JOB REPORT

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Project No. MP2-R-2 Date 1 November 1960

Project Name: Pollution Abatement in Regions M-4 through M-9.

Period Covered: 1 September 1969 to 1 September 1960. Job No. F-3.

An Investigation of the Existence of Pollution in Chiltipin Creek

Abstract: The Chiltipin Creek's main function at present is to transport oilfield waste from four major and two minor fields. This high saline and oily waste is slowly destroying nursery grounds for game fish and shrimp and increasing the salinity content of the Aransas River.

Objectives: To determine the extent of pollution damage to the creek and Copano Bay after the previous investigation.

Procedure: Six stations have been established along Chiltipin Creek from the point of entrance of the oilfield waste to the mouth of the creek. Samples were collected periodically and a chemical analysis determined.

Bio-assay studies were conducted on the marine indices, Lagodon rhomboides (pin perch), to determine the concentration of oilfield wastes in which 50% of the species could survive, commonly called the median toxicity threshhold value (MTT).

Data were obtained from the Railroad Commission's office on fields, numbers of wells, and salt water production.

Findings: In the previous job Chiltipin Creek was classed as biologically dead. This classification simply means that aquatic life cannot exist in Chiltipin Creek under the present conditions. At the present the creek is being used mainly as a route for disposal of oilfield waste. A judicial ruling has declared the creek as not being a public body of water; therefore, polluters cannot be prosecuted by the State.

Chiltipin Creek has 100 square miles of watershed to supply a natural flow. During the past year the creek had a natural flow one-tenth of the time. Under these conditions it would not seem feasible to establish the creek as a fresh-water stream and maintain a fresh water supply. However, the stream has several pot holes that could provide excellent fishing. Disregarding these facts we could say it would not be economically feasible from a fisheries standpoint to keep the creek free of oilfield wastes. However, the creek is not the only victim of the oilfield waste, for it empties its contents into a productive river and bay. Copano Bay, a secondary bay, is used as a nursery ground by shrimp and game fish and has as well a commercial, sports, and recreational value.

The oilfield waste in the creek begins approximately one mile above Sinton in West Sinton field. The creek meanders for 25 miles through four major fields and three minor fields collecting the waste from 463 wells, which discharged approximately 14 million gallons (356,000 barrels) of oilfield waste daily in 1960. This high saline waste averages 70,000 ppm total salts.

The previous study (Job F-3, Project MP2-R-1) proved the creek to be uninhabitable for freshwater species. The water had a 11.2% median toxicity threshhold value. Since this is the maximum tolerance for freshwater species, the creek would have to maintain a constant flow in excess of 30 cubic feet per second.

Toxicity studies conducted on the bleed water versus a marine index indicated a toxic component present in the oilfield wastes. Death resulted within 30 minutes when the indices were placed in 45 parts per thousand salinity of oilfield brine. These fish survived 41 parts per thousand salinity of bay-water. The survival ratio of bleedwater versus bay-water after acclimitization was the same, thus indicating a direct toxic effect. The ion ratio as shown in table 2 indicates a reverse ratio in magnesium and calcium in the bleedwater as compared to Copano Bay water. Burr (1934) proved there was a varying effect on the concentration of NaCl, $CaCl_2$, and $MgCl_2$. His results show that $MgCl_2$ kills fish more rapidly than NaCl or $CaCl_2$ at all concentrations used and $CaCl_2$ is much more toxic than an equal concentration of NaCl. Since the $CaCl_2$ content is high in the bleedwater and low in Copano Bay water, this could possibly be the toxic component.

Tides from Copano Bay affect a small portion of Chiltipin Creek. Mixing of bay water and oilfield wastes occurs at Station 5. The average salinity at this station was 39.0 parts per thousand. The decrease in salinity was uniform to Copano Bay. The monthly average at Station 4 was 53.1 ppt. Between the two stations there was a 10 ppt difference between the surface and bottom. The bleedwater formed a salt water tongue to Station 6 where thorough mixing occurred.

There would seem to be a few problems involved when using the bays as an outlet for the high saline wastes. The brine has no significant effect on the bay proper. The dilution effects are great enough to overcome any sudden increase in salinity, and most marine fishes have a wide salinity tolerance range. The greatest effect of the high saline waste is on the Aransas River.. A dam was built at the mouth end of theriver to keep the tide out so it could be maintained for drinking water for cattle. The tidal exchange formed a cut close to the mouth of the south branch of Chiltipin Creek. This deflected the tide from Chiltipin Creek and not only carries the bay water but the oilfield wastes as well into the river when the tide comes in. This waste has an influence 26 miles up the river. A survey of the Aransas River by Al Flury found the salinity as high as 73.0 parts per thousand at the Highway 77 bridge. This tidal exchange of highly saline water would prohibit any freshwater fish from existing in the Aransas River.

