JOB COMPLETION REPORT

State of TEXAS

Project No. F-7-R-4 Name: Fisheries Investigations and Surveys of the Waters of Region 1-B.

Job No. B-11 Title: Basic Survey and Inventory of Species Present, as well as Their Distribution in the Prairie Dog Town Fork of the Red River, its Tributaries and Watershed Within Childress, Hall, Brisco, Armstrong, Randall and Deaf Smith Counties, Texas.

Period Covered: June 1, 1956 through May 31, 1957

ABSTRACT

Twenty-one seine collections produced a total of 9,975 specimens for study. Twelve species, representing 4 families of freshwater fishes, were found in the river. The most abundant species are Cyprinodons which have no economic value, not even as a bait species. Except in headwater tributaries, and impoundments where the water quality is good, the Prairie Dog Town Fork of the Red River is valueless for game fish at the present time. It is often dry and always too shallow to maintain a game fish population. Since the water is not suitable for municipal or irrigation purposes, the construction of an impoundment on the river in the foreseeable future, for any purpose other than flood control, is unlikely.

OBJECTIVES

To gather fundamental data on the above waters in regard to their physical, chemical and biological aspects. To determine the distribution of the fish species present, their relative abundance and the ecological factors influencing their distribution.

ACKNOWLEDGMENTS

Dr. Walter Dalquest, whose employment with the Texas Game and Fish Commission terminated in October, 1956, set up the original stations, conducted all of the laboratory work and most of the field work on this job for the first 5 months. Since that time, Dr. Dalquest has helped with some phases of work conducted in Region 1-B and has checked the manuscript of this report. Grateful acknowledgment is also expressed to Dr. Carl Gray, Soils Scientist of Midwestern University and Wichita County Water Improvedment Districts, for making the numerous water analyses during this study. Data on water volume were obtained from Mr. John Joerns, United States Geological Survey, Water Resources Branch, Wichita Falls. Game Warden Cal Lovelace of Vega, served as a guide during the survey of the upper reaches of the Palo Duro and Tierra Blanca Creeks.

TECHNIQUES

Sample stations were established at five points along the length of the Prairie Dog Town Fork of the Red River. Ten collections were made at each sample

station during the study. At each station, chemical and physical data concerning the water were taken, and seine samples of the fishes present were preserved in formalin for laboratory examination and identifications. Since an adequate picture of the fish population at all points along the river could be determined by seining, no gill nets or fish toxicants were used. There are no important permanent-flowing tributaries of the Prairie Dog Town Fork; however, basic survey collections were taken from eight of its tributaries at a time when water was present. On several occasions, data could not be obtained from some of the stations because the river was dry.

PHYSICAL CHARACTERISTICS

The Prairie Dog Town Fork of the Red River received its first designation as "river" in extreme south-central Armstrong County, where Palo Duro Creek emerges from the Palo Duro Canyon. Palo Duro Creek originates in northwestern Deaf Smith County and continues westwardly to its confluence with Tierra Blanca Creek about 3 miles northeast of the city of Canyon, in Randall County. There it enters the head of Palo Duro Canyon and runs southeastwardly across Randall County, cuts across the southwest corner of Armstrong and northeast corner of Brisco Counties, and continues eastwardly across Hall and Childress to the extreme northwestern tip of Hardeman County. At this point, the Prairie Dog Town Fork loses its designation as a tributary, becomes the Red River, and serves as the boundary between Texas and Oklahoma. The westernmost extension of the Prairie Dog Town Fork is the tributary, Tierra Blanca Creek, which originates in extreme southwestern Deaf Smith County and continues eastward and northeastward to its confluence with Palo Duro Creek in Randall County. Tierra Blanca Creek serves as a drainage for northeastern Parmer and extreme northwestern Castro Counties, in addition to the southern section of Deaf Smith County, where the stream bed is located. The greatest length of the Prairie Dog Town Fork is approximately 200 miles, and it has a drainage area of about 8,200 square miles.

There are no impoundments on the main Prairie Dog Town Fork. Several small impoundments are present on both Palo Duro and Tierra Blanca Creeks. At least 3 small dams are located on Palo Duro, and 6 on Tierra Blanca before their conjunction. In addition to these small artificial lakes, Buffalo Lake, an impoundment of 1,875 surface acres, is located on Tierra Blanca Creek, 3 miles south of Umbarger, in Randall County. Downstream from the convergence of these two tributaries, a series of 3 Palo Duro Country Club Lakes is located on the main stream of Palo Duro Creek, and several others are located on the smaller canyon tributaries below. Since time did not permit a survey of all these tributary impoundments, this study was confined primarily to stations along the stream beds of the Prairie Dog Town Fork system. Some of the impoundments discussed above have been worked, however, and information concerning them is given in previous reports (F7R1, Job E-1; F7R3, Jobs B-9, B-4, E-1; and F7R4, Job B-9).

Palo Duro and Tierra Blanca Creeks originate in, and for some distance flow through, shallow Quaternaty sediments consisting of Recent prairie soils. Down-cutting is slight, and the creek beds in their uppermost reaches are scarcely three feet below the prairie surface. A few miles west of Umbarger, gradient increases and the creeks cut down through white, Pliocene caliche beds for some distance. At Buffalo Lake, Palo Duro Creek is rimmed by white cliffs over 100 feet in total height.

At the head of Palo Duro Canyon, the combined creeks plunge over the caprock. The effect is virtually a waterfall over 1,000 feet deep. White Pliocene sediments of Hemphillian age form the upper part of the gorge, but these soft rocks, mostly caliche,

have eroded several hundred yards back from the creek except in its upper (higher) parts. The bulk of the "drop-off" is formed of the harder Triassic rocks of the Docum group. Vertebrate fossils, mostly sterospondylous amphibians and phytosaurs, are common in these rocks. The floor of the canyon is made up of clays, sandstones and silts of the Double Mountain Group of Permian formations. These sediments contribute much of the dissolved mineral load of the Prairie Dog Town Fork.

