

## CHAPTER IV. WASHITA'94 RAIN GAGE AND GIS BENCH MARK LOCATIONS

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### A. INTRODUCTION

The rain gage instrumentation on the Little Washita River watershed was originally installed in 1961 as part of a 168 gage base network of a study area of the Southern Plains Watershed Research Center headquartered at Chickasha (Nicks, 1983). This network of gages was designed to provide precipitation data for 17 main stem and tributary sub-basins of a central reach of the Washita River. These gages were operated by the USDA - Agricultural Research Service through September 1986 when all of the instrumentation was discontinued and removed except 42 gages on or near the Little Washita River watershed. Fourteen of these gages were operated until 1992 at which time the Little Washita watershed was reactivated.

Originally, the locations of gages were plotted on available USGS quadrangle maps and their latitude, longitude and elevation were determined by manual vertical and horizontal scaling from these maps (Nicks, 1976). Beginning in 1992 new instrumentation was installed at all of the 42 stations on the Little Washita experimental area. Some of these stations, located on privately owned land, were moved to new locations to facilitate telemetering requirements of the new instrumentation. The locations of all of the gages were determined again using Geographical Positioning Systems (GPS) methods.

### B. METHODS AND RESULTS

A Trimble Navigation Community Base Station<sup>TM1</sup> was installed at the UDSA-ARS National Water Quality Laboratory, Durant, OK. The base station location and elevation had been established to within 2mm in the vertical and horizontal planes by using GPS equipment and 3 known bench marks in the Durant area. A Trimble Navigation Pathfinder Professional with a lap-top computer and Geolink<sup>1</sup> software were used as the rover station. The Little Washita study area ranges from 190 - to 225 - km from the Durant base station location. The rover antenna was place on the top of each rain gage funnel and a 10 min reading from the available satellites was taken. This timed sample usually produced approximately 600 records of latitude, longitude and elevation. These readings were then adjusted by using the time corresponding base station location data. Standard deviations of the mean horizontal location were 3 m or less for all stations. Vertical standard deviations ranged from approximately 3 - to 9 - m. Location of the rain gage network for the Little Washita watershed are given in Table IV-1.

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<sup>1</sup>Trade and manufacturer names are used only for clarity and do not imply endorsement by the USDA or the Agricultural Research Service.

Additional data were collected for meteorological sites installed for the Washita 94 study periods during April and August 1995. The rover was placed near the fence boundary of each of the sites. Similar timed readings were taken at each site and corrected to the base station data. The flux station sites were located in the same locations during both study periods in April and August (Table IV-2).

Forty two bench mark site locations identified on 7.5 minute quadrangle maps were located by GPS to assist in the correction of Digital Elevation Model (DEM) and other GIS layer data. The sites were also located on a July 3, 1992 SPOT satellite scene of the Little Washita watershed and surrounding area. The sites selected, in most cases, were road intersections or bench marks annotated on the quadrangle maps (see Figure IV-1, for example). However, US Coast and Geodetic Survey data sheets which list horizontal and vertical control data were not available for these bench marks. Table IV-3 lists the GPS locations of these bench mark sites. Because the actual sites were often in the center of busy highway and farm to market roads or obscured by dense overhead vegetation, offset location of the antenna from the bench marks are listed. In some cases the antenna was placed above the bench mark on a transit tripod.

### C. REFERENCES

Nicks, A. D. Agricultural Research Service precipitation facilities and related studies. USDA, ARS #41-176. pp. 71-81. 1971.

Nicks, A.D. Precipitation and Climate. In Hydrology Erosion and Water Quality Studies in the Southern Great Plains Research Watershed, 1961-1978. USDA-ARS ARM-S-29. pp. 20-45. 1983.

Table IV-1 GPS locations of the Little Washita Micronet stations.

