TEXAS BOARD OF WATER ENGINEERS

Durwood Manford, Chairman
R. M. Dixon, Member
O. F. Dent, Member

REVIEW OF CHEMICAL QUALITY-OF-WATER DATA COLLECTION PROGRAM IN THE BRAZOS RIVER BASIN

Prepared for

The Brazos River Authority

by

Engineering Services
Texas Board of Water Engineers

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INTRODUCTION

Waters of a stream system originate from rainfall and follow several paths before they reach the Earth's storage reservoirs—the oceans. In the circuitous paths followed by rainfall from the time of falling on the ground to the time of reaching the sea, it has an opportunity to have chemical constituents added in various amounts and differing types. Intense rainfall may result in flood runoff and thus the opportunity for the addition of dissolved solids is small and the quality of these flood waters good to excellent. Some of the rainfall infiltrates into the ground, and later, where a stream intersects the ground-water table, this in-transit ground water is contributed to the streamflow. Since water moves slowly through the ground, it has a much longer opportunity to collect chemical constituents.

Sometimes rainfall occurs on exposed geologic formations which are easily erodible and highly soluble, with the result that surface waters from these areas can have fairly high chemical contents. In other areas ground water can be available in very excellent quality. Numerous combinations of good, or poor, ground water and good, or poor, surface water, when mixed, can result in an excellent, a good, or a poor quality of water depending upon the combination which occurs. Thus, it is not easy to generalize whether water will be of good or poor quality from any given area.

In the past two decades a program has been initiated and carried on by the Board of Water Engineers and the Brazos River Authority, in cooperation with the U. S. Geological Survey, to obtain actual data on the chemical constituents of the surface waters of the Brazos River Basin.

Following a discussion in November 1960 with Mr. R. D. Collins, General Manager of the Brazos River Authority, the staff of the Board of Water Engineers has reviewed the data collection program in the Brazos River Basin as it concerns the chemical quality of surface waters. This report constitutes results of this review.

Many industries, and certainly municipalities, are desirous of data on the chemical characteristics of possible sources of supply. Much has been said of the quality of the Brazos River water. It should be pointed out early in any discussion that many of these reports are misleading and based on misinterpretation of meager data. In reviewing the chemical quality data which is available in the Brazos River Basin, it seems apparent that some of this apparent mis-information stems from a few miscellaneous chemical analyses made during extreme low flows when the chemical quality is at its poorest for any stream.

When reviewing the data available in the Brazos River Basin, consideration was given to: (1) the points where development has taken place in the form of reservoirs, (2) points of suggested future reservoirs, and (3) the points of additional use.

Inasmuch as a record at most locations needs both the daily stream discharges and daily samples for chemical analysis, this review contemplates that any additional data to be collected will have, generally, both stream discharge and chemical quality information obtained at the same location. Since many more stream-gaging stations are operated in the Brazos River Basin than chemical quality stations, this is not a particularily stringent differentiation.

While stream discharge measuring points need to be continuous from year to year to measure natural and man-made changes, chemical quality records need not be carried on indefinitely at all locations.

Two types of chemical quality stations should be incorporated in any program of data collection. The first is the index station. This is a station which is located at what might be referred to as control points in the basin and planned to be operated on a long time basis, to measure or indicate changes which take place in the chemical characteristics of the water as man-made changes occur in the basin. The second type of station would be the investigative station which would be operated for three to six years, dependent upon the range of streamflow conditions encountered. This type of station would give an indication of the quality of water originating within a prescribed tributary area. A third category of sampling considered was the miscellaneous sampling at sites where it is not necessary to have continuous daily samples of chemical quality.

EXISTING CHEMICAL QUALITY RECORDS

Chemical quality records have been obtained with varying degrees of continuity at 44 locations in the Brazos River Basin. These locations are listed in table 1, titled "Index to Chemical Quality Records for Streams in the Brazos River Basin in Texas, December 1960." While all of this information provides a backlog of data, some is more valuable than others.

The most significant of the data listed in table 1 are those stations at which samples of the daily chemical quality of surface water is obtained. At present 9 stations are operated in the Brazos River Basin where daily samples are obtained and analyzed by the U. S. Geological Survey. All of these stations are at, or near, stream discharge gaging stations. Where the items listed in table 1 are considered to have significance, the locations of the corresponding sampling points are shown in the attached map of the Brazos River Basin, identified as plate 1. The type of sampling and length of record are shown also on plate 1 as well as existing streamflow measuring stations and proposed major reservoir sites. These presently active stations are listed in table 2.