East of Palo Duro Canyon, the bed of the Prairie Dog Town Fork lies entirely in Permian sediments. The river bed is rimmed with sands and some shifting dunes of Recent age with, locally, some moderately extensive Pleistocene deposits. Age of these Pleistocene deposits remains to be determined, but Sangamon correlation seems likely at this time. Just north of the Prairie Dog Town Fork are found some deposits of early Pliocene (Clarendonian) age. The Triassic sediments are missing east of Palo Duro Canyon, and the succession is: Permian, early Pliocene (locally), late Pleistocene (locally) and Recent.

The U. S. Geological Survey discontinued its station on the Prairie Dog Town Fork of the Red River in 1954. Therefore, stream flow and run-off data are not available for the period of this survey. Data is available for the monthly and annual mean discharge and the monthly and annual run-off at various stations between 1924 and October, 1954. (See Tables 1 through 8).

DESCRIPTION OF STATIONS

CANYON STATION. Located on Palo Duro Creek at the Highway 87 crossing, just north of the city of Canyon. Stream does not flow here except during periods of rainfall. Station located in narrow, wooded valley that was dry for 8 months during the segment. When water was present, the bottom mud was contaminated with hydrogen sulfide, and the water was too stale to support fish life. This is the uppermost permanent station on the Prairie Dog Town Fork of the Red River.

PALO DURO CANYON STATION. Located at the first river crossing in Palo Duro State Park. The stream bed is narrow, about 50 feet wide. The valley is about 1 mile wide and 1500 feet deep. The river is all in Permian sediments. Immediate banks of the creek are of sod and sand. The stream is intermittent here. During most of our visits the water was in pools separated by dry sand. The bottom consisted of pool sand and mud with cobbles of various sizes.

TURKEY STATION. Located about 13 miles north of Turkey on Highway 70. The valley is broad, flat and shallow, in Permian rock. Along the sides of the river are cottonwoods and salt cedars with cliffs containing Permian sediments. The river bed is approximately 400 feet wide here, with flood marks 6 feet above the present level. It is a braided stream, of sand and quicksand. This station was dry 6 of the 10 months during the study.

NEWLIN STATION. Located at Newlin, or about 3 miles north of Estelline, on Highway 287. There is a broad valley here cut into Permian rocks of sandstone, silt and gypsum, partially covered with numerous vegetated sand dunes. A thin Pleistocene gravel layer lies between base of sand dunes and Permian rock, exposed where the river has cut through the dunes. The river bed is broad, about 100 feet, of braided sand and mud. There is evidence of flooding 10 feet above present level. This station was dry 8 of the 10 months of study.

CHILDRESS STATION. Located 8½ miles north of Childress. The valley is very broad with gentle slopes, partly concealed by moving and brush-anchored sand dunes. Exposed rock is Permian (shale, sandstone and gypsum). The river is broad, sandy and braided with shallow water that generally shifts from side to side. Banks are mostly cut into sand dunes with thin bed of firm gravel, probably Pleistocene in age, because fossil land snails were noted in the area. Running water was present every time the station was worked.

DESCRIPTION OF ADDITIONAL BASIC SURVEY STATIONS

TIERRA BLANCA CREEK AT HEREFORD. (June 14, 1956). This is the highest point on the creek for permanent water. Actually, the creek is dry above here, but this is the point at which the sewage effluent of the town of Hereford enters. The water is treated, well areated, of good quality, and green with algae.

ca.	na.	cl.	so4	co3	hco3	Total	pH
210	110	87	211	0	512	1130	-

HEAD OF PALO DURO CREEK. (June 14, 1956). This is the actual head of Tierra Blanca Creek, and therefore, head of the Prairie Dog Town Fork of the Red River. The station consisted of a small pond formed by damming the creek valley. The valley lies in a meadow and is hardly a swale, cut not more than a foot into the surface earth. Ducks and frogs are very abundant on the pool. Seining produced anostracans, notostracans, and even chonchostracans, but no fish. These arthropods indicate temporary water. The town of Vega is due north of this station.

Physical Data: Air Temperature - 80; Water Temperature - 86; Turbidity - 35.

ca.	na.	cl.	so4	co3	hco3	Total	pH
58	2	6	0	0	152	218	-

PALO DURO CREEK 8 miles south and 2 miles west of Weldorado. (June 14, 1956). The creek valley here is cut into the prairie soil only about four feet and to a width of about 35 feet. There are several pools over knee deep, but the local game warden stated that it was usually dry. Seining produced only one bullhead that probably escaped from a farm pond. The water is gray and turbid.

Physical Data: Air Temperature - 84; Water Temperature - 75; Turbidity - 35.

ca.	na.	cl.	so4	co3	hco3	Total	pH
54	2	0	0	0	128	184	-

PALO DURO CREEK 11 miles south of Weldorado. (June 14, 1956). Conditions here are very similar to those given immediately above. A small pool was found under the bridge, but seining took only arthropods and turtles. No fish were present.

Physical Data: Air Temperature - 81; Water Temperature - 79; Turbidity - 35

ca.	na.	cl.	so4	co3	hco3	Total	pH
58	3	2	24	0	149	236	-

PALO DURO CANYON CROSSING NUMBER 4. (June 14, 1956). This is the last crossing of Palo Duro Creek in Palo Duro Canyon. Conditions here are very similar to those at the regular station, but the bed of the creek is broader and more sandy. There are numerous small pools, and a few broad but shallow pools. The bottom is sandy. No fish were taken by seining.

