION — Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.



WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

DATE	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

RIVER STAGE

DATE	CONDITION	GAGE READING AT ___ A.M	TENDENCY	REMARKS (Special observations, etc..)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
SUM				

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge at
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds			

OBSERVER: Leave

SUPERVISING OFFICE: WSO PUEBLO, COLORADO

STATION INDEX NO: 05-4724-01

STATION (Climatological): LA JUNTA | (River Station, if different): 15 | MONTH: Oct | 19 97

STATE: COLORADO | COUNTY: Otero | RIVER:

TIME (local) OF OBSERVATION RIVER: | TEMP: 5AM | PRECIPITATION: 5AM | STANDARD TIME IN USE: MST

TYPE OF RIVER GAGE: | ELEVATION OF RIVER GAGE ZERO Ft.: | FLOOD STAGE Ft.: | NORMAL POOL STAGE Ft.:

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	90	49	59	0													
2	93	54	64	0													
3	91	55	65	0													
4	85	48	48	0													
5	91	47	47	0													
6	95	47	61	0													
7	81	50	57	0													
8	87	54	58	.34						✓		✓					
9																	
10	77	41	61	0													
11	85	60	65	0						✓	✓	✓					
12	84	47	47	1.07													
13	50	35	36	.30													
14	64	34	35	0													
15	75	33	39	0													
16	77	38	39	0													
17	74	36	38	0													
18	80	36	44	0													
19	83	42	44	0													
20	59	40	44	0													
21	63	42	42	0													
22	65	39	40	0													
23	78	36	43	0													
24	76	41	46	0													
25	61	19	19	1.29	8.0	6											
26	24	10	10	1.66	20.0	23											
27	32	8	14	0		21											
28	43	11	32	0		17											
29	45	16	19	0		14											
30	48	16	33	0		11											
31	54	28	35	0		9											
SUM			SUM	4.31	28.0		Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds					

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

(4.7)

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER: C. Steven

SUPERVISING OFFICER: WSO PUEBLO, COLORADO

STATION INDEX NO.: 05-4724-1

STATION (Climatological) Fowler (River Station, if different) | MONTH May | 19 97

STATE Colo | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. | PRECIPITATION 7:00 AM | STANDARD TIME IN USE MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Mark 'X' for all types occurring each day Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				0													
9				0													
10				0													
11				0													
12				0													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				.32													
20				0													
21				.05													
22				.22													
23				.28													
24				0													
25				0													
26				.25													
27				0													
28				0													
29				0													
30				.47													Pea size hail covered ground
31																	
SUM			SUM	1.36													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge abo
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER Edward Zellhaus

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-3079-1

STATION (Climatological) Fowler (River Station if different)

MONTH June 1997

STATE Colo

COUNTY Otero

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP

PRECIPITATION 7:00AM

STANDARD TIME IN USE MST

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets (ins and tenths)	At Ob Snow, ice pellets, hail, ice on ground (hrs.)
1				0		
2				0		
3				0		
4				0		
5				0		
6						
7				.88		
8				.06		
9				.15		
10				.11		
11				T		
12				T		
13				.04		
14				0		
15				0		
16				0		
17				0		
18				0		
19				.13		
20				0		
21				0		
22				0		
23				0		
24				0		
25				.20		
26				0		
27				0		
28				0		
29				0		
30				0		
31						
SUM			SUM	1.57		

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A M NOON P M

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

WEATHER (Calendar Day) — Mark 'X' for all types occurring each day.

Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above

RIVER STAGE

CONDITION	GAGE READING AT ___ A.M.	TENDENCY

REMARKS (Special observations, etc.)

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open
C. Upper surface o
D. Ice gorge above
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund.	Hail	Dam. Winds

OBSERVER Edward F. Dalhaus

S... OFFICE ...O PUEBLO, COLORADO

STATION INDEX NO 05-3079-1

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological)	(River Station, if different)	MONTH	19
Fowler		July	97

STATE	COUNTY	RIVER
Colo	Otero	

TIME (local) OF OBSERVATION RIVER	TEMP	PRECIPITATION	STANDARD TIME IN USE

TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO	FLOOD STAGE	NORMAL POOL STAGE
	Ft.	Ft.	Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				0													
9				0													
10				0													
11				0													
12				0													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				0													
20				0													
21				.03													
22				0													
23				0													
24				0													
25				0													
26				0													
27				.02													
28				0													
29				1.23													
30				0													
31				0													
SUM			SUM	1.25			Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds					

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1.28

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER: [signature]

SUPERVISING OFFICE: ...SO PUEBLO, COLORADO

STATION INDEX NO: 05-3079-1

STATION (Climatological): Fowler | (River Station, if different) | MONTH: April | 1997

STATE: Colo | COUNTY: Otero | RIVER:

TIME (local) OF OBSERVATION: 7:00AM | RIVER | TEMP. | PRECIPITATION | STANDARD TIME IN USE: MST

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0													
2				0													
3				0													
4				0													
5				1.80													
6				.32													
7				.63													
8				0													
9				0													
10				.32													
11				1.03													
12				.65													
13				0													Strong winds & Lightning
14				.84													
15				0													
16				0													
17				0													
18				.98													
19				0													
20				0													
21				0													
22				0													
23				0													
24				0													
25				0													
26				0													
27				.04													
28				0													
29				0													
30				0													
31				0													
SUM			SUM	5.11													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M

Mark 'X' for all types occurring each day.

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface with ice.
D. Ice gorge.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds

OBSERVER: Edward R Fellhauer

SUPERVISING OFFICE: NSO PUEBLO, COLORADO

STATION INDEX NO: 05-3079-1

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): FOWLER (River Station if different):
MONTH: Sept. 19 97
STATE: COLO
COUNTY: Otero
RIVER:
TIME (local) OF OBSERVATION:
TEMP:
PRECIPITATION: 7:00 AM.
STANDARD TIME IN USE: MTN.
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft.
FLOOD STAGE: Ft.
NORMAL POOL STAGE: Ft.

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc (Ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (Ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A M NOON P M 1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				T													
8				T													
9				0													
10				0													
11				0													
12				.10													
13				0													
14				0													
15				0													
16				0													
17				0													
18				0													
19				0													
20				.31													
21				.40													
22				0													
23				.15													
24				0													
25				0													
26				0													
27				0													
28				0													
29				0													
30				0													
31																	
SUM			SUM	.96													
				✓													

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds

OBSERVER: Edward P. Dillman

SUPERVISING OFFICE: WSO PUEBLO, COLORADO

STATION INDEX NO: 05-3079-1

STATION (Climatological): Fowler (River Station if different)

MONTH: Oct 19 92

STATE: Colo

COUNTY: Otero

RIVER:

TIME (local) OF OBSERVATION:

TEMP.:

PRECIPITATION: 7:00AM

STANDARD TIME IN USE: MTn

TYPE OF RIVER GAGE:

ELEVATION OF RIVER GAGE ZERO: Ft.

FLOOD STAGE: Ft.

NORMAL POOL STAGE: Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1				0													
2				0													
3				0													
4				0													
5				0													
6				0													
7				0													
8				.05													
9				0													
10				0													
11				0													Windy
12				.20													
13				.12													
14				0													
15				0													
16				0													
17				0													
18				0													
19				0													
20				0													
21				0													
22				0													
23				0													
24				0													
25				.90	4.0	4.0											Rain changed To Snow About 5:30 PM 24TH Stormy winds
26				.76	6.0	10.0											With 4-5' drifts
27				0		9											
28				0		7											
29				0		4											
30				0		2											
31				0		1											
SUM			SUM	2.03	10.0												

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11

Mark 'X' for all types occurring each day.

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog | Ice Pel. | Glaze | Thund | Hail | Dam. Winds

OBSERVER: Edward F Dellbrugge

SUPERVISING OFFICE: WSO PUEBLO, COLORADO

STATION INDEX NO.: 05-3079-1

STATION (Climatological) La Junta 20 So. (River Station if different)
MONTH May 19 97
STATE Colorado
COUNTY Otero
RIVER
TIME (local) OF OBSERVATION
TEMP 7:00 AM
PRECIPITATION 7:00 AM
STANDARD TIME IN USE MST
TYPE OF RIVER GAGE
ELEVATION OF RIVER GAGE ZERO Ft.
FLOOD STAGE Ft.
NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A M NOON P M	WEATHER (Calendar Day) Mark 'X' for all types occurring each day Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A M	TENDENCY	REMARKS (Special observations, etc.)
1	65	38	46	0														
2	81	37	42	0														
3	63	40	45	T														
4	73	40	46	0														
5	86	41	56	0														
6	76	45	63	0														
7	87	56	61	.05							X							
8	82	49	52	.02														
9	59	42	49	0														
10	77	48	55	0														
11	84	49	58	0														
12	73	43	45	0														
13	74	44	57	0														
14	88	45	56	0														
15	85	46	54	.03							X							
16	82	54	63	0														
17	90	58	65	0														
18	75	61	69	0														
19	93	43	44	.06							X							
20	65	48	56	0														
21	79	56	61	0														
22	83	47	59	0														
23	80	52	59	.23							X							
24	81	49	57	0														
25	81	49	64	0														
26	82	54	62	T							X							
27	79	44	53	0														
28	79	50	54	T														
29	82	54	61	0														
30	80	54	58	.09				X			X							
31	81	55	63	0														
SUM			SUM	1.48														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at
C. Upper surface of s
D. Ice gorge above ga
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam. Winds

OBSERVER Dorothy Simmons

SUP OFFICE PUEBLO, COLORADO

STATION INDEX NO 05-4726-01

STATION (Climatological) La Junta 20 So. (River Station, if different)

MONTH June 1997

STATE Colorado

COUNTY Otero

RIVER

TIME (local) OF OBSERVATION RIVER

TEMP 7:00 AM

PRECIPITATION 7:00AM

STANDARD TIME IN USE M

TYPE OF RIVER GAGE

ELEVATION OF RIVER GAGE ZERO Ft.

FLOOD STAGE Ft.

NORMAL POOL STAGE Ft.

WS FORM B-91
(12-93)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins and hundredths)	Snow, ice pellets (ins and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	92	53	64	0													
2	98	60	62	.08			X			X							
3	81	59	63	T													
4	87	53	62	0													
5	86	59	62	0													
6	98	58	60	0			X			X							
7	83	58	63	.42			X			X							
8	79	57	60	.03													
9	80	53	59	.70						X							
10	76	54	59	.06						X							
11	82	56	60	0						X							
12	92	59	63	0													
13	90	55	60	T													
14	83	59	67	0													
15	86	60	65	0													
16	85	52	60	.22						X							
17	75	54	62	.15						X							
18	88	55	68	0													
19	97	61	72	0													
20	101	71	74	0													
21	104	65	73	0													
22	94	61	74	0													
23	98	64	70	0													
24	99	64	69	0													
25	96	56	64	.03						X							
26	90	55	60	0						X							
27	93	60	70	0						X							
28	100	56	70	0													
29	102	61	67	0													
30	96	63	70	0						X							
31																	
SUM			SUM	1.39													

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved.

A.M. NOON P.M.

1 2 3 4 5 6 7 8 9 10 11 | 1 2 3 4 5 6 7 8 9 10 11

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above gage.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

Fog	Ice Pel.	Glaze	Thund	Hail	Dam. Winds
1	0	0	19	0	0

OBSERVER Dorothy Simmons

SUPERVISING OFFICE WSO PUEBLO, COLORADO

STATION INDEX NO 05-4726-0

STATION (Climatological) La Junta 2 SE (River Station, if different) | MONTH July | 19 97

STATE Colorado | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP 7:00 Am | PRECIPITATION 7:00 Am | STANDARD TIME IN USE MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (∿∿∿) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	104	65	74	0														
2	105	53	64	0														
3	92	63	63	0														
4	83	59	65	0														
5	88	59	67	.14							X							
6	98	55	70	0														
7	99	63	71	T							X							
8	102	63	69	0														
9	99	61	67	0							X							
10	98	59	69	.09														
11	99	67	72	.03							X							
12	98	59	68	.05														
13	99	60	69	0														
14	96	64	68	0														
15	100	65	72	0														
16	104	72	79	0														
17	107	65	76	0														
18	104	60	65	0														
19	99	65	69	0														
20	95	62	69	.21							X							
21	92	55	68	.59							X							
22	94	64	69	0														
23	98	65	71	0														
24	102	70	75	0														
25	101	72	78	0														
26	105	70	74	.04							X							
27	101	69	73	.03							X							
28	100	67	68	.30							X							
29	88	61	61	1.42							X							
30	90	65	66	0														
31	91	66	74	0														
SUM			SUM	2.90														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge ab
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

Fog	Ice Pel	Glaze	Thund	Hail	Dam Winds

OBSERVER Dorothy Sampson

SUPERVISING OFFICE WSO Pueblo

STATION INDEX NO 05-4726-01

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATION (Climatological): La Junta 20 South (River Station, if different):
MONTH: Aug. 19 97
STATE: Colorado
COUNTY: Otero
RIVER:
TIME (local) OF OBSERVATION RIVER: TEMP 7:00 AM PRECIPITATION 7:00 AM
STANDARD TIME IN USE: M
TYPE OF RIVER GAGE:
ELEVATION OF RIVER GAGE ZERO: Ft
FLOOD STAGE: Ft
NORMAL POOL STAGE: Ft

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (Ins and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT __ AM	TENDENCY
1	95	68	72	0						X						
2	96	67	68	.08												
3	94	64	70	T						X						
4	93	64	70	0												
5	92	63	65	.23						X						
6	75	63	63	.40						X						
7	65	56	54	.08												
8	81	59	64	0												
9	93	64	73	0												
10	86	57	62	1.34						X						
11	76	62	64	.80						X						
12	82	61	61	.82						X						
13	82	61	67	0												
14	90	62	66	0												
15	93	62	69	0												
16	95	65	72	0												
17	95	61	64	0						X						
18	81	63	65	.32						X						
19	85	60	66	0												
20	94	65	67	0												
21	92	60	66	0												
22	95	63	67	0						X						
23	91	64	69	0												
24	97	64	70	0												
25	98	70	74	0												
26	96	68	73	0												
27	98	69	71	0												
28	95	66	70	0												
29	97	68	70	0												
30	91	59	62	.03						X						
31	85	62	70	0												
SUM			SUM	4.10			Fog	Ice Pel.	Glaze	Thund	Hail	Dam Winds				

REMARKS (Special observations, etc.)

Aug 10 - Very strong thunder storm with intense lightning & thunder lasting a full hour. Some road flooding -

Aug 11 - Strong winds with thunder storm - lots of close lightning - The rain fell mostly between 4:15 - 4:30. Road flooding -

Aug. 12 - More road flooding.

PRECIPITATION: Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

CHECK BAR (For wire-weight) NORMAL CK. BAR
READING | DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

OBSERVER: Dorothy Simmons
SUPERVISING OFFICE: 150 Pueblo
STATION INDEX NO: 05-4726-01

STATION (Climatological) La Junta 2e South (River Station, if different) | MONTH Sept | 19 97

STATE Colorado | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7:00AM | PRECIPITATION 7:00AM | STANDARD TIME IN USE M

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX.	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved (A M NOON P M)	WEATHER (Calendar Day) Mark 'X' for all types occurring each day: Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.)
1	86	65	73	0														
2	94	69	69	0														
3	78	62	66	0														
4	82	60	63	0														
5	85	63	67	0														
6	90	59	62	0														
7	88	60	64	.03							X							
8	96	56	57	0														
9	91	53	60	0														
10	68	49	53	0														
11	89	54	58	0														
12	93	57	69	0							X							
13	92	54	64	0														
14	94	63	70	0														
15	95	58	54	0														
16	98	59	68	0														
17	89	59	60	0														
18	90	61	72	0														
19	100	55	57	0														
20	83	46	47	.01							X							
21	51	46	50	.78														
22				0														
23	76	48	52	0														
24	65	48	51	0														
25	91	39	48	0														
26	84	47	52	0														
27	94	52	57	0														
28	88	47	56	0														
29	81	48	50	0														
30	89	49	51	0														
31																		
Sum			SUM	1.82														

Sept. 21-22 - I missed getting the reading on the 21st. as I was called away - So I'm not sure if the 22nd. is right either).

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface [illegible]oth ice.
D. Ice gorge a[illegible]
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING | DATE

Fog | Ice Pel. | Glaze | Thund | Hail | Dam Winds

OBSERVER Dorothy Simmons

SUPERVISING OFFICE WSO Pueblo

STATION INDEX NO 05-4726-01

STATION (Climatological) La Junta 20 Se. (River Station, if different) | MONTH Oct | 19 97

STATE Colorado | COUNTY Otero | RIVER

TIME (local) OF OBSERVATION RIVER | TEMP. 7:00AM | PRECIPITATION 7:00AM | STANDARD TIME IN USE MT

TYPE OF RIVER GAGE | ELEVATION OF RIVER GAGE ZERO Ft. | FLOOD STAGE Ft. | NORMAL POOL STAGE Ft.

WS FORM B-91 (7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

DATE	TEMPERATURE F. 24 HRS ENDING AT OBSERVATION MAX	MIN	AT OBSN	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	88	51	62	0													Oct. 8-9-10 very windy.
2	90	62	66	0													
3	93	63	66	0													
4	85	45	57	0													At 8:45 PM. on Oct. 11 a
5	90	52	57	0													tornado hit our ranch taking
6	94	57	59	0													part of our roof - breaking cars
7	80	59	59	0													+ putting windows - taking all our
8	87	49	53	.14						X							barns and outbuildings
9	72	42	42	0													It hit four ranches 1 of
10	76	42	65	0													us in this area. uprooting
11	86	43	66	0													trees - taking barns and
12	83	48	48	.28						X			X				roofs - No one was
13	50	32	37	.62													injured and no homes
14	62	33	35	0													were destroyed.
15	71	33M	42	0													
16	73	35	35	0													Oct. 13 - Rain mixed
17	71	35	39	0													with snow - Melting as
18	78	39	44	0													it fell.
19	80	42	44	0													
20	54	39	45	0													Oct. 24 Rain changing
21	58	43	43	0													to snow. Strong wind
22	61	36	36	0				X									Blizzard conditions
23	76	35	43	0													
24	72	42	44	0													
25	55	10	20	1.85	12.0	12											Oct. 25 - Drifts up to
26	20	8	10	1.82	13.0	25											6 ft. Five lived
27	45	8	9	0		20											here for 25 years
28	59	9/16	26	0		15											and never seen
29	59	16	20	0		13											worse.
30	61	20	40	0		10											
31	63	33	50	0		6											
SUM			SUM	3.71				Fog	Ice Pel	Glaze	Thund	Hail	Dam. Winds				

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Upper surface of smooth ice.
D. Ice gorge above g
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.
H. Pool stage.

CHECK BAR (For wire-weight) NORMAL CK. BAR

READING	DATE

OBSERVER Dorothy Simmons

SUPERVISING OFFICE USO Pueblo

STATION INDEX NO. 05-47-26-01

UNEDITED LOCAL CLIMATOLOGICAL DATA
[NOAA, National Climatic Data Center] MONTH: 06/1997

Station Location: LA JUNTA, CO (LHX) lat: 38° 03', lon: -103° 31'
Elev(Ground): 4196 FeetTime Zone: Mountain Standard WBAN: 23067

date	Temperature (Fahrenheit) Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Deg Days Base 65 Degrees Heating	Cooling	Significant Weather	Snow/Ice on Gnd(In) 0600 LST Depth	1200 LST Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure (inches of Hg) Avg. Station	Avg. Sea level	Wind Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	max 5-sec Dir	max 2-min Speed	max 2-min Dir	date
01	96	53	75	6	54	61	0	10	TS	0.0	-	0	T	25.57	29.70	4.8	12	9.7	29	20	22	9	01
02	79	57	68	-1	59	62	0	3	RA FG	0.0	-	0	T	25.60	29.74	10.3	9	12.7	30	12	25	9	02
03	85	59	72	2	52	60	0	7	-	0.0	-	0	0.00	25.76	29.93	10.8	3	11.5	28	4	23	3	03
04	82	53*	68	-2	51	57	0	3	-	0.0	-	0	0.00	25.74	29.93	12.8	11	13.8	30	12	28	10	04
05	91	56	74	4	53	60	0	9	FG HZ	0.0	-	0	0.00	25.51	30.02	5.7	11	10.2	29	15	25	14	05
06	85	58	72	1	57	61	0	7	TS TSRA FG HZ	0.0	-	0	1.93	25.58	29.73	8.3	8	12.6	32	11	29	11	06
07	78	59	69	-2	59	61	0	4	TS TSRA	0.0	-	0	0.36	25.64	29.80	7.3	17	8.9	33	20	29	21	07
08	78	58	68	-3	55	59	0	3	TS TSRA	0.0	-	0	0.03	25.60	29.75	10.3	14	12.4	33	13	28	14	08
09	67	54	61*	-11	55	57	4	0	RA FG	0.0	-	0	0.35	25.71	29.94	10.8	11	12.4	30	8	25	11	09
10	81	54	68	-4	57	60	0	3	TS TSRA RA FG	0.0	-	0	0.06	25.73	29.94	9.8	12	11.6	34	17	26	17	10
11	88	57	73	1	54	61	0	8	FG+ FG	0.0	-	0	0.01	25.61	29.76	1.9	33	7.6	17	30	15	29	11
12	83	59	71	-2	52	59	0	6	TS TSRA	0.0	-	0	0.01	25.54	29.66	7.1	8	12.3	38	5	31	13	12
13	78	55	67	-6	55	59	0	2	TS TSRA FG	M	-	-	0.34	25.60	29.75	9.1	10	13.6	31	7	26	11	13
14	83	59	71	-2	56	62	0	6	-	0.0	-	0	0.00	25.60	29.75	15.5	16	17.8	36	16	30	16	14
15	83	55	69	-5	53	58	0	4	TS TSRA	0.0	-	0	T	25.55	29.70	4.6	32	11.4	44	27	38	34	15
16	75	54	65	-9	50	56	0	0	HZ	0.0	-	0	0.00	25.62	29.81	3.7	24	7.4	23	20	20	19	16
17	86	54	70	-4	51	59	0	5	-	0.0	-	0	T	25.65	29.82	4.0	32	8.1	28	1	17	2	17
18	93	58	76	1	51	61	0	11	TS	0.0	-	0	T	25.67	29.80	1.6	31	8.7	30	3	26	3	18
19	97	63	80	5	49	62	0	15	-	0.0	-	0	0.00	25.62	29.73	8.2	24	9.5	29	20	25	21	19
20	99	64	82*	7	45	61	0	17	-	0.0	-	0	0.00	25.46	30.79	5.7	27	9.5	24	31	21	30	20
21	90	64	77	2	56	64	0	12	-	0.0	-	0	0.00	25.58	29.82	7.6	6	10.5	25	8	22	8	21
22	97	63	80	4	51	62	0	15	-	0.0	-	0	0.00	25.60	29.72	12.4	17	13.9	37	15	33	15	22
23	94	61	78	2	54	63	0	13	TS	0.0	-	0	0.00	25.56	29.66	6.7	14	9.7	31	18	25	14	23
24	94	62	78	2	51	61	0	13	TS	0.0	-	0	T	25.63	29.76	3.8	2	11.3	48	2	39	3	24
25	89	57	73	-3	53	60	0	8	TS TSRA	0.0	-	0	0.18	25.78	29.95	4.8	16	12.1	53	19	39	23	25
26	90	54	72	-5	51	59	0	7	-	0.0	-	0	0.00	25.80	29.99	4.4	23	8.1	25	27	21	24	26
27	95	55	75	-2	46	59	0	10	-	0.0	-	0	0.00	25.67	29.82	4.8	28	10.4	36	32	30	32	27
28	97	58	78	1	44	59	0	13	-	0.0	-	0	0.00	25.58	29.70	5.7	26	8.0	20	30	16	30	28
29	92	62	77	0	55	63	0	12	TS TSRA	0.0	-	0	0.38	25.60	29.71	6.1	11	10.4	39	23	31	22	29
30	101*	55	78	0	48	61	0	13	-	0.0	-	0	0.00	25.55	29.66	7.2	24	9.2	28	25	24	26	30
	87.5	57.7	72.6	--------	52.6	60.2	.1	8.0	<Monthly Averages	Totals>		3.6	2.89	25.62	29.83	3.1	12.7	10.9	<Monthly Average				
			-1.0	--------	<----------Departure From Normal---------->								1.57										

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	4		-7	
Cooling:	239		-30	

Greatest 24-hr Precipitation: 1.53date: 6-7
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: 0 date:

	Sea Level Pressure	Date	Time
Maximum:	30.13	26	0553
Minimum:	29.45	20	2324

Number of Days with ----->
Max temp >= 90: 14
Max temp <= 32: 0
Thunderstorms : 13
Min temp <= 32: 0
Min temp <= 0 : 0
Heavy Fog : 1
Precipitation >= .01 inch: M
Precipitation >= .10 inch : M
Snowfall >= 1.0 inch : 0

UNEDITED LOCAL CLIMATOLOGICAL DATA
[NOAA, National Climatic Data Center] MONTH: 06/1998

Station Location: LA JUNTA, CO (LHX) lat: 38° 03', lon: -103° 31'
Elev(Ground): 4196 FeetTime Zone: Mountain Standard WBAN: 23067

date	Temperature (Fahrenheit) Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Deg Days Base 65 Degrees Heating	Cooling	Significant Weather	Snow/Ice on Gnd(In) 0600 LST Depth	1200 LST Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure (inches of Hg) Avg. Station	Avg. Sea level	Wind Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	max 5-sec Dir	max 2-min Speed	max 2-min Dir	date
01	97	53	75*	6	41	56	0	10	-	0.0	-	0.00	0.00	25.56	29.69	1.2	25	9.5	25	9	22	9	01
02	91	52	72	3	43	57	0	7	-	M	-	-	0.00	25.54	29.66	3.4	13	9.8	26	12	22	13	02
03	73	46	60	-10	45	50	5	0	FG HZ	M	-	-	T	25.62	29.80	15.0	8	16.1	33	4	26	5	03
04	67	44	56	-14	45	48	9	0	TS TSRA FG	M	-	-	T	25.58	29.81	15.7	9	16.2	36	3	31	3	04
05	51	42	47*	-23	39	43	18	0	FG	0.0	-	0.00	0.10	25.82	30.13	4.2	9	8.5	18	7	15	8	05
06	76	43	60	-11	44	51	5	0	-	0.0	-	0.00	0.01	25.81	30.07	4.6	15	7.4	21	17	18	16	06
07	85	49	67	-4	49	57	0	2	TS	0.0	-	0.00	T	25.50	30.63	16.8	19	17.8	44	17	38	17	07
08	79	49	64	-7	42	53	1	0	-	0.0	-	0.00	0.00	25.51	30.02	2.8	2	11.0	24	36	21	35	08
09	85	49	67	-5	40	53	0	2	-	0.0	-	0.00	0.00	25.63	29.82	8.3	17	10.5	36	18	29	18	09
10	86	48	67	-5	40	53	0	2	-	0.0	-	0	0.00	25.51	29.80	5.9	20	11.0	33	21	29	21	10
11	86	55	71	-1	38	53	0	6	-	0.0	-	0	0.00	25.50	29.75	7.0	26	10.7	32	25	22	24	11
12	88	52	70	-3	39	54	0	5	-	0.0	-	0.00	0.00	25.65	29.81	2.9	9	9.4	23	3	20	3	12
13	92	51	72	-1	35	52	0	7	HZ	0.0	-	0.00	0.00	25.52	30.14	11.5	28	14.9	53	29	46	28	13
14	83	49	66	-7	42	52	0	1	TS TSRA RA FG	0.0	-	0.00	0.35	25.60	29.76	7.7	33	13.6	53	35	47	35	14
15	71	50	61	-13	45	52	4	0	FG	0.0	-	0.00	0.07	25.63	29.84	1.6	2	9.2	24	32	21	32	15
16	92	49	71	-3	45	56	0	6	-	0.0	-	0	0.00	25.38	31.09	2.7	12	8.4	36	35	31	35	16
				--------					<Monthly Averages	Totals>													<Monthly Average
				--------	<----------Departure From Normal---------->																		

Degree Days Monthly Season to Date
Total Departure Total Departure
Heating:
Cooling:

Greatest 24-hr Precipitation: date:
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: date:

Sea Level Pressure Date Time
Maximum:
Minimum :

Number of Days with ----->
Max temp >= 90:
Max temp <= 32:
Thunderstorms : 3
Min temp <= 32:
Min temp <= 0 :
Heavy Fog : 0
Precipitation >= .01 inch:
Precipitation >= .10 inch :
Snowfall >= 1.0 inch : 0

UNEDITED LOCAL CLIMATOLOGICAL DATA
[NOAA, National Climatic Data Center] MONTH: 07/1997

Station Location: LA JUNTA, CO (LHX) lat: 38° 03', lon: -103° 31'
Elev(Ground): 4196 FeetTime Zone: Mountain Standard WBAN: 23067

date	Temperature (Fahrenheit) Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Deg Days Base 65 Degrees Heating	Cooling	Significant Weather	Snow/Ice on Gnd(In) 0600 LST Depth	1200 LST Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure (inches of Hg) Avg. Station	Avg. Sea level	Wind Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	max 5-sec Dir	max 2-min Speed	max 2-min Dir	date
01	100	67	84	6	36	58	0	19	-	0.0	-	0	0.00	25.57	29.65	5.9	27	13.6	30	4	28	3	01
02	89	53	71	-7	41	56	0	6	-	0.0	-	0	0.00	25.71	29.85	10.9	12	14.3	34	15	29	14	02
03	81	59	70	-8	48	57	0	5	-	0.0	-	0	0.00	25.78	29.95	9.5	5	13.4	29	3	25	3	03
04	86	51*	69*	-9	45	56	0	4	TS TSRA HZ	0.0	-	0	T	25.83	30.02	8.4	15	11.1	53	29	41	30	04
05	94	58	76	-2	52	61	0	11	TS TSRA TSRAGS GR HZ	0.0	-	0	0.08	25.75	29.90	3.3	11	9.4	46	8	39	8	05
06	93	54	74	-5	49	59	0	9	TS	0.0	-	0	0.00	25.71	29.86	2.7	21	8.9	59	26	48	25	06
07	98	59	79	0	47	59	0	14	-	0.0	-	0	0.00	25.68	29.81	3.4	31	10.0	39	34	33	34	07
08	96	60	78	-1	49	60	0	13	TS	0.0	-	0	T	25.75	29.88	2.9	12	8.0	25	36	22	36	08
09	95	57	76	-3	50	61	0	11	-	0.0	-	0	0.00	25.72	29.85	3.7	15	6.8	23	29	21	30	09
10	98	59	79	0	49	62	0	14	-	0.0	-	0	0.00	25.61	29.72	6.8	20	9.8	30	18	23	18	10
11	96	67	82	3	53	63	0	17	TS TSRA	0.0	-	0	0.09	25.60	29.68	3.7	26	10.8	49	32	44	32	11
12	98	60	79	0	50	62	0	14	-	0.0	-	0	0.00	25.65	29.76	7.5	23	9.4	25	23	20	18	12
13	93	62	78	-1	45	59	0	13	-	0.0	-	0	0.00	25.75	29.88	4.5	7	10.4	23	11	20	11	13
14	96	62	79	-1	52	62	0	14	-	0.0	-	0	0.00	25.81	29.96	10.8	10	13.8	38	11	33	10	14
15	101	62	82	2	53	64	0	17	-	0.0	-	0	0.00	25.78	29.92	3.5	11	8.7	29	8	25	8	15
16	104*	62	83	3	48	62	0	18	-	0.0	-	0	0.00	25.74	29.84	0.8	16	10.1	38	7	32	8	16
17	103	61	82	2	46	61	0	17	-	0.0	-	0	0.00	25.68	29.78	4.7	15	9.0	26	13	23	13	17
18	97	61	79	-1	57	65	0	14	-	0.0	-	0	0.00	25.67	29.78	9.5	11	10.9	28	11	24	12	18
19	94	64	79	-1	62	66	0	14	TS TSRA HZ	0.0	-	0	0.04	25.72	29.86	3.7	8	9.5	39	23	33	23	19
20	90	62	76	-4	60	64	0	11	TS TSRA	0.0	-	0	0.18	25.78	29.95	0.7	6	8.6	38	6	32	6	20
21	92	62	77	-3	60	66	0	12	-	0.0	-	0	0.00	25.78	29.94	4.1	13	8.9	33	12	29	11	21
22	95	62	79	-1	60	66	0	14	FG HZ	0.0	-	0	0.00	25.76	29.91	2.7	15	7.4	23	22	18	23	22
23	100	66	83	3	55	65	0	18	TS	0.0	-	0	0.00	25.69	29.82	6.8	21	9.2	29	16	24	17	23
24	100	67	84	4	54	65	0	19	-	0.0	-	0	0.00	25.71	29.82	3.7	23	9.0	21	19	17	21	24
25	102	70	86*	6	56	66	0	21	TS TSRA	0.0	-	0	0.05	25.69	29.81	2.4	14	7.8	29	3	24	3	25
26	99	65	82	2	58	66	0	17	-	0.0	-	0	T	25.68	29.83	3.4	24	8.5	40	25	34	25	26
27	98	68	83	3	58	66	0	18	TS TSRA	0.0	-	0	T	25.73	29.87	3.2	33	10.6	44	35	38	35	27
28	88	64	76	-3	62	66	0	11	TS TSRA RA FG	0.0	-	0	0.67	25.89	30.06	3.5	10	8.8	38	24	32	24	28
29	89	64	77	-2	64	67	0	12	TS TSRA	0.0	-	0	0.03	25.87	30.05	13.0	13	13.7	30	15	26	15	29
30	91	65	78	-1	61	67	0	13	FG	0.0	-	0	0.00	25.87	30.02	10.4	18	13.8	32	17	29	17	30
31	94	71	83	4	59	67	0	18	HZ	0.0	-	0	0.00	25.87	29.98	7.1	22	10.7	28	21	23	22	31
	95.2	62.1	78.7	-------	52.9	62.7	.0	13.8	<Monthly Averages	Totals>			1.14	25.74	29.87	2.7	14.8	10.2	<Monthly Average				
			-.6	-------	<----------Departure From Normal---------->								-1.27										

Degree Days Monthly Season to Date

	Total	Departure	Total	Departure
Heating:	0	0		
Cooling:	428	-15		

Greatest 24-hr Precipitation: 0.70date: 28-29
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: 0 date:

Sea Level Pressure	Date	Time
Maximum: 30.15	4	0750
Minimum : 29.56	1	0122

Number of Days with ----->
Max temp >= 90: 26
Max temp <= 32: 0
Thunderstorms : 12
Min temp <= 32: 0
Min temp <= 0 : 0
Heavy Fog : 0
.Precipitation >= .01 inch: 7
Precipitation >= .10 inch : 2
Snowfall >= 1.0 inch : 0

UNEDITED LOCAL CLIMATOLOGICAL DATA [NOAA, National Climatic Data Center] MONTH: 08/1997

Station Location: LA JUNTA, CO (LHX) lat: 38° 03', lon: -103° 31'
Elev(Ground): 4196 FeetTime Zone: Mountain Standard WBAN: 23067

date	Temperature (Fahrenheit)						Deg Days Base 65 Degrees		Significant Weather	Snow/Ice on Gnd(In)		Precipitation (In)		Pressure (inches of Hg)		Wind Speed=mph Dir=tens of degrees							date
	Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling		0600 LST Depth	1200 LST Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea level	Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	max 5-sec Dir	max 2-min Speed	max 2-min Dir	
01	94	67	81	2	61	67	0	16	TS	0.0	-	0	T	25.90	30.05	3.5	33	7.7	37	35	30	36	01
02	94	67	81	2	63	68	0	16	TS TSRA	0.0	-	0	0.38	25.88	30.06	2.2	27	10.0	40	28	32	24	
03	88	64	76	-3	64	68	0	11	-	0.0	-	0	0.00	25.90	30.08	2.2	7	6.6	21	8	18	8	02
04	91	64	78	-1	63	67	0	13	TS TSRA	0.0	-	0	0.19	25.97	30.16	3.8	4	9.4	39	9	32	8	
05	73	64	69	-10	64	65	0	4	TS TSRA RA FG	0.0	-	0	0.68	25.91	30.11	10.9	12	13.0	28	14	24	11	03
06	66	58	62*	-17	57	59	3	0	RA FG	0.0	-	0	0.15	25.93	30.15	6.1	3	11.0	26	3	22	3	
07	78	58	68	-10	55	60	0	3	-	0.0	-	0	0.00	25.87	30.09	4.3	15	7.5	18	14	14	13	04
08	90	57	74	-4	54	62	0	9	-	M	-	-	0.00	25.65	29.80	4.6	21	7.5	15	20	13	27	
09	83	62	73	-5	57	63	0	8	TS TSRA FG	0.0	-	0	0.19	25.71	29.85	5.2	4	13.1	33	3	29	3	05
10	73	60	67	-11	61	62	0	2	TS TSRA FG	0.0	-	0	0.23	25.77	29.97	10.9	12	12.2	48	12	39	11	
11	76	59	68	-10	50	57	0	3	TS TSRA FG HZ	0.0	-	0	0.54	25.77	29.96	3.1	8	7.5	33	4	29	3	06
12	81	61	71	-7	60	64	0	6	-	0.0	-	0	0.00	25.88	30.08	3.6	10	6.4	17	13	16	13	
13	87	62	75	-2	61	64	0	10	TS TSRA FG	0.0	-	0	0.18	25.81	29.97	2.0	18	10.4	55	32	46	32	07
14	90	59	75	-2	54	61	0	10	-	0.0	-	0	0.00	25.60	29.74	8.2	30	10.3	26	29	23	29	
15	90	60	75	-2	51	61	0	10	-	0.0	-	0	0.00	25.48	29.61	3.2	25	9.8	20	28	16	28	08
16	88	61	75	-2	55	62	0	10	TS	0.0	-	0	0.00	25.60	29.72	4.0	33	10.6	29	22	25	24	
17	79	60	70	-6	58	62	0	5	-	0.0	-	0	0.00	25.84	30.04	7.9	9	11.0	23	12	20	11	09
18	84	61	73	-3	60	64	0	8	TS	0.0	-	0	0.01	25.77	29.94	1.2	3	8.1	22	2	18	2	
19	92	57*	75	-1	53	61	0	10	-	0.0	-	0	0.01	25.81	29.96	2.9	32	9.6	36	4	30	2	10
20	89	63	76	0	57	64	0	11	TS	0.0	-	0	0.11	25.87	30.02	0.9	25	7.9	47	30	40	31	
21	94	60	77	2	58	64	0	12	TS TSRA	0.0	-	0	T	25.85	30.00	4.6	30	8.7	33	30	30	31	11
22	89	62	76	1	55	63	0	11	TS	M	-	-	0.00	25.90	30.05	1.2	27	6.7	24	2	20	1	
23	94	61	78	3	55	64	0	13	-	0.0	-	0	0.00	25.85	30.00	2.3	17	6.8	16	11	13	10	12
24	96	59	78	3	53	63	0	13	HZ	0.0	-	0	0.00	25.76	29.90	2.0	19	7.5	18	12	16	11	
25	95	61	78	4	58	65	0	13	-	0.0	-	0	0.00	25.74	29.88	2.2	35	8.7	25	29	22	29	13
26	95	67	81	7	57	66	0	16	-	0.0	-	0	0.00	25.75	29.87	3.8	23	10.0	23	12	16	12	
27	94	65	80	6	59	66	0	15	-	0.0	-	0	0.00	25.71	29.83	2.4	30	6.4	18	27	16	27	14
28	96*	65	81*	7	59	66	0	16	-	0.0	-	0	0.00	25.66	29.80	2.2	15	7.8	23	13	20	15	
29	94	64	79	6	56	63	0	14	TS	0.0	-	0	T	25.66	29.80	2.4	32	7.0	36	34	31	34	15
30	89	58	74	1	59	64	0	9	TS TSRA	0.0	-	0	T	25.74	29.89	1.4	34	9.2	32	8	26	8	
31	88	60	74	1	60	64	0	9	TS	0.0	-	0	T	25.76	29.91	3.7	13	8.5	36	16	31	16	16
																							17
																							18

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87.4	61.5	74.5	--------	57.7	63.5	.1	9.9	<Monthly Averages	Totals>		2.67	25.78	29.95	0.6	8	8.9 <Monthly Average
		-1.9	--------	<--------------------Departure From Normal---------------------->							-.94					

Degree Days Monthly Season to Date

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	3	3		
Cooling:	306	-51		

Greatest 24-hr Precipitation: 0.68 date: 5
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: 0 date:

Sea Level Pressure		Date	Time
Maximum:	30.27	6	2128
Minimum :	29.53	15	1746

Number of Days with ----->

Max temp >= 90 : 15
Max temp <= 32 : 0
Thunderstorms : 16
Min temp <= 32: 0
Min temp <= 0 : 0
Heavy Fog : 0
Precipitation >= .01 inch: 11
Precipitation >= .10 inch : 9
Snowfall >= 1.0 inch : 0

Takes care of Crowley County as well

State Code	County Code	Site Name	HQ State	HQ County
8	89	OTERO COUNTY FSA OFFICE	8	89

CED	Contact Name
ERNEST W HAMMER	JUDY GERINGER

Area Name	State Name	Site Type Name	Site District	Transmission ID	Time Zone
Southwest	Colorado	FSA County Office	1	AIE	Mountain

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Phone #	(719)254-7672 x2	ext.	
Fax #	(719)254-3420	ext.	

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	MAIL ADDRESS		STREET ADDRESS
Address	200 SOUTH 10TH	Address	204 SOUTH 10TH
Address		Address	
City	ROCKY FORD	City	ROCKY FORD
State	CO	State	CO
Zip	81067	Zip	81067

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Send a question, idea or comment to the County Office via the State Office.

If any of the information on this page is incorrect, please notify us.

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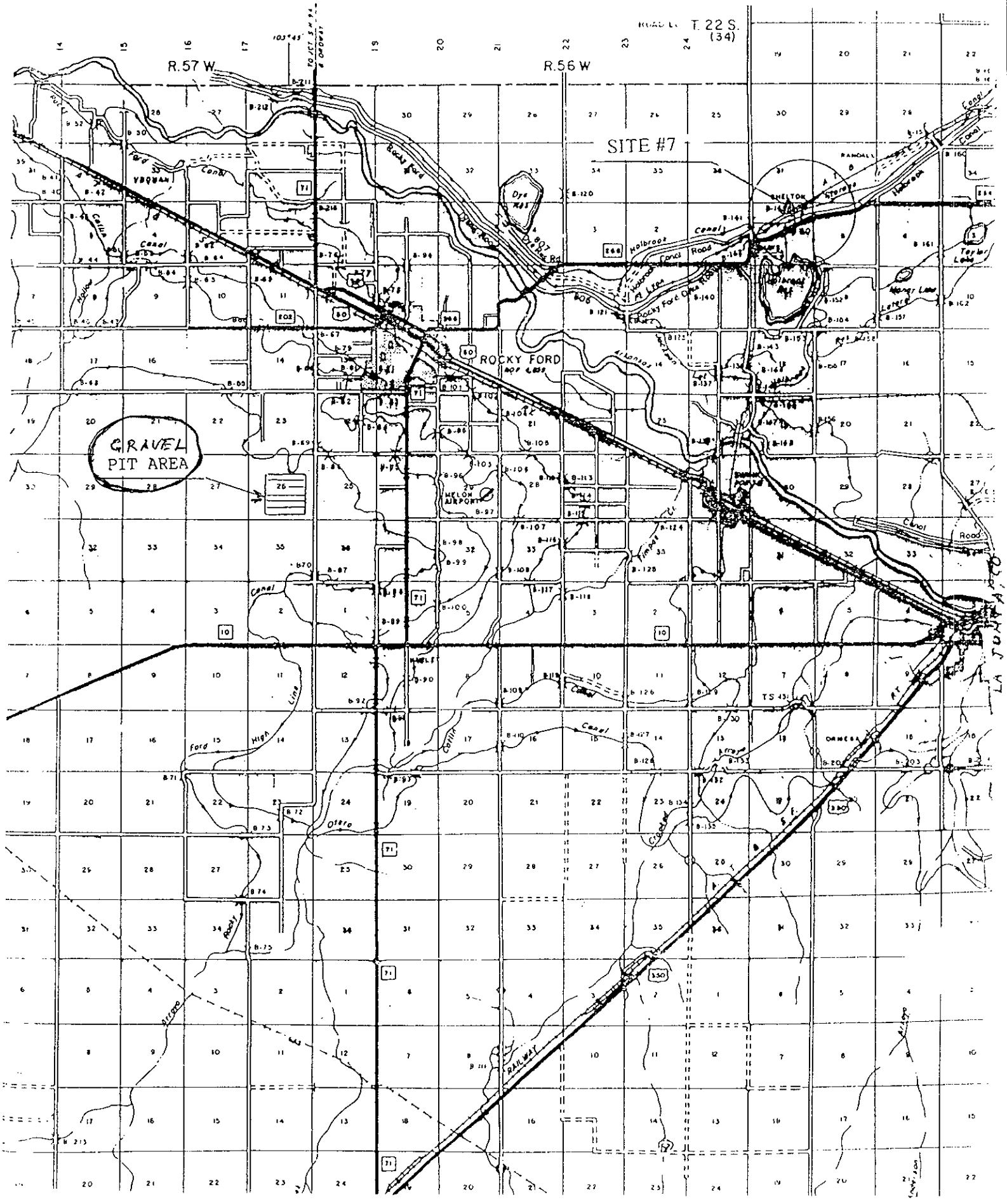
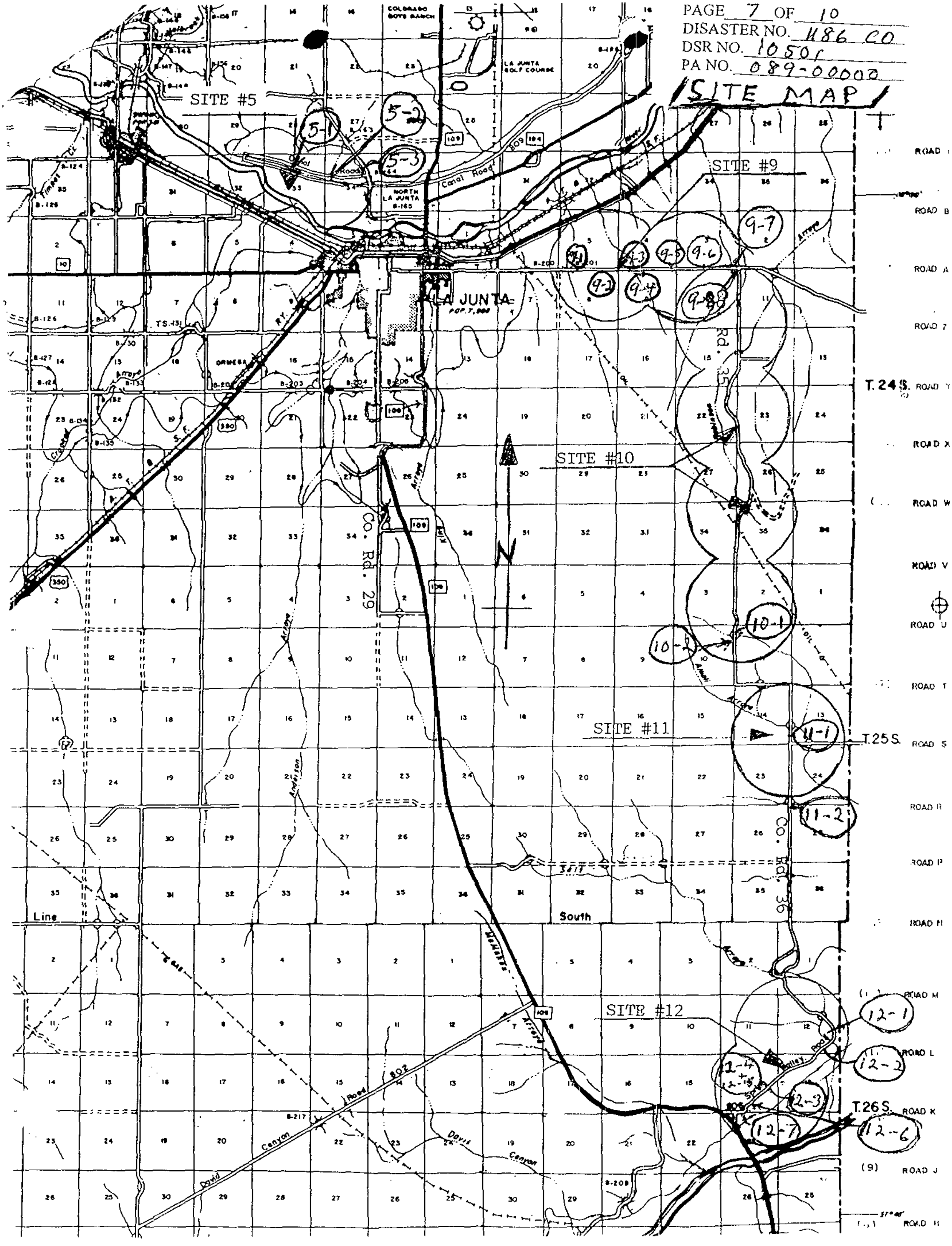
Otero County

MAP SHOWING LOCATION OF GRAVEL PIT (1 MILES WEST OF LA JUNTA, CO)

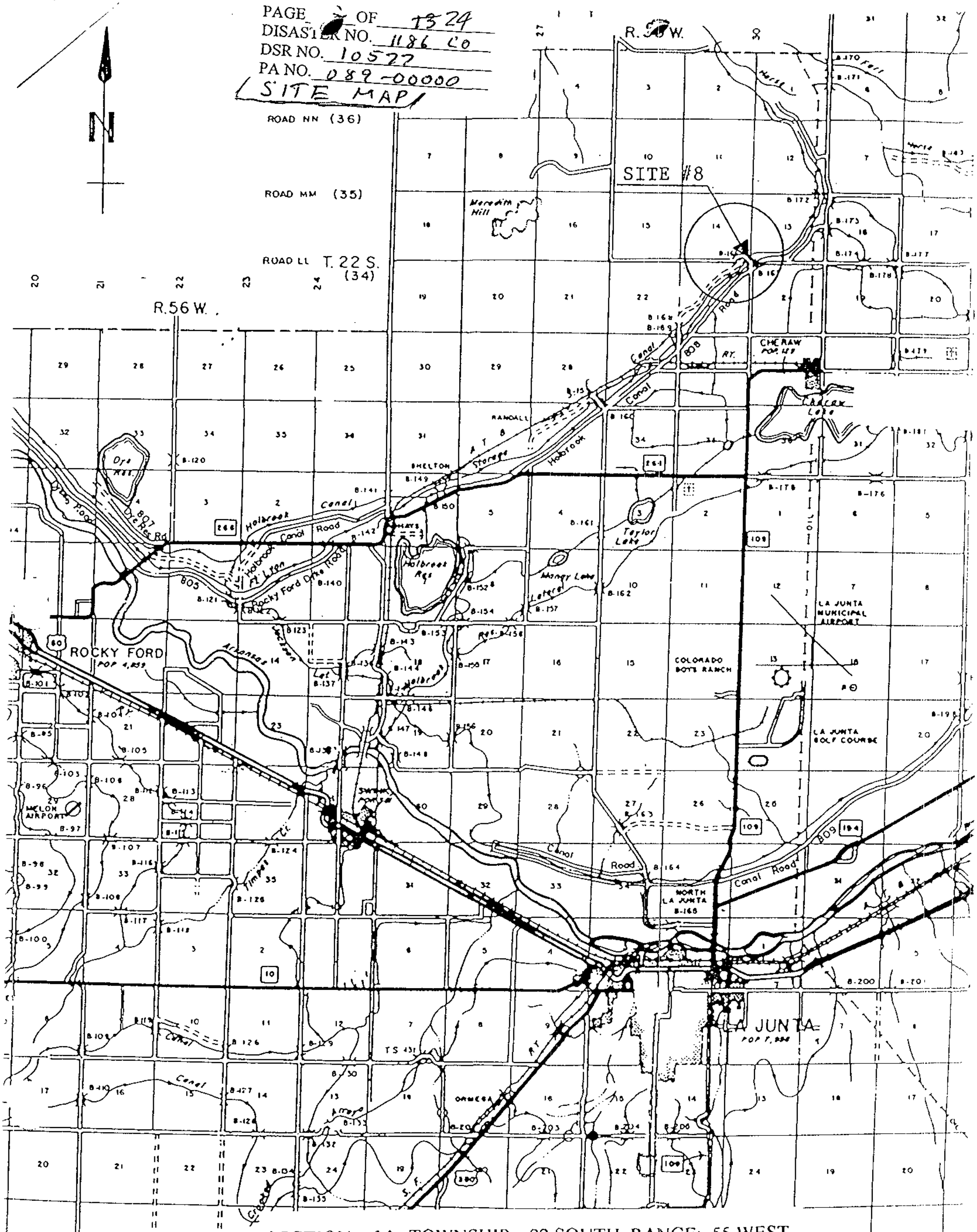


PAGE 7 OF 10
DISASTER NO. 1186 CO
DSR NO. 10501
PA NO. 089-00000

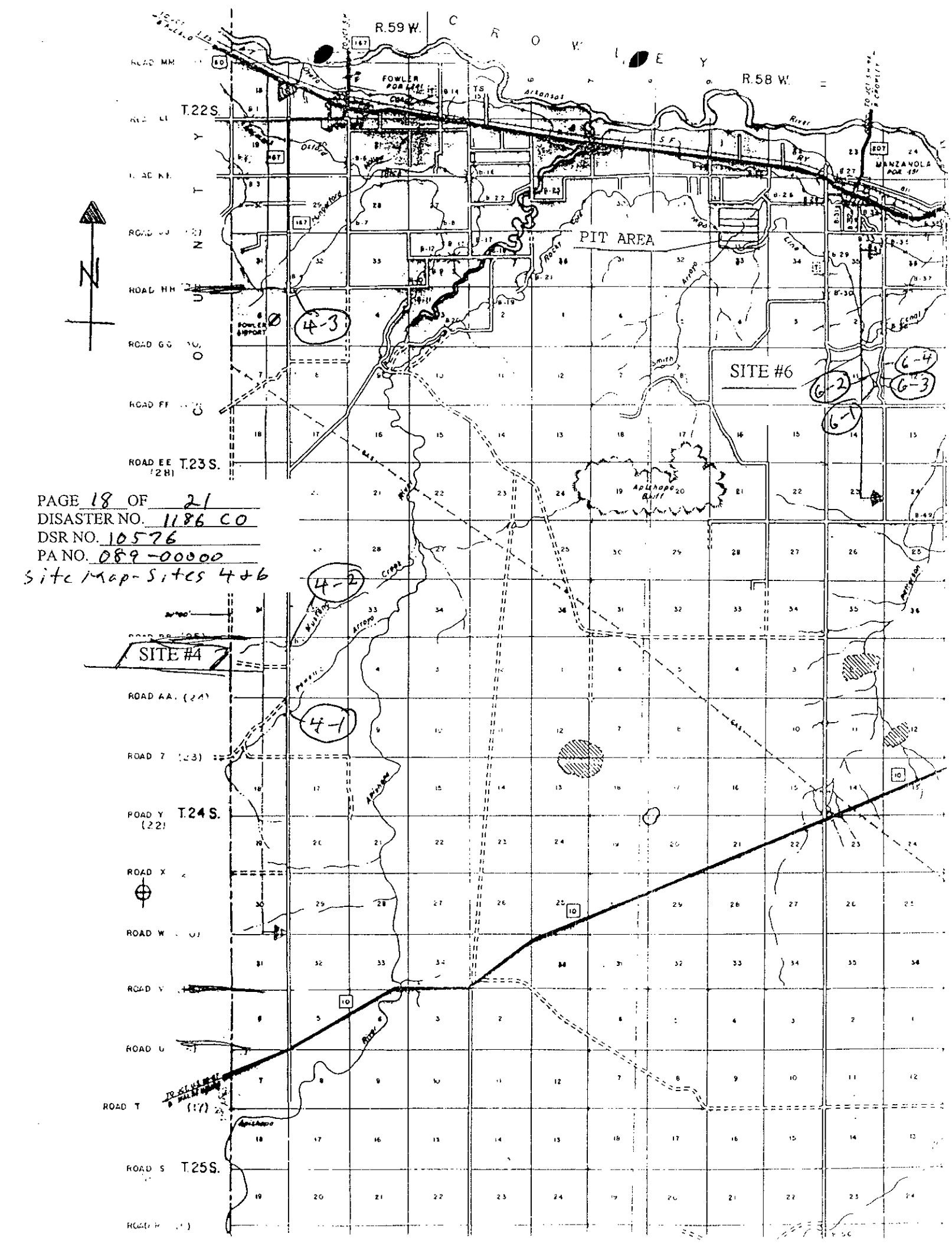
SITE MAP


SITE #5
5-1
5-2
5-3
SITE #9
9-1
9-2
9-3
9-4
9-5
9-6
9-7
9-8
SITE #10
10-1
10-2
SITE #11
11-1
11-2
SITE #12
12-1
12-2
12-3
12-4
12-6
12-7
COLORADO BOYS RANCH
LA JUNTA GOLF COURSE
NORTH LA JUNTA
LA JUNTA
Canal Road
Co. Rd. 29
Rd. 35
Co. Rd. 36
ORMEGA
Arroyo
Anderson
Crooked
David Canyon Road 802
Davis Canyon
Line
South
T.24S.
T.25S.
T.26S.
ROAD C
ROAD B
ROAD A
ROAD Z
ROAD Y
ROAD X
ROAD W
ROAD V
ROAD U
ROAD T
ROAD S
ROAD R
ROAD P
ROAD N
ROAD M
ROAD L
ROAD K
ROAD J
ROAD H
109
350
10
194

PAGE ___ OF 1324
DISASTER NO. 1186 CO
DSR NO. 10527
PA NO. 089-00000
SITE MAP



SECTION: 14 TOWNSHIP: 22 SOUTH RANGE: 55 WEST



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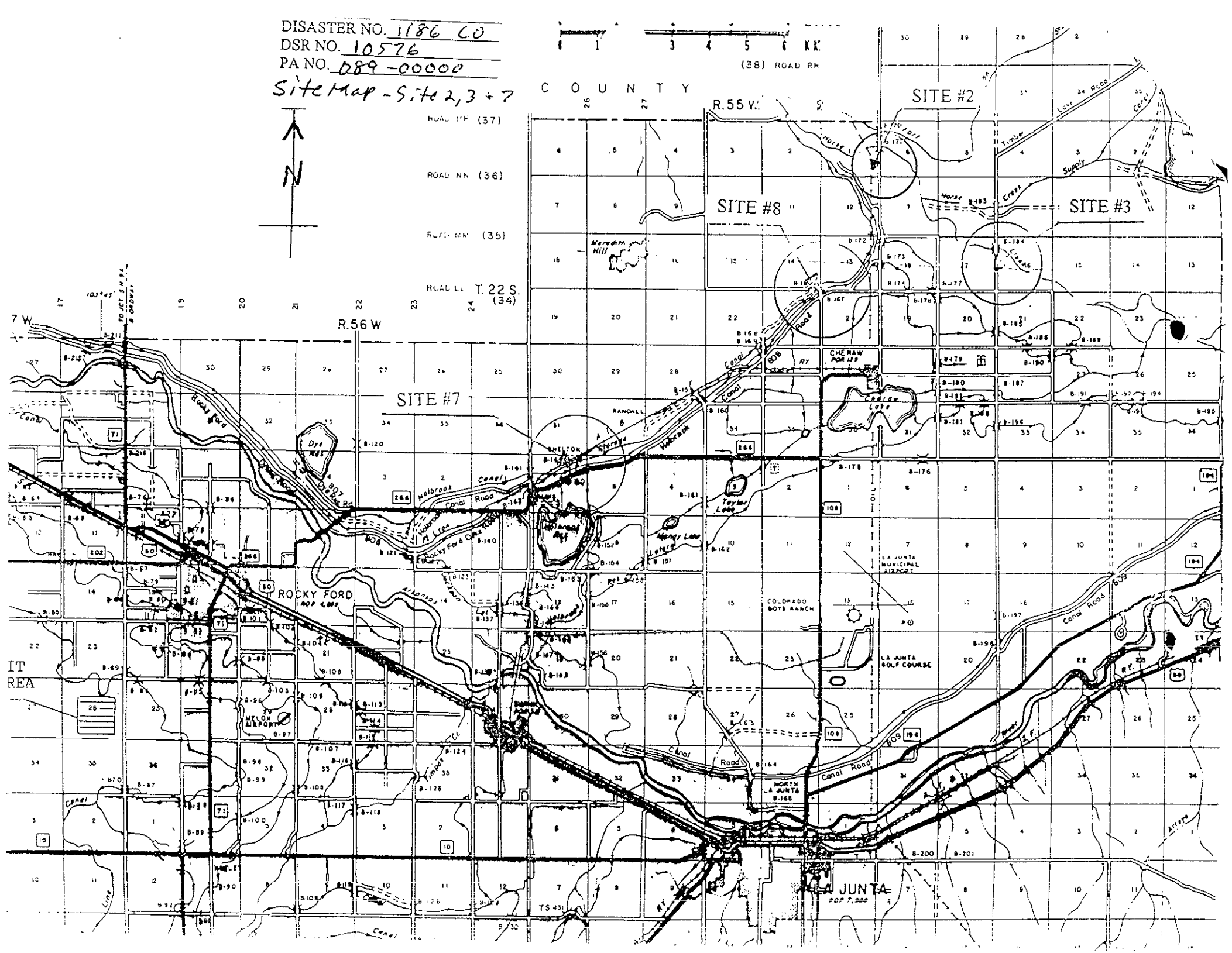
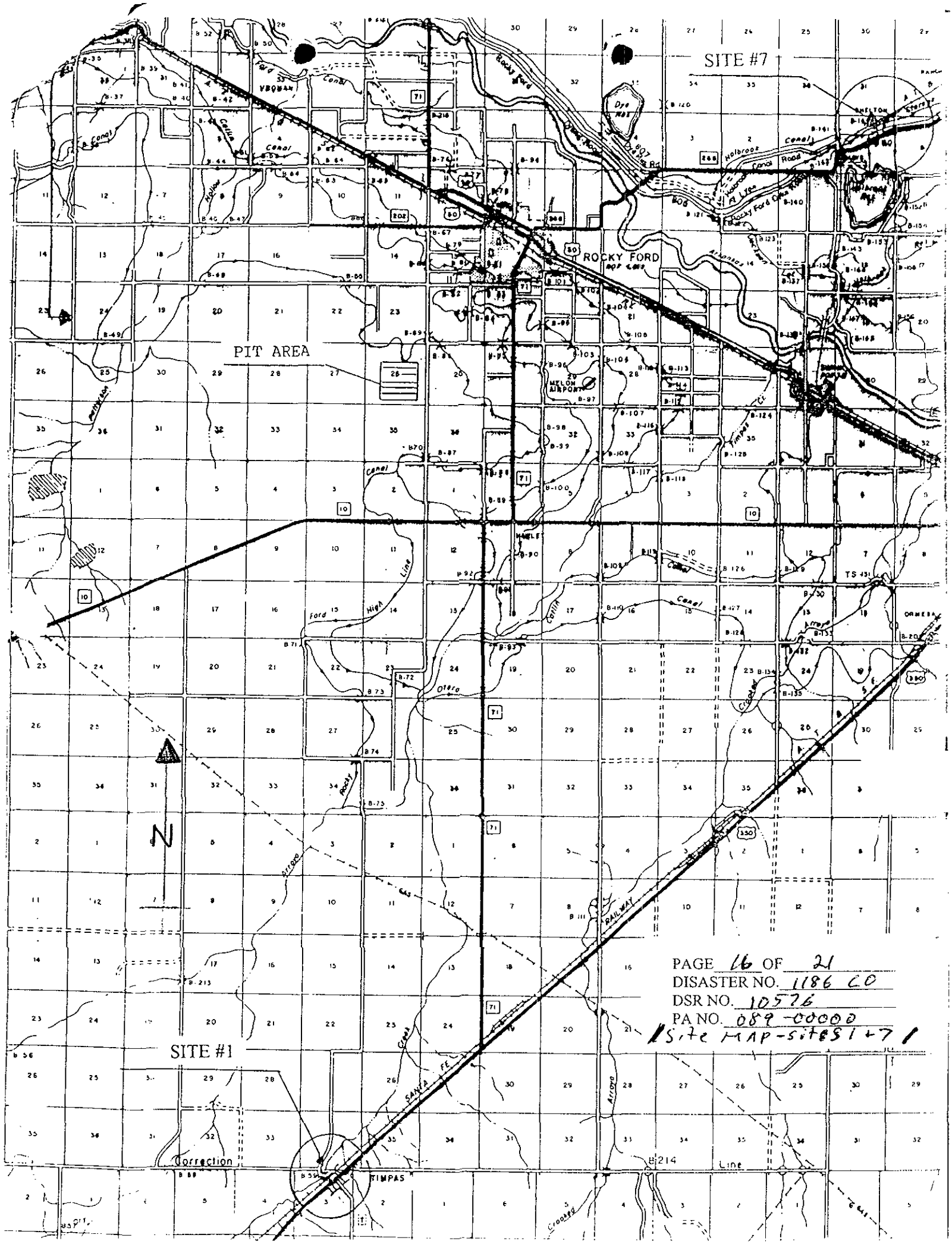
DISASTER NO. 1186 CO
DSR NO. 10576
PA NO. 089-00000
site map - sites 4 & 6

DISASTER NO. 1186 CO
DSR NO. 10576
PA NO. 089-00000

Site Map - Site 2, 3 + 7





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DISASTER NO. 1186 CO
DSR NO. 10576
PA NO. 089-00000
Site MAP-sites 1 & 7

Riverside Technology, inc.
2290 East Prospect Road, Suite 1 • Fort Collins, CO 80525
970/484-7573 • FAX 970/484-7593

Subject: Otero/Crowley FSA office
Computed: w/o Date: 5/6/98
Checked: Date:

Project/Proposal Name:
Project/Proposal No.: D479 Task: 52
Page of

1) Otero County Farm Service Area office — Ernest Hammer, CEO

- Canal broke in July 1997
  - → Highline Canal (S of Arkansas)
- east of La Junta Hwy 94 ; N of Cheraw
- Flooding from flooding → corn & alpha ~ 100 acres of each
  - → covered w/ silt
- July 28 – Aug 12 – period of substantial rains

Acres		Crop	loss
135	(35)	Cantelope	75
50		Honeydue	90
800	(300)	watermelon	80
120		pumpkin	95
20		squash	70
50		peppers	70
50		tomatoes	70
50		zinnia seed	80
25,800	(4800) ↓ 20%	alpha	30 (20)
		onions lost → insurable	
		pinto beans	

vegetables rot or quality no good

( ) ≡ Crowley County contribution

(Merl Venezio – Bent County 456-0557)

Spoke with Ernest Hammer

3. State Data

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 4/3/98

To: MARKUS RITSCH

Fax #: 970 484 2593

Agency: RTI.

From: TOM BROWNING

Fax#: (303) 866-4474
Phone: (303) 866-3441

9 Pages transmitted, including this cover sheet

TIMPAS CREEK REPORT AS REQUESTED

Sending Operator

Original Mailed __Yes ___No

Continental Divide near Leadville, Colorado. Between Leadville and Canon City it is a typical mountain stream with fairly steep slopes descending more than 6,000 feet in elevation in a distance of about 130 miles.

Between Canon City and Pueblo the river flows in a transitional region between the high mountains and the eastern plains.

Downstream of Pueblo, the river flows east across the eastern plains to the Kansas border. In this region the valley is between one and three miles in width with relatively flat slopes. The main tributaries of the Arkansas River are Fountain Creek, St. Charles River, Apishaza River and Timpas Creek.

Normal rainfall precipitation in the Arkansas River Basin ranges from approximately 12.5 inches per year in the lower elevations to approximately 16.8 inches per year in the mountainous regions (Reference 6). In the Timpas Creek Basin, normal annual precipitaion is 12.5 inches. Maximum and minimum temperature extremes range in the study basins from about 110°F in the lowlands to about -30°F in the highlands. Vegetation in the study basin consists of mesquite and willow bushes, with occasional groves of cottonwoods and juniper bushes. In the upper part of the basin, evergreens and aspen are predominant.

B. Study Reach Description

The study reach of this floodplain information report extends from the upstream limit of the Corps of Engineers study near La Junta for approximately 15.5 miles upstream to Rocky Ford. Two additional study areas include a 1.0 mile reach near Manzanola and 1.7 mile reach near Fowler. The Timpas Creek Study reach extends from the Arkansas River for a distance of 2.5 miles upstream. The Arkansas River and Timpas Creek valleys are generally broad and flat. Along the Arkansas River the land immediately adjacent to the river has heavy growths of trees and brush interspersed with meadows and cultivated land. Timpas Creek is bordered on both sides by cultivated lands. The towns of Swink, Rocky Ford, Manzanola and Fowler are generally located outside of the floodplains of the study streams and there is generally little development at present in the floodplains.

The portion of the Arkansas River Basin under consideration in this study has its downstream limit at the upstream limit of the 1977 Corps of Engineers Study. The upstream limit on the Arkansas is approximately 550 ft. upstream of Fowler, Colorado. The total study reach on the Arkansas River is 18.5 miles. Also included in this report is a 2.5 mile reach of Timpas Creek, starting at its confluence with the Arkansas River and extending upstream.

Table 1 shows approximate drainage areas at various points along the Arkansas.

TABLE 1 - DRAINAGE AREAS

Location	Area (sq. mi.)
LaJunta - Downstream Study Limit, Arkansas River	12,210
Rocky Ford - Upstream Study Limit, Arkansas River	11,090
Fowler - Upstream Limit of Arkansas River	10,900
Swink - Timpas Creek	496

Obstructions to floodflows within the study reaches include natural obstructions such as thick brush and other types of vegetations growing along the streambanks, and manmade obstructions such as bridges and diversion dams. There are 11 bridges within the study reaches, with 6 spanning the Arkansas, and 5 crossing Timpas Creek. During floods, these bridge obstructions impede floodflows and cause backwater conditions that may increase the flood heights upsteam of the obstructions, and velocities downstream of the obstructions.

Brush washed out during floods is carried downstream and may collect at bridges and in culverts, thus creating a damming effect and overbank flow. As floodflows increase, masses of debris may break loose and cause a wall of water and debris to surge downstream until another obstruction is encountered. In some instances, debris may collect to the point where structural capability is exceeded and a bridge is destroyed or abutments and approaches eroded and roadbeds damaged.

There are no existing or authorized flood control structures in the study reach however, the Corps of Engineers has prepared a flood control protection study for La Junta (Reference 3). There are two irrigation canal diversion dams near the downstream limit of the study reach of the Arkansas River near La Junta and one near the upstream limit, near Fowler. These downstream structures divert water from the Arkansas to the Fort Lyon Canal, and the upstream structure diverts water from the Arkansas River to the Otero Canal. However, during periods of very high runoff, diversions to the canal are often curtailed; consequently, any reduction of the flood peaks is uncertain and unlikely. The U.S. Bureau of Reclamation constructed Pueblo Dam on the Arkansas River, approxiamtely 6 miles upstream from the City of Pueblo, and approximately 70 miles upstream of La Junta. The dam will control Arkansas River flows up to 87,000 cfs, originating from the upper basin, but the reservoir will have only limited effect on flood flows in Otero County (Reference 7).

IV. HISTORY OF FLOODING

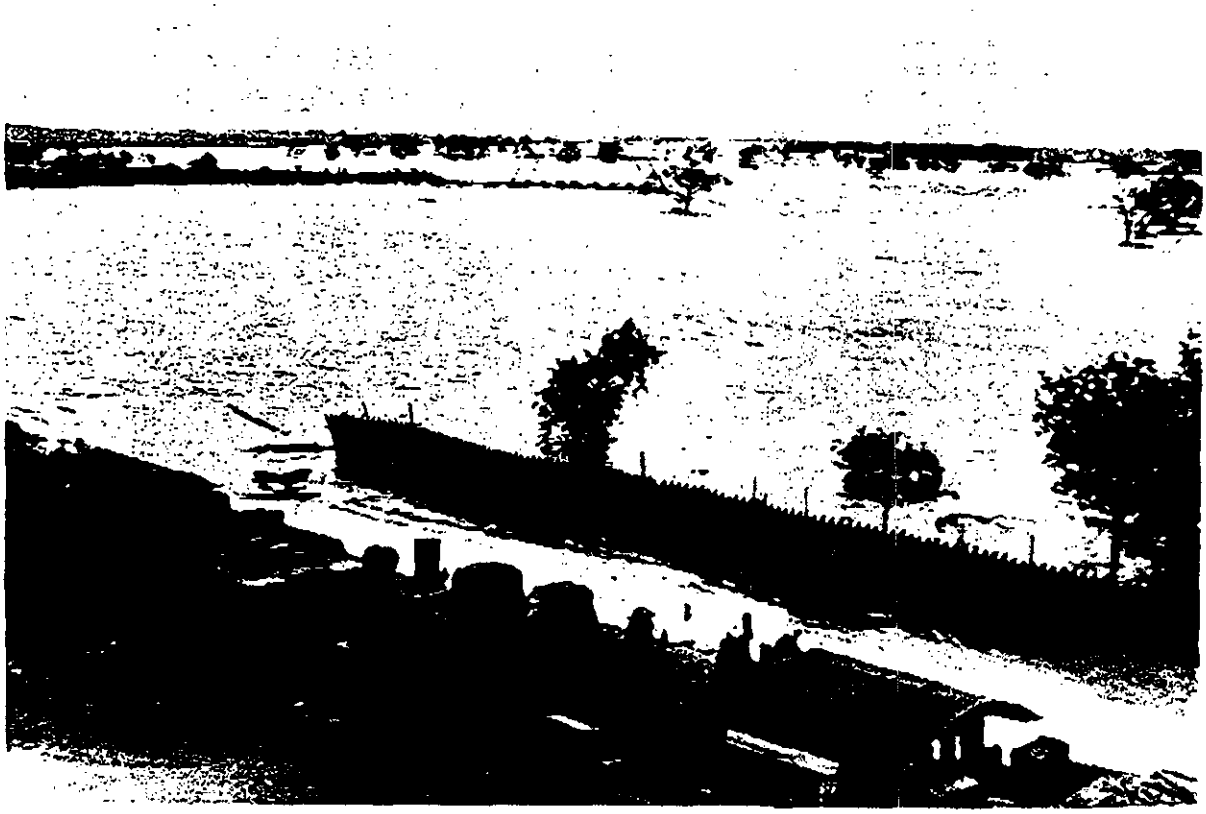
The Arkansas River and Timpas Creek have a long history of flooding, the earliest flood of record occuring in 1894. Large

floods also occured in 1921, 1923, 1936, 1942, 1955 and 1965; see Table 2 for peak discharges and dates (Reference 9).

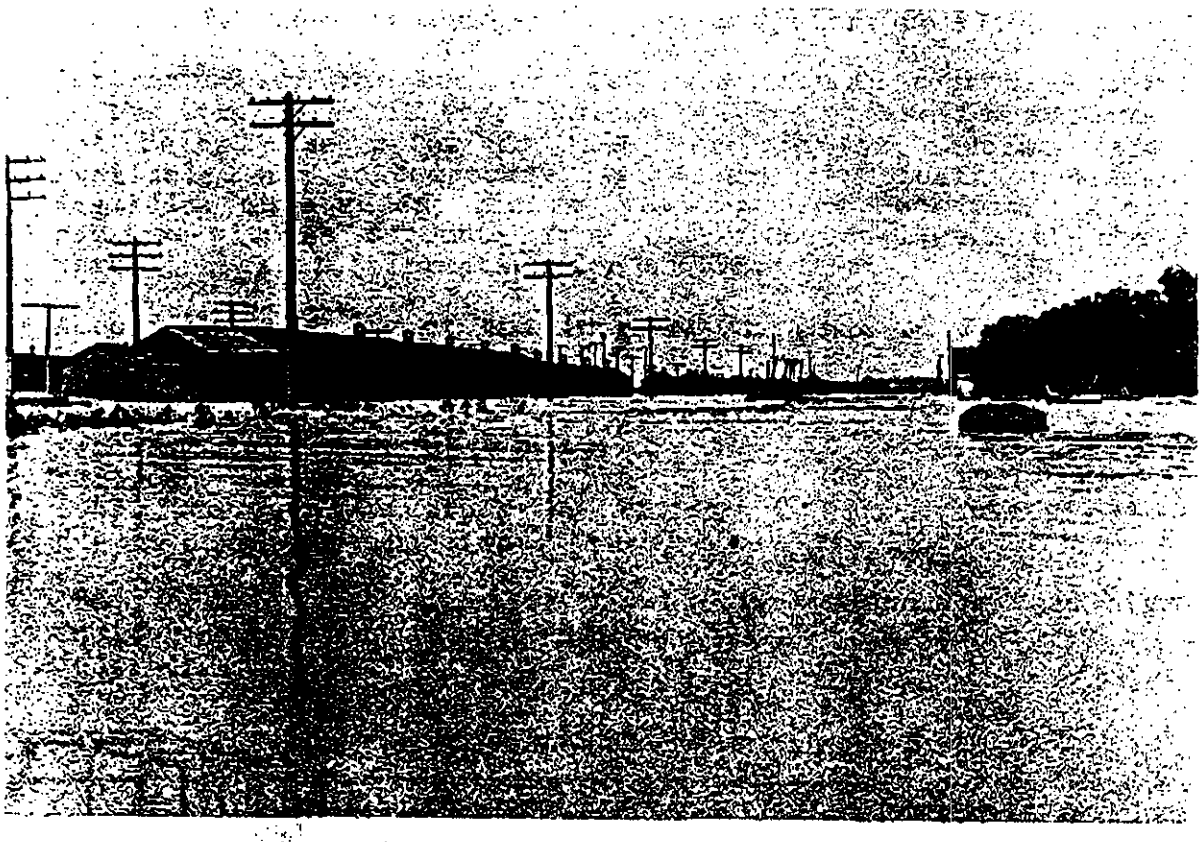
Information on the earlier historical floods that have occurred in the study area is very limited because streamflow records were not being made prior to 1894, eye-witness accounts are not available, and contemporary records are practically nonexistent. Regarding more recent floods, town records, newspaper accounts, and eye-witness accounts from long time residents of the area were sources of information for this report.

According to a few of the longtime citizens of Rocky Ford, the bridge on Highway 71 was washed out in the flood of 1921. U.S. Geologic Survey Water Supply Paper No. 1455-A indicates that this bridge washed out again in 1955 (Reference 8). Also water was remembered to have been at a depth of 2 or more feet in the railroad yard at LaJunta, Colorado during the 1921 flood. In 1965, the Swink underpass on Highway 50 was completely flooded due to high water on Timpas Creek.

The floods of 1921 and 1965 heavily damaged bridges and highways in the study area. The following pictures show examples of such destruction:



West Bridge to North La Junta, looking northwest from Santa Fe Railroad Yards, 1921 Flood (County Road No. 28)



First Street in La Junta, Looking East
from San Juan Avenue, 1965 Flood

TABLE 2*

HISTORICAL FLOOD PEAK DISCHARGES

ARKANSAS RIVER - OTERO COUNTY, COLORADO

YEAR	DATE	PEAK DISCHARGE (cfs)
1894	May 31	30,000
1921	June 4	200,000
1923	Aug. 23	60,000
1936	Aug. 8	33,000
1942	Apr. 25	34,800
1955	May 20	50,000
1965	June 19	33,000

TIMPAS CREEK, OTERO COUNTY, COLORADO

YEAR	DATE	PEAK DISCHARGE (cfs)
1903	June 8	11,200
1927	July	7,700
1942	Aug. 14	4,300
1945	Aug. 15	4,580
1950	July 24	9,510
1953	July 12	10,000
1956	July 23	15,500
1958	July 5	23,000

(*Information for these Tables taken from Reference 9)

V. FLOOD CHARACTERISTICS

Flooding on the Arkansas River results from the annual snowmelt in its headwater regions, which is augmented by periods of very heavy rain. Historical data indicates that peak discharges on the Arkansas River and Timpas Creek within the study area are closely related to heavy thunderstorm rainfall originating downstream of Pueblo. This type of cloudburst flow in the river is characterized by high peak flows of short duration. Flooding due to snowmelt is usually abated as the river reaches the plains, and has had little impact upon the study area. Pueblo Reservoir controls approximately 40% of the study watershed, consisting of the upper reaches and headwaters of the Arkansas River. This major flood control structure has a large impact on flood flows in the vicinity of Pueblo, but will have only limited effect on flood flows in the study area.

