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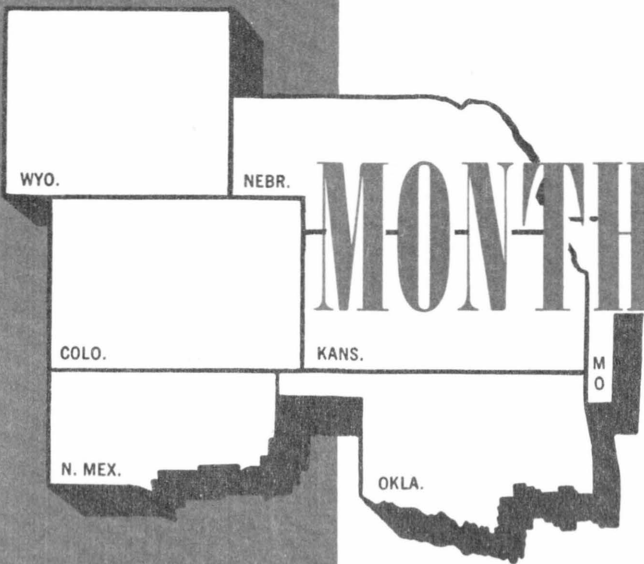

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In This Issue

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Forces Behind the Growth in

.... *Trade Credit*

ONE OF THE MOST notable shifts in the employment of funds by manufacturing corporations in recent years has been the exceptional growth of corporate notes and accounts receivable. Since these corporations also receive advances of credit through the growth of their accounts payable, the best measure of the extent to which corporate funds have been absorbed is the widening margin between receivables and trade payables, representing net credit extended to farmers, consumers, unincorporated business units, and nonmanufacturing corporations. The excess of receivables over payables of manufacturing corporations increased by $6.7 billion between 1951 and 1958—a period when inventories increased by $13.0 billion. These changes represented an 84 per cent increase in the excess of receivables and a 32 per cent gain in inventories. Most of the growth in the net credit extensions of these companies occurred between 1954 and 1958 when an increase of $5.7 billion was registered.

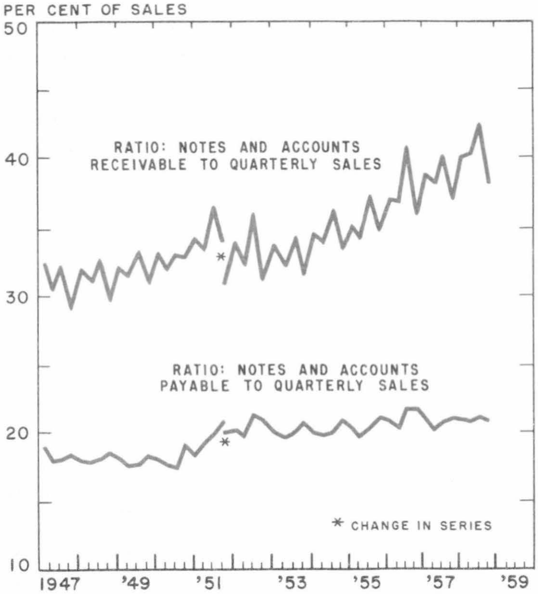
It is to be expected that increases in sales will produce corresponding increases in notes and accounts receivable, if credit practices remain approximately stable. However, growth of sales of manufacturing corporations would have led to an increase in the net excess of receivables over payables of only $2.0 billion between 1954 and 1958, leaving $3.7 billion to be attributed to changes of credit practices. A change of such magnitude clearly points to significant shifts in practices from those which had prevailed over the preceding postwar years.

A report dealing with some of the features of corporate net credit extensions was published in the June 1957 *Monthly Review*. On the basis of the data available at that time, it seemed probable that the accelerated growth of corporate notes and accounts receivable after 1954 had been stimulated by generally restricted credit conditions. Smaller businesses were thought to have turned increasingly to corporations for assistance when their access to bank credit was impaired by the limited availability of bank reserves and the pressing demands of larger borrowers for bank accommodation.

While shifts between trade credit and other sources of funds, in response to differences in costs and availabilities, may be one of the conditions that stimulates growth of trade credit, the uninterrupted growth of corporate net receivables in 1958, when bank reserve positions were relatively easy, has caused questions to be raised as to the significance of other factors in inducing shifts of credit practices. The earlier study was focused upon the net credit extended to others by corporations as representing a part of the mechanism

Chart 1.

