

PERFORMANCE REPORT

As required by

FEDERAL AID IN FISHERIES RESTORATION ACT

Federal Aid Project F-30-R-2

Statewide Fishery Management Recommendations

Job B: Management Recommendations for Proposed Reservoir and Other
Public Water Projects
Palo Duro Creek, 1976

Robert L. Bounds
Inland Fisheries Management Program Director

District I-A
Joseph E. Kraai
District Management Supervisor

Clayton T. Garrison
Executive Director
Texas Parks and Wildlife Department

David L. Pritchard
Chief, Inland Fisheries

Robert J. Kemp
Director of Fisheries

June 1, 1977

Performance Report
Job B, District I-A

State: Texas

Project Title: Statewide Public Waters Management

Project Section: Research and Surveys

Study Title: Management Recommendations for Proposed Reservoir and Other
Public Waters Projects

Contract Period: From January 1, 1976 through December 31, 1976

Program Narrative Objective Number: 2

Objective: To recommend habitat improvement, fisherman information, fish population manipulation, vegetation control, pollution control, fisherman access and facility development, and fishing regulations for existing and proposed public waters of Texas.

I. Abstract:

During 1976, a preimpoundment survey was conducted on Palo Duro Creek in the Texas Panhandle to provide basic biological data for designing a fisheries management plan for the proposed reservoir. This plan was to provide for optimum fishing recreation benefits from the reservoir over an extended period of time. The intermittent nature of Palo Duro Creek resulted in the collecting of relatively few species of fish and invertebrates. No game fishes were collected. Carp were found at several locations. Their presence poses a threat to the fishery of the proposed lake. Forage species collected were primarily those which prefer a stream environment. Recent events have occurred which resulted in the postponement of the lake's construction for a period of several years. Final fisheries management recommendations should not be formulated until the exact location of the dam is known and data concerning the lake's size and other characteristics become available. A second preimpoundment survey should be conducted within five years of actual impoundment.

II. Segment Objectives:

Conduct necessary surveys as outlined in "A Manual of Survey and Management Techniques for Reservoir and Stream Management" to accomplish the following procedures:

- A. Recommend fisheries management features for proposed water development
- B. Recommend fisheries management needs to other organizations having management authority on public waters.

- C. Prepare an annual report of survey results and management recommendations.

III. Introduction:

The impounding of Palo Duro Creek was first seriously considered when the Texas State Legislature created the Palo Duro River Authority. The purpose of the River Authority was to construct a dam and reservoir on Palo Duro Creek in Hansford County. Although an engineering feasibility study was completed during 1974, the River Authority did not reach a final agreement on initiating the project until early 1976. At this time Congress authorized the Corps of Engineers to investigate the water resources of Palo Duro Creek. New officers were placed on the Palo Duro River Authority Board and the project was turned over to the Corps of Engineers. Initiation of the project will probably be delayed for 8 to 20 years.

During 1976, District I-A personnel with the Inland Fisheries Section of the Texas Parks and Wildlife Department initiated a preimpoundment survey on the watershed to gather information on which to base management recommendations concerning the proposed reservoir.

IV. Study Area Description:

The valley formed by Palo Duro Creek in the area of the proposed reservoir site is broad and U-shaped. Several small canyons and one tributary stream intersect the stream at this point. The stream valley has steep sides and numerous points and rocky outcrops. Terrestrial vegetation is sparse in this area. Small stands of cottonwood trees line the creek banks in isolated locations and juniper trees and woody shrubs are occasionally found along the sides of the canyons. Prairie grasses are the dominant ground cover. Deep loam and clay and silt make up the primary soils of this region.

The primary land usage is agriculture and mineral operations. Corn, sorghum, wheat and cotton are the major crops produced. Oil, natural gas, helium and gypsum are produced in commercial quantities.

V. Procedures:

The classification of Palo Duro Creek was based on the work of Horton (1945). Stream order was determined through the use of USGS topographic maps. The intermittent nature of the stream required that sampling stations be established in areas where agricultural irrigation runoff provided a reliable source of water. Only three stations were found which were thought to maintain water throughout the sampling period.

Physical characteristics of the stream were determined for each station during each sampling period. Stream width and depth were determined by averaging several measurements at each station. Current velocity was determined by timing the progress of a float across a known distance of stream. Several tests were made at each station and an

average current velocity was determined. Other physical characteristics of the stream and its basin were determined by visual observation.