VI. HYDROLOGIC ANALYSIS

The 10, 50, 100, 500-year discharges for the Arkansas River and Timpas Creek are shown in Table 3.

The hydrological analysis for the Arkansas River was performed by the U.S. Army Corps of Engineers in 1978. Their analysis was based on statistical analyses of streamflow records covering up to an 80-year period at selected gaging stations operated by the U.S. Geological Survey (Reference 10). The flood flows for Timpas Creek were provided by the Colorado Water Conservation Board, and are based on an analysis of stream flow records using Colorado Water Conservation Board Technical Manual No. 1. Detailed description of the hydrologic analyses are documented in the Technical Addendum.

VII. HYDRAULIC ANALYSIS

Water surface profiles have been computed for the study reach for the 10-, 50-, 100-, and 500-year frequency floods. The flows are listed in Table-3 presented on pages 13 through 17.

The hydraulic characteristics of the study reach were documented based on a field investigation. Culvert and bridge geometry, channel and overbank roughness coefficients, flow obstructions, and the overall characteristics of the area were assessed during this investigation. The Manning's roughness coefficeints used in the hydraulic analysis were documented in a separate report prepared as part of the technical addendum. Photographs were included in the report to support the recommended values. Recommended roughness coefficients range from 0.030 to 0.035 for the channel and from 0.040 to 0.090 for the overbank areas.

The water surface elevations were computed using the U.S. Army Corps of Engineers HEC-2 Step Backwater Computer Program (Reference 11). The locations of the field surveyed cross sections, digitized cross sections from the rectified photographic maps of the Arkansas River, and the digitized cross sections from the topographic maps of Timpas Creek are shown by stream stationing on the flooded area maps (Plates 3 through 11) and the flood profiles (Plates 12 through 22). The stream stationing, 100-year flood elevations, as well as the 10, 50, 100, and 500-year flood discharges are also listed in Table 3, Pages 13 through 17.

The water surface elevations presented in Table-3 are based on computations which assume no reduction in the bridge conveyance capabilities due to debris. Water surface elevations may increase if significant debris blockage should occur.

The 10-, 50- 100-, and 500-year flood events were used as the flood frequencies for this floodplain analysis. Thus the data developed in this report will be compatible not only for regulation purposes, and H.B. 1041 designation but also for Federal Insurance Administration flood insurance rate studies.

These various flood events have an average occurrence of once in the number of years as indicated. For example, the 100-year flood occurs, on the average, once in a 100 year period, and has a one percent chance of being equaled or exceeded in any given year.

The particular uses for the various flood events in addition to those stated above are as follows:

10-year and 50-year Flood Events

Information regarding these lower frequency floods is especially useful for future engineering studies and land use planning purposes related to minor road systems, minor channel improvements, the location of parks and recreational facilities, agricultural lands, and appurtenant structures. For structures and uses of this type on the smaller tributaries or in areas where the high risk of structural failure is economically feasible, and the hazard to life and property nonexistent, the use of the lower frequency floods may be considered.

100-Year Flood Event -

The 100-year flood event may also be used for engineering design purposes where a lower risk of failure than the 10- or 50-year flood is desired. However, the most important use of the 100-year flood event lies in floodplain designation and land use regulation as set forth in the state statutes. The State of Colorado considers the 100-year frequency flood as the flood event to be used in designing and protecting structures and dwellings for human occupation. Therefore, all floodplain regulations are based upon the 100-year flood. Also, the area which would be inundated by the 100-year flood may be delineated as an area of state interest as set forth in H.B. 1041 -- the state's land use bill.

500-Year Flood Event -

The 500-year flood event is useful in making the public aware that floods larger than the 100-year flood can and do occur. Just because a person is living above the 100-year flood boundary does not mean that he is completely safe from flooding. The 500-year flood event can also be used for regulating high risk developments within the floodplain such as nuclear power plants, or the storage or manufacture of toxic or explosive materials.

Table 3 lists the discharge and water surface elevations for the 10- 50- 100-, and 500-year flood events at selected reference points.

Flooded Areas

The 100-year frequency flood has been selected by the State of Colorado as the flood event to be used for floodplain delineation and regulation. Thus the Flooded Area plates show only the boundary of the 100-year floodplain. The flooding limits were plotted at the cross section locations using the HEC-2 computer results, and then interpolated between cross sections by field investigation with the help of aerial photography and topographical maps of the area.

The area delineated on the Flooded Area plates as the 100-year floodplain meets the requirements of H.B. 1041 as an area of state interest. Also upon official approval of this report by the Colorado Water Conservation Board the area outlined by the 100-year flood boundary will be designated a floodplain area and may be regulated accordingly by the local officials.

Flood Elevations

Flood crest elevations for the 10-, 50-, 100-, and 500-year floods may be found in four separate locations in this report. The Flood Frequency-Elevations and Discharge Data table, Table 3, list these elevations at selected reference points. The Flooded Area Plates 3 through 11 give the plan view of the flooded area. The Flood Profile plates, Plates 12 through 22, show the streambed elevation and the high water elevations for all four frequency floods. Also the Cross Section plates, Plates 23 through 26, show a graphical representation of the high water elevations at typical valley cross sections throughout the study reach.

The Flood Profiles may be used in areas where controversy arises over the 100-year flood boundary on the Flooded Area plates. Since the Flood Profile plates give the elevations and distance or stationing from a known point, the high water elevations can be surveyed on the gound to alleviate any discrepancies on the base map.

Benchmarks used in the compilation of data for this study are included in the Technical Addendum.

1. Contacts

Fax Transmittal

Date April 13, 1998

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Marcus Reitch

FAX # 970 484 4593

Phone #

FROM: Phillips County Administration Office

TOTAL NUMBER OF PAGES INCLUDING THIS PAGE: 3

If you do not receive all pages or have any problems with reception, please call us back as soon as possible.

Phone: (970) 854-3778

MESSAGE:

Marcus -

attached is the article from the Haxtun - Fleming Herald and the rainfall record from the July 28 - Aug 12 time period.

Mrs. Thompson will give us the negatives so another set of photos will be made and forwarded. That may take a week - 10 days.

Sincerely,

Randy Schafer

OFF:FAX

May 21, 1998

Enclosed are the pictures you requested. The two pictures are taken at the bridge on Highway 59 where the Sandy Creek crosses. They will fit together if you match the dots at the bottom of the picture. The third picture is taken a mile west of our place. I'm not sure what that draw is called, however, it joins the Sandy in the corner of our pasture before it gets to the highway.

Robert L. Fetzer
3105 Co Rd 14
Haxtun, CO 80731

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/20/98
Call Placed/Received by: Markus Ritsch
Spoke With: Bob Fetzer/Phillips CO
Company/Affiliation: Weather Observer
Phone no.: 970-774-7349
Project No.: D479

Comments:

Bob did not save the Calendar in which he wrote PX amounts for 1997. He uses a tapered rain gauge from the local COOP to record PX and recalls that he read more than 4 inches on June 2, 1997.

His wife took phots of Sandy Creek on June 3. They are sending those photos.

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/18/98
Call Placed/Received by: Randy Schafer
Spoke With:
Company/Affiliation: Phillips County
Phone no.:
Project No.:

Comments:

Randy supplied the following name as the reference for the 4.5" observation of precipitation on the night of June 2, 1997.

Robert L. Fetzer
03105 County Road 14
8mi South & 1mi W of Haxtun
970-774-7349

Call Robert & get a copy of his PX log over what time period did he observe 4.5 inches?

Signature Marcus Pabst

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	4/23/98
Call Placed/Received by:	Markus Ritsch
Spoke With:	Jack Wieland
Company/Affiliation:	Colorado Division of Wildlife
Phone no.:	(970) 854-3512
Project No.:	D479

Comments:
The Means Lake Dam was constructed in 1955, the same time that Jumbo Reservoir was constructed up north. The reservoir was initially constructed as a **flood control structure** to protect Holyoke and communities in Nebraska. Currently the area is known as the Frenchman Creek State Wildlife Area and is used for recreational purposes. The structure is an earthen dam with a concrete spillway. The spillway was repaired about 3 years ago.

In June of 1997, the dam did not overtop but came within 2 inches of overtopping. The spillway was overtopped by about 2 feet.

Jack thinks/knows that the original storage capacity is severely reduced due to siltation.

The following was taken from the Colorado Division of Wildlife repor" titled, "Means Lake Master Management Plan 1984".

The earthen dam is 1200 feet long and 26 feet high.
The spillway is 100 feet wide and 56 inches deep and is located on the south side of the lake. There is a 24 inch valve outlet on north end of the lake.
Storage capacity: 135 surface acres with a max depth of 16 feet and minimum depth of 3 feet in 1955. Includes storage with the flood gates inplace. Assume an average depth of 9.5 feet and surface area of 130 acres = 1,200 acre-feet.
The elevation of the Frenchman Creek below Means Lake is 3725 feet.
The Division purchased the property in 1956 from several private individuals.

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/23/98
Call Placed/Received by: Markus Ritsch
Spoke With: Larry & Carol Haynes
Company/Affiliation: amateur weather obs.
Phone no.: (970) 854-3494
Project No.:

Comments:

Rainfall amounts for June 2, 1997? Ag raingauge.

fill in diary at night, 24 hour readings, readings observed in the am.

June 2 - 6 tenths
June 3 - 3 plus inches

Came all within a few 4-6 hour period the evening of June 2.

Signature Markus Ritsch

RECEIVED APR 2 2 1998

4-20-98

Dear Sir:

I am not sure this is the type of information you want on flooding in 1997.

We live 5 miles west & 3/4 mile north of Holyoke Colorado. The legal description is E½ 5-7-45. Early on June 15, 1997 we received over 5 inches of rain in about 3 hours.

We have some pictures of the resultant flooding if you would be interested in them.

If you have questions or would like more information feel free to call at (970) 854-3494

Thank you.

Larry & Carol Haynes
24643 County Rd 29
Holyoke CO 80734

PHILLIPS COUNTY COMMISSIONERS

JAMES R. MORT
JACK L. KENNEDY
KEITH L. SHARPE

970-854-2454

221 S. INTEROCEAN
HOLYOKE, COLORADO 80734

FAX 970-854-3811

TO: Riverside Technologies
Marcus
2290 E. Prospect Rd Suite 1
Ft. Collins, CO 80525

FROM: Randy Schafer
Phillips County Randy Schafer

DATE: April 21, 1998

Enclosed are the pictures that were taken about 11:00 a.m June 15. We have enclosed a map that is highlighted where the pictures were taken. We have also written on the back of the pictures.

Tom browning has a copy of a video of the flooded Frenchman Creek in the Holyoke area. We do have an aerial video of Sandy Creek during its flood stage. This creek comes from south of Fleming, and flows SE and deadends SE of Holyoke about 6 miles. It has caused major damage to roads as well as farmground the 3 times it flooded between late 96 through the fall of 97.

If you would like any further information, please let me know.

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/21/98
Call Placed/Received by: Markus Ritsch
Spoke With: Mark Brown
Company/Affiliation: Holyoke City manager
Phone no.: (970) 854-2266
Project No.:

Comments:

No dollar figures are available for damages incurred at the golf course during the June 14 Storm event.

Their efforts were primarily to remove debris off the course and to fix a few cart crossings.

Per Tom Browning - Golf Course 2^K

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/21/98
Call Placed/Received by: Marcus Ritsch
Spoke With: ~~Kevin Hilpipar~~ George LaValley
Company/Affiliation: NKC Railnet / Road Master
Phone no.: (308) 352-4899
Project No.:

Comments:

	June 2	June 14-15
RR Damage Estimate:	None	$30,000 - contractors Labor $2-5K - material

- Hwy 23 & Cut Rd 51

four points of damage.

Out of service for 3 days - $9K ~~no revenues~~ lost being out of service. due to car delays

Repair of fill & balast, no track damage - $2-5K

30K - Labor contract
2-5K - material
9K - Delays

~$43K - Total

Signature Marcus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/21/98
Call Placed/Received by: markus Ritsch
Spoke With: Trisha King
Company/Affiliation: ~~AG. Ext. office~~ Farm Service Agency - USDA
Phone no.: (970) 854-2812
Project No.:

Comments:

June 2 June 14-15

Crop Damage Estimate:
no dollar amounts just descriptions of damage for ~~both~~ June 14-15 event only.
~~events.~~ includes # of acres inundated and the growth stage of the crops

she will fax me the pages (cannot fax because it is not official)
She can only tell me over the phone.

No reports for June 2.

Precipitation Quantities:
NO, only when draught or extreme events. are they interested in this type of data.

Weld County: office manager Arnold Germann 970-356-8097

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/22/98
Call Placed/Received by: Markus Ritsch
Spoke With: Trisha King
Company/Affiliation: Ag. Ex. - USDA Farm Service Agency
Phone no.:
Project No.:

Comments:

	Affected Acres	% loss
wheat	8,000 ac	85
corn	6,000	80
millet	15,000	95
Beans	1,000	?
Sugar Beets	200	50

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/20/98
Call Placed/Received by: Markus Ritsch
Spoke With: ~~Gene~~ Grey, Jean
Company/Affiliation: Haxtun Harold
Phone no.: (970) 774-6118
Project No.: 0479

Comments:

Gene keeps PX records for the town of Haxtun.

She is going to get me some #'s by

April 24, 1998. ~~Eldon~~

June 2,

May 29 - Jun 3 - 2.88" - probably occured all on June 2

June 8 - .4"

June 11 .30

June 14 - 1.0"

June 18 - .05"

June 21 - .12"

Signature Marlene Pantzer

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/20/98
Call Placed/Received by: Markus Ritsch
Spoke With: Karen Manley
Company/Affiliation: Holyoke Chamber of Commerce
Phone no.: 970-854-2400
Project No.: D479

Comments:

steg Airport 854-2828

The population of Holyoke at the last Census (1990) was 2,000. Karen estimates the current population to be on the order of 2,500.

Amherst population - 100 - 150 people

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/20/98
Call Placed/Received by: markus Ritsch
Spoke With: Clark Renter/Fran
Company/Affiliation: weather observer
Phone no.: 970-774-7147
Project No.: D479

Rain Master - antomated Rainwise raingage

Comments:

1997 Rain Accumulations (7am - 7am): 24hour

Two Gauges - one manual, one antomatic

7am on June 2 - 0.35"
June 3 - 2.81"
June 4 - 0.0
June 5 .27
June 6 .9
June 14 - 2.09
June 15 - 0.00
June 19 - .43
June 21 - .15

June Tot 6.20"

July 11 .39"
July 19 .20"
July 25 .40"
July 27 .04"
July 28 .04"
July 29 .44"
July 30 .49"

July - 2.07" Total

Aug 4 .78"
Aug 5 .65"
Aug 6 .81"
Aug 10 .02"
Aug 11 .03"
Aug 13 .01"
Aug 14 .02"
Aug 26 .07"

Aug 2.39" Tot.

Signature Markus Ritsch

From: **"darrell" <ddndt@ria.net>**
To: **"Markus Ritsch" <mlr@riverside.com>**
Subject: **Re: 1997 Holyoke, CO Flood**
Date sent: **Sat, 18 Apr 1998 09:28:11 -0600**

Dear Markus Ritch,
The 1.5" rain was the night before the flood in Holyoke. this was Father's Day 1997. the moisture for the whole year at the Holyoke Veterinary service was only 12". the physical address for the Holyoke Veterinary Service is 41518 Hwy 6 Holyoke, CO. Sincerely, Darrell Tomky DVM -----Original Message----- From: Markus Ritsch <mlr@riverside.com> To: darrell <ddndt@ria.net> Date: Friday, April 17, 1998 11:20 AM Subject: Re: 1997 Holyoke, CO Flood

Darrell,

Thank you for the information. I have been out of the office for a couple of days so I appologize for the delayed response.

Can you give me the street address for the Holyoke Vetinary Service?

Also, the 1.5 inches of rain that you refer to, over what time period was that measured?

Did you measure precipitation for the entire season last year?
Do you have any precipitation amounts for June 2 or the period July 28 through August 12?

I appreciate any information you may have.

Thanks

Markus Ritsch

> Dear Markus Ritsch,
> The Father's Day flood 1997 the water in the Holyoke Veterinary
> Service
east of Holyoke was 6" deep. We only got an inch and a half of rain.
> Sincerely, > Darrell Tomky DVM > >

From: **"Markus Ritsch" <HORSETOOTH/MLR>**
To: **mlr**
Date sent: **Fri, 17 Apr 1998 11:20:12 MDT-0600**
Subject: **(Fwd) 1997 Holyoke, CO Flood**

------- Forwarded Message Follows -------
From: "darrell" <ddndt@ria.net>
To: <mlr@riverside.com>
Subject: 1997 Holyoke, CO Flood
Date: Wed, 15 Apr 1998 07:48:18 -0600

Dear Markus Ritsch,
The Father's Day flood 1997 the water in the Holyoke Veterinary Service east of Holyoke was 6" deep. We only got an inch and a half of rain. Sincerely, Darrell Tomky DVM

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Markus Ritsch
DATE: April 13, 1998
SUBJECT: 1997 Flooding

INDIVIDUAL: Randy Schafer
AFFILIATION: Phillips County
PHONE #: 970-854-3778

---

1. Affected streams and local drainages?
   Phillips County experienced three significant storm periods in 1997: June 2, June 14-15, and July 28-29. During these periods different streams were affected. The June 2 event affected Sandy Creek and Frenchman Creek. The June 14-15 even affected Frenchman Creek and Wildhorse Creek, and the July 28-29 events affected Sandy Creek and Frenchman Creek

2. Geographic extent of flooding?
   One flood inundation map exists which is a hand-drawn map that Tom Browning has for the event of June 14-15. The County has a map that shows all the road crossings that were damaged during the floods. This information is available as a list of road crossings as well as a hardcopy map showing the locations

3. Storm duration? Starting time and ending time of major storm event?
   July 30, 1997, Holyoke received little rain but the town of Haxtun recorded 1.6 inches. The night of August 5, 1997, Holyoke received little rain but the town of Haxtun recorded 1.65 inches. In early June (June 3) a large storm just south of Haxtun dumped over 4 inches (talk to Clark Rueter about precipitation amounts).

4. Rainfall amounts? Extent of rainfall? Rainfall bucket surveys? Precipitation gauging network?
   An isohyetal map for the June 14-15 event is available from Tom Browning. Two official weather spotters live in Phillips County: Clark Rueter (28 170 County Rd 13, North of Highway 6, 2 miles east of Haxtun) and Dale Anderson (in Holyoke). There is no rain gauge at the airport????

5. Documentation of high water marks? No photographs of high water marks with a person holding a survey rod exist. Again, the only available information was developed with Tom Browning for the June 14-15 event.

6. Estimated peak discharges? The only a estimates of discharge were recorded for the June 14-15 event with Tom Browning.

7. Estimated flood damages? June 2 event: No damage estimates are available. June 14-15 event: County roads and bridges: $264,111 (bridge repair was $5,226 of the total). Residential homes: $91,078, Commercial properties: $0, Agricultural Land: Talk to Trisha King at the Agricultural. Extension Office (970-854-2812), Airport: No damage RR: Talk to George LaValley, Road Master for NKC Railnet in Grant Nebraska (308-352-4899). Golf Course: Talk to Mark Brown

(970-854-2266) July 28-29: County roads and bridges: $50,746 (FEMA estimate) Residential properties: No damage, Commercial properties: No damage, Agricultural Land: Talk to Trisha King at the Agricultural. Extension Office (970-854-2812), Airport: No damage RR: Talk to George LaValley, Road Master for NKC Railnet in Grant Nebraska

8. Costs associated with the clean-up effort? Differentiate between local, state, and federal. No costs estimated with the clean-up effort.

9. Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal. No costs estimated with the flood-fight effort.

10. Types and amount of repair work after flooding? Repair work after the flooding consisted of repair to County roads and bridges, repair to railroad embankments, repair to the golf course.

11. Any previous/recent flood mitigation efforts that reduced damages? A small dam called Means Lake was constructed on the South Fork of Frenchman Creek in 1955. This dam was constructed for flood control. The lake may have attenuated the flood peak along Frenchman Creek during high flow. A State funded flood control project was completed several years ago near Paoli. The project consisted of enlarging a highway/railroad underpass on Frenchman Creek. Enlargement consisted of the removal of silt and debris. Paoli did not flood in 1997.

12. Any future mitigation needs as a result of the flooding? The City of Holyoke and the County are working together on a project to clean and repair Frenchman Creek in the Town of Holyoke. The floods of 1997 left a lot of debris.

13. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)? Two large culverts and a bicycle bridge (approximately 48 inches each) were installed just north of the airport runway to pass flow from Frenchman Creek under County Road 41. These culverts may have been undersized and restricted the flow during the extreme floods experienced in 1997.

14. Do you have any photos and/or video available? Are the photos in digital format? County commissioner Jim Mort has a video of the flooding. Randy Schafer is going to send us some select photos that he thinks may be of use to the report.

15. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc. The only map available from the County is one showing the location of road damage.

16. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)
All maps are in hardcopy.

17. Is there any existing documentation regarding the flooding?
Not that Randy is aware of.

18. Name of local newspaper? Do they have a web site?
The Holyoke Enterprise, no.

19. Do you have an internet site? Do you know of any related local sites?

Flooding

Flood 3 times, Sandy crk. Frenchman Crk.

June 2 – 4.5' South of Haxtun

June 15 –

July 28-29 – Flooded again

Damage Cost:

June 2 – No Cost estimate available

June 15 – $264,111 – Just County Roads & Bridges minor
$5,226 of total

July 28-29 ~~FEMA~~ $50,746 – County repair to Road

– No Cost estimates for residential Commercial properties

$40,500
13,757
23,079
~~37,041~~
3,742
10,000

} Residential Damage Estimates from County

No Commercial property Damage estimate.

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Ellie/Randy Schafer

FAX NO.: 970-854-3811

FROM: Markus Ritsch

DATE: 4/8/98

NO. OF PAGES: We are sending 4 Page(s) (Including this Page)

SUBJECT: Phone interview regarding 1997 flooding

COMMENTS:

Randy, 13th

I am working for the Colorado Water Conservation Board (Tom Browning) to prepare documentation regarding the flooding that occurred in 1997. You were identified as a good source of information for Phillips County. Tom Browning and I have prepared some questions that I would like to discuss with you over the phone on Friday, April ~~10th~~ at 9:00 am. I am including the questions in this fax to give you an idea as to the type of information we are collecting.

If I don't hear from you, I will assume you are available on Friday at 9:00 am for the phone call. I will initiate the call on Friday. You can reach me at (970) 484-7573 or by e-mail at mlr@riverside.com.

If you feel there are other individuals that could provide information, please feel free to include them in the discussion on Friday.

Thank you, I'm looking forward to talking with you.

Markus Ritsch

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Fax Haxtun Article

40 min

~~Fri~~ Apr 10 9am
mon 13th

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

Send photos

BY: Markus Ritsch
DATE:
SUBJECT: 1997 Flooding

INDIVIDUAL: Randy Schafer
AFFILIATION: Phillips County
PHONE #: (970) 854-3778

---

1. Affected streams and local watersheds? June 2 - Sandy Crk, Frenchman Crk
June 15 - Frenchman, Wild horse
July 28-29 - Sandy crk, Frenchman.

2. Geographic extent of flooding? Are flood inundation maps available?
- only Road crossings, have maps of damage to road crossings.

3. Storm duration? Starting time and ending time of major storm events? I realize that Phillips County had a significant event on June 14-15 of 1997. What were the events that justified the Presidential declaration of disaster for the period July 28 through August 12? - Holyoke got little rain, Haxtum had 2 nights 1.6" (July 30) - Aug 5 (1.65") during the July 28 - Aug 12 period
Haxtum Harold - Newspaper Aug 6 - story

4. Rainfall amounts? Have you generated any isohyetal maps?
June 15, map of rainfall, already

5. Rainfall bucket surveys?

6. Precipitation gauging data? Is there a rain gage at the airport? How about Dale Anderson where does he live? in Holyoke
Clark Ruter - Haxtum/Paoli
28 170 County Rd 13, N of Hwy 6, 2 miles East of Haxtun

7. Documentation of high water marks? Do you have any photos that show a person holding a survey rod next to a permanent structure documenting how high the water was?
No, only what Tom has.

8. Estimated peak discharges?

No, only what Tom did.

9. Estimated flood damages? How many homes, businesses, schools, churches were destroyed? How much farm land was destroyed? How many county roads, bridges, culverts, etc. were destroyed? Crop Damage estimate? RR damage? Airport? - no repair work done @ Airport

31 homes?

→ Call Extension Office (970-854-2812) for crop damage estimates - Trisha King, RR damage repair on the June 15 event, Kevin Hilpipper Road master NWKC Railnet PO Box 159 128 1st St Grant Neb 69146

10. Costs associated with the clean-up effort? Differentiate between county, state, and federal.

- Sherrif's Dept, No overtime
All volunteer fire Dept.

11. Costs associated with emergency operations/flood fight efforts? Differentiate between county, state, and federal.

- NO

12. Types and amounts of repair work after flooding?

- County Roads, Bridges,
- RR embankment
- Golf Course damage (854-2266) - Mark Brown

13. Any previous/recent flood mitigation efforts that reduced damages?

- 1 small Dam - means Dam Lake, Game & Fish
~~East~~ West of Holyoke on Frenchman
No Flood Control,
- landowner terraces
- County Flood Control Drainage Project, Highway/RR Bridge at Paoli, State funded enlarged underpass was silted in, also Frenchman.

14. Any future mitigation needs as a result of the flooding?

- Project to clean Frenchman Crk. County/City.

- looking at Structural Projects Dams, Levees,

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

- North of runway was 2 large Culverts (48") that backed up the flow on the June 15 event.
- Bycicle bridge may also have held flow back, just west of North end County Rd 41. ¼ mile west of N. end of runway

16. Do you have any photos and/or video available? Are the photos in digital format?

—To Send me some photos.
— Commissioner Jim Mort has video.

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

— County Rd damage map.

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

19. Is there any existing documentation regarding the flooding?

20. Name of local newspaper? Do they have a web site?

21. Do you have an internet site? Do you know of any related local sites?

Fax Transmittal

Date April 9, 1998

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Marcus Reich FAX # 970 - 4141 - 7593

Phone # _____

FROM: Phillips County Administration Office

TOTAL NUMBER OF PAGES INCLUDING THIS PAGE: 1

If you do not receive all pages or have any problems with reception, please call us back as soon as possible.

Phone: (970) 854-3778

MESSAGE:

- Rescheduled for Apr. 13th @ 9:00 a.m.

Marcus

I will be out of the office on Tuesday, April 14 when you planned to call. The (13th) 14th, or 17th are dates I will be in at least part of the day.

Sandy Schafer
Phillips County

OFF:FAX

From: **tom.browning@state.co.us**
To: **mlr@riverside.com**
Subject: **Phillips County**
Date sent: **Fri, 3 Apr 1998 08:28:55 -0700**

Hey Markus;

Contacts for Holyoke are:
Mark Brown (City Manager) and Steve Brown (Mayor or Council member)
The main number to the city is (970)854-2266.

Randy Schaefer is the Phillips County Administrator. The main number is (970)867-5616.

Tom

From: **tom.browning@state.co.us**
To: **mlr@riverside.com**
Subject: **Frenchman Creek**
Date sent: **Mon, 4 May 1998 13:43:16 -0600**

Markus;

When I was in Holyoke on June 17, the flow in the creek was minimal. I would guess in the range of 20 to 80 cfs or so. I'm not sure what the normal summertime baseflows are, if any.

I'll be faxing up the discharge estimates to you this afternoon.

Tom

2. Federal Data

WS FORM B-91
(7-89)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

RECEIVED APR 21 1998

Copy

STATE: MONTANA | COUNTY: Phillips | RIVER: — | MONTH: JUNE | 19 97

TIME (local): [illegible]VATION RIVER | TEMP.: 7A | PRECIPITATION: 7A | STANDARD TIME IN USE: MST

TYPE OF RIVER GAGE: — | ELEVATION OF RIVER GAGE ZERO: — Ft. | FLOOD STAGE: — Ft. | NORMAL POOL STAGE: — Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets. (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	ICE THICKNESS	REMARKS (Special observations, etc.)
1	83	56	64	0.00														
2	86	56	59	0.54														
3	75	55	58	1.85														
4	72	50	56	0.00														
5	69	54	61	0.00														
6	76	60	64	0.00														
7	75	55	65	0.00														
8	79	59	66	0.08														
9	74	55	55	0.27														
10	65	49	51	0.00														
11	70	56	60	0.19														
12	83	54	68	0.00														
13	74	55	56	0.00														
14	75	56	60	0.00														
15	81	55	59	1.49								X						
16	73	54	62	0.60														
17	77	56	64	0.00														
18	80	59	69	0.00														
19	91	61	69	0.23														
20	90	64	73	0.00														
21	87	62	63	0.02														
22	85	63	69	0.00														
23	94	62	66	0.00														W- RAIN
24	93	61	67	0.00														
25	79	60	63	0.67														
26	61	51	57	0.20														
27	82	57	68	0.00														
28	94	61	71	0.00														
29	93	64	72	0.00														
30	86	62	71	0.00														
X																		
SUM			SUM	4.89														

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen, but open at gage.
C. Unevenly [illegible] of smooth ice.
E. Ice gorge below gage.
F. Shore ice.
G. Floating ice.

CHECK BAR (For wire-weight: NORMAL CK. BAR

READING	DATE

Fog | Ice Pel | Glaze | Thund | Hail | Dam Winds

OBSERVER: DANE E ANDERSON

SUPERVISING OFFICE | STATION INDEX NO.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

(7-89)

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

STATE: OKLAHOMA	COUNTY: PHILLIPS	MONTH: JULY	19 77
TIME (local) C ...TION RIVER	TEMP. NA	PRECIPITATION NA	STANDARD TIME IN USE: MST
TYPE OF RIVER GAGE	ELEVATION OF RIVER GAGE ZERO Ft.	FLOOD STAGE Ft.	NORMAL POOL STAGE Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX.	MIN.	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets, (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)	Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M. 1 2 3 4 5 6 7 8 9 10 11	WEATHER (Calendar Day) Mark 'X' for all types occurring each day. Fog	Ice Pellets	Glaze	Thunder	Hail	Damaging Winds	Time of observation if different from above	RIVER STAGE CONDITION	GAGE READING AT ___ A.M.	TENDENCY	REMARKS (Special observations, etc.,)
1	92	64	72	0.00														
2	88	50	72	0.00														
3	78	55	58	0.00														
4	71	48	55	0.00														
5	78	52	59	0.00														
6	80	56	63	0.00														
7	83	61	65	0.00														
8	87	64	69	0.00														
9	89	59	69	0.00														
10	85	60	68	0.00														
11	91	65	69	0.00														
12	87	64	66	0.12														
13	90	59	68	0.00														
14	85	61	68	0.00														
15	80	61	69	0.00														
16	94	62	69	0.00														
17	96	65	74	0.00														
18	90	61	69	0.00														
19	93	62	70	0.00														
20	91	65	71	0.05														
21	83	63	65	0.00														
22	87	65	70	0.00														
23	91	65	73	0.00														
24	95	66	70	0.01														
25	93	69	75	0.00														
26	90	64	69	0.09														
27	93	67	71	0.00														
28	87	65	66	0.02														
29	76	63	65	0.69														
30	74	63	65	0.41														
31	77	65	69	0.00														
Sum			SUM	1.35														

CHECK BAR (For wire-weight; NORMAL CK. BAR

READING	DATE

CONDITION OF RIVER AT GAGE

A. Obstructed by rough ice.
B. Frozen but open at gage.
C. Upper surface of smooth ice.
E. Ice gorge below gage
F. Shore ice.
G. Floating ice.

OBSERVER: DALE E ANDERSON

SUPERVISING OFFICE

STATION INDEX NO

RECORD OF RIVER AND CLIMATOLOGICAL OBSERVATIONS

HOLYOKE — AUG 1994

STATE: COLO | COUNTY: PHILLIPS | RIVER: —

TIME (local) OF OBSERVATION RIVER: — | TEMP: 7A | PRECIPITATION: 7A | STANDARD TIME IN USE: MST

TYPE OF RIVER GAGE: — | ELEVATION OF RIVER GAGE ZERO: — Ft. | FLOOD STAGE: Ft. | NORMAL POOL STAGE: — Ft.

DATE	TEMPERATURE F. 24 HRS. ENDING AT OBSERVATION MAX	MIN	AT OBSN.	PRECIPITATION 24-HR AMOUNTS Rain, melted snow, etc. (ins. and hundredths)	Snow, ice pellets (ins. and tenths)	At Ob. Snow, ice pellets, hail, ice on ground (ins.)
1	86	69	71	0.00		
2	87	65	72	0.00		
3	87	66	72	0.00		
4	89	65	70	0.08		
5	86	64	68	0.00		
6	85	60	69	0.98		
7	76	57	63	T		
8	78	56	61	0.00		
9	75	61	64	0.00		
10	76	58	58	T		
11	62	51	51	0.16		
12	64	51	61	T		
13	[illegible]	57	63	0.00		
14	88	57	65	0.05		
15	85	59	66	0.02		
16	94	58	63	0.00		
17	[illegible]	57	58	0.00		
18	75	58	64	0.00		
19	76	55	63	0.00		
20	85	58	65	0.00		
21	82	62	64	0.00		
22	95	61	63	0.00		
23	86	60	67	0.00		
24	92	60	69	0.00		
25	95	62	69	0.00		
26	93	66	70	0.00		
27	91	65	68	0.03		
28	89	63	69	0.00		
29	96	66	71	0.00		
30	95	60	67	0.00		
31	85	59	65	0.00		
SUM			SUM	1.32		

Draw a straight line (——) through hours precipitation was observed, and a waved line (~~~~) through hours precipitation probably occurred unobserved. A.M. NOON P.M.

WEATHER (Calendar Day): Mark 'X' for all types occurring each day. Fog | Ice Pellets | Glaze | Thunder | Hail | Damaging Winds

Time of observation if different from above

RIVER STAGE: CONDITION | GAGE READING AT ___ A.M. | TENDENCY

REMARKS (Special observations, etc.)

CHECK BAR (For wire-weight) NORMAL CK. BAR — READING | DATE

CONDITION OF RIVER AT GAGE

OBSERVER

SEVERE WEATHER REPORTS/COORDINATION LOG

WSFO DENVER COLORADO

DATE: 6/15/91 PAGE 1 OF

TIME: (LOCAL)	CALL TO OR FROM:	DESCRIPTION:	INIT:
0032	Phillips Cty.	Highway 385 under water South of Holyoke	DBB
0133	Phillips Sheriff	Lots of flooding, Vehicles Washing of Roads	DBB
"	"	People Stranded in CARS!	"
0150	Sedgwick Sheriff	Minor Street flooding in Julesburg	DBB
0238	Phillips Sheriff	Highways 385N, 6W, + 23 Near Amherst	DBB
"	"	CLOSED!	"
0323	Phillips Sheriff	3.25" gust west of Holyoke	DBB
"	"	Lots of flooding yet. Most people stranded in cars earlier have been rescued.	" "
0339	Phillips Sheriff	6" Amherst	DBB/ET
0516	Phillips Sheriff	Frenchman Creek Holyoke Evacuating + Sandbagging	DBB
"	"	"A REAL MESS"	" "
0553	SEDGWICK	1.27" RAIN	JS
0634	Phillips Sheriff	Red Cross Businesses Flooded in Holyoke 3-5 FT. High in Buildings	DBB
		Flooding on Wildhorse Creek Too.	DBB
		Water Still Rising	DBB
725	4 E HAXTUN	2.09" PRECIP WIND GUST 56 FRENCHMAN CREEK OUT OF BANK	
0751	Phillips Sheriff	Waters Starting to Recede, Highways St.11	DBB
		Closed	

ZCZC DENLSRDEN DEF
TTAA00 KDEN DDHHMM

LOCAL STORM REPORT
NATIONAL WEATHER SERVICE DENVER CO
730 AM MDT SUN JUN 15 1997

...PRELIMINARY STORM REPORT FOR JUNE 15 1997...

TIME(MDT)	.....CITY LOCATION.....STATE ....COUNTY LOCATION....		...EVENT/REMARKS...
0032 AM 06/15/97	3 S HOLYOKE PHILLIPS	CO	FLASH FLOOD HIGHWAY 385 UNDER WATER.
0133 AM 06/15/97	HOLYOKE AND VICINITY PHILLIPS	CO	FLASH FLOOD VEHICLES WASHED OFF ROADS...PEOPLE STRANDED IN CARS.
0238 AM 06/15/97	HOLYOKE...AMHERST...PAOLI PHILLIPS	CO	FLASH FLOOD HIGHWAYS 385...6...AND 23 CLOSED DUE TO FLOODING.
0516 AM 06/15/97	HOLYOKE PHILLIPS	CO	FLASH FLOOD FRENCHMAN CREEK FLOODING HOLYOKE. SANDBAGGING EFFORTS FAILING.
0634 AM 06/15/97	HOLYOKE PHILLIPS	CO	FLASH FLOOD MANY BUSINESSES IN HOLYOKE FLOODED WITH 3 TO 5 FEET OF WATER.

BARJENBRUCH

15/0038 8 NE 4

ZCZC DENFFWDEN DEF
TTAA00 KDEN DDHHMM
COC095-150930-

BULLETIN - EAS ACTIVATION REQUESTED
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE DENVER CO
1233 AM MDT SUN JUN 15 1997

THE NATIONAL WEATHER SERVICE IN DENVER HAS ISSUED A FLASH FLOOD WARNING EFFECTIVE UNTIL 330 AM MDT FOR PEOPLE IN THE FOLLOWING COUNTIES

IN NORTHEAST COLORADO
PHILLIPS

INCLUDING THE FOLLOWING LOCATIONS
AMHERST...FAIRFIELD...HAXTUN...HIGHLAND CENTER...HOLYOKE...
PAOLI...PLEASANT VALLEY AND WAGES

AT 1230 AM MDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED VERY HEAVY RAIN CONTINUING OVER PHILLIPS COUNTY. UP TO 3 INCHES OF RAIN HAS ALREADY FALLEN IN THE HOLYOKE AND PAOLI AREA. THE PHILLIPS COUNTY SHERIFF INDICATED THAT HIGHWAY 385 SOUTH OF HOLYOKE WAS UNDER WATER.

THUNDERSTORMS WITH HEAVY RAIN WILL CONTINUE ACROSS THE AREA THROUGH 2 AM. ADDITIONAL RAINFALL AMOUNTS OF 1 TO 2 INCHES CAN BE EXPECTED....WITH A FEW SPOTS PICKING UP AS MUCH AS 3 MORE INCHES. EXCESSIVE RUNOFF FROM THIS STORM WILL CAUSE FLASH FLOODING OF SMALL CREEKS AND STREAMS.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS IMMINENT OR OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS. DO NOT ATTEMPT TO CROSS SWIFTLY FLOWING WATERS OR WATERS OF UNKNOWN DEPTH BY FOOT OR BY AUTOMOBILE. IF YOUR VEHICLE STALLS, ABANDON IT IMMEDIATELY AND SEEK HIGHER GROUND.

BARJENBRUCH

LAT...LON 4074 10207 4046 10208 4046 10269 4074 10263

15/0140

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COZ050-150930-

BULLETIN
FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
145 AM MDT SUN JUN 15 1997

...FLASH FLOOD WARNING FOR PHILLIPS COUNTY UNTIL 330 AM...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS

AMHERST...FAIRFIELD...HAXTUN...HIGHLAND CENTER...HOLYOKE...
PAOLI...PLEASANT VALLEY AND WAGES

AT 138 AM MDT...THE PHILLIPS COUNTY SHERIFF REPORTED THAT FLASH FLOODING WAS OCCURRING OVER MUCH OF THE COUNTY. AUTOMOBILES HAVE BEEN WASHED OFF THE ROAD AND MANY MOTORISTS WERE STRANDED IN THEIR CARS. THIS IS A DANGEROUS SITUATION!

THE HEAVY RAIN HAS ENDED FOR THE MOST PART OVER PHILLIPS COUNTY... BUT STREAMS WILL CONTINUE TO RISE DURING THE NEXT HOUR FROM EXCESSIVE RUNOFF. NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATES OVER 4 INCHES OF RAIN HAS FALLEN IN AREAS FROM PAOLI TO JUST NORTHWEST OF AMHERST. LINGERING THUNDERSTORMS SHOULD PRODUCE LESS THAN 1/2 INCH OF ADDITIONAL RAINFALL.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS.

DO NOT DRIVE ACROSS FLOODED AREAS. YOU NEVER KNOW HOW DEEP THE WATER REALLY IS!!!

BARJENBRUCH

LAT...LON 4074 10207 4046 10208 4046 10269 4074 10263

15 1024?

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COZ050-150930-

BULLETIN
FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
240 AM MDT SUN JUN 15 1997

...FLASH FLOOD WARNING FOR PHILLIPS COUNTY UNTIL 330 AM...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS

AMHERST...FAIRFIELD...HAXTUN...HIGHLAND CENTER...HOLYOKE...
PAOLI...PLEASANT VALLEY AND WAGES

THE PHILLIPS COUNTY SHERIFF REPORTED THAT FLASH FLOODING WAS OCCURRING OVER MUCH OF THE COUNTY. AUTOMOBILES HAVE BEEN WASHED OFF THE ROAD AND MANY MOTORISTS WERE STRANDED IN THEIR CARS. THIS IS A DANGEROUS SITUATION! MANY HIGHWAYS HAVE BEEN CLOSED...INCLUDING HIGHWAY 385 NORTH OF HOLYOKE...HIGHWAY 6 WEST OF HOLYOKE...AND HIGHWAY 23 IN THE AMHERST AREA.

THE HEAVY RAIN HAS ENDED FOR THE MOST PART OVER PHILLIPS COUNTY... BUT STREAMS WILL CONTINUE TO RISE DURING THE NEXT HOUR FROM EXCESSIVE RUNOFF FROM EARLIER STORMS. NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATES OVER 4 INCHES OF RAIN HAS FALLEN IN AREAS FROM PAOLI THROUGH AMHERST. LINGERING SHOWERS AND THUNDERSTORMS WILL CONTINUE THROUGH THE NEXT HOUR...BUT ADDITIONAL RAINFALL AMOUNTS SHOULD BE LESS THAN 1/2 OF AN INCH.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS.

DO NOT DRIVE ACROSS FLOODED AREAS. YOU NEVER KNOW HOW DEEP THE WATER REALLY IS!!!

BARJENBRUCH

LAT...LON 4074 10207 4046 10208 4046 10269 4074 10263

15/340!

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM

COZ050-151130-

BULLETIN
FLASH FLOOD WARNING
NATIONAL WEATHER SERVICE DENVER CO
400 AM MDT SUN JUN 15 1997

...FLASH FLOOD WARNING FOR PHILLIPS COUNTY EXTENDED UNTIL 530 AM...

THE WARNING INCLUDES THE FOLLOWING LOCATIONS...

AMHERST...FAIRFIELD...HAXTUN...HIGHLAND CENTER...HOLYOKE...
PAOLI...PLEASANT VALLEY AND WAGES

AT 340 AM...THE PHILLIPS COUNTY SHERIFF REPORTED THAT 6 INCHES OF RAIN HAS FALLEN IN AMHERST. FLASH FLOODING CONTINUED OVER MUCH OF PHILLIPS COUNTY AND NUMEROUS AUTOMOBILES HAVE BEEN WASHED OFF THE ROAD. MANY HIGHWAYS HAVE BEEN CLOSED...INCLUDING HIGHWAY 385 NORTH OF HOLYOKE...HIGHWAY 6 WEST OF HOLYOKE...AND HIGHWAY 23 IN THE AMHERST AREA.

THE HEAVY RAIN HAS ENDED FOR THE MOST PART OVER PHILLIPS COUNTY... BUT STREAMS WILL CONTINUE TO RISE DURING THE NEXT HOUR FROM EXCESSIVE RUNOFF FROM EARLIER STORMS. LINGERING SHOWERS AND A FEW THUNDERSTORMS WILL CONTINUE THROUGH 5 AM...BUT ADDITIONAL RAINFALL AMOUNTS SHOULD BE LESS THAN 1/2 OF AN INCH.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS.

DO NOT DRIVE ACROSS FLOODED AREAS. YOU NEVER KNOW HOW DEEP THE WATER REALLY IS!!!

BARJENBRUCH

LAT...LON 4074 10207 4046 10208 4046 10269 4074 10263

NE 3

15/0649

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM

COZ050-151400-

BULLETIN
FLASH FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
640 AM MDT SUN JUN 15 1997

...FLASH FLOOD WARNING IN EFFECT UNTIL 800 AM FOR PHILLIPS COUNTY...

THE FLASH FLOOD WARNING INCLUDES THE FOLLOWING LOCATIONS...

AMHERST...FAIRFIELD...HAXTUN...HIGHLAND CENTER...HOLYOKE...
PAOLI...PLEASANT VALLEY AND WAGES

THE PHILLIPS COUNTY SHERIFF REPORTED THAT MANY BUSINESSES IN THE TOWN OF HOLYOKE WERE FLOODED WITH 3 TO 5 FEET OF WATER. FRENCHMAN CREEK WAS WELL OUT OF ITS BANKS AND STILL RISING. SANDBAGGING EFFORTS WERE FAILING. THIS IS A DANGEROUS SITUATION!

PEOPLE ALONG FRENCHMAN CREEK...WILDHORSE CREEK...AND OTHER SMALL STREAMS AND CREEKS IN PHILLIPS COUNTY SHOULD TAKE ACTION NOW. MOVE PROPERTY AND YOURSELVES TO HIGHER GROUND IMMEDIATELY!

AS MUCH AS 6 INCHES OF RAIN FELL IN AMHERST OVERNIGHT...AND NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A LARGE AREA OF 4 TO 5.5 INCHES OF RAINFALL IN NORTHERN PHILLIPS COUNTY. LITTLE IF ANY ADDITIONAL RAINFALL IS EXPECTED.

A FLASH FLOOD WARNING MEANS THAT FLOODING IS OCCURRING. IF YOU ARE IN THE WARNING AREA MOVE TO HIGHER GROUND IMMEDIATELY. RESIDENTS LIVING ALONG STREAMS AND CREEKS SHOULD TAKE IMMEDIATE PRECAUTIONS.

DO NOT DRIVE ACROSS FLOODED AREAS. YOU NEVER KNOW HOW DEEP THE WATER REALLY IS!!!

BARJENBRUCH

LAT...LON 4074 10207 4046 10208 4046 10269 4074 10263

ZCZC DENSVSDEN DEF
TTAA00 KDEN DDHHMM COR
COZ050-150440-

SEVERE WEATHER STATEMENT...CORRECTED
NATIONAL WEATHER SERVICE DENVER CO
1025 PM MDT SAT JUN 14 1997

...SEVERE THUNDERSTORM WARNING FOR PHILLIPS COUNTY HAS EXPIRED...

THE NATIONAL WEATHER SERVICE IN DENVER HAS ALLOWED THE SEVERE THUNDERSTORM WARNING FOR SOUTHWESTERN PHILLIPS COUNTY TO EXPIRE AS OF 1005 PM MDT.

AS OF 1000 PM MDT...THE SEVERE THUNDERSTORM IN SOUTH CENTRAL PHILLIPS COUNTY HAS MOVED INTO NORTH-CENTRAL YUMA COUNTY.

THE STORM WAS MOVING SOUTHEAST AT 20 MILES PER HOUR.

BETWEEN 825 PM AND 835 PM MDT THE PUBLIC REPORTED HAIL 3/4 TO 1 INCH IN DIAMETER...WITH A FEW STONES UP TO 1 1/2 INCHES IN DIAMETER IN SOUTHWEST PHILLIPS COUNTY 3 MILES SOUTHEAST OF HIGHLAND CENTER... OR 17 MILES SOUTHWEST OF HOLYOKE.

BETWEEN 845 PM AND 850 PM MDT THE PUBLIC REPORTED A SMALL TORNADO IN A FIELD ABOUT 2 MILES SOUTH OF THE TOWN OF PAOLI...OR 8 MILES WEST OF HOLYOKE IN SOUTH-CENTRAL PHILLIPS COUNTY. THE BRIEF TORNADO REPORTEDLY CAUSED NO DAMAGE.

THUNDERSTORMS MOVING ACROSS PHILLIPS AND SEDGWICK COUNTIES MAY STILL PRODUCE LOCALLY HEAVY RAIN...SMALL HAIL AND STRONG GUSTY WINDS UNTIL 1045 PM MDT.

TAKE SHELTER IF SEVERE WEATHER APPROACHES YOU.

&
BAKER

ZCZC DENSVRDEN DEF
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COC095-150405-

BULLETIN - IMMEDIATE BROADCAST REQUESTED
SEVERE THUNDERSTORM WARNING
NATIONAL WEATHER SERVICE DENVER CO
938 PM MDT SAT JUN 14 1997

THE NATIONAL WEATHER SERVICE IN DENVER HAS ISSUED A SEVERE THUNDERSTORM WARNING EFFECTIVE UNTIL 1005 PM MDT FOR PEOPLE IN THE FOLLOWING COUNTIES...

IN NORTHEAST COLORADO
SOUTHWESTERN PHILLIPS

INCLUDING THE FOLLOWING LOCATIONS
HAXTUN AND HIGHLAND CENTER...

AT 932 PM MDT NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM 5 MILES SOUTHEAST OF HIGHLAND CENTER...OR ABOUT 15 MILES SOUTHWEST OF HOLYOKE.

AT 930 PM MDT THE PUBLIC REPORTED WIND DRIVEN HAIL 1 1/2 INCHES IN DIAMETER FROM THIS STORM 3 MILES SOUTHEAST OF HIGHLAND CENTER...OR ABOUT 17 MILES SOUTHWEST OF HOLYOKE.

THE STORM WAS MOVING EAST-NORTHEAST AT 30 MILES PER HOUR.

THIS IS A DANGEROUS STORM! IF YOU ARE IN THE PATH OF THE STORM...PUT YOUR CAR IN A GARAGE AND MOVE TO A SUBSTANTIAL SHELTER.

REPORT SEVERE WEATHER TO THE NEAREST LAW ENFORCEMENT AGENCY. THEY WILL RELAY YOUR REPORT TO THE NATIONAL WEATHER SERVICE FORECAST OFFICE IN DENVER.

&
BAKER
LAT...LON 4047 10219 4020 10254 4047 10290 4074 10254

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE FORECAST OFFICE
10230 Smith Road
Denver, CO 80239-3238

FAX TRANSMITTAL

DATE: 22 April, 1997 PAGE 1 OF 1

TO: Marcus FROM: Larry Tunnell

PHONE #: PHONE #: (303) 361-0661

FAX #: 970-484-7593 FAX #: (303) 371-5508

Marcus:

I have misplaced your telephone number so I am faxing you this. On June 2, 1997, I cannot find any record that we issued any products for Phillips County except a tornado watch, which was issued around 1:30PM. There were numerous severe thunderstorm warnings and tornado warnings issued for Morgan County and Weld County and a flash flood statement was issued for Morgan County about 11PM.

In going through our spotter reports for that day, the only spotter report from Phillips county that I can find is a report of heavy rain at Haxtun at 1118PM. Our radar indicated a storm total rainfall for Phillips County through 2:30AM on June 3rd of only around an inch. This may be the result of Phillips County being more than 125 miles from the radar.

It is also possible that I misunderstood the date or county that you were interested in. If this is the case, please give me a call.

Larry Tunnell

3. State Data

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 4/13/98

To: MARKUS RITSCH

Fax #: (970) 484-7593

Agency: RTC

From: TOM B

Fax#: (303) 866-4474
Phone: (303) 866-3441

7 **Pages transmitted, including this cover sheet**

Sending Operator

Original Mailed __Yes ___ No

FLOOD PLAIN INFORMATION REPORT

FRENCHMAN CREEK

HOLYOKE, COLORADO

PREPARED FOR THE CITY OF HOLYOKE, PHILLIPS COUNTY
AND THE COLORADO WATER CONSERVATION BOARD
BY U. S. ARMY CORPS OF ENGINEERS, KANSAS CITY DISTRICT

JUNE 1980

STUDY AREA DESCRIPTION

Drainage Basin Characteristics

The Frenchman Creek drainage basin is located in the northeast corner of the State in Logan, Sedgwick, and Phillips Counties. Its headwaters are within Logan County about 20 miles west of Holyoke. The creek flows in an easterly direction draining into the Republican River near Culbertson, Nebraska (see Basin Map, plate 1).

The basin divides into two sub-basins at the west edge of Holyoke. The North Fork has a drainage area of 164 square miles. The combined contributing drainage area for Frenchman Creek is 227 miles at U.S. Highway 385.

Drainage patterns of Frenchman Creek basin consist of low hills dividing the waterways. The larger waterways have well-defined channels, while the smaller ones are only a swale between drainage divides. The basin is elongated in shape with its major drainage flow patterns in a west to east direction. Ground elevations vary from a maximum of 4500 feet above National Geodetic Vertical Datum (ft., N.G.V.D.) in the headwaters to 3700 ft., N.G.V.D. at Holyoke.

The climate of northeast Colorado is semi-arid, with hot, dry summers and cold winters. Moist air currents from the Gulf of Mexico are the primary source of moisture. Precipitation in the form of localized and short duration thunderstorms accounts for much of the total annual precipitation.

HYDROLOGIC AND HYDRAULIC DETERMINATIONS

Flood Characteristics

Flood flows in this area of Colorado generally result from high intensity, short duration, cloudburst type thunderstorms. Frenchman Creek has experienced very few of these types of thunderstorms while adjacent basins have experienced extremely intense thunderstorms. Most of these thunderstorms occur from late spring to late summer. Due to the nature of these highly localized storms, the runoff is characterized by a quick buildup to a peak and then a tapering off.

Hydrologic Analysis

Flood frequency curves were prepared for Holyoke at U.S. Highway 385. Several methods were investigated to obtain the best possible comparison for frequency curve selection. These methods include streamflow data from the Wray, Colorado, report, three separate sets of regression equations (Reference 4, 5, 6), and a synthetic computer modeling technique (Reference 7).

The hydrologic analysis was carried out to establish the peak discharge-frequency relationships for floods of 10-, 50-, 100-, and 500-year recurrence intervals for the North Fork Republican River (Reference 8). The analysis used in this report is referred to in the Technical Addendum as the Upper Republican River Basin Regional Frequency Study (Reference 9). This technique is based on statistical analyses of the streamflow records of several drainage basins in the same geographical region as the North Fork Republican River basin. For a detailed description of the hydrologic analysis, refer to the Technical Addendum. Peak discharges for Frenchman Creek are shown in Table 3 on page 14.

Table 3

Summary of Discharges

Location	Drainage Area (sq. mi.)	Discharge in Cubic Feet per Second 10-year	50-year	100-year	500-year
Frenchman Creek at Highway 385	227	2750	6200	8200	14900
North Fork Frenchman Creek at mouth	164	2240	5200	6970	12640
South Fork Frenchman Creek at mouth	63	1170	2800	3740	6870

Hydraulic Analysis

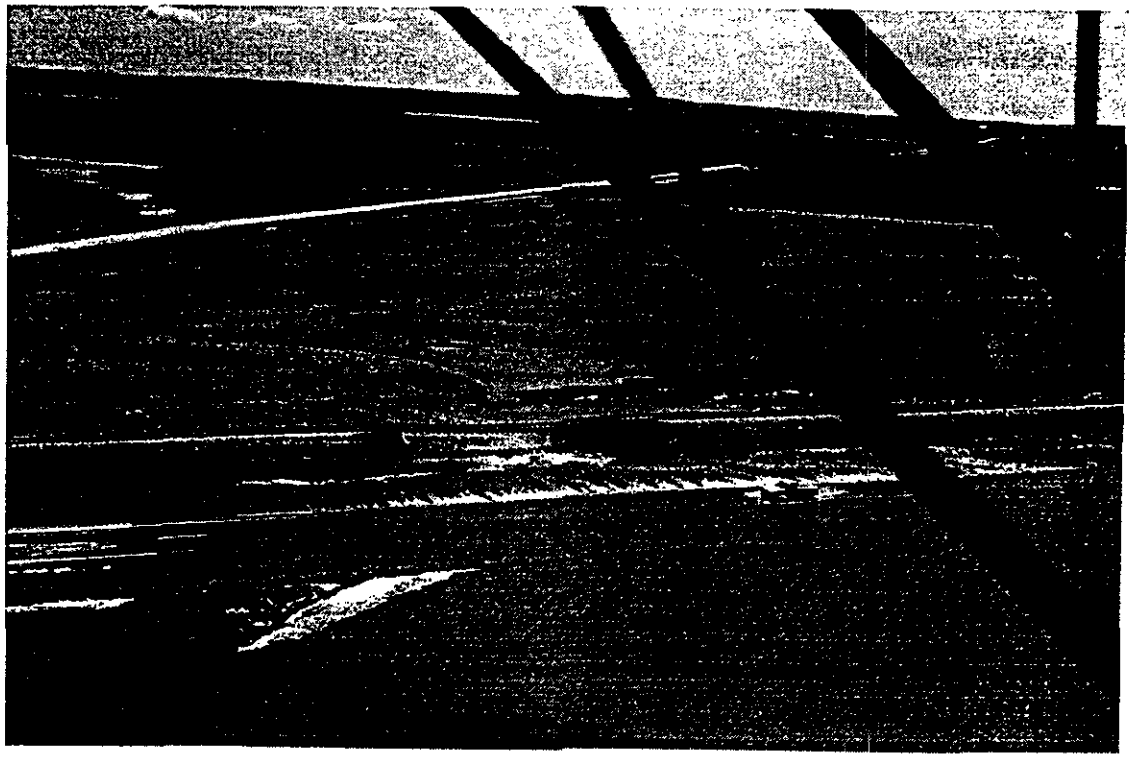
Analyses of the hydraulic characteristics of Frenchman Creek were carried out to provide estimates of the water surface elevations of floods of the selected recurrence intervals along the river. The water surface elevations were computed through use of the Corps of Engineers HEC-2 step backwater computer program (Reference 10). Cross sections for the backwater analysis were measured from two-foot contour topographic mapping. The approximate locations of the cross sections used in the backwater analysis are shown on the flooded area maps, plates 3 thru 18, and the flood profiles, plates 22 thru 28. The reference points and 100-year flood elevations are listed in Table 4 on pages 16 and 17.

Roughness factors (Mannings "N") for use in hydraulic computations were assigned on the basis of field inspection of flood plain areas. Frenchman Creek roughness factors are 0.04 for channel and 0.05 for the overbank areas. A detailed description of the hydraulic analysis is included in the Technical Addendum.

weld phillips

ENGINEERING TECHNICAL REPORT

Colorado Flood Documentation
Significant Floods of June 1997



Department of Natural Resources
Colorado Water Conservation Board
Flood Control and Floodplain Management Section
1313 Sherman Street, Room 721
Denver, Colorado 80203

June 1997

Holyoke / Phillips County Flood Event
June 15, 1997

MEMORANDUM

COLORADO WATER CONSERVATION BOARD
DARIES C. LILE
DIRECTOR

DATE: June 19, 1997

TO: File

FROM: Tom Browning TB

RE: **Phillips County/Holyoke flood of June 15, 1997**

On June 17 and 18, 1997 I performed field investigations in Phillips County in the vicinity of Holyoke, Colorado. A major rainstorm occurred late June 14 and early June 15 which caused flooding in the Frenchman Creek basin on the morning of June 15. As part of the field work, I conducted rainfall bucket surveys, estimated peak streamflows for various streams using indirect flow measurements, delineated the approximate floodplain limits within Holyoke, and obtained photographs. Following is a summary of findings :

STORM DESCRIPTION

- Storm developed on the evening of June 14 and generally moved from west to east.
- Rainfall began in Phillips County west of Holyoke around 9:45 pm on June 14 and ended around 12:30 or 1:00 am on June 15.
- Most of the rain fell in less than 2 hours in the beginning part of the storm
- Very little hail was produced by this storm. Small pockets of hail were reported to the south and west of Holyoke.

RAINFALL ESTIMATES

Rainfall estimates were obtained through bucket surveys, interviews with local officials and residents, and field observations. Rainfall estimates are shown (in inches) on the attached map. These amounts are for the storm total (about 3 hours).

FLOOD DAMAGES

Phillips County, the Town of Holyoke, The American Red Cross, and the Colorado OEM have performed damage surveys and have reported the following flood damages (to date) within Phillips County, Holyoke, and Amherst:

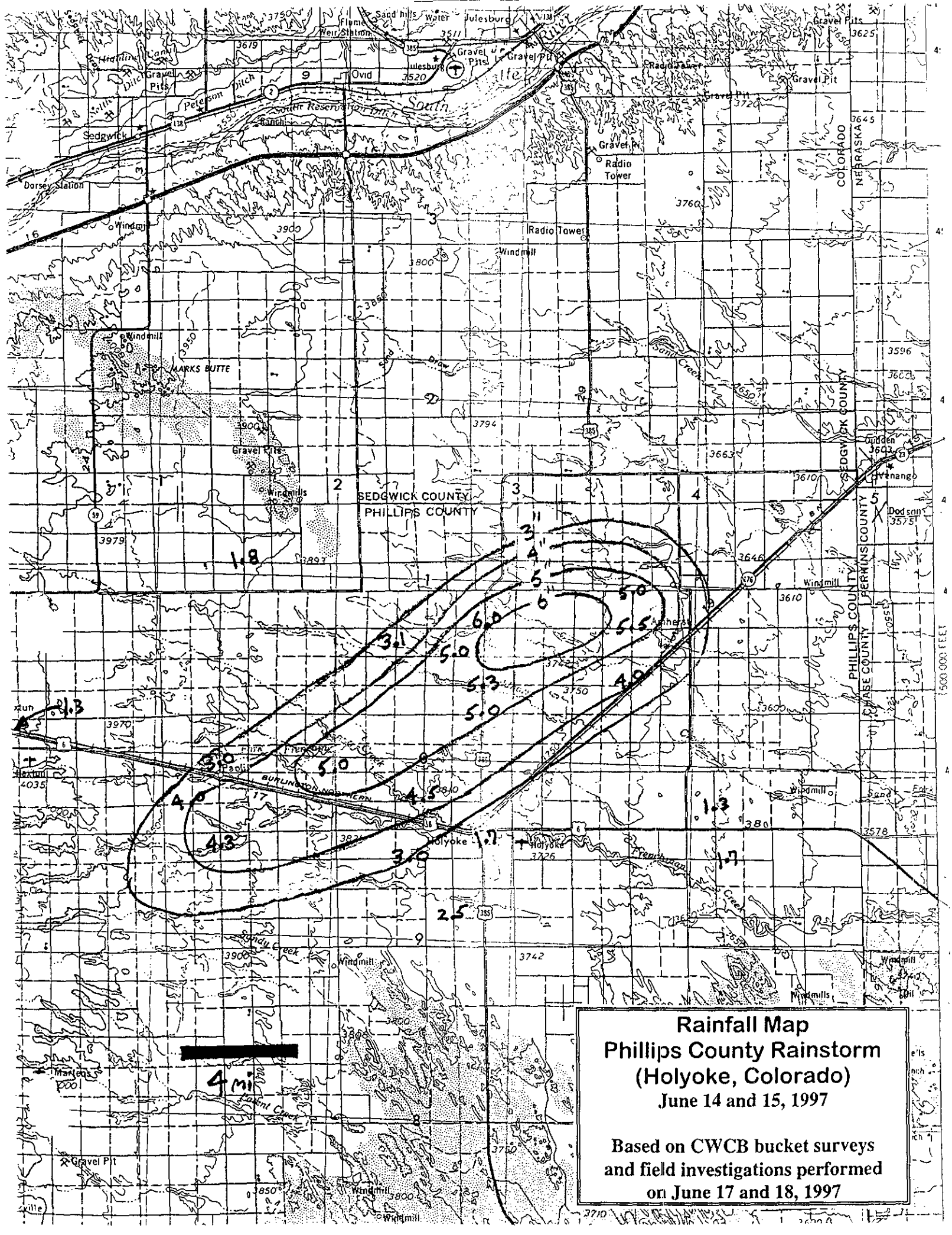
- 31 homes (7 are uninhabitable)
- 3 businesses
- 3 County road bridges
- At least 15-20 major washouts on County Roads (including low water crossings, culverts, etc.)
- Nearly 100 minor washouts on County Roads
- Severe damage to railroad line along Hwy 23
- Damage to the airport runway and washout of the culverts at the end of the runway
- Substantial damage to crops and fields
- Major debris accumulations

RUNOFF ESTIMATES

Runoff estimates were obtained for various streams using indirect flow measurement techniques. Channel cross-sections were obtained by using a hand level, survey rod, and a 100' tape. High water marks were good to excellent in all locations. Normal depth calculations were done using Manning's equation. Channel slopes were obtained from USGS Quad maps, and "n" values were estimated in the field. A range of flow values is presented to account for various uncertainties in estimating the peak flows.

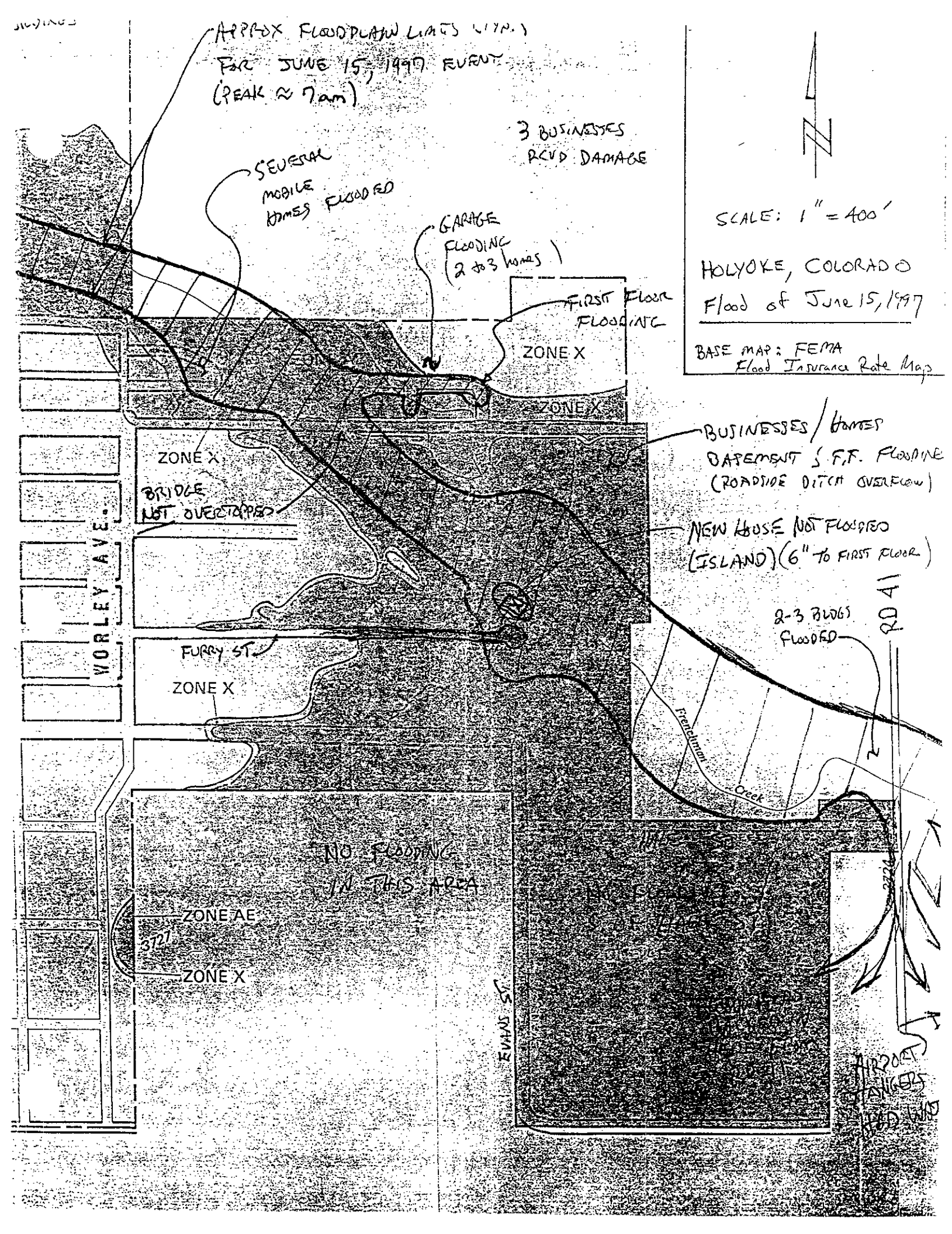
Location	Est. Peak flow (cfs)	Est. Flow Frequency*
N. Fork Frenchman Creek near Hwy 6, just west of Paoli	250 to 350	N/A
N. Fork Frenchman Creek d/s of Rd 37, just west of Holyoke	1,600 to 2,000	10-year
S. Fork Frenchman Creek near Rd 33, 3 mi west of Holyoke	1,800 to 2,200	25-year
S. Fork Frenchman Creek near Rd 35, 2 mi west of Holyoke	1,800 to 2,200	25-year
Frenchman Creek d/s of Hwy 6 in Holyoke	3,600 to 4,000	25-year
Frenchman Creek at golf course in Holyoke	3,600 to 4,000	25-year
Left bank trib to Frenchman Creek 1.5 mi northeast of Holyoke, near Hwy 23 and Rd 41	600 to 800	50-100-year
Left Bank trib to Wildhorse Creek at Amherst, near Hwy 23 and Rd 51.	1,800 to 2,200	100-year

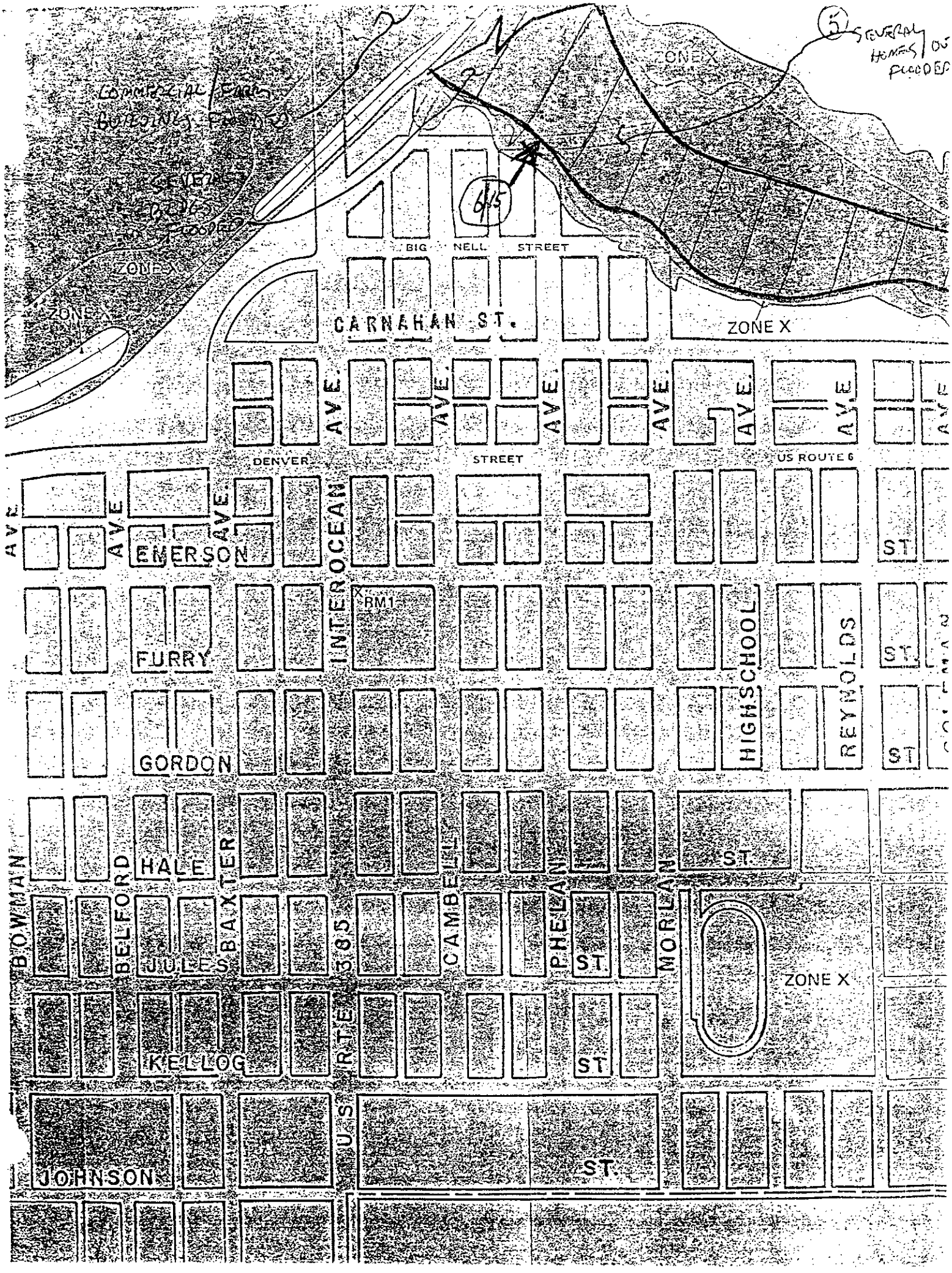
* Based on hydrology values published in "Floodplain Information Report, Frenchman Creek, Holyoke, Colorado" (June 1980) where available. Other frequency estimates based on regional regression equations for the Republican River basin.



Rainfall Map
Phillips County Rainstorm
(Holyoke, Colorado)
June 14 and 15, 1997

Based on CWCB bucket surveys and field investigations performed on June 17 and 18, 1997


APPROX FLOODPLAIN LIMITS (TYP.)
FOR JUNE 15, 1997 EVENT
(PEAK ≈ 7am)
3 BUSINESSES RCVD DAMAGE
SEVERAL MOBILE HOMES FLOODED
GARAGE FLOODING (2 to 3 HOMES)
FIRST FLOOR FLOODING
ZONE X
ZONE X
ZONE X
BRIDGE NOT OVERTOPPED
BUSINESSES / HOMES BASEMENT & F.F. FLOODING (ROADSIDE DITCH OVERFLOW)
NEW HOUSE NOT FLOODED (ISLAND) (6" TO FIRST FLOOR)
WORLEY AVE.
FURRY ST
ZONE X
2-3 BLDGS FLOODED
RD 41
Frenchman Creek
NO FLOODING IN THIS AREA
ZONE AE
3721
ZONE X
EVANS ST
3724
AIRPORT HANGERS
SCALE: 1" = 400'
HOLYOKE, COLORADO
Flood of June 15, 1997
BASE MAP: FEMA Flood Insurance Rate Map


COMMERCIAL BUILDINGS FLOODED
SEVERAL HOMES FLOODED
ZONE X
ZONE A
ZONE A
BIG NELL STREET
CARNAHAN ST.
ZONE X
DENVER STREET
US ROUTE 6
AVE.
AVE.
AVE.
AVE.
AVE.
AVE.
AVE.
AVE.
EMERSON
FURRY
GORDON
HALE
KELLOG
JOHNSON
INTERSTATE 385
INTERCOCEAN
BM1
HIGH SCHOOL
REYNOLDS
ST
BOWMAN
BELFORD
JULES
BAXTER
CAMBELL
PHELAN
MORLAN
ZONE X

4. Local Data

PHILLIPS COUNTY COMMISSIONERS

JAMES R. MORT
JACK L. KENNEDY
KEITH L. SHARPE

970-854-24[illegible]

221 S. INTEROCEAN
HOLYOKE, COLORADO 80734

FAX 970-854-3811

June 25, 1997

TO BROWNING 6 PAGES

Mr. Tommy Grier, Jr.
Director
Office of Emergency Management
15075 S. Golden Road
Golden, CO 80401-3979

RE: Flood damage in Phillips County

Dear Mr. Grier:

Phillips County has suffered substantial damage due to flooding occurring in the month of June. Fortunately this disaster has not caused serious injuries or taken lives. Red Cross representatives very capably attended to short term needs of displaced residents and assisted the efforts of volunteers in their immediate response to flood victims. No home owners, however, had flood insurance to assist in their recovery,

We are now picking up the pieces and proceeding onward. Major damage has occurred on county roadways. The western two-thirds of our county will be getting back to normalcy the end of next week. The road foreman in the eastern one-third of our county estimates it will take an additional four to six weeks of monumental effort just to get all the roads so they are open and passable again.

The county has sought the assistance in equipment and manpower of surrounding counties (i.e. Yuma County and Sedgwick County) which we will reimburse for their efforts. We also requested assistance from CDOT who has responded by providing 6 trucks and a front end loader and their personnel all week. Such assistance is very gratifying and overwhelming.

A flood report and our preliminary cost estimates to repair the county road damage are attached. They are above and beyond the county's regular budgeted resources. Due to that fact, the Board of County Commissioners has voted to declare a local emergency. Any disaster emergency monies available would greatly be appreciated.

Please let us know if additional information is needed.

Sincerely,

Jack L Kennedy

Jack Kennedy
Co-chairman

CC:RS:eb

CC: Jerry Smith, Deputy Director, Dept. of Local Affairs
Bob Wold, Regional Planner, Office of Emergency Management
Renee Stroh, Area Emergency Planner, Office of Emergency Management

Enclosures: Disaster Declaration
Preliminary Cost estimates for repairing flood damage
Flood report

PHILLIPS COUNTY DISASTER DECLARATION

WHEREAS, Phillips County suffered serious damage to roads, bridges, homes and businesses caused by heavy rains of 4" plus on June 2, 1997 and rains of 5" to 6" again on June 14, 1997; and

WHEREAS, the cost and magnitude of responding to and recovery from impact of the ensuing flood is far in excess of the county's available resources,

NOW THEREFORE, BE IT RESOLVED, that the Board of County Commissioners of Phillips County, Colorado declare this to be a local disaster.

Dated at Holyoke, Colorado, this 25th day of June, 1997.

Jack L Kennedy

Phillips County Board of Commissioners

Road Foreman
Robert L. Fetzer
03105 Cnty Road 14
8 mi S. 1m W.
774-7349

June 25, 1997

FLOOD REPORT

Phillips County received two back to back large rains which have caused damage to county roadways. Rainfall up to 4.5" fell the night of June 2, 1997, primarily in the west end of the county south of Haxtun. Rainfall from 5" to 6" fell again the night of June 14 in the Holyoke/Amherst areas. The area south of Haxtun/Paoli again received 4" plus on June 14. The combination of these storms and the resulting floods caused damage to a number of homes and businesses in the City of Holyoke.

The Red Cross damage assessment team report shows that seven single family homes received major damage, ten single family homes received minor damage, fourteen mobile homes had minor damage, three businesses had major damage, and four businesses received minor damage.

The KNC Railnet railroad line between Holyoke and Amherst also recieved major damage. One entire section of grade was washed downstream, leaving the line unusable for almost a week while private contractors re-built the grade.

A team composed of Bob Wold, Fred Sibley, and Renee Stroh from the Office of Emergency Management, Tom Browning from the Colorado Water Conservation Board, and Randy Schafer, local Emergency Manager, completed a windshield damage assessment on June 17 and 18.