Physical Data: Air Temperature - 97; Water Temperature - 88; Turbidity - 110

ca.	na.	cl.	so4	co3	hco3	Total	pH
908	720	78	2116	24	88	3934	-

MULBERRY CREEK. (June 12, 1956). Located about 3 miles northeast of Turkey station, this is a large creek, almost as large as the main river. The valley is broad, and the creek bed is braided sand. There are deep pools along the northern edge of the creek where the fish collection was made.

ca.	na.	cl.	so4	co3	hco3	Total	pH
918	160	204	2074	0	238	3594	-

Fish Collection: N. lutrensis - - - 2
Hybognathus - - - 11
Fundulus - - - - - 36

This station was sampled again May 24, 1957, during a period of light rain and following a period of very heavy rain on the watershed. Nothing was taken in swift running water on the south side of bridge. All specimens were taken on the north side of bridge in long pools of standing water.

Physical Data: Air Temperature - 65; Water Temperature - 64; Turbidity - 140.

ca.	na.	cl.	so4	co3	hco3	Total	pH
440	132	195	975	6	110	1858	7.90

Fish Collection: N. lutrensis - - - 10
Hybognathus - - - 25

MEMPHIS CREEK. (June 12, 1956). This is a small, swift, clear creek in a deep, vegetated valley just south of the town of Memphis. Bed is clean sand and rocks. Gypsum boulders are also present.

ca.	na.	cl.	so4	co3	hco3	Total	pH
1126	156	214	2518	0	262	4278	-

Fish Collection: N. lutrensis ---- 30
Gambusia affinis 6
Lepomis megalotis 1

LAKEVIEW CREEK. (June 12, 1956). A small, swift stream in a valley 50 feet wide, of clear, white sand. The water is shallow and stream gradient high.

ca.	na.	cl.	so4	co3	hco3	Total	pH
788	99	103	1820	0	177	1987	-

Fish Collection: Fundulus kansae only.

CHEMICAL CHARACTERISTICS OF WATER

The chemical nature of the water at the sample stations is given in Table 9. According to the analyses, the water quality of the headwater tributaries is good and should support all species of freshwater fish. Downstream from Palo Duro Station, the water becomes "gypy" and salty. Total salts become progressively higher downstream, suggesting that sub-surface springs are present in the river bed. These springs probably originate from the Double Mountain and Blain formations of the Texas permian. Although running water was present throughout the year at Childress Station, only four species of fish were present. All were salt tolerant species. Cyprinodons and Fundulus were present each time the station was worked. Only twice were the other two species found (Hybognathus and N. bairdi), and they were taken on visits made following heavy rains which diluted the total salts (see Table 9, Childress Station).

PHYSICAL CHARACTERISTICS OF WATER

Physical conditions at the sample stations are shown in Table 10. Twenty-eight of the fifty stations worked during the study were dry. Only Childress Station had running water throughout the year. Except in periods of rainfall, the water in the Prairie Dog Town Fork of the Red River is clear. For the purpose of this survey, turbidity was measured with a sichi disk. Measurements were made in the deepest water found at each station. Normally, the disk was clearly visible on the bottom, in which case the turbidity was recorded as the depth of the water "plus".

FISH COLLECTIONS

A total of 12 species, representing 4 families of freshwater fishes were taken from the Prairie Dog Town Fork of the Red River during the segment period. Monthly variations in species and numbers of fishes taken at each of the sample stations are given in Tables 11, 12, 13, 14 and 15. The total numbers of fishes taken at all of the permanent stations are given in Table 16.

There were 9,975 specimens collected from the three permanent sampling stations, 71.6 percent of which were taken at Childress Station, the only permanently flowing station in the system during the study.

Family Cyprinidae

Shiners and Minnows

Notropis potteri: chub shiner. A total of 20 specimens was taken, all at Newlin Station, in May 1957, immediately following a flood.

Notropis bairdi: Red River shiner. Although not numerous (0.82% of the total) this species was represented at every station (where water was present) at least once during the study. It was taken one time at Palo Duro, Turkey and Newlin Stations (June 1956), and twice at Childress Station (June 1956 and May 1957). Each occurrence followed heavy rain which flooded the river.

Notropis lutrensis: redhorse shiner. This species is abundant in the fresh, headwater tributaries of the Prairie Dog Town Fork, but absent from the river except during and immediately following rises.

Hybognathus placita: plains minnow. Present in headwater streams. Absent from the river except during periods of rainfall.

Pimephales promelas: fathead minnow. Taken only at Palo Duro Station. Plentiful in Buffalo Lake and small impoundments of headwater tributaries.

Pimephales vigilax: parrot minnow. Taken at Palo Duro each time the station was worked and water was present. Also present in creeks above Palo Duro. Not found in the river.

Family Ameiuridae

Freshwater catfishes

Ictalurus punctatus: channel catfish. Two specimens were taken at Palo Duro Station from an isolated pool in the creek bed. This species is plentiful in the headwater tributaries and ponds, but absent from the river.

Ictalurus melas: black bullhead. Two specimens were taken at Childress Station following the flood. Abundant in headwater tributary ponds.

Family Cyprinodontidae

Killifishes and topminnows

Fundulus kansae: plains killifish. This species is widely distributed throughout the system. It was taken at every station as well as the headwater tributaries.

Cyprinodon rubrofluviatilis: Red River pupfish. Comprising 69.5% of the total collection, this salt tolerant species was the most abundant of all fishes in the Prairie Dog Town Fork. Absent from Palo Duro Station and headwater tributaries, but present in all river stations where water was present.

Family Centrarchidae

Black basses and sunfishes

Lepomis cyanellus: green sunfish. Taken only at Palo Duro Station. Abundant in headwater streams and impoundments.

Lepomis megalotis: longear sunfish. Taken only at Palo Duro Station, on two occasions. Also recorded from Buffalo Lake and other smaller impoundments on the watershed.