Water quality measurements were made throughout the sampling period. Samples were analyzed in the field for oxygen, temperature, pH, conductivity and total alkalinity. Samples were sent to the regional chemist each sampling period for the determination of total hardness, turbidity, total dissolved solids, chlorides, nitrates and phosphates.

Visual inspections of the stations were made to determine the species of aquatic vegetation present in the stream.

Aquatic invertebrate samples were collected during May, June and August. A Surber sampler and an Ekman dredge were used to assess the benthic population. Surber samples were collected from riffle areas and dredge samples from pools. All macroinvertebrates collected were preserved in 5% ethol alcohol and returned to the laboratory for identification.

Fish populations were sampled using a 20-ft, 3/16 in. mesh straight seine and an electrofishing boat. Three seine drags were made at each station during each sampling period. Various habitat types were selected for the samples. The seine was held open to cover the entire stream width in most samples. Length of the drags varied with the amount of obstacles and cover in the stream. An electrofishing sample was collected during June and August at Station I. The entire shoreline of an impounded section of the stream was sampled with the shocking boat during the two months.

VI. Results:

A search of the literature indicated that no fisheries investigations have been conducted on Palo Duro Creek prior to 1976.

Channel Data: According to the Horton System of Stream Classification, Palo Duro Creek is a Group IV stream, both intermittent and interrupted. Following periods of locally heavy precipitation the stream maintains a substantial flow and often creates minor flooding. Sections of new stream channels are often formed and the stream bed is commonly scoured during these floods.

The average width of the channel varied throughout the year. During May the average width was 18.1 ft. During June it had increased to an average of 24.0 then decreased to an average of 21.5 ft at Stations I and II by August. During August Station III was dry.

Depths at the sampling stations ranged from a maximum of 31 in. at Station I in May to a minimum of 4.5 in. at Station II during August. The volume of flow varied from a maximum of 113.1 ft³/s during May to a minimum of no flow at Station III during August.

Stream bottom types were primarily combinations of muck, sand, silt and rubble. Small sections of the stream containing only a sand substrate were common.

Habitat: Pools were shallow and contained only a marginal amount of cover. Riffles became decreasingly common throughout the sampling period. Stream shade, undercut banks, boulders and other fish attractors were uncommon throughout the study area.

Water Quality: All water quality values measured were well within tolerance ranges of most species of fish.

Seven feedlots operate within the Palo Duro Creek watershed but investigations into these operations revealed adequate retention facilities are present in all cases and no effluent flows into the watershed.

Irrigation runoff from local farmland commonly enters directly into Palo Duro Creek. Water quality values indicated no excessive amounts of nitrates, phosphates or chlorides were associated with the runoff. No analyses were made to determine pesticide residue in either the stream bottom sediment or in fish flesh from Palo Duro Creek.

Vegetation: Aquatic vegetation was absent from the study area of Palo Duro Creek with the exception of isolated growths of filamentous algae. A few areas of smartweed and reeds bordered the stream.

Benthos: Very few organisms were collected in the benthic samples. A checklist of organisms collected is presented in Table 1. Low invertebrate production can be attributed to the intermittent character of the stream.

In addition to the above organisms, adult giant water beetles, whirligig beetles, damselflys and dragonflys were observed in or around Palo Duro Creek. The larvae stages of these organisms undoubtedly exist within the stream.

Fish Populations: Two electrofishing samples were collected above Station II. These samples resulted in the collection of 38 carp which weighed a total of 15.9 lb and three yellow bullheads weighing a total of 0.7 lb. Both species could become problematic in a lake environment. Seining proved to be the only fish collection method suitable for all three stations. Only 12 species of fishes were collected throughout the sampling period (Table 2). Red shiner was the most abundant species collected. They were collected from each station during each sampling period. Silvery minnow and plains killifish were abundant at Station III but absent from collections at the other two stations. Mimic shiners were common only at Station III. Fathead minnows were collected from all stations and were fairly common in the samples. Other species were taken only rarely during seining operations.

Station III, under the conditions present during 1976, is separated from the other two stations by an interrupted section of stream several miles in length. The effect of this barrier is apparent in the fish samples. Collections revealed that 11 species were collected from Station III, five from Station I and two from Station II. Station III, in all probability, will be below the area of the proposed dam and its fish population will not have access to the lake. Only five species of fishes were collected from that area of Palo Duro Creek which will be inundated by impoundment.