The flooding caused substantial damage to a majority of roads in the county. County road crews have been working to restore through roads since Tuesday, June 17. Most drainage ways, except Frenchman Creek, have now totally subsided. The three road district foremen met on Monday, June 23, 1997, and put together a preliminary cost estimate of the flood damage. These are preliminary figures only.

Road District #1 (Eastern 1/3 of the county) has 1 major washout which will require 1800 cu. yds. of road material, 75 large washouts which will require an average of 200 cu. yds. of road material per washout to repair (equivalent to 20 belly dump loads) and 32 smaller washouts which will require an average of 100 cu. yds. of road material.

Road District #2 (center 1/3 of the county) has 69 large washouts which will require an average of 60 cu. yds. of road material per washout and 39 smaller washouts which will require an average of 12 cu. yds.

Road District #3 (West 1/3 of county) has 10 large washouts which will require an average of 75 cu. yds. of road material per washout and 28 small washouts which will require an average of 20 cu. yds.

A newspaper account of the June 14th flood is also attached.

Randy Schafer

COST ESTIMATE FOR ROAD REPAIRS
PHILLIPS COUNTY FLOOD DAMAGE - JUNE 1997
PRELIMINARY COST ESTIMATE

FORCE ACCOUNT

EQUIPMENT			
Loader	465 hrs @ $69/hr	=	$32,085.00
Grader	750 hrs @ $75/hr	=	56,250.00
Backhoe	3 hrs @ $40/hr	=	120.00
Compactor	20 hrs @ 6.85/hr	=	137.00
Dozer	100 hrs @ $75/hr	=	7,500.00
Scraper	40 hrs @ $100/hr	=	4,000.00
Pickups	96 hrs @ $15/hr	=	1,440.00
Semi tractor	710 hrs @ 64.25/hr	=	45,617.50
Belly Dump trlr	710 hrs @ 13.10/hr	=	9,372.00
Dump trucks	780 hrs @ $22/hr	=	17,160.00
SUBTOTAL			173,681.00
FUEL			
Diesel	12,479 gal @ .91	=	11,356.00
Gasoline	2,648 gal @ .86	=	2,277.00
SUBTOTAL			13,633.00
LABOR			
	2000 hrs @ $9.60	=	19,200.00
	620 hrs @ 14.40	=	8,928.00
	440 hrs @ 10.17	=	4,475.00
	140 hrs @ 15.26	=	2,136.00
SUBTOTAL			34,739.00
MATERIALS			
Gravel and clay	25,918 cu. yd. @ $0.33	=	$8,553.00
Culverts	2 - 21" X 60' @ 8.16/ft	=	979.00
	1 - 48" X 60' @ 48.33/ft (plus flared ends)	=	2,900.00
SUBTOTAL			12,432.00
BRIDGE REPAIR			
Wilmon, Goddard, & Jaycox Bridges			5,226.00
FORCE AMOUNT TOTAL			239,711.00

CONTRACTED ITEMS

Yuma Co. belly dumps	140 hrs @ $65	=	$9,100.00
Yuma Co. Tandem	70 hrs @ $45	=	3,150.00
Sedgwick Co. belly dumps	10 hrs @ $65	=	650.00
St of Co. Twin Screws	250 hrs @ $40	=	(10,000) NO COST
St of Co. Dump trucks	50 hrs @ $30	=	(1,500) NO COST
SUBTOTAL			$12,900.00

TOTAL CONTRACTED ITEMS	12,900.00
GRAND TOTAL	252,611.00

Recorded Rainfall between July 28 - Aug 12

		Clark Reuter's gauge	In Town (Haxtun)
July	28	0.04	0.07
	29	0.44	.40
	30	0.49	1.57
Aug	4	0.78	—
	5	0.81	1.65
	6	—	.30
	8	0.65	.39
	11	0.04	.13

5. Calculations and Estimates

Phillips County - Frenchman Creek
Precipitation Frequency Analysis

Purpose:

The purpose of this calculation is to determine the storm precipitation totals for storm durations of 6-hr, 12-hr, and 24-hr, for a return interval of 100-yr. The precipitation quantities represent annual amounts (the seasonal precipitation quantities, May-October are not available for Phillips County).

Methodology:

The information presented in this calculation is developed from the NOAA, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Vol III - Colorado, 1973. Using the figures in the NOAA Atlas, the following information is obtained.

6-hr Precipitation Quantities

Return Interval	Precipitation (inches)
2-yr	1.9
5-yr	2.4
10-yr	2.8
25-yr	3.4
50-yr	3.8
100-yr	4.2

24-hr Precipitation Quantities

Return Interval	Precipitation (inches)
2-yr	2.2
5-yr	2.9
10-yr	3.4
25-yr	4.0
50-yr	4.5
100-yr	5.0

Using procedures outlined in the NOAA, Atlas 2 (page 16, Figure 17), the 12-hr precipitation quantities were estimated from the 6-hr and 24-hr values and are shown below.

12-hr, 100-yr Precipitation Quantities

Return Interval	Precipitation (inches)
100-yr	4.6

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
Phone: (303) 866-3441
FAX: (303) 866-4474

FAX COVER SHEET

Date: 5/4/98

To: MARKUS RITSCH **Fax #:** (970) 484-2593

Agency: RTi

From: Tom Brownly **Fax#: (303) 866-4474**
Phone: (303) 866-3441

4 Pages transmitted, including this cover sheet

Holyoke Flood Doc.
& estimates

Sending Operator

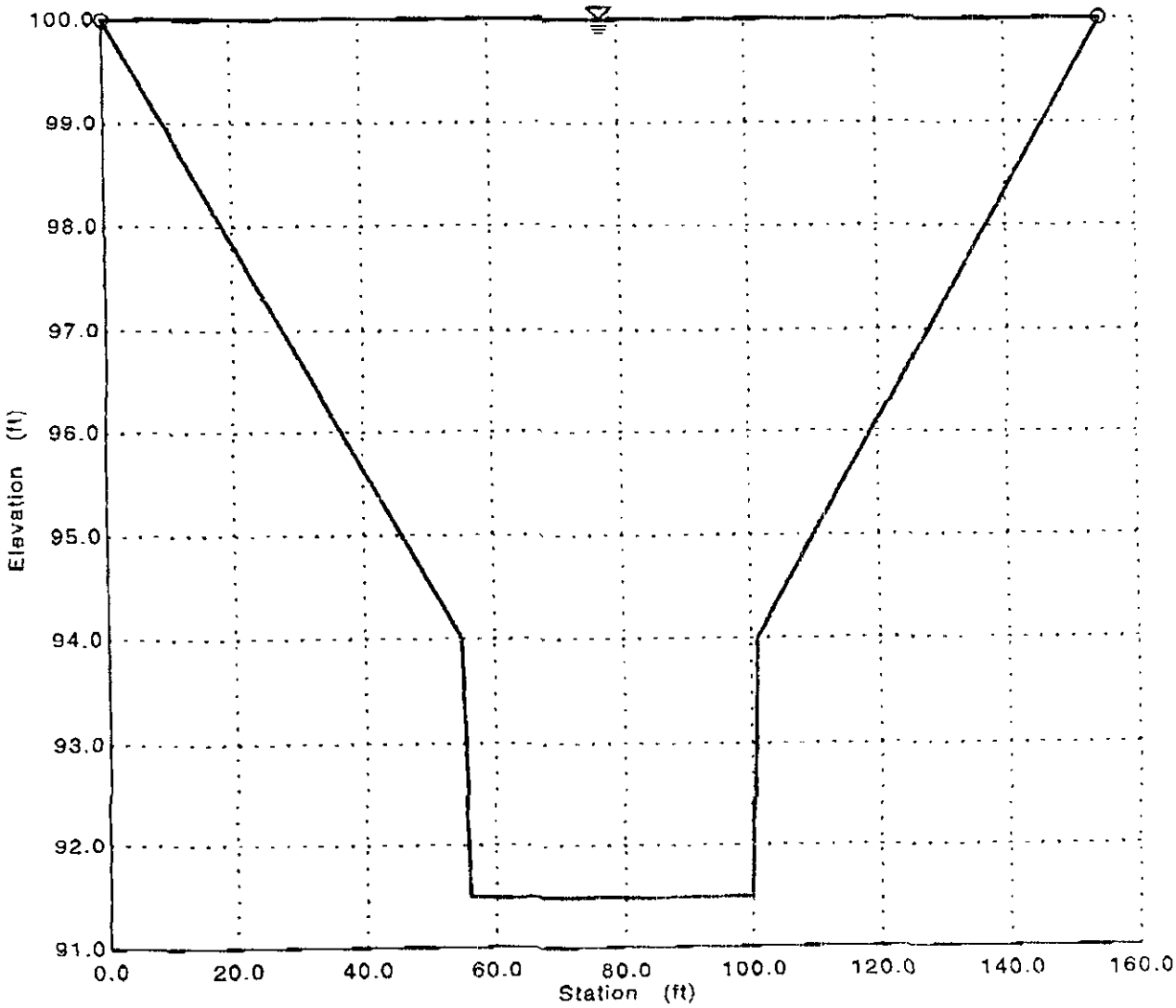
Original Mailed __Yes ___No

Frenchman Creek at Holyoke (golf course)

Cross Section for Irregular Channel

Project Description	
Project File	c:\scca\flood\holyoke\flows-1.fm2
Worksheet	Frenchman Creek at Holyoke (golf course)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

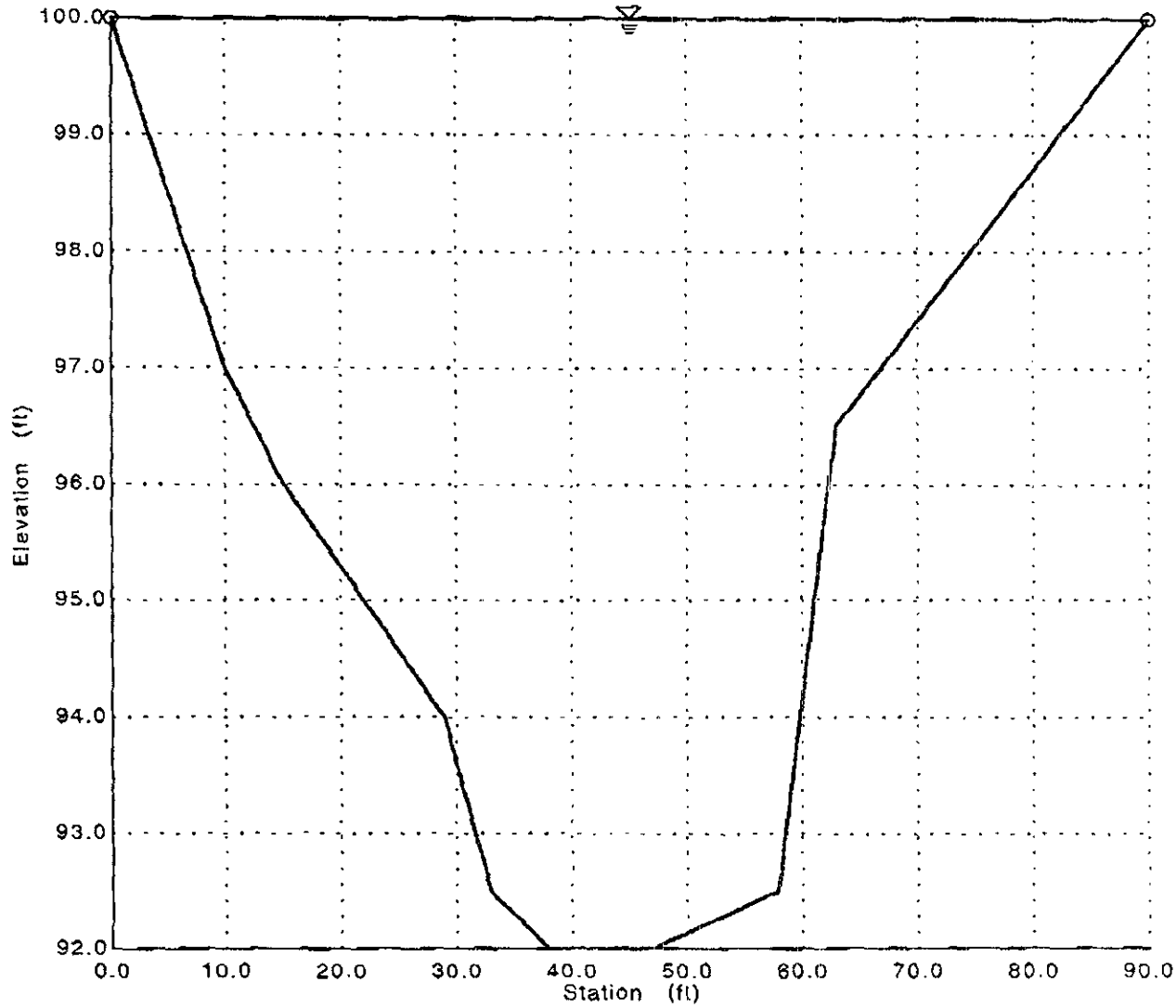
Section Data		
Wtd. Mannings Coefficient	0.035	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	100.00	ft
Discharge	3,702.09	cfs



N. Fork Frenchman Creek, d/s of Rd 37
Cross Section for Irregular Channel

Project Description	
Project File	c:\seca\flood\holyoke\flows-1.fm2
Worksheet	N. Fork Frenchman d/s Rd 37
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

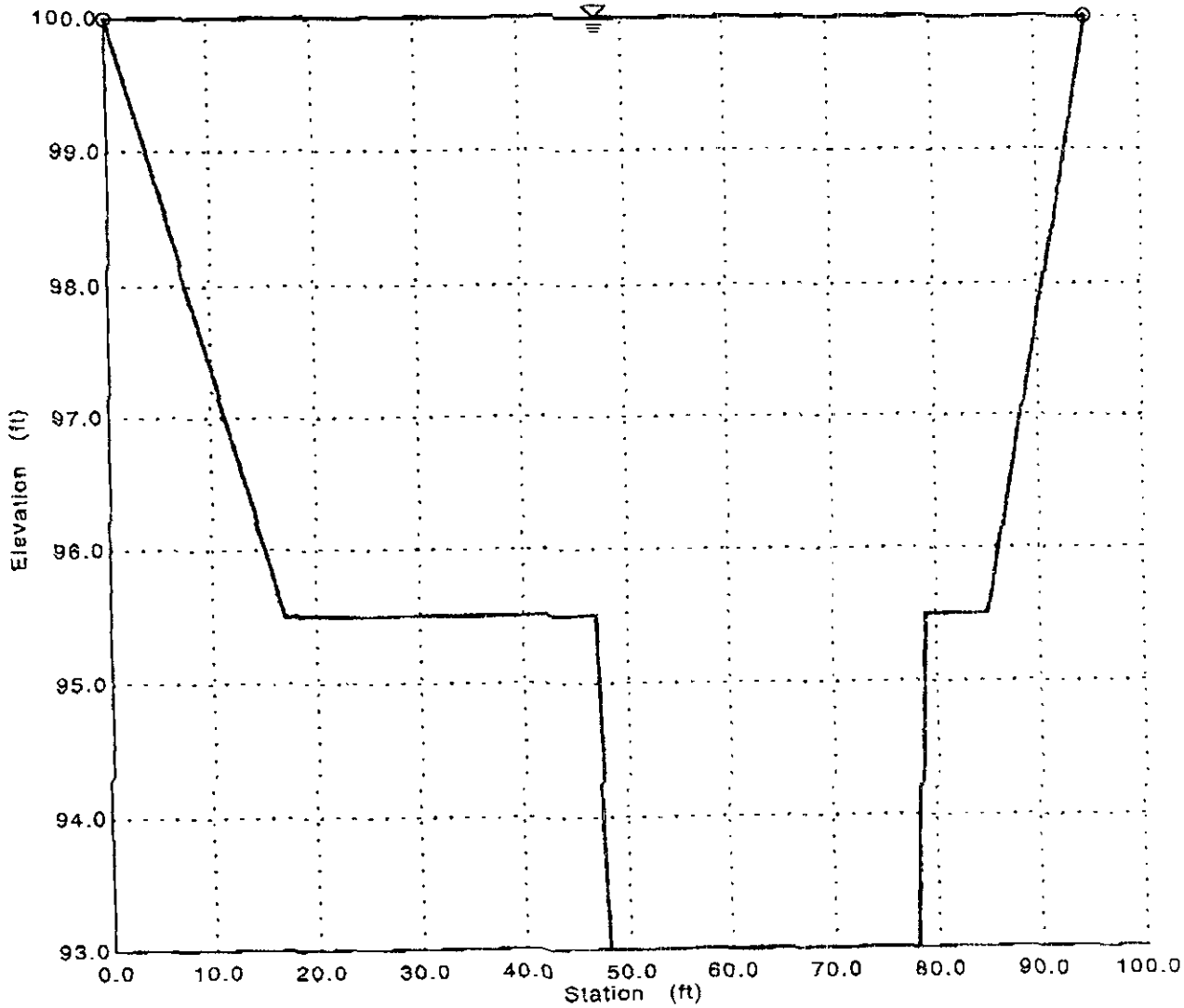
Section Data		
Wtd. Mannings Coefficient	0.040	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	100.00	ft
Discharge	1,764.15	cfs



S. Fork Frenchman Creek, near Rd 33
Cross Section for Irregular Channel

Project Description	
Project File	c:\seca\flood\holyoke\flows-1.fm2
Worksheet	S. Fork Frenchman Cr, near Rd 33
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.040	
Channel Slope	0.002000	ft/ft
Water Surface Elevation	100.00	ft
Discharge	1,995.32	cfs



1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/15/98
Call Placed/Received by: Bill Owen
Spoke With: Tony Garcia
Company/Affiliation: Prowers County Road and Bridge (east side)
Phone no.: (719) 537-6631
Project No.: D479

Comments:

- one concrete and two oversized rock crossings were damaged due to flood waters traversing the county roads
- flood waters remained for a couple days before receding
- County set up barricades and suggested detour routes soon after floods began to happen
- Slab washed out on Plum Creek where water depth was approximately a couple feet above the road
- Channel characteristics for tributaries near Holly:
  1) mostly dry with occassional springs here & there
  2) lots of sagebrush along the channels
  3) fairly well-defined & soils are very sandy
- Holly has a flood control dike (approx. 2 miles long) surrounding the town to protect it from Wild Horse Creek and Arkansas River flood waters

Signature Bill Owen

- Amity Canal overtopped mainly in western areas of the County

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/15/98
Call Placed/Received by: Bill Owen
Spoke With: Dan Neuhold
Company/Affiliation: CO State Engineer's office, Water Commissioner, Div. 2
Phone no.: 719 - 336 - 5364
Project No.: D479

Comments:

- no significant diversions on Wild Horse Creek that would affect gage records
- channels in these northern tribs of the Arkansas River have mild slopes, sandy bottoms, and little vegetation
- most of creek channel is intermittent, w/ water flowing only as a result of heavy rainfall
- lower Wild Horse Creek runs constantly @ 1/2 cfs or less
  ↳ near mouth
- Wiley Drainage flows result of natural groundwater seepage, irrigation return flows, and heavy precipitation events

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/15/98
Call Placed/Received by: Bill Owen
Spoke With: Grant McCormick
Company/Affiliation: Town of Holly, Town Administrator
Phone no.: (719) ~~333-3333~~ 537-6633
Project No.: D479

Comments:

- localized heavy rains caused approx. $4000 damage to one house in northern part of town
- this was unusual since the south side (near state highway 50) experiences more frequent flooding
- no drainage system along this highway, which contributes to the problem
- ~~town~~ erected barricades on flooded streets on the south side + state patrol was out providing traffic control along highway 50 to reduce cars hydroplaning in ± 1' ~~water~~
- 10 town citizens volunteered to help bail water out of ~~the basement at the damaged~~ damaged house
  ↳ one ran a County-donated grater to help erect a berm that was approx. 150' long
- Town costs associated with flood fighting efforts was ± $800-900 plus donated time + equipment
- new housing development in the area reduced ~~the~~ normal ponding time, which contributes to the problem

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/15/98
Call Placed/Received by: Bill Owen
Spoke With: Jeff Devere
Company/Affiliation: Prowers County Environmental Health
Phone no.: (719) 336-8989
Project No.: D479-56

Comments:

- County in process of developing a flood mitigation plan + are open to ~~suggestions~~ any technique that could help them
- Currently, they are more interested in passive rather than structural approaches to reduce flood hazards
- examples of passive techniques: park development, wetland enhancement, purchasing conservation easements or development rights
- examples of active (or structural) mitigation measures: culverts, channel improvements, riprap, + levees
- One area of immediate concern is land west of Lamar + south of Arkansas River
  → this area has high alkalinity contents (i.e. poor for ag use) + poor banks (i.e. prone for flooding)
  → possible solution to alleviate problem is to ~~build~~ create additional wetlands + build terraces to channel the flood waters back to the Arkansas
  → total ~~area~~ length approx. 1½-2 miles along Arkansas

Signature _____

- Suggested to contact Gary McCormick (town administrator) to find out about flooding details in Holly (719-537-6633)

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/12/98
Call Placed/Received by: Bill Owen
Spoke With: Don King
Company/Affiliation: Prowers County Road + Bridge Dept. (west side)
Phone no.: 719 - 336 - 5536
Project No.: D479-56

Comments:

- Wiley Drainage overflowed for approx. 9 hours between Hwy 196 + County Rd LL
- water washed out approaches at Cty Rd MM + Road 3; Cty Rd LL bridge washed out
  (↳ bridge ~14' high)
- water flowing over 3' across Road MM
- Amity Canal overtopped adding to problems; 2' water over roads in that area
- the Wiley vicinity was primary flooding area
- Emergency response : . Cty put up barricades + had employees out at the damaged bridges → total of 7 people out all night
  . state patrol out directing traffic at flooded areas of Hwy 287
  . road crew + sheriff's office at KOA campground (inundated)
  ↳ they opened up drainages here
  . County fire department also out helping w/ traffic control
- Marvin Rosencrans is Chief of Cty Fire Dept. (719) 336 - 4841

Signature Bill Owen

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	4/8/98
Call Placed/Received by:	Bill Owen
Spoke With:	Dale Fac
Company/Affiliation:	Homeowner in Prowers Co. (west of Lamar)
Phone no.:	719-336-7456 (W), 719-336-3586 (H)
Project No.:	D479 - 51

Comments:

I spoke with Mr. Fac after he left a phone message at RTi saying he experienced flooding in his basement during the 1997 floods. He indicated that he had water in his basement from approximately July 15 through Thanksgiving of 1997. Approximatley 3/4 of an inch of water was in his basement during that time period. Other neighbors also had problems, but their degree of flooding is unknown. He lives near the Green Belt drainage at 6810 County HH.5.

He belives he kept a newspapaer article from that time, which he will try to locate and send to us. He also belives the water in his basement was due to several contributing elements: the rain that fell, a high ground water table, and agriculture runoff. He did not collect any rainfall data on his property.

Signature Bill Owen

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: John Keenen, Lamar Daily News

FAX NO.: 719-336-2526

FROM: Lisa Pere

DATE: April 2, 1998

NO. OF PAGES: We are sending 1 Page(s) (Including this Page)

SUBJECT: Press Release

COMMENTS:

John,

Here's the press release. We're looking for additional info from the following counties: Weld, Morgan, Logan, Phillips, Clear Creek, Elbert, Lincoln, Crowley, Kiowa, Otero, Prowers, Baca, and La Plata. (We're also reporting on Larimer, but we already have an overload of info from Fort Collins.)

Press Release:

The Colorado Water Conservation Board is producing a statewide report documenting the 1997 flood season. If you have any specific information regarding the 1997 flooding (photos of damages or high water marks, precipitation measurements, streamflow observations, etc.) please contact Markus Ritsch at 2290 E. Prospect Rd., Ste. 1, Ft. Collins, CO 80525; phone (970) 484-7573; e-mail at mlr@riverside.com. Information is needed by April 20, 1998.

Markus Ritsch, who is managing our end of this project, is checking with the CWCB to clear the way for a phone interview. You asked if we would be coming down to Lamar. There's a good chance that we will, but it wouldn't be until May.

Thanks again for your time.

Sincerely,
Riverside Technology, inc.

Lisa Pere

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Danny McMillan

FAX NO.: (719) 336-4404

FROM: Bill Owen

DATE: April 2, 1998

NO. OF PAGES: We are sending 4 Page(s) (Including this Page)

SUBJECT: Questions concerning Prowers Country 1997 flood

COMMENTS:

Mr. McMillan:

I have attached a blank copy of the form I am using to elicit information from county and city personnel in your area about the 1997 floods. When you get a chance, I would appreciate any additional information you might have (or obtain) concerning these questions. If you happen to have any digital versions of maps or photographs of the flooding, we would be very interested in using these for our report. The report we are developing will be available in hardcopy and on the World Wide Web, so digital information is preferred. However, hardcopies would also be quite useful.

If you find anything that was not covered in this questionnaire that you think may be helpful in our efforts to document the flooding in Prowers County, I would appreciate if you could bring these to my attention within two weeks of this date so we may have time to include it in our report. Thanks again for your help and your time.

Sincerely,

Bill Owen

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Riverside Technology, inc.

2290 East Prospect Road, Suite 1
Fort Collins, Colorado 80525
PHONE (970) 484-7573
FAX (970) 484-7593

TO: Jeff Devere

FAX NO.: (719) 336-8989

FROM: Bill Owen

DATE: April 1, 1998

NO. OF PAGES: We are sending 4 Page(s) (Including this Page)

SUBJECT: Questions concerning Prowers Country 1997 flood

COMMENTS:

Mr. Devere:

I've attached a blank copy of the form I'm using to elicit information from county and city personnel in your area about the 1997 floods. When you get a chance, I would appreciate any additional information you might have (or obtain) concerning these questions. I have been able to contact Bob Ward and Jim Sidebottom with your help, and my conversations with them have been very informative.

If you find anything that you think may be helpful in our efforts to document the flooding in Prowers County, I would appreciate if you could bring these to my attention within two weeks of this date so we may have time to include it in our report. Thanks again for your help and your time.

Sincerely,

If you did not receive all the pages, or if any are illegible, please call (970) 484-7573.

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	3/31/98
Call Placed/Received by:	Bill Owen
Spoke With:	Bob Ward
Company/Affiliation:	City of Lamar (Building Inspector)
Phone no.:	(719) 336-2085
Project No.:	D479 - 51

Comments:

Mr. Ward indicated about 8 inches of rain fell in the west side of Lamar during a period in 1997. The primary problems within the city were leaky basements, for which no dollar amount were estimated. Alley-ways did need some re-grading after the flooding event. A few utilities were out of service including gas and telephone, but no sewer problems were reported. He suggested calling some additional City employees for answers to detailed questions concerning the repairs, outages, and clean-up costs:

1. Usayne Uray (sp?) of the Light and Plant department (336-7456)
2. Danny McMillan of the Water and Sanitation dept (336-2002)
3. Jeff Anderson, chief of the local fire department (336-7330)

Efforts were made to clean out some debris left in the Willow Creek. Mr. Ward also indicated that Jeff Devere would have the FEMA floodplain maps fro the 100, 500, and 50 year events.

Signature William Owen

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Bill Owen
DATE: 3/31/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Jeff Devere
AFFILIATION: Prowers County Envir. Health
PHONE #: (719) 336-8989

---

1. *Affected streams and local drainages?*

   Below John Martin Reservoir

2. *Geographic extent of flooding?*

   Along Arkansas River valley; he did not know about the flooding extent in the southern half of the county

3. *Storm duration? Starting time and ending time of major storm event?*

   Daily ("long term") afternoon storms

4. *Rainfall amounts? Extent of rainfall?*

   7.5 inches (anecdotal)

5. *Rainfall bucket surveys?*

   Unknown; we should call the John Kennen at the Lamar Daily News

6. *Precipitation gauging network?*

   Only in Lamar

7. *Documentation of high water marks?*

   No documentation; talk to Don King at the Prowers County west side Road and Bridge Dept. (336-5536) and Tony Garcia at Prowers County east side Road and Bridge Dept. (537-6631)

8. *Estimated peak discharges?*

   Check the Arkansas gage at the NRCS Lamar office

9. *Estimated flood damages?*

   Bridges out at Bristol (3 miles S of Wiley); some road damage west of Lamar
   Contact Jim Sidebottom, Prowers County Commissioner (336-9001), for more info about county damages west of Lamar

10. *Costs associated with the clean-up effort? Differentiate between local, state, and federal.*

    Track with city; call Bob Ward (336-2085) - Lamar building inspector/planning, etc.

11. *Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.*

    See questions 9 & 10

12. *Types and amounts of repair work after flooding?*

    Road and bridge repairs; post-disaster work non-existent

13. *Any previous/recent flood mitigation efforts that reduced damages?*

    No

14. *Any future mitigation needs as a result of the flooding?*

    Watershed plans in process

15. *Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?*

    None

16. *Do you have any photos and/or video available? Are the photos in digital format?*

    NOt aware of any; the 1995 flood in Wiley has some photos and Tom Browning (CWCB) has a video tape of the same flood

17. *Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.*

    No

18. *Are maps in hardcopy or digital format? (GIS, Autocad, etc.)*

    No

19. *Is there any existing documentation regarding the flooding?*

    COE studies of the 1965 flood laong the Arkansas river (50-75 year event); another flood occurred in 1922

20. *Name of local newspaper? Do they have a web site?*

21. *Do you have an internet site? Do you know of any related local sites?*

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Bill Owen
DATE: 3/31/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Jim Sidebottom
AFFILIATION: Prower County Administrator
PHONE #: (719) 336-9001

---

1. *Affected streams and local drainages?*

2. *Geographic extent of flooding?*

   Localized flooding, particularly west of Lamar

3. *Storm duration? Starting time and ending time of major storm event?*

4. *Rainfall amounts? Extent of rainfall?*

5. *Rainfall bucket surveys?*

   Several people have rain buckets, but no effort was made to summarize the recordings

6. *Precipitation gauging network?*

7. *Documentation of high water marks?*

   Not aware of any high water marks

8. *Estimated peak discharges?*

9. *Estimated flood damages?*

   Breeched an irrigation ditch in Wiley in 1995 and took out two bridges
   1997 floods occurred in lowa reas that are poorly drained (a confluence of a stream and irrigation ditch area)

10. *Costs associated with the clean-up effort? Differentiate between local, state, and federal.*

    No estimate of private homeowner damages

11. *Costs associated with emergency operations/flood fight efforts? Differentiate between local, state, and federal.*

    No County costs

12. *Types and amounts of repair work after flooding?*

    Road restoration

13. *Any previous/recent flood mitigation efforts that reduced damages?*

    COE John Martin Reservoir controlled releases; reservoir located approximately 25 miles upstream;
    After approximately 3000-4000 cfs, flooding begins in Lamar

14. *Any future mitigation needs as a result of the flooding?*

    $10,000 planning grant and a $100,000 action grant has been submitted to replace culverts, deepen ditches, raise ditches, and other efforts that would protect County roads

15. *Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?*

16. *Do you have any photos and/or video available? Are the photos in digital format?*

    Check with Ava Betz (336-2266) who is the editor at the Lamar Daily

17. *Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.*

18. *Are maps in hardcopy or digital format? (GIS, Autocad, etc.)*
19. *Is there any existing documentation regarding the flooding?*
20. *Name of local newspaper? Do they have a web site?* Lamar Daily; no
21. *Do you have an internet site? Do you know of any related local sites?*

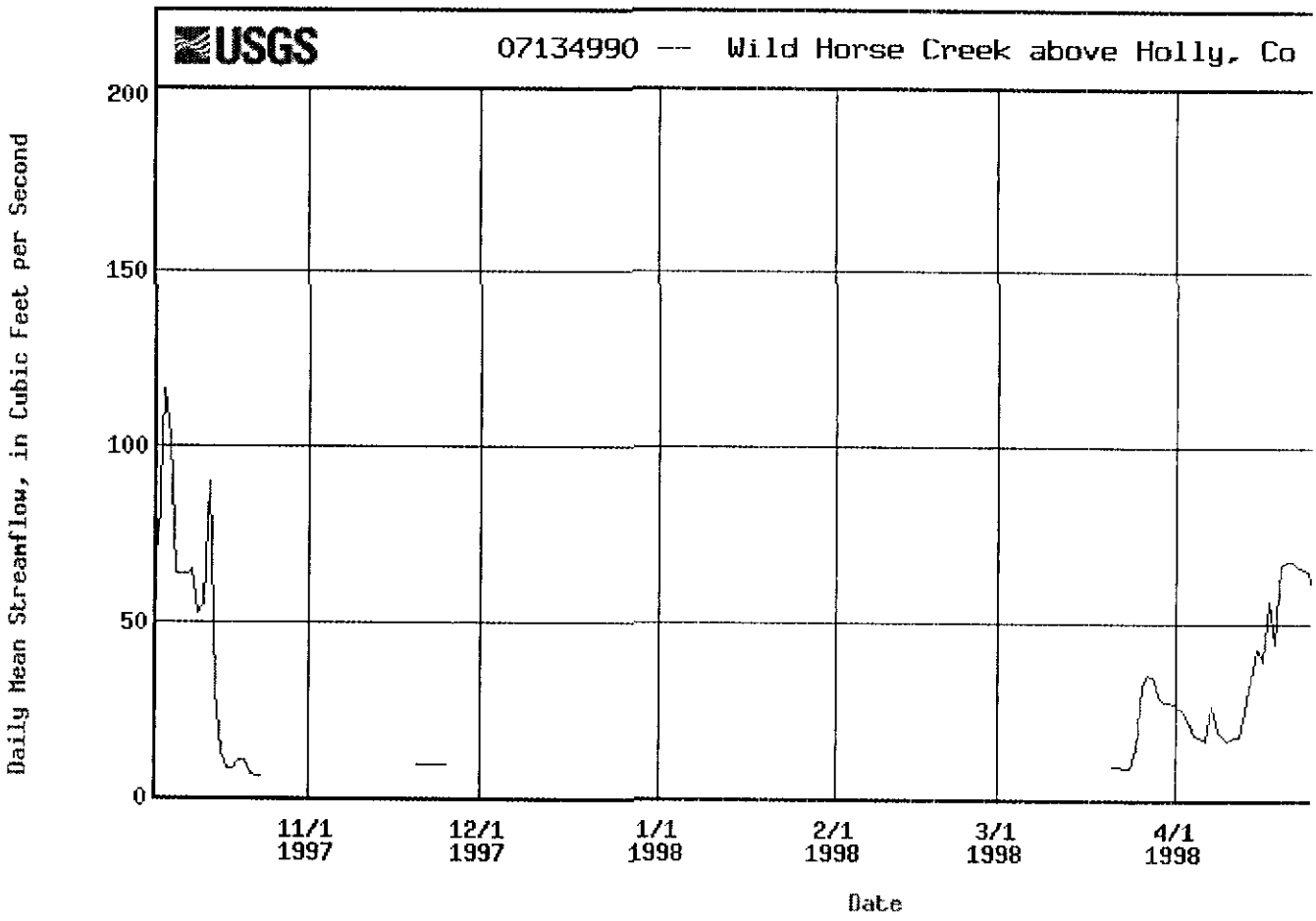
2. Federal Data

USGS

Provisional current year water data

PROVISIONAL DATA SUBJECT TO REVISION

07134990-- Wild Horse Creek above Holly, Co



Retrieve a Text Table of Data

Station Description

STATION.--07134990 WILD HORSE CREEK ABOVE HOLLY, CO

LOCATION.--Lat 38°03'29", long 102°08'10", in SW1/4SW1/4 sec. 10, T.23 S., R.42 W., Prowers County, Hydrologic Unit 11020009 (revised), on left bank, 50 ft upstream from County Road No. 34, 0.60 mi northwest of Holly, and 0.80 mi upstream from mouth.

DRAINAGE AREA.--270 mi2, approximately.

PERIOD OF RECORD.--June 1995 to current year (seasonal record only).

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 3,405 ft above sea level, from topographic map.

REMARKS.--Records poor. Natural flow of stream affected by diversions above station for irrigation and return flow from irrigated areas. Several measurements of specific conductance and water temperature were obtained and are published in the "Supplemental Water-Quality Data For Gaging Stations" section of this rep

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge during period of seasonal operati 1,270 ft3/s, May 26, 1996, gage height, 6.90 ft from flood mark, on basis of indirect determination of peak flow; minimum daily, 3.1 ft3/s, Sept. 19, 1995.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of seasonal operation, ft3/s, May 26, gage height, 6.90 ft from flood mark, on basis of indirect determination of peak flow; minimum daily, 4.7 ft3/s, June 12.

Maintained by: WebMaster@maildcolka.cr.usgs.gov
Hydrologic Information: co.data@maildcolka.cr.usgs.gov
Provisional Current Year Water Data page URL: http://nwis-colo.cr.usgs.gov/nwis/currentWY.html
Colorado District Home page URL: http://webserver.cr.usgs.gov/

Please direct questions or comments to:

District Chief
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225
Telephone: (303) 236-4882, ext. 258
Fax: (303) 236-4912
Office hours: 8:00 a.m. to 4:30 p.m. Mountain Time

Wild Horse Creek At Holly, Co. (07136000)

Station Information

Station Number	Latitude (ddmmss)	Longitude (dddmmss)	County	Basin Name	Drainage Area (miles^2)	Datum (ft above NGVD)
07136000	380245	1020705	Prowers	Upper Arkansas-John Martin	270	3380.36

Data Types Available

- Historical Streamflow Daily Values
- Peak Flow
- Map of region surrounding station
- EPA "Surf Your Watershed" for Upper Arkansas-John Martin.

The format of peakflow WATSTORE card images served by NWIS-W has changed slightly. All card images are still fully compliant with the WATSTORE manual and should work with PEAKFQ. The only change is that all information is now right justified in its field whereas before justification was different for different fields. (zcm 7/7/98)

Speed Update: A new server is being ordered to share the load with this one. This server should be installed within a month. This should improve the responsiveness of the NWIS-W software. We apologize for the delays. (zcm 7/7/98)

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

Go to the Colorado NWIS-W Data Retrieval page
Go to the Colorado Water Resources page
Get help with the terms used on these pages
Other states with USGS surface-water data retrieval pages

Comments and questions are welcome! Please visit our feedback page or email h2oteam@usgs.gov.

This page was created in real time by the NWIS-W package: (NWIS-W: 3.1 ; nwis-w: 3.1)

Station: John Martin | County: Bent | State: CO | Date (Month & yr.): MAY 97 | Time of Complete Observation (Local time): 0800 | Standard Time in Use: MDT

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
1	65	41	50													4976	34	2.55	3.75	.29			
2	79	42	43													5082	116	3.34		.41			
3	60	29	53																	.28			
4	72	40	58																	.28			
5	85	53	56													5344	252	2.49		.29			
6	76	31	56													5409	65	2.03	3.75	.46			
7	88	51	60													5446	56	3.42		.33			
8	82	48	52													5529	64	3.18		.24			
9	60	31	44													5580	51	2.86		.32			
10	72	39	51																	.34			
11	82	48	57																	.34			
12	71	42	45										.03			5813	233	1.80		.35			
13	70	42	52													5873	60	1.53	3.75	.27			
14	86	42	54													5931	58	3.33		.42			
15	81	47	56										.01			5982	51	2.96		.38			
16	79	53	60													6033	51	2.66		.30			
17	90	60	57																	.42			
18	93	51	56																	.43			
19	90	45	47										.51			6202	169	1.90	3.75	.42			
20	65	42	51													6242	40	3.57		.18			
21	76	57	58										.02			6379	137	3.22		.33			
22	77	55	56													6528	149	2.88		.34			100% Clr
23	78	53	57										.09			6589	61	2.78	3.75	.19			
24	77	50	62																	.31			
25	86	54	64																	.31			
26	78	51	63																	.32			
27	76	45	52													6813	234	2.49		.32			
28	68	45	52													6860	37	2.14	3.75	.35			
29	80	51	58										.01			6906	46	3.49		.25			
30	77	48	56										.02			6945	39	3.33		.14			
31	77	53	67																	.38			
Sum													.19										
Avg.												Greate						Adjusted Total					

WS FORM E-22 (9-58) | U.S. DEPARTMENT OF COMMERCE WBAN | OBSERVER | STATION NUMBER

Station: John Martin | County: Bent | State: CO | Date (Month & yr.): Jun 97 | Time of Complete Observation (Local time): 0800 | Standard Time in Use: MDT

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
1	90	55	68																	.38			
2	95	63	63										.02			7116	171	2.22	3.50	.37			
3	78	55	62										.01			7192	76	3.29		.22			100% Cldy
4	85	51	53													7236	44	3.00		.29			
5	79	54	63													7299	63	2.54		.46			
6	93	57	64													7378	79	2.28	3.75	.26			
7	84	61	61																	.26			
8	78	60	63																	.27			
9	78	61	61										.09			7626	248	3.14		.27			100% Cldy
10	63	52	56										.09			7708	82	3.13		.10			100% Cldy
11	79	52	58										.02			7787	79	2.89		.26			100% Cldy
12	91	58	66										T			7817	30	2.54	3.75	.35			
13	89	55	59										.29			7873	56	3.56		.48			
14	86	56	61																	.36			
15	86	60	67																	.35			
16	80	60	65										.12			8134	261	2.62		.35			
17	78	53	61													8163	29	2.49		.13			
18	88	54	70													8188	25	2.18	3.80	.31			
19	96	61	68													8209	21	3.44		.36			
20	100	64	67													8256	47	2.92	3.75	.52			
21	101	64	68																	.52			
22	92	68	70																	.51			
23	95	62	68													8508	252	2.20	3.75	.52			
24	94	61	68													8586	78	3.20		.55			
25	96	60	65										.09			8650	64	2.81		.48			
26	94	54	59													8739	89	2.42	3.75	.59	89	57	
27	92	59	64													8804	65	3.28		.47	87	61	
28	98	59	72																	.44			
29	99	63	70																	.45			
30	96	59	70													8969	165	2.02	3.75	.44	96	59	
31																							
Sum																							
Avg.																							

Greatest: .72

Adjusted Total

WS FORM E-7 (4-78)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: [signature]

STATION NUMBER: 05-4588

Station: John Martin | County: Bent | State: CO | Date (Month & yr.): July 97 | Time of Complete Observation (Local time): 0800 | Standard Time in Use: MDT

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
1	105	69	80													9059	90	3.07		.68	92	61	
2	101	53	61													9130	71	2.48	3.75	.59	90	58	
3	89	59	61													9224	94	3.16	3.75	.59	86	56	
4	80	53	58																	.45			
5	86	58	59																	.45			
6	95	57	65																	.45			
7	96	66	70										.04			9511	287	1.99	3.75	.45	93	58	
8	99	61	71													9576	59	3.30		.45			Thermo Broken
9	98	59	64													9625	55	2.89		.41			
10	97	62	71													9677	52	2.27	3.75	.62			
11	100	71	78													9815	138	3.10		.65			
12	99	61	69																	.52			
13	102	68	70																	.52			
14	96	61	70										.03			0047	232	1.58	3.75	.57			
15	97	60	62										.11			0134	87	3.33		.53			
16	101	59	69													0191	57	2.84		.49	95	65	
17	104	61	69													0233	42	2.32	3.75	.52	93	61	
18	103	57	66													0258	25	3.28		.47	90	64	
19	103	60	70																	.39			
20	96	67	68																	.39			
21	95	65	70										.08			0462	204	2.19	3.80	.39	92	50	
22	95	60	67													0510	48	3.36	"	.44	91	65	
23	99	65	74													0559	49	2.88		.48	93	68	
24	103	69	74													0636	77	2.26		.62	93	66	
25	100	63	77													0736	100	1.76	3.75	.50	95	67	
26	103	68	78																	.45			
27	101	70	78																	.45			
28	100	67	72										.05			0903	167	2.45		.45			
29	97	62	65										1.62			0957	54	3.50		.57	85	70	
30	86	65	67													1054	97	3.23		.27	83	74	
31	93	67	74													1205	151	2.73		.50	90	73	
Sum													1.93										
Avg.													Greatest					Adjusted Total					

WS FORM E-
(4-78)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: Stevens

STATION NUMBER: 05-4388

Station: John Martin | County: Bent | State: CO | Date (Month & yr.): Aug 97 | Time of Complete Observation (Local time): 0800 | Standard Time in Use: MDT

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	24 Hours Ending at Observation Min.	At Observation Dry-bulb	At Observation Wet-bulb	At Observation Dew Point	Supplemental Readings at ____ Dry-bulb	Supplemental Readings at ____ Wet bulb	Supplemental Readings at ____ Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	24 Hour Amounts: Snow, Ice Pellets, Hail (in. & tenths)	At Obsn Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	WIND: 24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	WATER TEMP. °F: 24 Hours Ending at Observation Min.	ADDITIONAL DATA/REMARKS
1	96	67	71													1309	104	2.25	3.75	.48	91	70	
2	93	71	80																	.42			
3	96	63	69																	.42			
4	95	61	67										1.89			1439	130	2.88		.42	95	67	
5	90	64	64										.40			1488	49	3.09		.19	88	52	
6	74	59	59										.97			1556	68	3.83		.23	74	64	
7	69	55	59										.103			1603	47	3.80	3.50	.06	67	61	
8	79	54	61													1646	43	3.15		.35	83	66	
9	89	59	68																	.16			
10	82	60	61																	.14			
11	70	60	62										.35			1829	183	2.76		.14			
12	76	59	64										.24			1877	68	2.85		.15	69	60	
13	82	57	63										1.65			1926	49	3.83	2.58	.30	90	65	Est Evap
14	86	62	66										.10			1988	72	2.36		.32	92	65	Pan Overflow
15	96	62	65													2043	45	2.61	3.75	.35	91	63	
16	93	65	72																	.31			
17	94	60	65																	.30			
18	81	65	68										.05			2171	128	2.89		.30	92	60	
19	85	59	63													2202	31	2.62		.27	88	64	
20	91	63	68													2250	48	2.27		.35	92	63	
21	91	60	64													2269	19	2.00	3.75	.27	95	65	
22	93	64	70													2303	34	3.39		.36	92	65	
23	91	61	74																	.35			
24	95	59	75																	.35			
25	96	65	69													2340	37	2.34	3.15	.35	95	65	
26	94	67	70													2355	15	3.38		.37	93	68	
27	95	64	68													2398	43	2.99		.39	93	67	
28	96	63	68													2468	10	2.79		.20	95	71	
29	97	67	69													2415	07	2.34	3.75	.45	96	68	
30	92	62	70																	.42			
31	93	63	67																	.42			
Sum													6.68										
Avg.												Great	1.89					Adjusted Total					

WS FORM E (4-78)

U.S. DEPARTMENT OF COMMERCE NOAA NATIONAL WEATHER SERVICE

OBSERVER (signature)

STATION NUMBER

Station: John Martin | County: Bent | State: CO | Date (Month & yr.): Sep 97 | Time of Complete Observation (Local time): 0800 | Standard Time in Use: MDT

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (Inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
1	87	65	74																	.42			
2	91	70	70										.98			2584	169	3.05		.42	92	65	
3	75	62	63													2614	30	2.94		.11	76	66	
4	80	57	61													2669	55	2.68		.26	85	64	
5	88	60	61													2734	65	2.38	3.75	.30	90	63	
6	89	62	70																	.24			
7	92	63	67																	.24			
8	92	60	65													2819	85	2.93		.24	90	65	
9	90	59	60													2867	48	2.69		.25	90	62	
10	75	55	57										.02			2898	31	2.58		.13	83	60	
11	86	52	56													2960	62	2.20	3.75	.38	88	60	
12	90	59	66													2965	5	3.40		.35	88	60	
13	91	56	74																	.31			
14	93	63	80																	.31			
15	94	59	63													3086	120	2.45		.32	88	61	
16	94	62	67													3158	73	3.33		.42	86	62	
17	87	52	54													3188	30	2.98		.35	86	59	
18	88	54	67													3238	50	2.75		2.3	83	62	
19	98	56	58													3281	43	2.30	3.75	.45	98	58	
20	82	51	51																	.20			
21	51	45	46																	.04			
22	65	45	60										.78			3506	225	4.09	3.00	.04			Est Evap - Pan Overflow
23	65	52	52										.02			3566	60	2.75		.27			
24	67	47	52													3621	55	2.60		.15	68	63	
25	68	45	50													3649	28	2.41		.19	68	54	
26	81	47	49													3677	28	2.30	3.50	.11	75	52	
27	99	99	64																	.25			
28	86	54	62																	.25			
29	75	48	53													3787	110	2.74		.26	81	62	
30	93	47	47													3809	22	2.53		.21	77	56	
31																							
Sum													1.80										
Avg.												Greatest						Adjusted Total					

WS FORM E-22 (4-78)

U.S. DEPARTMENT OF COMMERCE NOAA NATIONAL WEATHER SERVICE

OBSERVER: [signature]

STATION NUMBER: 05-4388

Station: John Martin | County: Bent | State: CO | Date (month & yr.): Oct 97 | Time of Complete Observation (Local time): 1400 MST | Standard Time in Use: 0800

RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

DATE	AIR TEMPERATURE °F: 24 Hours Ending at Observation Max.	Min.	At Observation Dry-bulb	Wet-bulb	Dew Point	Supplemental Readings at ____ Dry-bulb	Wet-bulb	Dew Point	PRECIPITATION: Time of beginning	Time of ending	Time of beginning	Time of ending	24 Hour Amounts: Rain, Melted snow, etc. (in. & hundredths)	Snow, Ice Pellets, Hail (in. & tenths)	At Obsn. Snow, Ice Pellets, Hail, Ice on ground (in.)	WIND: Anemometer Dial Reading (Miles)	24 Hour Movement	EVAPORATION (inches & hundredths): Gage Reading or Amount Added +	Reading When Tank Filled or Amount Removed −	Amount of Evaporation	WATER TEMP. °F: 24 Hours Ending at Observation Max.	Min.	ADDITIONAL DATA/REMARKS
1	95	47	52													3845	36	2.30		.23	78	55	
2	88	50	55													3877	32	2.06	3.75	.24	80	63	
3	92	55	61													3971	94	3.41		.34	77	56	
4	86	48	60																	.30			
5	86	52	59																	.30			
6	92	59	61													4169	198	2.50	3.75	.31	65	55	
7	79	58	61													4254	85	3.44		.31	75	56	
8	87	55	56										.22			4439	185	3.21		.45	76	52	
9	72	34	37													4542	103	2.99		.22	68	46	
10	72	37	63													4666	124	2.67	3.75	.32	65	45	
11	NR																			.41			
12	NR																			.39			
13	NR																			.39			
14	86	33	36										1.10			5230	564	3.27		.39	76	42	Tornado Activity 10/12
15	69	38	41													5369	134	3.15		.12	58	40	
16	72	36	36													5403	34	3.02		.13	60	43	
17	68	36	38													5426	23	2.91		.11	60	43	
18	73	38	45																	.12			
19	80	45	50																	.12			
20	57	44	47													5528	102	2.55		.12	64	45	
21	53	41	41													5580	52	2.45		.10	50	42	
22	57	35	40													5622	42	2.49		.104	55	42	
23	70	40	45													5659	37	2.30		.119	61	41	
24	72	42	44													5693	34	2.15	3.75	.15	61	45	
25	52	22	22																	.15	NR		Chg to MST
26	26	18	23																	0.0			
27	34	22	25																	.09			EST Evap
28	41	23	30										1.79		22	6105	412			.09			
29	45	22	26													6154	49			.11			
30	46	26	31													6238	84			.18			Avg Evap
31	52	31	40													6311	73			.18			Remove Pan 10/25
Sum																							
Avg.													3.11										
												Greatest						Adjusted Total					

WS FORM E-2 (4-78)

U.S. DEPARTMENT OF COMMERCE
NOAA
NATIONAL WEATHER SERVICE

OBSERVER: [signature]

STATION NUMBER: 05-4300

UNEDITED LOCAL CLIMATOLOGICAL DATA [NOAA, National Climatic Data Center] MONTH: 08/1997

Station Location: LAMAR, CO (LAA) lat: 38° 04', lon: -102° 41'
Elev(Ground): 3703 FeetTime Zone: Mountain Standard WBAN: 03013

date	Temperature (Fahrenheit) Max	Min	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Deg Days Base 65 Degrees Heating	Cooling	Significant Weather	Snow/Ice on Gnd(In) 0600 LST Depth	1200 LST Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure (inches of Hg) Avg. Station	Avg. Sea level	Wind Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-sec Speed	Dir	max 2-min Speed	Dir	date
01	95	66	81*	81	64	68	0	16	RA FG	M	-	-	0.34	26.32	30.03	3.0	32	7.9	43	2	36	2	01
02	92	66	79	79	66	69	0	14	RA FG	M	-	-	0.45	26.36	30.06	1.0	32	8.5	52	24	41	24	02
03	90	65	78	78	66	69	0	13	-	M	-	-	0.00	26.36	30.09	1.1	2	4.0	17	23	15	24	03
04	90	66	78	78	65	68	0	13	RA FG	M	-	-	0.57	26.43	30.17	3.2	9	6.5	36	8	28	7	04
05	73	64	69	69	64	65	0	4	RA FG	M	-	-	1.23	26.38	30.15	5.6	12	10.9	31	16	26	35	05
06	66	57	62*	62	59	60	3	0	RA FG	M	-	-	0.92	26.37	30.16	7.5	7	9.8	29	5	23	7	06
07	77	56	67	67	56	60	0	2	-	M	-	-	0.01	26.36	30.12	5.0	15	7.9	24	10	16	15	07
08	89	56*	73	73	57	63	0	8	-	M	-	-	0.00	26.11	29.82	4.0	19	6.4	16	21	14	21	08
09	82	60	71	71	61	65	0	6	-	M	-	-	T	26.16	29.86	6.1	4	10.1	26	2	22	2	09
10	68	60	64	64	61	62	1	0	RA FG	M	-	-	0.43	26.26	30.01	9.4	12	11.1	33	9	28	10	10
11	75	58	67	67	61	62	0	2	RA FG+ FG	0.0	-	-	0.53	26.24	29.99	5.7	8	7.8	28	10	23	9	11
12	82	59	71	71	61	64	0	6	-	M	-	-	0.00	26.35	30.09	2.0	11	5.8	15	10	13	10	12
13	87	62	75	75	63	66	0	10	RA FG HZ	0.0	-	-	0.38	26.26	29.98	3.9	18	11.1	41	28	32	30	13
14	90	59	75	75	58	63	0	10	-	M	-	-	0.01	26.05	29.74	4.5	27	6.6	15	28	13	24	14
15	92	59	76	76	55	63	0	11	-	M	-	-	0.00	25.95	29.62	5.0	21	8.7	147	36	16	18	15
16	91	59	75	75	60	65	0	10	-	M	-	-	T	26.02	29.70	3.3	33	8.1	26	7	23	6	16
17	79	58	69	69	58	62	0	4	-	M	-	-	0.00	26.33	30.07	5.2	10	8.7	21	3	17	3	17
18	83	62	73	73	63	66	0	8	RA FG	M	-	-	0.14	26.24	29.96	3.7	15	8.1	22	21	17	21	18
19	90	59	75	75	58	64	0	10	FG+ FG	M	-	-	0.01	26.25	29.96	2.6	29	7.5	40	33	32	32	19
20	91	61	76	76	60	65	0	11	-	M	-	-	T	26.30	30.03	2.4	13	6.2	22	18	21	19	20
21	93	58	76	76	61	66	0	11	FG+ FG	M	-	-	0.00	26.27	30.00	2.1	33	4.6	20	32	16	32	21
22	89	59	74	74	57	64	0	9	-	M	-	-	0.00	26.34	30.06	1.1	20	4.2	20	26	16	24	22
23	94	57	76	76	57	64	0	11	-	M	-	-	0.00	26.30	30.02	4.6	16	6.9	25	17	20	17	23
24	96*	57	77	77	56	64	0	12	-	M	-	-	0.00	26.24	29.91	4.9	17	7.7	23	17	20	17	24
25	94	61	78	78	60	66	0	13	-	M	-	-	0.00	26.20	29.88	2.6	15	6.5	26	17	21	18	25
26	95	63	79	79	58	66	0	14	-	M	-	-	0.00	26.20	29.88	7.9	18	11.4	26	17	22	17	26
27	93	62	78	78	61	67	0	13	-	M	-	-	0.00	26.16	29.83	0.9	31	5.6	24	18	20	18	27
28	95	62	79	79	60	67	0	14	-	M	-	-	0.00	26.13	29.81	1.6	18	5.5	17	15	14	15	28
29	91	65	78	78	58	65	0	13	-	M	-	-	T	26.11	29.79	1.6	32	8.0	41	29	33	30	29
30	89	57	73	73	59	64	0	8	FG	M	-	-	0.22	26.20	29.90	1.1	29	6.6	32	33	24	34	30
31	86	61	74	74	63	66	0	9	FG	M	-	-	0.02	26.22	29.93	4.7	13	7.6	23	13	20	14	31
	87.0	60.5	73.8	--------	60.2	64.8	.1	9.2	<Monthly Averages	Totals>			0.78	26.24	29.96	1.5	13.6	7.6	<Monthly Average				

	73.8	--------	<----------Departure From Normal---------->	0.78

Degree Days	Monthly		Season to Date	
	Total	Departure	Total	Departure
Heating:	4	4		
Cooling:	285	285		

Greatest 24-hr Precipitation: 0.39 date: 13-14
Greatest 24-hr Snowfall: date:
Greatest Snow Depth: 0 date:

Sea Level Pressure Date Time

Maximum:	30.27	6	2217
Minimum :	29.55	16	0010

Number of Days with ----->

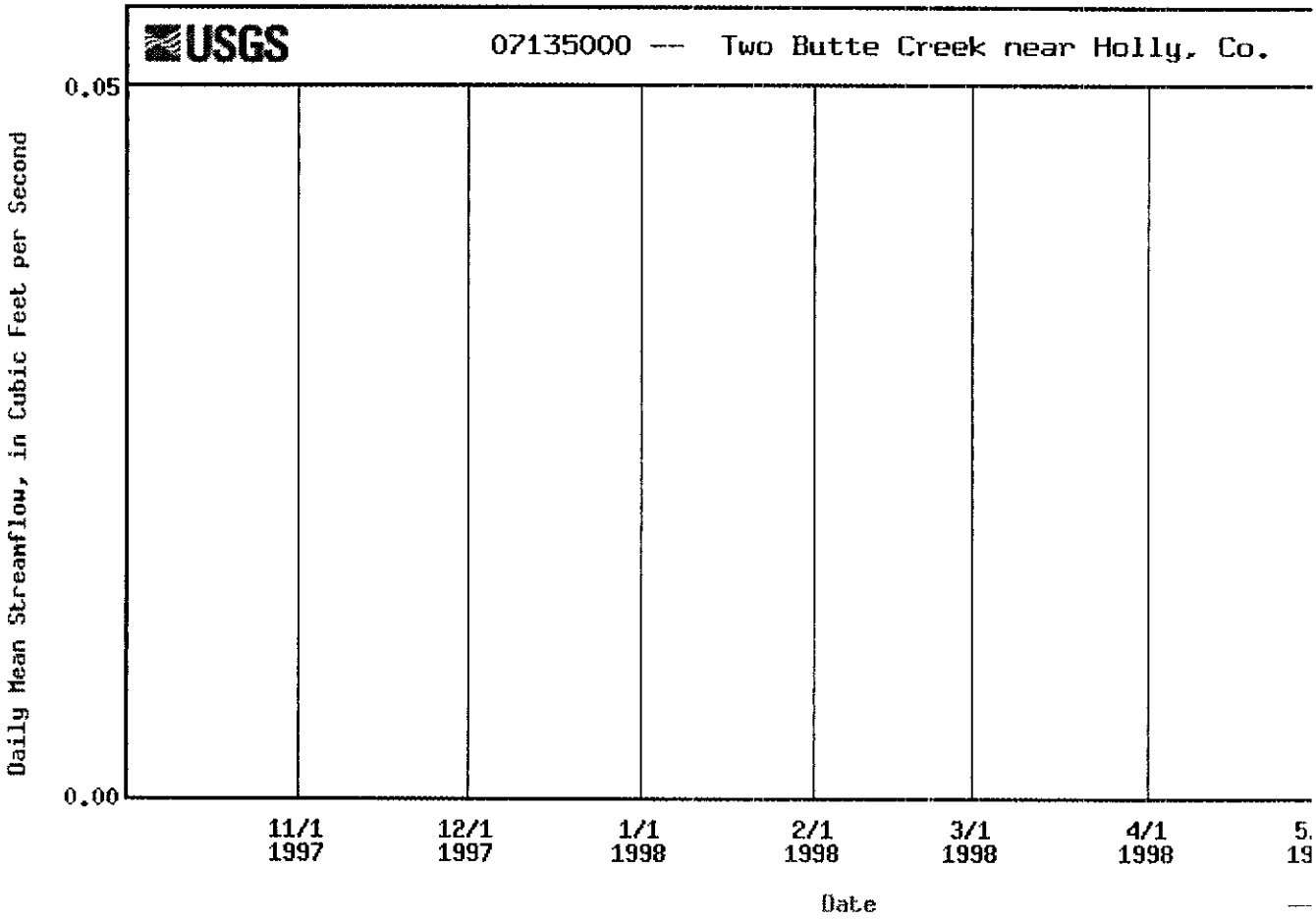
Max temp >= 90	17	Min temp <= 32: 0	Precipitation >= .01 inch: M
Max temp <= 32	: 0	Min temp <= 0 : 0	Precipitation >= .10 inch : M
Thunderstorms	: 0	Heavy Fog : 3	Snowfall >= 1.0 inch : 0

USGS

Provisional current year water data

PROVISIONAL DATA SUBJECT TO REVISION

07135000-- Two Butte Creek near Holly, Co.



Retrieve a Text Table of Data

Station Description

STATION.--07135000 TWO BUTTE CREEK NEAR HOLLY, CO.

LOCATION.--Lat 38°01'40", long 102°08'19", in SE1/4SE1/4 sec. 21, T.23 S., R.42 W., Prowers County, Hydrologic Unit 11020013 (revised), on right bank 15 ft upstream from county road DD, about 1 mi upstream from mouth, and 2.9 mi southwest of Holly.

DRAINAGE AREA.--817 mi2.

PERIOD OF RECORD.--April 1942 to September 1946. June 1995 to current

year (seasonal record only).

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 3,415 ft above sea level, from topographic map.

REMARKS.--No estimated daily discharges. Records fair. Natural flow of stream affec by Two Butte Reservoir, (capacity, 40,000 acre-feet), from which most of creek is diverted for irrigation.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge during period of seasonal operati 756 ft3/s, May 26, 1996, gage height, 8.68 ft, result of slope-area determination of peak flow; no flow, most of the time.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period of seasonal operation, ft3/s, May 26, gage height, 8.68 ft, result of slope-area determination of peak flow; no flow, most of the time.

Maintained by: WebMaster@maildcolka.cr.usgs.gov
Hydrologic Information: co.data@maildcolka.cr.usgs.gov
Provisional Current Year Water Data page URL: http://nwis-colo.cr.usgs.gov/nwis/currentWY.html
Colorado District Home page URL: http://webserver.cr.usgs.gov/

Please direct questions or comments to:

District Chief
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225
Telephone: (303) 236-4882, ext. 258
Fax: (303) 236-4912
Office hours: 8:00 a.m. to 4:30 p.m. Mountain Time

USDA Farm Service Agency offices

State Code	County Code	Site Name	HQ State	HQ County
8	99	PROWERS COUNTY FSA OFFICE	8	99

5/6/98 will call back

CED – County Exec Director	Contact Name
CHAD HART	CHAD HART

Area Name	State Name	Site Type Name	Site District	Transmission ID	Time Zone
Southwest	Colorado	FSA County Office	1	AIG	Mountain

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Phone #	(719)336-3437	ext.	
Fax #	(719)336-3732	ext.	

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	MAIL ADDRESS		STREET ADDRESS
Address	3501 SOUTH MAIN	Address	3501 SOUTH MAIN
Address	SUITE A	Address	SUITE A
City	LAMAR	City	LAMAR
State	CO	State	CO
Zip	81052	Zip	81052

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Send a question, idea or comment to the County Office via the State Office.

If any of the information on this page is incorrect, please notify us.

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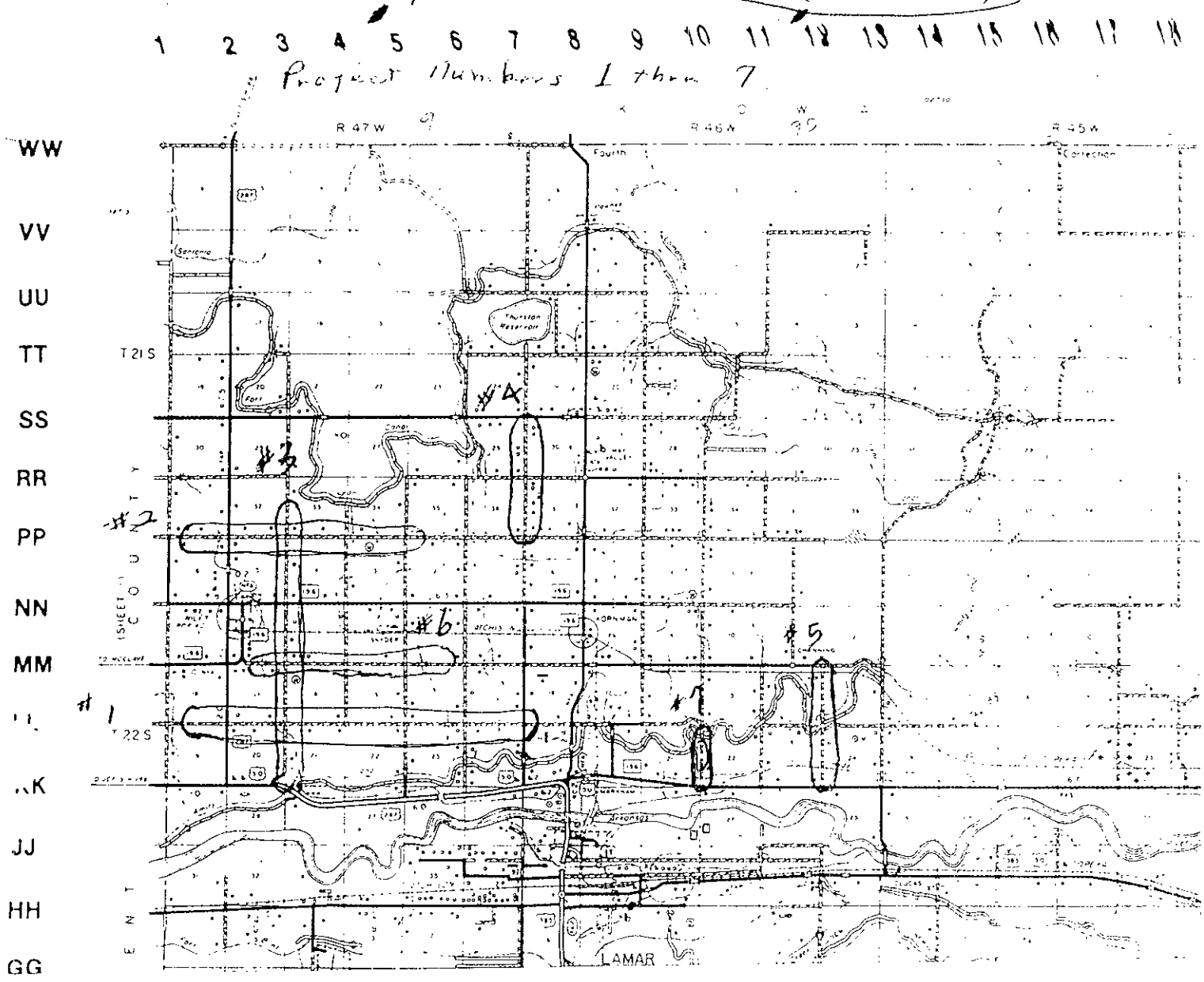
Flood Damaged Roads, Prowers County - 1997

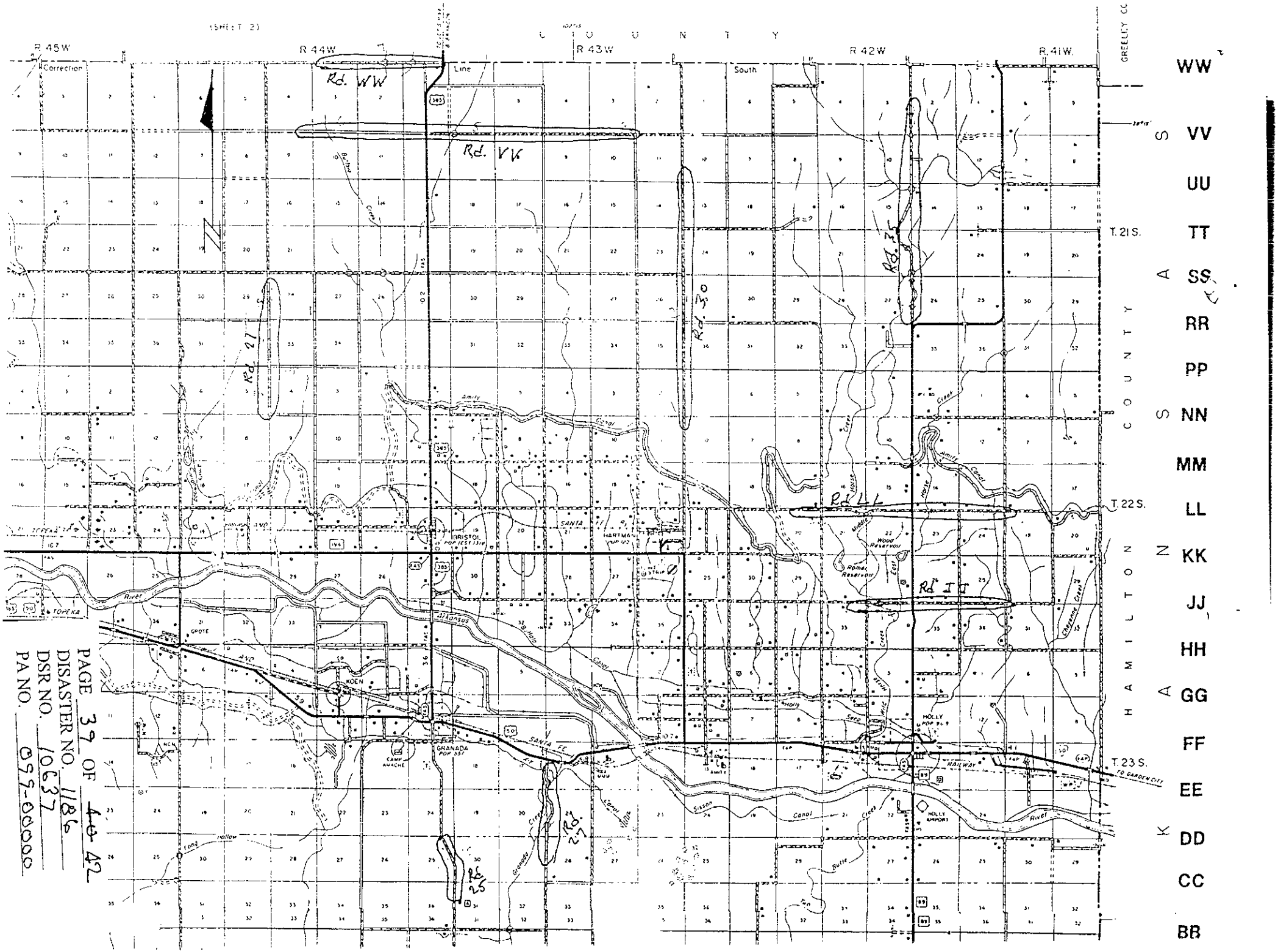


Project #7

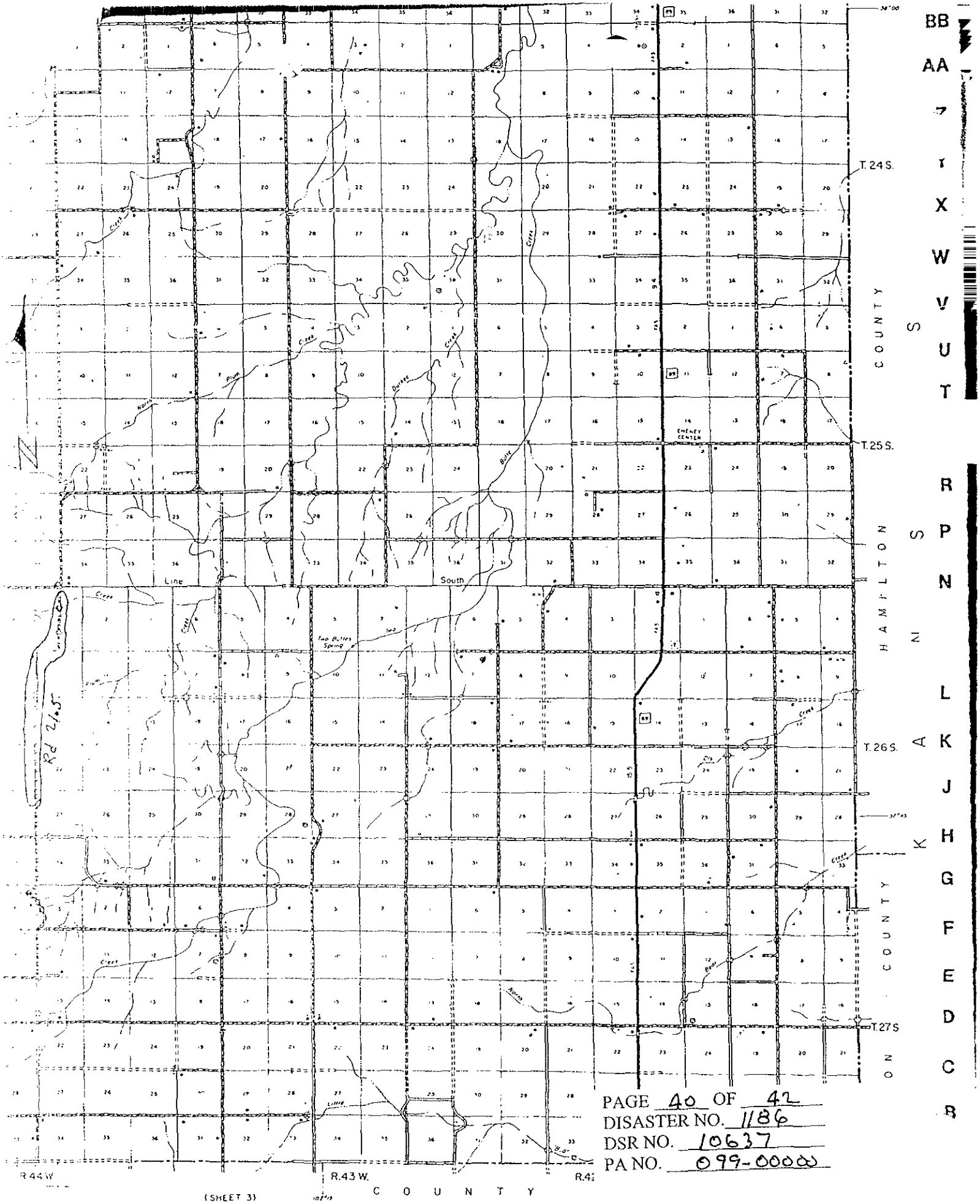
Reconstruct Road and Regravel

$5000

080272 0001-0020



PAGE 39 OF 42
DISASTER NO. 1186
DSR NO. 10637
PA NO. 097-00000



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DISASTER NO. 1186
DSR NO. 10637
PA NO. 099-00000

BB AA Z Y X W V U T S R P N L K J H G F E D C B A

1 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

3. State Data

STATE OF COLORADO

Colorado Water Conservation Board
Department of Natural Resources
721 Centennial Building
1313 Sherman Street
Denver, Colorado 80203
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Date: 4/3/98

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LAMAR FIS AS REQUESTED

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A second coordination meeting held on November 5, 1979 was attended by city and county officials, and the study contractor, Camp Dresser & McKee Inc. Camp Dresser & McKee Inc. informed the City of their intentions and solicited any information on new developments or existing problems in the study area.

FEMA, the State, the City of Lamar and Prowers County were contacted regarding the availability of any reports studies, or investigations which may contain information relative to flooding problems in the community. A 1976 flood study prepared by Ken O'Brien and Associates for the U.S. Army Corps of Engineers, was received.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Lamar, Prowers County, Colorado. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed study in Lamar were determined by FEMA, community officials, and the study contractor during the meeting in June 1979.

Floods caused by overflow of the Arkansas River and Willow Creek were studied in detail. The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through May 1986. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Lamar.

2.2 Community Description

The City of Lamar is located in southeastern Colorado in the northwestern portion of Prowers County. Total land area within the corporate boundaries is approximately 3.3 square miles. The Colorado Population Report Series CP 26 #79(C-1) reported the population of Lamar in 1979 as 8224 (Reference 2).

Adjacent communities to Lamar include Holly, Colorado, approximately 20 miles to the east and La Junta which is approximately 50 miles to the west. The Arkansas River, which flows eastward on the south end of the city is one of the principal rivers in Colorado. The length of study for the Arkansas River at the City of Lamar is 1.7 miles with a drainage area above Lamar of 19,780 square miles.

Willow Creek is a tributary of the Arkansas River with a drainage area of 40 square miles and a study reach of 2.6 miles.

Economic activities of the area primarily include ranching and farming. Principal crops of the area are wheat, alfalfa, corn, and other row crops.

Tourist and recreation sites in the area include: the old Santa Fe trail north of Lamar; John Martin Reservoir, 18 miles to the west; the Great Plains Reservoir System, 12 miles to the north and the Two Buttes area, 30 miles to the south.

The Atchison Topeka and Santa Fe Railroad runs through the area and carries freight and Amtrak passenger trains. Main highways in the area include U.S. Highways 50 and 287.

The industrial areas are located in the northern and southern sections of Lamar. Commercial areas are located along a single main street and in shopping areas east and south of town. The residential areas of Lamar extend outward from Main Street and south of town along Willow Creek. Housing in the area is a combination of older and new houses which were built in the last ten years. The flood plains of all the flooding sources considered in the study are essentially fully developed.

Climate of the area is generally warm and dry, with 13 inches of precipitation per year and summer temperatures in the 90's. Winters in the Lamar area are usually mild with an average temperature of 27°F.

Principal geographical characteristics include a wide river valley with rolling grasslands. Vegetation includes cottonwoods along the Arkansas River with crops and grassland outside the valley.

There is a fairly extensive water system in the Lamar area including Dry Creek, Clay Creek, and Willow Creek, the latter flows through Lamar. Ditches and canals in the vicinity include: Fort Bent Canal, Lamar Canal, Hyde Canal, Vista Del Rio Ditch, and Amity Canal. Reservoirs in the area include the Great Plains Reservoir System, John Martin Reservoir, and Two Buttes Reservoir.

2.3 Principal Flood Problems

Headwaters of the Arkansas River originate in the San Isabel Mountains near Leadville, Colorado. Effects of heavy snow melt or heavy rains occurring in the upper portion of the drainage basin are reduced by the John Martin Reservoir. Flooding in Lamar is dependent on localized heavy rainfall below the John Martin Dam.

The most severe flood in recent history occured in June 1965. Torrential rains in eastern Colorado, western Kansas, and New Mexico,

caused wide spread flooding in the Arkansas River basin. In Colorado alone, damage estimates by a special congressional committee, totalled $43 million. Damage in Lamar was estimated at $1.2 million.

The Tri-State Daily News (Reference 3) reported on June 22, 1965, "The John Martin Reservoir stored some 273,138 acre feet of water which otherwise would have poured down on the staggering towns." A U.S.G.S. report on the 1965 flood added, ".... the uncontrolled tributary inflow below the John Martin Reservoir was so outstanding that towns from Lamar, Colorado to Dodge City, Kansas were extensively damaged."