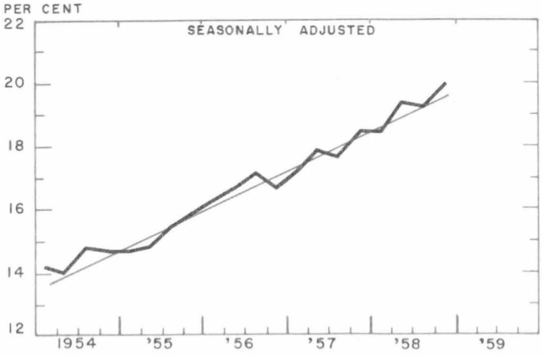
Ratios of Notes and Accounts Receivable and Accounts Payable, Manufacturing Corporations, 1947-58



SOURCE: The **Quarterly Financial Report of Manufacturing Corporations,** Federal Trade Commission and Securities and Exchange Commission.

Chart 2.

Excess of Receivables Over Payables in Relation to Sales, Manufacturing Corporations, Adjusted for Seasonal Variations



through which capital is rationed. The present report examines recent changes in some detail by breaking down aggregate credit extensions of manufacturing corporations to determine the specific industries in which growth has been greatest, and through this process to gain some understanding of the conditions which have led to the growth.

Chart 1 sets forth the changes in notes and accounts receivable and accounts payable in relation to sales of manufacturing corporations in the postwar period, excluding both receivables from and prepayments by the U. S. Government. As can be observed, the margin between the two lines was comparatively stable until 1954. The concurrent stability of payables in relation to sales indicates that manufacturing corporations as a group extended credit to other groups.

Chart 2 depicts the growth of net credit extended in relation to sales, corrected for seasonal changes, and with a straight-line trend superimposed. It is particularly interesting that the chart shows no evidence of a cyclical response in late 1957 and 1958. While the chart seems to indicate a steady movement of credit practices toward greater liberality, three avenues of investigation should be explored before such an inference is drawn. First, it is essential to examine the data to determine precisely what is measured by corporate receivables. Second, the growth of receivables in relation to sales by industry and for shorter time periods can be inspected to determine the sources of the changes. Third, changes in the corporate financial position may influence the prospects for further growth and questions can be raised on this score as well.

Characteristics of the Data

The *Quarterly Financial Report of Manufacturing Corporations,* the source of the data used in this study, includes all large corporations and a sample of smaller units but excludes the activities of finance subsidiaries of certain companies. Growth of receivables held by a company or industry therefore may not appear in the corporate statement after the volume attains a size which justifies the establishment of a separate finance company. A case in point is the automobile industry in which dealer and customer financing are handled by sales finance companies, both captive and independent, and by banks. Similar arrangements exist in such lines as farm and road-building equipment, printing machinery, and a variety of other durable goods lines. The establishment of such financing outside the manufacturing group undoubtedly has prevented the growth of receivables from being even larger or, alternatively, has permitted total credit available to nonmanufacturing units to be greater than otherwise. A contrary effect upon corporate receivables is produced when a company decides to carry in its own accounts the receivables which theretofore had been sold to banks and other lenders. The incentive in such cases has been the higher rate charged on instalment loans compared with the cost of funds obtained from banks, the open market, or internal sources. Both of these developments are commonly found in the durable goods industries.

Of the two counterposed influences, it is probable that outside financing arrangements have had the greater influence and hence that receivables might have grown even more rapidly in their absence. Many of these institutions of the credit market existed before 1954 but the variety of transactions financed probably has broadened extensively. On the other hand, the comparatively high levels of receivables to sales ratios in some of the industries strongly suggest that both instalment sales paper and ordinary trade credit are involved. To the extent that these instalment notes would be acceptable to specialized lenders, these receivables can be removed from the corporate financial statement at the convenience of the corporation, even if in some cases the corporation were required to guarantee payment. Some part of the receivables which corporations have disposed of does reflect contingent liabilities of this kind.

Another practice which affects the meaning of the data involves the treatment of leasing of equipment. When a lease contract includes an option to purchase, current accounting practice allows the gross amount that will be realized from the transaction, including interest and carrying charges, to be entered as an account receivable. These practices, together with the treatment of instalment sales credits, clearly overstate the volume of accounts receivable which should be considered to be current assets.