Of the 9 chemical quality sampling stations being operated in the Brazos River Basin, 4 are financed by the Brazos River Authority, 1 by the West Central Texas Municipal Water District, 1 by the Corps of Engineers, and 3 by the Board of Water Engineers. Generally, the Brazos River Authority's financial participation has been in the area up stream from Possum Kingdom Dam while the

Table 1.--Index to Chemical Quality Records for Streams in the Brazos River Basin in Texas, December 1960
(Published by, or in the files of, the U. S. Geological Survey, Austin, Texas)

Station	Frequency	Period of Operation
1. Rough Creek at mouth near Rotan	Intermittent	August 1959 to present
2. Double Mountain Fork Brazos River near Rotan	Daily	December 1949 to September 1951
3. Double Mountain Fork Brazos River near Aspermont	Daily	October 1948 to November 1951, September 1956 to present
4. McDonald Creek near Post	Intermittent	August 1959 to present
5. White River near Crosbyton	1/ Intermittent	October 1950 to present
6. Red Mud Creek near Claremont	Monthly	August 1959 to present
7. Butte Creek near Jayton	Intermittent	December 1959 to present
8. Salt Fork Brazos River near Peacock	Daily	December 1949 to September 1951
9. Short Croton Creek near Jayton	Monthly	November 1959 to present
10. Croton Creek below Short Croton Creek near Jayton	Monthly	August 1959 to present
11. Croton Creek near Jayton	Semi-monthly	July 1959 to present
12. Salt Croton Creek at Weir A near Aspermont	Intermittent	October 1956 to June 1957
13. Salt Flat Creek at Weir B near Aspermont	Intermittent	October 1956 to March 1959
14. Salt Croton Creek at Weir C near Aspermont	Intermittent	October 1956 to March 1959
15. Salt Croton Creek at Weir D near Aspermont	Intermittent	October 1956 to present
16. Haystack Creek near Aspermont	Intermittent	October 1956 to present
17. Salt Croton Creek near Aspermont	Semi-monthly	October 1956 to present
18. Salt Croton Creek at Falls near Aspermont	Intermittent	March 1959 to present
19. Salt Croton Creek at mouth near Aspermont	Monthly	December 1957 to August 1958
20. Salt Fork Brazos River near Aspermont	Daily	October 1948 to October 1951, October 1956 to present
21. North Croton Creek near Haskell	Monthly	October 1959 to present
22. Mustang Creek near Knox City	Monthly	August 1959 to present
23. Brazos River at Seymour	Intermittent	July 1942, April to September 1950
do	Daily	August 1959 to present
24. Miller's Creek near Seymour	Intermittent	February 1957 to present
25. Clear Fork Brazos River at Nugent	Daily	August 1948 to September 1953
26. Paint Creek near Haskell	Daily	December 1949 to September 1951
27. Clear Fork Brazos River at Fort Griffin	Intermittent	May 1941 to June 1942
do	Daily	November 1949 to September 1951
28. Hubbard Creek near Breckenridge	Daily	April 1955 to present
29. Brazos River near South Bend	Daily	January 1942 to March 1948
30. Salt Creek at Olney	Daily	April 1958 to September 1960
31. Salt Creek near Newcastle	Daily	April 1958 to March 1960
32. Oak Creek near Graham	Intermittent	April 1958 to August 1960
33. Lake Graham	Intermittent	April 1958 to September 1960
34. Brazos River at Possum Kingdom Dam near Graford	Daily	January 1942 to present
35. Brazos River at Whitney Dam near Whitney	Daily	October 1947 to May 1948, October 1948 to present

See footnotes at end of table.

Table 1.--Index to Chemical Quality Records for Streams in the Brazos River Basin in Texas, December 1960--Continued

Station	Frequency	Period of Operation
36. Brazos River near Marlin	Intermittent	October 1947 to January 1952
37. Lampasas River near Belton	2/ Daily	April 1943 to June 1944
38. Leon River near Eastland	Daily	September 1950 to September 1953
39. Lake Belton	1/ Intermittent	September 1955 to present
40. Little River at Cameron	Daily	October 1959 to present
41. Brazos River near Bryan	Intermittent	August 1946 to February 1952
42. Navasota River near Easterly	2/ Daily	January 1942 to December 1942
43. Navasota River near Bryan	Daily	October 1958 to present
44. Brazos River at Richmond	2/ Daily	August 1941 to September 1944
do	Daily	October 1945 to present

1/ Samples collected only once or twice yearly.
2/ Conductances and occasional partials run on filtrates from Board of Water Engineers-Soil Conservation Service sediment program.