The 1965 U.S.G.S. report stated the peak flow for Willow Creek was 24,300 cfs. Flow in the Arkansas River at Lamar was recorded at 72,800 cfs with a maximum gage height of 18.9 feet. A previous flood in 1921 carried 130,000 cfs but the maximum gage height was only 17 feet.

Other large floods (greater than 30,000 cfs) on the Arkansas River occurred in 1923, 1929, 1934, 1936, and 1942. The John Martin Dam began flow regulation in 1943. Flood history of the Willow Creek drainage area is limited.

2.4 Flood Protection Measures

The City of Lamar has adopted flood plain management regulations determined by FEMA. Along Willow Creek, a levee has been built, and the channel has been dredged to protect the city from frequent flooding.

An earthen levee along Willow Creek exists on the left bank from First Avenue to the downstream comporate limits. Field inspection revealed the levee was in good structural condition. The 100-year flood elevation was calculated to be three feet below the top of the levee at each cross-section (A-N). The 500-year flood overtops the levee at approximately cross-section "M", and flows into the city, creating shallow flooding areas.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in this community, standard hydrologic, and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of the magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of

having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the county at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out by the U.S. Army Corps of Engineers (Reference 1) to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals. Flows on the Arkansas River from the U.S. Army Corps of Engineer's hydrology report were obtained using a synthetic unit hydrograph for ten subareas of the Arkansas River basin and routing them to Lamar, as described by the method in EM1110-2-1408, "Routing of Floods through River Channels" (Reference 4). Flows on Willow Creek were calculated by the U.S. Army Corps of Engineers using a synthetic unit hydrograph that was developed from a flood event on Salt Draw near Orla, Texas. The flows were compared to a gage station analysis of the Arkansas River U.S.G.S. gage at Lamar. The Arkansas River at Lamar gage has a period of record of 1921 to the current year, with the data from 1944 to the current year reflecting the operation of John Markin Reservoir. The peak flows obtained by the U.S. Army Corps of Engineers, in their gage analysis, agreed with the unit hydrograph analysis. The study contractor checked this gage analysis by using Reference 5, and obtained peak flow rates within the 90 percent confidence limits of the frequency-discharge curve obtained in the "Review Survey for Water Resource Development, Lamar, Colorado, and Vicinity, Hydrology (Revised) 1978" (Reference 1). The peak discharges used in this study are shown in Table 1.

Table 1 - Summary of Discharges

Flooding Source and Location	Drainage Area (square mile)	Peak Discharge (cfs) 10-Year	50-Year	100-Year	500-Year
Arkansas River					
At Lamar	19,780	11,200	28,000	40,000	84,000
Willow Creek					
At Siphon	40	2,900	8,600	12,800	28,400

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide esti-

mates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Water surface elevations for the 10-, 50-, 100-, and 500-year floods for the Arkansas River and Willow Creek were computed using the U.S. Army Corps of Engineers HEC-2 Water Surface Profiles Program (Reference 6). Cross sections for this analysis were obtained from aerial photographs flown in April 1980 (Reference 7), coupled with appropriate field verification. All bridges and culverts were measured in the field to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Starting water surface elevation for the 10-, 50-, 100-, and 500-year floods along the Arkansas River and Willow Creek were calculated using a slope area method with estimated energy grade line slopes and approximated water surface elevations.

Roughness factors (Mannings "n" values) were determined by field inspection. Ground level photography aided in the selection of roughness factors and aerial photography was used to determine the limits of each roughness zone. Roughness values for the main channel of Willow Creek ranged from 0.024 to 0.030 with flood plain values ranging from 0.024 to 0.035 for all floods. Roughness values for the main channel of the Arkansas River ranged from 0.02 to 0.03 with a flood plain value of .065. Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. The flood profiles presented in this study are based on the effects of flow through unobstructed hydraulic structures and area, thus, considered valid only if these structures do not fail and remain unobstructed.

Horizontal control is based on Colorado State Plane Coordinate System South Zone 1929 USC, and the vertical control is based upon the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries for the 100-, and 500-year floods each have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4800, with a contour interval of 2 feet (Reference 7). In cases where the 100-and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may not lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communites in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood may be carried without substantial increase in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of a maximum one-foot rise in water-surface elevation over the 100-year water surface, for the encroached floodway. The results of these computations were tabulated at selected cross sections for Willow Creek (Table 2). A floodway was not computed for the Arkansas River because it would be totally outside the corporate limits of Lamar.

As shown on the Flood Boundary and Floodway Map, the floodway boundaries were determined at cross sections, and between cross sections the boundaries were interpolated. In cases where the floodway and

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MARKUS - Floodplain information for Prowers County and lower Arkansas River Basin.

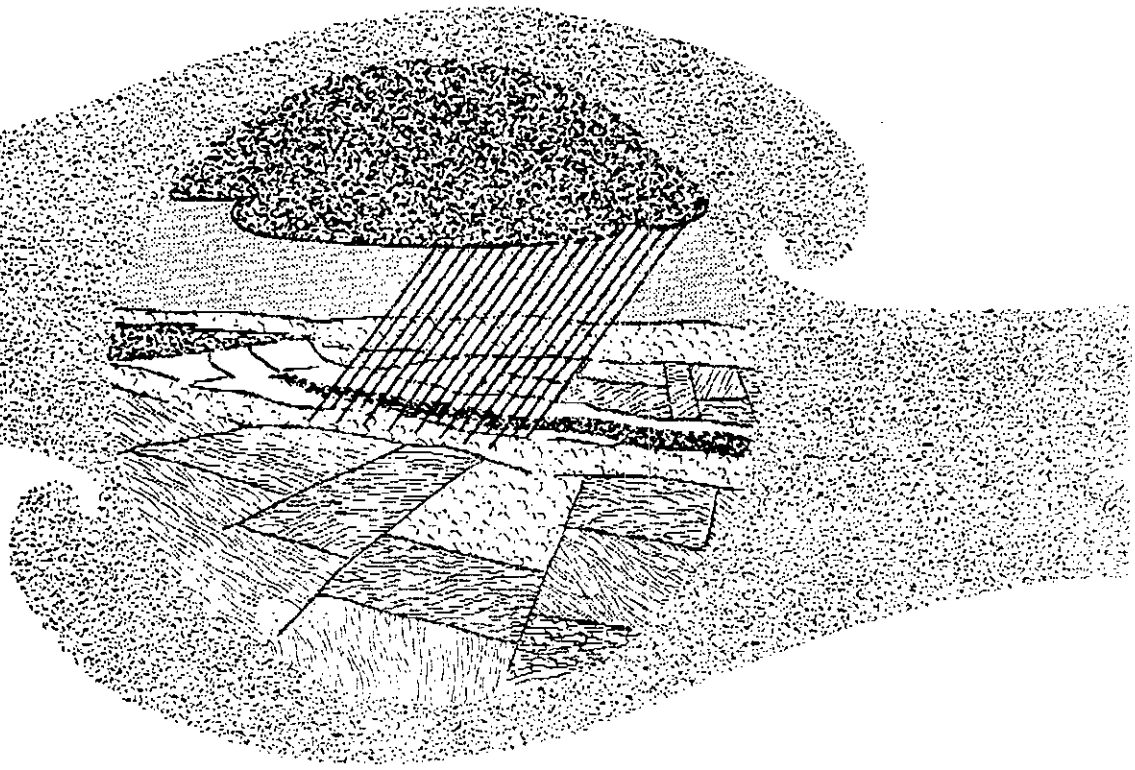
The Prowers County Firm maps do not have an FIS that accompanies the maps.

-Tom

Designated 40
2-26-75

SPECIAL FLOOD HAZARD INFORMATION

ARKANSAS RIVER and TRIBUTARIES
Great Bend, Kansas, To John Martin Dam, Colorado



PREPARED BY
DEPARTMENT OF THE ARMY
UQUERQUE DISTRICT, CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

JUNE 1974

BACKGROUND INFORMATION

3. DRAINAGE BASIN FEATURES.- The Arkansas River originates in the central part of the Rocky Mountains near Leadville, Colorado. Its waters enter the Mississippi River, approximately 20 miles north of McGehee, Arkansas, after following a 1,460 mile course through the States of Colorado, Kansas, Oklahoma and Arkansas. Runoff is received from one of the highest regions in North America. At least 25 Colorado peaks in the upper watershed exceed 14,000 feet in elevation. These include Mount Elbert, the highest point in Colorado, at an elevation of 14,431 feet. Above Great Bend, Kansas, the total watershed area comprises 34,356 square miles, with 6,002 square miles classified as noncontributing. The major contributing subbasin area, consisting of 18,130 square miles, is controlled 286 miles upstream from Great Bend by John Martin Dam near Las Animas, Colorado.

4. The Arkansas River is a typical torrential mountain stream until it emerges from central Colorado's Royal Gorge Canyon, a nationally famous scenic attraction with steep walls over 1,000 feet high. Below the canyon, at about 5,300 feet elevation, the valley gradually grows wider and descends through the foothills to reach 4,700 feet at Pueblo, Colorado. From Pueblo through the fertile Great Plains region to Great Bend, the river is characterized by a wide streambed with low banks that occasionally shifts across a broad, well developed, irrigated valley.

5. STREAMFLOW CHARACTERISTICS.- Stream slopes vary from a maximum of about 110 feet per mile in the mountain reaches to 7.5 feet per mile immediately below John Martin Dam; then gradually decrease to less than 6 feet per mile near Great Bend. In addition to regulation by John Martin Dam, natural streamflows are affected by transmountain diversions, storage reservoirs, irrigation diversions and return flows, groundwater withdrawals, and power developments along the river channel. Pertinent drainage areas and maximum known discharges for the Arkansas River and its tributaries are given in Table 1.

6. Past historic floods originating on the Purgatoire River, Fountain Creek, and other major tributaries in the upper Arkansas

TABLE 1

DRAINAGE AREAS AND MAXIMUM DISCHARGES

Location	Mile Above Mouth of Ark River	Contributing Drainage Area (sq. mi.)	Maximum Discharge (c.f.s.)	Date of Discharge
Arkansas River:				
Colorado				
Below John Martin Reservoir	1,157.7	18,132	180,000	Jun 5, 1921
Lamar	1,137.3	18,830	130,000	Jun 5, 1921
Holly	1,105.0	23,425	110,000	Oct 20, 1908
Kansas				
Coolidge	1,099.5	23,702	158,000	Jun 17, 1965
Syracuse	1,080.9	23,906	174,000	Jun 17, 1965
Garden City	1,024.2	24,703	130,000	Jun 19, 1965
Dodge City	970.2	25,017	82,000	Jun 19, 1965
Kinsley	920.3	25,406	49,800	Jun 21, 1965
Larned	897.4	26,017	40,000	Jun 22, 1965
Great Bend	873.2	38,354	27,800	Jun 23, 1965
Tributaries:				
Colorado				
Caddoa Creek at Caddoa	1,157.5	131	37,600	Jun 18, 1965
Big Sandy Creek near Lamar	1,127.5	2,840	3,600	Jun 17, 1965
Wolf Creek near Granada	1,117.3	63	35,300	Jun 17, 1965
Two Butte Creek near Holly	1,105.6	817	182,000	Jun 17, 1965
Wild Horse Creek	1,104.5	272	22,000	Aug 28, 1935
Kansas				
Mulberry Creek south of Dodge City	920.3	74	1,220	Oct 16, 1968
Pawnee River near Larned	897.3	2,010	16,300	Jul 28, 1958
Walnut Creek at Albert	868.7	1,306	12,700	Sep 22, 1959
White Woman Creek near Leoti	-	750 (noncontributing drainage area)	2,120	Aug 15, 1968

watershed have caused frequent flood problems along areas now protected by John Martin Dam. Completion of the dam, which began storing water in December 1948, greatly reduced the severity and frequency of flooding in the lower Arkansas valley. Flooding from major tributaries that enter the Arkansas' main stem below the dam has continued to plague the lower communities, as the unusual June 1965 flood demonstrated. The high peaks resulting from this flood led many local people to believe that "the dam had broken." Actually, the vast reservoir storage area behind the dam had contained the destructive flood originating in the upper watershed and prevented a disaster of major proportions in the lower valley.

7. The major uncontrolled areas that contributed most towards flood peaks in 1965 lie south of the Arkansas' main stem. Although Big Sandy Creek (a north-bank tributary and the largest single drainage area consisting of 3,426 square miles) attained peaks of 60,700 cubic feet per second near Calhan, Colorado, only 3,600 cubic feet per second were recorded at the creek's mouth. Valley storage and high infiltration, along with numerous undefined noncontributing areas and several small Soil Conservation Service flood-retarding structures, act to substantially reduce flood peaks throughout this major drainage basin. The total uncontrolled contributing drainage area of about 5,570 square miles (including Big Sandy Creek) exists within the first 60 river miles from John Martin Dam to about the Colorado-Kansas State line. In contrast, only about 1,700 square miles of contributing drainage area enter the reach between the State line and Kinsley, Kansas, a distance of about 180 river miles. This reduction results from the White Woman Creek closed basin, which contains 2,250 square miles of noncontributing drainage area. Surface runoff from intense storms occurring over the central portion of the watershed is greatly reduced by infiltration and surface storage within this closed basin.

8. Broad flat valleys and mild channel gradients combine effectively to create temporary storage areas in the Arkansas River flood plains. The detention of significant floodwater volumes extends

the duration of flooding, but progressively reduces flood peaks downstream. A low volume, high peak, cloudburst type of storm in the upper watershed can cause severe localized flooding, but have little effect downstream. Studies of flood history show that peak attenuation on the Arkansas River continues without interruption between the Colorado-Kansas State line and Great Bend where the absence of significant tributaries results in minimum inflow as shown on Plate A-2.

9. From Kinsley to the mouth of Walnut Creek near Great Bend, a distance of about 50 river miles, three major drainages--Pawnee River, Big Coon Creek, Walnut Creek--along with various minor drainages, add about 4,520 square miles of contributing drainage area. The communities of Kinsley, Larned, and Great Bend are vulnerable to the flows of these tributaries as well as the attenuated floodflows from upper watershed areas.

10. HISTORICAL FLOODS.- Various historical sources disclose that at least 12 floods occurred on the Arkansas River between 1826 and 1900 which were of sufficient size to be remembered by pioneer settlers or reported in early-day newspapers. Descriptive accounts give details that were meaningful to area residents of the time, but they rarely provide definitive data to enable valid magnitude determinations. These early floods are generally identified in connection with the present-day locations of Las Animas, Lamar, Fort Lyon, La Junta, Trinidad, and Pueblo, in Colorado. The last and most significant flood of the pre-1900 era occurred in May 1894 when, at Pueblo, five lives were lost and $2 million in property damage was sustained from the combined flooding of Fountain Creek, Dry Creek, and the Arkansas River. This flood was headlined in the Colorado Chieftain: "Highest Water on Record Visits Pueblo." Following are descriptions of especially large or damaging floods that have occurred on the Arkansas River since 1900.

a. Flood of June 1921. This flood was reportedly the largest yet to be experienced along the Arkansas River. During the

June 2-5 period, a severe storm over Colorado caused excessive runoff to create peak flows of 103,000 cubic feet per second (c.f.s.) at Pueblo and 165,000 c.f.s. at Lamar. After the flood, 78 bodies were recovered at Pueblo, which also suffered $10 million in property losses. Farther downstream, Dodge City, Kansas, reported a peak discharge of 32,000 c.f.s. and floodwaters sufficiently deep in places to compel horses to swim across streets. Severe damage was incurred at Larned, Kansas, as well.

b. Flood of August 1929.- In August 1929, a storm caused the Purgatoire River to flood and this led to a high stage on the Arkansas River at Lamar, Colorado.

c. Flood of April 1942.- Caused by excessive rainfall coupled with snowmelt, this flood attained a peak discharge of 21,000 c.f.s. at Dodge City, Kansas. Many basements were flooded, but structural damage was relatively minor. Downstream at Larned, the flood was described as the worst in Larned's history. Through the efforts of volunteers manning the local dike, however, the city avoided disaster and became the only city along the Arkansas to escape serious damage.

d. Flood of June 1949.- At Dodge City, Kansas, the crest stage was 13.3 feet with 16,200 c.f.s. discharge. This was the first flood to reach Dodge City since the completion of John Martin Dam in October 1948, and the dam's regulatory operation appreciably reduced the effects of the flood. Although damages were thus minimized, some residents were forced to evacuate their homes to escape the rising waters.

e. Flood of May 1951.- Produced by sustained rainfall over southeastern Colorado on the watershed below John Martin Dam, Holly, Colorado, was the first community to suffer significant inundation. In Kansas, Syracuse and Garden City were forewarned and able to prepare sufficiently to escape major damage. Despite flood fighting efforts at Dodge City, the city's dikes were breached and flooding resulted. At Larned, the floodwaters were successfully controlled.

Total damages incurred in Colorado and Kansas reached an estimated $3.5 million.

f. Flood of July 1951.- Heavy rains over the Arkansas River watershed between Garden City and Great Bend, Kansas, led to flooding on the Pawnee River. Great Bend became the principal victim when, on 13 July, the city's dike failed and about 145 city blocks were flooded. The Red Cross and State National Guard organizations evacuated 250 persons; some 1,250 homes and 65 business were damaged; and about $150,000 in damages resulted.

g. Flood of July 1958.- Intense rainstorms and runoff over the Pawnee River and Walnut Creek drainage areas produced floodflows that threatened Larned but did not overtop the city's dikes. At Great Bend, however, the floodwaters outflanked the levee and caused extensive damage within the city.

h. Flood of June 1965.- During the June 13-19 period, sustained and heavy rainstorms produced floodflows extending from the headwaters of Fountain Creek in Colorado to below Great Bend in Kansas. John Martin Reservoir successfully contained the total floodwater volume received from upstream drainages, storing 336,000 acre-feet of water by 30 June. Below John Martin Dam, a flood of unprecedented magnitude resulted--generated entirely in the drainage area between the dam and the Colorado-Kansas State line. The flood of June 1965 was the greatest on record for the Arkansas River, and property damages inflicted between John Martin Dam and Great Bend eventually reached an estimated total of $40 million.

(1) Colorado: On 17 June, Lamar experienced flooding south of its railroad tracks, and Granada was flooded to depths of about 6 feet. At Holly, floodwaters destroyed the levees extending along U.S. Highway 50 to the river, resulting in water depths to 8 feet within the town and evacuation of the entire 1,100 population. The rains covering Colorado at this time were so intense that the Arkansas River was discharging 200,000 c.f.s. at the Colorado-Kansas border in spite of the storage retained in John Martin Reservoir.

(2) Kansas: As the flood moved into Kansas, it covered the entire Arkansas valley flood plain, extending over 2 miles wide in places. Floodwaters entered Syracuse at about 5:00 p.m. on 17 June, attaining a peak flow of about 200,000 c.f.s.; an area south of the railroad tracks and the water supply system were severely damaged. Lakin minimized damage through a successful flood fight. Flooding at Garden City began on the evening of 18 June and considerable damage resulted in an area south of the railroad tracks. At Dodge City on 19 June, floodflows reached a maximum stage of 15.7 feet and 82,000 c.f.s. Here, the railroad embankment saved the main business district to the north, but floodwaters attained depths of 9 feet south of the embankment and about 1,500 people were evacuated from the area. In Dodge City and nearby Wilroads Gardens, total urban losses were estimated at $3,783,000, including damages to 615 residences and 155 businesses in Dodge City. At Kinsley, the peak discharge was 49,800 c.f.s. at about midday on 21 June; approximately 800 people were evacuated. By the time the flood reached Larned and Great Bend, reduced peaks and volume allowed it to be controlled and serious urban losses were avoided. Low-lying farmlands were moderately damaged.

11. FLOOD PROBLEMS.- Costly floods may be expected to recur in the Arkansas River subbasin between John Martin Dam and Great Bend, Kansas, regardless of existing and authorized flood control projects. Most losses involve flooded agricultural land in the valley, but properties along tributaries and in low-lying urban areas also suffer. Flood damages are caused when the runoff from steep tributary streams converges into the broad valleys with flatter slopes and lower energy gradients. These low-velocity floodflows not only increase the duration of flooding, but permit sediment and debris to be deposited on the valley's most productive lands. Floods are governed by the nature of storm patterns and tributary runoff. For example, when rainfall is concentrated over one tributary watershed, flood damages are generally limited to the single tributary

stream effected. In the case of larger and more general storms, however, these produce flood discharges on many tributaries which combine on the river's main stem to cause widespread damage.

a. Arkansas River Valley.- The Arkansas River valley is subject to flooding from two major contributing areas, one of which lies between John Martin Dam and the Colorado-Kansas State line, and the other between Dodge City and Great Bend. From the State line to the mouth of the Pawnee River near Larned, flood peaks are generally reduced by valley storage. Plate A-2 missing or see Table 2 shows the attenuation of peak flows for various historic floods progressing down the Arkansas valley.

b. Lamar, Colorado.- Lamar is partially protected from floods on Willow Creek by a levee and channel constructed by local interests to divert flow around the city's eastern edge. In early settlement times, the creek's natural outfall to the Arkansas River passed directly through the area now occupied by Lamar as a modern-day city. Large floods such as experienced in June 1965 overtop the levee-channel system and return to the old natural watercourse directly through Lamar. The business district and a large part of the city's residential area south of the AT&SF railroad are vulnerable to flooding from Willow Creek. North of the AT&SF, the area is subjected to Arkansas River overflows. Tributaries that directly influence peak flows on the Arkansas at Lamar include Caddoa, Mud, and Dry Creeks.

c. Granada, Colorado.- Wolf Creek emerges from a sand hill area about 1 mile west of Granada and turns southeast (from a northerly course) to approach the city along the AT&SF railroad. At Granada's outskirts, the creek again turns abruptly to the northeast and flows under the railroad bridge. A levee and channel constructed by local interests helps to direct small flows beneath the railroad bridge, but the system is ineffective against large magnitude floods. Past floods that have breached the levee and entered the community occurred in July 1935, June 1949, May 1951, May 1958, and June 1965. A flood in May 1955 damaged the levees and agricultural land. The 1965 flood forced the entire community to evacuate to the higher land south of Granada.

TABLE 2

ARKANSAS RIVER PEAK DISCHARGES*
(cubic feet per second)

Location	Mile Above Mouth	June 1965 Flood	Standard Project Flood	Intermediate Regional Flood	10-Year Flood
Lamar, Colorado	1,137.3	74,000	89,000	40,000	10,800
Syracuse, Kansas	1,080.9	174,000	158,000	68,000	20,700
Kendall, Kansas	1,068.0	170,000	153,000	67,000	20,000
Lakin, Kansas	1,048.1	160,000	152,000	61,000	18,000
Garden City, Kansas	1,024.2	130,000	114,000	53,000	14,500
Dodge City, Kansas	970.2	82,000	80,000	40,000	8,900
Larned, Kansas	897.4				
Above Pawnee River		40,000	43,000	37,800	6,100
Below Pawnee River		40,000	71,200	39,200	8,500
Great Bend, Kansas	873.2	27,800	76,000	42,000	13,000

TABLE 3

ARKANSAS RIVER TRIBUTARY PEAK DISCHARGES*
(cubic feet per second)

Stream & Location	Standard Project Flood	Intermediate Regional Flood
Willow Creek at Lamar, Colorado	20,500	14,600
Pawnee River at Larned, Kansas	54,100	15,200
Walnut Creek at Diversion above Great Bend, Kansas	37,500	20,300
Little Walnut Creek at Diversion above Great Bend, Kansas	22,800	13,000

*Discharges differ from previously published data at some locations due to change in the statistical frequency analysis.

Raw File Format

Data Records

Each record is a series of comma delimted fields representing one months data for one type of data (INFO records are an exception).

Here's a description of the data types:

Type	Description	Units
INFO	Station information (see below)	
DYSW *	Daily occurence of weather. 00 - No occurence 01 - Smoke or haze 02 - Fog 04 - Drizzle 05 - Ice pellets (sleet) 06 - Glaze 07 - Thunder 08 - Hail 09 - Dust ot sand storm 10 - Blowing snow 11 - High wind 12 - Tornado 13 - Rain 14 - Snow If more than one DYSW occurs, they will be packed 01122. Additional DYSW records will be used if more than 2 DYSW's occur.	
EVAP *	Pan evaporation	0.01 inches
MNPN *	Minimum evaporation pan temperature	Degrees F.
MXPN *	Maximum evaporation pan temperature	Degrees F.
PRCP	Precipitation	0.01 inches
TMAX	Maximum temperature	Degrees F.
TMIN	Minimum temperature	Degrees F.
TOBS *	Observation time temperature	Degrees F.
SNOW	Snowfall	0.1 inches
SNDP	Snow depth on the ground	inches
WDMV *	Wind movement	Miles
WTEQ *	Water equivalent of snow on the ground	0.01 inches
SOxy *	Soil temperature at observation time	Degrees F.
SNxy *	Minimum soil temperature	Degrees F.
SXxy *	Maximum soil temperature	Degrees F.

Not all stations report all of these parameters. Those marked with a * are present in the Colorado Climate Center database for 1993 - present.

All data records have this format:

Field	Description
0	Station number
1	Year
2	Month
3	Type (see type list below)
4-ndays	Values; each value consists of an integer and/or one or more alphabetic flags (see flag list below).

Codes

m - missing

t - trace
a - accumulated period
h - hail (Ft Collins only).

INFO Records

INFO records contain:

Field	Description
0	Station number
1	Beginning Year
2	End Year
3	Type (INFO)
4	Latitude (ddmm, dd=degrees, mm=minutes)
5	Longitude (dddmm)
6	Elevation (feet)
7	Station name

List File Format

Header Record

Field	Description
0	Station number
1	Latitude (ddmm, dd=degrees, mm=minutes)
2	Longitude (dddmm)
3	Elevation (feet)
4	Station name

Data Records

Field	Description
0	Year
1	Month
2	Day
3	TMAX (see above)
4	TMIN (see above)
5	PRCP (see above)
6	SNOW (see above)
7	SNDP (see above)

Data Codes

1 and 2 - maximum and mininum temperatures

9999 = missing data

3 - daily total precipitation in 0.01 inches.

9999 = missing data
9998 = trace
9997 = accumulated period

4 - daily snowfall in 0.1 inches.

9999 = missing data

```
            9998 = trace
            9997 = accumulated period

     5    - snow depth on ground in inches.

            9999 = missing data
            9998 = trace
```

Each year present in the stations's history will be listed completely, i.e. missing days will be listed but coded as missing. Missing years will not be listed.

Punch Card File Format

Header Card - (6X,2I6,3A10,4I6) -- One for each year's data.

Columns	1 - 6	: blank.
	7 - 12	: year.
	13 - 18	: station number.
	19 - 48	: 30 character station name.
	49 - 54	: station latitude in degrees and minutes. (packed DDMM)
	55 - 60	: station longitude in degrees and minutes. (packed DDDMM)
	61 - 66	: station elevation in feet.
	67 - 72	: division.

Data Cards - (I6,4I2,11I6)

Columns	1 - 6	: station number.
	7 - 8	: last two digits of year.
	9 - 10	: month (1 = January).
	11 - 12	: day of 1st datum on card.
	13 - 14	: key indicating type of data, where: 1 = maximum temperature in degrees Fahrenheit. 2 = minimum temperature in degrees Fahrenheit. 3 = precipitation in 0.01 inches. 4 = snowfall in 0.1 inches. 5 = snow depth on ground in inches.
	15 - 80	: data in 6 column fields (11 per card).

Note: The data is written in blocks of one year. Missing data is coded as missing; i.e. the blocks are complete. If more than one data type is done, all data is listed for one month before the next month is listed.

Data codes are the same as for the 'List Format' above.

If you have any questions please email johnk@ulysses.atmos.colostate.edu.

Colorado Climate Center
(http://ulysses.atmos.colostate.edu/dly_form.html)

54770 3804 10237 3640 LAMAR

1995	5	20	77	51	0	0	0
1995	5	21	63	50	2	0	0
1995	5	22	78	54	4	0	0
1995	5	23	76	43	2	0	0
1995	5	24	48	42	6	0	0
1995	5	25	51	41	35	0	0
1995	5	26	60	46	9998	0	0
1995	5	27	72	49	126	0	0
1995	5	28	66	43	9998	0	0
1995	5	29	65	50	3	0	0
1995	5	30	58	50	50	0	0
1995	5	31	66	51	12	0	0
1995	6	1	72	46	6	0	0
1995	6	2	81	46	1	0	0
1995	6	3	82	56	30	0	0
1995	6	4	82	52	44	0	0
1995	6	5	73	52	44	0	0
1995	6	6	82	58	0	0	0
1997	7	27	100	64	0	9999	9999
1997	7	28	97	64	5	9999	9999
1997	7	29	86	64	105	9999	9999
1997	7	30	82	67	9	9999	9999
1997	7	31	90	68	0	9999	9999
1997	8	1	93	65	0	9999	9999
1997	8	2	94	68	78	9999	9999
1997	8	3	91	65	90	9999	9999
1997	8	4	88	66	0	9999	9999
1997	8	5	88	64	82	9999	9999
1997	8	6	72	59	212	9999	9999
1997	8	7	66	55	10	9999	9999
1997	8	8	76	56	0	9999	9999
1997	8	9	89	60	0	9999	9999
1997	8	10	82	60	1	9999	9999
1997	8	11	67	59	34	9999	9999
1997	8	12	74	58	74	9999	9999
1997	8	13	82	62	84	9999	9999
1997	8	14	87	58	52	9999	9999
1997	8	15	90	58	0	9999	9999
1997	8	16	92	58	0	9999	9999
1997	9	19	98	53	0	9999	9999
1997	9	20	79	45	10	9999	9999
1997	9	21	50	43	157	9999	9999
1997	9	22	61	45	25	9999	9999
1997	9	23	76	52	3	9999	9999
1997	9	24	63	48	0	9999	9999

54076 3803 10207 3390 HOLLY

1997	7	26	100	62	0	9999	9999
1997	7	27	100	66	0	9999	9999
1997	7	28	101	66	1	9999	9999

1997	7	29	87	64	58	9999	9999
1997	7	30	85	65	7	9999	9999
1997	7	31	87	66	0	9999	9999
1997	8	1	94	67	0	9999	9999
1997	8	2	95	66	0	9999	9999
1997	8	3	94	66	18	9999	9999
1997	8	4	91	65	11	9999	9999
1997	8	5	96	65	0	9999	9999
1997	8	6	79	60	316	9999	9999
1997	8	7	66	53	29	9999	9999
1997	8	8	70	56	0	9999	9999
1997	8	9	64	53	0	9999	9999
1997	8	10	77	54	0	9999	9999
1997	8	11	88	53	185	9999	9999
1997	8	12	73	60	56	9999	9999
1997	8	13	87	60	0	9999	9999
1997	8	14	86	58	106	9999	9999
1997	8	15	92	58	0	9999	9999
1997	8	16	95	58	0	9999	9999

54388	3804	10256	3810	JOHN MARTIN DAM

4. Local Data

FAX COVER PAGE

TO: Bill Owen
Fax: 970-484-7593

April 2, 1998

FROM: Jim Sidebottom
Prowers County
719-336-9001
Fax 719-336-2255

SUBJECT: 1997 County Road Flood Damage Estimates

Bill,

Following are copies of the cost estimates that were provided to FEMA for partial reimbursement. I hope this is of assistance. If you need additional data, please feel free to call.

28 12

Prowers County	Flood Damage		1997	July 12-Aug 28	west District
	Hours	Cost @ Hr		Total Cost	
Loader 966	89	$60.00		5340	
Excavator 1085 C	36	$47.99		1727.64	
Excavator 307 Cat	13	$36.00		468	
Road Grader 140 G	156	$41.08		6408.48	
Trk & B. dump Trailers	165	$48.90		8068.5	
End Dump TRUCKS	14	$22.68		317.52	
Gravel	7900 ton	$1.32		10428	
Fill Dirt	158 ton	$1.00		158	
Operator Hours	620	$18.00		11160	
Management Hours	38	$24.00		912	
Total				44,105.70	
Grand Total					

Damaged Roads West District		Tons of		Project
Road Number		Material	Cost	Number
LL (7to28) 6 Miles	6 MILES	1700	9491.1	1
PP (287to5)	4 MILES	2000	11166	2
Rd. 3 (h 50-pp)	5 MILES	2000	11166	3
Rd 7 (pp-ss)	2Miles	800	4466.4	4
Rd.11.5 (196-mm)	2 MILES	400	2233.2	5
MM(287-rd.6)	3 MILES	700	3908.1	6
Rd.10 (196-LL)	1 MILE	300	1674.9	7
Total	23 Miles	7900	44,105.70	
	COMMENTS			

This is a cost estimate for repairs on flood damage,Occuring between July 12 and August 28 . Some of these roads were damaged in earlier storms and repaired and damaged again in the later storms .

The Equipment rental rates are not the rates set by Prowers County, but by the Sta Highway Department.

If you have any questions feel free to contact Donald Koehn , Prowers Cou Road and Bridge Department At (719) 336-5536

Prowers County Flood Damage		1997	28 12-Jul	12 28-Aug
	Hours	Cost @ HR		Total cost
Loader 966	212	$60.00		12720
Excavator 1085c		$47.99		
Excavator 307 Cat		$36.00		
Road Grader 140 G	242	$41.08		9941.3
Trk & B. Dump Trailer's	635	$48.90		31051.5
End Dump Truck's		$22.68		
Gravel 12160		$1.32 Ton		16051.2
Fill Dirt		$1.00 Ton		
Operator Hours	1070	$18.00		19260
Management Hours	67	$24.00		1608
Total				90,632.00
	Damaged Roads East District			
Road Number				
G, 38, B, D, #31				
LL,JJ,KK,#35 #37				
SS,VV,#30,#21,#22,#23,#29				
#25,#27,#21,#23.RD.P				
			COMMENTS	
This is a cost estimate for repairs on flood damage, Occuring between July 12 and August 28 . Some of these roads were damaged in eairlier storms and repaired and damaged again in later storms.				
The Equipment rental rates are not the rates set by Prowers County But by the State Highway Department.				
If you have any questions feel free to contact Tony Garcia, Prowers County Road & Bridge Department At (719)537-6631				

1. Contacts

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:	8/6/98
Call Placed/Received by:	Markus Ritsch
Spoke With:	Tom Browning
Company/Affiliation:	CWCB
Phone no.:	303-866-3441
Project No.:	D479

Comments:

Tom and I discussed the damage estimates for Weld County for the period June through July of 1997 for residential and commercial properties. I had one estimate of damage which was on the order of $10,000 (Sarchet 1998a) to a single family residence. This was the only damage estimate in the Damage Cost Table. Tom thought that this number ($10,000) was not representative of the entire county. I concurred. We estimated that between ten and fifty private residences were damaged during this period which translates to a total damage estimate for residential properties to be on the order of several hundred thousand of dollars.

The same argument was made for commercial properties. The single damage estimate I had was for the Kilgore Supply store ($10,000 Greeley Tribune 1997c).

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: June 4, 1998
Call Placed/Received by: Markus Ritsch
Spoke With: Fred Sarchet
Company/Affiliation: Privat Citizen
Phone no.:
Project No.:

Comments:

Damage Estimate to private residences as a result of flooding on July 28, 1997.

Structure	Damage ($)
Fred's House & Barn Fred's Truck	3,000
Bill Sarchett' Residence	1,000 - 3,000
Church @ Corner	2,000 - 3,000
	6,000 - 9,000

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/5/98
Call Placed/Received by:
Spoke With: manual Montoya
Company/Affiliation: Farmers Irrigation Company
Phone no.: 303-659-7373
Project No.:

Comments:

No measuring device on the Seep Ditch.

Does have lake elevations at Milton Reservoir. He is going to check the Lake level data to see what type of flow occured in the seep Ditch.

Normal flow 50-80 cfs

Restricted by culvert on Rd 32.

Signature Markus Pantoja

United States Department of Agriculture
Farm Service Agency
Weld County FSA Office
4302 West 9th Street Road
Greeley, Colorado 80634-1398
Telephone 970-356 8097

May 1, 1998

Mark Rich
Riverside Technology
2290 East Prospect Road
Suite 1
Fort Collins, CO 80525

Dear Mr. Rich:

The enclosed news articles are all I have for 1997 status. I hope they will be of some value to you, along with the estimated figures I gave you by phone.

If I can be of further help, please feel free to contact this office.

Sincerely

Arnold V. Germann
County Executive Director

AVG/mjf

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 6/4/98

Call Placed/Received by:

Spoke With: Orval Thomason

Company/Affiliation: weather Observer

Phone no.: 303-536-4663

Project No.:

Comments:

8 inches on July 18

4 inches a week later

18" of water in basement.

Signature Markus Pritsch

1" – 43,560 ft²

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

North of Rd 20 1/8 mi
west of Rd 41

Date:
Call Placed/Received by: Markus Pitsch
Spoke With: Fred Sarchet
Company/Affiliation: Weather Observer in Hudson
Phone no.: (~~970~~) 536-4671
303
Project No.:

Comments:

What creek/creeks flooded? none specific 7.55 inches on July 28th
Can we determine High water marks?
Flooding due to general water or did a creek run out-of-bank?
photos? Fred's Brother took pictures (Bill Sarchet 303-536-4830)
Any other people in the area measure PX?

~~Start a~~

water Drains from about 2mi to the West, County Road 41 Crosses the drainage + caused the flow to back-up. Also flooded at the Church, (Intersection Cnty Rd 22 & 41 S.E. Corner), Brother (1/2 mi South of Fred).

Signature Markus Pitsch

$43,560\ ft^2 \cdot 1'' \frac{1ft}{12''} = 3,630\ ft^3 \cdot 7.48$

$27,000\ gal$

3,259[illegible]

$325,900\ \frac{gal}{Ac\text{-}ft}$

Riverside Technology, inc.

[illegible]
([illegible])[illegible]

TELEPHONE CALL SUMMARY SHEET

Date: June 2, ~~May 26,~~ [illegible]

Call Placed/Received by: Markus Ritsch / Bill Ellett

Spoke With: Rick Gable – [illegible]

Company/Affiliation: CDOT Sterling

Phone no.: 970-522-0481

Project No.:

I got these from Denny vols

Comments: Damage Estimates for Weld County

	Eng	Contract	maint
2 Bridges on Highway 71	~ [illegible]	[illegible]	$ 0
Coal Crk → 1 Bridge on Highway 14	~ [illegible]	~4 [illegible]	$57,524
~~Box Culvert N. of Stoneham~~			$ 0
~~Bridge on Cottonwood Crk.~~			$ 0

6/2/98

Hwy 71 [illegible]

Temporary Repairs: Cont. [illegible]

Permanent Repairs: Cont. ~~[illegible]~~ $45,000 [illegible]

[illegible]

1) [illegible] over Cottonwood Ck, replaced [illegible] (Same [illegible]

2) Bridge over S. [illegible] Ck

Going to replace bridge on Hwy 14. Maintenance [illegible] has contracted to a consultant to build a new bridge. Projected [illegible] about 8.5 million. Projected in-house engineering [illegible]

Signature ______________________

Box culvert N. of Stoneham & bridge over Cottonwood Creek are the same structure. This is one of the [illegible] bridges [illegible] that were repaired. The other bridge was over S. [illegible]

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:

Call Placed/Received by: Markus Ritsch

Spoke With: Ann Cloepfil / Fred Rossman

Company/Affiliation: CDOT/Weld Co Denny Vols

Phone no.: 970-353-1232

Project No.: ~~356-2812~~ ~~[illegible]~~ 350-2182

Comments:

Damage Estimates for 1997:

Highway 71 E-Pawnee (2 Bridges)

Highway 14 Bridge – Coal Creek mile Post 167.34

Box Culvert North of Stoneham

Bridge north of Stoneham (Cottonwood Creek)

Engineering 970-522-0481
Sterling: ~~522-6904~~
Talk to Rick Gable about projects in Weld County or Leroy Miller
Allen Pierce 522-~~6905~~ 9620

Eng + Proj Cont + maint = Total

Coal Creek - Hwy 14 → $57,524 - maint labor,

Only Maint Cost associated with Flooding in 1997 for Weld CO.

must add engineering, Project Contract work from Rick Gable

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/20/98
Call Placed/Received by: Markus Ritsch
Spoke With: Ed Clor
Company/Affiliation: weather observer in Nunn
Phone no.: 897-2314
Project No.:

Comments:

Precip Data -

7am on	June 2	Trace
7am on	June 3	1/2"
7am on	June 13	0.20"
7am on	June 17	1.25"

went on vacation →

No photographs taken, knows of no other Contacts that record precipitation.

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/15/98
Call Placed/Received by: Markus Ritsch
Spoke With: Ed Herring
Company/Affiliation: Weld County Finance
Phone no.: (970) 356-4000
Project No.: D479

Comments:

County Damage Estimates:

Weld County sustained no damage during the Presidential Disaster Declaration Period. The County sustained major damage in June then again after Aug 8, 1997. The County tracks damage to County Roads and Bridges. No damage estimates are available for State highways or residential properties.

Month	County Structures Damaged	$
June 97	Roads/Bridges	$405,199
Aug 97	Roads/Bridges	$1,103,139

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:
Call Placed/Received by: Tellez
Spoke With: Jerry ~~[illegible]~~
Company/Affiliation: City of Greeley
Phone no.: 350-9798
Project No.:

Comments:

June 13 - evening in west Greeley. Sheep Draw

Discharge Estimates - no
Photographs of High water - yes
Damage Estimates - Damage to Bridges covered by the County. Possibly the F Street Bridge talk to Bridge.
A little field work,

Floodplain maps

Flood Inundation Boundary maps - NO

11th Ave, 10th Street.
Windsor South Highway 34 busines Exit going East, takes into 10th St, to 11th ave.

City Hall
2nd Public work,

Signature [illegible]

---

out till the 27th

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/11/98
Call Placed/Received by: MLR
Spoke With: Steve Bagley
Company/Affiliation: Greeley
Phone no.: 350-9792
Project No.: XD

Comments:

Monitor Greeley #3
28th, Grapevine, Sheep Draw,

what creeks typically see nuisance flooding on an annual basis?
Sheep Draw sees frequent flooding however they didn't pay much attention until recently because of the development in the watershed
Damage estimates? None, however they may have surveyed some high water marks.

Discharge estimates?

photos? yes - see Bert.

Signature Marlene Porter

4, Creeks other? Greeley Ditch #3 has some flooding problems

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date:
Call Placed/Received by: Markus Ritsch
Spoke With: Harold Weisbrook
Company/Affiliation:
Phone no.: 970-437-5434
Project No.:

Comments:

May 25, 1997 STorm Event:
Started on the 24th mid afternoon ended on the 25th.

Son Lives in Nebraska 1/2 mile into Neb.
2 miles North of 134.
Son measured 7 inches most in a 3hour period to 4hour period. 3pm - 7pm
off Road 125,
Son lives 5 1/2 miles straight North. of Harold

Signature Markus Ritsch

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 5/1/98
Call Placed/Received by: Markus Ritsch
Spoke With: Mary Ashby
Company/Affiliation: Central Plains EXP. Range
Phone no.: 970-897-2226
Project No.: D479

Comments:

8am - 8am

June 2 - 1.22 in

June 12 - .04 in

wind, air temp also recorded,

July 27 - 1.14

28 - .38

29 - 1.45

30 - .04

Signature Markus Ritsch

1/

Riverside Technology, inc.

TELEPHONE CALL SUMMARY SHEET

Date: 4/30/98
Call Placed/Received by: Markus Ritsch
Spoke With: Arnold Germann
Company/Affiliation: Farm Service Agency - Weld County also NRCS
Phone no.: (970) 356-8097
Project No.:

Comments:

June 2, 1997

	Crop	Affected Acres	% Damage
	alfalfa	3000	4%
	beans	1000	3
Sug	beets	250	1%
	Barley	300	3
	Onions	2000	11

June 13, 1997

	Wheat	~~15~~ 1000	15
	Corn	10,000	20
Sug	beats	2500	20
	Onions	1500	20
	barley	1500	20
	pinto beans	1200	20

June 14 - nothing

Signature Markus Ritsch

over →

July 28, 29, 30 – no damage losses reported.

	acres	%
wheat	0	
corn	0	
beets	0	
onions	0	

NE

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
TELEPHONE CONVERSATION RECORD

BY: Markus Ritsch
DATE: 4/27/98
SUBJECT: 1997 Flooding

INDIVIDUAL: Drew Scheltinga
AFFILIATION: Weld County
PHONE #: (970) 356-4000

---

1. Affected streams and local watersheds during the 1997 flood season?
   Pawnee Crk, Sand Crk, Horse Crk, Crow Crk, Coal Crk, Fort Lupton Aristocrat Subdivision, ranchettes Greeley, Sheep Draw (Drew expects sheep draw to be annexed by Greeley in the next 20 yrs)
2. Geographic extent of flooding? Are flood inundation maps available?
   no flood inundation maps-
   Do have a map showing dots w/road washouts,
3. Storm duration? Starting time and ending time of major storm events? I realize that Weld County had significant events on June 2 and June 13 of 1997. What were the events that justified the Presidential declaration of disaster for the period July 28 through August 12?
   - no info
4. Rainfall amounts for the events? Have you generated any isohyetal maps?
   - no info
5. Rainfall bucket surveys?
   - no info
6. Precipitation gauging data?
   - no county gauges
7. Documentation of high water marks? Do you have any photos that show a person holding a survey rod next to a permanent structure documenting how high the water was?
   - video tape, of a helicopter trip, 2 days after the Aug Storm

8. Estimated peak discharges?

– no

9. Estimated flood damages? How many homes, businesses, schools, churches were destroyed/damaged? How much farm land was destroyed/damaged? How many county roads, bridges, culverts, etc. were destroyed/damaged?

Pawnee – 1 barn lost, Aug event. mostly a bridge repair

$95,073 – re-imbursed by FHWA – Aug Storm only

$267,516 – FEMA monies – County roads

10. Costs associated with the clean-up effort? Differentiate between county, state, and federal.

Weld County spent not reimbursed

$648,127 – not much Bridge work

(for entire year. mostly roads,

11. Costs associated with emergency operations/flood fight efforts? Differentiate between county, state, and federal.

– no

12. Types and amounts of repair work after flooding?

13. Any previous/recent flood mitigation efforts that reduced damages?

– no dams, Levees, Retention Ponds

– not rip-rapins is included

14. Any future mitigation needs as a result of the flooding?

– NO

15. Special or unique circumstances affecting flooding (man-made features, project failures, design limitations, failure of ditches or embankments)?

— None

16. Do you have any photos and/or video available? Are the photos in digital format?

— 1 video
— Some FEMA photos

17. Have you developed any maps related to the flooding? isohyetal, watershed, inundation boundaries, damage areas, etc.

— 1 damage location maps.

18. Are maps in hardcopy or digital format? (GIS, Autocad, etc.)

—

19. What existing documentation do you have regarding the flooding?

— No,

20. Does the County have an internet site? Do you know of any related local sites?

— No

Steve Basley - 970-350-9792
Greeley

2. Federal Data

United States Department of Agriculture
Agricultural Research Service
Northern Plains Area
CPER
58009 WCR 37
Nunn, CO 80648

MESSAGE TRANSMITTAL

DATE: May 1 1998

TO: Marcus
SUBJECT: Data
PHONE: (970) 484-7573
FAX: 484-7593

FROM: CPER
PHONE: (970) 897-2226
FAX: (970) 897-2463

NO. OF PAGES INCLUDING THIS COVER SHEET 4

MESSAGE: Call if you have any more questions

If you do not receive the number of pages indicated above, or if the transmittal is not readable, please call the above number.

CPER - 1997

PRECIPITATION

HEADQUARTERS

Reading in inches for 24 hour period ending at 8:AM of entry

DATE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1												
2				.08		.10			T			
3				.01		1.22						.05
4			.13			.01		2.14				
5		.02	.10	.55				.05	.36			
6	.02	.06						1.01				
7								.02				
8							.03		T	.14		
9						.69						.07
10	.16			.24		.10					.19	T
11	.22			.05		.14		.79				
12		.12						.10			.07	
13	.28	.02				.04		1.51				
14			.02					T				
15			.25		.01				.04			
16	.04			.03		.39						
17						.03						
18						.23		.46				
19		.12				.34		.03	.14			
20								.01				
21				.06			.21			.02		
22				.05	.08		.15	.10	.98			
23					1.36				.08			
24	.01	.06		.15		.33	.08		.06	.40		
25				.23		.06	.11					
26		.04				T						
27	.04	.03			.16					.56		
28	.03				.09		1.14					
29				.06	.11		.38	.03				
30				.06	.42		1.45					
31							.04					
MONTHLY TOTAL	.80	.47	.50	1.57	2.23	3.68	3.59	6.25	1.66	1.12	.26	.12
ACCUM. TOTAL	.80	1.27	1.77	3.34	5.57	9.25	12.84	19.09	20.75	21.87	22.13	22.25

CPER Air Temps (F)

Day	Month	Year	Max.	Min.	Ave.
1	06	97	81.0	56.0	68.5
2	06	97	69.0	50.0	59.5
3	06	97	68.0	46.0	57.0
4	06	97	70.0	45.0	57.5
5	06	97	76.0	52.0	64.0
6	06	97	70.0	52.0	61.0
7	06	97	71.0	52.0	61.5
8	06	97	68.0	52.0	60.0
9	06	97	58.0	52.0	55.0
10	06	97	65.0	48.0	56.5
11	06	97	77.0	48.0	62.5
12	06	97	72.0	49.0	60.5
13	06	97	64.0	50.0	57.0
14	06	97	71.0	47.0	59.0
15	06	97	70.0	47.0	58.5
16	06	97	68.0	41.0	54.5
17	06	97	70.0	50.0	60.0
18	06	97	80.0	50.0	65.0
19	06	97	85.0	52.0	68.5
20	06	97	83.0	52.0	67.5
21	06	97	78.0	53.0	65.5
22	06	97	85.0	51.0	68.0
23	06	97	78.0	51.0	64.5
24	06	97	74.0	49.0	61.5
25	06	97	76.0	45.0	60.5
26	06	97	78.0	45.0	61.5
27	06	97	82.0	50.0	66.0
28	06	97	86.0	50.0	68.0
29	06	97	85.0	50.0	67.5
30	06	97	84.0	48.0	66.0
1	07	97	75.0	42.0	58.5
2	07	97	73.0	42.0	57.5
3	07	97	68.0	39.0	53.5
4	07	97	74.0	39.0	56.5
5	07	97	75.0	42.0	58.5
6	07	97	83.0	42.0	62.5
7	07	97	89.0	48.0	68.5
8	07	97	82.0	50.0	66.0
9	07	97	85.0	50.0	67.5
10	07	97	86.0	48.0	67.0
11	07	97	80.0	46.0	63.0
12	07	97	85.0	46.0	65.5
13	07	97	80.0	47.0	63.5
14	07	97	85.0	44.0	64.5
15	07	97	93.0	50.0	71.5
16	07	97	91.0	50.0	70.5
17	07	97	92.0	48.0	70.0
18	07	97	90.0	55.0	72.5
19	07	97	76.0	54.0	65.0
20	07	97	80.0	52.0	66.0
21	07	97	84.0	52.0	68.0
22	07	97	86.0	54.0	70.0
23	07	97	90.0	54.0	72.0
24	07	97	84.0	57.0	70.5
25	07	97	85.0	54.0	69.5
26	07	97	88.0	56.0	72.0
27	07	97	78.0	57.0	67.5
28	07	97	68.0	56.0	62.0
29	07	97	74.0	49.0	61.5
30	07	97	75.0	58.0	66.5
31	07	97	77.0	56.0	66.5

ANEMOMETER CPER 1997

DATE	Reading	M/W	M/D	M/hr.
1 7 97	2158	1035	129.4	5.4
1 13 97	3333	1175	195.8	8.2
1 21 97	4515	1182	147.8	6.2
1 27 97	5561	1046	174.3	7.3
2 3 97	6511	950	135.7	5.7
2 10 97	7394	883	126.1	5.3
2 19 97	8575	1181	131.2	5.5
2 24 97	9225	650	130.0	5.4
3 03 97	9895	370	52.9	2.2
3 10 97	0675	780	111.4	4.6
3 26 97	3351	2676	167.3	7.0
3 31 97	4448	1097	219.4	9.1
4 7 97	6406	1958	279.7	11.7
4 14 97	7702	1296	185.1	7.7
4 21 97	9076	1374	196.3	8.2
4 28 97	0525	1449	207.0	8.6
5 7 97	2444	1919	213.2	8.9
5 12 97	3359	915	183.0	7.6
5 27 97	6018	2659	177.3	7.4
6 2 97	6767	749	124.8	5.2
6 9 97	7854	1087	155.3	6.5
6 16 97	8909	1055	150.7	6.3
6 23 97	9745	836	119.4	5.0
6 30 97	0525	780	111.4	4.6
7 7 97	1646	1121	160.1	6.7
7 14 97	2678	1032	147.4	6.1
7 21 97	3488	810	115.7	4.8
7 30 97	4647	1159	128.8	5.4
8 4 97	5108	461	92.2	3.8
8 11 97	6046	938	134.0	5.6
8 18 97	7004	958	136.9	5.7
8 27 97	7802	798	88.7	3.7
9 2 97	8482	680	113.3	4.7
9 8 97	9109	627	104.5	4.4
9 15 97	9847	738	105.4	4.4
9 22 97	0849	1002	143.1	6.0
9 29 97	1696	847	121.0	5.0
10 6 97	2625	929	132.7	5.5
10 13 97	4005	1380	197.1	8.2
10 22 97	5078	1073	119.2	5.0
10 27 97	6250	1172	234.4	9.8
11 3 97	7939	1689	241.3	10.1
11 10 97	9097	1158	165.4	6.9
11 19 97	0517	1420	157.8	6.6
11 24 97	1101	584	116.8	4.9
12 1 97	2060	959	137.0	5.7
12 8 97	2815	755	107.9	4.5
12 15 97	4473	1658	236.9	9.9
12 22 97	5365	892	127.4	5.3
12 29 97	7202	1837	262.4	10.9

To: Marcus

From: CPER

FAX: 484-7573

Day	Mo	Yr	Max	Mean	Min
1	05	97	58.0	32.0	45.0
2	05	97	51.0	31.0	41.0
3	05	97	64.0	28.0	46.0
4	05	97	76.0	30.0	53.0
5	05	97	67.0	36.0	51.5
6	05	97	74.0	37.0	55.5
7	05	97	72.0	38.0	55.0
8	05	97	56.0	22.0	39.0
9	05	97	66.0	22.0	44.0
10	05	97	77.0	32.0	54.5
11	05	97	52.0	27.0	39.5
12	05	97	69.0	26.0	47.5
13	05	97	72.0	32.0	52.0
14	05	97	63.0	36.0	49.5
15	05	97	71.0	35.0	53.0
16	05	97	80.0	40.0	60.0
17	05	97	81.0	40.0	60.5
18	05	97	76.0	40.0	58.0
19	05	97	61.0	38.0	49.5
20	05	97	76.0	32.0	54.0
21	05	97	73.0	46.0	59.5
22	05	97	56.0	48.0	52.0
23	05	97	66.0	45.0	55.5
24	05	97	70.0	46.0	58.0
25	05	97	60.0	43.0	51.5
26	05	97	53.0	44.0	48.5
27	05	97	62.0	42.0	52.0
28	05	97	60.0	42.0	51.0
29	05	97	60.0	47.0	53.5
30	05	97	66.0	46.0	56.0
31	05	97	79.0	48.0	63.5

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COC123-020145-

SMALL STREAM FLOOD ADVISORY STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
745 PM MDT FRI AUG 1 1997

...SMALL STREAM FLOOD ADVISORY CANCELLED FOR CENTRAL WELD COUNTY...

THE SMALL STREAM FLOOD ADVISORY FOR CENTRAL WELD COUNTY HAS BEEN CANCELLED. THE RAIN HAD MOVED EAST OF THE AREA.

RADAR ESTIMATES INDICATED 3 INCHES OF RAIN FELL SOUTHEAST OF PURCELL...WITH 1 TO 2 INCHES OVER THE REST OF THE AREA.

LOCALIZED FLOODING CAN STILL BE EXPECTED ALONG COAL CREEK...SAND CREEK AND LITTLE SAND CREEK...AS WELL AS CROW CREEK.

SOME ROADWAYS MAY BE UNDER WATER. DO NOT ATTEMPT TO DRIVE THROUGH WATER OF UNKNOWN DEPTH.

LESZCYNSKI

ZCZC DENFFSDEN DEF
TTAA00 KDEN DDHHMM
COZ043-141800-

FLOOD STATEMENT
NATIONAL WEATHER SERVICE DENVER CO
650 AM MDT FRI JUN 13 1997

...FLOOD WARNING CONTINUES ALONG THE SOUTH PLATTE RIVER IN EASTERN WELD COUNTY...

THE NATIONAL WEATHER SERVICE IN DENVER IS CONTINUING A FLOOD WARNING EFFECTIVE UNTIL 10 AM THIS MORNING FOR PEOPLE ALONG THE SOUTH PLATTE RIVER...FROM KERSEY TO THE WELD-MORGAN COUNTY LINE.

AUTOMATED RIVER GAGES INDICATE THAT THE SOUTH PLATTE RIVER NEAR KERSEY HAS CRESTED JUST ABOVE FLOOD STAGE...AND WAS NOW BEGINNING TO RECEDE. HOWEVER...THE CREST WAS MOVING DOWNSTREAM TO THE HARDIN AND MASTERS AREAS.

THE LATEST REPORT FROM THE SHERIFFS OFFICE INDICATED THAT MINOR PASTURE FLOODING WAS NOW OCCURRING ALONG THIS STRETCH OF RIVER. PEOPLE THAT LIVE OR HAVE PROPERTY ALONG THE SOUTH PLATTE RIVER IN EASTERN WELD AND WESTERN MORGAN COUNTY SHOULD STILL BE ON THE LOOKOUT FOR HIGH WATER. NEVER DRIVE THROUGH A FLOODED ROADWAY.

BARJENBRUCH

14/0654

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ZCZC DENNOWDEN
M-EM-^@TTAA00 KDEN 140000

SHORT TERM FORECAST
NATIONAL WEATHER SERVICE DENVER CO
601 PM MDT FRI JUN 13 1997

COZ043-140700-
SOUTHERN WELD COUNTY-
INCLUDING...GREELEY...FORT LUPTON
601 PM MDT FRI JUN 13 1997

.NOW...
...TORNADO WATCH IN EFFECT UNTIL 8 PM AND...
...HEAVY RAIN CONTINUES IN PORTIONS OF WELD COUNTY...

THUNDERSTORMS SITTING NEARLY STATIONARY OVER CENTRAL AND SOUTH-CENTRAL
WELD COUNTY WILL CONTINUE TO PRODUCE MODERATE TO HEAVY RAINFALL...
RESULTING IN FLOODING OF PASTURE LANDS...DRAINAGE DITCHES AND LOW
AREAS ALONG THE SOUTH PLATTE AND CACHE LA POUDRE RIVERS AROUND
GREELEY...PLATTEVILLE...KERSEY AND BARNESVILLE.  STORMS COULD PRODUCE
HAIL UP TO AN INCH IN DIAMETER AND RAINFALL RATES UP TO 2 INCHES PER
HOUR.  IN ADDITION...ISOLATED FUNNEL CLOUDS AND SMALL TORNADOES ARE
ALSO POSSIBLE.  TEMPERATURES THROUGH 8 PM WILL REMAIN IN THE MID AND
UPPER 50S.

$$
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ZCZC DENFFWDEN DEF
TTAA00 KDEN DDHHMM
COC123-141600-

BULLETIN - EAS ACTIVATION REQUESTED
FLOOD WARNING
NATIONAL WEATHER SERVICE DENVER CO
630 PM MDT FRI JUN 13 1997

THE NATIONAL WEATHER SERVICE IN DENVER HAS ISSUED A FLOOD WARNING EFFECTIVE UNTIL 1000 AM MDT FOR PEOPLE IN THE FOLLOWING COUNTIES

IN NORTHEAST COLORADO
CENTRAL WELD

INCLUDING THE FOLLOWING LOCATIONS
KERSEY...HARDIN...DEARFIELD AND MASTERS

A FLOOD WARNING HAS BEEN ISSUED ALONG THE SOUTH PLATTE RIVER FROM KERSEY EAST TO THE WELD-MORGAN COUNTY LINE.

HOMES IN KERSEY HAVE BEEN FLOODED AND HIGHWAY 34 EAST OF KERSEY HAS ALSO BEEN FLOODED.

A FLOOD WARNING MEANS THAT FLOODING IS IMMINENT OR HAS BEEN REPORTED.

ALL INTERESTED PARTIES FROM KERSEY EAST TO THE WELD-MORGAN COUNTY LINE ALONG THE SOUTH PLATTE RIVER SHOULD TAKE NECESSARY PRECAUTIONS IMMEDIATELY.

KLEYLA...WSFO DENVER

Rec'd 6:32 PM WM

FOREST TO GRASSLAND INFORMATION CENTER
Arapaho and Roosevelt National Forests
and Pawnee National Grassland
1311 S College, Fort Collins, CO 80524

RECREATION OPPORTUNITIES
Local Pawnee District Office at:
660 "O" Street, Greeley C 80631
Office Hours: 8:00 a.m.-4:30 p.m. Mon.-Fri.
Phone: 970/353-5004

Before traveling on the Pawnee National Grassland, purchasing a Pawnee map is recommended. This will help distinguish between public and private lands. The cost of the map is $4.00 each and it is available at the local Pawnee District Office as well as at the Visitor Center in Fort Collins.

CROW VALLEY RECREATION AREA -- A grove of elm and cottonwood trees provide a unique facility on the open prairie. A ball diamond, group camping area, the Steward J. Adams Education Site, group picnic area, and ten-unit family campground provide opportunities for bird watching, team sports and games, camping, picnicking or just relaxing. The fee for the family campground is $8/unit/night for the seven single- family units and $12/unit/night for the three double family units. One double unit is available for those with special needs and we ask that you leave this unit open until all other spaces are filled. Facilities include tables, fire rings, drinking water, and toilets. Parties interested in reserving the group picnic area, the three group campsites, or Steward J. Adams Education Site should contact the Greeley Office. The only developed facility on the Grassland, the Crow Valley Recreation Area, is 1/4 miles north of Colorado highway 14 on Weld County Road 77 near Briggsdale.

PAWNEE BUTTES TRAIL -- The Pawnee Buttes are 45 minutes northeast of Crow Valley and Briggsdale. An easy one and a half-mile trail provides an opportunity to view the Buttes up close. Mountain bikes are not allowed on the Pawnee Buttes Trail. The Buttes stand approximately 300 feet above the surrounding prairie. Climbing on the Buttes is not recommended because the sandstone is crumbling. For maximum sun and heat protection, take a hat, sunglasses, water and sunscreen . Temperatures topping one hundred degrees can be encountered in July and August -- outings planned for mornings and late afternoons will offer more moderate temperatures. HAWKS AND FALCONS NEST IN THE ROCKY CLIFFS. PLEASE DO NOT DISTURB THEM. The adults may desert their eggs or young birds if disturbed. The overlook and the cliffs are closed to public access March 1 - June 30 to protect the nesting birds.

OTHER OPPORTUNITIES -- Bird watching is a very popular activity. The Grassland supports many bird species, especially during migration. The area is known internationally as an area to see birds of prey, and has good breeding populations of unique high plains species such as the mountain plover, burrowing owl, McCown's and chestnut-collared longspur. A pamphlet describing a motor vehicle bird tour that leaves the Crow Valley Recreation Area and tours the west side of Grassland is available at Crow Valley and the District Office.

NOTE: The mountain plover is a possible threatened or endangered species and **must not** be disturbed when nesting. Use binoculars and telephoto lens to observe this species. Research indicates human activity closer than 200 meters may disturb birds. Disturbances from people wanting to get closer can drive an adult off the nest, and this may result in a destroyed generation due to sunlight heating the eggs.

The use of mountain bicycles on the Grassland is increasing. Mountain bikes are not allowed on the Pawnee Buttes Trail. The free brochure "Birding on the Pawnee by Automobile or Mountain Bike" is suggested for mountain bikers. Using Weld County Road 96 for the return trip to the Crow Valley Recreation Area will avoid traffic on Colorado Highway 14.

The rich Grassland history is represented by old cemeteries and nearby museums. The Briggsdale Heritage House is in an old school house and has many photo albums and other forms of written history. The hours are flexible. Please call **970/656-3612** to make arrangements for a visit . The Grover Grassland Museum is in the old railroad depot -- call **970/895-2349** for information. The public can explore the old homesteads and gain an appreciation of history. However, on National Forests and Grasslands, collecting artifacts, arrowheads, vertebrate fossils or barn wood is prohibited. All these things should be studied by a trained archaeologist to gain knowledge of past inhabitants. If you take artifacts home the knowledge is lost forever. Contact the Pawnee District Office if you find arrowheads or other important artifacts.

Please stay on the vehicle travel routes marked with numbered posts as shown on the map. Vehicle tracks across the prairie attract more users. Over time, deep ruts that remain for years can occur. If a numbered post is not present, motor vehicle travel on that route is prohibited.

TIPS FOR YOUR ENJOYMENT AND SAFETY -- A large container of water is standard equipment. Water is very important as dehydration is a real threat in the warm months of the year.

On summer outings hats with wide brims will provide added protection from sun and heat . Gloves help protect your hands when crossing fences or opening gates, and a waterproof windbreaker helps protect against the unexpected cold wind and rain. We suggest long pants or trousers and sturdy shoes for better protection from insect bites, cactus spines, sharp pointed yucca leaves, and sudden drops in temperature. Mosquitoes and gnats can become a real nuisance in spring and summer, especially when the wind dies down. Trail users need to keep a look out for prairie rattlers.

Winter on the prairie can be dangerous if a traveler becomes stranded in a snowstorm without proper equipment. Before starting a tour on the Grassland be sure to check the weather reports. Take extra clothing, blankets, tire chains, a shovel and sand, and some non-perishable food in the event you become stranded. Tell a friend or neighbor where you are going and the time you should return home.

The prairie provides a unique opportunity for solitude and open spaces. Take the time to appreciate a soaring hawk, a gentle breeze caressing a carpet of flowers and grasses, and the cloud shadows creating a mosaic on the horizontal landscape. From a safe vantage point, you may be able to observe the power of a thunderstorm and enjoy the coolness and clean smell after it passes. There is much to see on the Grassland if you take the time to look!

AN INTRODUCTION to the PAWNEE BUTTES

VITAL STATISTICS

LOCATION: NE corner of Weld County, about 13 miles south of the WY/CO border
ELEVATION: Approximately 5,500 feet
LENGTH: 530 feet (East Butte); 370 feet (West Butte)
HEIGHT: Estimated to be between 200 and 300 feet
AVERAGE WIND VELOCITY AT 3 PM: 15 MPH

GEOLOGY

Believe it or not, if you had been at the site of the Pawnee Buttes between 90 and 70 million years ago, you would have been swimming in a vast sea. After this, the earth's surface began to move, thrusting up the ground somewhat, and causing the sea to drain and deposit sediments. Between 38 and 5 million years ago, streams crossing the area laid down more sediments on top of those left by the sea. These hardened into sandstones and siltstones which are now grouped by geologists into three Formations: White River, Arikaree, and Ogallala. You can see all of these at the Buttes. Around 5 million years ago, the whole region was uplifted thousands of feet, and increased stream power prompted tremendous erosion. The tops of the Buttes represent the pre-erosion ground surface, which means that if you'd been here a few million years ago, you'd have been standing two or three hundred feet higher!

PALEONTOLOGY

It has been said that the Pawnee Buttes are one of the finest sources of vertebrate fossils in the world--over 100 species have been recovered in their White River Formation deposits. In 1870, O.C. Marsh of Yale's Peabody Museum led the first scientific expedition to the Buttes to collect fossils, and several other expeditions were launched shortly thereafter. Finds at Pawnee Buttes have included several species of horse (including three-toed and dwarf versions), rhinocerous, ancient swine and camel, a hippopotamous-like animal, turtle, large vulture, and cormorant. Please keep in mind that while you are free to examine any vertebrate fossils you find, they are protected by law and must not be removed.

ECOLOGY

Bison would have been the most common mammal seen from the Pawnee Buttes just 125 years ago. Herds in the recent past included over 60 million animals! Today antelope and domestic cattle are the most common large herbivores in the area, though you may spot deer in nearby draws. Raptors (protected by seasonal closures) and swallows nest in the surrounding cliffs. In fact, birding on the Grassland is often described as "world class." Finally, you could see prairie rattlers cooling under or sunning on top of colorful lichen-covered rocks. Over 400 species of plants are found in the vicinity of the Buttes. Look especially for the brilliant mid-June display of Prickly Pear cactus flowers, Purple locoweed, and white Prairie phlox. Few trees adorn the landscape, but conditions on windswept cliffs do allow an occasional lonely Pinyon, Juniper, or Limber pine tree to grow.

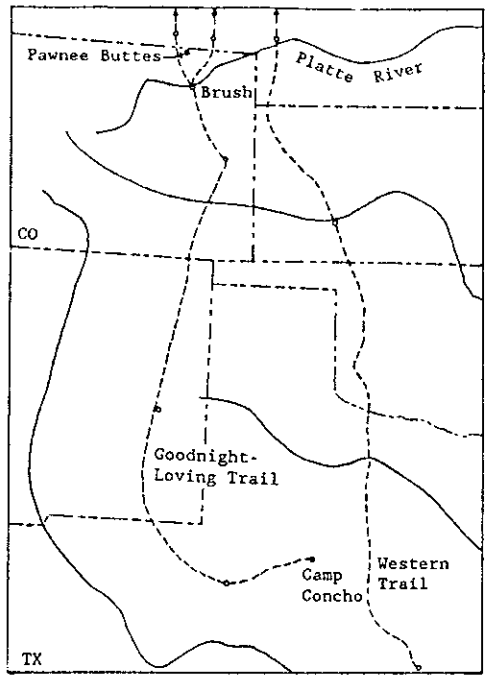
ARCHAEOLOGY

The Pawnee Buttes themselves have not been the site of many archaeological finds. There are at least two reasons for this. First, the Buttes are relatively far from good water sources, so prehistoric people would probably not have stayed long. Secondly, the Buttes are subject to extensive visitation, and many artifacts have undoubtedly been illegally collected. It is important to realize that any artifact over 50 years old is protected by law, and cannot be removed. If you are interested in the archaeology of the Grassland in general, you can obtain the pamphlet "Archaeology on the Pawnee Grassland," produced by the U.S. Forest Service.

PAWNEE BUTTES: RECENT HISTORY

CHRONOLOGY

1720: Don Pedro de Villasur of Spanish New Mexico reaches the Platte River.
1739: Peter and Paul Mallet, French traders, reach northeast Colorado.
1806: Zebulon Pike explores area. Establishes boundaries of LA purchase.
1819: Stephen Long explores and describes country along the S. Platte.
1840: Interest in Oregon Territory mounts. Many follow the Oregon Trail.
1861: J. W. Iliff sinks savings into cattle, ushering in the "cattle era."
1862: Homestead Act passed, providing settlers with 160 acres of land.
1866: Oliver Loving and Charles Goodnight trail longhorns north from TX.
1869: Union Pacific railroad completed.
1870: Denver Pacific railroad finished.
1873: First mention of Pawnee Buttes on Government Land Office plat.
1874: Barbed wire available. Allows prairie to be fenced for agriculture.
1874-75: Native American populations have been forced out of NE Colorado.
1877: Desert Land Act gives homesteaders 640 acres, but land must be irrigated within three years.
1884: All bison have been exterminated.
1885-86: Harsh winters and falling beef prices devastate the cattle industry.
1888: Soren Nelson (and many others) homestead in NE CO.
1880-90: Drought years, many leave.
1893-94: More drought, more leave.
1900-10: Second wave of immigration.
1909: Enlarged Homestead Act passed.
1916: Stock-Raising Homestead Act gives settlers 640 acres "stock raising" land.
1917-20: Third wave of immigration.
1931: Major drought strikes, nation immersed in the Depression.
1934-36: More drought years.
1935: Federal government begins purchasing marginal private land. Soil Conservation Service takes over relief effort in 1938; the Forest Service in '54.
1930-40: Period of emigration.
1960: Pawnee Nat'l Grassland created.
1961: Pawnee Buttes are evaluated but rejected for National Monument status.
1974: James Michener publishes Centennial, set on the Grassland. Pawnee Buttes are "Rattlesnake Buttes."



CATTLE TRAILS
(Modified from Badaracco 1971)

SPRING ROUNDUP

"As soon as the new grass got hig' enough to keep the saddle horses in goc condition, the roundup would start. Each of the larger outfits would send a wagon with as many men and horses as were needed to handle their cattle... From 15 to 20 wagons would meet at Julesburg where a roundup boss would be appointed. There would be from 100 to 150 mounted men and they were sent out in the shape of a fan with the base at the point where the roundup was to be held. All cattle within that radius and from 5 to 10 miles out from the river were to be driven in to the roundup grounds. As many as 10,000 head were driven in sometimes, but if there were more than 2,500 or 3,000 they were cut into bunches of about 200 head...After the cattle were brought in, everybody would go to camp to get dinner and change horses. After dinner, back to the herd went the cowboys."
-Eugene Williams (In Go West Young Man, Ball 1970)

PAWNEE NATIONAL GRASSLAND
FACT SHEET
Greeley, Colorado -April 1998

AREA

Net area Pawnee National Grassland.	193,060 Acres
Central Plains Experimental Range	14,639 Acres
Private land turned in for grazing	20,843 Acres

GRAZING (1997 Season)

Grazing area open for use	192,647 Acres
Grazing area closed	413 Acres
Grazing allotments	154
Paid permits	21
1997 grazing fee	$1.35

	PAWNEE ASSOCIATION		CROW VALLEY ASSOCIATION			
	Summer	**winter**	**summer**	**winter**	**Summer Tot.**	**Winter Tot.**
Number of head grazed	3,823	501	4,474	542	= 8,297	1,043
Animal Unit Months	31,970	3,395	28,538	3,672	= 60,508	7,067

Number of head for exchange of use.....= 748
Animal Unit Months on exchange of use...= 5,068

ADMINISTRATIVE COSTS AND DEVELOPMENT WORK FOR GRAZING YEAR 1997

Crow Valley Association..... $15,216.01
Pawnee Association..... $14,572.04

LAND USES

Oil & gas leases	99
Special Uses	30
Oil & gas wells, producing	50
Oil & gas sites in rehab	15
Annual oil & gas revenues.	$310,000
• Oil and Gas Pipelines	70 mi.
Powerlines	90 mi.
Minuteman Missile Site	10 Sites.
Minuteman Missile Site. Cable	42 mi.
Telephone buried cable	48 mi.

RECREATION

Developed: Crow Valley Recreation Area (family and group campgrounds, group picnic ground, ball diamond, Steward J. Adams Education Site).

Camping	5,600 visitor days
Picnicking	600 visitor days

Dispersed: Pawnee Buttes Trailhead and Overlook 1.5 mile trail to West Butte for hiking and horseback riding.

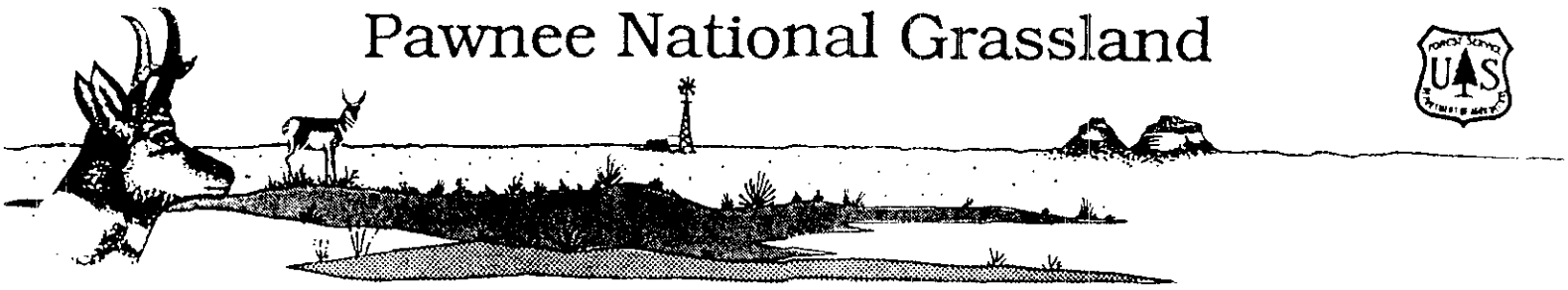
Hunting	1,500 visitor days
Birdwatching	2,000 visitor days
Hiking	5,000 visitor days

WILDLIFE

56 Exclosures for 1021 acres.
200+ structures, 86 escape ramps,
3 Guzzlers, 60 tree cribs,
30 Artificial nests. 5 living snow fences
2 Living Barns.
Management for indicator species
(Mtn. plover, prairie dogs,
Ferruginous Hawks, antelope, prairie falcons).

GRAZING IMPROVEMENTS

Fence (miles)	583
Cattleguards	92
Wells	174
Springs	2
Reservoirs	7
Pipeline (miles)	113
Dams	21



INTRODUCTION

TO THE

PAWNEE NATIONAL GRASSLAND HISTORY

This history of the Pawnee National Grassland was researched and prepared by Dorothy and Lee Rhoads, former Forest Service Volunteers who lived near Briggsdale. It provides a good historical background of the settlement of the area and evolution of the National Grassland. Some of the current uses and features of the Pawnee are also discussed. I hope this brief history will help you more fully appreciate this unique resource and landscape called the Pawnee National Grassland.

DISTRICT RANGER
PAWNEE NATIONAL GRASSLAND

HISTORY OF THE PAWNEE NATIONAL GRASSLAND

During the early stages of American expansion, the high plains of northeastern Colorado were prime grazing land for large populations of deer, antelope, elk, and buffalo. The human population consisted of Indians and a few fur trappers. Before 1850, a fur trader named Elbridge Gerry settled where Crow Creek joined the South Platte River east of present-day Greeley. In 1861, John Wesley Iliff started his first cow camp on Crow Creek above Gerry's place. In 1866, the Union Pacific Railroad announced it would soon be laying rails across southwestern Nebraska. Buffalo were killed by the thousands to feed the railroad construction crews and for their hides, which were in great demand in the East. The buffalo soon became scarce. The next year, Iliff established a cow camp approximately 5 miles down Crow Creek from Cheyenne, Wyoming, to provide beef to the railroad crews and also establish a shipping point to the East. In 1868, he bought $40,000 worth of cattle from Charles Goodnight, who trailed them north from Texas. This established the Goodnight-Loving trail through this area. Goodnight continued trailing herds for Iliff through 1876. By 1877, Iliff's domain stretched from the South Platte River north to the Chalk Bluffs by the Colorado-Wyoming border, and from the mountains east to the present Kansas border. He was the biggest cattleman in Colorado.

The Homestead Act of 1862 allowed only 160 acres per homestead, and at least one-quarter (40 acres) of that had to be tilled. Later Acts allowed a total of 320 acres. One of these was the Timber Culture Act, enacted in 1873, allowing the settler to pick up an additional 160 acres by agreeing to plant 2,700 seedlings on 10 acres, of which 675 should be alive and healthy at the time of final proving up, 5 years later. These acts/laws were aimed primarily at land east of and along the west bank of the Mississippi River, and were not appropriate for the high plains. Major John Wesley Powell, an explorer of the West and later director of the United State Geological Survey, wrote a report in 1875, called "Lands of the Arid Region of the U. S." He recommended that settlement areas be blocked out in no less than 1,275 acres, giving the settler a reasonable chance of survival. He further recommended that without a dependable water supply, it was futile to plow the grasslands. The lands should be left in grass, and that plots of less than 2,560 acres would not be successful in this dry area. The wisdom of these recommendations was demonstrated in later years.