Station No.	Latitude	Longitude	Elevation
110	35°00'51.55434"N	98°00'20.06643"W	378.29
111	35°00'57.25244"N	97°57'06.32859"W	360.10
121	34°57'31.28604"N	97°53'54.51623"W	343.18
122	34°58'22.25683"N	97°57'09.95959"W	367.70
123	34°58'16.07913"N	98°00'20.25290"W	381.43
124	34°58'22.10009"N	98°03'28.75879"W	387.31
125	34°59'08.58622"N	98°07'40.84998"W	419.17
130	34°57'23.31933"N	98°17'04.74457"W	437.08
131	34°57'01.06652"N	98°14'00.81297"W	458.22
132	34°56'34.49046"N	98°10'55.42007"W	455.70
133	34°56'56.70076"N	98°07'41.18278"W	429.81
134	34°56'11.67867"N	98°04'31.00533"W	383.41
135	34°55'38.33256"N	98°01'11.42021"W	365.42
136	34°55'39.70147"N	97°57'56.10899"W	343.36
137	34°56'42.20599"N	97°55'22.55897"W	347.48
144	34°52'44.34091"N	97°55'01.56151"W	387.41
145	34°53'03.20287"N	97°58'16.89152"W	368.32
146	34°53'07.37256"N	98°01'22.98082"W	358.18
147	34°54'24.82785"N	98°04'32.69444"W	417.48
148	34°53'56.98057"N	98°07'41.31080"W	430.55
149	34°53'54.38619"N	98°10'51.13830"W	420.25
150	34°54'21.93233"N	98°15'03.79378"W	430.53
151	34°54'47.56000"N	98°17'33.97065"W	446.38
152	34°51'40.14998"N	98°15'03.83141"W	415.59
153	34°51'18.85008"N	98°12'00.19689"W	414.15
154	34°51'18.84750"N	98°08'13.29218"W	392.74
155	34°50'27.33996"N	98°01'12.65929"W	390.44
156	34°50'34.63752"N	97°57'30.39687"W	396.98
157	34°49'29.45427"N	97°54'44.29055"W	408.45
158	34°47'00.86287"N	97°55'57.87330"W	408.56
159	34°47'47.93634"N	97°59'35.65364"W	438.78
160	34°48'01.02637"N	98°02'13.13092"W	411.20
161	34°47'50.16874"N	98°05'25.97686"W	407.29
162	34°48'26.92962"N	98°08'29.44400"W	404.56
163	34°48'35.92989"N	98°11'52.78523"W	396.59
164	34°49'17.87979"N	98°16'44.14249"W	408.58
165	34°46'57.92293"N	98°08'43.65328"W	400.46
166	34°45'13.70122"N	98°05'22.26084"W	390.70
167	34°45'16.09230"N	98°02'12.12885"W	397.55
168	34°45'15.15834"N	97°58'38.76737"W	417.83
181	34°52'11.02742"N	98°18'04.87745"W	402.20
182	34°50'41.81573"N	98°04'23.45625"W	369.67

Table IV-2 Flux Station Locations Washita 94 Field Experiment Little Washita River Watershed

Station No.	Latitude	Longitude	Elevation (m)
Flux 1	34°55'22.37377"N	97°58'31.43722"W	347.24
Flux 2	34°57'25.04444"N	98°04'34.30561"W	402.11
Flux 3	34°56'25.67961"N	98°18'45.67155"W	415.60
Flux Ly*	34°54'50.72326"N	98°17'33.04365"W	447.17
Flux 5	34°50'29.59365"N	98°04'01.47929"W	364.63

\* Lysimeter flux station site.

Table IV-3 SPOT Image locations Washita 94 Field Experiment Little Washita River Watershed

