TEXAS
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REPORT 26

BASE-FLOW STUDIES BIG ELKHART AND LITTLE ELKHART CREEKS TRINITY RIVER BASIN, TEXAS Quantity and Quality, September 15-16, 1965

AUGUST 1966

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BIG ELKHART AND LITTLE ELKHART CREEKS

TRINITY RIVER BASIN, TEXAS

Quantity and Quality, September 15-16, 1965

By

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Prepared by the U.S. Geological Survey
in cooperation with the
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INTRODUCTION

These base-flow studies were made by the U.S. Geological Survey under the 1966 cooperative agreement with the Texas Water Development Board that provided for the investigation of the water resources of Texas.

The object of the studies was to determine the quantity and quality of the streamflow of Big Elkhart and Little Elkhart Creeks at the time of the investigation. Among the factors evaluated were: any apparent interchange of surface and ground water in the base flow; and the suitability of the streamflow for domestic, municipal, irrigation, and industrial uses, respectively. For purposes of this report, base flow was defined as that part of the precipitation that had percolated into the ground and was discharged to the stream. River miles were measured in an upstream direction, zero being assigned to the mouth of each creek.

One reach on each of the creeks was selected for study. The Big Elkhart reach extended from the creek mouth, at the Trinity River, to a county highway bridge, which was 26.0 river miles upstream and 3.5 miles northwest of Grapeland (Figure 5). The Little Elkhart reach extended from the creek mouth to the old Grapeland-Crockett highway bridge, 17.5 river miles upstream and 4.3 miles south of Grapeland (Figure 5). The mouth of Little Elkhart Creek is at mile 1.3 on Big Elkhart Creek.

Conditions for determining gains or losses of streamflow were favorable during the report period (September 15-16, 1965). It was preceded by about 14 days without rainfall, and by less-than-average rainfall from May to September. Weather conditions during the study varied from cloudy and cool to clear and hot. Conditions were good for high evapotranspiration. According to measurements of flow at sites 8 and 19 (Figure 5) on each day of the investigation, the streamflow remained essentially constant.

In both creeks, the streambeds are composed principally of sand that has been blown and washed in from the adjacent hills. The stream channels are characterized by long pools formed chiefly by sand bars, and by some mud and silty clay bars. The channels are cut in flat bottomed valleys throughout most of the reaches. On the flood plains, patches of land with dense growths of

deciduous trees and bushes intersperse open areas that support only small grasses and bushes. Little farming is done on the flood plains of either creek.

Background information available for this work was limited. No base-flow investigations of the reaches had been made prior to 1965, except for a few measurements of water discharge made and a few water samples collected at site 7 (mile 11.7) during 1962-64.

Data on the quantity and quality of base flows are used in the selection of reservoir sites for information on the amount of base flow and probable quality of impounded water and on channel gains or losses, which could affect storage in potential reservoirs. Data in this report are pertinent to the reservoir to be built on Little Elkhart Creek under State of Texas Permit No. 2165 issued June 22, 1965, to the Houston County Water Control and Improvement District No. 1. The dam will be near mile 7 on Little Elkhart Creek, will impound 19,500 acre-feet for water supply, and will inundate the creek channel to mile 14, approximately, when water reaches spillway crest at elevation 260 feet.

RELATION OF GEOLOGY TO BASE FLOW

The Big Elkhart and Little Elkhart Creeks flow across the outcrop areas of four geologic formations--the Sparta Sand, Weches Greensand, Queen City Sand, and alluvium (Figure 5). These geologic units, which consist generally of sandy and shaly beds, contribute various amounts of water to the streams and sustain their flow.

The Sparta Sand, disconformably overlying the Weches Greensand, has a maximum thickness of about 300 feet and consists of sand, sandy shale, and shale. The lower part of the Sparta is predominantly medium sand, generally unconsolidated and massively bedded. The sand grades upward into finer thin-bedded sand and sandy shale. The uppermost part of the Sparta commonly consists of lignitic chocolate-colored shale and thin-bedded silty sand. The Sparta Sand, the principal source of ground water in Houston County, supplying wells with capacities ranging from less than 100 gpm (gallons per minute) to more than 1,000 gpm, yields the largest amounts of base flow to the streams.

The Weches Greensand, disconformably overlying the Queen City Sand, consists of as much as 100 feet of glauconitic fossiliferous marl, sand, sandstone, shale, and limestone, plus iron concretions and thin lenticular beds of iron-cemented sandstone. Locally, the lower contact of the Weches is difficult to determine because its sediments have a color similar to those in the upper part of the Queen City Sand. The Weches, not known to yield water to wells in Houston County, was not found to contribute much base flow to the streams in the study area.

The Queen City Sand consists chiefly of cross-bedded, fine to medium sand interbedded with sandy and lignitic shale and has a maximum thickness of about 300 feet. The sand generally ranges from gray to tan in color, but where overlain by the Weches the sand generally is red because of iron leached from the overlying formation. The Queen City Sand, which yields less than 500 gpm of water to wells in the northwestern half of Houston County, seemed to be contributing a small amount of base flow to the streams during this investigation.