Barbed wire was invented in 1874 and cattlemen were soon using it to enclose public lands for their free and exclusive use. By manipulating the Homestead Act of 1862, Iliff had his cowhands homestead and fence 160 acres at key locations surrounding water. He then purchased the established "homestead" from the cowhands. For example, the earliest record of homestead entry in the Pawnee Buttes area was by Peter Welch in 1887. However, he sold his tract to Iliff 2 years earlier. In 1885, President Grover Cleveland ordered all fences removed from public land. Although it took several years for this to be accomplished, it was the beginning of the end for the big ranchers like Iliff.

By the mid 1880's the homesteaders had begun breaking sod in the grassland country. The railroads encouraged settlers to come west with statements like "the rain-belt has moved westward" and "rain follows the plow". They wanted to

attract farmers from the East and Midwest hoping that they would become future freight customers. In 1887, a branch of the Chicago, Burlington & Quincy was built from Kansas through Sterling into Cheyenne.

The bitter winter of 1886-87 brought the loss of thousands of cattle by starvation or freezing to death. At this time Chicago beef prices also took a big drop and the large ranchers went broke. Farmers flocked to the big ranches which were being carved into quarter section (160 acres) homesteads. The dry years of 1889 and 1890 forced many newcomers to leave, and by 1893-94 it was so severe that many of the new towns that had sprung up along the railroad, like Stoneham, Raymer, and Buckingham, virtually dried up. A few settlers survived. One of these was Soren Nelson, in 1894 the first actual homesteader to file for his title. He was known as "Pawnee Buttes" Nelson from Texas to Montana.

By 1905, to approximately 1910, the rains returned to the grasslands and settlers migrated to the area in even greater numbers. Keota boomed, as did Grover and Briggsdale. Homesteading continued to increase over the next few years and reached its peak between 1914 and 1918. Over 35 percent of the land was plowed, forcing most of the large stockmen out of the area. By this time Iliff had moved on to Texas.

In 1918, Keota's population peaked around 140. All was going well until an influenza epidemic struck and many died. At the same time drought and hail also struck. When farm prices and production dropped, the farmers source of income was gone. Those who stayed struggled to keep their land. Two attempts were made to save the town and increase its income. Mining for kaolinite and oil drilling were to be financed out of Utah, but the deal fell through. Next, the Keota Pioneers Oil and Gas Association was organized and two shares of stock were given for each acre leased for mineral development. Although oil was discovered in 1924, it was too late to save the town. Nature at its worst struck that same year with cloudbursts, deep snows, high winds, tornadoes, hail, and lightning that burned the wheat. The Town Site Company put all lots on sale and Keota had seen the last of its prosperous days. Some farmers tried to return their land to grass, but few had much success. The period between 1929 and 1937 was a violent time on the plains with rustling, land jumping and even murder.

In the area east of the Rockies, from Texas to Montana, dryland farming became the major economy and large areas were plowed. During wet years, the yield was bountiful and more land came under the plow. With the advent of tractors and combines, even more land could be cultivated. By 1930, about 60 percent of the high plains grassland in Weld County had been plowed up. The big ranches were gone, and dryland farming was the dominate economy.

In the 1930's the drought and winds returned. Winds of 50-60 miles an hour became common along the Front Range of the Rockies from Texas to the Canadian border, carrying away the dry topsoil. During two dust storms the sun was almost blotted out in Washington D. C., and dust reportedly fell on ships 300 miles out on the Atlantic. The farms were literally blown away and this "Dust Bowl" area became a virtual desert. These dry years and low prices again took their toll on farmers. Bankruptcy and tax sales were common and many of the farmers gave up and moved on, leaving the land to be claimed by creditors and

for delinquent taxes. By the mid 1930's, the northeastern Weld County population dwindled from a high of over 600 familes to a low of around 64.

During 1933-34, the Federal Government undertook a relief effort through the Work Project Administration (WPA) and the Public Works Administration (PWA) to stabilize the economy. However, this only prolonged the agony. Emergency funding was soon provided to resettle some of the families. The first land was purchased by 1934 and the families relocated on land more conducive to farming. Congress passed the "Bankhead-Jones Farm Tenant Act" in 1937, authorizing the Soil Conservation Service to purchase sub-marginal farm land. The same year, the Resettlement Administration was formed in the Department of Agriculture. The stated objectives of the new office were: "to relocate families, purchase the more severely damaged land, rehabilitate and develop the area, change the use on purchased lands and exert influence on the use of neighboring land, and maintain stability and flexibility of the land". The next 2 years saw the office change hands and names. It was the Farm Security Administration, the Land Policy Section of the Agriculture Department, and the Bureau of Agriculture Economics. Finally, in 1938 responsibility was given to the Soil Conservation Service where it remained until 1954, when it was transferred to the Forest Service. During the period of 1934-54, most of the present area was acquired through purchase, and in some cases by mutual transfer, (swapping). The acquired land was in many cases, small isolated parcels. The "swapping" was done to form more economic and manageable tracts for both the private owner and the Government.

The area along Crow Creek near Briggsdale, was the first reclamation and demonstration plot in this area. Seventy acres of meadow improvement began with the construction of two dams and three diversion ditches to spread the flood water over the meadows and provide limited irrigation on other areas. Throughout the other acquired areas, existing fences were torn down, moved, or new fences constructed to surround an economically manageable pasture. Springs were developed and wells dug. Windmills were erected and "catch basins" constructed to collect as much run-off water as possible. The policy was "no cow would have to go more than three-quarters of a mile for water". The plowed and denuded lands were planted to mostly crested wheatgrass, an introduced species from Russia which is well adapted to our climate and is palatable to livestock. Trees were planted to form wind breaks and provide habitat for wildlife. Within 2 years, the planted grasses revegetated the plowed areas, and grazing was allowed on a limited basis.

The Crow Valley Grazing Association was formed in 1937 in northwestern Weld County; the next year it changed its name to the Crow Valley Livestock Co-Operative, Inc. The association was composed of the ranchers in the area and the Soil Conservation Service on a cooperative basis. Grazing rules were agreed upon and the association was responsible for their execution. The Soil Conservation Service continued to develop conservation practices, rehabilitate the land, and monitor its use. The Pawnee area in northeastern Weld County was acquired in 1938, and the Pawnee Livestock Co-operative Association was formed in 1941. The next year the name was changed to the Pawnee Cooperative Grazing Association and its organization was patterned after the Crow Valley Association's success.

Formation of the grazing associations, fencing the area into larger tracts, and the use of range riders eliminated the unauthorized use of the public lands by "day herders" (ranchers from outside the area bringing in large herds and badly overgrazing the land--an off-shoot of the open range practice of former years). From the early days of the reclamation process to the present, grazing has shown an increase from practically none to around 9,000 head. The native grasses are slowly replacing the crested wheat and other grasses planted as a conservation measure. The soil blows very little now, but constant watch must be kept to prevent another dust bowl.
This was not accomplished without trials, anger, and frustration. Attempts were made to have the land returned to private ownership, but were defeated. The deep-seated individualism of the westerner made it difficult for them to accept a change from the old ways. Successful demonstrations and evident restoration of the land occurred and gradually the new, proven methods of land management were accepted by most of the population, both association members and nonmembers.

The area was transferred from the Soil Conservation Service to the Forest Service in 1954. The Forest Service began managing the area by the multiple-use sustained-yield concept. The Forest Service was given permanent control in 1960, and the "National Grasslands" were formed. The Pawnee National Grassland is one of 19 throughout the Nation: one each in Oregon and Idaho, the rest are scattered from Texas to North Dakota.

In 1960, the Multiple Use-Sustained Yield Act reaffirmed the right to develop mineral resources, primarily oil and gas. The Forest Service specifies the revegetation procedures to be followed by the private operators while conducting their exploration, drilling, and production activities. Currently there are 210 active oil and gas leases (managed by the Bureau of Land Management) on the Pawnee National Grassland. As of June 1986, 21 of these have producing wells on them.

There have been 12 Minuteman missile sites constructed on the Grassland. These fenced areas (approximately 2 acres each) are administered by the U. S. Air Force and public access is not permitted.

Photographers, birdwatchers, and hikers will find the Pawnee Buttes an interesting landmark. The Buttes are sedimentary rock formations, one-half mile apart, rising 350 feet above the plains to an elevation of 5375 feet. Due to the instability of these sandstone towers, climbing is not recommended.

The cliffs in this area are a preferred nesting area for many birds of prey. March through June is their critical breeding and nesting season, and disturbance at this time could cause the eggs to be abandoned. Please remain on the established trail during this critical time. Binoculars are useful while observing these raptors.

The Buttes are almost entirely surrounded by private land. The Forest Service owns the West Butte and only a portion of the East Butte. The only public access is the 2 mile foot trail that begins on the top of the escarpment.

The Crow Valley Recreation Area, near Briggsdale, was part of one of the first reclamation projects in the area. A ball diamond, picnic area with shelter,

fire grates, roads, and rest rooms were constructed, mainly with Work Project Administration (WPA) labor. The town of Briggsdale formed a Park Committee, who contracted with the Resettlement Administration to maintain it in good condition, and to make improvements for a period of 10 years. The contract could be renewed if both parties were agreeable. However, it was renewed only once. In 1959, the community decided it did not wish to continue maintenance of the site, but retained the ball diamond under a Special Use Permit until 1977.

The Forest Service has since developed camp sites, a cooking shelter, a water system, and an education center, constructed with the help of the Daughters of the American Revolution. It was dedicated in 1981 to the memory of Steward J. Adams, District Ranger of the Pawnee National Grassland at the time of his death in 1979. The Crow Valley Recreation Area is the only camping facility in this area.

3. State Data

Colorado Climate Center Data

Markus

County	Station ID	Station No.	Year	Month	Day	PPT (0.01 inches)
Weld	Greeley UNC	53553	1997	7	29	0
			1997	7	30	**112**
			1997	7	31	0
			1997	8	3	0
			1997	8	4	25
			1997	8	5	75
			1997	8	6	67
			1997	8	7	0
			1997	10	22	0
			1997	10	23	27
			1997	10	24	79
			1997	10	25	98
			1997	10	26	0
Weld	Longmont 2ESE	55116	1997	6	6	0
			1997	6	7	**229**
			1997	6	8	1
			1997	6	9	17
			1997	6	10	20
			1997	6	11	3
			1997	6	12	0
			1997	6	13	32
			1997	6	14	36
			1997	6	15	1
			1997	6	16	2
			1997	6	17	1
			1997	6	18	0
			1997	7	28	0
			1997	7	29	43
			1997	7	30	0
			1997	8	4	0
			1997	8	5	63
			1997	8	6	**102**
			1997	8	7	31
			1997	8	8	0
			1997	10	23	0
			1997	10	24	12
			1997	10	25	63
			1997	10	26	12
			1997	10	27	0
Weld	New Raymer 21N	55934	1997	5	24	0
			1997	5	25	**258**
			1997	5	26	8
			1997	5	27	65
			1997	5	28	0
			1997	5	29	73
			1997	5	30	77
			1997	5	31	3
			1997	6	1	0
			1997	6	2	20
			1997	6	3	27
			1997	6	4	0

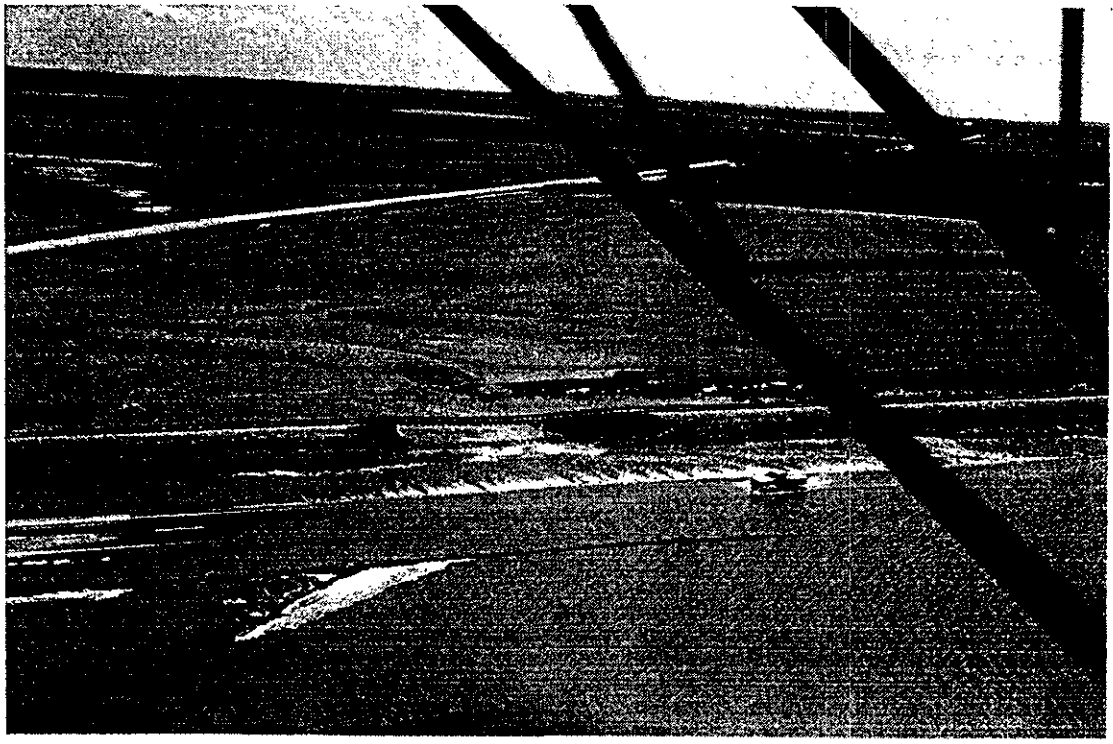
			1997	6	5	0
			1997	6	6	0
			1997	6	7	0
			1997	6	8	7
			1997	6	9	**105**
			1997	6	10	31
			1997	6	11	10
			1997	6	12	0
			1997	6	13	42
			1997	6	14	0
			1997	6	15	**127**
			1997	6	16	0
			1997	7	21	0
			1997	7	22	**154**
			1997	7	23	0
			1997	7	28	0
			1997	7	29	96
			1997	7	30	5
			1997	7	31	7
			1997	8	1	0
			1997	8	2	0
			1997	8	3	18
			1997	8	4	7
			1997	8	5	2
			1997	8	6	**192**
			1997	8	7	46
			1997	8	8	0
			1997	9	18	0
			1997	9	19	2
			1997	9	20	81
			1997	9	21	16
			1997	9	22	4
			1997	9	23	0
			1997	10	23	0
			1997	10	24	77
			1997	10	25	56
			1997	10	26	3
			1997	10	27	0
Phillips	Holyoke	54082	1997	6	1	0
			1997	6	2	54
			1997	6	3	**185**
			1997	6	4	0
			1997	6	14	0
			1997	6	15	**149**
			1997	6	16	0
			1997	7	27	0
			1997	7	28	2
			1997	7	29	65
			1997	7	30	41
			1997	7	31	0
			1997	8	5	0
			1997	8	6	98

			1997	8	7	0
			1997	10	11	0
			1997	10	12	82
			1997	10	13	12
			1997	10	14	0
			1997	10	23	0
			1997	10	24	1
			1997	10	25	**192**
			1997	10	26	29
			1997	10	27	0

weld
phillips

ENGINEERING TECHNICAL REPORT

Colorado Flood Documentation
Significant Floods of June 1997



Department of Natural Resources
Colorado Water Conservation Board
Flood Control and Floodplain Management Section
1313 Sherman Street, Room 721
Denver, Colorado 80203

June 1997

ENGINEERING TECHNICAL REPORT

Colorado Flood Documentation
Significant Floods of June 1997

Prepared By:
Thomas W. Browning, P.E.

Department of Natural Resources
Colorado Water Conservation Board
Flood Control and Floodplain Management Section
1313 Sherman Street, Room 721
Denver, Colorado 80203

June 1997

Weld County Flood Event
June 2, 1997

MEMORANDUM

COLORADO WATER CONSERVATION BOARD
DARIES C. LILE
DIRECTOR

DATE: June 13, 1997

TO: File

FROM: Tom Browning

RE: **Weld County flood of June 2, 1997**

On June 11, 1997 Larry Lang and I performed field investigations in Weld County north of the Greeley area. A significant rainstorm occurred on Monday, June 2 which caused flooding in portions of the county. As part of the field work, we conducted rainfall bucket surveys and estimated peak discharges for several streams using indirect flow measurements. Following is a summary of our findings :

STORM DESCRIPTION

- The storm developed in the late evening of June 2, and flooding occurred into the early morning hours of June 3. The NWS issued a flash flood warning at 3:00 am on June 3 for central Weld County, and specifically for Crow Creek in the Barnesville area.
- Most or all of the rain fell within a 30 to 45 minute time period.
- Very little hail was produced by this storm.

RAINFALL ESTIMATES

Rainfall estimates were obtained through bucket surveys, interviews with local officials and residents, and field observations. Rainfall estimates are shown (in inches) on the attached map. These amounts generally occurred within a 30 to 45 minute time period.

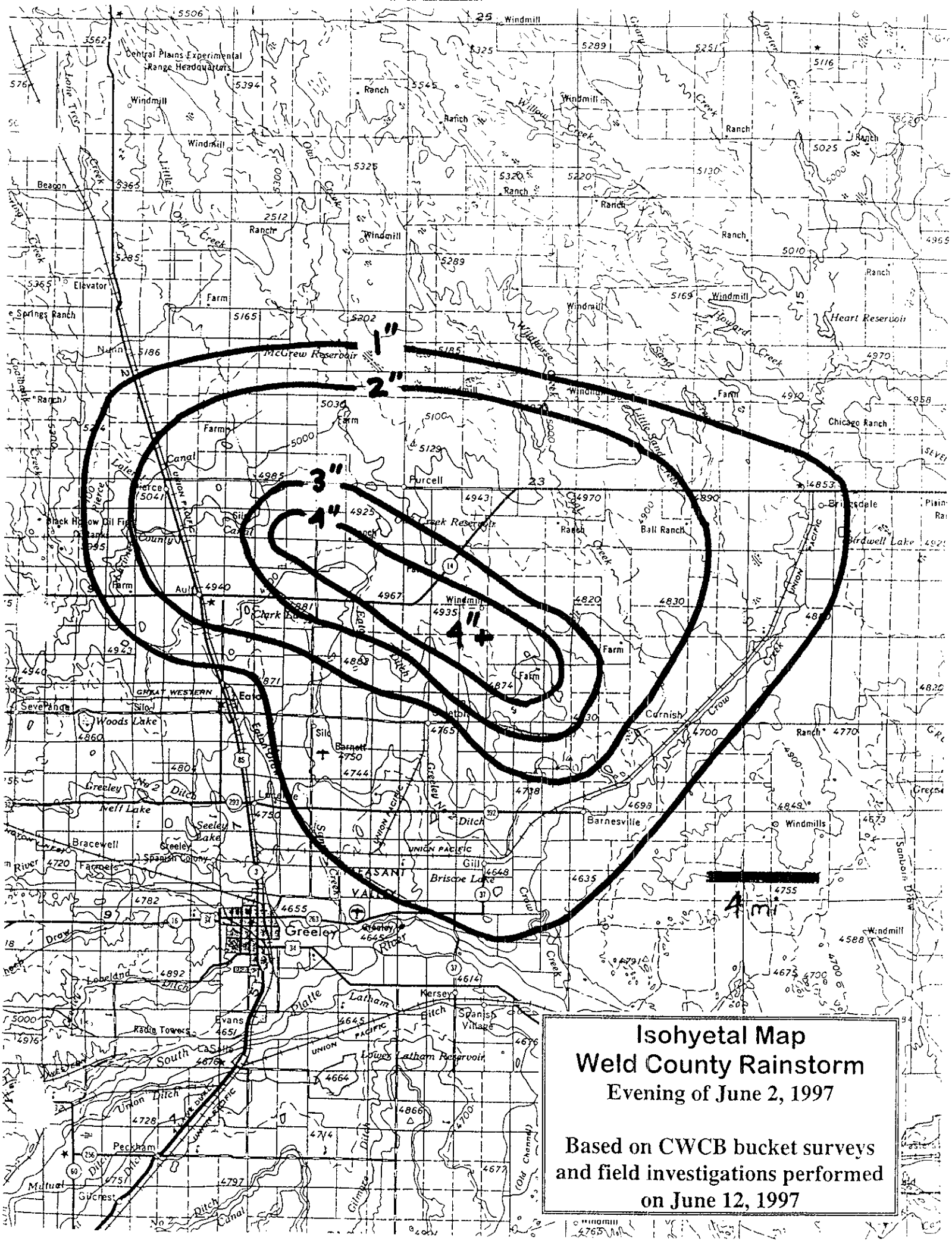
FLOOD DAMAGES

A flood damage survey was not performed by CWCB staff. However, flood damages were noted during the field visit which included basement flooding in numerous homes, erosion/washout/overtopping damage to several county roads, damage to crops and fields, and debris accumulations.

RUNOFF ESTIMATE

Runoff estimates were obtained for several streams using indirect flow measurement techniques. Channel cross-sections were estimated in the field using a hand level and a 100' tape. High water marks were good to excellent at all locations. The flow estimates are presented below:

Location	Est. Peak flow
Crow Creek at Cornish	150-250 cfs
Crow Creek at Barnesville	900-1,200 cfs
Willow Creek at Galeton	30-50 cfs
Owl Creek at Rd 90, u/s of Owl Creek Res.	600-900 cfs
Lone Tree Creek at Hwy 14	150-250 cfs
Lone Tree Creek near intersection of Rd 43/74	400-600 cfs


1"
2"
3"
4"
4"+
4 mi
Isohyetal Map
Weld County Rainstorm
Evening of June 2, 1997
Based on CWCB bucket surveys and field investigations performed on June 12, 1997

Weld County Flood Event
June 13, 1997

MEMORANDUM

COLORADO WATER CONSERVATION BOARD
DARIES C. LILE
DIRECTOR

DATE: June 25, 1997

TO: File

FROM: Tom Browning

RE: **Weld County/Sheep Draw flood of June 13, 1997**

On June 24 Larry Lang and I performed field investigations in Weld County west of Greeley. A significant rainstorm occurred on the evening of Friday, June 13 which caused flooding in the Sheep Draw basin. As part of the field work, we conducted rainfall bucket surveys and estimated peak discharges in Sheep Draw using indirect flow measurements. Following is a summary of our findings :

STORM DESCRIPTION

- The storm developed on the evening of June 13 and generally moved from northwest to southeast.
- Rainfall began in Weld County west of Greeley around 5:00 pm.
- Most or all of the rain fell within a one hour time period.
- Hail was produced by this storm, but the amount and size of the hail was spatially quite variable.

RAINFALL ESTIMATES

Rainfall estimates were obtained through bucket surveys, interviews with local officials and residents, and field observations. Rainfall estimates are shown (in inches) on the attached map. These amounts are for the storm total (about 1 hour).

FLOOD DAMAGES

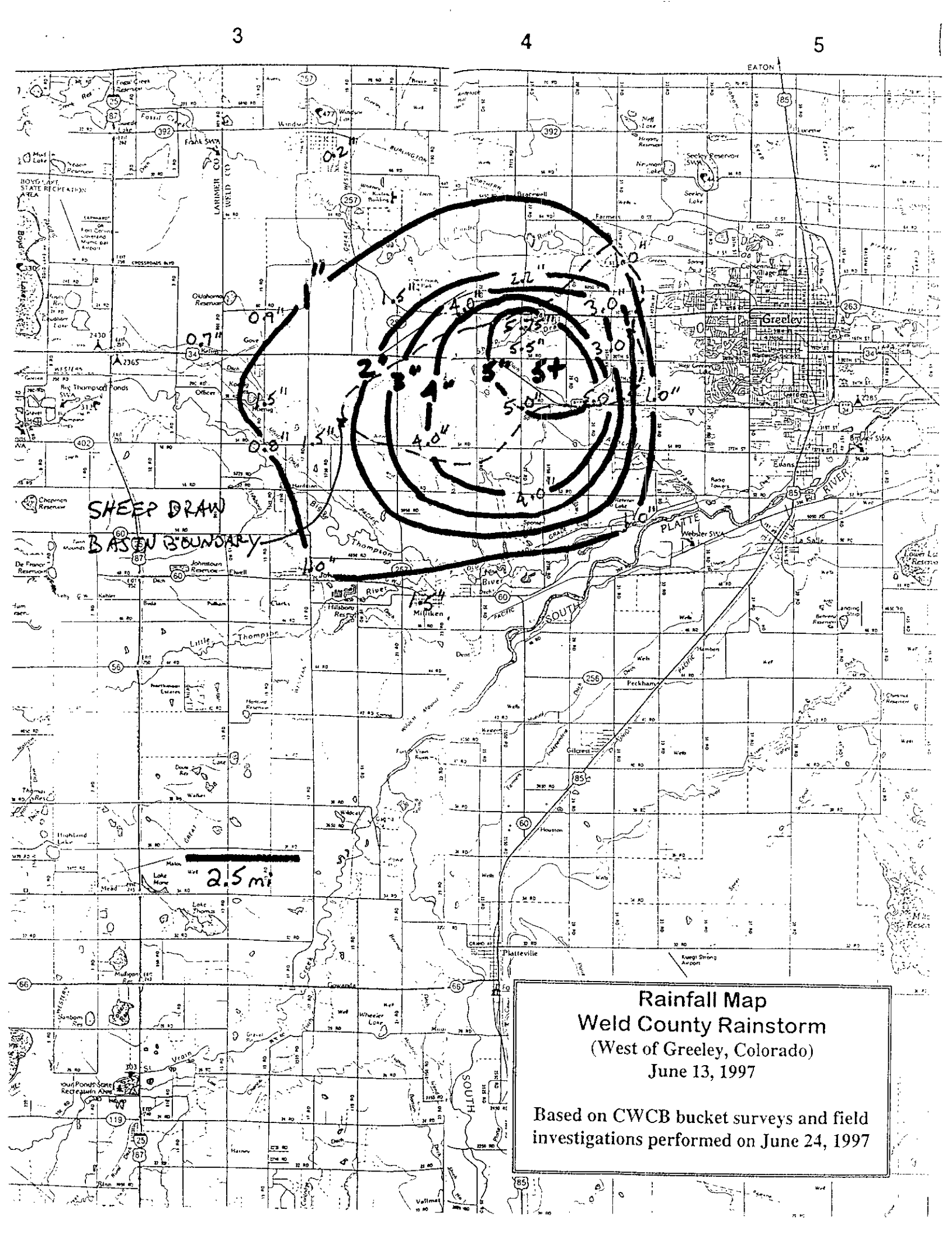
A flood damage survey was not performed by CWCB staff. However, flood damages were noted during the field visit which included basement flooding in numerous homes, damage or overtopping of several county road bridges, erosion/washout damage to several county roads, damage to crops and fields, and significant debris accumulations.

RUNOFF ESTIMATE

A runoff estimate was obtained for Sheep Draw using indirect flow measurement techniques. A channel cross-section was obtained by using a survey instrument, survey rod, and a 100' tape. High water marks were excellent on both the left and right overbanks. A channel slope was surveyed in the field, and "n" values were estimated for the overbanks and main channel. The normal depth flow estimate is presented below:

Location	Est. Peak flow	50-year flow*
Sheep Draw, approx. 300' d/s of Highway 34	3,200 cfs	3,100 cfs

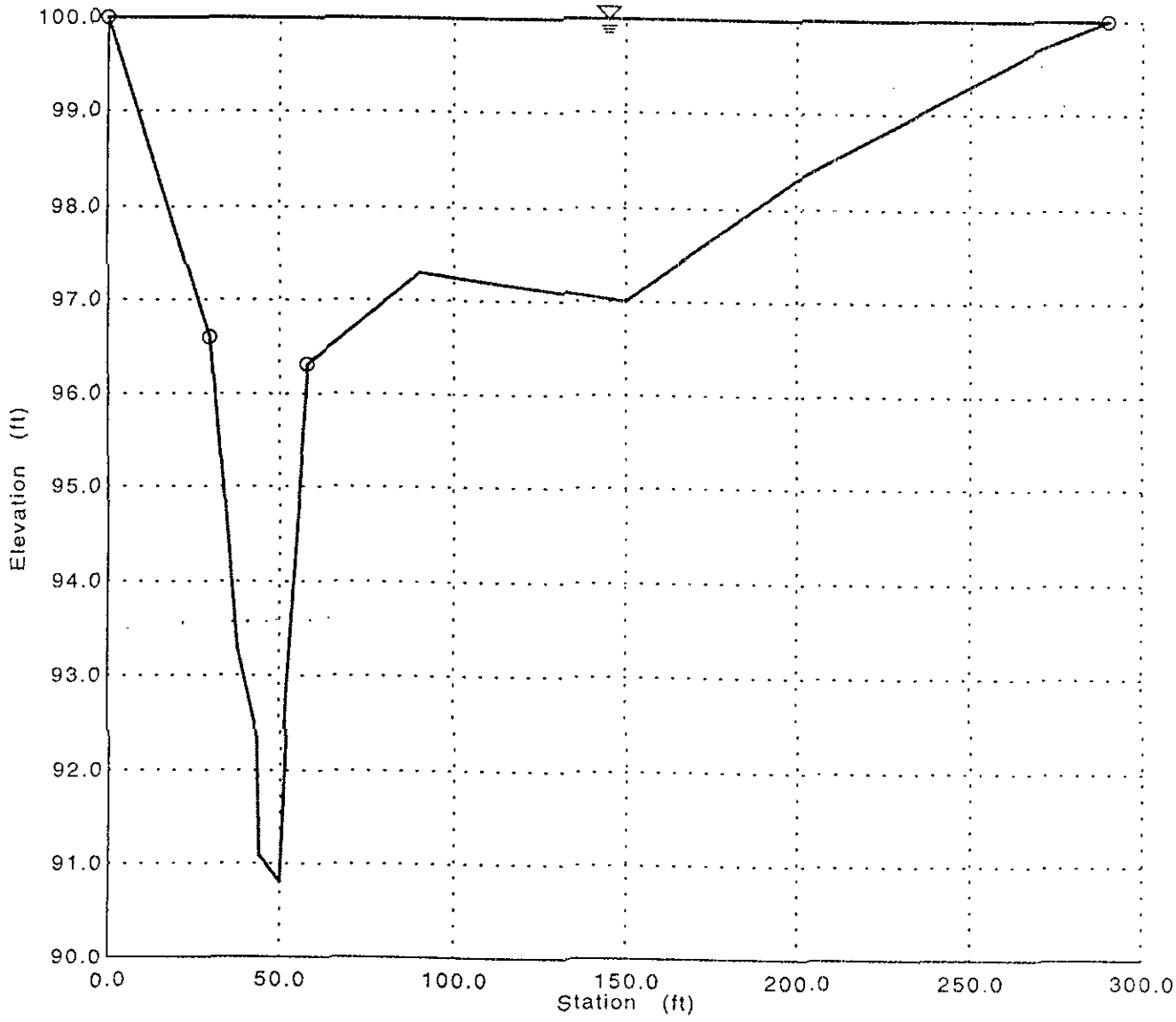
* Based on hydrology values published in "Special Study, Cache La Poudre River Basin, Larimer-Weld Counties, Colorado, Floodplain Analysis, Sheep Draw" (October 1981).


3
4
5
EATON
SHEEP DRAW
BASIN BOUNDARY
Greeley
PLATTE RIVER
SOUTH PLATTE
Platteville
Rainfall Map
Weld County Rainstorm
(West of Greeley, Colorado)
June 13, 1997
Based on CWCB bucket surveys and field investigations performed on June 24, 1997

Sheep Draw d/s of Hwy 34 near Greeley
Cross Section for Irregular Channel

Project Description	
Project File	c:\seca\flood\flud-doc\shp-drw.fm2
Worksheet	Sheep Draw d/s of Hwy 34 near Greeley
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.032	
Channel Slope	0.003000	ft/ft
Water Surface Elevation	100.00	ft
Discharge	3,213.54	cfs



STATION — 1 3on 4NW

TIME OF REGULAR OBSERVATION 6:45 A.M.

MOUNTAIN STATES WEATHER SERVICES
Serving the Rocky Mountain West

MONTH August YEAR 1997

RECORD OF DAILY WEATHER OBSERVATIONS

DATE	24 HR HI TEMP	24 HR LO TEMP	TEMP AT OBSN.	AMOUNT OF PRECIPITATION (IN)	AMOUNT OF SNOWFALL (IN)	AMOUNT OF SNOW / ICE ON GROUND	TIME OF PRECIPITATION OCCURRENCE (1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11)	WEATHER DAYS (A B C D E F G H I)	REMARKS	DATE
1	82	61	63	.03	0	0				1
2	84	61	66	.03	0	0				2
3	84	58	59	.82	0	0				3
4	85	59	63	T	0	0				4
5	83	62	63	.47	0	0				5
6	74	58	60	2.84	0	0			Basement Flooded	6
7	66	54	56	.80	0	0				7
8	76	56	58	0	0	0				8
9	88	57	60	0	0	0				9
10	70	57	60	.30	0	0				10
11	70	57	59	.31	0	0				11
12	71	56	58	.05	0	0				12
13	74	55	56	.02	0	0				13
14	82	55	63	0	0	0				14
15	79	53	57	0	0	0				15
16	90	56	56	0	0	0				16
17	78	56	60	T	0	0				17
18	78	56	61	.37	0	0				18
19	78	53	57	.04	0	0				19
20	77	56	59	.02	0	0				20
21	80	58	61	0	0	0				21
22	87	56	60	.04	0	0				22
23	82	55	55	.12	0	0				23
24	89	56	58	.01	0	0				24
25	88	58	61	0	0	0				25
26	82	61	64	0	0	0				26
27	86	59	61	.01	0	0				27
28	86	60	63	0	0	0				28
29	88	61	62	T	0	0				29
30	87	57	57	0	0	0				30
31	83	57	61	T	0	0				31
TOTAL	3512	1774		6.34		MAX.	MAIL COMPLETED FORMS TO: Mountain States Weather Services	A B C D E F G H I		TOTAL
AVG.	81.0	57.2				DATE				

Special observations, notes and supplementary precipitation measurements: _____

A. Lt. Fog B. Hvy. Fog C. Thunder D. Sleet E. Hail F. Glaze G. Duststorm H. Haze/Smoke I. Blwg. Snow

REPORT SEVERE WEATHER IMMEDIATELY TO
(303) 224-9192
ALL OTHER CALLS
(303) 484-WIND

OBSERVER Fred Sarchet

MSWS Form F-16
Rvsd March 1, 1987

STATION Eaton 4NW

TIME OF REGULAR OBSERVATION 6:45 A.M.

MOUNTAIN STATES WEATHER SERVICES
Serving the Rocky Mountain West

MONTH July YEAR 1997

RECORD OF DAILY WEATHER OBSERVATIONS

DATE	24 HR HI TEMP	24 HR LO TEMP	TEMP AT OBSN.	AMOUNT OF PRECIPITATION (IN)	AMOUNT OF SNOWFALL (IN)	AMOUNT OF SNOW / ICE ON GROUND	TIME OF PRECIPITATION OCCURRENCE 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11	WEATHER DAYS A B C D E F G H I	REMARKS	DATE
1	92	58	60	0	0	0				1
2	85	48	54	0	0	0				2
3	83	52	54	0	0	0				3
4	74	53	59	0	0	0				4
5	82	52	56	0	0	0				5
6	80	51	57	.02	0	0				6
7	87	55	59	0	0	0				7
8	89	59	62	0	0	0				8
9	90	52	58	0	0	0				9
10	91	52	62	0	0	0				10
11	91	60	61	T	0	0				11
12	83	54	59	T	0	0				12
13	89	53	62	0	0	0				13
14	84	59	62	0	0	0				14
15	89	59	62	0	0	0				15
16	95	57	63	0	0	0				16
17	96	62	66	0	0	0				17
18	97	60	63	0	0	0				18
19	94	61	64	0	0	0				19
20	85	57	59	.03	0	0		X		20
21	74	57	61	0	0	0				21
22	90	61	64	.04	0	0				22
23	93	62	65	0	0	0				23
24	92	65	66	.11	0	0				24
25	91	69	67	.22	0	0				25
26	95	59	62	.03	0	0				26
27	88	62	70	T	0	0			8:30 Observ.	27
28	85	64	64	.05	0	0				28
29	—	—	—	7.55	8	8			Basement Flooded	29
30	—	—	—	.47	8	8				30
31	—	—	—	0	0	0				31
TOTAL	1474	1613		8.52	11	MAX. 8				TOTAL
AVG.	88.4	57.6				DATE				

MAIL COMPLETED FORMS TO: Mountain States Weather Services

A B C D E F G H I

Special observations, notes and supplementary precipitation measurements:

A. Lt. Fog B. Hvy Fog C. Thunder D. Sleet E. Hail F. Glaze G. Duststorm H. Haze/Smoke I. Blwg Snow

REPORT SEVERE WEATHER IMMEDIATELY TO
(303) 224-9192
ALL OTHER CALLS
(303) 484-WIND

OBSERVER Fred Sarchet

MSWS Form F-18
Rvsd March 1, 1987

4. Local Data

PROJECT NO._____

LIDSTONE & ANDERSON, INC.
760 WHALERS WAY, SUITE B-200
FORT COLLINS, COLORADO 80525
Phone (970) 226-0120 Fax (970) 226-0121

FAX TRANSMITTAL

DATE: 5-29-98 **TIME:** 2:20 pm

TO: Marcus

Rti

BUSINESS PHONE:_____ **FAX:** 484-7593

NUMBER OF PAGES TO FOLLOW: 3

FROM: Brad Anderson

COMMENTS:

Table 3.1. Inventory of Existing Drainage Facilities.

Facility Name and/or Type	Location [EPA SWMM ID]	Condition	Maximum Storage Volume (acre-feet)	Maximum Discharge Capacity[1] (cfs)
Highway 257 Detention Pond	West of Highway 257 Road Crossing [303]	fair, small culvert outlet	41.6	0[2] 171[3]
Irrigation Reservoir #1	Southwest of US 34 Bypass and Country Road 25 Intersection [305]	fair, no principal spillway	29.7[4]	0[2] 1,879[3]
Irrigation Reservoir #2	Southwest of US 34 Bypass and County Road 25 Intersection [307]	fair, no principal spillway	10.7[4]	0[2] 218[3]
Irrigation Reservoir #3	East of County Road 25, South of US 34 Bypass [310]	fair, no principal spillway	23.0[4]	0[2] 509[3]
County Road 25 Detention Pond	Adjacent to County Road 25, South of US 34 Bypass [337]	fair, small culvert outlet	8.6	0[2] 604[3]
Irrigation Reservoir #4	Downstream of County Road 25 Detention Pond [311]	fair, six small culvert outlets	19.9	139[2] 624[3]
US Highway 34 Bypass Culvert	West of County Road 25 Intersection [258]	fair, partial sediment blockage	NA	1,380
County Road 25 Culvert	North of US 34 Bypass Intersection [489]	fair, partial sediment blockage	NA	1,865
83rd Avenue Bridge	North of 20th Street [467]	fair, vegetation encroachment	NA	3,820
71st Avenue Bridge	South of 10th Street [424]	fair, vegetation encroachment	NA	4,175
10th Street Bridge	Between 59th Avenue and 71st Avenue [428]	good	NA	11,365
4th Street Bridge	Between 59th Avenue and 71st Avenue [459]	good	NA	19,075
F Street Bridge	West of 59th Avenue [481]	fair, limited capacity	NA	1,330
County Road 25 Culvert	County Road 25 and US 34 Bypass Intersection [311]	fair, partial sediment blockage	NA	350
Irrigation Reservoir #5	Southwest of 4th Street and 59th Avenue Intersection [330]	fair, no principal spillway	2.1[4]	0[2] 74[3]
Greeley No. 3 Ditch	Traverses Northern Tip of Basin [NA]	fair	NA	100

[1] Maximum discharge capacity prior to flooding or street overtopping.
[2] Discharge when water surface is at invert of emergency spillway.
[3] Combined spillway discharge with surcharged storage capacity.
[4] For existing reservoirs with no principal spillway, maximum storage measured from crest of emergency spillway to the top of dam embankment prior to overtopping.

10th Street Bridge. This structure also consists of a two-span bridge with an 18-inch pier within the channel of Sheep Draw. The bridge opening is approximately 106 feet in width and 12.9 feet in height. The depth of flow at which roadway overtopping occurs is approximately 16.4 feet. The capacity of the bridge prior to overtopping the roadway was calculated to be 11,365 cfs. The 100-year existing condition discharge in Sheep Draw at 10th Street is 4,930 cfs.

71st Avenue Bridge. This single span bridge has an opening which is approximately 40 feet wide and 8.3 feet in height. The depth of flow at which roadway overtopping occurs is approximately 10.5 feet. The capacity of the bridge prior to overtopping the roadway was determined to be 4,175 cfs. The 100-year existing condition discharge in Sheep Draw at 71st Avenue is 4,155 cfs.

83rd Avenue Bridge. This crossing structure consists of a single span bridge which incorporates a bridge opening that is approximately 38 feet wide and 6.5 feet in height. The depth of flow associated with overtopping the roadway is approximately 8.8 feet. The capacity of the bridge prior to overtopping the roadway was calculated to be 3,820 cfs. The 100-year existing condition discharge in Sheep Draw at 83rd Avenue is 3,803 cfs.

County Road 25 Culvert. The crossing at County Road 25 is a 7'H x 14'W reinforced concrete box culvert. At this location, roadway overtopping occurs at a depth of approximately 14.8 feet from the invert of the culvert. The capacity of the culvert prior to overtopping is 1,865 cfs. The 100-year existing condition discharge in Sheep Draw at County Road 25 is 2,663 cfs.

U.S. Highway 34 Bypass Culvert. The crossing at U.S. Highway 34 Bypass is also a 7'H x 14'W reinforced concrete box culvert. The overtopping flow depth for this structure is approximately 13.8 feet measured from the culvert invert. The capacity of the culvert prior to overtopping is 1,380 cfs. The 100-year existing condition discharge in Sheep Draw at U.S. Highway 34 Bypass is 2,453 cfs.

Tributary Crossing of Country Road 25. A major tributary crosses the intersection of County Road 25 and the U.S. Highway 34 Bypass immediately upstream of Sheep Draw. The crossing structure consists of a 66-inch RCP. The depth of flow associated with overtopping the roadway is approximately 11.4 feet. The capacity of the culvert prior to overtopping is 350 cfs. The 100-year existing condition discharge at this location is estimated to be 590 cfs.

Within the Sheep Draw Basin, road crossings of several additional tributaries to Sheep Draw also exist. These tributaries convey significant storm flows that may require crossing structures capable of passing the 100-year existing condition discharge. This master planning effort did not inventory or specifically identify these road crossings. It is noted, however, that several of these crossing structures provided inadequate capacity to convey runoff generated during relatively minor storm events and were experiencing sedimentation problems. As land development occurs within the basin, these structures should be more closely inventoried and evaluated.

has additional detention storage capacity above the normal water surface. Storm runoff captured by the reservoir is released through six 24-inch RCP's; additional discharge beyond the capacity of the RCP's will overtop the reservoir embankment. For the purposes of this master planning effort, the normal water surface was assumed to be the invert elevation of the six RCP's. Approximately 19.9 acre-feet is stored in the reservoir prior to overtopping the dam embankment in the vicinity of the outlet pipes. The 100-year historic discharge from the reservoir is 624 cfs of which 139 cfs is conveyed through the pipes. The 100-year storage volume is 25.1 acre-feet which corresponds to a ponding depth of approximately 4.1 feet above the invert of the outlet pipes and an overtopping depth of approximately 0.7 feet above the reservoir embankment.

Irrigation Reservoir #5. This facility is an existing irrigation reservoir located on a tributary to Sheep Draw southwest of the intersection of 4th Street and 59th Avenue. The pond has additional detention storage capacity above the normal water surface; storm flows are released through an earthen spillway in the pond embankment. Assuming the normal water surface rests at the elevation of the spillway crest, the 100-year historic discharge through the spillway is 74 cfs which corresponds to a storage volume of 2.1 acre-feet and a depth of approximately 1.0 feet above the invert of the spillway.

3.2 Major Road Crossings

There are seven major road crossings on the main stem of Sheep Draw. The lower five crossings are bridges across Sheep Draw; the remaining two crossings are reinforced box culverts. The capacity of each crossing was calculated using the HEC-2 Water Surface Profile program using the normal bridge option. Table 3.1 summarizes the location, condition, and hydraulic capacity of each crossing structure. A brief description of each road crossing is provided in the following paragraphs.

F Street Bridge. This bridge incorporates an opening which is approximately 20 feet wide and 6.5 feet in height. The depth of flow at which roadway overtopping occurs is approximately 7.3 feet. The capacity of the bridge prior to overtopping the roadway was calculated to be 1,330 cfs. The 100-year existing condition discharge in Sheep Draw at F Street is 5,075 cfs.

4th Street Bridge. This crossing structure is a two-span bridge which includes an 18-inch pier within the channel of Sheep Draw. The bridge opening is approximately 107 feet wide and 10.6 feet high. The overtopping flow depth for this structure was determined to be 12.6 feet. The capacity of the bridge prior to overtopping the roadway was estimated to be 19,075 cfs. The 100-year existing condition discharge in Sheep Draw at 4th Street is 5,040 cfs.

Jeff Rulli

JERRY: DATE YOUR MEASUREMENTS MADE PRIOR TO STORM? COULD BE 6/16/97. STORM 6/13/97.

Bert

City of Greeley
FAX Transmittal

FAX # (970) 350-9736

Date 7-2-97

TO: Brad Anderson

COMPANY:

FAX PHONE: 970 226-0121

SENT FROM: Bert Leauland - Public Works

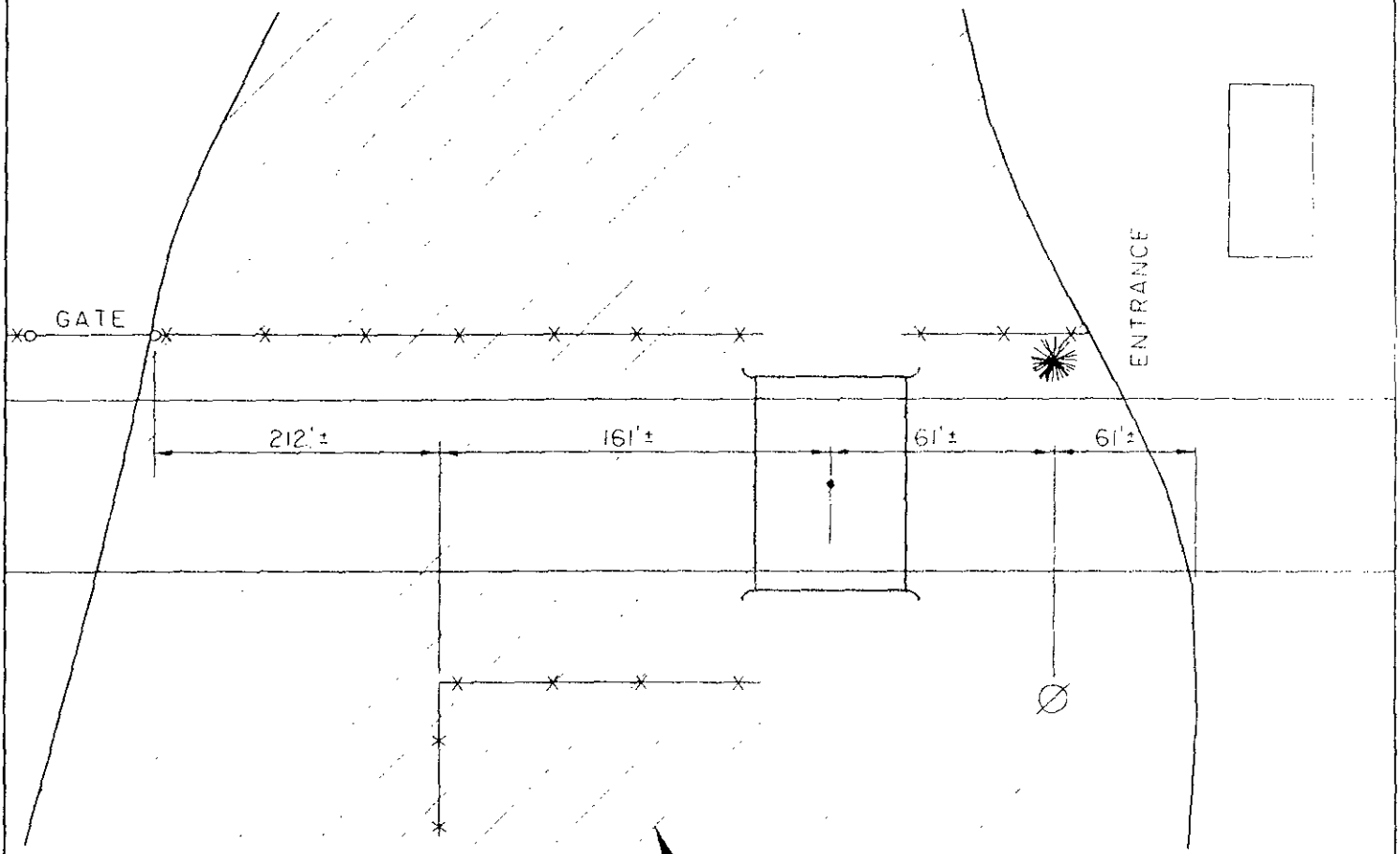
NUMBER OF PAGES (including cover sheet): 8

If you do not receive all pages call (970) 350- 9788

COMMENTS OR INSTRUCTIONS:

Thank You - Have a Great Day!

"F" STREET BRIDGE
WEST OF 59TH AVENUE
SHEEP DRAW DRAINAGE BASIN

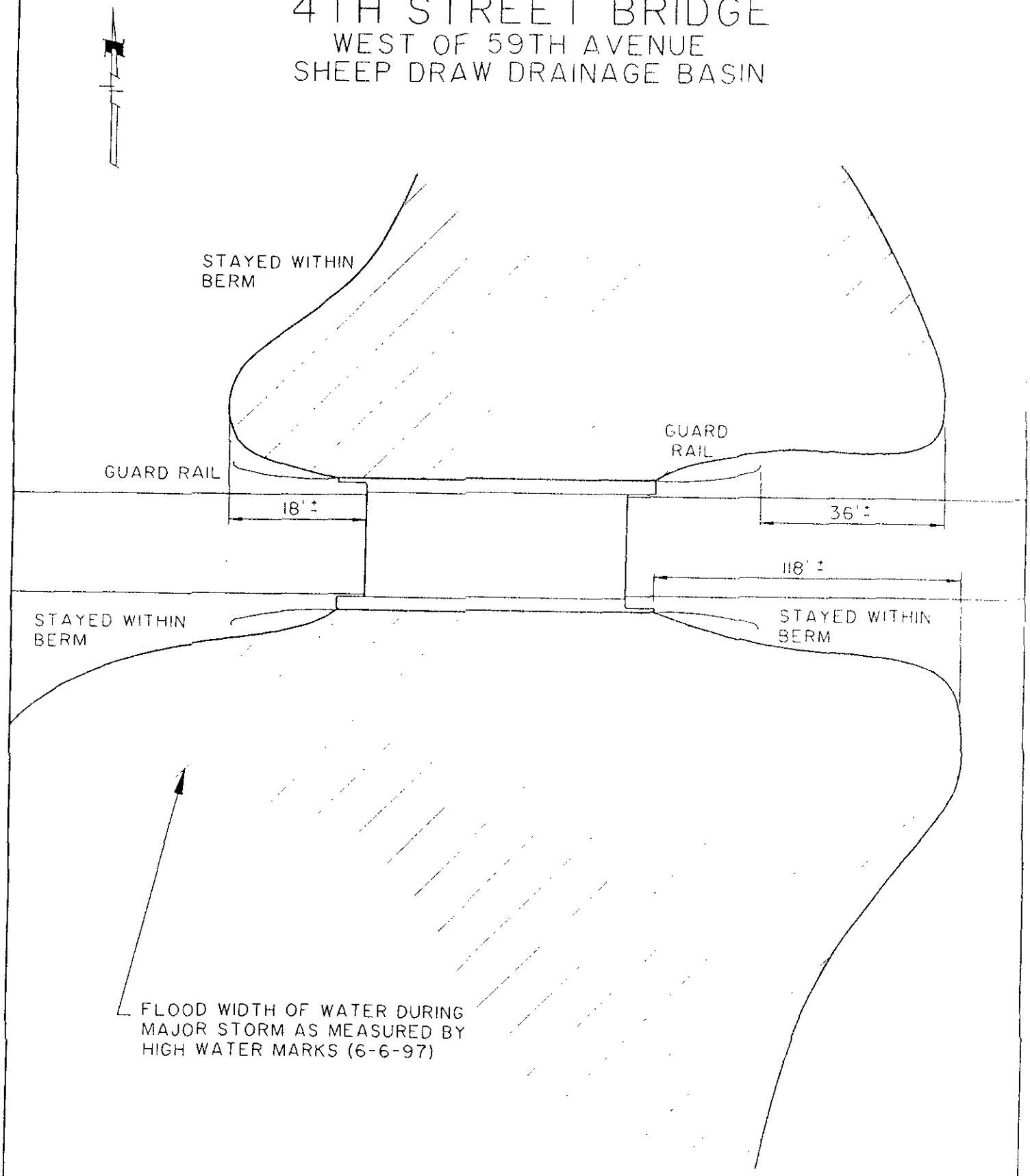


FLOOD WIDTH OF WATER DURING MAJOR STORM AS MEASURED BY HIGH WATER MARKS (6-6-97)

City of GREELEY, COLORADO
DIVISION OF ENGINEERING
1000 TENTH STREET GREELEY COLORADO 80631

FSTREET

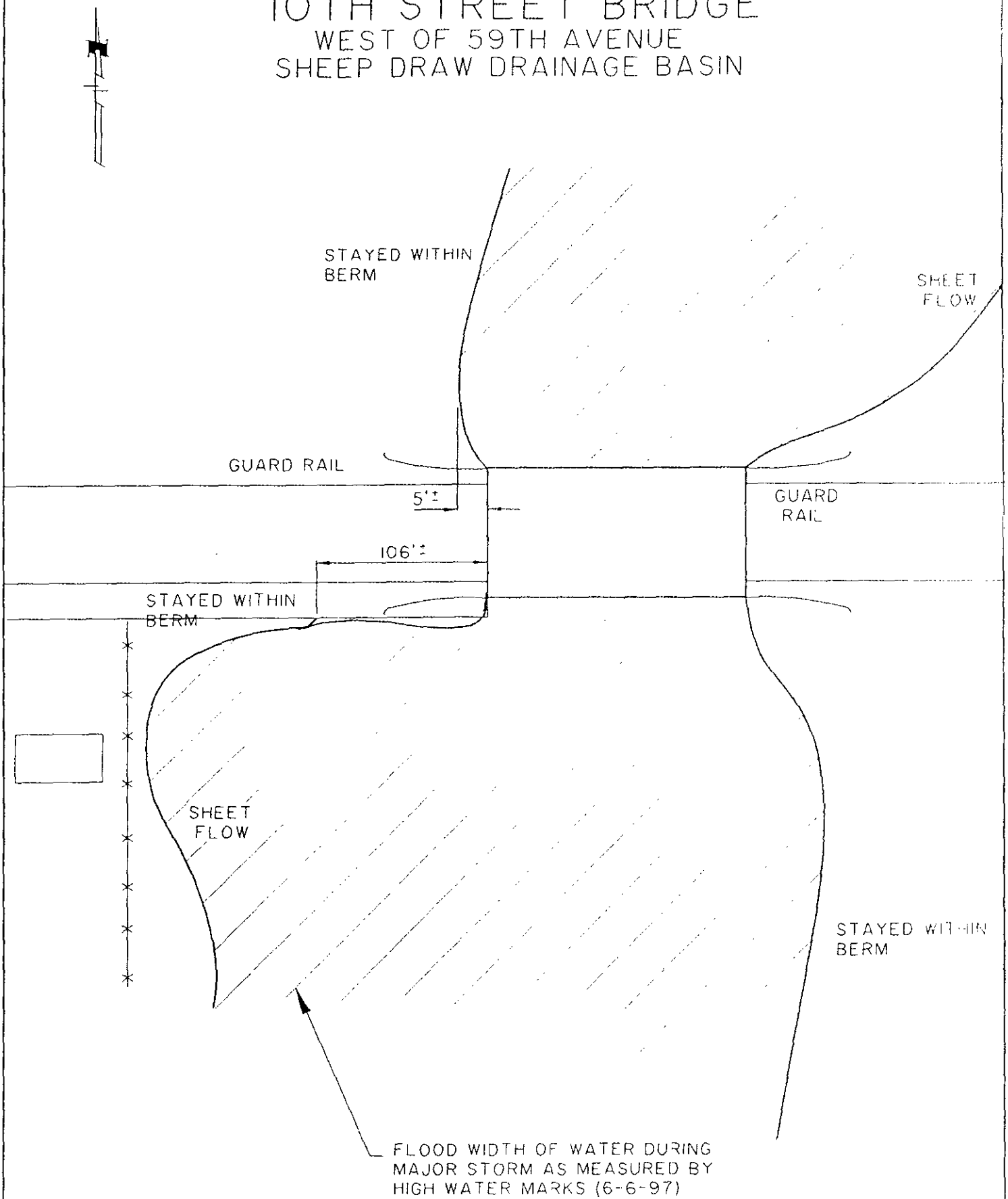
4TH STREET BRIDGE
WEST OF 59TH AVENUE
SHEEP DRAW DRAINAGE BASIN



City of GREELEY, COLORADO
DIVISION OF ENGINEERING
1000 TENTH STREET GREELEY COLORADO 80631

4STREET

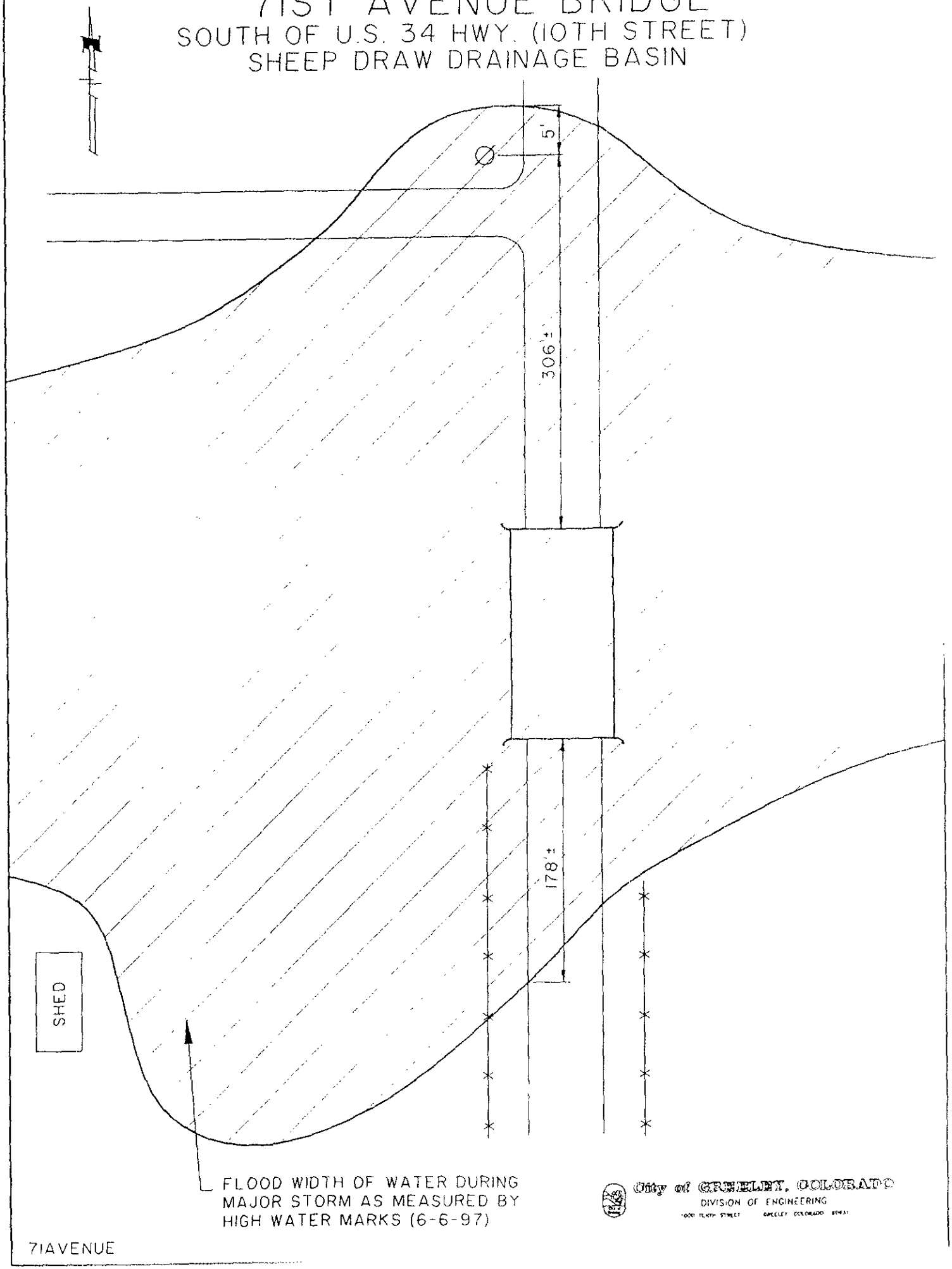
10TH STREET BRIDGE
WEST OF 59TH AVENUE
SHEEP DRAW DRAINAGE BASIN



City of GREELEY, COLORADO
DIVISION OF ENGINEERING
1100 TENTH STREET GREELEY COLORADO 80631

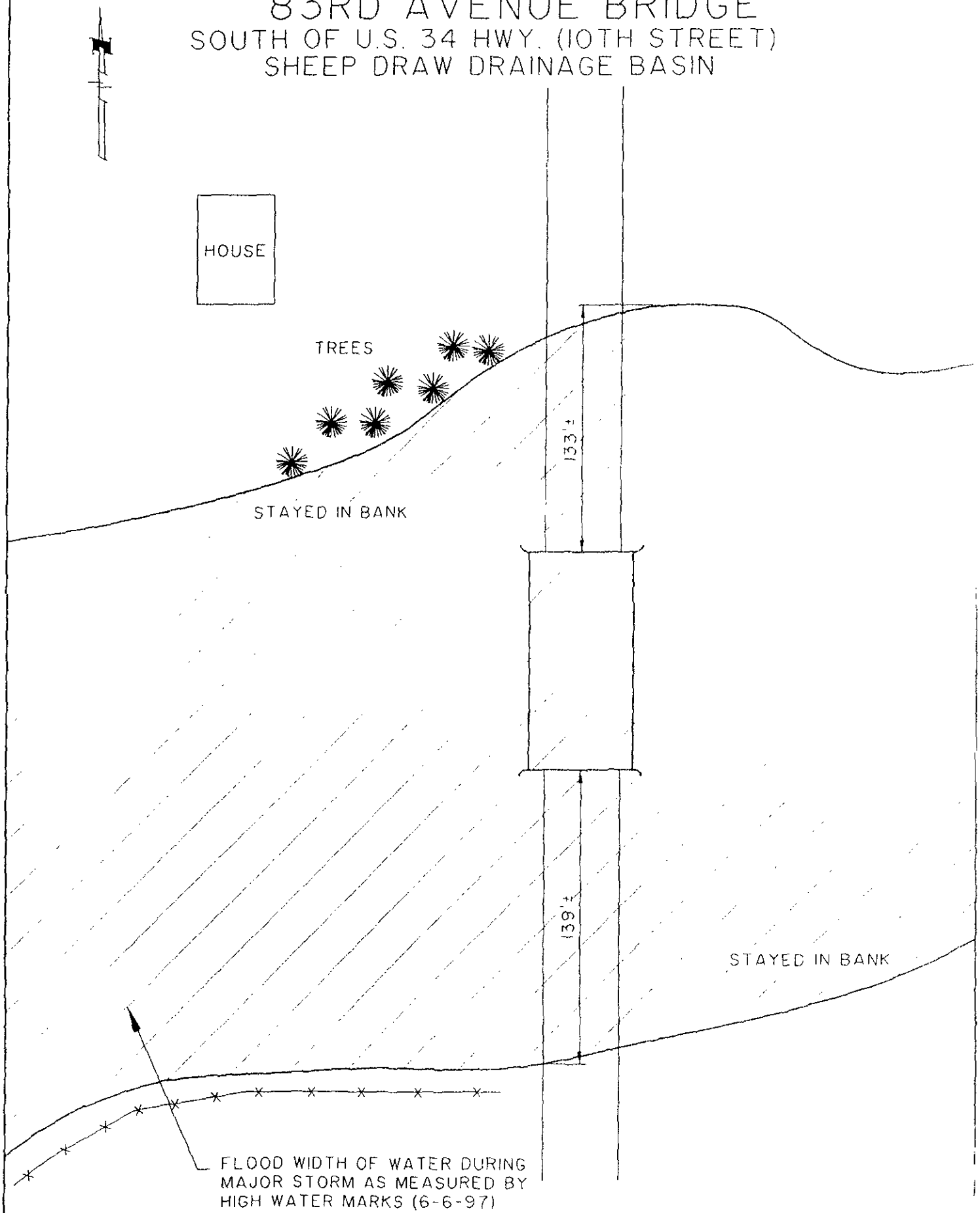
10STREET

71ST AVENUE BRIDGE
SOUTH OF U.S. 34 HWY. (10TH STREET)
SHEEP DRAW DRAINAGE BASIN



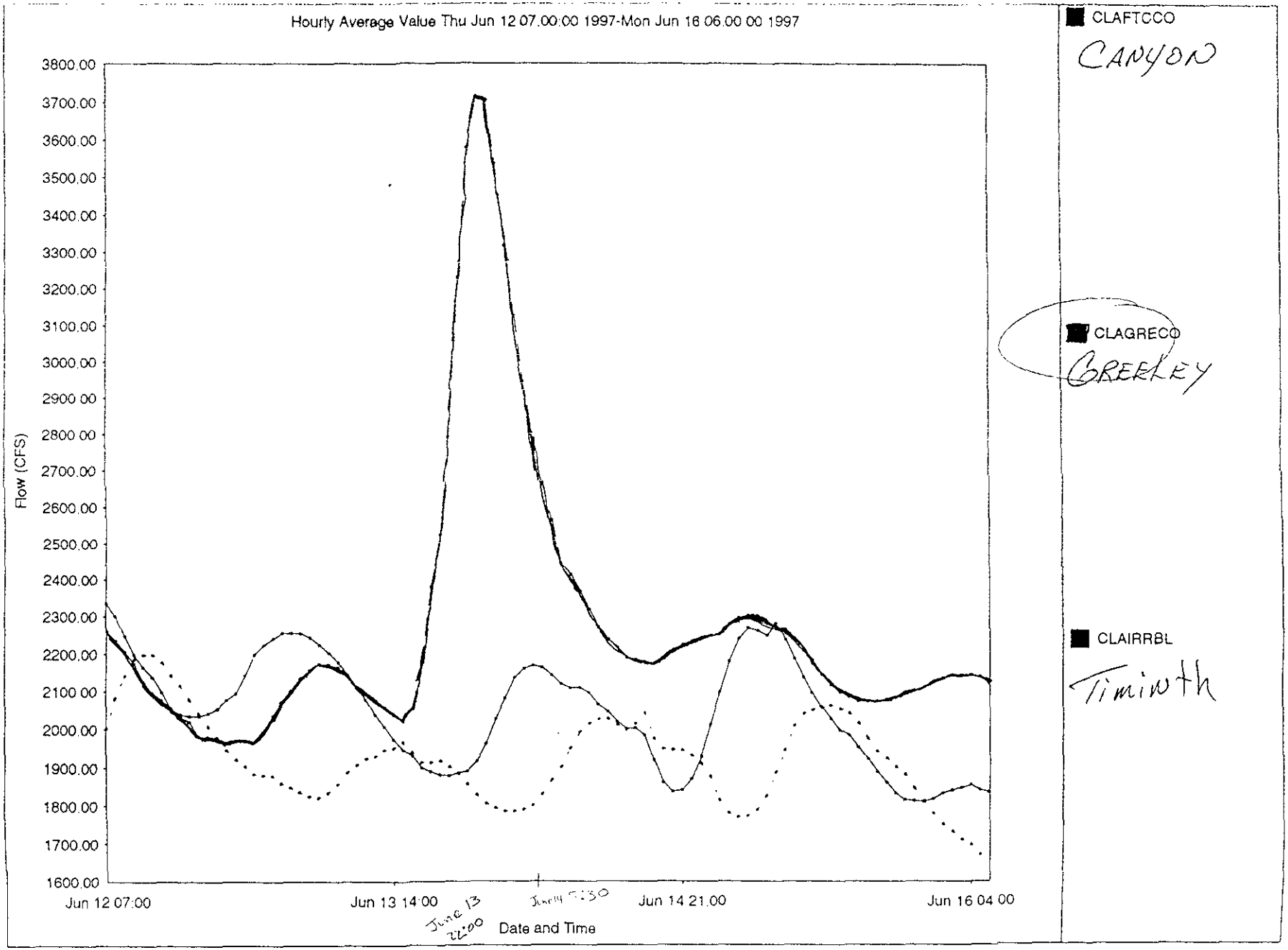
City of GREELEY, COLORADO
DIVISION OF ENGINEERING
1000 TENTH STREET GREELEY, COLORADO 80631

83RD AVENUE BRIDGE
SOUTH OF U.S. 34 HWY. (10TH STREET)
SHEEP DRAW DRAINAGE BASIN



City of GREELEY, COLORADO
DIVISION OF ENGINEERING
1000 TENTH STREET GREELEY, COLORADO 80631

83AVENUE


Hourly Average Value Thu Jun 12 07.00.00 1997-Mon Jun 16 06.00 00 1997
Flow (CFS)
3800.00
3700.00
3600.00
3500.00
3400.00
3300.00
3200.00
3100.00
3000.00
2900 00
2800 00
2700.00
2600.00
2500.00
2400.00
2300.00
2200.00
2100 00
2000.00
1900.00
1800.00
1700.00
1600.00
Jun 12 07:00
Jun 13 14:00
Jun 14 21.00
Jun 16 04 00
June 13 22:00
Date and Time
CLAFTCCO
CANYON
CLAGRECO
GREELEY
CLAIRRBL
Timinth

Greeley/Weld Economic Development Action Partnership, Inc.
822 7th Street, Suite 550
Greeley, CO 80631
(970) 356-4565 • Fax (970) 352-2436

Fax Cover Sheet

DATE:	4/30/98	**TIME:**	12:01 PM
TO:	Marcus	**PHONE:**	(970) 484-7573
		FAX:	(970) 484-7493
FROM:	Laura Sullivan		
RE:	Population		

Number of pages including cover sheet: 2

Message
Demographic Profile follows per your request.

If you encounter any problems during this transmission or do not receive the total number of pages indicated above, please call (970) 356-4565 immediately.

WELD COUNTY, COLORADO

DEMOGRAPHIC PROFILE

(Updated April, 1998)

ECONOMY

Annual Rate Of Inflation - 1997

Weld County	+ 5.0%
Denver	+ 3.5%
United States	+ 1.7%

Weld County Personal Income

(in billions)

1994	1995	1996	1997 (est.)
$2.529	$2.700	$2.867	$3.000

Unemployment (annual average)

	1993	1994	1995	1996	1997
Weld Co.	4.8	4.9	4.2	4.2	3.8
Greeley	4.8	4.9	4.2	4.2	3.8

Per Capita Income - 1997 (est.)

Weld Co.	Colorado	U.S. Avg.
$ 19,400	$ 26,700	$ 25,400

- Weld County Average Non-Farm Wage (1997 est.) $25,230
- Median Household Income in Weld County (1997 est.) $35,700

ACCRA Cost of Living Index

(Comparisons of Urban Areas)

4th Qtr. 1997

Metro Area	100% Composite Index
Boston, MA	138.1
Philadelphia, PA	123.6
Washington, DC	121.7
Los Angeles, CA	117.6
Flagstaff, AZ	112.1
Portland, OR	107.3
Denver, CO	105.9
Fort Collins, CO	104.9
Albuquerque, NM	103.1
GREELEY, CO	102.1

POPULATION

Population Characteristics

	Weld Co.	Greeley
Population (Census)		
1960	72,344	26,314
1970	89,297	33,902
1980	123,438	53,006
1990	131,821	60,536
2002 (proj.)	172,028	73,656
1997 Estimates		
Ethnic Distribution		
White	76.3%	75.0%
Hispanic	22.8%	23.6%
Black	0.4%	0.7%
American Indian/Eskimo	0.4%	0.4%
Asian	0.8%	1.2%
Other	0.2%	0.2%
Age Distribution		
Under 21	33.3%	32.8%
21-44	36.1%	37.9%
45-64	19.7%	17.8%
Over 64	10.7%	11.6%
Median Age	32.5	31.3
Housing Units	57,618	26,023
Household Size	2.73	2.54

Weld County Population

	1980 Census	1990 Census	July 1996 Estimates
Weld County	**123,438**	**131,821**	**151,108**
Ault	1,056	1,107	1,295
Brighton (MCP)	—	17	39
Broomfield (MCP)	—	4	12
Dacono	2,321	2,228	2,345
Eaton	1,932	1,959	2,394
Erie (MCP)	1,231	1,244	1,705
Evans	5,063	5,876	7,088
Firestone	1,204	1,358	1,563
Fort Lupton	4,251	5,159	5,712
Frederick	855	988	1,498
Garden City	85	199	266
Gilcrest	1,025	1,084	1,162
Greeley	53,006	60,536	67,410
Grover	158	135	142
Hudson	698	918	1,092
Johnstown	1,535	1,579	2,133
Keenesburg	541	570	675
Kersey	913	980	1,077
La Salle	1,929	1,803	1,864
Lochbuie	895	1,168	1,230
Mead	356	456	818
Milliken	1,506	1,605	1,790
New Raymer	80	98	108
Northglenn (MCP)	—	—	21
Nunn	295	324	362
Pierce	878	823	897
Platteville	1,662	1,515	1,937
Severance	102	106	238
Windsor	4,277	5,062	7,029
Unincorporated	35,542	33,002	37,206

(MCP = Multi-County Places)

1998 Population Estimates:

Greeley	Greater Greeley*
72,282	82,500

*Includes Evans, Garden City, Greeley & LaSalle

EMPLOYMENT AND WAGES

Weld County Employment - 1996

Industry	Number	% of Total Employment	% of Private Employment
TOTAL	59,085		
Private	49,440	84%	
Agriculture	3,601	6%	7%
Mining	904	2%	2%
Construction	3,378	6%	7%
Manufacturing	11,171	19%	23%
Trans. Comm. P.U.	1,933	3%	4%
Wholesale Trade	3,605	6%	7%
Retail Trade	9,822	17%	20%
F.I.R.E.	2,452	4%	5%
Services	12,570	21%	25%
Non-classified	4	—	—
Government	9,645	16%	

Weld County Average Annual Wages

	1995	1996	% Change
All Industries	$23,467	$24,525	4.51%
Private Sector	$23,258	$24,393	4.88%
Agriculture	$17,910	$18,691	4.36%
Mining	$35,061	$36,756	4.83%
Construction	$27,479	$28,497	3.70%
Manufacturing	$31,745	$33,813	6.51%
Trans. Comm. P.U.	$29,449	$30,761	4.46%
Wholesale Trade	$28,948	$30,380	4.95%
Retail Trade	$12,639	$13,208	4.50%
F.I.R.E.	$28,605	$31,139	8.86%
Services	$19,835	$20,393	2.81%
Government	$24,551	$25,198	2.64%

Labor Force/Employment 1997

(avg. annual unadjusted figures)

Weld County Labor Force	82,856
% change in 12 months	+.4%
Weld County Employment	79,889
% change in 12 months	+.57%
Weld County Unemployment Rate	3.84%
Greeley Labor Force	38,449
% change in 12 months	+.21%
Greeley Employment	36,973
% change in 12 months	+.67%
Greeley Unemployment Rate	3.86%

MAJOR EMPLOYERS

Company	Product/Service	Number of Employees
ConAgra Companies	*Meat packing/ag commodities, ag services*	4,159
Kodak Colorado Division	*Photographic films and papers*	2,439
State of Colorado	*Government (includes UNC classified)*	1,697
North Colorado Medical Center	*Regional hospital*	1,850
School District 6	*Public education*	1,750
Aims Community College	*Vocational education/Arts & Sciences*	1,454
University of Northern Colorado	*State university (non-classified)*	1,100
Weld County	*Government*	1,000
Hewlett Packard	*Scanning and data storage devices*	925
State Farm Insurance	*Regional office*	986
City of Greeley	*Government*	701
McLane Western	*Grocery warehouse/wholesale distribution*	607
Startek, Inc.	*Technical support/fulfillment*	575

Other Major Employers include:

Sykes Enterprises
Concepts Direct
RR Donnelley Norwest
EFTC Manufacturing
DOVatron Colorado
Tagawa Greenhouse
Colorado Greenhouse
Golden Aluminum
Universal Forest Products
National Hog Farms
Meadow Gold Dairy
Metal Container Corporation
Plastic Art Products

Rainfall Bucket Survey

The flood documentation team interviewed several persons living in the vicinity to inquire about rainfall amounts recorded for the July 28, 1997 storm event.

Rainfall Bucket Survey

Name	Location	Phone	Rainfall
Fred Sarchet	9061 Weld Cty Rd 41	303-536-4671	7.55 inches
Bill Sarchet	8627 Weld Cty Rd 41	303-536-4830	6 + inches
Dale Feit	17977 Weld Cty Rd 20	303-536-4802	8 + inches
Rusty Riley	6261 Weld Cty Rd 41	303-536-4825	0.75 inches
Tex Turley	1/2 mile east of Rd 33 on Rd 20	303-	7 + inches
James Michael	10395 Weld Cty Rd 39	303-536-4363	
Orval Thomason	20529 Weld Cty Rd 22	303-536-4663	8 + inches
Andy Haller	20520 Weld Cty Rd 20	303-536-4897	8 + inches

Precipitation Totals - At Weld County Roads 41 & 20

Year	January	February	March	April	May	June	July	August	September	October	November	December
1994	0.43	0.25	0.23	0.68	0.41	2.64	0.41	2.28	0.83	1.70	0.60	0.17
YTD 1994	0.43	0.68	0.91	1.59	2.00	4.64	5.05	7.33	8.16	9.86	10.46	10.63
1995	0.07	0.26	0.19	1.98	4.08	3.55	0.77	0.34	1.08	0.34	0.15	0.02
YTD 1995	0.07	0.33	0.52	2.50	6.58	10.13	10.90	11.24	12.32	12.66	12.81	12.83
1996	0.38	0.06	0.53	0.31	2.52	2.45	2.37	2.02	2.34	0.43	0.40	0.03
YTD 1996	0.38	0.44	0.97	1.28	3.80	6.25	8.62	10.64	12.98	13.41	13.81	13.84
1997	0.35	0.31	0.32	1.52	0.91	2.09	8.52	6.34	1.16	1.48	0.68	0.27
YTD 1997	0.35	0.66	0.98	2.50	3.41	5.50	14.02	20.36	21.52	23.00	23.68	23.95
Ave.94-97	0.31	0.22	0.32	1.12	1.98	2.68	3.02	2.75	1.35	0.99	0.46	0.12
YTD Ave.	0.31	0.53	0.85	1.97	3.95	6.63	9.65	12.39	13.75	14.73	15.19	15.31

5. Calculations and Estimates

Assumptions Used in the Hydraulic Computations

In order to estimate peak discharges, the CWCB flood documentation team employed Manning's equation. The application of Manning's equation to open channel flow problems requires that several generalizing assumptions be made.