VII. Recommendations:

Because the project initiation dates are unknown and the exact location and size of the proposed reservoir are undetermined, it would be inappropriate to formulate management recommendations for the lake at this time. It is recommended that a second preimpoundment survey be conducted within five years of the project completion date. Data collected during 1976 should be used for reference and for comparative purposes with the findings of this proposed study. In addition, it is recommended that a sample of fish from each station be analyzed for pesticide residue when the stream is resurveyed.

VIII. Cost: \$1,100.

Prepared by: Joseph E. Kraai
District Management Supervisor

Date January 31, 1977

Approved by: Robert L. Bantz
Project F-30-R Program
Director

William C. Provine
Assistant Program Director
Project F-30-R

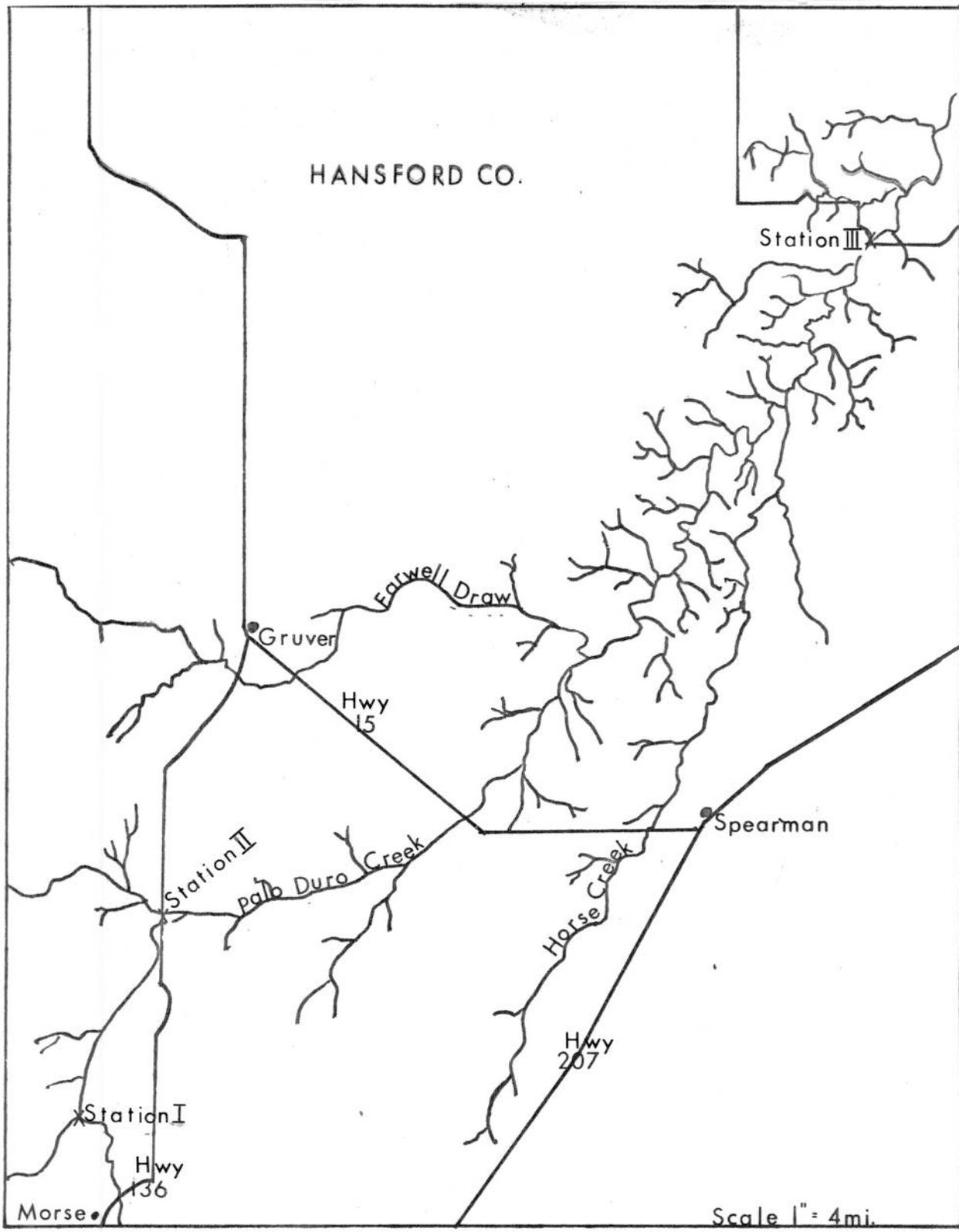


Figure 1. Preimpoundment study area, Palo Duro Creek, Texas, 1976.