The data on corporate receivables also could be misleading if they had been influenced by changes in mail float. This may occur as follows: when a debtor draws a check in payment of an invoice, he reduces his statement of cash and his accounts payable. If the debtor and the creditor should prepare financial statements while the check is in transit, the receivable of the creditor would exceed the payable of the debtor by the amount of the check. No problem would arise from this lag in payments, provided the proportion of all payments in the mail float at the time financial statements were prepared remained approximately stable. If shifts should occur in payment practices—such as the introduction of cycle billing—which increased the proportion of payments in mail float at the time financial statements were prepared, a widening of the difference between receivables and payables would result that would not represent a true growth of net receivables. The evidence upon which to base an evaluation of this possibility is meager.

One indication that changes in mail float have not distorted the volume of receivables is that the best available estimates suggest that business mail float has not shown a significant

Gross Receivables-Sales Ratios and Net Credit Extensions in Manufacturing Industries

Ratios are adjusted to show relation to 1 month's sales; figures in parentheses are days of sales represented by receivables.

Industries	Ratios 1954	1956	1958	Net Credit Extensions Produced by Shifts of Practices 1954-1958 (In Millions)
Nondurables	1.02(31)	1.12(34)	1.19(36)	$1,797
Food and kindred products	0.66(20)	0.74(22)	0.79(24)	454
Tobacco	0.59(18)	0.62(19)	0.58(17)	–57
Textile mill products	1.23(37)	1.35(40)	1.41(42)	134
Apparel and related products	1.30(39)	1.36(41)	1.34(40)	–86
Paper and allied products	1.03(31)	1.00(30)	1.18(35)	134
Printing and publishing	1.55(47)	1.55(47)	1.67(50)	148
Chemicals	1.19(36)	1.29(39)	1.36(41)	318
Petroleum	1.10(33)	1.25(38)	1.39(42)	522
Rubber and plastics	1.66(50)	1.73(52)	*	
Leather	1.51(45)	1.52(46)	1.58(47)	35
Durables	1.08(32)	1.16(35)	1.25(38)	1,909
Transportation equipment	0.60(18)	0.68(20)	0.66(20)	71
Electrical equipment	1.23(37)	1.33(41)	1.35(41)	254
Other machinery	1.54(46)	1.59(48)	1.83(55)	608
Other fabricated metal products	1.22(37)	1.31(39)	1.42(43)	223
Primary metals	0.94(28)	1.03(31)	1.10(33)	284
Stone, clay, and glass	1.21(36)	1.24(37)	1.42(43)	106
Furniture and fixtures	1.35(41)	1.34(40)	1.38(41)	–15
Lumber and wood products	1.22(37)	1.20(36)	1.28(38)	45
Instruments	1.39(42)	1.52(46)	1.61(48)	73
Miscellaneous	1.47(44)	1.46(44)	1.62(49)	63

*A comparable ratio could not be computed because of a change of classification.

SOURCE: Derived from **Quarterly Financial Report of Manufacturing Corporations.** Federal Trade Commission and Securities and Exchange Commission.

upward trend over the past 8 years when other elements of float were rising. Since total business transactions have increased, the proportion of business mail float to transactions apparently has fallen. If such broad comparisons have any validity, it appears that any influence exerted by mail float would have caused an understatement rather than an overstatement of the growth.

These attributes of the data on corporate receivables point to the intimate relationship of this financial network to the broader components of the financial system. Receivables pass into and out of the financial statements of manufacturing corporations as the comparative advantages of alternative actions change or become apparent. Practices which lead to both overstatement and understatement are to be found, and the volume of receivables that represent current assets also is probably overstated, particularly in lines where leasing and instalment sales are included. An indefinite amount of contingent liability also exists for those notes which have been sold to lenders on a full recourse basis and for loans to retailers that have been guaranteed by the supplier.

Growth of Receivables by Manufacturing Activity

The table sets forth the ratios of receivables to sales by broad groups of manufacturing companies. The ratios were computed by averaging the receivables at the end of each quarter of the year and dividing by the average monthly sales in the year. Thus a ratio of 1.00 means that receivables outstanding are equal to an average month's sales.

Roy A. Foulke of Dun and Bradstreet prepared a study in 1959 based upon data collected early in 1958 from 193 manufacturing companies. His report, entitled "Current Trends in Terms of Sale," indicates that 62 per cent of the firms considered trade obligations to be due on net terms 30 days after invoice, shipment, or delivery date. If all payments were made in accordance with these terms, the ratio of receivables to sales would be somewhat less than 1.00. In case all debtors took the discount, paying in 10 days, goods delivered up to the 20th of the month would be paid for by the 30th and the receivables on that date would equal about one third of a month's sales. The ratio then would be 0.33. The report also indicated that more than half of the manufacturing firms reduced or eliminated the cash discount between 1953 and 1958 and this might have caused more receivables to run the full 30 days allowed.