Flow in open channels typically occurs as turbulent flow over rough surfaces. Open channel flow is also seldom either steady or uniform. (Steady flow has characteristics that do not vary with time while uniform flow implies that a constant cross sectional area and velocity occur at each section within a reach.) Steady, uniform flow almost never occurs in open channels (Morris and Wiggert, Applied Hydraulics in Engineering, 2nd edition, 1972).

In engineering applications, the Manning's equation has been used extensively and has been shown to be quite reliable even though it is an empirical approach derived for application to the following conditions:

- uniform flow in which the rate of head loss is equal to the bed slope
- steady flow

The open channel flow computations contained herein are treated as approximate solutions based on the assumptions of both steady and uniform flow. In actuality, the floods investigated in this study generally exhibited rapidly-rising and receding floodwave conditions that occurred in highly variable natural channels and adjacent floodplains. Flow characteristics under these circumstances were unlikely to be either steady or uniform.

Approaches are available for estimating floodwave flows, but they require substantial amounts of time and data that were not practical for these investigations. Manning's equation was used due to its general acceptance in the engineering community, and because of its relative ease of application. The Manning "n" values used in the calculations were based on engineering judgement, the reasonableness of results, and the understanding that the "n" term represented energy loss factors not typically found in steady, uniform flows.

COLORADO WATER CONSERVATION BOARD
FLOOD DOCUMENTATION REPORT
FIELD TRIP RECORD

BY: Markus Ritsch
DATE: June 6, 1998
SUBJECT: July 28, 1997 Flooding

LOCATION: Southern Weld Co.
MAIN CONTACT: Fred Sarchet
PHONE #: 303-536-4671

Field Trip Weld County - Northwest of Hudson

A severe thunderstorm producing extremely heavy precipitation approximately 7 miles northwest of Hudson developed on the evening of July 28, 1997. This storm event developed during the same time period as the storm event experienced in Fort Collins, Larimer County. A weather observer in the area recorded 7.55 inches of rainfall during a 7 hour period from 4:00 p.m. to 11:00 p.m. on July 28. In addition to this weather observer, the NWS Doppler radar that captured the Fort Collins storm event also captured this event and shows a storm total of more than 6 inches.

The primary contact for this visit is Fred Sarchet (9061 Weld County Road 41). Fred is a weather observer for Mountain States Weather who observed 7.55 inches of rain on July 28. Fred's brother, Bill Sarchet also lives in the area and observed 6.0 + inches of rain on July 28. Bill also took photographs of the flooding in the area.

The goals for this visit include interviewing Fred and Bill as well as other persons in the area, visiting the flooded areas and taking photographs, establishing high water marks, determining channel cross sections, and assessing general flood damage.

On June 4, 1998, a flood documentation team from Riverside Technology inc. performed field work in southern Weld County. The field work began by interviewing Fred and Dot Sarchet. The following information was provided by Fred and Dot:

- Rain started falling about 4 pm on July 28 and ended about 10 pm
- The flows reached their peak at the house at approximately 11 pm
- All the water was out of the house by morning of July 19
- The water reached a depth of 2.5 feet surrounding their house
- Little to no hail was observed in the storm
- Little lightning was observed during the storm
- Portions of County Road 20 were completely washed out (see photographs)
- Portions of County Road 22 were washed out
- County Road 41 was not washed out but was overtopped by as much as 8 inches in places
- The total distance of overtopping on County Road 41 was approximately 0.2 miles
- The time of peak flow (6 to 8 inches) over County Road 41 was approximately 11 pm
- By 1:30 am on July 29, the depth of water of County Road 41 had receded to approximately 2 to 3 inches
- By 3:00 am on July 29, there was no water on the roadway of County Road 41
- The Beebe Seep Ditch was able to contain all the surface runoff during the event. Talk to Manual Montoya (303-659-7373) at the Farmers Irrigation Company.

Rainfall Bucket Survey

The flood documentation team interviewed several persons living in the vicinity to inquire about rainfall amounts recorded for the July 28, 1997 storm event.

Rainfall Bucket Survey

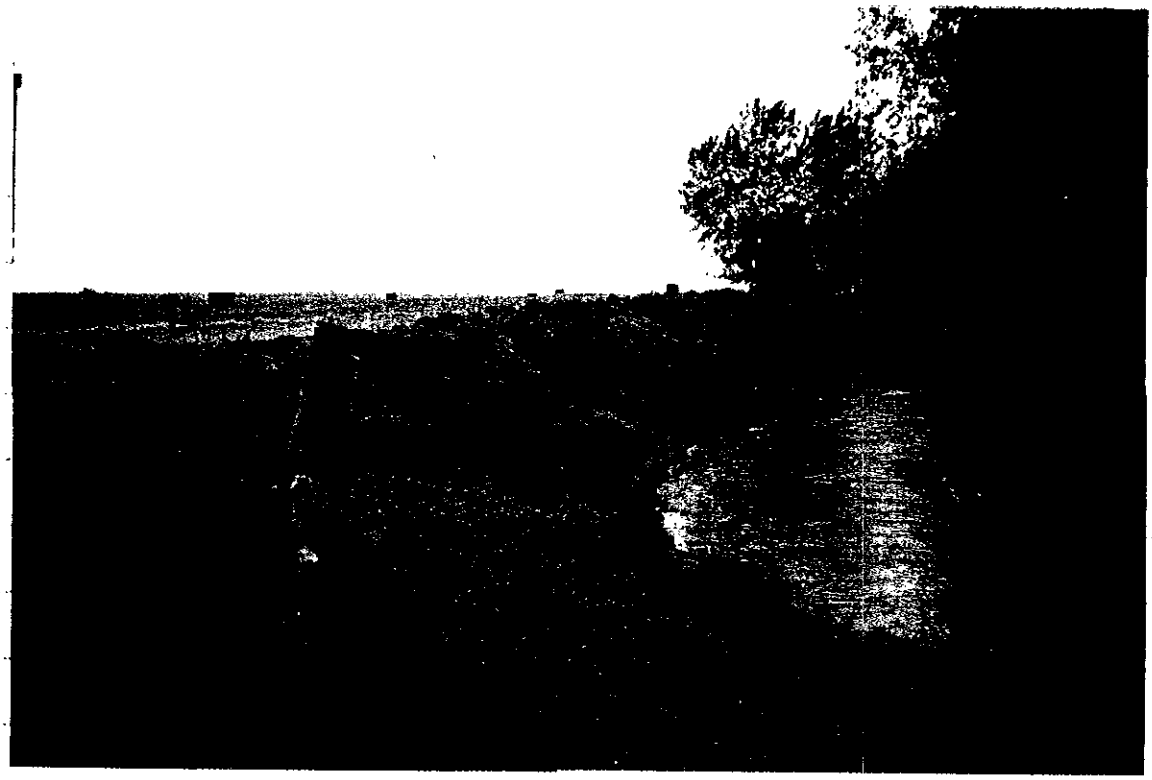
Name	Location	Phone	Rainfall
Fred Sarchet	9061 Weld Cty Rd 41	303-536-4671	7.55 inches
Bill Sarchet	8627 Weld Cty Rd 41	303-536-4830	6 + inches
Dale Feit	17977 Weld Cty Rd 20	303-536-4802	8 + inches
Rusty Riley	6261 Weld Cty Rd 41	303-536-4825	0.75 inches
Tex Turley	1/2 mile east of Rd 33 on Rd 20	303-	7 + inches
James Michael	10395 Weld Cty Rd 39	303-536-4363	
Orval Thomason	20529 Weld Cty Rd 22	303-536-4663	8 + inches
Andy Haller	20520 Weld Cty Rd 20	303-536-4897	8 + inches

Photographs Taken During Field Trip

June 4, 199
Southern Weld County, NW of Hudson

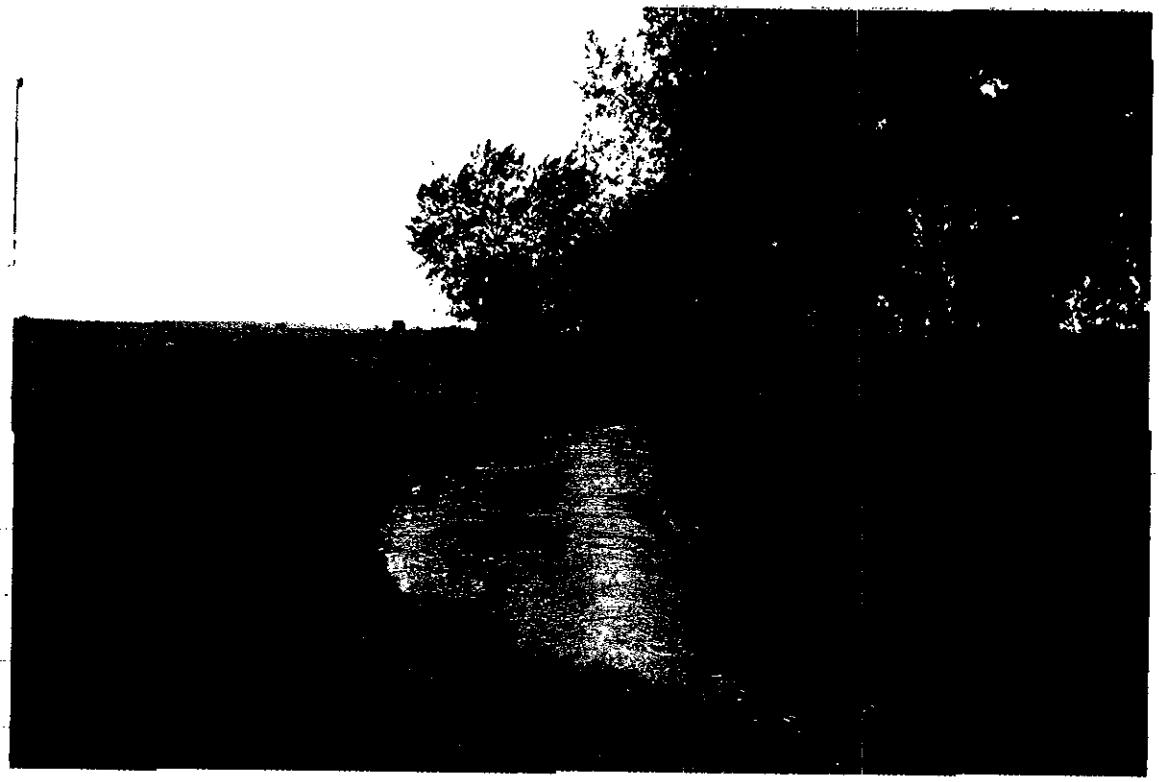
Culvert under Cnty Road 41
Good example of siltation that limits conveyance capacity of Culvert.

Beebe Seep Canal

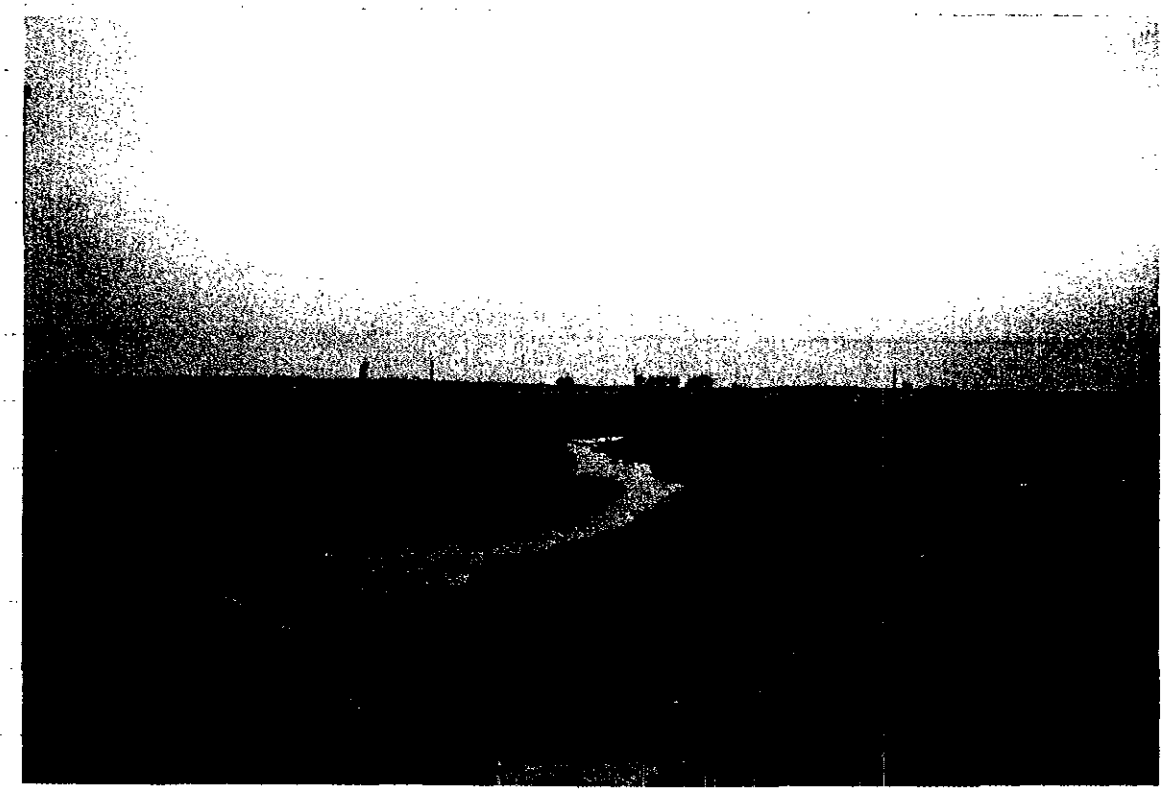


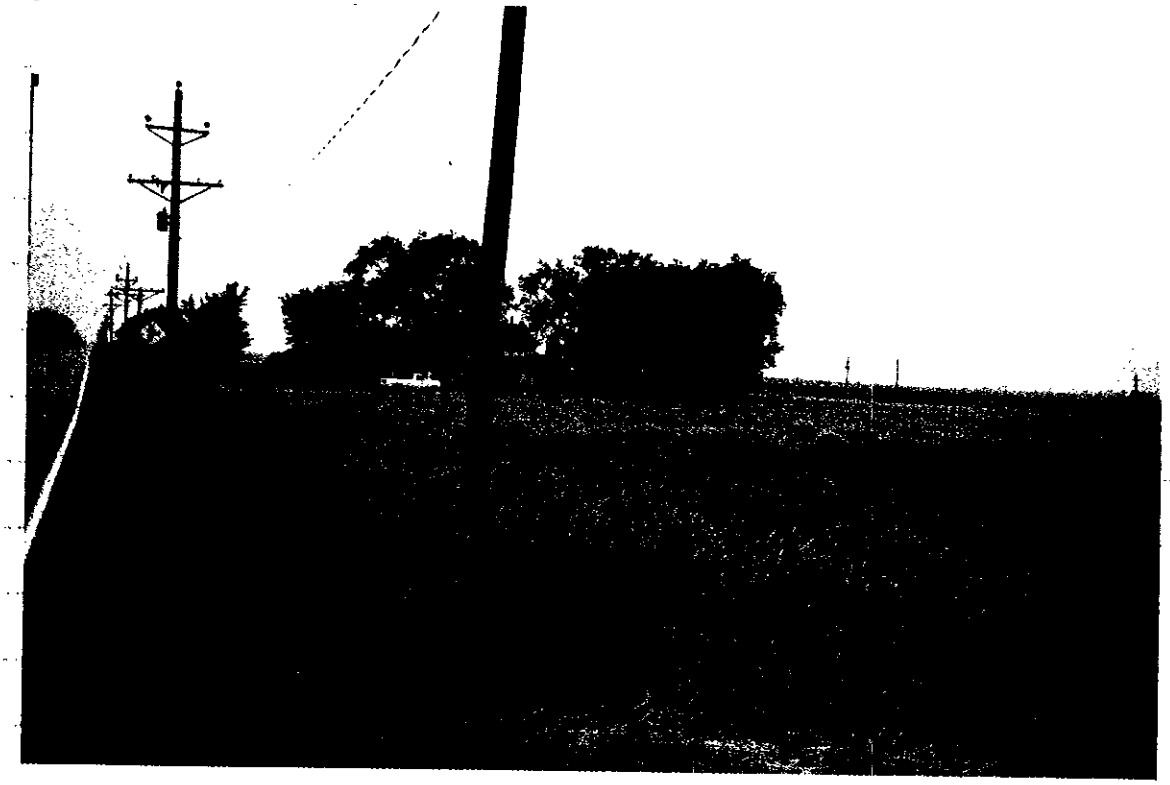
According to the local residents, all Flood waters were contained by this canal. flowed into and

Beebe Seep Canal

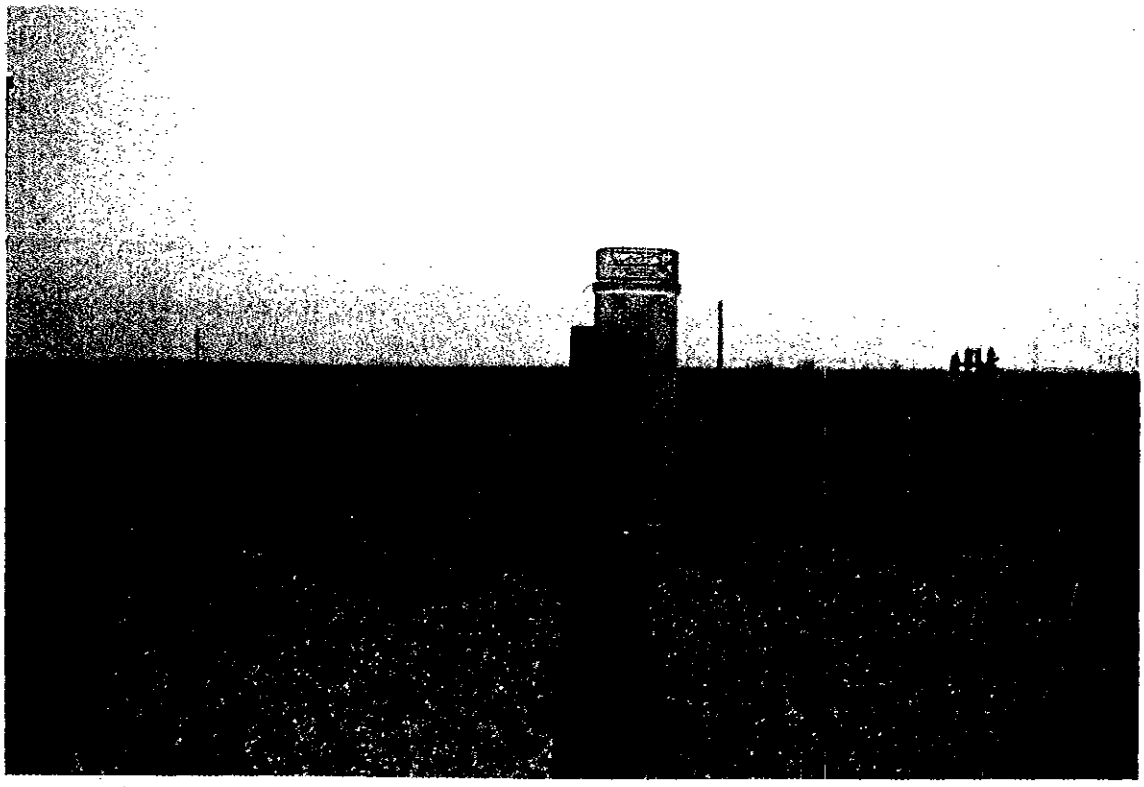


Beebe Seep Canal

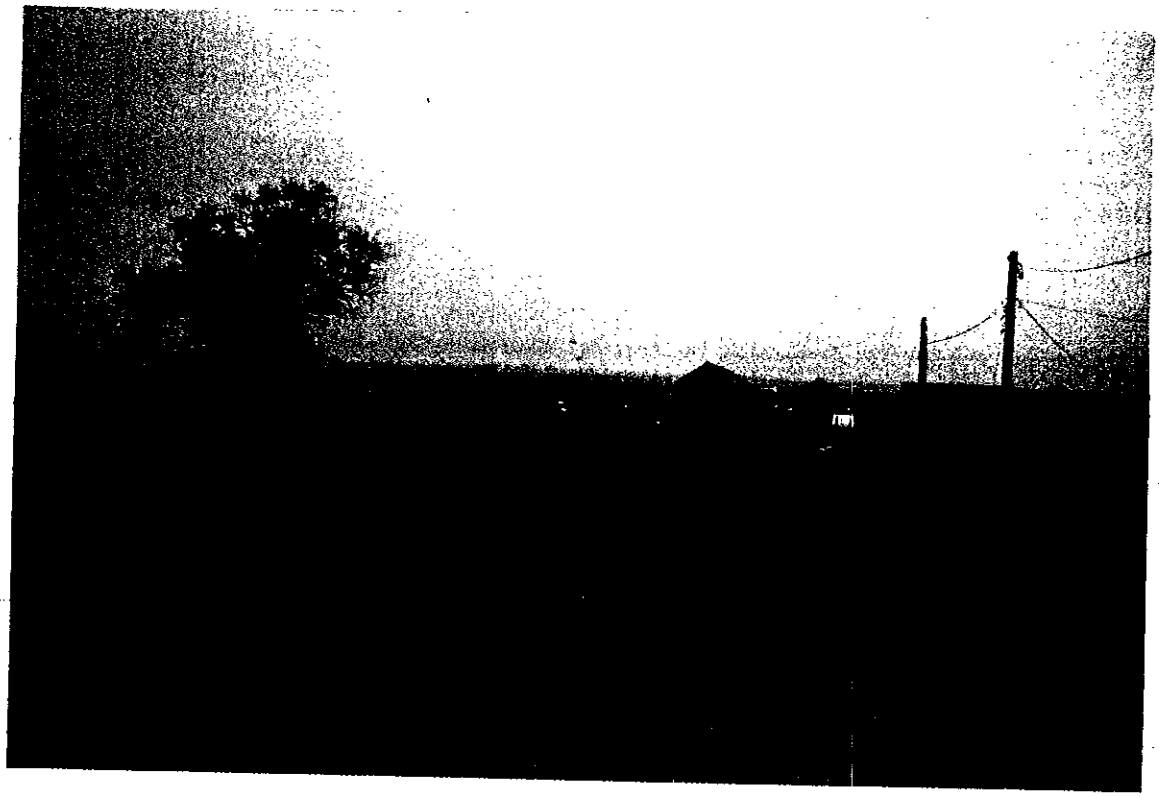




Fred's house looking South on CR 41.
This whole area was inundated.

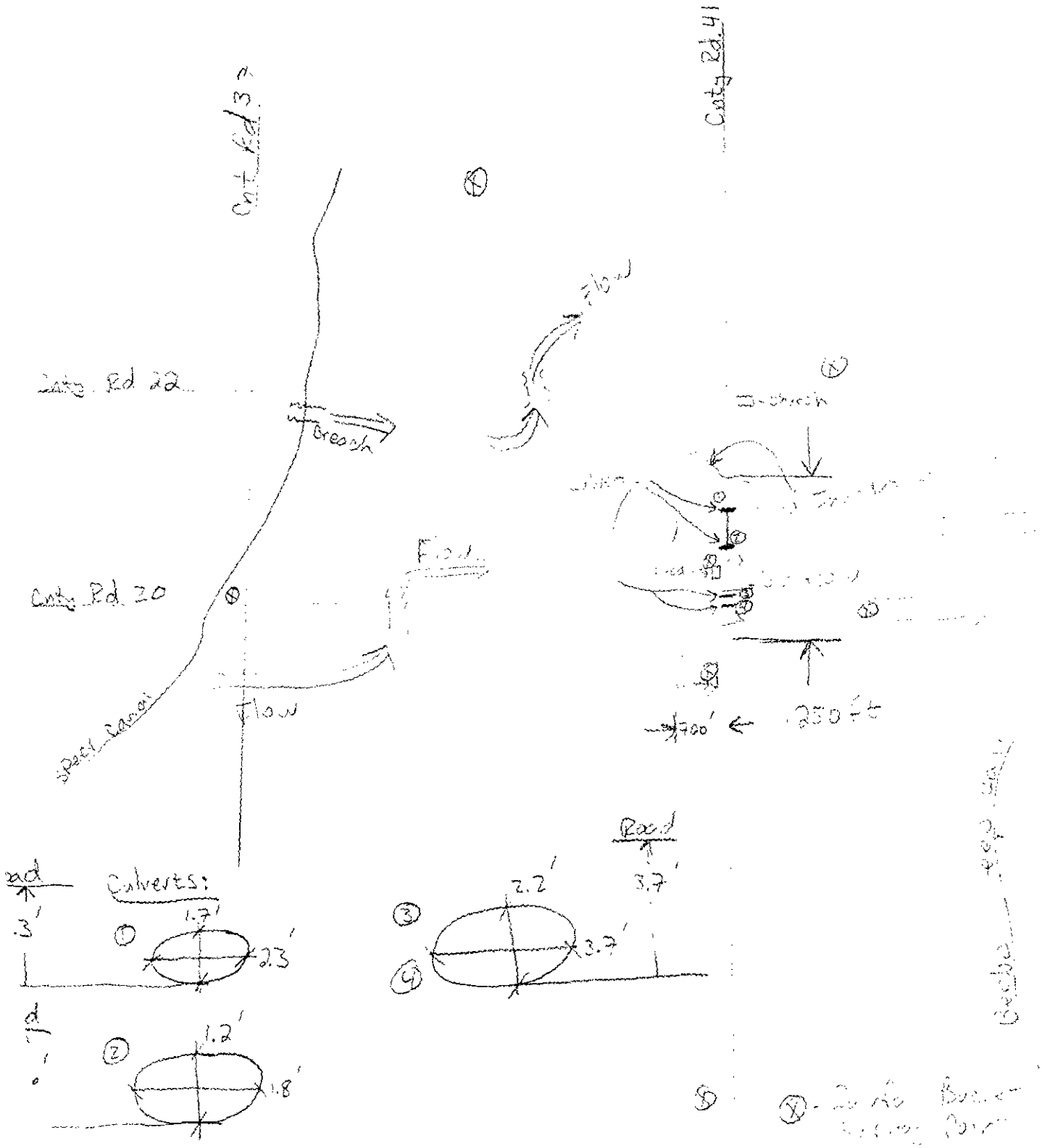


Fred's Rain gauge (MSW issue)



Fred's sheds just north of his house on CR 41. This whole area was inundated.

Schematic of Areas Inundated by Flood Water on July 18, 1997



Weld County - Sheep Draw, N.W. of Greeley, Colorado-Nebraska Border
Precipitation Frequency Analysis

Purpose:

The purpose of this calculation is to determine the storm precipitation totals for storm durations of 6-hr, 12-hr, and 24-hr, for a return interval of 100-yr. The precipitation quantities represent annual amounts (the seasonal precipitation quantities, May-October are not available for Weld County).

Methodology:

The information presented in this calculation is developed from the NOAA, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Vol III - Colorado, 1973. Using the figures in the NOAA Atlas, the following information is obtained.

100-yr, 6-hr Precipitation Quantities

Location	Precipitation (inches)
Sheep Draw, W. Greeley	3.3
12 miles North West of Greeley	3.3
Colo-Neb Border, 21 miles North of New Raymer	3.3

100-yr, 24-hr Precipitation Quantities

Location	Precipitation (inches)
Sheep Draw, W. Greeley	4.0
12 miles North West of Greeley	3.8
Colo-Neb Border, 21 miles North of New Raymer	4.0

Using procedures outlined in the NOAA, Atlas 2 (page 16, Figure 17), the 12-hr precipitation quantities were estimated from the 6-hr and 24-hr values and are shown below.

100-yr, 12-hr Precipitation Quantities

Location	Precipitation (inches)
Sheep Draw, W. Greeley	3.7
12 miles North West of Greeley	3.6
Colo-Neb Border, 21 miles North of New Raymer	3.7

Approximate Flood Hydrograph for Sheep Draw

Purpose:

The purpose of this calculation file is to calculate an approximate flood hydrograph for Sheep Draw for the June 14, 1997 event. The flood hydrograph will be used in documentation of eastern Colorado flooding for the Colorado Water Conservation Board (CWCB).

Method:

Sheep Draw empties into the Cache La Poudre River between the Timnath, CO and Greeley, CO gauges. Therefore, the hydrograph representing the flood on Sheep Draw can be estimated by taking the difference in hydrographs at these two locations.

Hourly discharge measurements for June 12 through 16 for the Cache La Poudre River at the Timnath, CO gauge were obtained from Rick Neam of the USGS in Lakewood. Discharge measurements at the Greeley, CO gauge were obtained from Bob Cooper of the State Division of Water Resources in Greeley, CO. In addition, head-gate flows for the major diversions along the Cache La Poudre River between Timnath and Greeley were obtained from Shawn Hoff who is the Poudre River Water Commissioner. Fossil Creek is also tributary to the Cache La Poudre River between these two gauges.

A hydrograph was made for the Timnath and Greeley gauges based on data from June 12 through 16. According to Shawn Hoff, the travel time between Timnath and Greeley along the Cache La Poudre River is about 10 yours, depending of discharge. Therefore, the discharge data at Timnath was shifted forward by 10 hours to account for the travel time down the river. The resulting discharge values were then subtracted from those at the Greeley gauge to generate an approximate flood hydrograph for Sheep Draw.

The diversion rates at each of the head gates between Timnath and Greeley were summed for the period of the hydrograph, as were the return flows. The average difference between the diversion rate and return flow was added to the approximate hydrograph of Sheep Draw to account for river water in canals and ditches. The average diversion rate was small (~46 cfs), however. This is probably because most ditches were turned off or had only minor flows because there had been significant rain for several days prior to the June 14th flooding event. Flows from Fossil Creek (~250 cfs, per George Sievers) were subtracted from the approximate flood hydrograph of Sheep Draw.

All calculations were done in an Excel file.

An additional estimate of the Sheep Draw flood hydrograph was made by only using the Greeley Gauge data. The baseflow at the Greeley Gauge for June 14 through 16 was estimated to be appoximately 2,100 cfs. This baseflow amount was then subtracted from the actual discharge measurements at the Greeley Gauge to generate an approximate flood hydrograph. These calculations were also done in an Excel file.

Results/Conclusion:

The raw data, time shifted data, and hydrographs are included in this calculation file. In addition, the Excel file is archived in F:\home\wje\cwcb\hydrogph.xls. The peak discharge based on this approximate hydrograph for Sheep Draw was approximately 1,300 cfs for the June 14th, 1997 event.

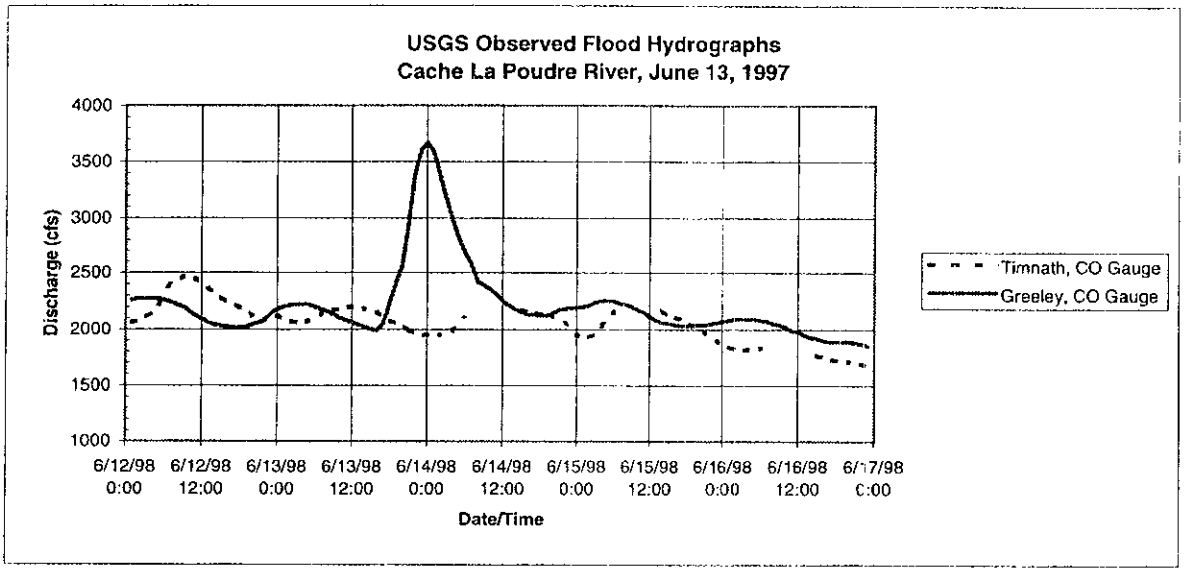
The peak discharge for the June 14, 1997 flood event on Sheep Draw calculated with this method is less than half of what was estimated by the CWCB based on slope-area discharge estimates and bridge capacities. A possible explaination for this difference was offered by Shawn Hoff. According to Shawn, the Greeley No. 3 canal picks up much of the flow that comes down Sheep Draw because Sheep Draw does not have a large defined channel for much of its length. A large event of several thousand cfs could not be contained in the Sheep Draw channel and would spill into the Greeley No. 3 canal. But the capacity of the Greeley No. 3 is not large enough to hold that much water either, so it overtopped and a large portion of the Sheep Draw flood traveled about 1/4 mile over pasture land before reaching the Cache La Poudre River. This overland flow coupled with flood attenuation due to backwaters behind bridges and along the river could explain why the flood discharge at the Greeley gauge was much less than the flood discharge estimated for Sheep Draw by the CWCB.

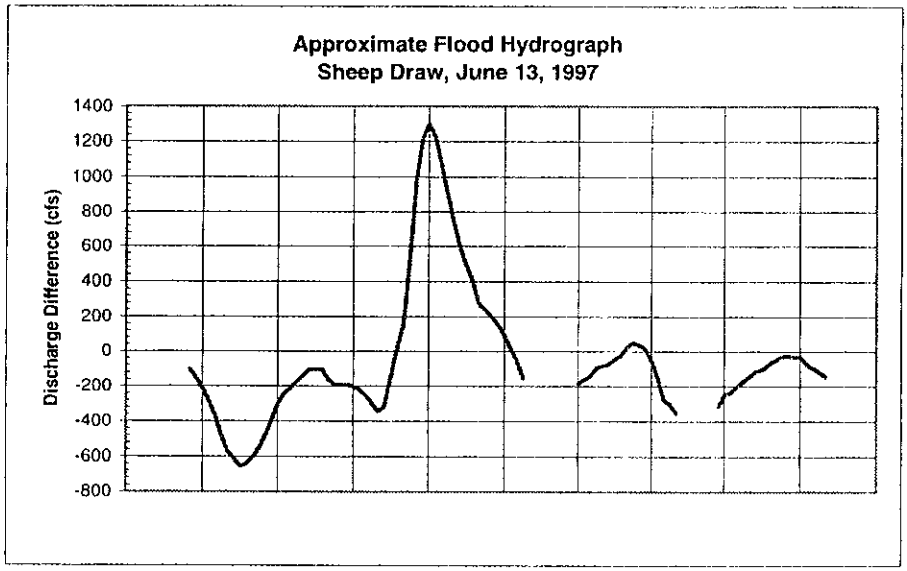
The peak discharge using only the Greeley Gauge data was a little less than 1,600 cfs. This estimate is considered to be more accurate because it involves less variables. It is simply the difference between observed discharges from June 12 through 16 and the calculated base-flow for this period of time. In addition, it accounts for any gains or loses along the river due to interactions with ground water.

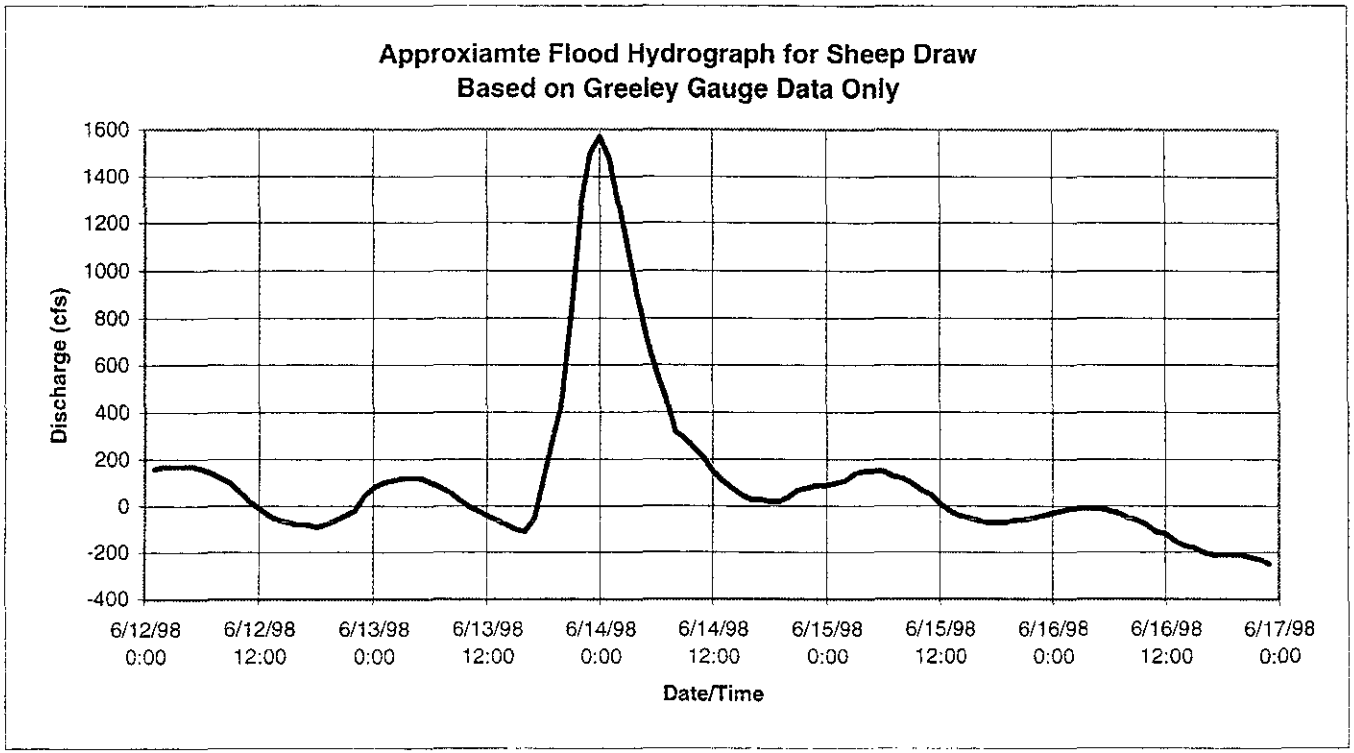
The base-flow at both the Timnath and Greeley gauges was about 2,100 cfs from June 12 through 16. However, it is also known that approximately 250 cfs is added to the river from Fossil Creek. If all other surface water sources and sinks are accounted for, then the reason that the Greeley gauge doesn't register 250 cfs more than Timnath could be that the Cache La Poudre River loses water to the ground water system over that reach of river.

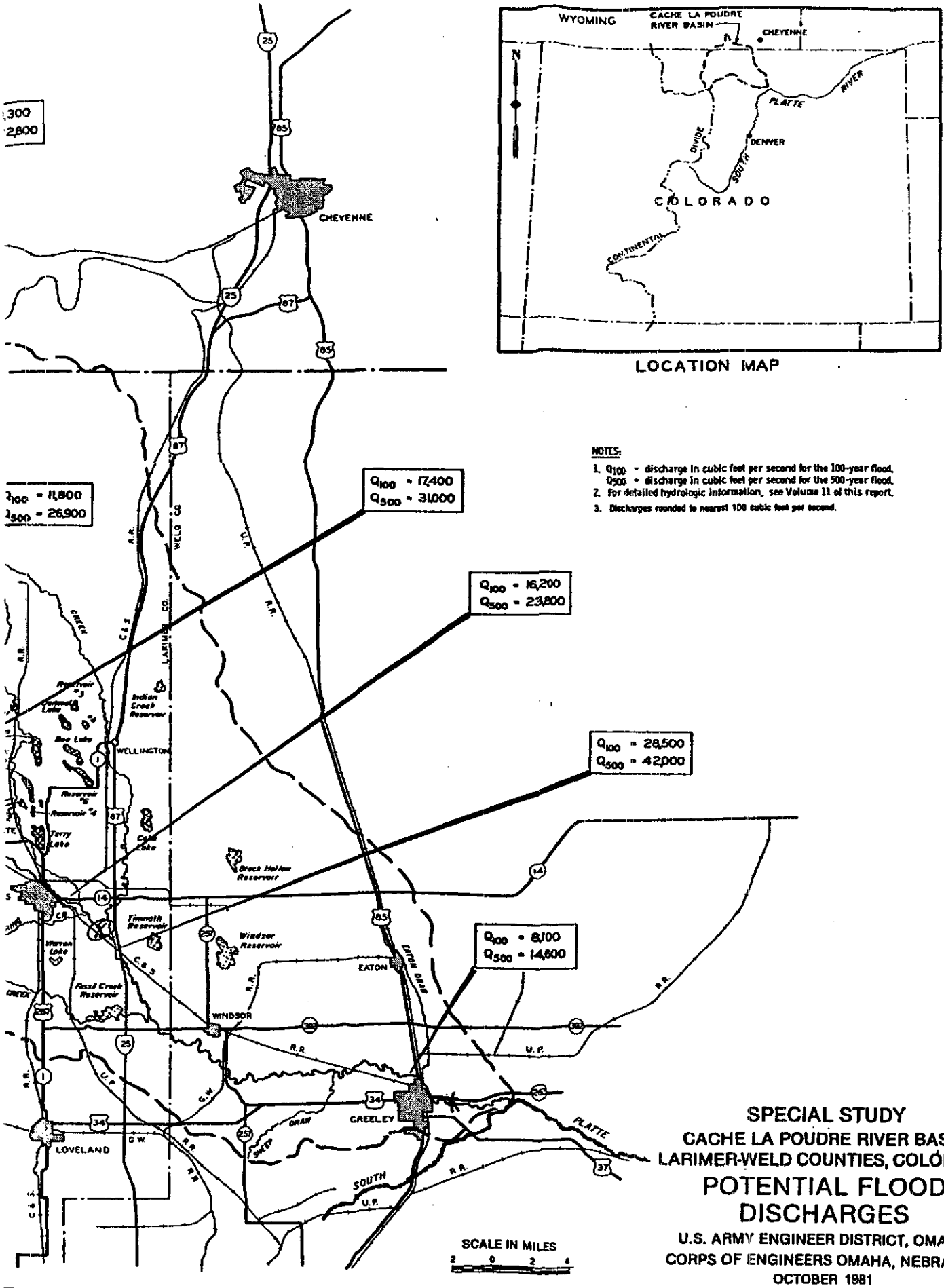
Contacts:

Bob Cooper, State Division of Water Resources, Greeley, CO	(970) 352-8712
George Sievers, State Division of Water Resources, Greeley, CO	(970) 352-8712
Rick Neam, USGS, Lakewood, CO	(303) 236-9404 ext. 20
Shawn Hoff, Poudre River Water Commissioner, Ft. Collins, CO	(970) 226-3303


USGS Observed Flood Hydrographs
Cache La Poudre River, June 13, 1997
Discharge (cfs)
4000
3500
3000
2500
2000
1500
1000
6/12/98 0:00
6/12/98 12:00
6/13/98 0:00
6/13/98 12:00
6/14/98 0:00
6/14/98 12:00
6/15/98 0:00
6/15/98 12:00
6/16/98 0:00
6/16/98 12:00
Date/Time
Timnath, CO Gauge
Greeley, CO Gauge


Approximate Flood Hydrograph
Sheep Draw, June 13, 1997
Discharge Difference (cfs)
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800


Approxiamte Flood Hydrograph for Sheep Draw
Based on Greeley Gauge Data Only
Discharge (cfs)
1600
1400
1200
1000
800
600
400
200
0
-200
-400
6/12/98 0:00
6/12/98 12:00
6/13/98 0:00
6/13/98 12:00
6/14/98 0:00
6/14/98 12:00
6/15/98 0:00
6/15/98 12:00
6/16/98 0:00
6/16/98 12:00
6/17/98 0:00
Date/Time



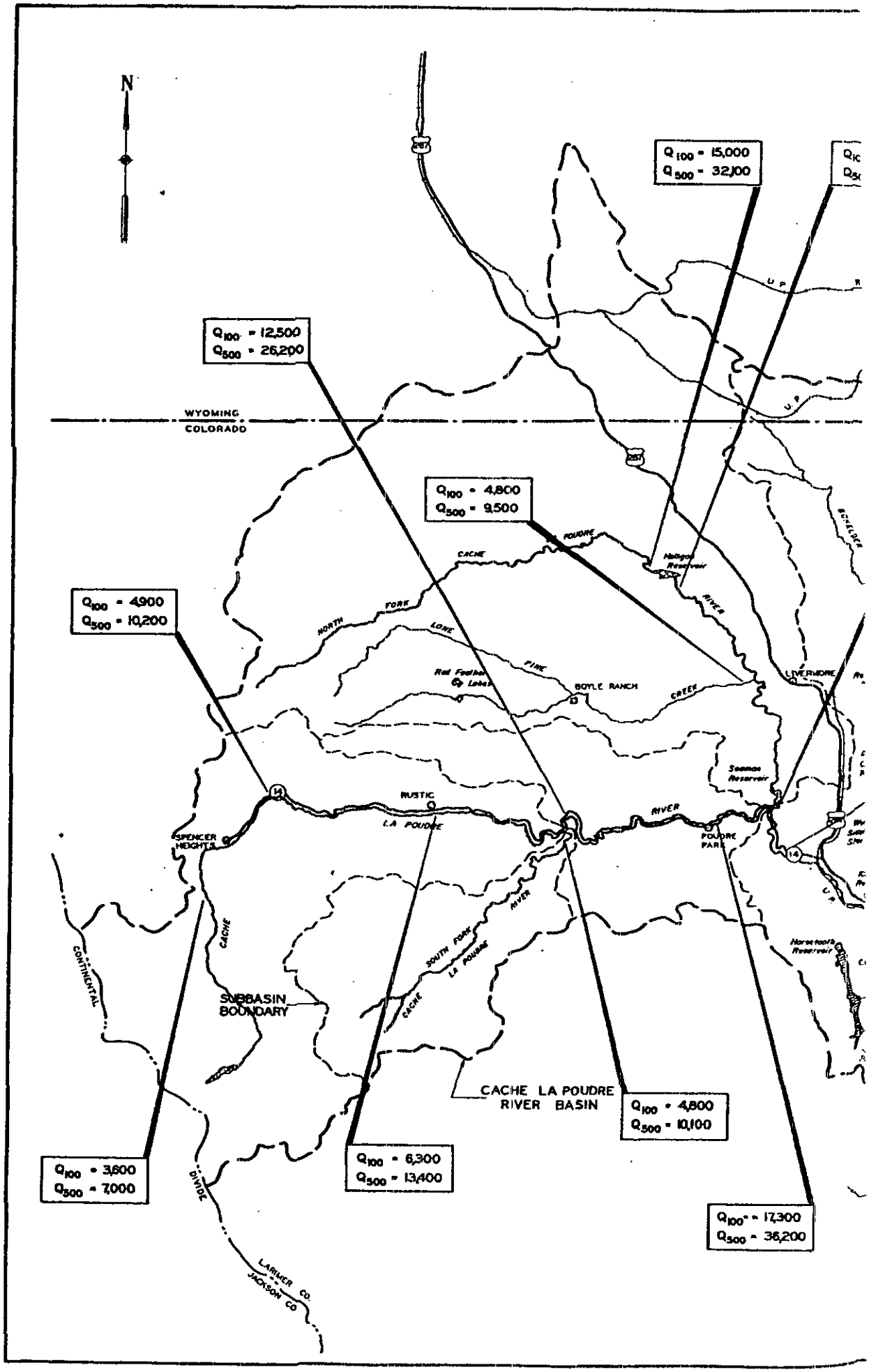
LOCATION MAP

NOTES:

1. Q_{100} = discharge in cubic feet per second for the 100-year flood, Q_{500} = discharge in cubic feet per second for the 500-year flood.
2. For detailed hydrologic information, see Volume II of this report.
3. Discharges rounded to nearest 100 cubic feet per second.

SPECIAL STUDY
CACHE LA POUDRE RIVER BASIN
LARIMER-WELD COUNTIES, COLORADO
POTENTIAL FLOOD DISCHARGES

U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
OCTOBER 1981


N
Q_{100} = 15,000
Q_{500} = 32,100
Q_{100} = 12,500
Q_{500} = 26,200
WYOMING
COLORADO
Q_{100} = 4,800
Q_{500} = 9,500
Q_{100} = 4900
Q_{500} = 10,200
CACHE
POUDRE
RIVER
NORTH
FORK
LONE
PINE
CREEK
BOYLE RANCH
LIVERMORE
RUSTIC
LA POUDRE
RIVER
SPENCER HEIGHTS
POUDRE PARK
CACHE
SOUTH FORK
LA POUDRE
RIVER
CONTINENTAL
SUBBASIN BOUNDARY
CACHE LA POUDRE RIVER BASIN
Q_{100} = 4,800
Q_{500} = 10,100
Q_{100} = 3,600
Q_{500} = 7,000
Q_{100} = 6,300
Q_{500} = 13,400
Q_{100} = 17,300
Q_{500} = 36,200
DIVIDE
LARIMER CO.
JACKSON CO.

Cache La Poudre River Hydrographs, June 1997

Date Time	Greeley Discharge (cfs)	Timnath Discharge (cfs)	Diffference (cfs)
6/12/98 1:00	2260	2060	200
6/12/98 2:00	2270	2070	200
6/12/98 3:00	2270	2100	170
6/12/98 4:00	2270	2140	130
6/12/98 5:00	2270	2200	70
6/12/98 6:00	2260	2310	-50
6/12/98 7:00	2240	2390	-150
6/12/98 8:00	2220	2430	-210
6/12/98 9:00	2200	2460	-260
6/12/98 10:00	2160	2460	-300
6/12/98 11:00	2120	2440	-320
6/12/98 12:00	2090	2410	-320
6/12/98 13:00	2060	2360	-300
6/12/98 14:00	2040	2330	-290
6/12/98 15:00	2030	2280	-250
6/12/98 16:00	2020	2240	-220
6/12/98 17:00	2020	2220	-200
6/12/98 18:00	2010	2190	-180
6/12/98 19:00	2020	2160	-140
6/12/98 20:00	2040	2120	-80
6/12/98 21:00	2060	2100	-40
6/12/98 22:00	2080	2080	0
6/12/98 23:00	2140	2120	20
6/13/98 0:00	2180	2120	60
6/13/98 1:00	2200	2090	110
6/13/98 2:00	2210	2070	140
6/13/98 3:00	2220	2060	160
6/13/98 4:00	2220	2060	160
6/13/98 5:00	2220	2070	150
6/13/98 6:00	2200	2100	100
6/13/98 7:00	2180	2130	50
6/13/98 8:00	2160	2160	0
6/13/98 9:00	2130	2170	-40
6/13/98 10:00	2100	2180	-80
6/13/98 11:00	2080	2200	-120
6/13/98 12:00	2060	2200	-140

Irrigation Canals/Ditches				
Structure	Date	Diverted (cfs)	Returned (cfs)	Total (cfs)
Ogilvy Ditch	12-Jun	7.3	65.7	-58.4
	13-Jun	42.3	34.7	7.6
	14-Jun	66.0	0.0	66.0
	15-Jun	65.0	--	--
	16-Jun	63.0	--	--
Canal 3	12-Jun	23.8	26.2	-2.4
	13-Jun	22.4	26.6	-4.2
	14-Jun	40.5	7.5	32.9
	15-Jun	39.4	7.6	31.8
	16-Jun	36.1	9.9	26.1
B H Eaton Ditch	12-Jun	--	16.9	--
	13-Jun	--	12.4	--
	14-Jun	--	13.2	--
	15-Jun	--	13.5	--
	16-Jun	--	11.4	--
Whitney Ditch	12-Jun	10.0	32.0	-22.0
	13-Jun	3.0	9.2	-6.2
	14-Jun	0.0	0.0	0.0
	15-Jun	--	--	--
	16-Jun	--	--	--
New Cache Ditch	12-Jun	21.0	--	--
	13-Jun	20.0	--	--
	14-Jun	20.0	--	--
	15-Jun	20.0	--	--
	16-Jun	19.0	--	--
TOTAL AVERAGE		103.7	57.4	46.4

6/13/98 13:00	2040	2200	-160						
6/13/98 14:00	2020	2180	-160						
6/13/98 15:00	2000	2170	-170						
6/13/98 16:00	1990	2150	-160						
6/13/98 17:00	2050	2110	-60						
6/13/98 18:00	2230	2080	150						
6/13/98 19:00	2400	2050	350						
6/13/98 20:00	2560	2030	530						
6/13/98 21:00	2940	1990	950						
6/13/98 22:00	3380	1970	1410						
6/13/98 23:00	3600	1950	1650						
6/14/98 0:00	3670	1950	1720						
6/14/98 1:00	3580	1950	1630						
6/14/98 2:00	3380	1950	1430						
6/14/98 3:00	3180	1960	1220						
6/14/98 4:00	2990	1990	1000						
6/14/98 5:00	2820	2030	790						
6/14/98 6:00	2680	2100	580						
6/14/98 7:00	2570								
6/14/98 8:00	2420								
6/14/98 9:00	2390								
6/14/98 10:00	2350								
6/14/98 11:00	2310								
6/14/98 12:00	2250								
6/14/98 13:00	2210								
6/14/98 14:00	2180								
6/14/98 15:00	2150	2170	-20						
6/14/98 16:00	2130	2160	-30						
6/14/98 17:00	2130	2150	-20						
6/14/98 18:00	2120	2130	-10						
6/14/98 19:00	2120	2130	-10						
6/14/98 20:00	2140	2120	20						
6/14/98 21:00	2170	2090	80						
6/14/98 22:00	2180	2050	130						
6/14/98 23:00	2190	1990	200						
6/15/98 0:00	2190	1950	240						
6/15/98 1:00	2200	1930	270						
6/15/98 2:00	2210	1930	280						
6/15/98 3:00	2240	1960	280						
6/15/98 4:00	2250	2030	220						
6/15/98 5:00	2250	2130	120						
6/15/98 6:00	2250	2150	100						

6/15/98 7:00	2230	2190	40						
6/15/98 8:00	2220								
6/15/98 9:00	2200								
6/15/98 10:00	2170								
6/15/98 11:00	2150								
6/15/98 12:00	2110								
6/15/98 13:00	2080								
6/15/98 14:00	2060	2170	-110						
6/15/98 15:00	2050	2120	-70						
6/15/98 16:00	2040	2110	-70						
6/15/98 17:00	2030	2090	-60						
6/15/98 18:00	2030	2060	-30						
6/15/98 19:00	2030	2030	0						
6/15/98 20:00	2040	2000	40						
6/15/98 21:00	2040	1980	60						
6/15/98 22:00	2050	1940	110						
6/15/98 23:00	2060	1900	160						
6/16/98 0:00	2070	1870	200						
6/16/98 1:00	2080	1840	240						
6/16/98 2:00	2090	1820	270						
6/16/98 3:00	2090	1810	280						
6/16/98 4:00	2090	1820	270						
6/16/98 5:00	2090	1820	270						
6/16/98 6:00	2080	1830	250						
6/16/98 7:00	2070	1840	230						
6/16/98 8:00	2050								
6/16/98 9:00	2040								
6/16/98 10:00	2020								
6/16/98 11:00	1990								
6/16/98 12:00	1980								
6/16/98 13:00	1950								
6/16/98 14:00	1930								
6/16/98 15:00	1920	1770	150						
6/16/98 16:00	1900	1750	150						
6/16/98 17:00	1890	1730	160						
6/16/98 18:00	1890	1720	170						
6/16/98 19:00	1890	1730	160						
6/16/98 20:00	1890	1710	180						
6/16/98 21:00	1880	1700	180						
6/16/98 22:00	1870	1690	180						
6/16/98 23:00	1850	1670	180						

Cache La Poudre River Hydrographs, June 1997						
Date Time	Greeley Discharge (cfs)	Timnath Discharge (cfs)	Diffference (cfs)	Ditches (cfs)	Fossil Creek (cfs)	Net Diffference (cfs)
6/12/98 1:00	2260			46	250	
6/12/98 2:00	2270			46	250	
6/12/98 3:00	2270			46	250	
6/12/98 4:00	2270			46	250	
6/12/98 5:00	2270			46	250	
6/12/98 6:00	2260			46	250	
6/12/98 7:00	2240			46	250	
6/12/98 8:00	2220			46	250	
6/12/98 9:00	2200			46	250	
6/12/98 10:00	2160	2060	100	46	250	-104
6/12/98 11:00	2120	2070	50	46	250	-154
6/12/98 12:00	2090	2100	-10	46	250	-214
6/12/98 13:00	2060	2140	-80	46	250	-284
6/12/98 14:00	2040	2200	-160	46	250	-364
6/12/98 15:00	2030	2310	-280	46	250	-484
6/12/98 16:00	2020	2390	-370	46	250	-574
6/12/98 17:00	2020	2430	-410	46	250	-614
6/12/98 18:00	2010	2460	-450	46	250	-654
6/12/98 19:00	2020	2460	-440	46	250	-644
6/12/98 20:00	2040	2440	-400	46	250	-604
6/12/98 21:00	2060	2410	-350	46	250	-554
6/12/98 22:00	2080	2360	-280	46	250	-484
6/12/98 23:00	2140	2330	-190	46	250	-394
6/13/98 0:00	2180	2280	-100	46	250	-304
6/13/98 1:00	2200	2240	-40	46	250	-244
6/13/98 2:00	2210	2220	-10	46	250	-214
6/13/98 3:00	2220	2190	30	46	250	-174
6/13/98 4:00	2220	2160	60	46	250	-144
6/13/98 5:00	2220	2120	100	46	250	-104
6/13/98 6:00	2200	2100	100	46	250	-104
6/13/98 7:00	2180	2080	100	46	250	-104
6/13/98 8:00	2160	2120	40	46	250	-164
6/13/98 9:00	2130	2120	10	46	250	-194
6/13/98 10:00	2100	2090	10	46	250	-194
6/13/98 11:00	2080	2070	10	46	250	-194
6/13/98 12:00	2060	2060	0	46	250	-204
6/13/98 13:00	2040	2060	-20	46	250	-224
6/13/98 14:00	2020	2070	-50	46	250	-254
6/13/98 15:00	2000	2100	-100	46	250	-304
6/13/98 16:00	1990	2130	-140	46	250	-344
6/13/98 17:00	2050	2160	-110	46	250	-314
6/13/98 18:00	2230	2170	60	46	250	-144
6/13/98 19:00	2400	2180	220	46	250	16
6/13/98 20:00	2560		360	46	250	156
6/13/98 21:00	2940		740	46	250	536
6/13/98 22:00	3380		1180	46	250	976
6/13/98 23:00	3600	2180	1420	46	250	1216

Phase Shifted Data

6/14/98 0:00		2170	1500	46	250	1296
6/14/98 1:00	3580	2150	1430	46	250	1226
6/14/98 2:00	3380	2110	1270	46	250	1066
6/14/98 3:00	3180	2080	1100	46	250	896
6/14/98 4:00	2990	2050	940	46	250	736
6/14/98 5:00	2820	2030	790	46	250	586
6/14/98 6:00	2680	1990	690	46	250	486
6/14/98 7:00	2570	1970	600	46	250	396
6/14/98 8:00	2420	1950	470	46	250	266
6/14/98 9:00	2390	1950	440	46	250	236
6/14/98 10:00	2350	1950	400	46	250	196
6/14/98 11:00	2310	1950	360	46	250	156
6/14/98 12:00	2250	1960	290	46	250	86
6/14/98 13:00	2210	1990	220	46	250	16
6/14/98 14:00	2180	2030	150	46	250	-54
6/14/98 15:00	2150	2100	50	46	250	-154
6/14/98 16:00	2130			46	250	
6/14/98 17:00	2130			46	250	
6/14/98 18:00	2120			46	250	
6/14/98 19:00	2120			46	250	
6/14/98 20:00	2140			46	250	
6/14/98 21:00	2170			46	250	
6/14/98 22:00	2180			46	250	
6/14/98 23:00	2190			46	250	
6/15/98 0:00	2190	2170	20	46	250	-184
6/15/98 1:00	2200	2160	40	46	250	-164
6/15/98 2:00	2210	2150	60	46	250	-144
6/15/98 3:00	2240	2130	110	46	250	-94
6/15/98 4:00	2250	2130	120	46	250	-84
6/15/98 5:00	2250	2120	130	46	250	-74
6/15/98 6:00	2250	2090	160	46	250	-44
6/15/98 7:00	2230	2050	180	46	250	-24
6/15/98 8:00	2220	1990	230	46	250	26
6/15/98 9:00	2200	1950	250	46	250	46
6/15/98 10:00	2170	1930	240	46	250	36
6/15/98 11:00	2150	1930	220	46	250	16
6/15/98 12:00	2110	1960	150	46	250	-54
6/15/98 13:00	2080	2030	50	46	250	-154
6/15/98 14:00	2060	2130	-70	46	250	-274
6/15/98 15:00	2050	2150	-100	46	250	-304
6/15/98 16:00	2040	2190	-150	46	250	-354
6/15/98 17:00	2030			46	250	
6/15/98 18:00	2030			46	250	
6/15/98 19:00	2030			46	250	
6/15/98 20:00	2040			46	250	
6/15/98 21:00	2040			46	250	
6/15/98 22:00	2050			46	250	
6/15/98 23:00	2060	2170	-110	46	250	-314
6/16/98 0:00	2070	2120	-50	46	250	-254
6/16/98 1:00	2080	2110	-30	46	250	-234
6/16/98 2:00	2090	2090	0	46	250	-204
6/16/98 3:00	2090	2060	30	46	250	-174

Phase Shifted Data

6/16/98 4:00	2090	2030	60	46	250	-144
6/16/98 5:00	2090	2000	90	46	250	-114
6/16/98 6:00	2080	1980	100	46	250	-104
6/16/98 7:00	2070	1940	130	46	250	-74
6/16/98 8:00	2050	1900	150	46	250	-54
6/16/98 9:00	2040	1870	170	46	250	-34
6/16/98 10:00	2020	1840	180	46	250	-24
6/16/98 11:00	1990	1820	170	46	250	-34
6/16/98 12:00	1980	1810	170	46	250	-34
6/16/98 13:00	1950	1820	130	46	250	-74
6/16/98 14:00	1930	1820	110	46	250	-94
6/16/98 15:00	1920	1830	90	46	250	-114
6/16/98 16:00	1900	1840	60	46	250	-144
6/16/98 17:00	1890			46	250	
6/16/98 18:00	1890			46	250	
6/16/98 19:00	1890			46	250	
6/16/98 20:00	1890			46	250	
6/16/98 21:00	1880			46	250	
6/16/98 22:00	1870			46	250	
6/16/98 23:00	1850			46	250	
		1750				
		1730				
		1720				
		1730				
		1710				
		1700				
		1690				
		1670				

Data (Greeley only)

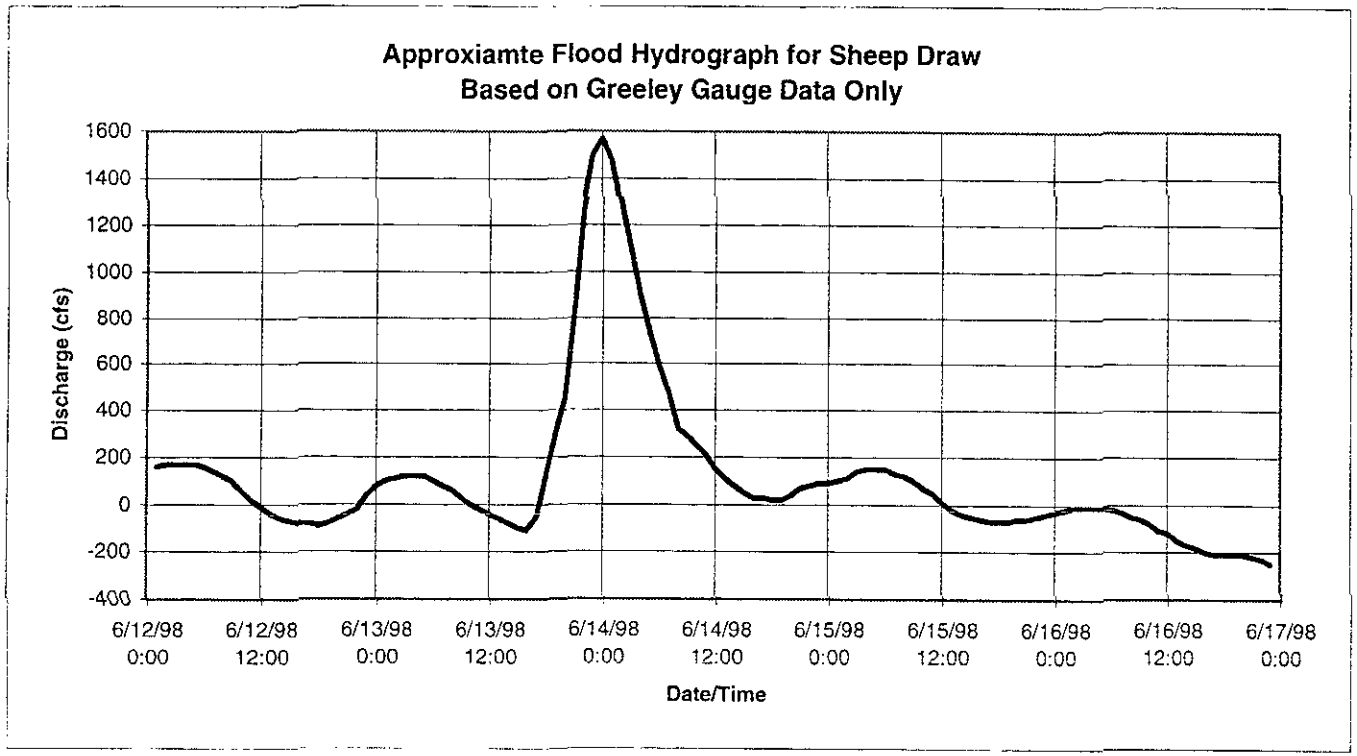
Date Time	Greeley Discharge (cfs)	Minus Baseflow (cfs)
6/12/98 1:00	2260	160
6/12/98 2:00	2270	170
6/12/98 3:00	2270	170
6/12/98 4:00	2270	170
6/12/98 5:00	2270	170
6/12/98 6:00	2260	160
6/12/98 7:00	2240	140
6/12/98 8:00	2220	120
6/12/98 9:00	2200	100
6/12/98 10:00	2160	60
6/12/98 11:00	2120	20
6/12/98 12:00	2090	-10
6/12/98 13:00	2060	-40
6/12/98 14:00	2040	-60
6/12/98 15:00	2030	-70
6/12/98 16:00	2020	-80
6/12/98 17:00	2020	-80
6/12/98 18:00	2010	-90
6/12/98 19:00	2020	-80
6/12/98 20:00	2040	-60
6/12/98 21:00	2060	-40
6/12/98 22:00	2080	-20
6/12/98 23:00	2140	40
6/13/98 0:00	2180	80
6/13/98 1:00	2200	100
6/13/98 2:00	2210	110
6/13/98 3:00	2220	120
6/13/98 4:00	2220	120
6/13/98 5:00	2220	120
6/13/98 6:00	2200	100
6/13/98 7:00	2180	80
6/13/98 8:00	2160	60
6/13/98 9:00	2130	30
6/13/98 10:00	2100	0
6/13/98 11:00	2080	-20
6/13/98 12:00	2060	-40
6/13/98 13:00	2040	-60
6/13/98 14:00	2020	-80
6/13/98 15:00	2000	-100
6/13/98 16:00	1990	-110
6/13/98 17:00	2050	-50
6/13/98 18:00	2230	130
6/13/98 19:00	2400	300
6/13/98 20:00	2560	460
6/13/98 21:00	2940	840
6/13/98 22:00	3380	1280
6/13/98 23:00	3600	1500
6/14/98 0:00	[redacted]	1570
6/14/98 1:00	3580	1480

Greeley Baseflow ~2,100 cfs

2100

6/14/98 2:00	3380	1280
6/14/98 3:00	3180	1080
6/14/98 4:00	2990	890
6/14/98 5:00	2820	720
6/14/98 6:00	2680	580
6/14/98 7:00	2570	470
6/14/98 8:00	2420	320
6/14/98 9:00	2390	290
6/14/98 10:00	2350	250
6/14/98 11:00	2310	210
6/14/98 12:00	2250	150
6/14/98 13:00	2210	110
6/14/98 14:00	2180	80
6/14/98 15:00	2150	50
6/14/98 16:00	2130	30
6/14/98 17:00	2130	30
6/14/98 18:00	2120	20
6/14/98 19:00	2120	20
6/14/98 20:00	2140	40
6/14/98 21:00	2170	70
6/14/98 22:00	2180	80
6/14/98 23:00	2190	90
6/15/98 0:00	2190	90
6/15/98 1:00	2200	100
6/15/98 2:00	2210	110
6/15/98 3:00	2240	140
6/15/98 4:00	2250	150
6/15/98 5:00	2250	150
6/15/98 6:00	2250	150
6/15/98 7:00	2230	130
6/15/98 8:00	2220	120
6/15/98 9:00	2200	100
6/15/98 10:00	2170	70
6/15/98 11:00	2150	50
6/15/98 12:00	2110	10
6/15/98 13:00	2080	-20
6/15/98 14:00	2060	-40
6/15/98 15:00	2050	-50
6/15/98 16:00	2040	-60
6/15/98 17:00	2030	-70
6/15/98 18:00	2030	-70
6/15/98 19:00	2030	-70
6/15/98 20:00	2040	-60
6/15/98 21:00	2040	-60
6/15/98 22:00	2050	-50
6/15/98 23:00	2060	-40
6/16/98 0:00	2070	-30
6/16/98 1:00	2080	-20
6/16/98 2:00	2090	-10
6/16/98 3:00	2090	-10
6/16/98 4:00	2090	-10
6/16/98 5:00	2090	-10

6/16/98 6:00	2080	-20				
6/16/98 7:00	2070	-30				
6/16/98 8:00	2050	-50				
6/16/98 9:00	2040	-60				
6/16/98 10:00	2020	-80				
6/16/98 11:00	1990	-110				
6/16/98 12:00	1980	-120				
6/16/98 13:00	1950	-150				
6/16/98 14:00	1930	-170				
6/16/98 15:00	1920	-180				
6/16/98 16:00	1900	-200				
6/16/98 17:00	1890	-210				
6/16/98 18:00	1890	-210				
6/16/98 19:00	1890	-210				
6/16/98 20:00	1890	-210				
6/16/98 21:00	1880	-220				
6/16/98 22:00	1870	-230				
6/16/98 23:00	1850	-250				


Approxiamte Flood Hydrograph for Sheep Draw
Based on Greeley Gauge Data Only
Discharge (cfs)
1600
1400
1200
1000
800
600
400
200
0
-200
-400
6/12/98 0:00
6/12/98 12:00
6/13/98 0:00
6/13/98 12:00
6/14/98 0:00
6/14/98 12:00
6/15/98 0:00
6/15/98 12:00
6/16/98 0:00
6/16/98 12:00
6/17/98 0:00
Date/Time

ROY ROMER
Governor

HAROLD (HAL) D. SIMPSON
State Engineer

DIVISION OF WATER RESOURCES

WATER DIVISION 1

Alan D. Berryman
Division Engineer
800 8th Ave.-Room 321 ARIX Bldg.
Greeley, Colorado 80631
~~(303)~~ 352-8712
970

FAX COVER SHEET

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Bill Elliot
970-484-7593

OFFICE: Riverside Technology

FROM: Bob Cooper

TOTAL NUMBER OF PAGES INCLUDING THIS COVER SHEET: 5

DATE: 5-21-98

IF YOU DO NOT RECEIVE ALL OF THE PAGES AS INDICATED OR QUALITY IS UNACCEPTABLE, PLEASE CALL US BACK AS SOON AS POSSIBLE.

Telephone: (303) 659-0579

Fax Number: (303) 659-0579

MESSAGE: Jun 12-16 Hourly Discharges
Cache la Poudre @ Greeley

Greeley No. 3 picks up a lot of Sheep Draw. Most of water overtopped No. 3. Overland flow about ¼ mile across a pasture. Sheep Draw doesn't have a defined channel. Spring Ck flood didn't hardly show up at Timnath. Also, there are two diversion dams between Sheep Draw & Greeley.

"LAGRECO JUN12 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE= 7.10 EQUIVALENT STAGE= 7.02 MEAN Q= 2140.00
MEAN SHIFT= -0.09 MEAN DATUM= 0.00 NVALS= 96
MAX STAGE= 7.24 AT 0115 MIN STAGE= 6.94 AT 1545

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.23	-0.09		2260.00	13	7.01	-0.09		2060.00
2	7.24	-0.09		2270.00	14	6.98	-0.09		2040.00
3	7.24	-0.09		2270.00	15	6.96	-0.09		2030.00
4	7.24	-0.09		2270.00	16	6.94	-0.09		2020.00
5	7.24	-0.09		2270.00	17	6.94	-0.09		2020.00
6	7.23	-0.09		2260.00	18	6.94	-0.10		2010.00
7	7.21	-0.09		2240.00	19	6.95	-0.10		2020.00
8	7.19	-0.09		2220.00	20	6.99	-0.10		2040.00
9	7.17	-0.09		2200.00	21	7.02	-0.10		2060.00
10	7.13	-0.09		2160.00	22	7.05	-0.10		2080.00
11	7.09	-0.09		2120.00	23	7.12	-0.10		2140.00
12	7.05	-0.09		2090.00	24	7.16	-0.10		2180.00

CR,+ or - n => CHANGE DAY CURSOR-UP => EDIT MODE EXIT => EXIT/SAVE CHANGES
QUIT => EXIT/CHANGES NOT SAVED SAVE => SAVE CHANGES/NO EXIT

^LAGRECO JUN13 1997 (FINAL)

RATING TABLE: CLAGRECO25

MEAN STAGE=	7.32	EQUIVALENT STAGE=	7.25	MEAN Q=	2370.00
MEAN SHIFT=	-0.10	MEAN DATUM=	0.00	NVALS=	96
MAX STAGE=	8.48	AT 2345	MIN STAGE=	6.92	AT 1545

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.18	-0.10		2200.00	13	6.99	-0.10		2040.00
2	7.19	-0.10		2210.00	14	6.96	-0.10		2020.00
3	7.20	-0.10		2220.00	15	6.93	-0.10		2000.00
4	7.20	-0.10		2220.00	16	6.93	-0.11		1990.00
5	7.20	-0.10		2220.00	17	7.01	-0.11		2050.00
6	7.18	-0.10		2200.00	18	7.22	-0.11		2230.00
7	7.16	-0.10		2180.00	19	7.40	-0.11		2400.00
8	7.14	-0.10		2160.00	20	7.56	-0.11		2560.00
9	7.11	-0.10		2130.00	21	7.89	-0.11		2940.00
10	7.07	-0.10		2100.00	22	8.25	-0.11		3380.00
11	7.04	-0.10		2080.00	23	8.43	-0.11		3600.00
12	7.01	-0.10		2060.00	24	8.48	-0.11		3670.00

CR,+ or - n => CHANGE DAY CURSOR-UP => EDIT MODE EXIT => EXIT/SAVE CHANGES
QUIT => EXIT/CHANGES NOT SAVED SAVE => SAVE CHANGES/NO EXIT

^LAGRECO JUN14 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE= 7.43 EQUIVALENT STAGE= 7.34 MEAN Q= 2450.00
MEAN SHIFT= -0.11 MEAN DATUM= 0.00 NVALS= 96
MAX STAGE= 8.48 AT 0015 MIN STAGE= 7.12 AT 1730

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	8.41	-0.11		3580.00	13	7.20	-0.11		2210.00
2	8.25	-0.11		3380.00	14	7.17	-0.11		2180.00
3	8.09	-0.11		3180.00	15	7.15	-0.12		2150.00
4	7.93	-0.11		2990.00	16	7.13	-0.12		2130.00
5	7.79	-0.11		2820.00	17	7.13	-0.12		2130.00
6	7.67	-0.11		2680.00	18	7.12	-0.12		2120.00
7	7.57	-0.11		2570.00	19	7.12	-0.12		2120.00
8	7.42	-0.11		2420.00	20	7.14	-0.12		2140.00
9	7.39	-0.11		2390.00	21	7.17	-0.12		2170.00
10	7.34	-0.11		2350.00	22	7.18	-0.12		2180.00
11	7.30	-0.11		2310.00	23	7.19	-0.12		2190.00
12	7.24	-0.11		2250.00	24	7.19	-0.12		2190.00

CR,+ or - n => CHANGE DAY CURSOR-UP => EDIT MODE EXIT => EXIT/SAVE CHANGES
QUIT => EXIT/CHANGES NOT SAVED SAVE => SAVE CHANGES/NO EXIT

LAGRECO JUN15 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE= 7.12 EQUIVALENT STAGE= 7.01 MEAN Q= 2130.00
MEAN SHIFT= -0.13 MEAN DATUM= 0.00 NVALS= 96
MAX STAGE= 7.25 AT 0345 MIN STAGE= 7.00 AT 1615

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.20	-0.12		2200.00	13	7.08	-0.13		2080.00
2	7.21	-0.12		2210.00	14	7.05	-0.13		2060.00
3	7.24	-0.12		2240.00	15	7.03	-0.13		2050.00
4	7.25	-0.12		2250.00	16	7.01	-0.13		2040.00
5	7.25	-0.12		2250.00	17	7.00	-0.13		2030.00
6	7.25	-0.12		2250.00	18	7.00	-0.13		2030.00
7	7.23	-0.12		2230.00	19	7.00	-0.13		2030.00
8	7.22	-0.12		2220.00	20	7.01	-0.13		2040.00
9	7.20	-0.12		2200.00	21	7.02	-0.13		2040.00
10	7.17	-0.12		2170.00	22	7.03	-0.13		2050.00
11	7.15	-0.12		2150.00	23	7.05	-0.13		2060.00
12	7.11	-0.12		2110.00	24	7.06	-0.13		2070.00

CR,+ or - n => CHANGE DAY CURSOR-UP => EDIT MODE EXIT => EXIT/SAVE CHANGES
QUIT => EXIT/CHANGES NOT SAVED SAVE => SAVE CHANGES/NO EXIT

'AGRECO JUN16 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE= 6.93 EQUIVALENT STAGE= 6.79 MEAN Q= 1970.00
MEAN SHIFT= -0.14 MEAN DATUM= 0.00 NVALS= 96
MAX STAGE= 7.09 AT 0200 MIN STAGE= 6.74 AT 2345

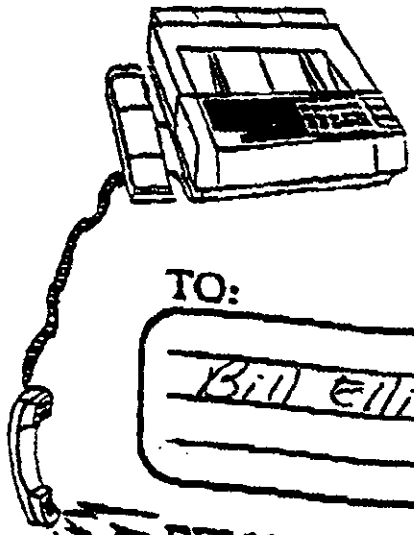
HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.08	-0.13		2080.00	13	6.90	-0.14		1950.00
2	7.09	-0.13		2090.00	14	6.87	-0.14		1930.00
3	7.09	-0.13		2090.00	15	6.85	-0.14		1920.00
4	7.09	-0.13		2090.00	16	6.82	-0.14		1900.00
5	7.09	-0.13		2090.00	17	6.81	-0.14		1890.00
6	7.08	-0.13		2080.00	18	6.81	-0.14		1890.00
7	7.06	-0.13		2070.00	19	6.81	-0.14		1890.00
8	7.03	-0.13		2050.00	20	6.81	-0.14		1890.00
9	7.01	-0.13		2040.00	21	6.79	-0.14		1880.00
10	6.98	-0.13		2020.00	22	6.78	-0.14		1870.00
11	6.96	-0.14		1990.00	23	6.76	-0.14		1850.00
12	6.94	-0.14		1980.00	24	6.74	-0.14		1840.00

CR,+ or - n => CHANGE DAY CURSOR-UP => EDIT MODE EXIT => EXIT/SAVE CHANGES
QUIT => EXIT/CHANGES NOT SAVED SAVE => SAVE CHANGES/NO EXIT

U.S. GEOLOGICAL SURVEY
LAKEWOOD FIELD HEADQUARTERS
FACSIMILE TRANSMITTAL

PHONE NO. 303/236-9404

FAX NO. 303/236-4855



DATE: 5/22/98

TO:

Bill Elliot

FROM:

Rick Neam x 20
USGS

REMARKS:

Deb Brandal x 19

Bill- Our Coal Creek site was installed 7/1/97 so no data for 6/2.
The Lone Tree site was discontinued several years ago.