The oilfield brine is not the problem in Copano Bay that it is in the river unless a drouth increased the salinity in Copano Bay to the extent it would not dilute the high saline waste. Oil was found at Station six 90% of the time. On one occasion 300 parts per million oil was found at the mouth of the creek and draining into Copano Bay. Visual observation would indicate no damage was being done. The oil spreads until it forms a monomolecular layer invisible to the eye. From the biological view point the disappearance of the oil from the surface does not mean the polluant has been eliminated. These oil molecules collect on clay particles suspended in the water and settle to the bottom covering any vegetation in the area. Stirring the bottom at the mouth of Chiltipin Creek for two minutes produced oil slick 100 square feet.

Copano Bay, a secondary bay, provides extensive nursery grounds for shrimp and game fish. These smaller forms depend on the vegetated areas and microscopic organisms to survive. The covering of this nursery bottom with oil constitutes a major pollution problem.

The separation of oil from waste in the Chiltipin Creek area is accomplished by gravity separation, usually an earthen pit with a four inch inlet and a four inch drainage. The dimensions of the pits can vary from a small hand dug pit to the larger, better constructed pits. Occasionally there will be a two phase pit one draining into the other before being released. These gravity separators would seem to suffice if one were to glance at the final effluent. However, it is impossible to get rid of all of the oil by this procedure, because the retention time is not long enough to separate the oil and water. The volume of water going into the pit keeps the water agitated, and the oil in emulsion is lost in the final effluent. This small concentration of oil from one well joining with the small concentration of oil from the other 460 wells has resulted in heavy concentrations of oil found at all stations 95% of the time.

Pomeroy (1954), says that oilfield brine being discharged into an estuary may require a very long retention time or a degree of treatment greater than can be accomplished by plain gravity separation. A ten acre pond is required to successfully handle 1,000 barrels of brine a day.

Comments: As stated above, it is impossible to separate the oil and water under the present procedure. If each well averages 10.0 ppm oil in its final effluent, an amount not visible to the eye, an accumulation from the 463 wells would and is sending large amounts of oil into Copano Bay. This dispersed oil settles to the bottom and reduces the productivity of the bay and also produces oily tasting fish and oysters. This could possibly be remedied by large retention ponds in excess of ten acres/1,000 barrels per day of oilfield waste. Salt water injection wells have proven successful in other fields.

Prepared by Roy W. Spears, Accepted by Howard T. Lee
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Flury, Al. Basic Survey and Inventory of Fish Species Present in the Aransas River. Texas Game andFish Commission Job Completion Report, 1956.

Pomeroy, Richard. Disposal of waste water from oil fields in the coastal counties of California. Sew. and Ind. Waste, Vol. 26, No. 1., 1954.

Spears, Roy W. An Investigation of the Existence of Pollution in Chiltipin Creek, May 15, 1958 to May 15, 1959, Job. F-3, Project MP2-R-1, Project Reports for 1958-1959 of the Marine Fisheries Division, Texas Game and Fish Commission.

Table 1

Monthly Averages of Salinity and Oil Concentration

Station	Salinity o/oo	Oil ppm	Date
1	74.0	20.0	September 1959
2	70.0	----	
3	69.0	----	
4	65.0	15.0	
5	51.0	10.0*	
6	48.0	30.0*	
1	21.0	----	October 1959
2	20.0	25.0	
3	17.0	----	
4	15.0	----	
5	10.0	----	
6	9.0	0.0	
1	65.0	30.0	November 1959
2	64.0	25.0	
3	70.0	----	
4	63.0	----	
5	45.0	----	
6	31.0	35.0*	
1	63.0	45.0	December 1959
2	63.0	37.0*	
3	59.0	----	
4	61.0	82.0*	
5	40.0	52.0	
6	29.0	----	
1	74.0	74.0	January 1960
2	70.0	52.0	
3	67.0	----	
4	61.0	----	
5	42.0	----	
6	35.0	110.0*	
1	69.0	81.0	February 1960
2	69.0	50.0	
3	65.0	----	
4	60.0	140.0	
5	39.0	----	
6	35.0	95.0	
1	58.0	110.0	March 1960
2	58.0	75.0	
3	49.0	----	
4	45.0	----	
5	30.0	----	
6	19.0	50.0	

Table 1 Continued

Station	Salinity o/oo	Oil ppm	Date
1	45.0	37.0	April 1960
2	45.0	20.0	
3	36.0	----	
4	31.0	----	
5	20.0	51.0*	
6	14.0	36.0*	
1	79.0	87.0	May 1960
2	79.0	35.0	
3	68.0	----	
4	65.0	----	
5	54.0	----	
6	49.0	25.0	
1	76.0	51.0	June 1960
2	75.0	42.0	
3	68.0	----	
4	65.0	----	
5	59.0	275.0*	
6	55.0	3000.0*	

* - Denotes one sample taken in that month.