Following is a list of fishes that were not taken in the Prairie Dog Town Fork of the Red River, but have been recorded from Buffalo Lake and other smaller impoundments on the headwater tributaries:

Dorosoma cepedianum: gizzard shad
Carpiodes carpio: river carpsucker
Cyprinus carpio: carp
Carassius auratus: Goldfish
Phenacobius mirabilis: suckermouth minnow
Notropis percobromus: plains shiner
Notropis girardi: Arkansas River shiner
Pylodictus olivaris: flathead catfish
Gambusia affinis: gambusia (common mosquitofish)
Micropterus salmoides: largemouth bass
Lepomis macrochirus: bluegill
Lepomis humilis: orangespotted sunfish
Lepomis auritus: yellowbelly sunfish
Pomoxis annularis: white crappie
Percina caprodes: logperch
Roccus chrysops: white bass. This species is not native to this area. It is being experimentally introduced into Buffalo Lake as an additional sport species, as well as a predacious species to aid in the control of gizzard shad and other rough fish (F-7-R-3 and F-7-R-4, Job F-1).

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Date: July 26, 1957

Table 1. Monthly and Yearly Mean Discharge at Gage Station Above Buffalo Lake.
(Drainage area, 2,075 square miles of which 1,500 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1938	-	-	-	-	-	-	-	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-	-	-	-	-
1940	-	-	0.86	1.69	1.47	1.01	1.00	0.59	0.05	-	-	-	-
1941	-	0.06	-	.13	.35	.91	.59	386	438	30.0	3.90	10.5	70.9
1942	247	14.6	6.61	4.00	4.00	4.75	10.8	2.95	2.49	.5	8.73	15.6	27.2
1943	13.2	2.20	8.01	2.94	2.56	2.34	3.17	3.36	1.35	11.1	.02	-	4.24
1944	-	.20	1.35	1.73	1.54	1.34	1.12	.95	19.6	1.02	1.01	.41	2.50
1945	.27	.54	1.17	1.44	1.62	1.39	1.20	.44	-	-	38.3	.32	3.95
1946	1.24	.74	1.16	1.95	1.34	1.16	.77	.28	-	-	-	8.34	1.40
1947	66.5	2.31	2.06	2.42	1.97	2.31	1.71	47.6	4.18	.17	.02	-	11.1
1948	-	-	.47	.64	1.39	1.15	.47	.57	1.71	-	.54	1.03	.66
1949	-	.01	.21	.58	1.06	.83	1.38	162	22.9	5.47	1.00	.80	16.6
1950	.88	1.18	1.56	1.52	1.69	1.38	1.23	.34	2.27	70.4	6.71	23.1	9.45
1951	5.05	2.22	2.18	2.24	2.95	1.95	1.55	191	12.6	2.52	.41	.18	19.0
1952	.43	.87	1.29	1.54	1.70	1.35	2.54	1.35	1.03	9.67	.01	-	1.82
1953	-	.37	.97	1.02	.88	.95	20.6	.42	.01	-	2.85	.56	2.36
1954	89.7	1.55	.99	1.09	1.01	.71	.75	29.6	108	5.75	.46	.01	20.1

Note: All discharge is measured in cubic feet per second.

Table 2. Monthly and Yearly Run-off at Gage Station above Buffalo Lake.
(Drainage area, 2,075 square miles of which 1,500 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1938	-	-	-	-	-	-	-	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-	-	-	-	-
1940	-	-	53	104	84	62	60	36	2.8	-	-	-	-
1941	-	3.8	0	7.7	19	56	35	23,750	26,060	476	240	647	51,290
1942	15,170	871	407	246	222	292	641	181	148	31	537	926	19,670
1953	815	131	493	181	142	144	189	207	80	685	1.4	-	3,070
1944	-	12	83	106	89	82	67	58	1,170	62	62	24	1,820
1945	17	32	72	88	90	85	71	27	-	-	2,360	19	2,860
1946	76	44	72	120	75	71	46	17	-	-	-	496	1,020
1947	4,090	137	127	149	109	142	102	2,930	249	10	1.0	-	8,050
1948	-	-	29	39	80	70	28	35	102	-	33	61	477
1949	-	.4	13	36	59	51	82	9,960	1,360	336	62	48	12,010
1950	54	70	96	94	94	85	73	21	135	4,330	413	1,380	6,840
1951	311	132	134	138	164	120	92	11,730	751	155	25	11	13,760
1952	27	52	80	95	98	83	151	83	61	595	.6	-	1,330
1953	-	22	60	63	49	59	1,220	26	.4	-	175	34	1,710
1954	5,520	92	61	67	56	44	44	1,820	6,450	354	29	.8	14,540

Note: All run-off is measured in acre feet.

Table 3. Monthly and Annual Mean Discharge, Approximately 15 Miles Above Palo Duro Canyon Station.
(Drainage area, about 3,369 square miles of which about 2,658 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1924	-	-	-	-	16.1	17.7	11.2	9.06	4.00	37.3	6.68	2.32	-
1925	0.40	0.56	1.04	4.90	6.48	3.82	5.18	2.93	12.5	20.5	31.0	31.7	10.1
1926	13.7	5.79	4.34	3.95	3.23	2.80	2.80	26.0	30.6	.79	.25	-	7.87
1938	-	-	-	-	-	-	-	43.0	1.70	.02	.04	-	-
1939	194	-	-	1.06	-	-	4.34	-	21.0	.11	3.06	-	2.60
1940	-	-	-	-	-	-	-	16.6	-	-	-	-	1.41
1941	-	-	-	-	-	-	-	30.6	537	38.6	2.77	.12	50.2
1942	432	48.0	8.23	7.99	6.26	6.65	9.02	4.65	5.4	.57	-	-	44.3
1943	9.39	2.28	2.62	2.70	2.66	2.82	2.67	.82	.11	26.7	.01	-	4.45
1944	-	-	.02	1.52	1.16	1.26	.64	.03	1.73	21.0	.50	.17	2.36
1945	-	.003	.15	.32	.58	.29	.38	.05	-	-	1.82	-	.30
1946	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	84.5	1.34	.21	.17	.04	.15	.47	55.9	1.29	-	-	-	12.2
1948	-	-	-	-	-	-	-	-	-	-	3.84	4.37	.68
1949	.25	12.8	.08	.19	.26	1.68	.65	48.6	40.6	.32	.38	4.73	9.23

Note: All discharge is measured in cubic feet per second.