NUMBER OF PAGES EXCLUDING THIS COVER SHEET ____

UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY - COLORADO DISTRICT 05/22/98

STATION NUMBER 06752280 CACHE LA POUDRE R AB BOXELDER C, NR TIMNATH, CO. STREAM SOURCE AGENCY USGS
LATITUDE 403256 LONGITUDE 1050028 DRAINAGE AREA 1246.00 DATUM 4862.00 STATE 08 COUNTY 069
DISCHARGE, IN CFS COMPUTED UNIT VALUES (INSTANTANEOUS)

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
					JUNE 12, 1997				
00:15:00	2060	05:15:00	2220	10:15:00	2450	15:15:00	2270	20:15:00	2120
00:30:00	2060	05:30:00	2240	10:30:00	2450	15:30:00	2270	20:30:00	2110
00:45:00	2060	05:45:00	2290	10:45:00	2450	15:45:00	2260	20:45:00	2110
01:00:00	2060	06:00:00	2310	11:00:00	2440	16:00:00	2240	21:00:00	2100
01:15:00	2060	06:15:00	2330	11:15:00	2430	16:15:00	2240	21:15:00	2100
01:30:00	2070	06:30:00	2350	11:30:00	2420	16:30:00	2230	21:30:00	2100
01:45:00	2070	06:45:00	2370	11:45:00	2410	16:45:00	2220	21:45:00	2090
02:00:00	2070	07:00:00	2390	12:00:00	2410	17:00:00	2220	22:00:00	2080
02:15:00	2070	07:15:00	2400	12:15:00	2400	17:15:00	2210	22:15:00	2100
02:30:00	2070	07:30:00	2410	12:30:00	2390	17:30:00	2210	22:30:00	2110
02:45:00	2080	07:45:00	2420	12:45:00	2380	17:45:00	2200	22:45:00	2120
03:00:00	2100	08:00:00	2430	13:00:00	2360	18:00:00	2190	23:00:00	2120
03:15:00	2110	08:15:00	2440	13:15:00	2350	18:15:00	2190	23:15:00	2120
03:30:00	2120	08:30:00	2450	13:30:00	2340	18:30:00	2170	23:30:00	2120
03:45:00	2130	08:45:00	2460	13:45:00	2330	18:45:00	2170	23:45:00	2120
04:00:00	2140	09:00:00	2460	14:00:00	2330	19:00:00	2160	24:00:00	2120
04:15:00	2160	09:15:00	2470	14:15:00	2310	19:15:00	2150		
04:30:00	2170	09:30:00	2460	14:30:00	2300	19:30:00	2140		
04:45:00	2170	09:45:00	2460	14:45:00	2290	19:45:00	2130		
05:00:00	2200	10:00:00	2460	15:00:00	2280	20:00:00	2120		
					JUNE 13, 1997				
00:15:00	2110	05:15:00	2070	10:15:00	2190	15:15:00	2170	20:15:00	2020
00:30:00	2100	05:30:00	2080	10:30:00	2200	15:30:00	2160	20:30:00	2010
00:45:00	2090	05:45:00	2090	10:45:00	2200	15:45:00	2150	20:45:00	2000
01:00:00	2090	06:00:00	2100	11:00:00	2200	16:00:00	2150	21:00:00	1990
01:15:00	2080	06:15:00	2110	11:15:00	2200	16:15:00	2130	21:15:00	1990
01:30:00	2080	06:30:00	2120	11:30:00	2200	16:30:00	2130	21:30:00	1980
01:45:00	2070	06:45:00	2120	11:45:00	2200	16:45:00	2120	21:45:00	1980
02:00:00	2070	07:00:00	2130	12:00:00	2200	17:00:00	2110	22:00:00	1970
02:15:00	2070	07:15:00	2140	12:15:00	2200	17:15:00	2110	22:15:00	1960
02:30:00	2070	07:30:00	2140	12:30:00	2200	17:30:00	2100	22:30:00	1960
02:45:00	2060	07:45:00	2150	12:45:00	2200	17:45:00	2090	22:45:00	1960
03:00:00	2060	08:00:00	2160	13:00:00	2200	18:00:00	2080	23:00:00	1950
03:15:00	2060	08:15:00	2160	13:15:00	2190	18:15:00	2070	23:15:00	1950
03:30:00	2050	08:30:00	2160	13:30:00	2190	18:30:00	2070	23:30:00	1950
03:45:00	2050	08:45:00	2170	13:45:00	2180	18:45:00	2060	23:45:00	1950
04:00:00	2060	09:00:00	2170	14:00:00	2180	19:00:00	2050	24:00:00	1950
04:15:00	2060	09:15:00	2170	14:15:00	2170	19:15:00	2040		
04:30:00	2060	09:30:00	2170	14:30:00	2170	19:30:00	2040		
04:45:00	2070	09:45:00	2180	14:45:00	2170	19:45:00	2030		
05:00:00	2070	10:00:00	2180	15:00:00	2170	20:00:00	2030		

STATION NUMBER 06752280 CACHE LA POUDRE R AB BOXELDER C, NR TIMNATH, CO. STREAM SOURCE AGENCY USGS
LATITUDE 403256 LONGITUDE 1050328 DRAINAGE AREA 1246.00 DATUM 4862.00 STATE 08 COUNTY 069
DISCHARGE, IN CFS COMPUTED UNIT VALUES (INSTANTANEOUS)

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
					JUNE 14, 1997				
00:15:00	1950	03:30:00	1970	06:45:00	2140	18:00:00	2130	21:15:00	2080
00:30:00	1940	03:45:00	1980	15:00:00	2170	18:15:00	2140	21:30:00	2070
00:45:00	1940	04:00:00	1990	15:15:00	2170	18:30:00	2140	21:45:00	2060
01:00:00	1950	04:15:00	1990	15:30:00	2170	18:45:00	2140	22:00:00	2050
01:15:00	1950	04:30:00	2010	15:45:00	2160	19:00:00	2130	22:15:00	2030
01:30:00	1950	04:45:00	2020	16:00:00	2160	19:15:00	2130	22:30:00	2020
01:45:00	1950	05:00:00	2030	16:15:00	2160	19:30:00	2130	22:45:00	2010
02:00:00	1950	05:15:00	2050	16:30:00	2150	19:45:00	2120	23:00:00	1990
02:15:00	1950	05:30:00	2070	16:45:00	2150	20:00:00	2120	23:15:00	1990
02:30:00	1950	05:45:00	2080	17:00:00	2150	20:15:00	2110	23:30:00	1970
02:45:00	1960	06:00:00	2100	17:15:00	2140	20:30:00	2100	23:45:00	1960
03:00:00	1960	06:15:00	2110	17:30:00	2130	20:45:00	2100	24:00:00	1950
03:15:00	1970	06:30:00	2120	17:45:00	2130	21:00:00	2050		
					JUNE 15, 1997				
00:15:00	1950	04:00:00	2030	13:45:00	2170	17:30:00	2070	21:15:00	1970
00:30:00	1940	04:15:00	2040	14:00:00	2170	17:45:00	2070	21:30:00	1960
00:45:00	1940	04:30:00	2060	14:15:00	2160	18:00:00	2060	21:45:00	1950
01:00:00	1930	04:45:00	2070	14:30:00	2150	18:15:00	2050	22:00:00	1940
01:15:00	1930	05:00:00	2110	14:45:00	2140	18:30:00	2050	22:15:00	1930
01:30:00	1930	05:15:00	2120	15:00:00	2120	18:45:00	2040	22:30:00	1920
01:45:00	1930	05:30:00	2140	15:15:00	2120	19:00:00	2030	22:45:00	1910
02:00:00	1930	05:45:00	2140	15:30:00	2120	19:15:00	2030	23:00:00	1900
02:15:00	1940	06:00:00	2150	15:45:00	2120	19:30:00	2020	23:15:00	1890
02:30:00	1950	06:15:00	2150	16:00:00	2110	19:45:00	2010	23:30:00	1880
02:45:00	1950	06:30:00	2170	16:15:00	2110	20:00:00	2000	23:45:00	1880
03:00:00	1960	06:45:00	2170	16:30:00	2100	20:15:00	1990	24:00:00	1870
03:15:00	1980	07:00:00	2190	16:45:00	2090	20:30:00	1980		
03:30:00	1990	13:15:00	2190	17:00:00	2090	20:45:00	1990		
03:45:00	2010	13:30:00	2180	17:15:00	2080	21:00:00	1980		
					JUNE 16, 1997				
00:15:00	1860	03:45:00	1820	14:45:00	1760	18:15:00	1720	21:45:00	1680
00:30:00	1860	04:00:00	1820	15:00:00	1770	18:30:00	1720	22:00:00	1690
00:45:00	1850	04:15:00	1820	15:15:00	1760	18:45:00	1720	22:15:00	1680
01:00:00	1840	04:30:00	1820	15:30:00	1760	19:00:00	1710	22:30:00	1680
01:15:00	1830	04:45:00	1820	15:45:00	1750	19:15:00	1730	22:45:00	1670
01:30:00	1830	05:00:00	1820	16:00:00	1750	19:30:00	1730	23:00:00	1670
01:45:00	1820	05:15:00	1820	16:15:00	1750	19:45:00	1720	23:15:00	1670
02:00:00	1820	05:30:00	1820	16:30:00	1750	20:00:00	1710	23:30:00	1670
02:15:00	1820	05:45:00	1830	16:45:00	1740	20:15:00	1710	23:45:00	1670
02:30:00	1810	06:00:00	1830	17:00:00	1730	20:30:00	1700	24:00:00	1670
02:45:00	1810	06:15:00	1830	17:15:00	1730	20:45:00	1700		
03:00:00	1810	06:30:00	1840	17:30:00	1730	21:00:00	1700		
03:15:00	1810	06:45:00	1840	17:45:00	1730	21:15:00	1690		
03:30:00	1810	07:00:00	1840	18:00:00	1720	21:30:00	1690		

TOTAL P 83

DIVISION OF WATER RESOURCES | STATE OF COLORADO | OFFICE OF THE STATE ENGINEER

'ISION 1 DISTRICT 3 | ANNUAL WATER DIVERSION REPORT | IRRIGATION YEAR: 1997
(11/01/1996 - 10/31/1997)

STRUCTURE NAME: CANAL 3 DITCH (934) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : IRRIGATION (1)
TYPE :

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1							40.000*	28.800*	73.070*	0.000*	50.800*	28.700*	1
2							43.600*	30.200*	71.900*		51.100*	26.100*	2
3							49.800*	29.800*	64.200*		46.600*	29.400*	3
4							51.200*	30.100*	68.300*		42.800*	26.400*	4
5							52.300*	31.100*	62.700*		41.700*	24.300*	5
6							57.070*	26.400*	62.800*		40.600*	21.300*	6
7							55.450*	24.300*	63.500*		31.100*	22.800*	7
8							57.000*	24.300*	62.600*		31.600*	17.600*	8
9							44.100*	30.900*	59.800*		26.000*	14.300*	9
10							54.300*	35.210*	60.600*		29.100*	15.500*	10
11							55.300*	29.600*	60.400*		42.520*	17.600*	11
12							71.500*	23.800*	55.000*		34.200*	16.100*	12
13							80.100*	22.400*	60.500*		38.300*	18.500*	13
14							79.830*	40.470*	59.200*		46.200*	30.100*	14
15						30.000*	78.100*	39.380*	58.800*	7.000*	37.800*	26.200*	15
16						39.330*	76.500*	36.060*	56.500*	15.500*	41.600*	24.600*	16
						28.300*	70.600*	27.700*	57.300*	15.500*	39.600*	16.900*	17
						34.100*	66.300*	27.300*	62.000*	15.500*	39.000*	21.700*	18
19						16.700*	70.100*	26.000*	63.300*	14.500*	31.700*	16.600*	19
20						23.800*	70.100*	35.800*	64.200*	13.500*	47.500*	10.300*	20
21						32.200*	70.100*	56.000*	61.200*	12.500*	35.300*	6.300*	21
22						42.200*	40.100*	59.200*	59.400*	10.300*	32.300*	3.600*	22
23						40.200*	26.100*	62.700*	59.000*	10.000*	46.060*	9.200*	23
24						9.900*	39.000*	52.800*	62.800*	10.300*	34.100*	11.000*	24
25						0.000*	36.000*	55.910*	43.800*	32.500*	35.300*	10.800*	25
26							35.000*	47.600*	38.700*	56.100*	35.200*	6.000*	26
27							35.000*	47.560*	41.200*	47.800*	30.000*	1.400*	27
28							34.000*	51.100*	58.800*	47.600*	27.600*	12.400*	28
29							35.000*	51.100*	62.600*	42.400*	26.800*	13.600*	29
30							37.000*	57.200*	42.200*	49.400*	28.300*	8.700*	30
31							39.000*		30.300*	49.300*		0.000*	31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	296.73	1649.55	1140.79	1806.67	449.70	1120.78	508.00	
DAYS USED	0	0	0	0	0	10	31	30	31	17	30	30	
AVG SFD	0.00	0.00	0.00	0.00	0.00	29.67	53.21	38.03	58.28	26.45	37.36	16.93	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	588.56	3271.88	2262.76	3583.53	891.98	2223.07	1007.62	

ANNUAL TOTAL SFD : 6972.22 SFD
TOTAL DAYS USED : 179.00 DAYS
ANNUAL TOTAL ACRE FEET : 13829.40 AF

* Indicates Observed data, U Indicates User supplied data.
All other data is interpreted from previous observed value.

WATER COMMISSIONER

Seh

REPORT DATE: 3/02/1998

DIVISION OF WATER RESOURCES | STATE OF COLORADO | OFFICE OF THE STATE ENGINEER

DIVISION 1 DISTRICT 3 | ANNUAL WATER DIVERSION REPORT | IRRIGATION YEAR: 1997
(11/01/1996 - 10/31/1997)

STRUCTURE NAME: CANAL 3 DITCH (934) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : OTHER (Q)
TYPE : RELEASE TO RIVER (7)

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DAY
1							16.000*	25.200*	7.930*	7.300*	17.200*	35.300*	1
2							14.400*	26.800*	13.100*	8.700*	15.900*	37.900*	2
3							8.200*	28.200*	16.800*	18.000*	19.400*	34.600*	3
4							6.800*	27.900*	13.700*	17.000*	18.200*	36.600*	4
5							5.700*	25.900*	18.300*	18.000*	18.300*	38.700*	5
6							0.930*	25.600*	17.200*	12.000*	22.400*	40.700*	6
7							0.550*	27.700*	17.500*	0.820*	28.900*	39.200*	7
8							0.000*	27.700*	19.400*	10.000*	28.400*	44.400*	8
9							12.900*	20.100*	17.200*	30.000*	34.000*	47.700*	9
10							3.700*	15.790*	15.400*	20.000*	30.900*	46.500*	10
11							3.700*	19.400*	12.200*	16.000*	17.480*	43.400*	11
12							1.500*	26.200*	10.000*	16.000*	25.800*	45.900*	12
13							0.900*	26.600*	10.000*	16.000*	21.700*	42.500*	13
14							1.170*	7.530*	10.000*	16.000*	13.800*	33.900*	14
15							6.900*	7.620*	10.000*	16.000*	21.200*	35.800*	15
16						0.670*	6.500*	9.940*	10.000*	17.500*	17.400*	35.400*	16
17						11.700*	7.400*	15.300*	10.000*	17.500*	20.400*	43.100*	17
18						5.900*	12.700*	15.700*	10.000*	17.500*	23.000*	41.300*	18
19						3.300*	9.900*	18.000*	10.000*	17.500*	28.300*	45.400*	19
20						6.200*	9.900*	11.200*	10.000*	17.500*	18.500*	51.700*	20
21						7.800*	9.900*	15.000*	10.000*	17.500*	33.700*	55.700*	21
22						2.600*	9.900*	12.800*	10.000*	19.700*	36.700*	57.400*	22
23						12.000*	9.900*	6.300*	10.000*	20.000*	23.940*	51.800*	23
24						55.800*	15.000*	10.200*	10.000*	19.700*	34.900*	50.000*	24
25						68.000*	15.000*	3.090*	15.000*	10.500*	32.700*	51.200*	25
26						57.000*	15.000*	7.400*	15.000*	11.900*	32.800*	56.000*	26
27						41.000*	15.000*	6.440*	15.000*	13.200*	35.000*	59.600*	27
28						32.000*	15.000*	15.900*	15.000*	13.400*	37.400*	49.600*	28
29						31.000*	15.000*	11.900*	26.600*	17.600*	37.200*	47.400*	29
30						41.000*	15.000*	7.800*	31.800*	15.600*	35.700*	32.300*	30
31							15.000*		27.700*	18.700*		0.000*	31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	375.97	279.45	505.21	444.83	487.12	781.22	1331.00	
DAYS USED	0	0	0	0	0	15	30	30	31	31	30	30	
AVG SFD	0.00	0.00	0.00	0.00	0.00	25.06	9.32	16.84	14.35	15.71	26.04	44.37	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	745.74	554.29	1002.08	882.32	966.20	1549.55	2640.04	

ANNUAL TOTAL SFD : 4204.80 SFD
TOTAL DAYS USED : 197.00 DAYS
ANNUAL TOTAL ACRE FEET : 8340.22 AF

* Indicates Observed data, U Indicates User supplied data.
All other data is interpreted from previous observed value.

WATER COMMISSIONER

This is a Non-additive Classification -

REPORT DATE: 3/02/1998

DIVISION OF WATER RESOURCES | STATE OF COLORADO | OFFICE OF THE STATE ENGINEER

IVISION 1 DISTRICT 3 | ANNUAL WATER DIVERSION REPORT | IRRIGATION YEAR: 1997
(11/01/1996 - 10/31/1997)

STRUCTURE NAME: OGILVY DITCH (937) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : IRRIGATION (1)
TYPE :

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DAY
1							3.900*		81.000*	68.000*	88.000*	14.500*	1
2							12.600*		77.000*	69.000*	88.000*	14.500*	2
3							14.200*		76.000*	66.000*	91.000*	14.500*	3
4							14.000*		75.000*	75.000*	79.000*	4.800*	4
5							14.000*		71.000*	79.000*	53.900*	0.000*	5
6							13.200*	7.800*	70.000*	83.000*	56.700*		6
7							13.400*	8.000*	71.000*	82.000*	55.300*		7
8							14.000*	7.800*	75.000*	75.000*	53.900*		8
9							14.800*	7.400*	78.000*	75.000*	53.900*		9
10							54.700*	7.500*	77.000*	76.000*	46.900*		10
11							53.200*	7.400*	78.000*	81.000*	36.400*		11
12							54.700*	7.300*	75.000*	79.000*	30.600*		12
13							56.200*	42.300*	71.000*	81.000*	30.000*		13
14							55.500*	66.000*	71.000*	83.000*	29.400*		14
15							58.500*	65.000*	72.000*	82.000*	28.200*		15
16							68.400*	63.000*	74.000*	79.000*	28.200*		16
17							74.700*	61.000*	73.000*	80.000*	28.800*		17
18							72.900*	61.000*	80.000*	80.000*	28.200*		18
19							75.600*	61.000*	82.000*	81.000*	28.200*		19
20							78.300*	18.300*	82.000*	77.000*	35.400*		20
21							81.000*	17.400*	86.000*	74.000*	38.400*		21
22							80.100*	18.000*	88.000*	71.000*	39.000*		22
23							58.800*	18.900*	88.000*	70.000*	39.600*		23
24							55.300*	16.800*	90.000*	70.000*	39.000*		24
25						7.600*	52.500*	15.900*	84.000*	70.000*	39.000*		25
26						6.800*	51.100*	15.300*	84.000*	68.000*	16.000*		26
27						5.000*	52.500*	17.700*	82.000*	78.000*	15.750*		27
28						4.700*	48.300*	59.100*	80.000*	84.000*	15.000*		28
29						4.600*	49.000*	78.000*	76.000*	84.000*	14.750*		29
30						4.700*	0.000*	75.000*	78.000*	85.000*	14.500*		30
31									73.000*	88.000*			31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	33.40	1345.40	822.90	2418.00	2393.00	1241.00	48.30	
DAYS USED	0	0	0	0	0	6	29	25	31	31	30	4	
AVG SFD	0.00	0.00	0.00	0.00	0.00	5.57	46.39	32.92	78.00	77.19	41.37	12.08	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	66.25	2668.60	1632.22	4796.10	4746.52	2461.52	95.80	

ANNUAL TOTAL SFD : 8302.00 SFD
TOTAL DAYS USED : 156.00 DAYS
ANNUAL TOTAL ACRE FEET : 16467.02 AF

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WATER COMMISSIONER

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DIVISION OF WATER RESOURCES | STATE OF COLORADO | OFFICE OF THE STATE ENGINEER

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STRUCTURE NAME: OGILVY DITCH (937) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : OTHER (Q)
TYPE : RELEASE TO RIVER (7)

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1							35.100*	75.000*				43.500*	1
2							50.400*	80.000*				43.500*	2
3							56.800*	74.000*				43.500*	3
4							56.000*	76.000*				14.500*	4
5							56.000*	78.000*			23.100*	0.000*	5
6							52.800*	70.200*			24.300*		6
7							53.600*	72.000*			23.700*		7
8							56.000*	70.200*			23.100*		8
9							59.200*	66.600*			23.100*		9
10							18.300*	67.500*			20.100*		10
11							17.800*	66.600*			15.600*		11
12							18.300*	65.700*			20.400*		12
13							18.800*	34.700*			20.000*		13
14							18.500*	0.000*			19.600*		14
15							19.500*				18.800*		15
16							7.600*				18.800*		16
7							8.300*				19.200*		17
8							8.100*				18.800*		18
19						26.800*	8.400*				18.800*		19
20						57.000*	8.700*	42.700*			23.600*		20
21						66.000*	9.000*	40.600*			25.600*		21
22						73.000*	8.900*	42.000*			26.000*		22
23						73.000*	25.200*	44.100*			26.400*		23
24						76.000*	23.700*	39.200*			26.000*		24
25						68.400*	22.500*	37.100*			26.000*		25
26						61.200*	21.900*	35.700*			48.000*		26
27						45.000*	22.500*	41.300*			47.250*		27
28						42.300*	20.700*	12.900*			45.000*		28
29						41.400*	21.000*	0.000*			44.250*		29
30						42.300*	70.000*				43.500*		30
31							73.000*						31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	672.40	946.60	1232.10	0.00	0.00	689.00	145.00	
DAYS USED	0	0	0	0	0	12	31	22	0	0	26	4	
AVG SFD	0.00	0.00	0.00	0.00	0.00	56.03	30.54	56.00	0.00	0.00	26.50	36.25	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	1333.71	1877.58	2443.87	0.00	0.00	1366.63	287.61	

ANNUAL TOTAL SFD : 3685.10 SFD
TOTAL DAYS USED : 95.00 DAYS
ANNUAL TOTAL ACRE FEET : 7309.40 AF

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WATER COMMISSIONER

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STRUCTURE NAME: WHITNEY IRR DITCH (930) SOURCE: NATURAL STREAMFLOW (1)

SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :

USE : OTHER (Q)

TYPE : RELEASE TO RIVER (7)

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DAY
1							25.500*	25.000*	16.000*		13.000*	24.000*	1
2							23.000*	38.000*	13.000*		13.000*	24.000*	2
3							22.100*	27.000*	12.000*		13.000*	24.000*	3
4							22.100*	43.000*	10.000*		21.500*	24.000*	4
5							22.100*	37.000*	15.000*	41.000*	20.000*	24.000*	5
6							22.100*	34.000*	13.000*	0.000*	22.000*	24.000*	6
7							16.100*	30.000*	12.000*	49.000*	23.000*	7.000*	7
8							16.100*	30.000*	10.000*	18.000*	23.000*	0.000*	8
9							15.000*	28.000*	5.000*	0.000*	23.000*		9
10							23.000*	33.000*	10.000*		23.000*		10
11							27.000*	32.000*	8.000*		23.000*		11
12							30.000*	32.000*	8.000*		23.000*		12
13							30.000*	9.200*	6.000*		23.000*		13
14							22.000*	0.000*	6.000*		21.500*		14
15							22.000*		8.000*		21.500*		15
16							16.000*		4.000*		21.000*		16
7							15.000*		6.000*		21.500*		17
8							16.000*		9.000*		21.500*		18
19							13.000*		9.000*		21.100*		19
20							14.000*		8.000*		21.100*		20
21							14.000*		6.000*		21.800*		21
22							17.000*	51.000*	6.000*		23.100*		22
23							20.000*	42.000*	6.000*		23.100*		23
24							23.000*	43.000*	10.000*	10.600*	26.300*		24
25							22.000*	41.000*	10.000*	13.000*	26.300*		25
26							25.000*	39.000*	10.000*	13.500*	26.300*		26
27							25.000*	37.000*	10.000*	13.000*	24.000*		27
28							25.000*	37.000*	27.000*	13.000*	24.000*		28
29							25.000*	35.000*	7.900*	13.000*	24.000*		29
30							25.000*	25.000*	0.000*	13.500*	24.000*		30
31							25.000*			13.000*			31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	0.00	658.10	748.20	280.90	210.60	655.60	151.00	
DAYS USED	0	0	0	0	0	0	31	22	29	11	30	7	
AVG SFD	0.00	0.00	0.00	0.00	0.00	0.00	21.23	34.01	9.69	19.15	21.85	21.57	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	0.00	1305.34	1484.05	557.17	417.73	1300.38	299.51	

ANNUAL TOTAL SFD : 2704.40 SFD

TOTAL DAYS USED : 130.00 DAYS

ANNUAL TOTAL ACRE FEET : 5364.18 AF

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STRUCTURE NAME: WHITNEY IRR DITCH (930) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : IRRIGATION (1)
TYPE :

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1							4.000*	15.000*	45.000*	58.000*	39.000*	8.000*	1
2							4.000*	2.000*	48.000*	61.000*	39.000*	8.000*	2
3							4.000*	10.000*	48.000*	61.000*	39.000*	8.000*	3
4							4.000*	12.000*	50.000*	52.000*	21.500*	8.000*	4
5							4.000*	12.000*	50.000*	17.000*	20.000*	8.000*	5
6							4.000*	12.000*	52.000*	0.000*	22.000*	8.000*	6
7							10.000*	12.000*	53.000*		23.000*	2.300*	7
8							10.000*	12.000*	55.000*	43.000*	23.000*	0.000*	8
9							12.000*	14.000*	55.000*	67.000*	23.000*		9
10							14.000*	10.000*	55.000*	65.000*	23.000*		10
11							16.000*	10.000*	55.000*	49.000*	23.000*		11
12							16.000*	10.000*	55.000*	49.000*	23.000*		12
13							16.000*	3.000*	55.000*	50.000*	23.000*		13
14							21.000*	0.000*	55.000*	50.000*	21.500*		14
15							29.000*		55.000*	49.000*	21.500*		15
16							32.000*		55.000*	14.600*	21.000*		16
7							34.000*		55.000*	0.000*	21.500*		17
8							30.000*		55.000*		21.500*		18
19							30.000*		55.000*		10.900*		19
20							32.000*		55.000*		10.900*		20
21							32.000*		55.000*		11.200*		21
22							32.000*	4.000*	55.000*		11.900*		22
23							26.000*	10.000*	55.000*		11.900*		23
24							23.000*	15.000*	55.000*	31.900*	8.700*		24
25							20.000*	14.000*	55.000*	39.000*	8.700*		25
26							15.000*	16.000*	55.000*	40.500*	8.700*		26
27							15.000*	18.000*	55.000*	39.000*	8.000*		27
28							15.000*	28.000*	40.000*	39.000*	8.000*		28
29							15.000*	30.000*	11.600*	39.000*	8.000*		29
30						29.500*	15.000*	40.000*	0.000*	40.500*	8.000*		30
31							15.000*		13.000*	39.000*			31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	29.50	549.00	309.00	1510.60	993.50	563.40	50.30	
DAYS USED	0	0	0	0	0	1	31	22	30	22	30	7	
AVG SFD	0.00	0.00	0.00	0.00	0.00	29.50	17.71	14.05	50.35	45.16	18.78	7.19	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	58.51	1088.94	612.90	2996.28	1970.61	1117.50	99.77	

ANNUAL TOTAL SFD : 4005.30 SFD
TOTAL DAYS USED : 143.00 DAYS
ANNUAL TOTAL ACRE FEET : 7944.51 AF

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STRUCTURE NAME: B H EATON DITCH (931) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : IRRIGATION (1)
TYPE :

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1									24.600*	2.500*	23.900*	20.000*	1
2									23.600*	2.500*	23.900*	6.700*	2
3									23.300*	2.500*	21.900*	0.000*	3
4									27.100*	9.400*	18.400*		4
5									33.000*	25.000*	19.000*		5
6									33.000*	25.000*	21.000*		6
7									34.000*	25.000*	18.700*		7
8									35.000*	15.400*	18.400*		8
9									31.000*	2.960*	18.600*		9
10									27.500*	2.960*	18.400*		10
11									30.000*	4.100*	18.100*		11
12									31.400*	28.500*	18.100*		12
13									28.600*	28.500*	18.400*		13
14									29.200*	28.500*	18.100*		14
15							2.000*		28.100*	28.500*	17.800*		15
16							2.000*		26.400*	27.400*	17.800*		16
7							2.000*		28.100*	13.300*	17.800*		17
18							2.000*		30.700*	4.100*	17.500*		18
19							2.000*		26.100*	3.800*	18.900*		19
20							5.000*		29.200*	3.600*	22.600*		20
21							0.000*		29.000*	3.400*	22.800*		21
22									28.900*	3.300*	22.900*		22
23									29.200*	3.100*	22.900*		23
24								7.300*	31.100*	16.800*	22.300*		24
25								14.300*	30.000*	21.100*	21.900*		25
26								20.900*	30.000*	21.000*	21.400*		26
27								21.500*	29.600*	21.000*	20.000*		27
28								23.900*	28.900*	20.600*	20.300*		28
29								21.000*	4.900*	20.800*	20.000*		29
30								21.600*	2.500*	24.300*	20.000*		30
31									2.500*	25.000*			31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	0.00	15.00	130.50	828.50	463.92	601.80	26.70	
DAYS USED	0	0	0	0	0	0	6	7	31	31	30	2	
AVG SFD	0.00	0.00	0.00	0.00	0.00	0.00	2.50	18.64	26.73	14.97	20.06	13.35	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	0.00	29.75	258.85	1643.33	920.19	1193.67	52.96	

ANNUAL TOTAL SFD : 2066.42 SFD
TOTAL DAYS USED : 107.00 DAYS
ANNUAL TOTAL ACRE FEET : 4098.74 AF

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STRUCTURE NAME: B H EATON DITCH (931) SOURCE: NATURAL STREAMFLOW (1)
SOURCE STREAM : CACHE LA POUDRE RIV (9) FROM :
USE : OTHER (Q)
TYPE : RELEASE TO RIVER (7)

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1								15.800*					1
2								18.100*					2
3								16.000*					3
4								12.100*					4
5								15.200*					5
6								16.900*					6
7								16.900*					7
8								16.900*					8
9								16.900*					9
10								16.900*					10
11								16.900*					11
12								16.900*					12
13								12.400*					13
14							4.700*	13.200*					14
15							13.700*	13.500*					15
16							14.900*	11.400*					16
17							16.100*	10.100*					17
18							16.800*	8.900*					18
19							17.100*	9.100*					19
20							14.100*	13.100*					20
21							19.100*	16.000*					21
22							21.100*	14.700*					22
23							26.000*	7.900*					23
24							23.300*	0.000*					24
25							21.300*						25
26							20.300*						26
27							20.000*						27
28							20.300*						28
29							20.300*						29
30							15.200*						30
31							15.200*						31
TOTAL SFD	0.00	0.00	0.00	0.00	0.00	0.00	319.50	325.80	0.00	0.00	0.00	0.00	
DAYS USED	0	0	0	0	0	0	18	23	0	0	0	0	
AVG SFD	0.00	0.00	0.00	0.00	0.00	0.00	17.75	14.17	0.00	0.00	0.00	0.00	
TOTAL AF	0.00	0.00	0.00	0.00	0.00	0.00	633.73	646.22	0.00	0.00	0.00	0.00	

ANNUAL TOTAL SFD : 645.30 SFD
TOTAL DAYS USED : 41.00 DAYS
ANNUAL TOTAL ACRE FEET : 1279.95 AF

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STRUCTURE NAME: NEW CACHE LA POUDRE CO D (929)
SOURCE STREAM : CACHE LA POUDRE RIV (9) +++ TOTAL WATER THROUGH STRUCTURE +++

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1	2.430	0.000	4.300	0.000			30.000	143.000	314.000	9.400	31.800	0.600	1
2	2.430		4.300				28.000	117.000	335.000	1.800	50.000	0.600	2
3	2.430		4.300				39.000	24.000	212.000	31.000	81.000	0.600	3
4	2.430		4.300				41.000	24.000	407.500	303.000	153.000	0.550	4
5	2.430		4.300				55.000	24.000	441.000	229.000	185.000	0.550	5
6	2.430		4.300				203.000	23.000	384.500	23.000	156.000	88.550	6
7	2.430		4.300				251.000	23.000	419.900	14.000	105.000	201.550	7
8	2.430		4.300				205.000	23.000	416.700	7.900	124.000	206.550	8
9	2.430		4.300				243.000	23.000	324.000	9.900	160.000	200.550	9
10	2.430		4.300				259.000	22.000	326.100	22.700	137.000	193.550	10
11	2.420		4.300				259.000	22.000	315.100	47.000	126.000	186.550	11
12	2.420		4.300				300.000	21.000	354.700	127.000	162.000	191.550	12
13	2.420		4.300				266.000	20.000	328.900	112.000	146.000	179.550	13
14	2.420		4.300				280.000	20.000	326.000	99.000	103.000	109.550	14
15	2.420		4.300				198.000	20.000	352.500	110.000	106.000	116.550	15
16	2.420		4.300				189.000	19.000	329.900	90.000	165.000	155.550	16
	2.420		4.300				331.000	19.000	248.000	115.000	171.000	91.550	17
18	2.420		4.300				398.000	19.000	233.900	125.000	171.000	0.550	18
19	2.420		4.300				292.000	19.000	168.900	138.000	143.000	0.550	19
20	2.420		4.300				410.000	20.000	151.900	130.000	17.000	0.550	20
21	2.420		4.300				397.000	19.000	121.900	118.000	16.000	0.550	21
22	2.420		4.300				326.000	28.000	136.400	79.000	11.000	0.550	22
23	2.420		4.300				258.000	69.000	139.600	101.000	11.000	0.550	23
24	2.420		4.300				194.000	28.000	160.000	101.000	10.000	0.550	24
25	2.420		4.300				180.000	25.000	133.900	88.000	8.300	0.550	25
26	2.420		4.300				183.000	17.000	185.400	123.000	6.300	0.550	26
27	2.420		4.200				183.000	91.000	144.700	128.000	0.000	0.550	27
28	2.420		4.200				182.000	158.000	210.000	123.000		0.550	28
29	2.420		4.200				163.000	199.000	226.000	112.000		0.550	29
30	2.420		4.200			5.100	122.000	235.000	138.000	142.000		0.550	30
31			4.200				135.000		21.000	34.000		0.550	31
TOTAL SFD	72.70	0.00	132.80	0.00	0.00	5.10	6600.00	1514.00	8007.40	2893.70	2555.40	1932.20	
DAYS USED	30	0	31	0	0	1	31	30	31	31	26	31	
AVG SFD	2.42	0.00	4.28	0.00	0.00	5.10	212.90	50.47	258.30	93.35	98.28	62.33	
TOTAL AF	144.20	0.00	263.41	0.00	0.00	10.12	13091.10	3003.02	15882.68	5739.65	5068.64	3832.52	

ANNUAL TOTAL SFD : 23713.30 SFD
TOTAL DAYS USED : 242.00 DAYS
ANNUAL TOTAL ACRE FEET : 47035.33 AF

* Indicates Observed data, U Indicates User supplied data.
All other data is interpreted from previous observed value.

WATER COMMISSIONER

Seth

REPORT DATE: 3/02/1998

DIVISION OF WATER RESOURCES | STATE OF COLORADO | OFFICE OF THE STATE ENGINEER

ISION 1 DISTRICT 3 | ANNUAL WATER DIVERSION REPORT | IRRIGATION YEAR: 1997
(11/01/1996 - 10/31/1997)

STRUCTURE NAME: RIVER PT BELOW NEW CACHE (2929)
SOURCE STREAM : CACHE LA POUDRE RIV (9)

SOURCE: COMBINED (6)
FROM :
USE : OTHER (Q)
TYPE : ADMINISTRATIVE RECORD ONLY (0)

DAY	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	
1	32.000*	73.000*	45.000*	76.000*	52.000*	8.600*	122.000*	465.000*	84.000*	324.000*	367.000*	236.000*	1
2	29.000*	71.000*	46.000*	76.000*	49.000*	8.600*	91.000*	854.000*	83.000*	198.000*	377.000*	240.000*	2
3	66.000*	66.000*	59.000*	76.000*	45.000*	9.100*	71.000*	1760.000*	81.000*	169.000*	231.000*	246.000*	3
4	140.000*	67.000*	78.000*	76.000*	43.000*	8.800*	72.000*	1930.000*	84.000*	75.000*	83.000*	237.000*	4
5	143.000*	66.000*	73.000*	76.000*	42.000*	10.000*	75.000*	1990.000*	86.000*	94.000*	107.000*	235.000*	5
6	139.000*	68.000*	71.000*	77.000*	41.000*	7.800*	67.000*	1940.000*	85.000*	837.000*	178.000*	182.000*	6
7	134.000*	76.000*	68.000*	77.000*	29.000*	7.800*	72.000*	2200.000*	87.000*	584.000*	86.000*	81.000*	7
8	123.000*	78.000*	68.000*	77.000*	15.000*	7.800*	76.000*	2230.000*	88.000*	387.000*	89.000*	198.000*	8
9	118.000*	86.000*	73.000*	77.000*	11.000*	7.600*	78.000*	2450.000*	84.000*	473.000*	96.000*	197.000*	9
10	137.000*	92.000*	77.000*	76.000*	9.900*	8.100*	95.000*	2320.000*	84.000*	609.000*	92.000*	196.000*	10
11	138.000*	90.000*	77.000*	77.000*	12.000*	7.600*	103.000*	2130.000*	85.000*	757.000*	87.000*	190.000*	11
12	133.000*	85.000*	77.000*	77.000*	13.000*	7.200*	106.000*	2000.000*	88.000*	637.000*	93.000*	191.000*	12
13	133.000*	82.000*	77.000*	77.000*	17.000*	7.000*	101.000*	1880.000*	84.000*	619.000*	90.000*	212.000*	13
14	147.000*	78.000*	77.000*	77.000*	17.000*	6.600*	101.000*	1920.000*	85.000*	571.000*	83.000*	220.000*	14
15	147.000*	72.000*	77.000*	76.000*	16.000*	6.500*	157.000*	1920.000*	83.000*	567.000*	81.000*	111.000*	15
16	155.000*	66.000*	77.000*	76.000*	12.000*	4.400*	156.000*	1620.000*	83.000*	515.000*	88.000*	76.000*	16
17	124.000*	134.000*	77.000*	73.000*	17.000*	3.100*	110.000*	1530.000*	83.000*	540.000*	89.000*	132.000*	17
18	86.000*	258.000*	77.000*	64.000*	18.000*	2.100*	114.000*	1600.000*	84.000*	555.000*	89.000*	224.000*	18
19	105.000*	183.000*	77.000*	60.000*	15.000*	29.000*	113.000*	1870.000*	82.000*	464.000*	149.000*	224.000*	19
20	109.000*	101.000*	77.000*	56.000*	58.000*	75.000*	126.000*	2270.000*	83.000*	315.000*	333.000*	230.000*	20
21	91.000*	33.000*	77.000*	53.000*	55.000*	63.000*	150.000*	2520.000*	83.000*	259.000*	444.000*	215.000*	21
22	85.000*	38.000*	77.000*	52.000*	13.000*	61.000*	228.000*	2450.000*	84.000*	193.000*	473.000*	218.000*	22
23	84.000*	45.000*	77.000*	51.000*	12.000*	61.000*	360.000*	1920.000*	84.000*	153.000*	482.000*	218.000*	23
24	91.000*	45.000*	77.000*	51.000*	13.000*	82.000*	267.000*	1650.000*	87.000*	142.000*	437.000*	239.000*	24
25	86.000*	45.000*	77.000*	55.000*	14.000*	63.000*	142.000*	1160.000*	84.000*	102.000*	388.000*	293.000*	25
26	75.000*	45.000*	77.000*	72.000*	11.000*	28.000*	112.000*	802.000*	84.000*	99.000*	338.000*	229.000*	26
27	82.000*	45.000*	77.000*	65.000*	13.000*	18.000*	75.000*	546.000*	82.000*	99.000*	240.000*	242.000*	27
28	75.000*	44.000*	77.000*	53.000*	13.000*	17.000*	74.000*	322.000*	232.000*	99.000*	252.000*	271.000*	28
29	69.000*	44.000*	77.000*		11.000*	22.000*	74.000*	193.000*	1440.000*	135.000*	232.000*	271.000*	29
30	69.000*	44.000*	77.000*		8.600*	61.000*	213.000*	93.000*	475.000*	333.000*	234.000*	269.000*	30
31		44.000*	76.000*		8.600*		261.000*		555.000*	411.000*		289.000*	31
TOTAL SFD	3145.00	2364.00	2274.00	1929.00	704.10	708.70	3962.00	48535.00	4976.00	11275.00	6408.00	6612.00	
DAYS USED	30	31	31	28	31	30	31	30	31	31	30	31	
AVG SFD	104.83	76.26	73.35	68.89	22.71	23.62	127.81	1617.83	160.52	363.71	213.60	213.29	
TOTAL AF	6238.11	4688.99	4510.48	3826.17	1396.58	1405.71	7858.63	96269.17	9869.90	22363.96	12710.27	13114.90	

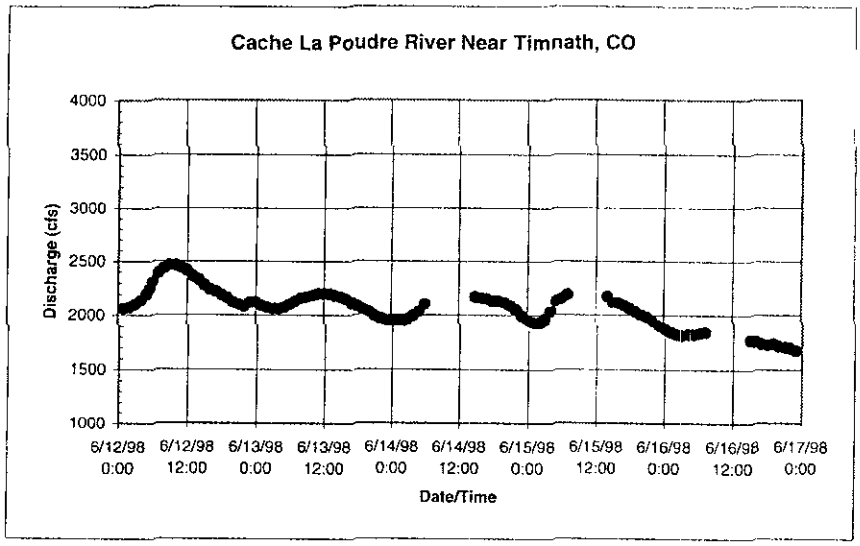
ANNUAL TOTAL SFD : 92892.80 SFD
TOTAL DAYS USED : 365.00 DAYS
ANNUAL TOTAL ACRE FEET : 184252.87 AF

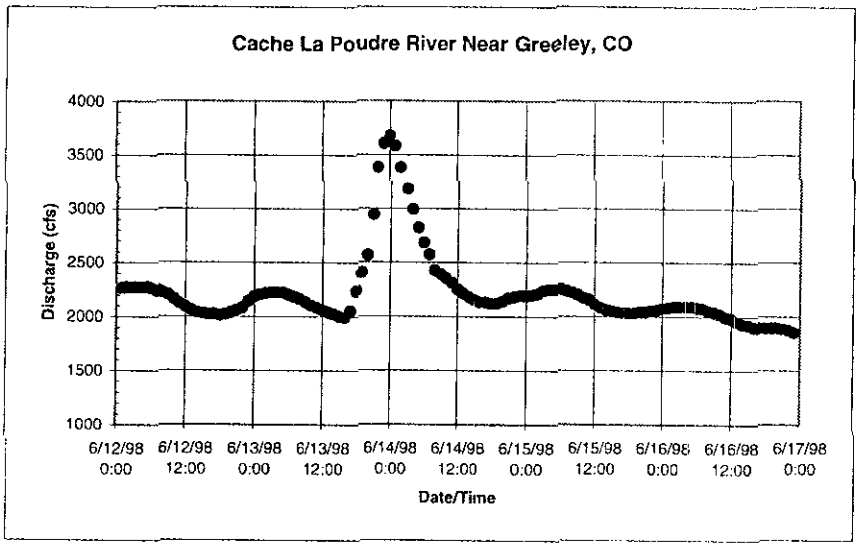
* Indicates Observed data, U Indicates User supplied data.
All other data is interpreted from previous observed value.

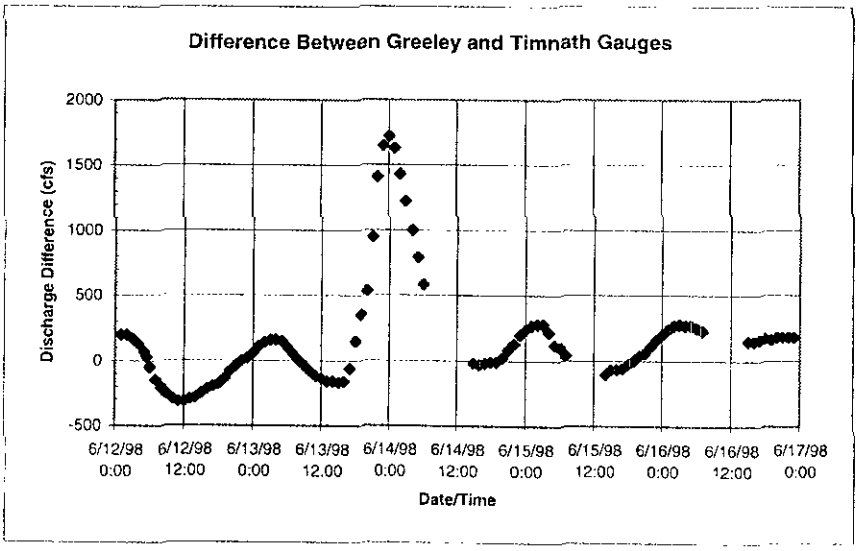
WATER COMMISSIONER

- This is a Non-additive Classification -

REPORT DATE: 3/02/1998







(No Time shift of ... irrigation ditches)

ROY ROMER
Governor

HAROLD (HAL) D. SIMPSON
State Engineer

DIVISION OF WATER RESOURCES

WATER DIVISION I

Alan D. Berryman
Division Engineer
800 8th Ave.-Room 321 ARIX Bldg.
Greeley, Colorado 80631
(303) 352-8712
970

FAX COVER SHEET

PLEASE DELIVER THE FOLLOWING PAGES TO:

TO: Bill OWEN 970-484-7593

OFFICE: Riverside Technology

FROM: Bob Cooper

TOTAL NUMBER OF PAGES INCLUDING THIS COVER SHEET: 6

DATE: May 18, 1997

IF YOU DO NOT RECEIVE ALL OF THE PAGES AS INDICATED OR QUALITY IS UNACCEPTABLE, PLEASE CALL US BACK AS SOON AS POSSIBLE.

Telephone: (303) 659-0579

Fax Number: (303) 659-0579

MESSAGE: Flow Data - Cache la Padre @ Greeley & Timnath

Gauge Seminar

USGS Lakewood
(303) 236-9404
Bob Bristol
June 12-16, 1997

USGS report

06752500 CACHE LA POUDRE RIVER NEAR GREELEY, CO

LOCATION.--Lat 40°25'04", long 104°38'22", in NW¼ sec.11, T.5 N., R.65 W., Weld County, Hydrologic Unit 10190007, on right bank 25 ft downstream from highway bridge, 2.9 mi east of courthouse in Greeley, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--1,877 mi².

PERIOD OF RECORD.--Streamflow records, March to October 1903, August to November 1904, January 1914 to December 1919, June 1924 to current year. Monthly discharge only for some periods, published in WSP 1310. Water-quality data available, November 1951 to September 1952, August 1954 to August 1956, December 1963 to September 1966, October 1967 to September 1968, October 1970 to September 1982.

REVISED RECORDS.--WSP 1440: 1935, 1938(M), 1942-43. WSP 1730: Drainage area.

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 4,610 ft above sea level, from topographic map. See WSP 1710 or 1730 for history of changes prior to Dec. 14, 1933.

REMARKS.--Records fair except for July 1 to Sept. 9, and estimated daily discharges, which are poor. Natural flow of stream affected by transmountain and transbasin diversions, storage reservoirs, power developments, diversion for municipal supply, diversions upstream from station for irrigation of about 250,000 acres, and return flow from irrigated areas.

COOPERATION.--Records collected and computed by Colorado Division of Water Resources and reviewed by Geological Survey.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1996 TO SEPTEMBER 1997
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e251	e135	153	167	147	104	83	33	266	146	560	335
2	e216	e128	156	167	143	99	89	66	621	72	269	328
3	e146	e127	151	168	141	101	88	38	1280	78	124	312
4	e133	e182	156	170	136	108	89	34	1870	75	130	141
5	e125	e231	151	150	140	109	93	32	1950	69	152	92
6	e140	e233	152	152	143	99	82	32	2040	69	711	139
7	e130	e236	145	140	141	99	81	24	2120	76	889	114
8	e122	e232	152	147	141	97	84	31	2320	77	524	91
9	e116	e226	159	143	138	95	89	44	2320	71	523	106
10	e119	e228	175	149	137	101	89	44	2550	51	516	115
11	e116	e249	181	114	143	104	87	57	2340	50	815	118
12	e113	e244	175	69	143	104	86	56	2140	53	706	108
13	e109	e225	170	138	127	106	84	47	2370	39	657	102
14	e110	e235	158	140	125	107	81	51	2450	42	614	102
15	e106	e245	139	146	123	106	86	70	2130	38	545	100
16	e114	e252	142	156	121	102	76	77	1970	41	543	100
17	e118	e246	79	153	119	101	64	62	1670	34	712	103
18	e124	e211	106	152	121	107	64	53	1670	33	579	106
19	e117	e199	137	144	123	105	36	63	1740	46	554	109
20	e115	e222	151	143	114	102	26	66	1950	57	417	258
21	e115	e212	152	154	101	145	58	79	2220	48	355	396
22	e121	e202	149	152	109	128	40	220	2330	42	272	453
23	e121	e199	157	144	108	99	38	353	2120	43	225	480
24	e115	e198	154	141	129	97	87	364	1830	62	188	462
25	e114	e203	152	136	129	98	97	245	1460	67	152	417
26	e131	e194	147	135	137	99	41	159	897	61	106	381
27	e122	e188	154	136	147	96	28	160	561	56	97	302
28	e124	e190	156	136	119	87	24	126	376	123	100	272
29	e123	e175	160	138	---	86	24	127	295	1180	91	260
30	e132	155	155	139	---	82	26	134	198	877	161	245
31	e137	---	161	144	---	82	---	226	---	633	332	---
TOTAL	3995	6202	4685	4463	3645	3155	2020	3173	50054	4409	12619	6647
MEAN	129	207	151	144	130	102	67.3	102	1668	142	407	222
MAX	251	252	181	170	147	145	97	364	2550	1180	889	480
MIN	106	127	79	69	101	82	24	24	198	33	91	91
AC-FT	7920	12300	9290	8850	7230	6260	4010	6290	99280	8750	25030	13180

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1903 - 1997, BY WATER YEAR (WY)

MEAN	95.7	114	106	96.2	103	104	114	218	492	103	54.2	58.6
MAX	337	368	237	249	311	343	836	3045	4786	1475	407	222
(WY)	1962	1962	1985	1984	1984	1980	1983	1980	1983	1983	1997	1997
MIN	7.13	6.63	34.5	37.4	38.1	33.9	7.77	9.58	9.45	13.0	5.43	9.53
(WY)	1935	1935	1935	1935	1935	1935	1935	1954	1977	1954	1940	1948

SUMMARY STATISTICS	FOR 1996 CALENDAR YEAR		FOR 1997 WATER YEAR		WATER YEARS 1903 - 1997	
ANNUAL TOTAL	77253.3		105067			
ANNUAL MEAN	211		288		137	
HIGHEST ANNUAL MEAN					872	1983
LOWEST ANNUAL MEAN					27.9	1940
HIGHEST DAILY MEAN	1740	Jun 17	2550	Jun 10	6090	Jun 14 1983
LOWEST DAILY MEAN	[a]8.0	Apr 24	[b]24	Apr 28	.80	Oct 3 1946
ANNUAL SEVEN-DAY MINIMUM	8.3	Apr 21	34	May 3	1.5	Aug 22 1946
INSTANTANEOUS PEAK FLOW			3670	Jun 13	6360	Jun 14 1983
INSTANTANEOUS PEAK STAGE			8.48	Jun 13	[c]8.92	Jun 14 1983
ANNUAL RUNOFF (AC-FT)	153200		208400		99060	
10 PERCENT EXCEEDS	306		568		193	
50 PERCENT EXCEEDS	147		136		76	
90 PERCENT EXCEEDS	56		57		16	

e-Estimated.
b-Also occurred Apr 29 and May 7.
a Also occurred Apr 25.
c-Maximum gage height, 8.95 ft, Jun 22, 1983.

CO WR report

PLATTE RIVER BASIN

06752500 CACHE LA POUDRE RIVER NEAR GREELEY, CO

LOCATION.--Lat 40°25'04", long 104°39'22", in NW¼ sec. 11, T.5 N., R.65 W., Weld County, Hydrologic Unit 10190007, on right bank 25 ft downstream from highway bridge, 2.9 mi east of courthouse in Greeley, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--1,877 mi².

GAGE.--Water-stage recorder with satellite telemetry. Elevation of gage is 4,610 ft above National Geodetic Vertical Datum of 1929, from topographic map. See WSP 1710 or 1730 for history of changes prior to Dec. 14, 1933.

REMARKS.--Primary record is taken from hourly satellite gage readings, and is complete. Reliability of record is questionable from Oct. 1-Nov. 29, 1996 due to inlet plugged. New multiple inlets were installed Apr. 30, 1997, increasing reliability of the record. The record is fair, except for the periods Oct. 1-Nov. 29, 1996; Jul. 1-Sep. 9, 1997, which are poor due to inlet problems. Station maintained by Jim Clark and record developed by Jim Clark and Robert Cooper.

RATING TABLE.--CLAGRECO25 USED FROM 01-OCT-1996 TO 30-SEP-1997

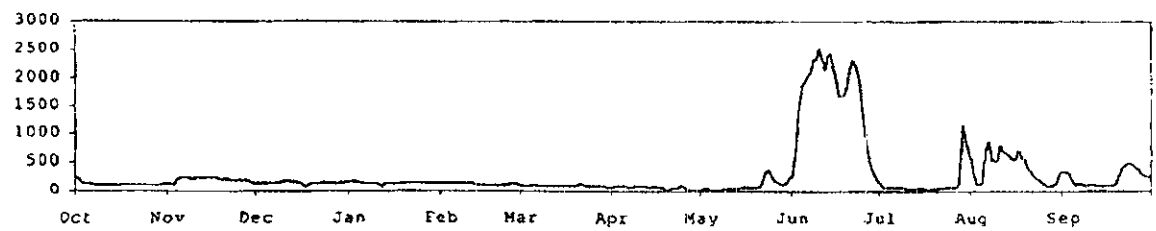
DISCHARGE, IN CFS, WATER YEAR OCTOBER 1996 TO SEPTEMBER 1997
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	251	135	153	167	147	104	83	33	266	146	560	335
2	216	128	156	167	143	99	89	66	621	72	269	328
3	146	127	151	168	141	101	88	38	1280	78	124	312
4	133	182	156	170	136	108	89	34	1870	75	130	141
5	125	231	151	150	140	109	93	32	1950	69	152	92
6	140	233	152	152	143	99	82	32	2040	69	711	139
7	130	236	145	140	141	99	81	24	2120	76	889	114
8	122	232	152	147	141	97	84	31	2320	77	524	91
9	116	226	159	143	138	95	89	44	2320	71	523	106
10	119	228	175	149	137	101	89	44	2550	51	516	115
11	116	249	181	114	143	104	87	57	2340	50	815	118
12	113	244	175	69	143	104	86	56	2140	53	706	108
13	109	225	170	138	127	106	84	47	2370	39	657	102
14	110	235	158	140	125	107	81	51	2450	42	614	102
15	106	245	139	146	123	106	86	70	2130	38	545	100
16	114	252	142	156	121	102	76	77	1970	41	543	100
17	118	246	79	153	119	101	64	62	1670	34	712	103
18	124	211	106	152	121	107	64	53	1670	33	579	106
19	117	199	137	144	123	105	36	63	1740	46	554	109
20	115	222	151	143	114	102	26	66	1950	57	417	258
21	115	212	152	154	101	145	58	79	2220	48	355	396
22	121	202	149	152	109	128	40	220	2330	42	272	453
23	121	199	157	144	108	99	38	353	2120	43	225	480
24	115	198	154	141	129	97	87	364	1830	62	188	462
25	114	203	152	136	129	98	97	245	1460	67	152	417
26	131	194	147	135	137	99	41	159	897	61	106	381
27	122	188	154	136	147	96	28	160	561	56	97	302
28	124	190	156	136	119	87	24	126	376	123	100	272
29	123	175	160	138	---	86	24	127	295	1180	91	260
30	132	155	155	139	---	82	26	134	198	877	161	245
31	137	---	161	144	---	82	---	226	---	633	332	---
TOTAL	3995	6202	4685	4463	3645	3155	2020	3173	50054	4409	12619	6647
MEAN	129	207	151	144	130	102	67.3	102	1668	142	407	222
AC-FT	7920	12300	9290	8850	7230	6260	4010	6290	99280	8750	25030	13180
MAX	251	252	181	170	147	145	97	364	2550	1180	889	480
MIN	106	127	79	69	101	82	24	24	198	33	91	91

CAL YR 1996 TOTAL	77253.3	MEAN	211	MAX	1740	MIN	8.0	AC-FT	153200
WTR YR 1997 TOTAL	105067	MEAN	288	MAX	2550	MIN	24	AC-FT	208400

MAX DISCH 0.00 CFS AT 2315 01-OCT-1996 GH 2.98 FT. SHIFT 0.08 FT. MAX GH 8.48 FT. AT 2345 13-JUN-1997

FOR MORE COMPLETE OR DETAILED INFORMATION SEE DAILY OR MONTHLY RECORD.



CLAGRECO JUN13 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE=	7.32	EQUIVALENT STAGE=	7.25	MEAN Q=	2370.00
MEAN SHIFT=	-0.10	MEAN DATUM=	0.00	NVALS=	96
MAX STAGE=	8.48	AT 2345	MIN STAGE=	6.92	AT 1545

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.18	-0.10		2200.00	13	6.99	-0.10		2040.00
2	7.19	-0.10		2210.00	14	6.96	-0.10		2020.00
3	7.20	-0.10		2220.00	15	6.93	-0.10		2000.00
4	7.20	-0.10		2220.00	16	6.93	-0.11		1990.00
5	7.20	-0.10		2220.00	17	7.01	-0.11		2050.00
6	7.18	-0.10		2200.00	18	7.22	-0.11		2230.00
7	7.16	-0.10		2180.00	19	7.40	-0.11		2400.00
8	7.14	-0.10		2160.00	20	7.56	-0.11		2560.00
9	7.11	-0.10		2130.00	21	7.89	-0.11		2940.00
10	7.07	-0.10		2100.00	22	8.25	-0.11		3380.00
11	7.04	-0.10		2080.00	23	8.43	-0.11		3600.00
12	7.01	-0.10		2060.00	24	8.48	-0.11		3670.00

ENTER NUMBER OF DAYS FORWARD OR BACK (+/-)(DEFAULT IS 1).
TYPE QUIT TO RETURN TO SELECTION MENU

LAGRECO JUN14 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE=	7.43	EQUIVALENT STAGE=	7.34	MEAN Q=	2450.00
MEAN SHIFT=	-0.11	MEAN DATUM=	0.00	NVALS=	96
MAX STAGE=	8.48	AT 0015	MIN STAGE=	7.12	AT 1730

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	8.41	-0.11		3580.00	13	7.20	-0.11		2210.00
2	8.25	-0.11		3380.00	14	7.17	-0.11		2180.00
3	8.09	-0.11		3180.00	15	7.15	-0.12		2150.00
4	7.93	-0.11		2990.00	16	7.13	-0.12		2130.00
5	7.79	-0.11		2820.00	17	7.13	-0.12		2130.00
6	7.67	-0.11		2680.00	18	7.12	-0.12		2120.00
7	7.57	-0.11		2570.00	19	7.12	-0.12		2120.00
8	7.42	-0.11		2420.00	20	7.14	-0.12		2140.00
9	7.39	-0.11		2390.00	21	7.17	-0.12		2170.00
10	7.34	-0.11		2350.00	22	7.18	-0.12		2180.00
11	7.30	-0.11		2310.00	23	7.19	-0.12		2190.00
12	7.24	-0.11		2250.00	24	7.19	-0.12		2190.00

ENTER NUMBER OF DAYS FORWARD OR BACK (+/-)(DEFAULT IS 1).
TYPE QUIT TO RETURN TO SELECTION MENU

*AGRECO JUN06 1997 (FINAL)
RATING TABLE: CLAGRECO25

MEAN STAGE=	6.96	EQUIVALENT STAGE=	6.88	MEAN Q=	2040.00
MEAN SHIFT=	-0.08	MEAN DATUM=	0.00	NVALS=	96
MAX STAGE=	7.12	AT 0500	MIN STAGE=	6.77	AT 1500

HOUR	STAGE	SHIFT	DATUM	Q	HOUR	STAGE	SHIFT	DATUM	Q
1	7.03	-0.08		2080.00	13	6.83	-0.08		1940.00
2	7.06	-0.08		2110.00	14	6.79	-0.08		1920.00
3	7.08	-0.08		2120.00	15	6.77	-0.08		1900.00
4	7.11	-0.08		2150.00	16	6.77	-0.08		1900.00
5	7.12	-0.08		2160.00	17	6.77	-0.08		1900.00
6	7.12	-0.08		2160.00	18	6.80	-0.08		1920.00
7	7.12	-0.08		2160.00	19	6.83	-0.08		1940.00
8	7.09	-0.08		2130.00	20	6.88	-0.08		1980.00
9	7.05	-0.08		2100.00	21	6.93	-0.08		2020.00
10	7.00	-0.08		2060.00	22	6.97	-0.08		2040.00
11	6.94	-0.08		2020.00	23	7.01	-0.08		2070.00
12	6.88	-0.08		1980.00	24	7.04	-0.08		2090.00

ENTER NUMBER OF DAYS FORWARD OR BACK (+/-)(DEFAULT IS 1).
TYPE QUIT TO RETURN TO SELECTION MENU

100 Year Peak Discharge Calculations

Purpose:

Estimate the peak 100-year discharge for several creeks in Weld County, CO using the methodology developed by the Colorado Water Conservation Board (CWBC). The watersheds evaluated here include Lone Tree Creek, Owl Creek, Willow Creek, and Crow Creek.

Methods/Equations:

The CWBC has developed regression equations to calculate 100-year peak discharge for watersheds in Colorado. The state is divided into subregions based on stream characteristics and a regression equation has been developed for each subregion. The input the equations is the area of the watershed in square miles. The area for Lone Tree Creek and Crow Creek was found on the USGS Water Resources web site and the area of Owl Creek and Willow Creek were found with a digital planimeter. The following table shows the area in square miles and the CWBC subregion for each watershed:

Drainage/Gauge	Area (mi^2)	CWBC Subregion
Lone Tree Creek near Greeley, CO (includes Owl Creek)	571[1]	
Lone Tree Creek w/o Owl Creek (571 minus 174)	397	SPL-4 or SPL-1
Crow Creek near Barnesville, CO	1,324[1]	SPL-1
Willow Creek	88[2]	SPL-1
Owl Creek	174[2]	SPL-1

[1] Area of watershed found on internet. //waterdata.usgs.gov.nwis-w/CO/
[2] Area of watershed found with digital planimeter.

The following equations were used to calculate the 100-year peak discharge:

Subregion SPL-1 $\quad Q = 707.9(Area)^{0.654}$

Subregion SPL-4 $\quad Q = 800.8(Area)^{0.478}$

where, Q = 100-year peak discharge in cubic feet per second (cfs)
$Area$ = area of watershed in square miles $(2<Area<1{,}090)$

These equations came from *Guidelines for Determining 100-Year Flood Flows for Approximate Floodplains in Colorado*, Colorado Department of Natural Resources, Colorado Water Conservation Board, July 1997. The equation for subregion SPL-1 is only recommended by the CWBC for

watersheds with an area between 2 and 1,090 square miles. Note that the Crow Creek watershed is somewhat larger than this. Therefore, this equation may not yield valid results for Crow Creek. The equation for subregion SPL-4 is only recommended by the CWBC for watersheds with an area between 1 and 445 square miles.

Results:

100-year peak discharge estimates for Lone Tree Creek, Owl Creek, Willow Creek, and Crow Creek in Weld County, CO using CWBC methods are:

Watershed	SPL-1 Discharge	SPL-4 Discharge
Lone Tree Creek	35,447 cfs	13,988 cfs
Crow Creek	77,927 cfs	
Willow Creek	13,233 cfs	(Wrong Willow Creek!)
Owl Creek	20,668 cfs	

Crow Creek Near Barnsville, Co.

Station Information

Station Number	Latitude (ddmmss)	Longitude (dddmmss)	County	Basin Name	Drainage Area (miles^2)	Datum (ft above NGVD)
06756500	402935	1042635	Weld	Crow	1324.00	4670.00

Data Types Available

7/25/15 - 9/30/57
no data ("0")

- Historical Streamflow Daily Values
- Map of region surrounding station
- EPA "Surf Your Watershed" for Crow.

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

Peakflow data is now available up to WY 1996.

The NWIS-W server's official URL is now http://waterdata.usgs.gov/nwis-w/

←Go to the Colorado NWIS-W Data Retrieval page
←Go to the Colorado Water Resources page
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Comments and questions are welcome! Please visit our feedback page or email h2oteam@qvarsx.er.usgs.gov.

This page was created in real time by the NWIS-W package: (NWIS-W: 3.01pr ; nwis-w: 3.0pr)

Lonetree Creek Near Greeley, Co.

Station Information

Station Number	Latitude (ddmmss)	Longitude (dddmmss)	County	Basin Name	Drainage Area (miles^2)	Datum (ft above NGVD)
06753990	402633	1043518	Weld	Lone Tree-Owl	571.43	4630

Data Types Available

- Peak Flow
- Map of region surrounding station
- EPA "Surf Your Watershed" for Lone Tree-Owl.

We are aware of a problem with the clickable county imagemaps. When you click on a map you may not get stations for the county you expected, or the click may register as having missed the state. We are working on this problem.

Peakflow data is now available up to WY 1996.

The NWIS-W server's official URL is now http://waterdata.usgs.gov/nwis-w/

←Go to the Colorado NWIS-W Data Retrieval page
←Go to the Colorado Water Resources page
Get help with the terms used on these pages
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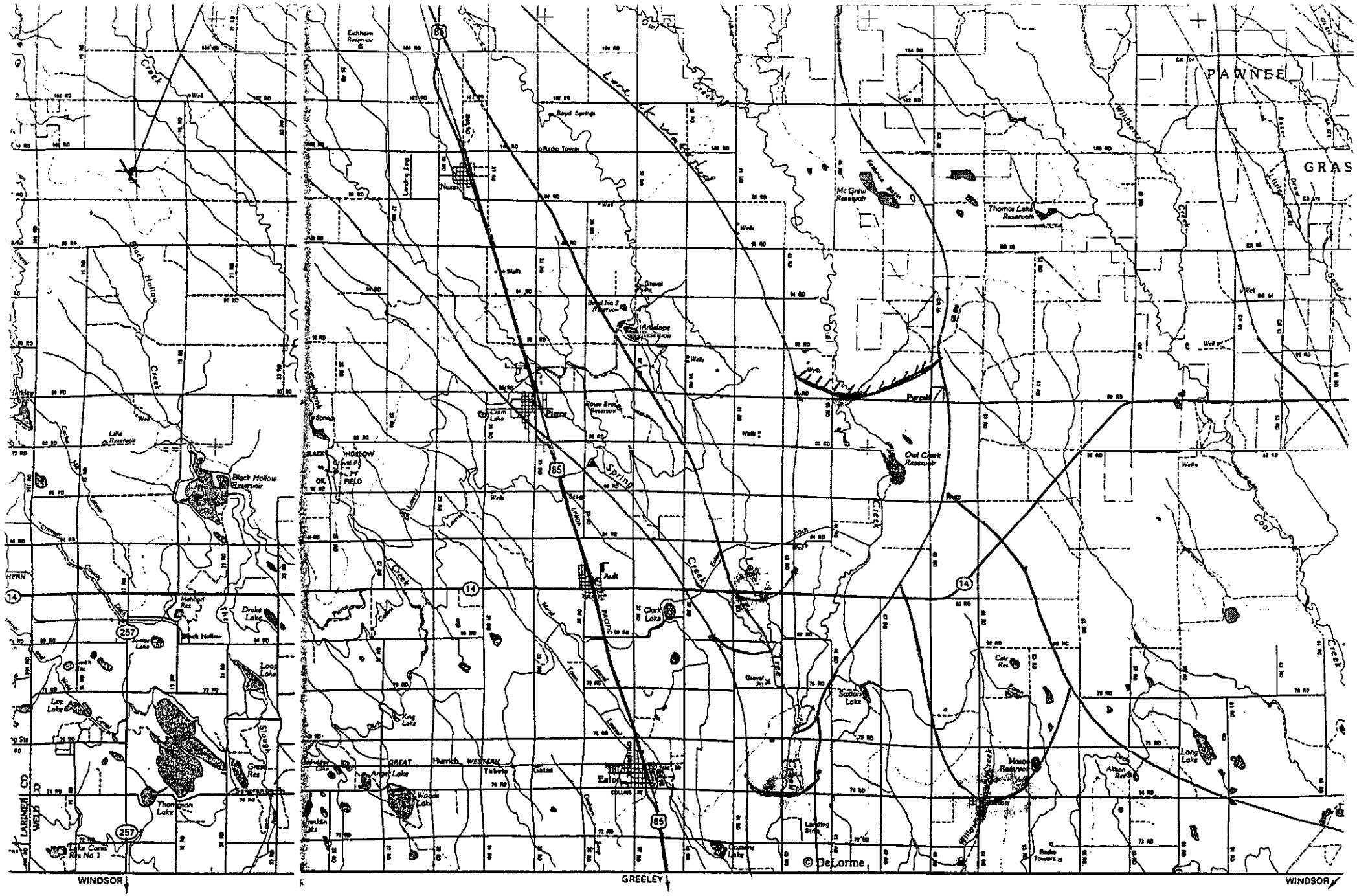
Comments and questions are welcome! Please visit our feedback page or email h2oteam@qvarsx.er.usgs.gov.

This page was created in real time by the NWIS-W package: (NWIS-W: 3.01pr ; nwis-w: 3.0pr)



6 7 8 9 10

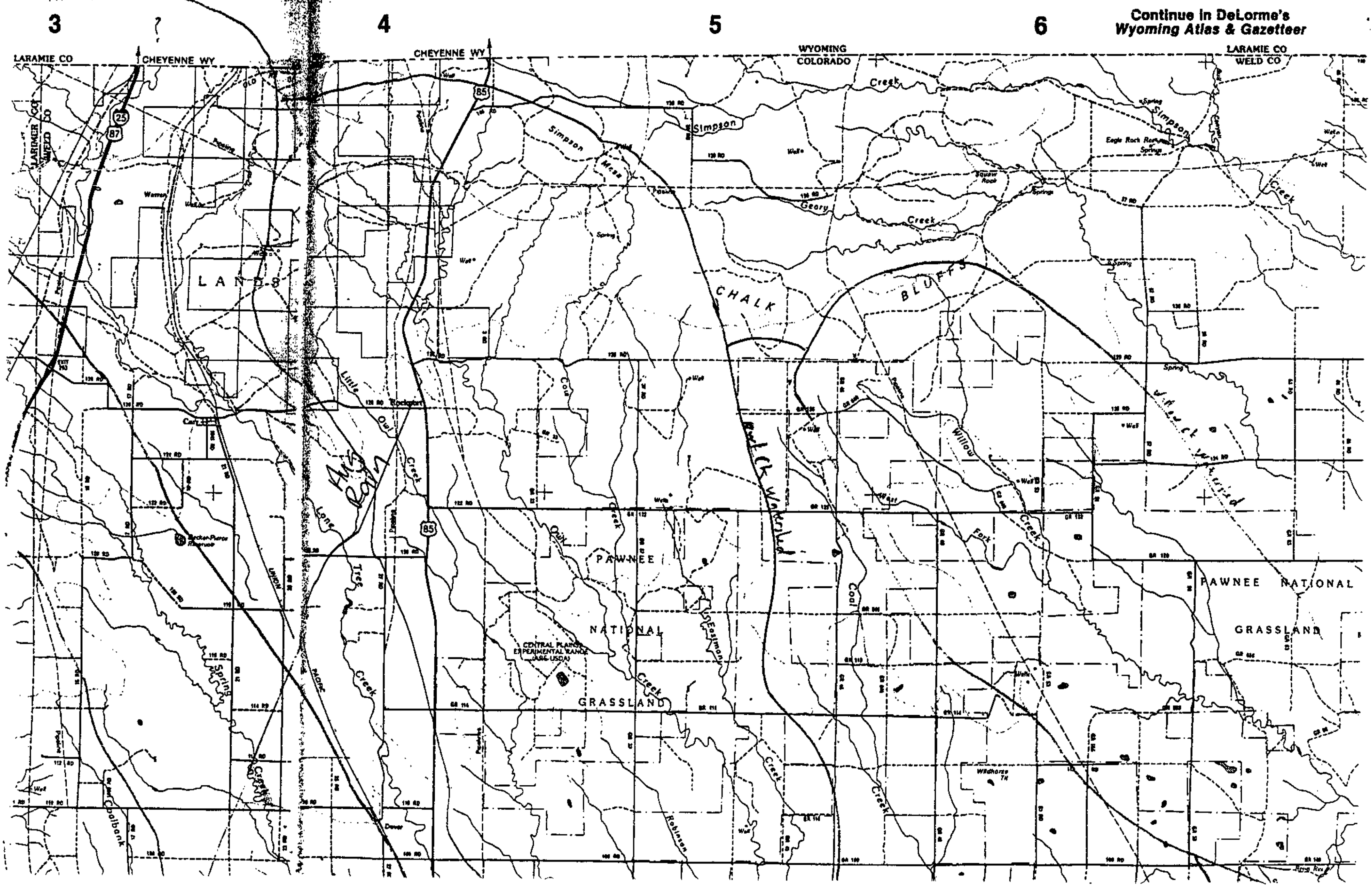
4 5 6

Scale 1:160,000

1 inch represents 2.5 miles

Contour interval
300 feet (91.4 meters)

Continue on Page 31



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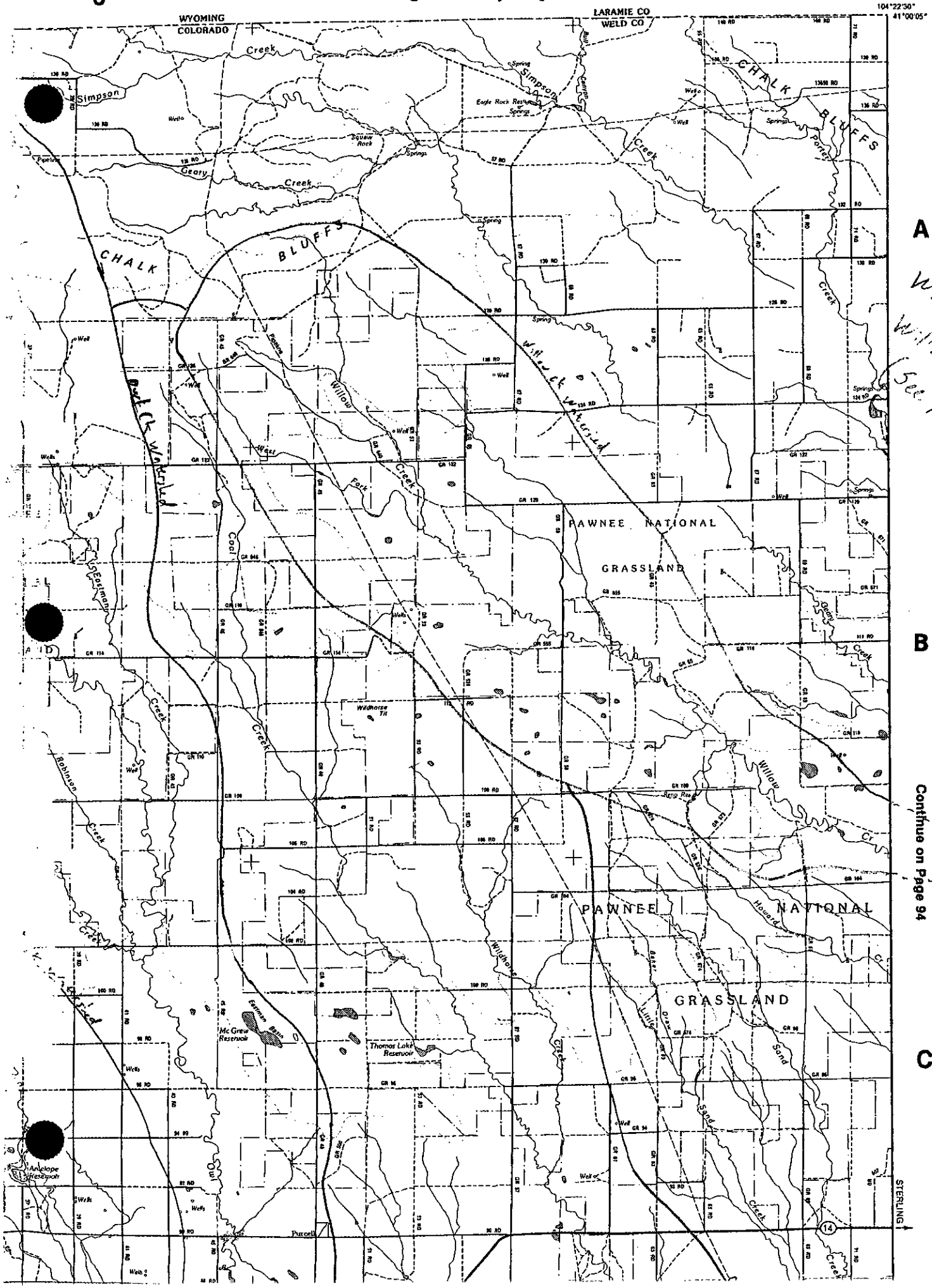
Continue in DeLorme's
Wyoming Atlas & Gazetteer
LARAMIE CO
CHEYENNE WY
CHEYENNE WY
WYOMING
COLORADO
LARAMIE CO
WELD CO
LARIMER CO
WELD CO
Simpson
Simpson
Mesa
Creek
Simpson
Eagle Rock Reservoir
Squaw Rock
Geary
Creek
Creek
CHALK
BLUFFS
LANDS
Little
Owl
Creek
Rockport
Carr
Becker-Pierce Reservoir
Lone
Tree
Creek
Spring
Creek
Coalbank
UNION
PACIFIC
Cow
Creek
Owl
Creek
PAWNEE
NATIONAL
GRASSLAND
CENTRAL PLAINS EXPERIMENTAL RANGE (ARS-USDA)
Eastman
Creek
Robinson
Creek
Coal
Creek
Willow
Fork
Creek
PAWNEE NATIONAL
GRASSLAND
Wildhorse Tank
Dover

Continue in DeLorme's
Wyoming Atlas & Gazetteer



Continue on Page 94

Riverside Technology, inc
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410/740-8220 • FAX 410/740-8221

Subject: 100yr Peak Discharge - CWCB Method
Computed: wje Date: 5/19/98
Checked: _____ Date: _____

Project/Proposal Name: _____
Project/Proposal No.: 0479 Task: 54
Page _____ of _____

Purpose: Estimate the year 100 yr discharge for several creeks in Weld County

Drainage / Gauge	Area (mi^2)	CWCB Subregion
Lonetree Ck Near Greeley, CO	571.43 mi^2 ① (includes Owl Ck) (197 alone)	SPL-4 ⇒ SPL-1
Crow Ck near Barnesville, CO	1324 mi^2 ①	SPL-1
Willow Ck	88 ②	SPL-1
Owl Ck	174 ②	SPL-1

① //waterdata.usgs.gov/nwis-w/CO/

② Planimeter

Eqn's SPL-1 $Q = 707.1(A)^{.654}$

SPL-4 $Q = 800.8(A)^{.478}$

Results	SPL-1	SPL-4
Lonetree Ck	35,447 cfs	13,988 cfs
Crow Ck	77,927 cfs	
Willow Ck	13,233 cfs	
Owl Ck	20,668 cfs	

Addendum

Addendum to 100 Year Peak Discharge Calculations

Purpose:

Several other gauging sites were analyzed using the CWBC method. These included Willow Creek at Galeton, Owl Creek at County Road 90, Lone Tree Creek at Hwy 14, and Lone Tree Creek at County Road 43 and 74.