Table 2

A Comparison of the Chemical Composition of the Waters of Chiltipin Creek, Oilfield Brine, and Copano Bay

ion	Chiltipin Creek[1]	Oilfield Brine[2]	Copano Bay[3]
Bicarbonates	161.0 ppm	210.0	70.0
Sulfates	179.0	21.0	726.0
Chlorides	24,276.0	42,516.0	5,200.0
Calcium	927.0	1,421.0	138.0
Magnesium	305.0	325.0	275.0
Sodium & Potassium	14,645.0	25,621.0	3,020.0
Silica	35.0	28.0	15.0
Iron & Al. Oxides	10.0	39.0	2.0
TOTAL SOLIDS	40,538.0	70,181.0	9,446.0

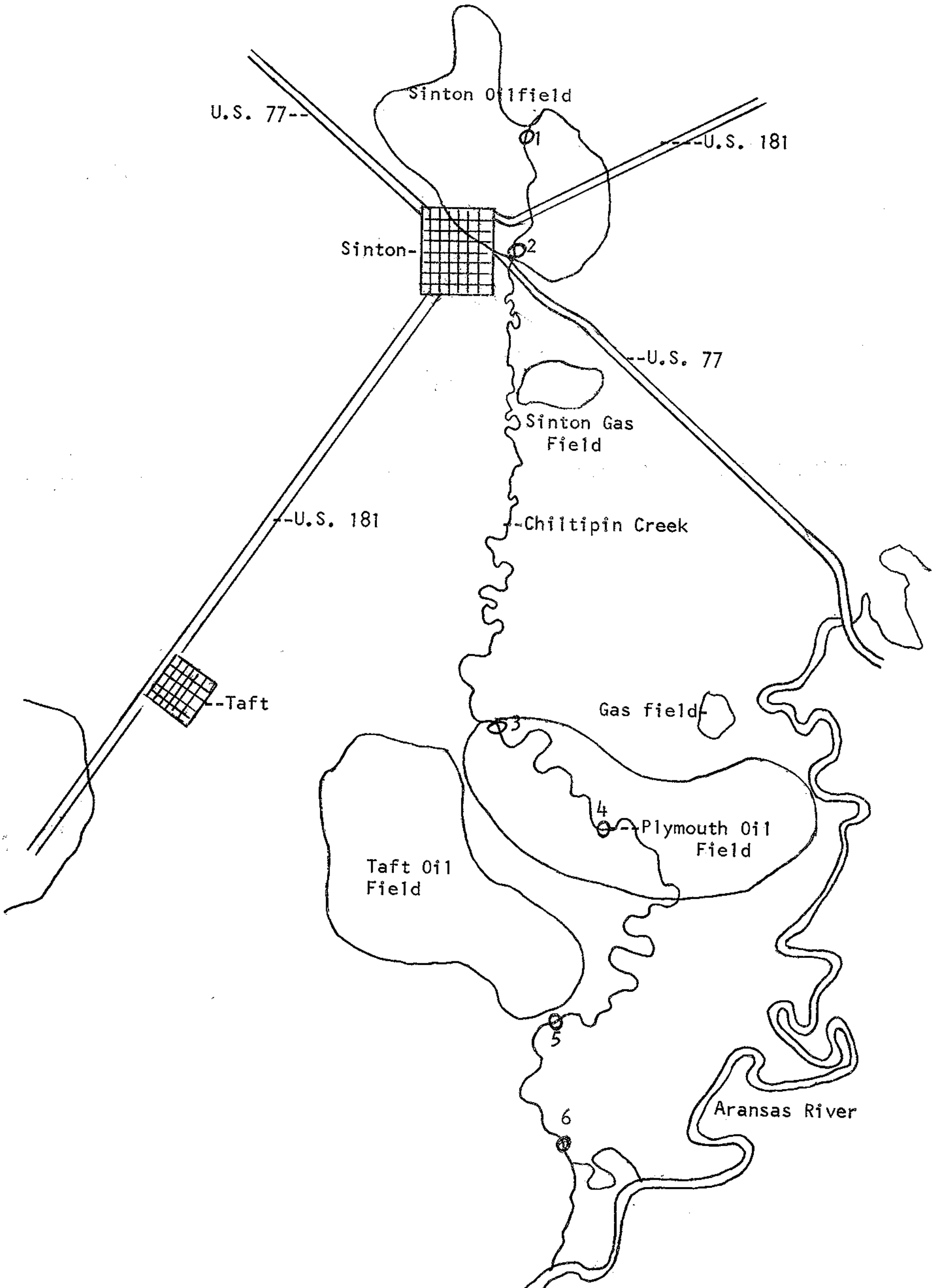
1. One composite of six samples on separate days from station 1 through 6.
2. One composite of six samples on separate days near station 1 through 6.
3. Analysis from previous report, Job F-3, Project MP-2R-1.