Table 1. Average chemical characteristics of water from Palo Duro Creek, Hansford County, Texas,
 May and August, 1976.

Station	Temp (C)	D.O. (ppm)	pH	Total Alk. (ppm)	Specific Conductance umhos/cm	Turbidity JTU	Cl (ppm)	Hardness (ppm)
1	23.6	7.10	9.0	211	577	29.5	27	175
2	23.1	14.5	9.0	170	341	32.5	26	180
3	18.8	9.6	8.2	190	525	12.0	84	325

Table 2. A checklist of aquatic invertebrates collected from Palo Duro Creek, Hansford County, Texas, 1976.

Common Name	Taxon
Crayfish	Family Decapoda
Midge larvae	Family Chironomidae
Blackfly larvae	Family Simuliidae
Mayfly larvae	Family Baetidae
Aquatic annelids	Order Oligochaeta



Table 3. Seine sample statistics, three stations, Palo Duro Creek, Hansford County, Texas, 1976.

Species	May 2			June 2			August 19		
	Station			Station			Station		
	I	II	III	I	II	III	I	II	III
Carp						1			
Silvery minnow			167			169			
Red shiner	833	484	225	71	339	403	376	184	
<u>Notropis</u> larvae			537						
Mimic shiner			79		12				
Fathead minnow	7	3	9	8	12	2	14		
River carpsucker			2			2			
Plains killifish			439			26			
Mosquitofish			6			2			
Green sunfish			5						
Bluegill						1			

Appendix I

Stream Descriptive Data

Stream Descriptive Data

1. Name of Stream Palo Duro Creek
2. Watershed North Canadian River
3. Location Texas County in the Oklahoma Panhandle and Hansford, Ochiltree, Sherman, Moore, Dallam, and Hutchinson counties of the Texas Panhandle.
4. Length The length of the area under study was approximately 50 miles.
5. Basic Topography Gentle to moderate relief represented by broad, slightly rolling to smooth surface interrupted by distinct erosional features such as Palo Duro Creek.
6. Source Surface runoff and irrigation tailwater.
7. Tributaries From North Canadian River; Palo Duro Creek, Hackberry Creek, Horse Creek, Farwell Draw, North Palo Duro Creek and South Palo Duro Creek.
8. Barriers Gravel road overflow 2 miles north of Morse, Texas
9. Pollution No sources of pollution were found which provided an effluent into Palo Duro Creek.
10. Controlling Authority and Water Use Palo Duro River Authority. Water used for municipalities, agriculture, and recreation.
11. Endangered Populations None
12. Accessibility Only at public road crossings.
13. Longitudinal Gradient 3756 ft. msl to 2700 ft. msl
14. Flow Data SEE Attached forms (Forms 2).
15. Land Use Agriculture, petroleum industry, minerals.

Appendix II

Physicochemical Characteristics

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date May 4, 1976
 Station Number II Collection Number I Surveyed by Kraai, Bagwell, Conway
 Time 4:25pm Sky Cloudy Wind S.W. 15-30mph Water Level normal
 Air Temp. -- °C Secchi Disc less than 2 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity umho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	2	19.2	10.1	320	9.2	8	205.2		32	190

Transect Data:

Subsample #1: Location: Hwy 136, bridge 8 mi. South of Gruver, Texas Avg. Width 16.3 ft.

Depth (units inches) 30 9 0 (average depth 13 inches)

Current Velocity (method: Weighted float, timed over a known distance. 76.3 cfs)

Sample Point: 1 17.8 14.6 17.0 sec 2 timed over 25 ft. 3

Bottom Composition: (Indicate Percentage of Substrate Type) Muck 50 % Detritus --- %

Clay --- % Silt --- % Sand 50 % Gravel --- % Rubble --- % Boulder --- % Bedrock --- %

Stream Shade (check type shade): Densely shaded --- Partly shaded --- Open XXX

Subsample #2: Location ----- Width ----- ft.