Table 4. Monthly and Annual Run-off, Approximately 15 Miles Above Palo Duro Canyon Station.
(Drainage area, about 3,369 square miles of which about 2,658 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1924	-	-	-	-	924	1,090	664	557	238	2,290	411	138	-
1925	24.4	33.1	63.9	301	360	235	308	180	745	1,260	1,900	1,880	7,290
1926	845	344	267	243	179	172	167	1,600	1,820	48.6	15.3	-	5,700
1938	-	-	-	-	-	-	-	2,640	161	1.4	2.4	-	-
1939	119	-	-	65	-	-	258	-	1,250	6.7	188	-	1,890
1940	-	-	-	-	-	-	-	1,020	-	-	-	-	1,020
1941	-	-	-	-	-	-	-	1,880	31,930	2,370	170	7.1	36,360
1942	26,560	2,860	506	491	348	409	537	286	32	35	-	-	32,060
1943	577	136	161	166	148	173	159	51	6.3	1,640	.6	-	3,220
1944	-	-	1.4	93	66	78	38	2.0	103	1,290	31	10	1,710
1945	-	.2	8.9	1.9	32	18	22	3.4	-	-	112	-	216
1946	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	5,200	80	13	11	2.2	9.1	28	3,440	77	-	-	-	8,860
1948	-	-	-	-	-	-	-	-	-	-	236	260	496
1949	15	762	5.0	12	14	104	39	2,990	2,420	20	23	282	6,690

Note: All run-off is measured in acre feet.

Table 5. Monthly and Annual Mean Discharge at Turkey Station.
(Drainage area, 5,972 square miles of which 4,479 is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1939	-	-	-	7.57	-	-	-	-	186	12.3	144	-	-
1940	-	-	-	-	-	-	22.3	61.6	41.6	-	21.5	78.8	18.7
1941	8.00	102	-	-	.01	7.40	11.0	307	1,231	188	125	80.9	171
1942	1038	100	28.5	9.75	1.29	12.6	43.3	3.41	48	22.0	91.2	43.0	122
1943	350	2.77	36.2	7.76	-	-	132	147	74.9	82.6	-	15.3	71.4
1944	-	-	16.5	21.3	7.85	3.17	-	32.9	51.6	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	176	-
1950	12.8	-	-	-	-	-	.17	28.0	82.3	384	81.0	239	69.3
1951	1.11	.05	.73	3.07	1.78	.20	.20	103	87.3	8.63	-	-	-

Note: All discharge is measured in cubic feet per second.

Table 6. Monthly and Annual Run-off at Turkey Station.
(Drainage area, 5,972 square miles of which 4,479 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1939	-	-	-	466	-	-	-	-	11,080	756	8,840	-	-
1940	-	-	-	-	-	-	1,330	3,790	2,470	-	1,320	4,690	13,600
1941	492	6,060	-	-	.6	455	657	18,900	73,250	11,590	7,700	4,810	123,900
1942	63,840	5,950	1,750	600	72	775	2,580	210	2,860	1,350	5,610	2,560	88,160
1943	21,540	165	2,230	477	-	-	7,830	9,020	4,460	5,080	-	908	51,710
1944	-	-	1,010	1,310	452	195	-	2,020	3,070	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	10,500	-
1950	786	-	-	-	-	-	9.9	1,720	4,900	23,590	4,980	14,190	50,180
1951	68	3.0	45	189	99	12	12	6,320	5,200	531	-	-	-

Note: All run-off is measured in acre feet.

Table 7. Monthly and Yearly Mean Discharge at Newlin Station.
(Drainage area, 7,293 square miles of which 4,769 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1924	-	-	-	35.5	5.09	75.4	1.26	-	0.63	174	809	1.58	-
1925	524	4.60	-	2.69	.01	-	50.2	227	73.2	361	1690	994	330
1938	-	-	-	-	13.5	43.9	0.02	280	794	92.2	26.0	126	-
1939	20.4	-	-	61.0	-	-	5.17	16.2	183	16.8	121	-	36.3
1940	-	-	-	-	-	-	49.8	55.3	45.8	-	238	171	46.7
1941	.39	249	.34	.06	6.49	13.9	164	748	2959	482	242	108	413
1942	1359	84.5	64.2	12.3	2.05	14.4	410	6.92	33.2	30.5	63.7	28.1	178
1943	606	8.56	28.3	7.31	.20	-	146	200	127	272	-	1.93	118
1944	-	-	13.8	16.8	5.63	8.32	-	24.7	162	117	7.19	44.8	33.3
1945	72.8	10.4	102	15.1	4.00	23.3	97.9	13.4	25.9	172	45.9	13.4	50.2
1946	1.16	-	-	.52	6.67	.32	-	22.9	150	.71	176	251	50.5
1947	1967	49.1	89.5	9.18	-	1.69	156	1023	406	14.6	-	-	314

Note: All discharge is measured in cubic feet per second.

Table 8. Monthly and Yearly Run-off at Newlin Station.
(Drainage area, 7,293 square miles of which 4,769 square miles is probably noncontributing)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Annual
1924	-	-	-	2,200	293	4,640	75.0	-	37.5	10,700	49,800	93.8	-
1925	32,200	274	-	165	.4	-	2,980	13,900	4,360	22,200	104,000	59,100	239,000
1938	-	-	-	-	750	2,700	1.2	17,190	47,270	5,670	1,600	7,520	-
1939	1,260	-	-	3,750	-	-	307	993	10,910	1,030	8,040	-	26,290
1940	-	-	-	-	-	-	2,960	3,400	2,730	-	14,620	10,190	33,900
1941	24	14,810	21	3.6	361	854	9,750	45,990	176,100	29,640	14,860	6,450	298,900
1942	83,560	5,030	3,950	755	114	883	24,400	426	1,980	1,880	3,920	1,670	128,600
1943	37,230	509	1,740	449	11	-	8,700	12,320	7,530	16,750	-	115	85,350
1944	-	-	851	1,030	324	512	-	1,520	9,650	7,180	442	2,660	24,170
1945	4,480	617	6,280	931	22	1,430	5,830	821	1,540	10,550	2,820	797	36,320
1946	71	-	-	32	370	19	-	1,410	8.900	44	10,790	14,910	36,550
1947	120,900	2,920	5,500	565	-	104	9,270	62,920	24,180	900	-	-	227,300

Note: All run-off is measured in acre feet.