Table 3

Average Salt Water Production from Fields Over 24 hour Period

Field	Bbls. Salt Water	No. of Wells
Plymouth	44,888	147
Taft	105,075	125
Sinton	51,011	60
Midway	145,547	65
Portilla	8,582	62
Mudflats	72	3

Figure I - Sampling Stations



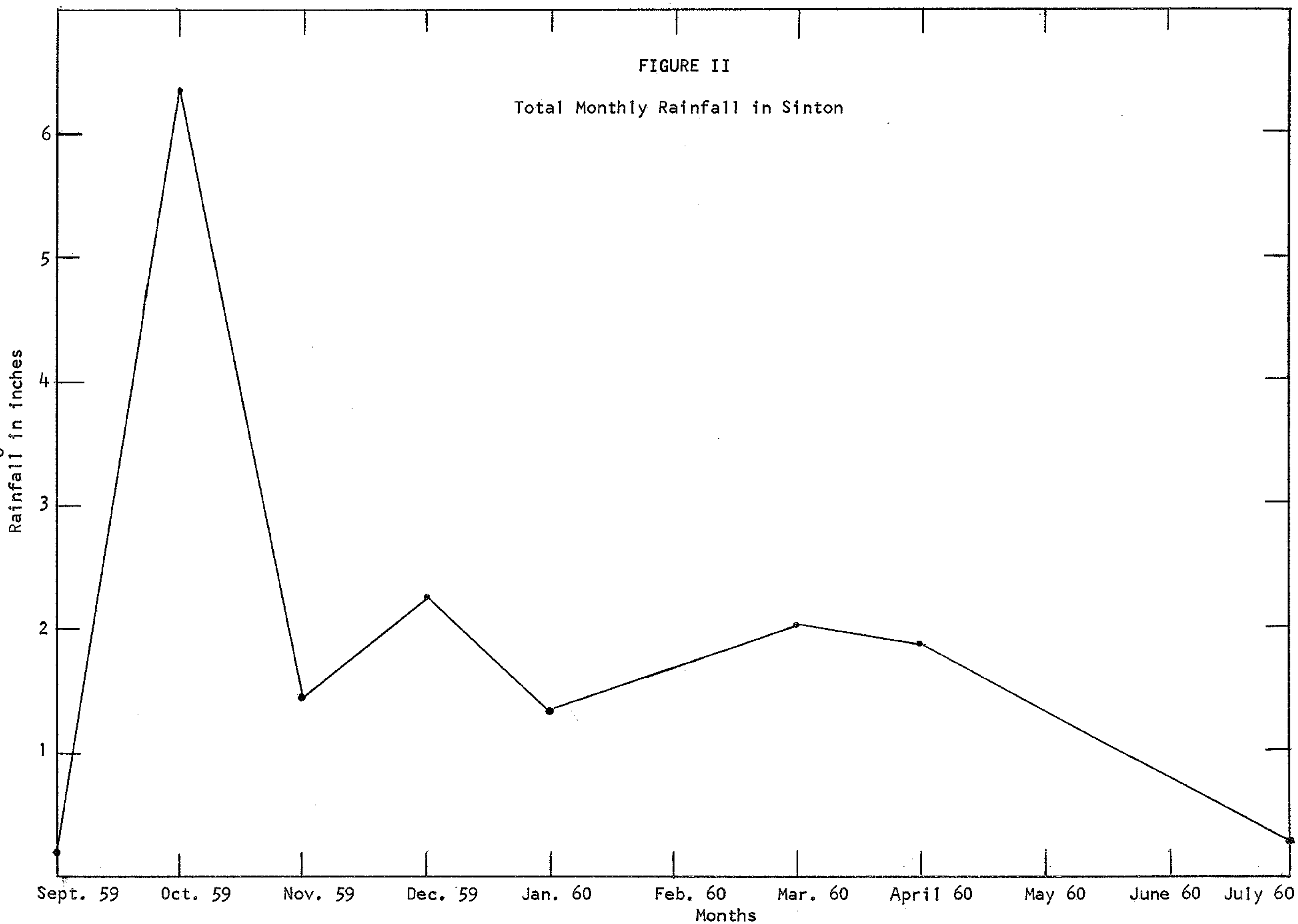


FIGURE II
Total Monthly Rainfall in Sinton
Rainfall in inches
6
5
4
3
2
1
Sept. 59
Oct. 59
Nov. 59
Dec. 59
Jan. 60
Feb. 60
Mar. 60
April 60
May 60
June 60
July 60
Months