Depth (units -----) -----

Current Velocity (method -----) -----

Sample Point: 1 ----- 2 ----- 3 -----

Bottom Composition: (Indicate Percentage of Substrate Type) Muck --- % Detritus --- %

Clay --- % Silt --- % Sand --- % Gravel --- % Rubble --- % Boulder --- % Bedrock --- %

Stream Shade (check type shade): Densely shaded --- Partly shaded --- Open ---

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream ---

b. Equal to the average width of the stream XXX

c. Less than the average width of the stream ---

Cover in pool areas (check one): Abundant --- Intermediate --- Exposed XXX

Percent of stream in pools 10 %, riffles 90 %, and flats --- %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date May 4, 1976
 Station Number III Collection Number I Surveyed By Kraai, Bagwell, Conway
 Time 12:00pm Sky Cloudy Wind S.W. 20-30mph Water Level normal
 Air Temp. -- °C Secchi Disc less than 4 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity umho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	3	17.2	9.2	775	8.0	14	209.0		95	320

Transect Data:

Subsample #1: Location: 1 mi. North & 3 mi. West of FM. 760 ending. Avg. Width 19.2 ft.

Depth (units inches) average depth 12 inches

Current Velocity (method: Weighted float, timed over a known distance. 113.1 cfs)

Sample Point: 1 37 sec 31.4 30 sec 2 timed over 25 ft. 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %
 Clay _____ % Silt 1 % Sand 98 % Gravel 1 % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open XXX

Subsample #2: Location _____ Width _____ ft.

Depth (units _____)

Current Velocity (method _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %
 Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream XXX
 b. Equal to the average width of the stream _____
 c. Less than the average width of the stream _____

Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed XXX

Percent of stream in pools 10 %, riffles 190 %, and flats _____ %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date June 2, 1976
 Station Number I Collection Number II Surveyed By Kraai, Bagwell, Conway
 Time 1:20pm Sky Clear Wind S.W. 5-15mph Water Level 5 inches below normal
 Air Temp. 28 °C Secchi Disc less than 5 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity µmho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	1	29.0	9.0	875	9.0	47	222.3		21	190

Transect Data:

Subsample #1: Location: 2 mi. North of Morse, Texas off Hwy. 136 Avg. Width 23 ft.

Depth (units inches) 16 20 22 0 (average depth 14.5")

Current Velocity (method: Weighted float, timed over known distance.)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck 50 % Detritus _____ %

Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble 50 % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open XXX

Subsample #2: Location _____ Width _____ ft.

Depth (units _____)

Current Velocity (method _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %

Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream _____
 b. Equal to the average width of the stream XXX
 c. Less than the average width of the stream _____

Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed XXX

Percent of stream in pools 25 %, riffles 2 %, and flats 73 %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date June 2, 1976
 Station Number II Collection Number II Surveyed By Kraai, Bagwell, Conway
 Time 11:30am Sky Clear Wind S.W. 5-15mph Water Level 1-1½ ft. above normal
 Air Temp. 28 °C Secchi Disc less than 2 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conductivity umho/cm	pH	Turbidity JIU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	2	24.0	8.0	363	8.8	57	171.0		21	170

Transect Data:

Subsample #1: Location: Hwy. 136, bridge 8 mi. South of Gruver, Texas Avg. Width 20 ft.

Depth (units inches) avg. depth 29 inches

Current Velocity (method: Weighted float, timed over a known distance.)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck 33 % Detritus _____ %

Clay _____ % Silt _____ % Sand 33 % Gravel 34 % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open XXX

Subsample #2: Location _____ Width _____ ft.

Depth (units _____)

Current Velocity (method _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %

Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream _____
 b. Equal to the average width of the stream XXX
 c. Less than the average width of the stream _____

Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed XXX

Percent of stream in pools 25 %, riffles 2 %, and flats 73 %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date June 2, 1976
 Station Number III Collection Number II Surveyed By Kraai, Bagwell, Conway
 Time 2:30pm Sky Clear Wind S.W. 5-15mph Water Level above normal 8-12"
 Air Temp. 26 °C Secchi Disc less than 2 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity umho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	3	20.5	10.0	275	8.5	10	171.0		74	330

Transect Data:

Subsample #1: Location: 1 mi. North and 3 mi. West of FM.760 ending. Avg. Width 28 ft.

Depth (units inches) 16 24 30 0 (average depth 17.5 inches)

Current Velocity (method: Weighted float, timed over a known distance. 6.3 cfs)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %

Clay _____ % Silt 1 % Sand 98 % Gravel 1 % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded XXX Open _____

Subsample #2: Location _____ Width _____ ft.