Table 9. Chemical Nature of the Water at the Sample Station.

Date	Calcium	Sodium	Chloride	Sulfate	Carbonates	Bicarbonates	Total Salts	pH
				CANYON STATION				
6/14/56	86	30	36	24	0	250	426	-
8/13/56	dry							
9/24/56	dry							
10/21/56	dry							
12/6/56	dry							
1/17/57	dry							
2/18/57	dry							
3/12/57	dry							
4/12/57	dry							
5/22/57	46	16	17	0	0	162	241	7.92
				PALO DURO STATION				
6/14/56	744	116	45	1810	0	201	2916	-
8/13/56	664	150	57	1670	0	201	2742	7.5
9/24/56	792	156	107	1987	0	120	3162	7.60
10/21/56	dry							
12/6/56	dry							
1/17/57	dry							
2/18/57	18	111	40	96	12	132	409	8.60
3/12/57	dry							
4/12/57	346	132	36	975	6	90	1585	7.92
5/23/57	598	105	65	1411	0	192	2371	7.75
				TURKEY STATION				
6/12/56	924	2100	4242	772	0	119	8157	-
8/13/56	dry							
9/24/56	dry							
10/21/56	dry							
12/6/56	dry							
1/17/57	dry							
2/19/57	1998	10302	16090	3730	18	122	32260	7.69
3/12/57	dry							
4/12/57	954	13568	21034	1834	0	420	37810	-
5/22/57	890	2835	4848	1368	15	142	10098	7.75
				NEWLIN STATION				
6/12/56	1552	3200	5156	3318	0	125	13551	-
8/13/56	dry							
9/24/56	dry							
10/21/56	dry							
12/6/56	dry							
1/17/57	dry							
2/9/57	dry							
3/12/57	dry							
4/12/57	dry							
5/22/57	760	1764	3025	1286	18	120	6973	7.95

Table 9. (Continued).

CHILDRESS STATION

6/12/56	1248	6600	10029	3125	0	104	21106	-
8/13/56	2540	24048	36033	7473	0	116	70210	-
9/24/56	2512	18090	23830	12322	0	252	57006	7.50
10/21/56	1024	9045	14342	960	48	312	25731	7.20
12/6/56	2284	19520	29997	5539	0	150	57490	8.5
1/17/57	3108	20975	32882	6432	12	144	63453	8.2
2/18/57	1912	16482	25649	4267	12	61	48383	7.50
3/12/57	2208	19095	29998	4512	9	76	55898	7.50
4/9/57	2174	18291	30133	2520	9	144	53271	7.50
5/22/57	964	3851	6426	1330	6	396	12973	-

Table 10. Physical Conditions at the Sample Stations.

Date	Air Temp.	Water Temp.	Turbidity (mm.)
		CANYON STATION	
6/14/56	86	77	40
8/13/56	dry		
9/24/56	dry		
10/21/56	dry		
12/6/56	dry		
1/17/57	dry		
2/18/57	dry		
3/12/57	dry		
4/12/57	dry		
5/22/57	dry		
		PALO DURO STATION	
6/14/56	97	88	115
8/13/56	104	84	450 - almost dry
9/24/56	79	88	300 plus
10/21/56	dry		
12/6/56	dry		
1/17/57	dry		
2/18/57	dry		
3/12/57	dry		
[illegible]12/57	46	55	500 plus
[illegible]23/57	70	68	420
		TURKEY STATION	
6/12/56	95	68	35
8/13/56	dry		
9/24/56	dry		
10/21/56	dry		
12/6/56	dry		
1/17/57	dry		
2/19/57	43	41	400 plus
3/12/57	dry		
4/12/57	34	43	310
5/22/57	86	82	100
		NEWLIN STATION	
6/12/56	90	72	110
8/13/56	dry		
9/24/56	dry		
10/21/56	dry		
12/6/56	dry		
1/17/57	dry		
2/19/57	dry		
[illegible]12/57	dry		
[illegible]12/57	dry		
5/22/57	81	74	60

Table 10. (Continued).

CHILDRESS STATION

6/12/56	90	75	120
8/13/56		79	300 plus - very salty and low
9/24/56	88	90	300 plus
10/21/56	67	64	40 - raining
12/6/56	64	53	350 plus
1/17/57	32	27	350 plus (Water frozen over except in rapid running stream)
2/18/57	52	47	400 plus
3/12/57	81	61	400 plus
4/9/57	60	60	460 plus
5/22/57	77	73	40 (Collections made following recent rains)

Table 11. Monthly Variation in Species and Numbers of Fishes at Canyon Station, Prairie Dog Town Fork.

Species	* 6/14	** 8/13	** 9/24	** 10/21	** 12/6	** 1/17	** 3/12	** 4/12	* 5/23	Total	% of Total

* - Water present, but no fish taken in considerable seining.
** - Dry

Table 12. Monthly Variation in Species and Numbers of Fishes at Palo Duro Station, Prairi Dog Town Fork.