Methods/Equations:

The same equations were used for this addendum as were used for the four streams in the main calc file. The main difference here is that all areas were found using a digital planimeter. Also, it was determined that there are two Willow Creeks in Weld County. This addendum calculates the 100-Year peak discharge for the Willow Creek at Galeton, CO. Maps used for the planimeter are included in this file, as are hand written notes on watershed area and peak discharge calculations. The following table shows the area in square miles and the CWBC subregion (which defines which equation to use) for each watershed:

Drainage/Gauge	Area (mi^2)	CWBC Subregion
Crow Creek at Cornish	1,316	N/A
Crow Creek at Barnesville	1,324	N/A
Willow Creek at Galeton	13.2	SPL-1
Owl Creek at CR 90	158.8	SPL-1
Lone Tree Creek at Hwy 14	280.2	SPL-1 or SPL-4
Lone Tree Creek at CR 43 and 74	285	SPL-1 or SPL-4

The following equations were used to calculate the 100-year peak discharge:

Subregion SPL-1 $$Q = 707.9(Area)^{0.654}$$

Subregion SPL-4 $$Q = 800.8(Area)^{0.478}$$

where, Q = 100-year peak discharge in cubic feet per second (cfs)
$Area$ = area of watershed in square miles ($2<Area<1{,}090$)

These equations came from *Guidelines for Determining 100-Year Flood Flows for Approximate Floodplains in Colorado*, Colorado Department of Natural Resources, Colorado Water Conservation Board, July 1997. The equation for subregion SPL-1 is only recommended by the CWBC for watersheds with an area between 2 and 1,090 square miles. The equation for subregion SPL-4 is only recommended by the CWBC for watersheds with an area between 1 and 445 square miles.

Results:

100-year peak discharge estimates for Willow Creek, Owl Creek, and Lone Tree Creek in Weld County, CO using the CWBC methods are:

Drainage/Gauge	SPL-1 Discharge	SLP-4 Discharge
Willow Creek at Galeton	3,827	
Owl Creek at CR 90	19,468	
Lone Tree Creek at Hwy 14	28,224	11,842
Lone Tree Creek at CR 43 and 74	28,539	11,938

Note: The drainage area of crow creek is larger than recommended for using the CWBC method. Therefore, an alternate method will be used. It is hoped that the 100-year peak discharge for Crow Creek can be estimated using the USGS ANNIE program. Input to this program will be annual peak discharges from the Barnesville gauge for as long a period as is available.

Other item of interest: 5/26/98 Talked to Bob Brandal at USGS in Lakewood, CO. He told me that the Barnesville gauge was operated between 1951 & 1957, but that the entire creek was diverted for irrigation before the gauge. Therefore, there are no discharge data for this gauge. (web site is empty too.) Bill Elliott

I talked to George Seivers in the Greeley office of the Division of Water Resources (970-352-8712) and he told me that there are several ditches that take water out of the Poudre River between Timnath and Greeley. These include the Timnath Ditch, Whitney Ditch, Jones Ditch, Greeley No. 2 and No. 3 Canals, Boydman-Freeman Ditch, and Ogolby Ditch. (spelling is uncertain on these ditch names) George told me that the Greeley No. 2 is the biggest ditch and it was turned off on June 13 because there had been rain for several days prior to June 13. He thought it was likely that most, if not all, of these ditches we turned off on June 13. He also told me that Fossil Creek releases were about 250 cfs on June 13.

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Subject: Planimeter
Computed: wje Date: 5/21/98
Checked: Date:

Project/Proposal Name: CWBC
Project/Proposal No.: Task:

Crow Ck @ Cornish
(Area between Cornish & Barnesville)

5250 acres
5250 acres ÷ 640 acres/mi² = 8.25 mi²

Barnesville area: 1,324 mi²
- Cornish to Barnesville: 8 mi²
1,316 mi²

Willow Ck @ Galeton

8,477 acres
8,288
8,477 avg. = 8446 = 13.2 mi²
8,540

Owl Ck @ CR 90
(Area between CR 90 & confluence w/ Cone Tree Ck)

9868 acres
9678
9615 avg. = 9726 = 15.2 mi²
9742

Total Owl Ck = 174 mi²

Owl Ck @ CR 90 = 174 mi² - 15.2 mi² = 158.8 mi²

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Subject: Planimeter
Computed: wjc Date: 5/21/98
Checked: _____ Date: _____

Project/Proposal Name: CWBC
Project/Proposal No.: _____ Task: _____

Lone Tree Ck

downstream of Hwy 14:

13,221 acres
13,600
13,600 avg. = 13,410 = 20.95 mi²
13,221

downstream of CR 43 & 74

10,501 acres
10,501
10,311 avg. = 10,390 = 16.2 mi²
10,248

Spring Ck

61,170 acres
61,550 avg. = 61,381 = 95.9 mi²
61,423

Lone Tree - Spring Ck = 397 - 95.9 = 301.1 mi²

Lone Tree Ck @ Hwy 14 = 301.1 mi² - 20.95 mi² = 280.15 mi²

Lone Tree Ck @ CR 43 & 74 = 301.1 mi² - 16.2 mi² = 284.9 mi²

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Subject: 100-yr pk discharge
Computed: wjc Date: 5/21/98
Checked: _____ Date: _____

Project/Proposal Name: CWBC
Project/Proposal No.: _____ Task: _____
Page 1 of _____

Method:

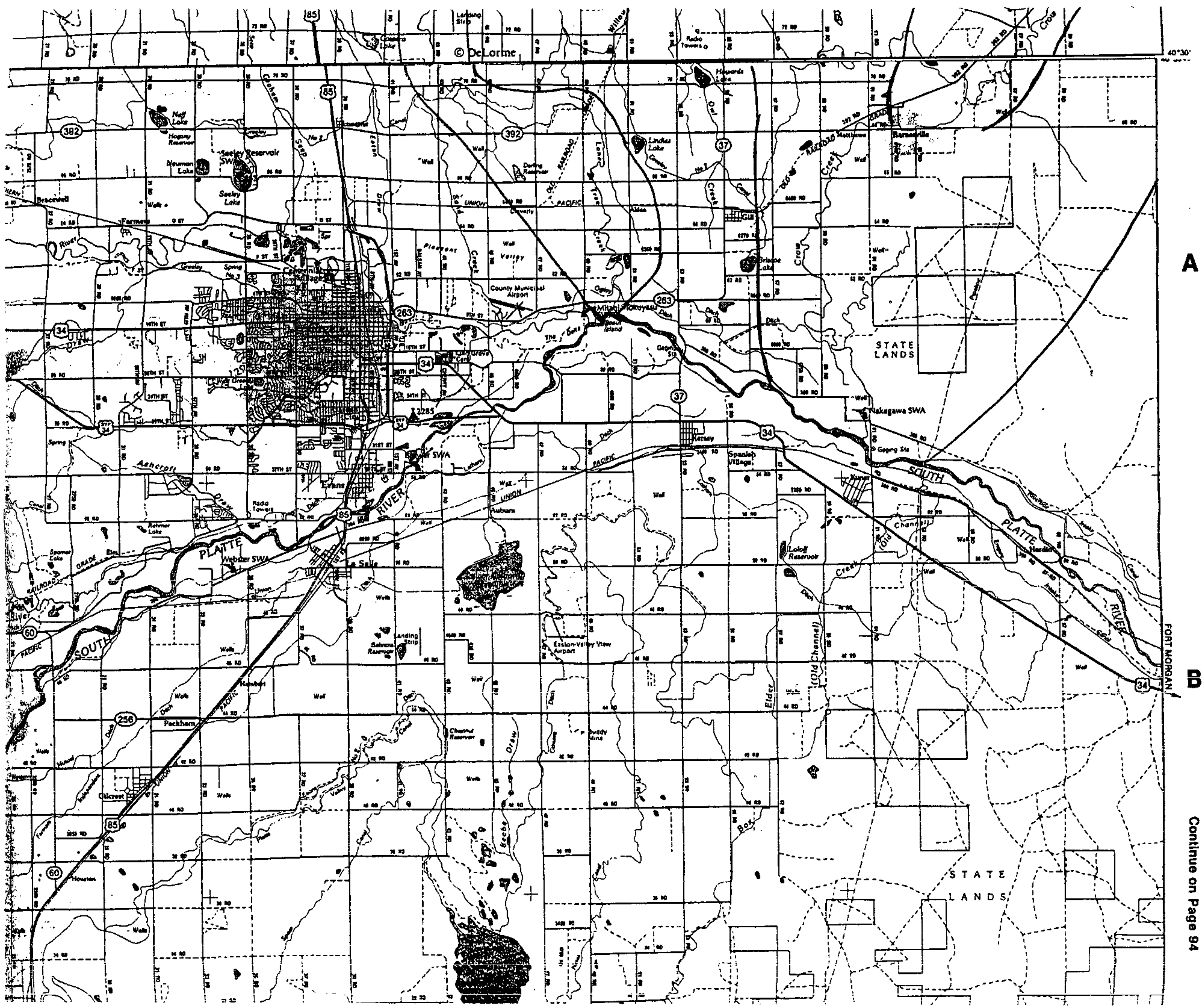
Gauge	Area (mi^2)	Method
Crow Ck @ Cornish	1,316	HEC SWSTAT
Crow Ck @ Barnesville	1,324	HEC SWSTAT
Willow Ck @ Galeton	13.2	CWBC SPL-1
Owl Ck @ CR 90	158.8	CWBC SPL-1
Lone Tree Ck @ Hwy 14	280.2	CWBC SPL-1 or 4
Lone Tree Ck @ CR 43 & 74	285	CWBC SPL-1 or 4

Eq^n s SPL-1 $Q = 707.9\ (Area)^{0.654}$

SPL-4 $Q = 800.8\ (Area)^{0.478}$

Results:

Gauge	100-yr Peak Discharge (cfs) SPL-1	SPL-4
Willow Ck @ Galeton	3,827	
Owl Ck @ CR 90	19,468	
Lone Tree Ck @ Hwy 14	28,224	11,842
Lone Tree Ck @ CR 43 & 74	28,539	11,938


© DeLorme
40°30'
Seeley Reservoir SWA
Seeley Lake
Neuman Lake
Neff Lake
Lindlee Lake
Howards Lake
Barnesville
Gill
Briscoe Lake
County Municipal Airport
Kersey
Spanish Village
Nakagawa SWA
STATE LANDS
SOUTH PLATTE RIVER
Evans
Auburn
La Salle
Webster SWA
Hardin
Loloff Reservoir
Eaton-Valley View Airport
Landing Strip
Peckham
Gilcrest
Houston
FORT MORGAN
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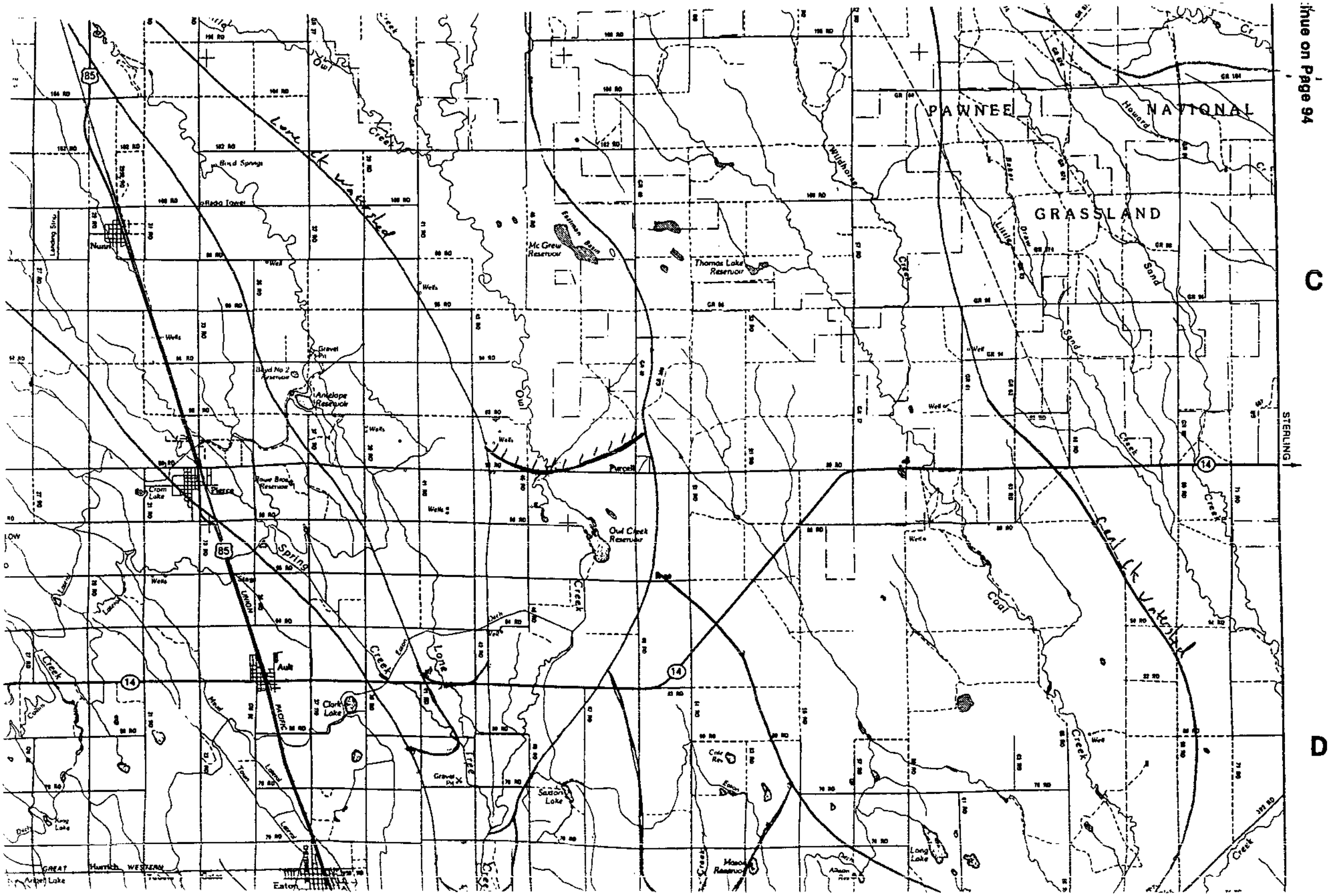

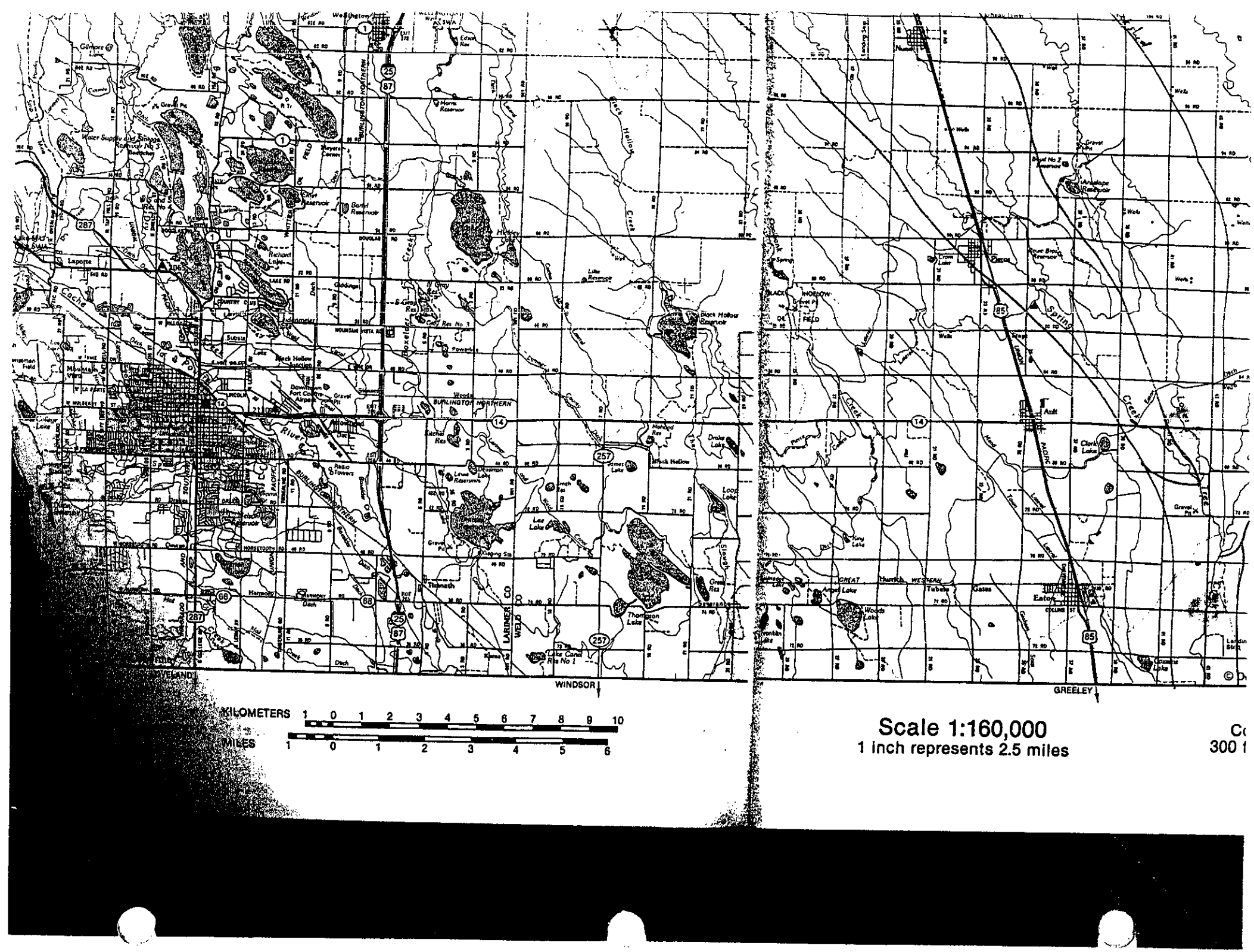
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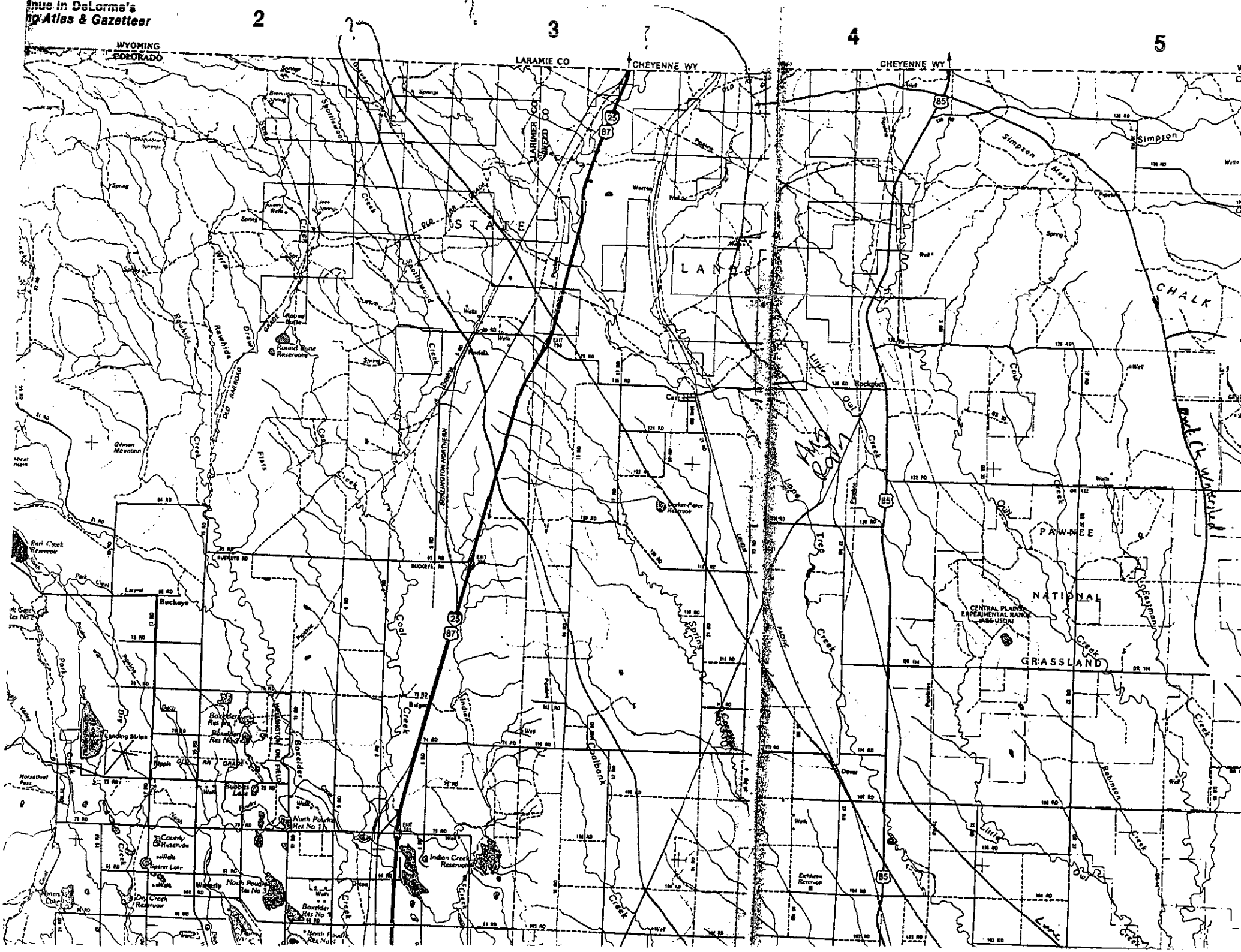
MILES
Scale 1:160,000
1 inch represents 2.5 miles
WINDSOR
GREELEY
LARIMER CO
WELD CO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WYOMING
COLORADO
LARAMIE CO
CHEYENNE WY
CHEYENNE WY
STATE
LAND
CHALK
PAWNEE
NATIONAL
GRASSLAND
CENTRAL PLAINS EXPERIMENTAL RANGE
Simpson
Simpson Mesa
Rawhide Draw
Spottswood Creek
Coal Creek
Lone Tree Creek
Spring Creek
Crow Creek
Owl Creek
Little Owl Creek
Big Owl Creek
Calbank Creek
Dry Creek
Robinson Creek
Eastman
Gilman Mountain
Rawhide Flats
Rawhide Buttes
Roberts Ranch Reservoirs
Decker-Parker Reservoir
Indian Creek Reservoir
Boxelder Res No 1
Boxelder Res No 2
Boxelder Res No 3
North Poudre Res No 1
North Poudre Res No 2
Bucklin Lake
Cavern Lake
Lower Latham
Upper Latham
Eckhorn Reservoir
Bucheye
BUCKEYE RD
Landing Strips
Horsethief Pass
Dover
BURLINGTON NORTHERN
PACIFIC
BOXELDER OIL FIELD
GRADE
OLD RAILROAD
Old Wells
Wells
Springs
Tanks
Ponds
Dams
Roads
Trails
Fences
Power Lines
Pipelines
Canals
Ditches
Gas Wells
Oil Wells
Oil & Gas Wells
Dry Holes
Abandoned Wells
Gas Fields
Oil Fields
Oil & Gas Fields
Mines
Quarries
Gravel Pits
Sand Pits
Cemeteries
Churches
Schools
Buildings
Houses
Barns
Sheds
Towers
Windmills
Fire Towers
Lookouts
Campgrounds
Picnic Areas
Trailheads
Boat Ramps
Fishing Sites
Hunting Areas
Wildlife Areas
Refuges
Parks
Golf Courses
Airports
Airstrips
Helipads
Heliports
Runways
Taxiways
Aprons
Hangars
Terminals
Control Towers
Weather Stations
Radio Towers
Radio Stations
Television Towers
Television Stations
Microwave Towers
Microwave Stations
Satellite Dishes
Satellite Stations
Radar Towers
Radar Stations
Navigation Towers
Navigation Stations
Beacons
Lighthouses
Buoys
Markers
Signs
Gates
Barriers
Fences
Walls
Bridges
Tunnels
Culverts
Fords
Ferries
Docks
Piers
Wharves
Boat Launches
Boat Slips
Boat Moorings
Boat Anchorages
Boat Repair
Boat Rentals
Boat Sales
Boat Storage
Boat Supplies
Boat Services
Boat Clubs
Boat Associations
Boat Museums
Boat Tours
Boat Rides
Boat Races
Boat Shows
Boat Parades
Boat Festivals
Boat Regattas
Boat Competitions
Boat Events
Boat Activities
Boat Recreation
Boat Sports
Boat Fishing
Boat Hunting
Boat Camping
Boat Picnicking
Boat Hiking
Boat Biking
Boat Skiing
Boat Snowmobiling
Boat Swimming
Boat Diving
Boat Surfing
Boat Sailing
Boat Rowing
Boat Canoeing
Boat Kayaking
Boat Rafting
Boat Tubing
Boat Water Skiing
Boat Wakeboarding
Boat Jet Skiing
Boat Parasailing
Boat Hang Gliding
Boat Paragliding
Boat Ballooning
Boat Flying
Boat Gliding
Boat Soaring
Boat Skydiving
Boat Bungee Jumping
Boat Rock Climbing
Boat Mountain Climbing
Boat Caving
Boat Spelunking
Boat Orienteering
Boat Geocaching
Boat Letterboxing
Boat Treasure Hunting
Boat Scavenger Hunting
Boat Photography
Boat Painting
Boat Drawing
Boat Sketching
Boat Writing
Boat Reading
Boat Studying
Boat Learning
Boat Teaching
Boat Training
Boat Education
Boat Research
Boat Science
Boat Technology
Boat Engineering
Boat Mathematics
Boat Physics
Boat Chemistry
Boat Biology
Boat Geology
Boat Meteorology
Boat Astronomy
Boat Oceanography
Boat Limnology
Boat Hydrology
Boat Ecology
Boat Environmental Science
Boat Conservation
Boat Preservation
Boat Restoration
Boat Management
Boat Administration
Boat Planning
Boat Development
Boat Construction
Boat Maintenance
Boat Repair
Boat Operation
Boat Navigation
Boat Piloting
Boat Steering
Boat Docking
Boat Mooring
Boat Anchoring
Boat Launching
Boat Retrieving
Boat Towing
Boat Salvaging
Boat Rescue
Boat Safety
Boat Security
Boat Law Enforcement
Boat Regulation
Boat Licensing
Boat Registration
Boat Insurance
Boat Taxes
Boat Fees
Boat Permits
Boat Tickets
Boat Fines
Boat Penalties
Boat Violations
Boat Accidents
Boat Injuries
Boat Deaths
Boat Statistics
Boat Reports
Boat Records
Boat Archives
Boat Libraries
Boat Museums
Boat Exhibits
Boat Displays
Boat Collections
Boat Artifacts
Boat History
Boat Culture
Boat Tradition
Boat Folklore
Boat Mythology
Boat Religion
Boat Spirituality
Boat Philosophy
Boat Ethics
Boat Morality
Boat Values
Boat Beliefs
Boat Attitudes
Boat Perceptions
Boat Emotions
Boat Feelings
Boat Moods
Boat Personality
Boat Character
Boat Identity
Boat Self
Boat Ego
Boat Id
Boat Superego
Boat Unconscious
Boat Subconscious
Boat Dreams
Boat Nightmares
Boat Fantasies
Boat Imagination
Boat Creativity
Boat Art
Boat Music
Boat Dance
Boat Theater
Boat Film
Boat Literature
Boat Poetry
Boat Prose
Boat Drama
Boat Comedy
Boat Tragedy
Boat Satire
Boat Parody
Boat Irony
Boat Metaphor
Boat Simile
Boat Allegory
Boat Symbolism
Boat Imagery
Boat Sound
Boat Rhythm
Boat Meter
Boat Rhyme
Boat Alliteration
Boat Assonance
Boat Consonance
Boat Onomatopoeia
Boat Personification
Boat Hyperbole
Boat Understatement
Boat Paradox
Boat Oxymoron
Boat Pun
Boat Wordplay
Boat Language
Boat Communication
Boat Speech
Boat Writing
Boat Reading
Boat Listening
Boat Speaking
Boat Signing
Boat Gesturing
Boat Body Language
Boat Facial Expression
Boat Eye Contact
Boat Touch
Boat Smell
Boat Taste
Boat Sight
Boat Hearing
Boat Vision
Boat Perception
Boat Cognition
Boat Memory
Boat Learning
Boat Thinking
Boat Reasoning
Boat Problem Solving
Boat Decision Making
Boat Judgment
Boat Evaluation
Boat Assessment
Boat Measurement
Boat Quantification
Boat Statistics
Boat Probability
Boat Chance
Boat Luck
Boat Fate
Boat Destiny
Boat Free Will
Boat Determinism
Boat Causality
Boat Correlation
Boat Regression
Boat Prediction
Boat Forecasting
Boat Modeling
Boat Simulation
Boat Optimization
Boat Control
Boat Feedback
Boat Adaptation
Boat Evolution
Boat Natural Selection
Boat Genetics
Boat Heredity
Boat Variation
Boat Mutation
Boat Recombination
Boat Speciation
Boat Extinction
Boat Biodiversity
Boat Ecosystem
Boat Community
Boat Population
Boat Species
Boat Organism
Boat Cell
Boat Tissue
Boat Organ
Boat System
Boat Body
Boat Mind
Boat Consciousness
Boat Self-Awareness
Boat Intelligence
Boat Wisdom
Boat Knowledge
Boat Truth
Boat Reality
Boat Existence
Boat Being
Boat Nothingness
Boat Infinity
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Boat Diversity
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Boat Simplicity
Boat Order
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Boat Randomness
Boat Pattern
Boat Structure
Boat Function
Boat Purpose
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Boat Quality
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Boat Magnetism
Boat Electricity
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Boat Heat
Boat Sound
Boat Wave
Boat Particle
Boat Atom
Boat Molecule
Boat Element
Boat Compound
Boat Mixture
Boat Solution
Boat Reaction
Boat Process
Boat Change
Boat Transformation
Boat Conversion
Boat Exchange
Boat Transfer
Boat Flow
Boat Cycle
Boat Rhythm
Boat Pulse
Boat Vibration
Boat Oscillation
Boat Resonance
Boat Interference
Boat Diffraction
Boat Reflection
Boat Refraction
Boat Absorption
Boat Emission
Boat Radiation
Boat Spectrum
Boat Color
Boat Light
Boat Dark
Boat Shadow
Boat Image
Boat Picture
Boat Photograph
Boat Film
Boat Video
Boat Television
Boat Computer
Boat Internet
Boat Website
Boat Email
Boat Chat
Boat Forum
Boat Blog
Boat Wiki
Boat Podcast
Boat Vlog
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Boat Twitter
Boat YouTube
Boat Instagram
Boat Pinterest
Boat LinkedIn
Boat Google
Boat Yahoo
Boat Bing
Boat Wikipedia
Boat Amazon
Boat eBay
Boat PayPal
Boat Craigslist
Boat Netflix
Boat Hulu
Boat Spotify
Boat Pandora
Boat iTunes
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Boat Windows
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Boat iPhone
Boat iPad
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Boat Palm
Boat Garmin
Boat TomTom
Boat Magellan
Boat Delorme
Boat Rand McNally
Boat National Geographic
Boat Lonely Planet
Boat Fodor's
Boat Frommer's
Boat Rough Guides
Boat Moon
Boat Footprint
Boat Insight Guides
Boat Michelin
Boat Berlitz
Boat Dorling Kindersley
Boat Eyewitness
Boat Time Out
Boat Let's Go
Boat Rick Steves
Boat Arthur Frommer
Boat Fodor
Boat Baedeker
Boat Murray
Boat Blue Guide
Boat Cadogan
Boat Hachette
Boat Gallimard
Boat Larousse
Boat Bordas
Boat Nathan
Boat Hatier
Boat Belin
Boat Casterman
Boat Dargaud
Boat Glénat
Boat Delcourt
Boat Soleil
Boat Dupuis
Boat Le Lombard
Boat Casterman
Boat Dargaud
Boat Glénat
Boat Delcourt
Boat Soleil
Boat Dupuis
Boat Le Lombard

Calculation File to Estimate Peak Discharge for Northern Weld County

Purpose: The purpose of this calculation file is to estimate the peak discharge associated with the storm event of May 24, 1997 in northern Weld County using indirect flow measurements. This storm event had peak rainfall totals for a 6-hour period in excess of 8 inches. The storm cells developed approximately 21 miles north of Raymer and moved in a northeast direction across Sidney Draw into Nebraska.

Methodology: On June 8, 1997 an RTi flood documentation team (Markus Ritsch and Bill Ellett) performed a field investigation in northern Weld County. The field work began with a meeting between the flood documentation team and Harold and Mark Weisbrook. Harold is a wheat farmer and NWS cooperative weather observer who maintains 9 rain gauges on his farm. Harold recorded total rain accumulations of between 2.5 and 3.0 inches at his farm approximately 5 miles south of the Colorado-Nebraska border. His son Mark who lives approximately 1/2 mile north of the Colorado-Nebraska border maintains 1 rain gauge and recorded a total rain accumulation of more than 7 inches for the storm event of May 24, 1997. The information contained within this calculation file was developed from the interview with Harold and Mark and the associated field work.

Storm Description:

- The storms began in the afternoon of May 24, 1997 approximately 4:30 p.m.
- The heavy rainfall occurred during a 4-hour period ending approximately 8:00 p.m.
- Several large storm cells developed in approximately the same location (over Sidney Draw) and moved in a northeast direction. Harold used the term "train" effect to describe the development and subsequent movement of storm cells to the northeast.
- There was a large amount of hail associated with the storm cells. Mark reported golf-ball sized hail stones to a depth of 6 inches.
- There was a large amount of lightning and thunder associated with the storm cells.

Rainfall Estimates:

Rainfall estimates were obtained from Harold and Mark Weisbrook in addition to a storm total precipitation radar imaged from the NWS Doppler radar. Rainfall estimates are shown (in inches) on the attached map.

Flood Damages:

A complete flood damage survey was not performed by the flood documentation team. However, flood damages were noted during the field visit which included damage and overtopping of several county roads, erosion/washout damage to several county roads, damage to corps and fields, and debris accumulations.

Runoff Estimate:

Harold and Mark Weisbrook identified several locations where they thought evidence of high water still existed. A trip was made to each of these locations to assess those with the highest potential for estimating a peak discharge based on evidence of high water. The final location chosen was on an

un-named tributary directly north of Sidney Draw in Kimball County Nebraska. The watershed sits on the Colorado-Nebraska state line and has a total drainage area upstream of the measured cross sections of approximately 22.6 square miles. The drainage area was determined manually using a digital planimeter and 1:24,000 scale USGS quad maps.

A runoff estimate was obtained for the un-named drainage using indirect flow measurement techniques. Several channel cross-sections were obtained using a survey instrument and stadia rod. High water marks were identified by debris lines on barbed wire fences and fence posts that ran parallel to the channel. A channel slope was surveyed in the field, and Manning's "n" values were estimated for the overbanks and main channel.

The attached figure shows the surveyed cross sections and the computation of the average cross sectional area. The average cross sectional area is computed to be 342 square feet.

The channel slope was surveyed to be approximately 0.0035 feet per feet. The channel slope determined from a 1:24,000 scale USGS topography map (1972) for the same channel reach was estimated to be on the order of 0.0033 feet per feet. For calculation purposes, the slope was assumed to be 0.0034 feet per feet.

The channel consisted of a grass lined channel with no alluvial deposits. There were no gravels, rocks or other deposits in the channel. There were no shrubs or trees growing in the channel or on the banks. Photographs of the channel were taken and are shown in the document. Using the U.S. Soil Conservation Service's field test results for grassed channels (See Chow 1959) a range of Manning's "n" was chosen (0.023 to 0.030).

The wetted perimeter was measured to be approximately 135.5 feet.

The Chezy-Manning equation is employed under the assumption of normal flow to estimate the discharge. Inputs to the Chezy-Manning equation consist of slope of the hydraulic grade line (assumed to be the channel slope), cross sectional area (342 sq. ft.), wetted perimeter (135.5 ft), and Manning's n (0.023 to 0.030). The Chezy-Manning equation is expressed mathematically as follows:

$$Q = \frac{1.49}{n} * A * (r_H)^{\frac{2}{3}} * \sqrt{S}$$

Where Q=discharge (cfs)
n=Manning's n
rH=hydraulic radius (area/wetted perimeter) (ft)
S=slope (ft/ft)

Solving the Chezy-Manning equation under the assumption of normal flow for various values of "n" is shown in the table below.

Discharge Estimates

Manning's "n"	Discharge	Velocity
0.023	2,395 cfs	7.0 fps
0.030	1,836 cfs	5.4 fps

The resulting velocities are less than 10 fps (typically the upper limit for an open channel) and are considered reasonable.

100-year Discharge Estimate:

A comparison of the computed discharge (1,836 cfs to 2,395 cfs) is made relative to a regional 100-year discharge estimate. The discharge associated with a return interval of 100-years can be estimated using a regional equation developed by the Colorado Water Conservation Board (Guidelines for determining 100-year flood flows for approximate floodplains in Colorado, vs 3.0, July 1997). The region of consideration is in the South Platte River Basin, Eastern Plains Subregion (SPL-1). The regional regression equation for this region (SPL-1) is:

$$Q = 707.9*(A)^{0.654}$$

Where Q=100-year peak discharge (cfs)
A=Drainage area (sq. mi.)

Using an area of 22.6 square miles, the equation is solved for the 100-year peak discharge. The resulting discharge is approximately 5,400 cfs.

Conclusion:

A field visit was conducted in northern Weld County to investigate and measure the remaining channel evidence of the peak flow experienced as a result of the May 24, 1997 storm event. The parameters required to establish a peak discharge estimate using indirect methods were determined from the data collected during the field visit. The Chezy-Manning equation was solved under the assumption of normal flow to determine the peak discharge of 1,836 cfs to 2,395 cfs.

The CWCB regional guidelines were used to establish the approximate 100-year peak discharge for the watershed visited during the field trip. The CWCB guidelines established an approximate 100-year peak flow to be 5,400 cfs.

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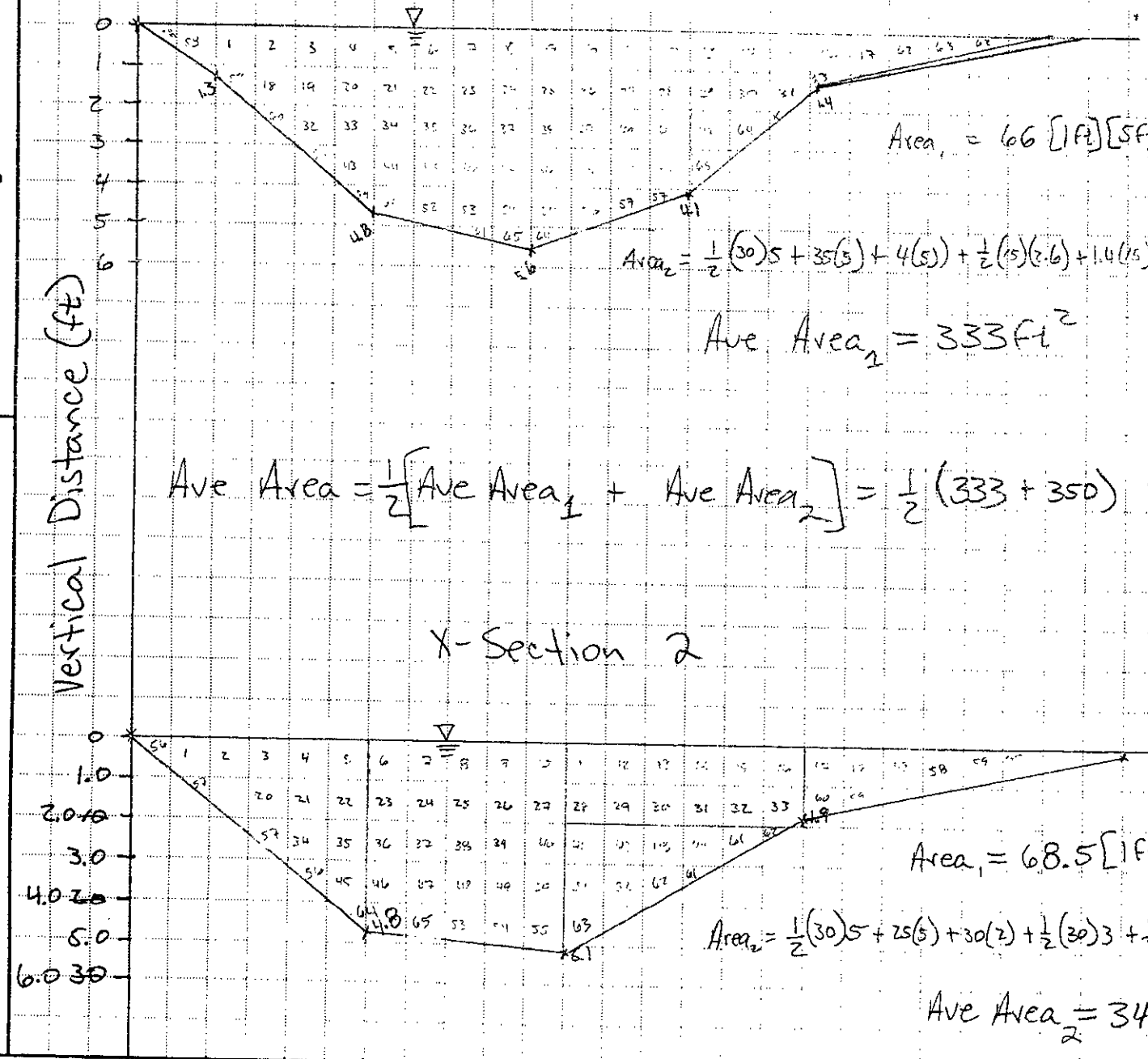
Project/Proposal Name: _____ Task: _____
Project/Proposal No.: _____ Page _____ of _____

Subject: Stream X-Section
Computed: MLR Date: _____
Checked: _____ Date: _____

X-Section 1



$Area_1 = 66\,[1\,ft][5\,ft] = 330\,ft^2$

$Area_2 = \frac{1}{2}(30)5 + 35(5) + 4(5)) + \frac{1}{2}(15)(2.6) + 1.4(15) + \frac{1}{2}(35)1.4 = 335\,ft^2$

$Ave\ Area_1 = 333\,ft^2$

$Ave\ Area = \frac{1}{2}[Ave\ Area_1 + Ave\ Area_2] = \frac{1}{2}(333 + 350) = \underline{342\,ft^2}$

X-Section 2

$Area_1 = 68.5\,[1\,ft][5\,ft] = 342.5\,ft^2$

$Area_2 = \frac{1}{2}(30)5 + 25(5) + 30(2) + \frac{1}{2}(30)3 + \frac{1}{2}(45)2 = 350\,ft^2$

$Ave\ Area_2 = 346\,ft^2$

Watershed Calculation for unnamed creek in northern Weld County, and Nebraska

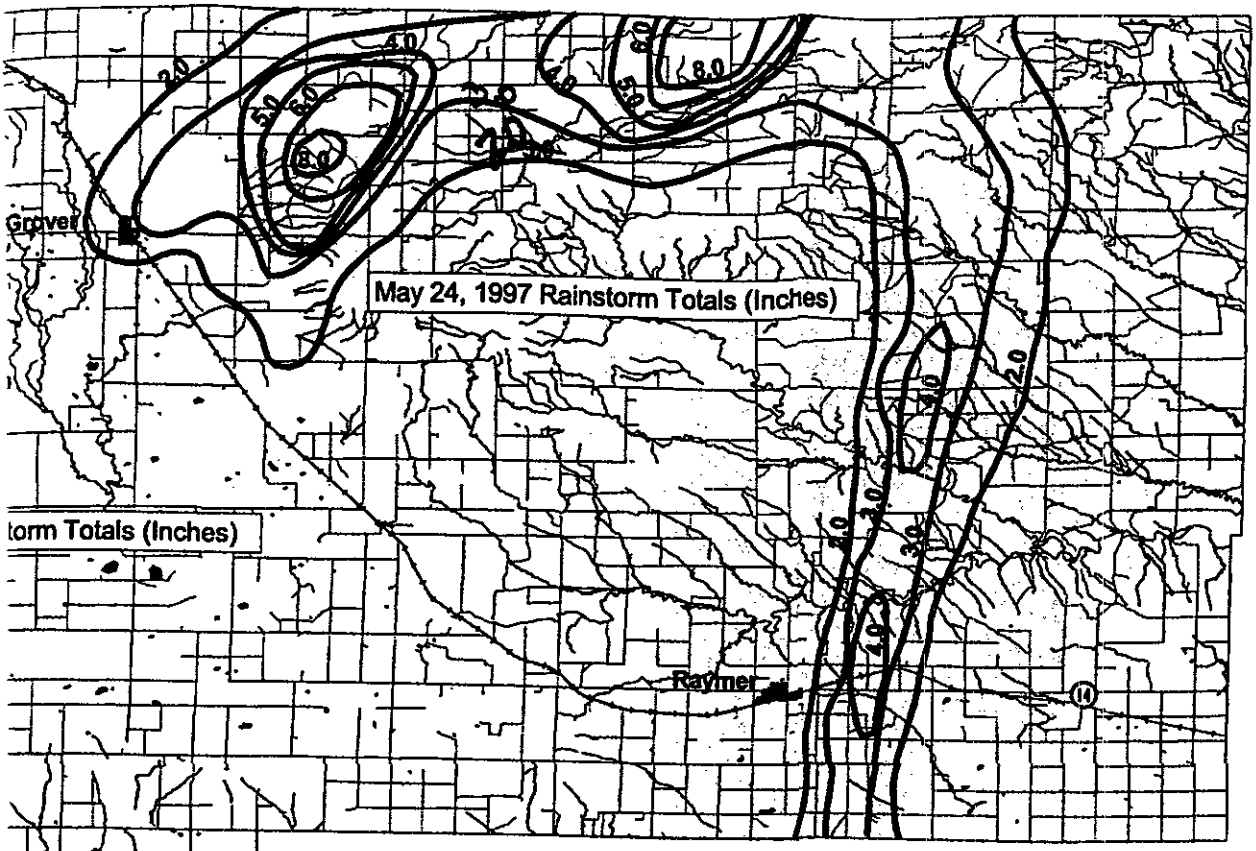
Using four 1:24000 USGS quadrangle maps (Busnell SE, Busnell SW, VIM School, and Dolan Spring) the watershed boundary from the RTi channel surveys was delineated to the headwaters.

The area of the unnamed creek watershed was calculated using *Placom* Digital Planimeter. The water shed was divided into five areas (one for each quadrangle, and two for Dolan Spring quadrangle) that were traced using the planimeter. Four traces were done for each area and this was averaged to determine the area.

		Area in Acreage		
Busnell SE	Busnell SW	VIM School	Dolan Spring	
5535.0	2015.4	1080.3	4099.1	1759.2
5569.4	2015.4	1071.7	4090.6	1750.7
5535.2	2020.5	1067.5	4100.5	1753.5
5532.4	2018.3	1076.8	4091.1	1757.8
5543.0 = AVG	2017.4 = AVG	1074.1 = AVG	4095.3 = AVG	1755.3 = AVG

The five averages were added together to give the total area of watershed

5543.0
2017.4
1074.1
4095.3
1755.3
14,485.1 acres = Total
22.6 square miles



Weld County
Precipitation Map

- 4.0 Isohyetal Line (Inches)
- Rivers and Streams
- Canals and Ditches
- Interstate Highways
- Primary Roads
- Secondary Roads
- Railroads
- Lakes and Reservoirs
- Municipal Boundaries

N

5 0 5 10 15 20 25 30

Miles

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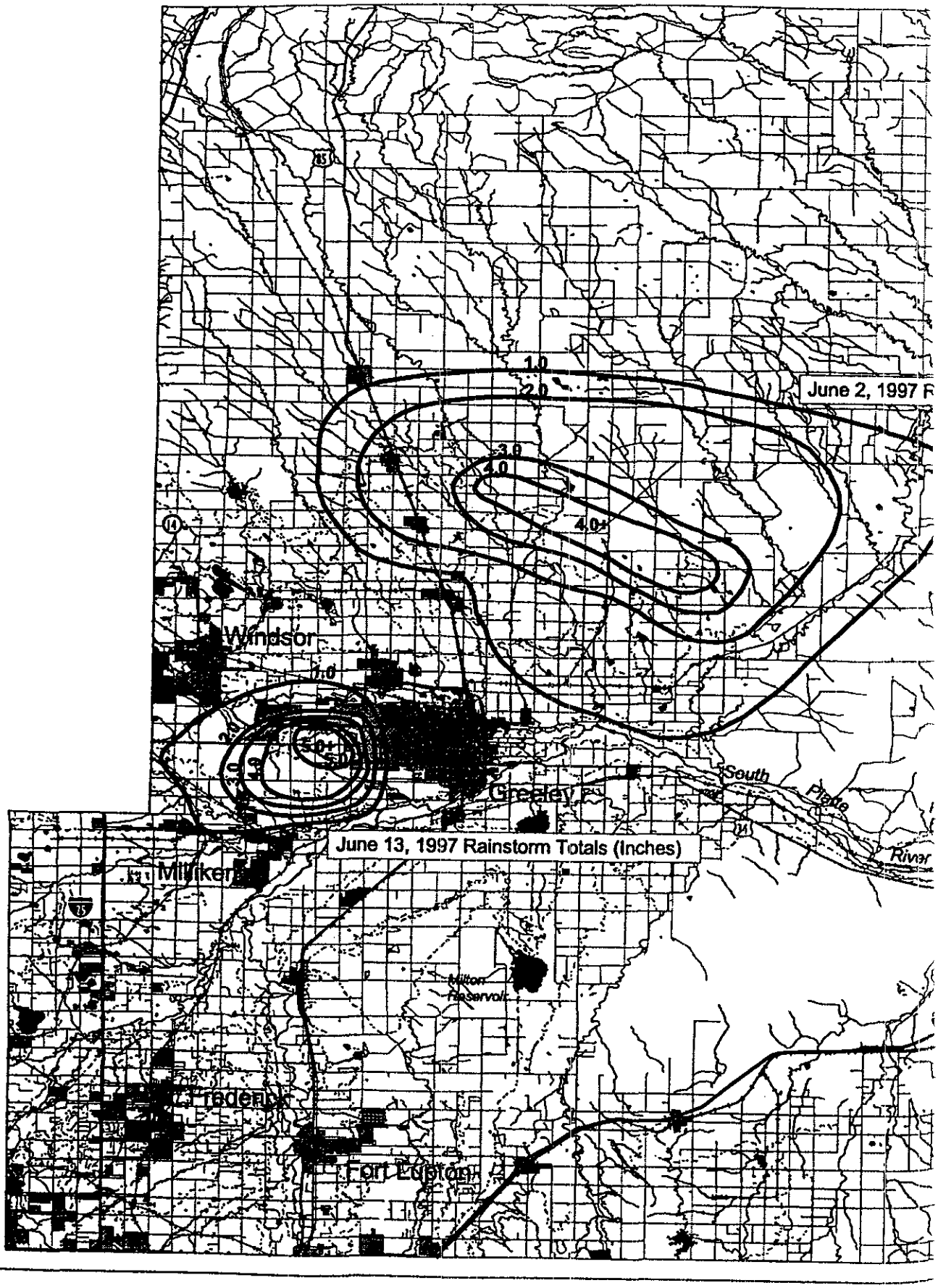
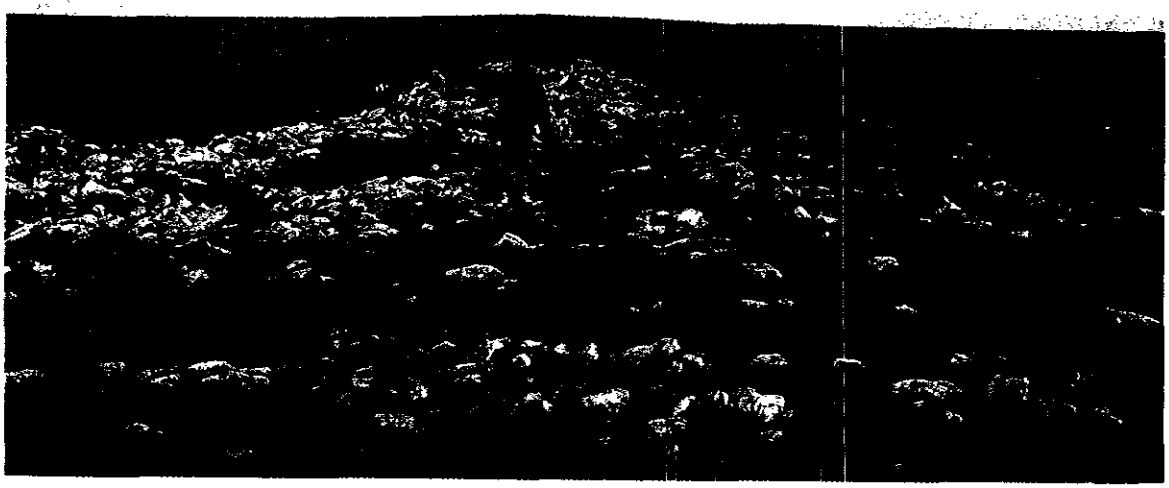
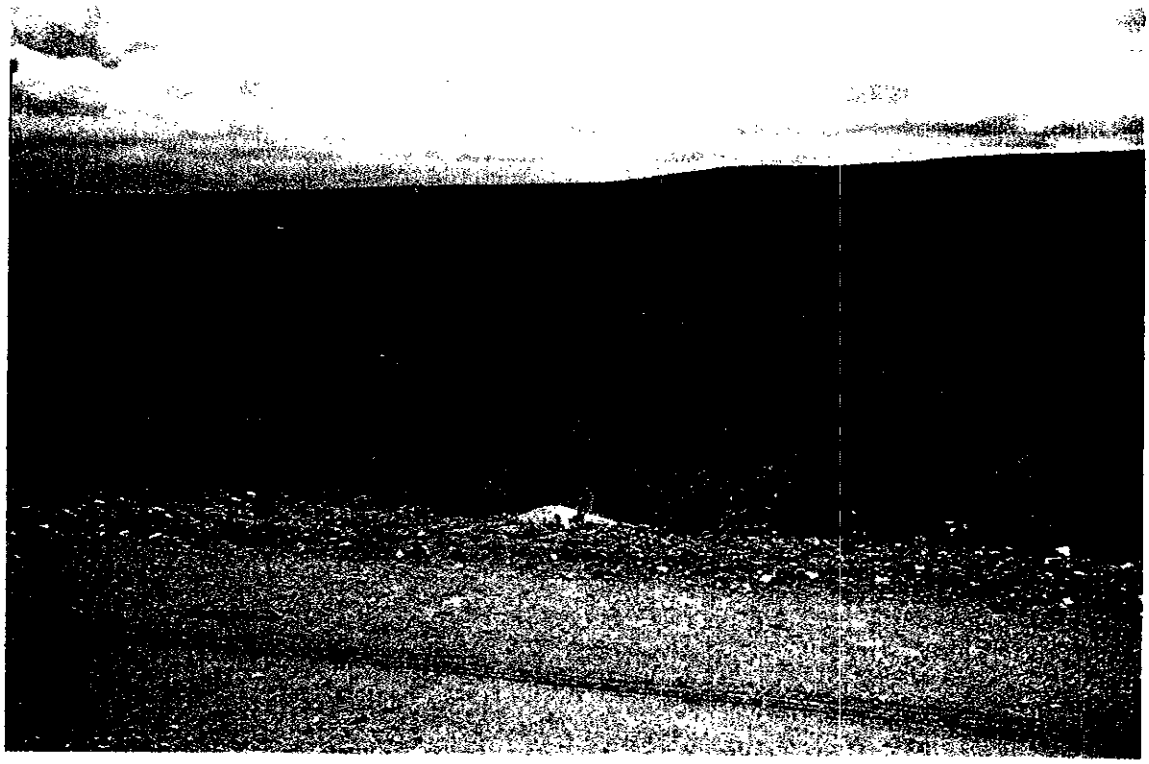

June 2, 1997 R
1.0
2.0
3.0
4.0
4.0+
Windsor
Greeley
South
Platte
River
Milliken
Milton
Reservoir
Frederick
Fort Lupton
June 13, 1997 Rainstorm Totals (Inches)

First stop on June 8, 1998

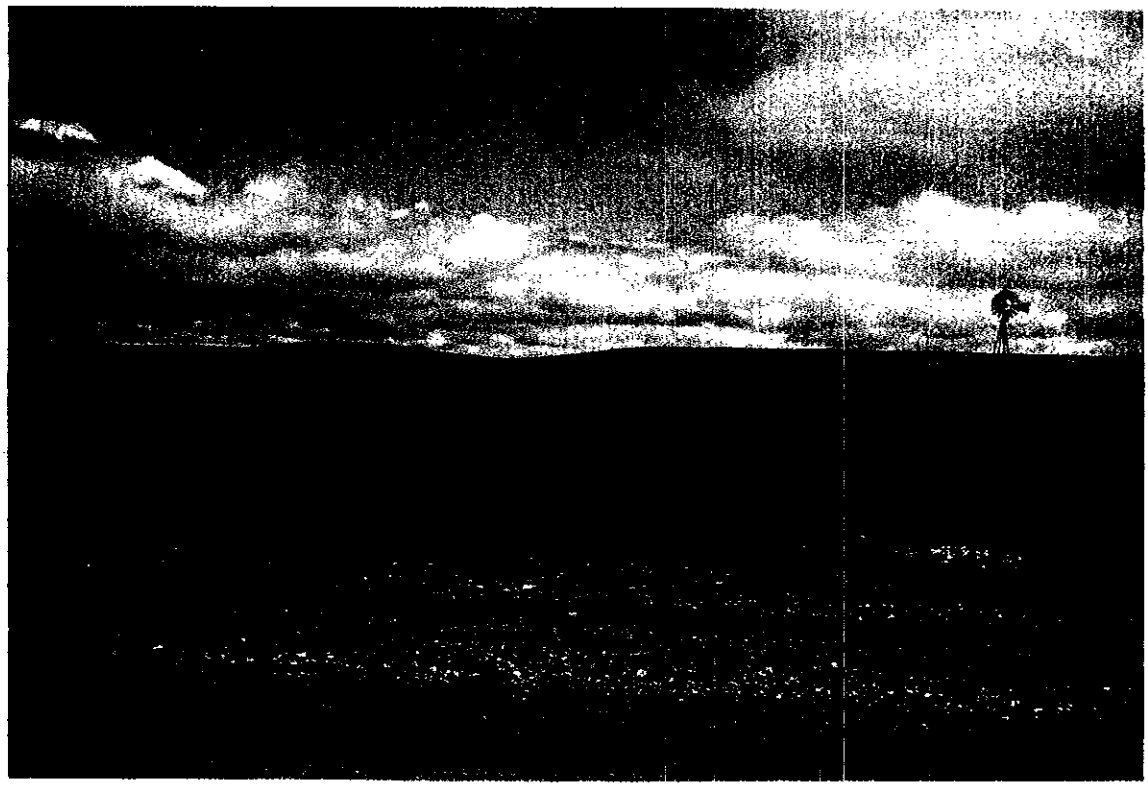


A rock dam constructed in the flood path. The water was about four feet deep here. Notice how the flood dispersed the rocks from the dam.

second stop June 8, 1998 - Un-named Drainage North of Sidney Draw

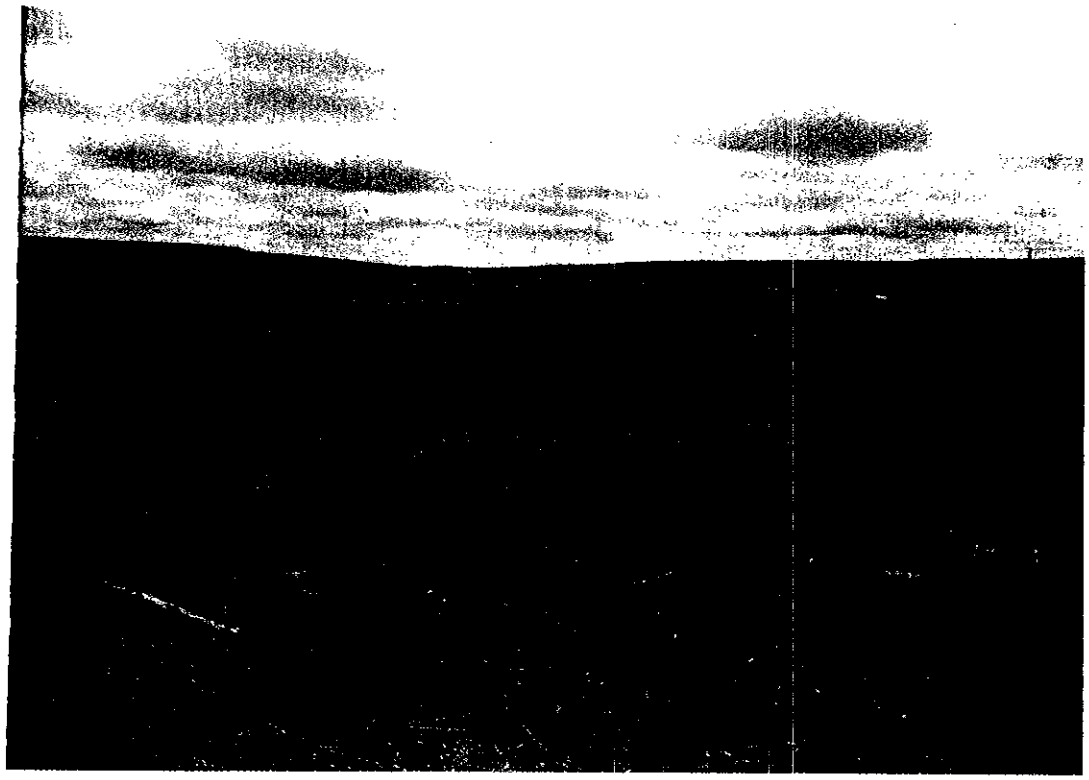


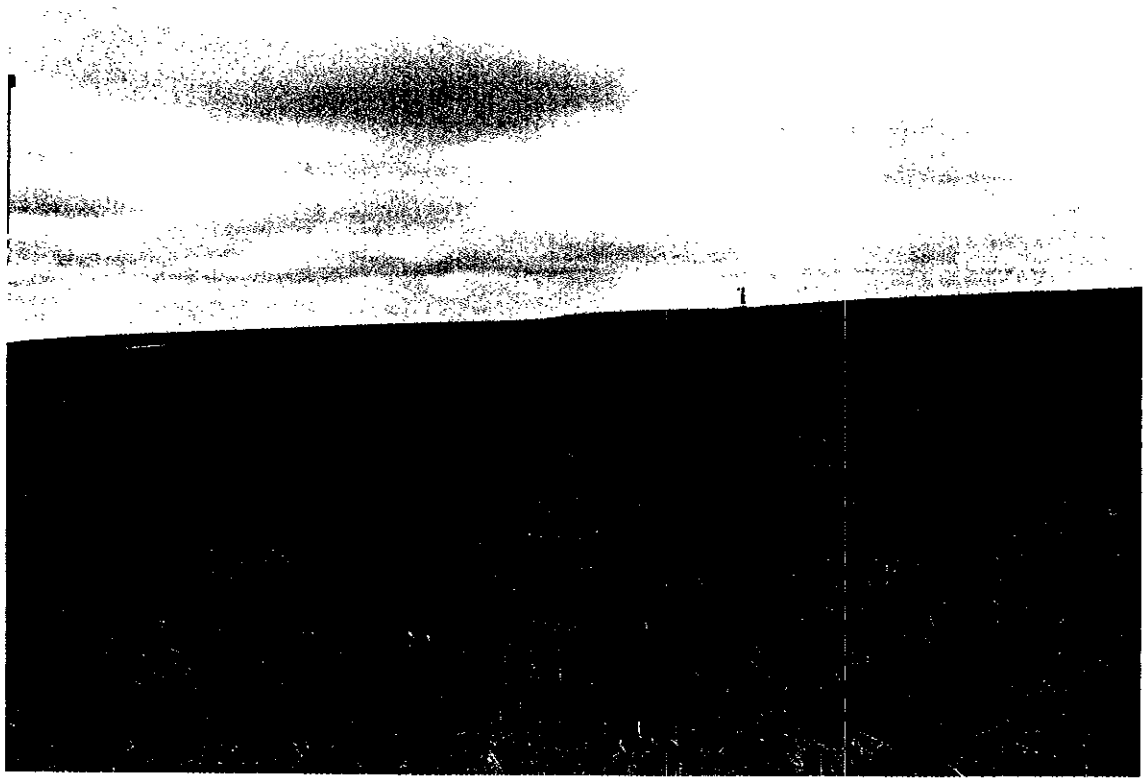
looking upstream from Kimball County Road 25. Flood debris was found along the fence that ran parallel to the road.



Looking down stream

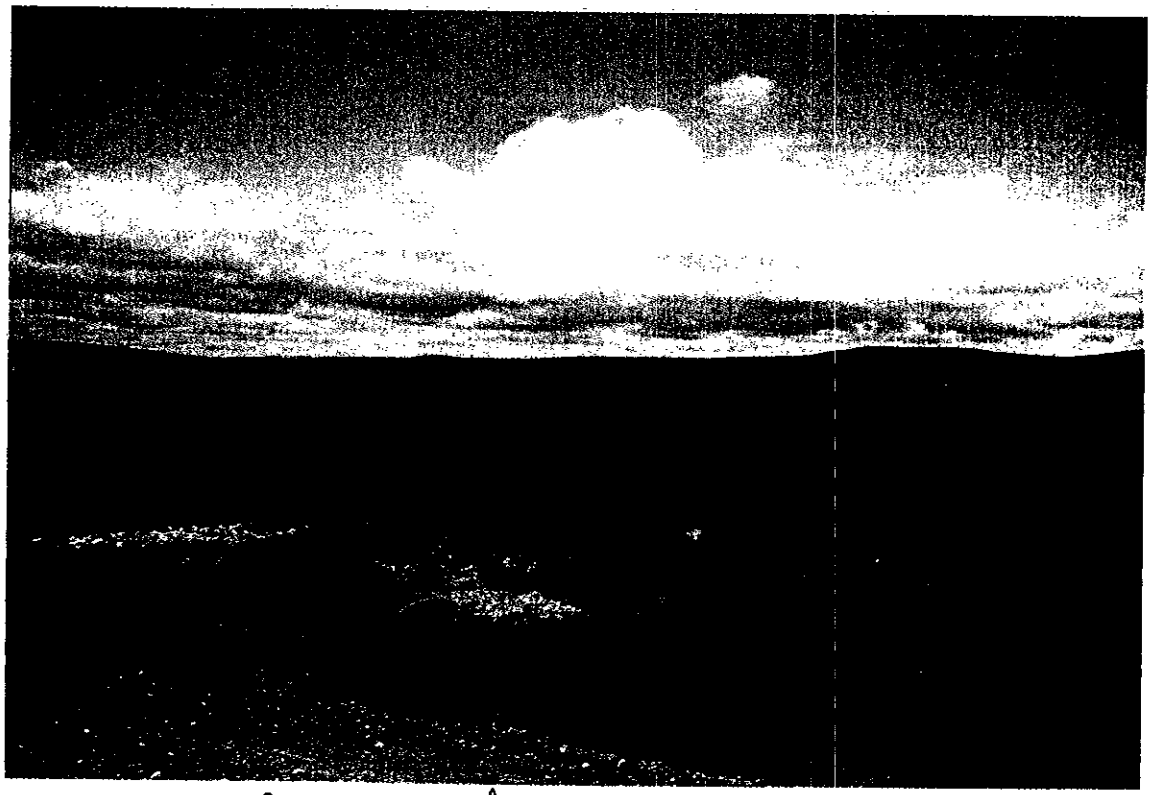
Walking up stream from Kimball Cnty Rd 25. 3/6





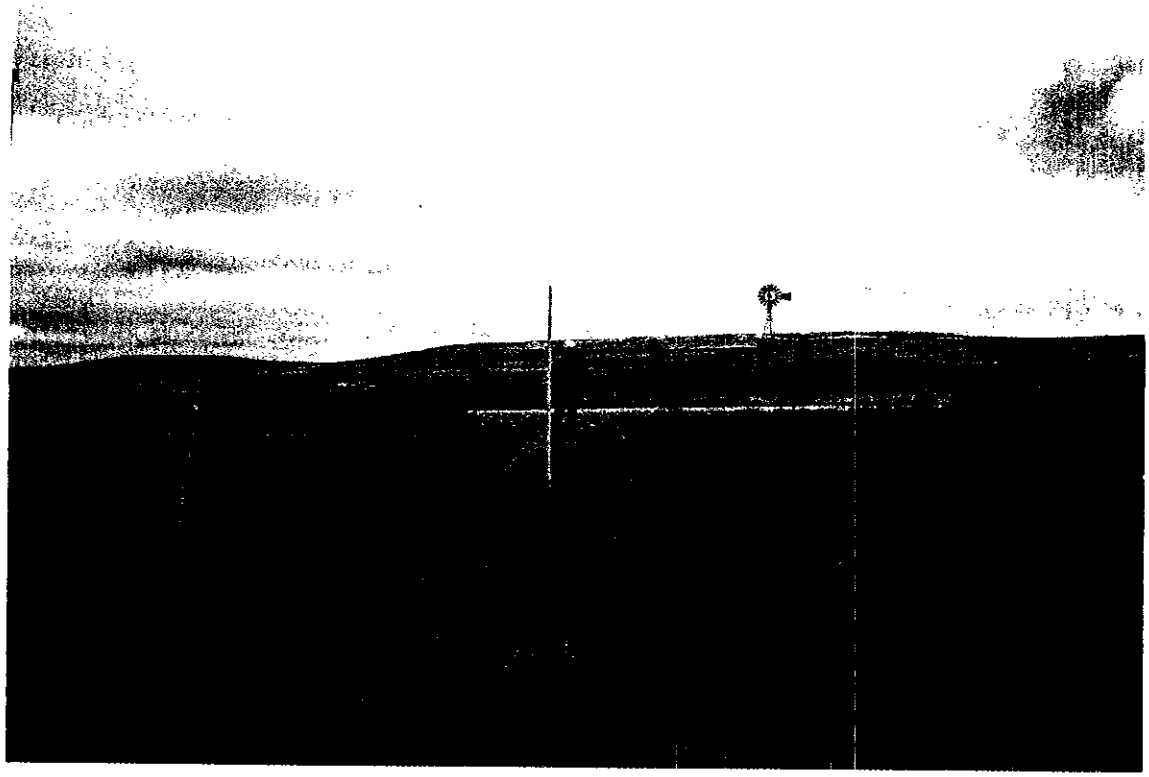
Grass lined channel (crested wheat Grass?)
No cobbles/boulders in channel.

looking at culvert outlet down stream of Kimball Cnty Rd 25. A large scour hole has been filled in with tumble weeds.



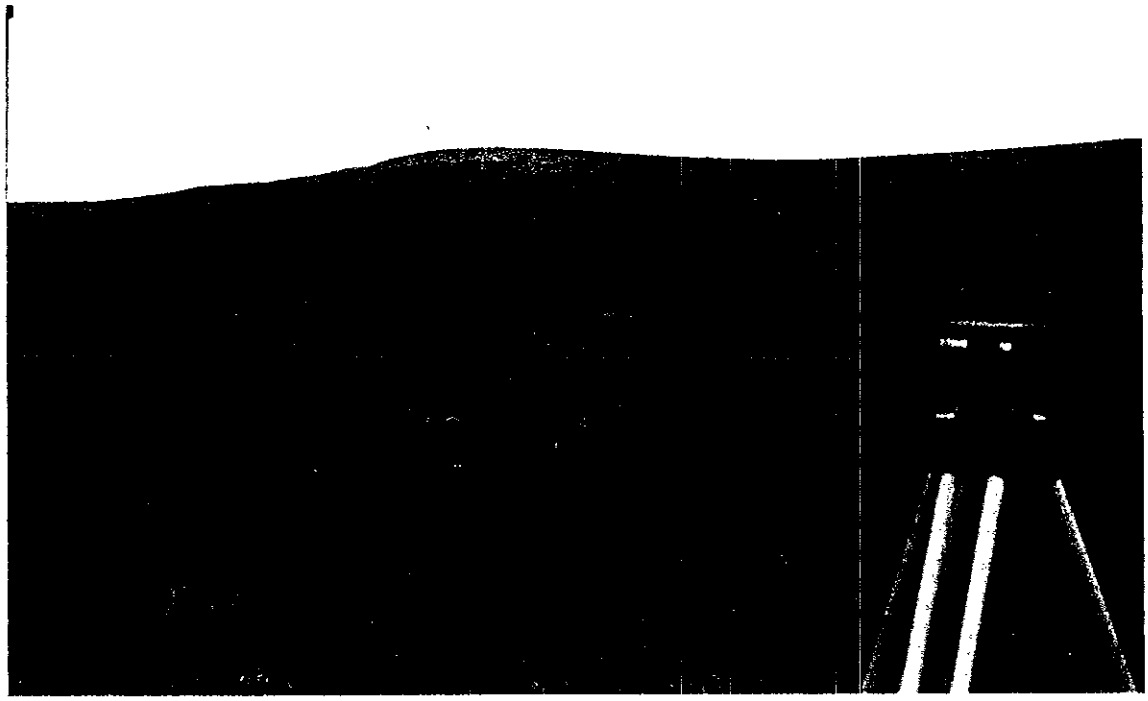
Looking further down stream from Kimball Cnty Rd 25.

Flood Stage @ Kimball cnty Rd 25



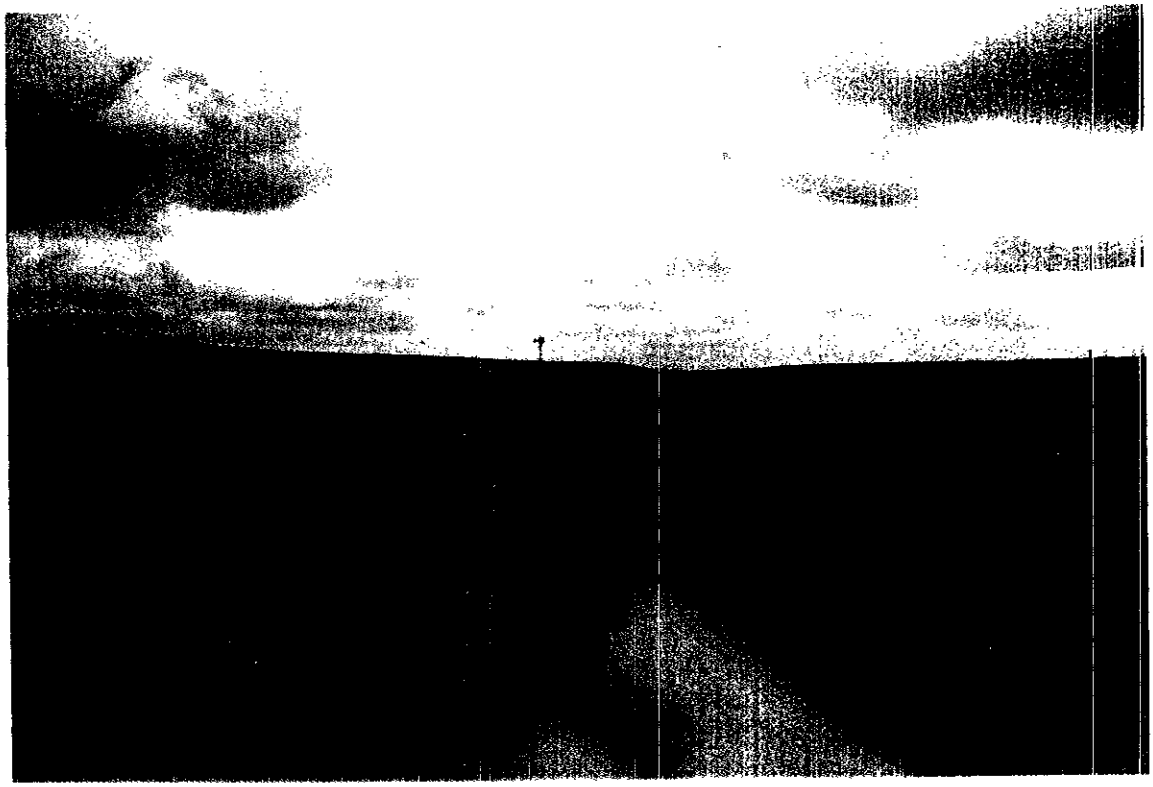
Approximate flood stage as determined from debris lines along fence.

Third stop June 8, 1998



looking downstream

Final site where X-sections were surveyed. Approximately 1/2 mile downstream of Kimball cnty Rd 25. Found very good flood debris along the fence posts on left side of photo.



Looking upstream