Two general impressions are gained by inspection of the industry ratios. One of these is that in spite of the expansion of receivables in recent years, most industries have ratios that are not exceptionally high. In the food and kindred products, tobacco, transportation, and primary metals industries, the ratios are relatively low. On the other hand, consistently higher ratios prevail in the printing and publishing, leather, nonelectrical machinery, furniture and fixtures, instruments, and miscellaneous groups. This difference in ratios probably results in part from the size of the firm to which products are sold and the financial arrangements necessary to the sale of durable goods. In part, it may also reflect the terms which retailers of the product offer to their own customers, such as those which characterize the furniture and fixture business. In the food industry, turnover of inventory is high, especially in perishables, and consequently even short terms of payment may represent an advance of credit equal to or greater than the value of the inventory of the retailer.

The second impression is that the growth of receivables-sales ratios has been quite irregular in magnitude and timing in the various industries. Over the 4-year interval, changes in ratios were small in the tobacco, apparel and related products, transportation equipment, and lumber and wood products industries. The period from 1954 to 1956 witnessed most of the change in ratios in the food and kindred products, textile mill products, petroleum, electrical equipment, primary metals, and instruments industries. The change of practices during the 2 years led to an increase of net receivables of $1.7 billion, of which $1.0 billion was in the nondurable goods group. The petroleum group accounted for $348 million of this amount, probably as a consequence of widening use of credit cards.

Between 1956 and 1958, the major changes in ratios were in the paper, printing and publishing, nonelectrical machinery, other fabricated metal products, stone, clay, and glass, lumber and wood, and miscellaneous groups. Shifts of practice during this period produced an increase of $2.0 billion in net receivables with the durable goods group representing $1.2 billion. Nonelectrical machinery alone was responsible for $560 million of the growth.

The impression of irregularity in the change of credit practices is confirmed by reference to financial statements of leading companies in a number of industries. The most extreme ratios were found in some of the companies manufacturing recreation equipment, one of which had receivables equal to 10.6 months' sales. A diversified producer of machinery had receivables equal to 2.88 months' sales.

Although most ratios of receivables to sales have increased, few of the changes were of sizable proportions, and yet it is notable that changes in some of the industries having large sales were sufficient to increase receivables substantially. For example, the small change of practices in foods and kindred products and chemical and allied products between 1954 and 1958 led to increases of $454 million and $418 million, respectively, in receivables. The larger changes in petroleum and nonelectrical machinery produced gains of $522 million and $608 million. These four lines accounted for more than half of the net growth of receivables attributable to changes of credit practices.

Alternative Interpretations

The variability of the changes in receivables-sales ratios since 1954, both in magnitude and timing, suggests that there has been a general movement toward greater use of trade credit, with individual industries adopting or expanding practices which led to marked increases in the volume of their sales financed on longer maturities. The specific factors leading to unusual increases in credit are explainable in terms of conditions peculiar to the marketing of individual products and the ancillary financial requirements. The explanation of the general underlying movement must be sought in more pervasive changes in the business and financial environment.

Perhaps the broadest basis for the increase of receivables is the favorable credit experience during the moderate, short-lived business recessions of the postwar period that enabled larger companies to advance credit with growing confidence. But the increase of receivables in relation to sales as a consequence of favorable credit experience at some point becomes self-limiting, owing to increases in risk exposure. Growth of risk occurs as less desirable situations are financed, as a larger proportion of receivables are noncurrent, as a larger volume of recourse and guaranteed loans are underwritten by suppliers, and as the liquidity of corporations is reduced. To illustrate the last of these, the proportion of the current assets of manufacturing corporations represented by cash and Treasury securities declined from 27.4 per cent in 1954 to 21.9 per cent in 1958, while the proportion represented by receivables rose from 22.5 per cent to 26.7 per cent.

Growth of competition also has been cited by some analysts as a major force in the expansion of trade credit. Narrowing of profit margins has been stressed as one evidence of this. For example, although both 1954 and 1958 were years of recession, in 6 of the 10 industries producing durable goods, profit margins were distinctly lower in the latter year; a similar result occurred in one half of the industries producing nondurable goods. Such data are not conclusive, of course, for a number of other developments could have created the same result. Intensification of competition also is given as the reason that financing plans have become a more common feature of marketing strategy and for the fact that the point of decision on credit to be offered is reported to have moved to higher levels of management in a number of cases.