Species	6/14	8/13	9/24	* 10/21	* 12/6	* 1/17	* 2/18	* 3/12	4/12	5/23	Total	% of Total
N. bairdi									2		2	.11
N. lutrensis	36	691	11						51	145	934	52.65
Hybognathus	11								124	24	159	8.96
P. vigilax	41	120	3						158	24	346	19.50
P. promelas									140	11	151	8.51
I. punctatus									2		2	.11
F. kansae	27	36							56	27	146	8.23
L. cyanellus	1	17	1						5		24	1.35
L. megalotis	1	9									10	.56
Total	117	873	15						538	231	1774	99.98
% of Total	6.6	49.2	.9						30.3	13.0		100.00

* Dry

Table 13. Monthly Variation in Species and Numbers of Fishes at Turkey Station, Prairie Dog Town Fork.

Species	6/12	* 8/13	* 9/24	* 10/21	* 12/6	* 1/17	2/19	* 3/12	4/12	5/22	Total	% of Total
N. bairdi	5										5	.64
Hybognathus	97									432	529	68.25
F. kansae	16						2		12	4	34	4.40
Cyprinodon	8						49		150		207	26.70
Total	126						51		162	436	775	99.99
% of Total	16.3						6.6		20.9	56.2		100.00

* Dry

Table 14. Monthly Variation in Species and Numbers of Fishes at Newlin Station, Prairie Dog Town Fork.

Species	6/12	* 8/13	* 9/24	* 10/21	* 1/17	* 2/19	* 3/12	* 4/12	5/22	Total	% of Total
N. bairdi	62									62	22.30
N. lutrensis	1								2	3	1.10
N. potteri									20	20	7.20
Hybognathus	40								60	100	36.00
F. kansae	39									39	14.00
Cyprinodon	53								1	54	19.40
Total	195								83	278	100.00
% of Total	70.1								29.9		100.00

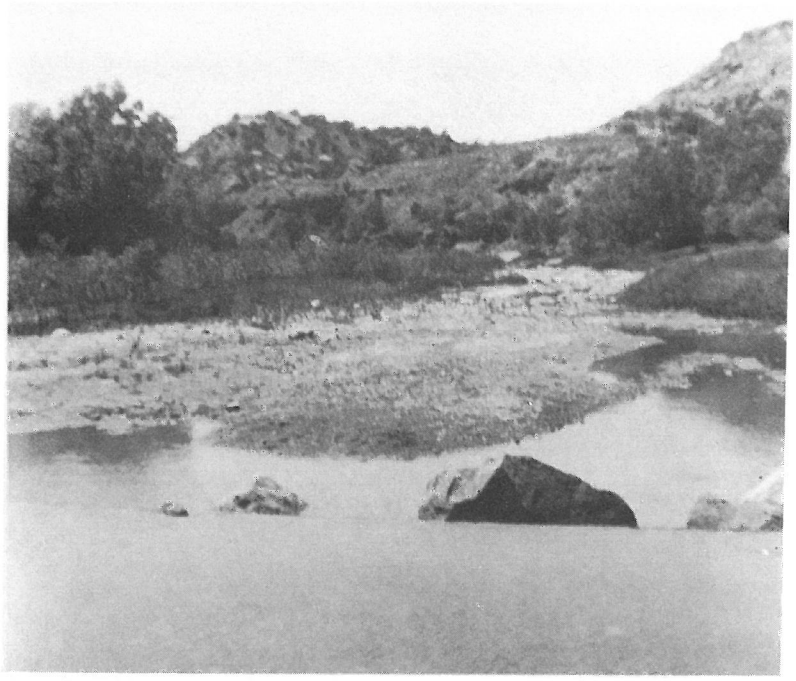
* Dry

le 15. Monthly Variation in Species and Number of Fishes at Childress Station, Prairie Dog Town Fork.

Species	6/12	8/13	9/24	10/21	12/6	1/17	2/18	3/12	4/9	5/22	Total	% of Total
N. bairdi	4									9	13	.18
Hybognathus	11									176	187	2.62
I. melas										2	2	.03
F. kansae	103	31	16	11	28	4	6	45	24	2	270	3.78
Cyprinodon	441	241	33	28	865	538	1944	1781	802	3	6676	93.39
Total	559	272	49	39	893	542	1950	1826	826	192	7148	100.00
% of Total	7.8	3.8	.7	.5	12.5	7.6	27.3	25.5	11.5	2.7		99.9

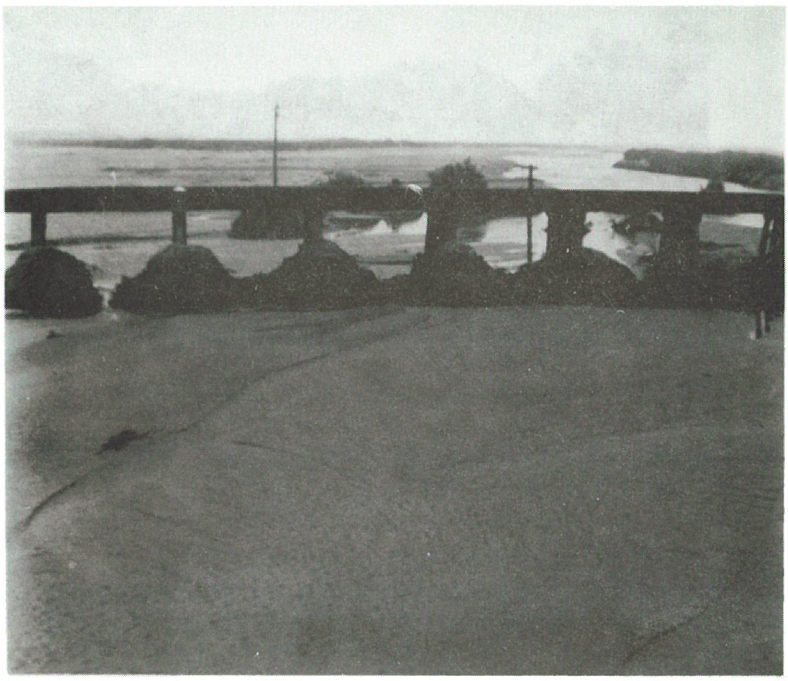
Table 16. Total Numbers of Fishes Taken at Stations on The Prairie Dog Town Fork of Red River.