Quadrangle Site No.	Latitude	Longitude	Elevation (m)	Offset
Chickasha 1	35°06'58.85731"N	97°59'58.63075"W	382.12	23m S of inter.
Chickasha 2	35°00'54.10346"N	97°59'16.26139"W	377.21	N edge inter. center
Chickasha 3	35°05'32.21174"N	97°57'41.64214"W	345.43	On BM
Chickasha 4	35°04'23.17555"N	97°56'17.90787"W	359.58	Inter RR and road
Chickasha 4A	35°06'07.97034"N	97°56'48.44021"W	339.26	Inter RR and road
Chickasha 5	35°02'38.06327"N	97°52'54.61781"W	371.54	3m E inter center
Chickasha 6	35°01'49.28716"N	97°53'26.66598"W	331.36	On BM
Lavery 1	34°55'39.23560"N	98°06'38.49008"W	452.84	N edge inter center
Lavery 2	34°56'30.61365"N	98°05'35.10003"W	408.37	N edge inter center
Lavery 3	34°55'39.06226"N	98°05'34.80371"W	392.33	On BM
Lavery 4	34°56'16.10650"N	98°02'25.64644"W	368.24	1.25m above BM
Lavery 5	34°59'07.95438"N	98°00'18.02526"W	388.91	N edge inter center
Lavery 6	34°58'14.95551"N	98°00'17.83000"W	375.46	1.25m above BM
Lavery 6A	34°58'15.25388"N	98°00'18.17389"W	372.89	3m N 3m W of BM
E Ninneka 1	34°59'09.01909"N	97°53'58.69369"W	362.83	S edge inter center
E Ninneka 2	34°53'10.73569"N	97°56'26.87354"W	388.79	Inter. RR and road
E Ninneka 3	34°54'46.99651"N	97°52'54.69610"W	347.18	On BM
Rush Spr. 1	34°51'46.05825"N	97°55'02.07798"W	413.72	On BM
Rush Spr. 2	34°50'58.27264"N	97°54'50.81957"W	367.03	On BM
Rush Spr. 3	34°47'52.75426"N	97°54'51.11914"W	415.37	Center Y inter
Rocky Ford 1	34°50'26.58995"N	98°04'17.86173"W	365.87	Inter center
Rocky Ford 2	34°47'00.00000"N	98°01'08.89434"W	408.81	On BM
Cyril 1	34°59'59.67422"N	98°11'54.37108"W	404.54	.6m S .6m W of BM
Cyril 2	34°56'31.20555"N	98°10'50.87271"W	448.36	6m N 6m W of BM
Cyril 3	34°59'59.40034"N	98°07'39.97388"W	430.44	On BM
Cyril 3A	34°59'58.97326"N	98°07'41.60766"W	422.19	6m S 6m W of Inter
Cyril 4	34°56'30.66424"N	98°07'41.48051"W	429.57	4m S of BM
Cyril 5	34°55'39.29137"N	98°11'54.88743"W	441.30	10m N 6m W of inter
Cyril 6	34°55'39.02169"N	98°09'48.21778"W	429.20	S edge inter center
Cyril 7	34°53'54.80079"N	98°12'57.88089"W	423.38	5m S of BM
Cyril 8	34°53'54.38619"N	98°10'51.13830"W	420.25	8m E 10m S of BM
Cyril 9	34°53'02.20290"N	98°11'54.43937"W	411.63	8m S 9m E of BM
Fletcher 1	34°50'26.34503"N	98°14'52.94471"W	414.41	On BM
Fletcher 2	34°48'41.89844"N	98°11'42.42571"W	398.50	S edge inter center
Fletcher 3	34°50'26.02082"N	98°08'59.04514"W	375.66	S edge inter center
Apache 1	34°59'08.77386"N	98°21'24.01235"W	427.31	E edge inter center
Apache 2	34°57'24.44104"N	98°21'23.99344"W	407.70	10m N 8m E BM
Apache 3	34°56'31.83659"N	98°21'24.61118"W	400.33	W edge inter center
Apache 4	34°55'39.10553"N	98°21'23.94158"W	396.08	6m N 6m E of BM
Apache 5	34°57'24.39947"N	98°18'14.39435"W	421.64	17m N 5m W of BM
Apache 5A	34°57'24.21479"N	98°19'17.86551"W	408.73	5m N 8m W of BM
Apache 6	34°53'03.10881"N	98°18'13.87587"W	421.39	8m N 3m E of BM
Apache 7	34°59'08.26327"N	98°16'07.96741"W	409.48	On BM