Table 2.--Active Daily Chemical Quality Surface Water Sampling Stations in the Brazos River Basin in Texas, January 1, 1961

Station	Source of Funds				Total Annual Cost
	State or Local		Federal		
	Agency	Amount	Agency	Amount	
1. Double Mountain Fork Brazos River near Aspermont	BRA	$ 600	USGS	$ 600	$1,200
2. Salt Fork Brazos River near Aspermont	BRA	600	USGS	600	1,200
3. Brazos River at Seymour	BRA	800	USGS	800	1,600
4. Hubbard Creek near Breckenridge	1/ WCTMWD	600	USGS	600	1,200
5. Brazos River at Possum Kingdom Dam near Graford	BRA	400	USGS	400	800
6. Brazos River at Whitney Dam near Whitney	---	---	3/ C of E	1,000	1,000
7. Little River at Cameron	BWE	700	USGS	700	1,400
8. Navasota River near Bryan	BWE	700	USGS	700	1,400
9. Brazos River at Richmond	BWE	2/ ---	USGS	1,400	1,400

1/ West Central Texas Municipal Water District.
2/ State share included in direct expenditures.
3/ Corps of Engineers, U. S. Army.

program in the lower portion of the basin is financed by the Board of Water Engineers. All participation, other than that of the Corps of Engineers below Whitney Dam, has been in cooperation with the U. S. Geological Survey.

DISCUSSION OF DATA NEEDS

Development of reservoirs on the Brazos River tributaries downstream from Whitney Dam will be needed to serve future water requirements of an expanding industrial economy. Municipalities and industries will be concerned about the quality as well as quantity of water available to them. With additional reservoirs in this portion of the basin it appears that the quality of the water reaching the Richmond gaging station can be maintained by selective reservoir releases.

Data are not available by which a determination of this type can be made. It is highly desirable that new chemical quality investigative-type daily sampling be initiated on those important lower tributaries where chemical quality data are not now being obtained.

Long-term records have been obtained of the chemical quality below Possum Kingdom Dam and at Richmond. These index stations should be continued to reflect any changes in quality due to man-made regulatory measures and to provide data for engineering and hydrologic studies of basin water quality.

As water supplies of the basin upstream from Possum Kingdom Dam are much less in magnitude than those of the lower portion of the basin, the chemical characteristics of the available supplies become more important. The coverage of the chemical quality data network should be expanded slightly in this upper area to obtain a more complete picture of the chemical characteristics of the water from each tributary area.

Investigation of small surface-water supplies for towns and cities in the basin will be aided by a regular miscellaneous sampling program at selected stream discharge stations. These data would also be of considerable assistance in any chemical quality study of portions of the basin.

SUGGESTED PROGRAM

On the basis of this review and the anticipated need for chemical quality-of-water data and information, it is suggested that the program of collection of chemical quality data in this basin should include:

1. A continuation of the sampling program currently in operation.

2. Initiate an investigative-type sampling program at the following existing streamflow measuring stations:

   A. Yegua Creek near Somerville

   B. Lampasas River at Youngsport

   C. Brazos River near Bryan

3. Establish streamflow measuring stations and obtain daily samples at the following sites:

   A. Brazos River at South Bend Dam Site at F.M. 209 or State Highway 24. Operate concurrently with Seymour quality station until correlation is established.

   B. Clear Fork Brazos River at Eliasville.

4. Initiate a systematic miscellaneous sampling program at the following streamflow measuring stations to obtain samples monthly or at each regular visit to these stations by U. S. Geological Survey personnel and at each special visit to these stations during flood times:

   A. Palo Pinto Creek near Santo

   B. Paluxy Creek at Glen Rose

   C. Nolands River at Blum

   D. Aquilla Creek near Aquilla

   E. North Bosque River near Clifton

   F. Middle Bosque River near McGregor

   G. San Gabriel River at Georgetown

   Also at the time of each regular or monthly visit to the Georgetown station, obtain samples from the North Fork San Gabriel and from the South Fork San Gabriel Rivers at conveniently accessible locations.

5. Initiate a systematic miscellaneous sampling program at the following reservoirs:

   A. Lake Waco - obtain a sample at 3-month intervals from the lake and daily samples of releases from the lake.

   B. Proctor Reservoir - obtain a sample at 3-month intervals from the lake and daily samples of releases from the lake, after impoundment begins.