Species	Canyon	Palo Duro	Turkey	Newlin	Childress	Total	% of Total
N. bairdi	0	2	5	62	13	82	.82
N. lutrensis	0	934		3		937	9.39
N. potteri	0			20		20	.20
Hybognathus	0	159	529	100	187	975	9.77
P. vigilax	0	346				346	3.47
P. promelas	0	151				151	1.51
I. punctatus	0	2				2	.02
I. melas	0				2	2	.02
F. kansae	0	146	34	39	270	489	4.90
Cyprinodon	0		207	54	6676	6937	69.54
L. cyanellus	0	24				24	.24
L. megalotis	0	10				10	.10
Total	0	1774	775	278	7148	9975	99.98
% of Total		17.8	7.8	2.8	71.6		100.00



Palo Duro Canyon station showing isolated pool below creek crossing. This station was dry five of the ten times it was worked during the study.

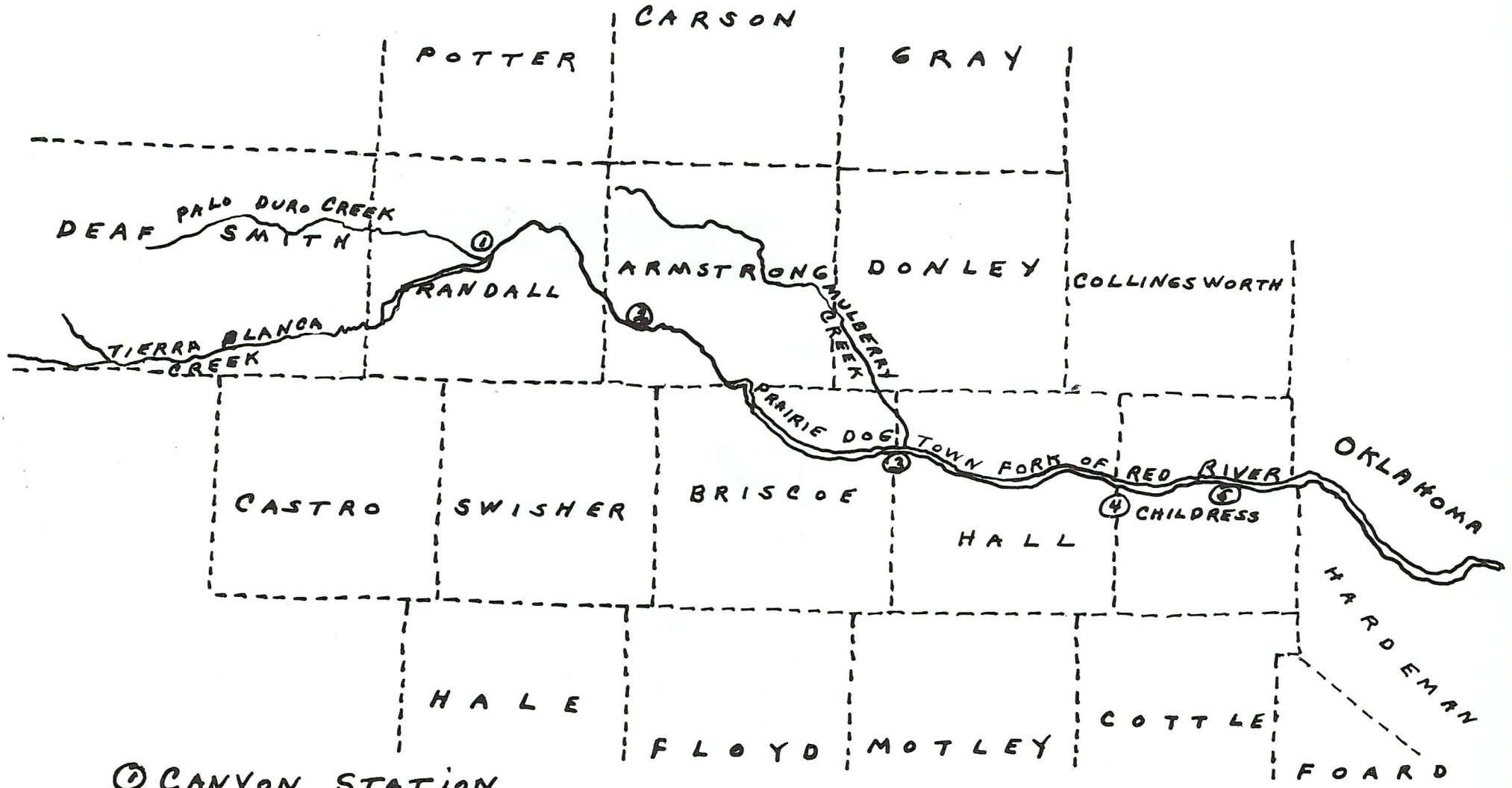
Turkey station following recent rains. This station was dry six of the ten times it was worked during the study.



Newlin station following recent rains. Water was found here only twice during the study. Railroad bridge in foreground was temporarily damaged beyond use by floods in May 1957.

Childress station showing normal stream flow.

Mulberry Creek during a rise. This creek, which is dry except during rains, is as large as the north and south forks of the river at this point.


CARSON
POTTER
GRAY
DEAF SMITH
PALO DURO CREEK
RANDALL
TIERRA BLANCA CREEK
ARMSTRONG
DONLEY
COLLINGSWORTH
MULBERRY CREEK
PRAIRIE DOG TOWN FORK OF RED RIVER
OKLAHOMA
CASTRO
SWISHER
BRISCOE
HALL
CHILDRESS
HARDEMAN
HALE
FLOYD
MOTLEY
COTTLE
FOARD
1 CANYON STATION
2 PALO DURO CANYON STATION
3 TURKEY STATION
4 NEWLIN STATION
5 CHILDRESS STATION