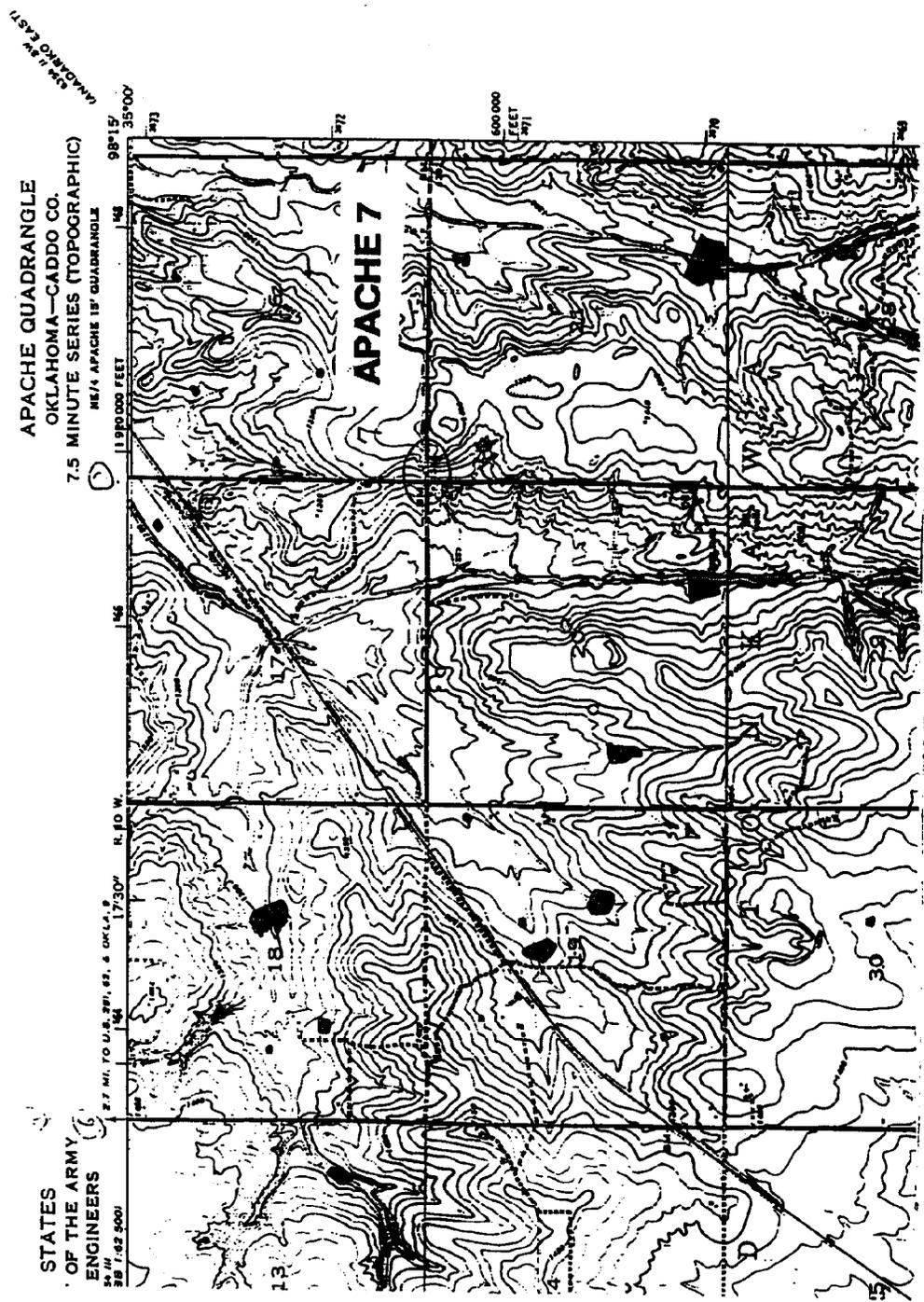


Figure IV-1. Example of U.S.G.S. 7.5-Minute Quadrangle (Apache Quad) and bench mark location.