   C. Belton Reservoir - obtain a sample at 3-month intervals from the lake and daily samples of releases from the lake.

   D. White River Reservoir - obtain a sample at 3-month intervals after impoundment begins.

6. Periodically review the chemical quality-of-water data collection program to discontinue portions of the program for which sufficient data have been obtained, and initiate work which is then indicated as being needed.

Prepared by Surface Water Division

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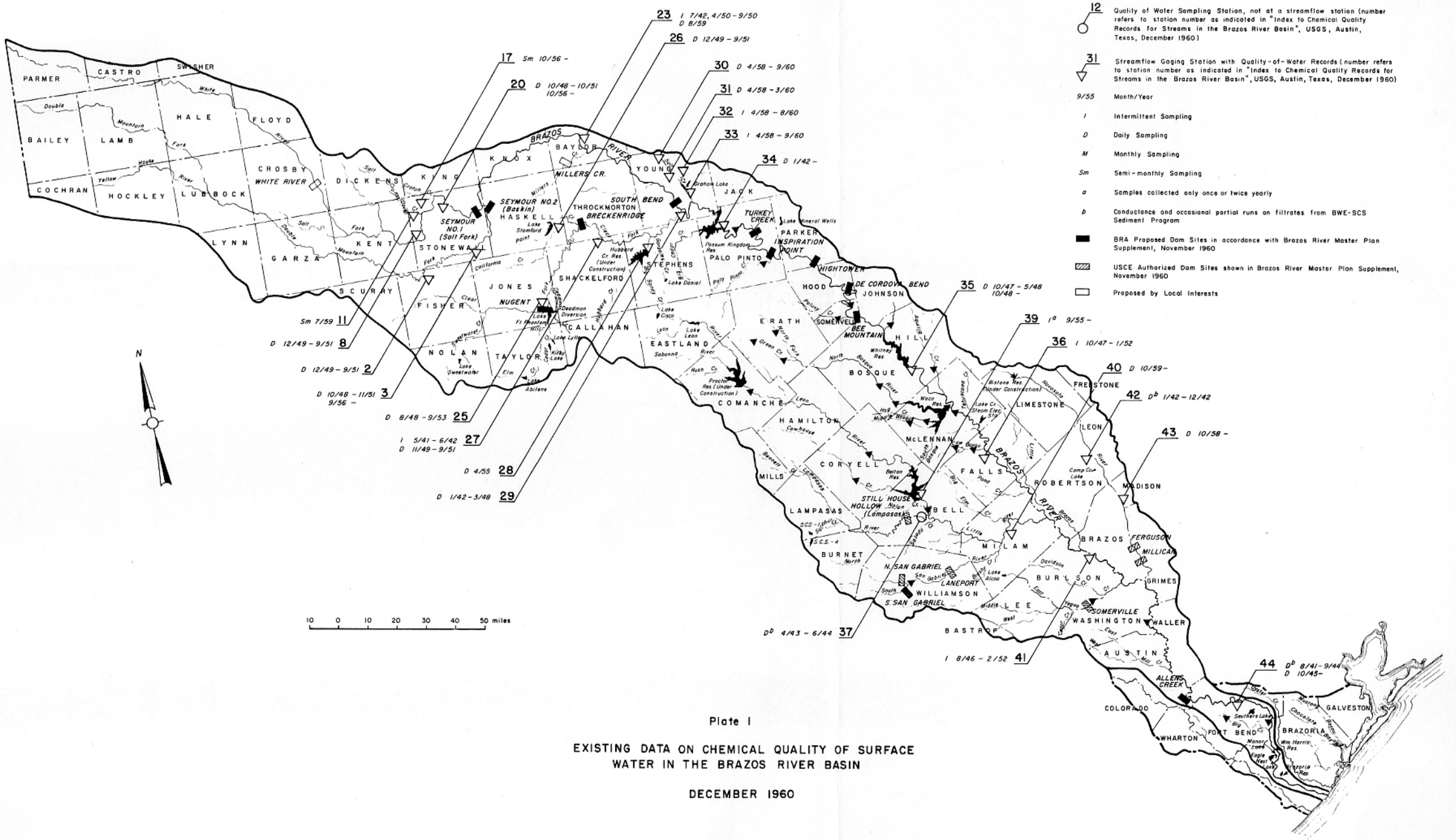

Plate 1

EXISTING DATA ON CHEMICAL QUALITY OF SURFACE WATER IN THE BRAZOS RIVER BASIN

DECEMBER 1960