Depth (units _____)

Current Velocity (method _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %

Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream _____
 b. Equal to the average width of the stream XXX
 c. Less than the average width of the stream _____

Cover in pool areas (check one): Abundant _____ Intermediate XXX Exposed _____

Percent of stream in pools 5 %, riffles 0 %, and flats 95 %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date August 19, 1976Station Number I Collection Number III Surveyed By Bagwell, ConwayTime 10:50am Sky Clear Wind S. 0-5mph Water Level below normal 4"Air Temp. -- °C Secchi Disc less than 5 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity umho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	1	23.8	11.0		9.0		222.3			

Transect Data:

Subsample #1: Location: 2 mi. North of Morse, Texas off Hwy.136 Avg. Width 23 ft.Depth (units inches) 15 21 22 0 average depth 14.5"Current Velocity (method: Weighted float, timed over a known distance. 12.4 cfs)Sample Point: 1 avg. 12.6 sec 2 timed over 21 ft. 3 _____Bottom Composition: (Indicate Percentage of Substrate Type) Muck 50 % Detritus _____ %Clay _____ % Silt _____ % Sand 50 % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open XXX

Subsample #2: Location _____ Width _____ ft.

Depth (units _____) _____

Current Velocity (method _____) _____

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %

Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream XXX
b. Equal to the average width of the stream _____
c. Less than the average width of the stream _____Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed XXXPercent of stream in pools 10 %, riffles 90 %, and flats _____ %

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date August 19, 1976
 Station Number II Collection Number III Surveyed By Bagwell, Conway
 Time 12:30 pm Sky partly cloudy Wind S. 0-5mph Water Level below normal 2 1/2"
 Air Temp. -- °C Secchi Disc less than 2 inches

Water Samples:

Depth Inches	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conduc- tivity umho/cm	pH	Turbidity JTU	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
10	2	26.0	11.0		9.0		205.2			

Transect Data:

Subsample #1: Location: Hwy. 136, bridge 8 mi. South of Gruver, Texas Avg. Width 20 ft.
 Depth (units inches) average depth 4.5 inches
 Current Velocity (method: weighted float, timed over a known distance. 8.28 cfs)
 Sample Point: 1 average 23 sec 2 timed over 25 ft. 3 _____
 Bottom Composition: (Indicate Percentage of Substrate Type) Muck 50 % Detritus _____ %
 Clay _____ % Silt _____ % Sand 50 % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %
 Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open XXX
 Subsample #2: Location _____ Width _____ ft.
 Depth (units _____) _____
 Current Velocity (method _____) _____
 Sample Point: 1 _____ 2 _____ 3 _____
 Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____ % Detritus _____ %
 Clay _____ % Silt _____ % Sand _____ % Gravel _____ % Rubble _____ % Boulder _____ % Bedrock _____ %
 Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream _____
 b. Equal to the average width of the stream XXX
 c. Less than the average width of the stream _____
 Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed XXX
 Percent of stream in pools 10 %, riffles 90 %, and flats _____

Stream Survey Form

Stream Name Palo Duro Creek County Hansford Date August 19, 1976

Station Number III Collection Number III Surveyed By Bagwell, Conway

Time 2:00pm Sky partly cloudy Wind S.O-5mph Water Level ---

Air Temp. --- °C Secchi Disc --- inches

Water Samples:

Depth Meters	Bottle #	Water Temp. °C	Diss. Oxygen mg/l	Conductivity umho/cm	pH	Turbidity JTC	Alkalinity		Chlorides mg/l	Hardness mg/l
							Phen. mg/l	M. O. mg/l		
		This site, had no water water at this time.								

Transect Data:

Subsample #1: Location: 1 mi. North & 3mi. West of FM. 760 ending. Width _____ ft.

Depth (units _____) _____

Current Velocity (method: _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____% Detritus _____%

Clay _____% Silt _____% Sand _____% Gravel _____% Rubble _____% Boulder _____% Bedrock _____%

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Subsample #2: Location _____ Width _____ ft.

Depth (units _____) _____

Current Velocity (method _____)

Sample Point: 1 _____ 2 _____ 3 _____

Bottom Composition: (Indicate Percentage of Substrate Type) Muck _____% Detritus _____%

Clay _____% Silt _____% Sand _____% Gravel _____% Rubble _____% Boulder _____% Bedrock _____%

Stream Shade (check type shade): Densely shaded _____ Partly shaded _____ Open _____

Existing Stream Conditions:

Average width of pool (check one): a. Greater than the average width of the stream _____
 b. Equal to the average width of the stream _____
 c. Less than the average width of the stream _____

Cover in pool areas (check one): Abundant _____ Intermediate _____ Exposed _____

Percent of stream in pools _____%, riffles _____%, and flats _____%