Mr. Foulke, in the study cited earlier, considers that two particular influences which came into play between 1953 and 1958 were the mounting needs for more capital that accompanied rising sales volume, and "tight money." For the smaller firm, the primary source of capital is retained earnings and the rate of accumulation was thought to have lagged behind the need, in many instances. Pressure for faster clean-up of short-term loans by lenders caused many firms to lean more heavily on suppliers, placing pressure upon them to grant more liberal terms.

The testimony cited by Mr. Foulke as well as reports from other sources as to the significant part played by restricted bank credit availability in the early phases of the current expansion of receivables makes it difficult to dismiss this factor on the ground that the growth continued in the succeeding period of ease. It is quite possible that restricted credit supplies served to trigger the easing of trade credit practices and the move, once taken, could not be reversed easily, particularly when competition for markets was intensified by falling demand. If this were a reasonably accurate description of the process by which the change was induced, it would not necessarily follow that another period of credit restraint would be the occasion for a further easing in credit practices. The failure of credit practices in 1958 to revert to the earlier patterns means that growth began in the current business expansion at a higher level of risk exposure than before, although risk may not yet be judged to have reached a level which would inhibit further growth of receivables in relation to sales.

Water Availability—The Problem of Quality

In the earlier articles of this series on water resources, emphasis has been placed upon the concept of water depletion or consumption, i.e., that portion of the water supply which is lost by evapotranspiration or embodiment in a product and is unavailable for further use. Thus, demand for water in the Nation and the Tenth Federal Reserve District has been measured in terms of depletion[1] and water productivity calculations for various industries have been made on a similar basis. So long as primary emphasis is placed upon the quantity of water supply and demand, this approach is quite reasonable since the portion of water used but not consumed by a particular activity is available for reuse. Obviously, when the gross diversion of water for various purposes exceeds the available supply in a particular area, each gallon of water is, on the average, used more than once. Multiple use is not only possible but it is already in existence on an impressive scale in particular areas.

Theoretically, the water supply of a given area could be used and reused until it is completely consumed. The practical difficulty which occurs, however, is that the water discharged by a user is seldom of the same quality as when it was diverted. Thus, in most uses which involve consumption of water, some degree of pollution occurs in the undepleted residual which may make it unsuitable for subsequent use. Hence, a complete analysis of available water supplies and of water productivity in various uses would have to regard the extent of pollution involved in specific uses and the costs, if any, of reclaiming the polluted discharge for beneficial uses. In considering these questions, it is well to recall that one of the most valuable uses of the Nation's streams is to aid in the disposal of the immense amount of waste products generated by our urbanized industrial society. The intelligent question at the present time is not whether streams should be used for this purpose but rather how unwarranted damage to other uses can be avoided when they are so utilized.

The Pollution Problem

Pollution is ordinarily attributed to industrial and municipal uses of water and these uses do contribute to the problem on a grand scale.[2] Not only are the traditional sources of municipal and industrial pollution still extant, but changing technology has created new problems. Little is known about the chemically complex wastes which much of modern industry expels into the Nation's rivers, either in terms of the characteristics of the polluted water in successive uses or, perhaps more importantly, in terms of its possible physiological effects on plant and animal life, including man.

[1] *However, in establishing the over-all supply available for municipal, agricultural, and industrial purposes, an allocation of water was made for pollution abatement.*

[2] *The paper and food products industries present perhaps the most striking cases. Some idea of the scale at which industrial pollution may occur is provided by the fact that a single sugar refinery may discharge organic pollutants equivalent in oxygen-consuming power to the sewage of a city of perhaps 600,000 persons.*

However, water used for irrigational purposes in agriculture is not free of the pollution problem. In addition to the well-known process of siltation which often results from faulty land management, an additional difficulty due to agricultural use grows out of the very heavy extent to which irrigational water is depleted by evapotranspiration in successive uses. As much as two thirds of the water diverted for irrigation may be transpired during the initial use, while in municipal and industrial uses less than 10 per cent is ordinarily consumed. The residual portion of water that has been subject to evapotranspiration retains practically all of the dissolved salts originally contained in the full volume of water but, of course, in much more concentrated form. Thus, if the water originally taken in is relatively saline, as it is in many streams and wells in arid and semi-arid areas, the concentration of salts in any given residual unit of water could, after several successive usages, become very high indeed. In addition, the level of salinity in the return flow from irrigation is almost always increased by the leaching of soluble minerals from the earth. The results of these processes are already evident in such significant river basins in the District as the Arkansas, the Platte, the Pecos, and the Rio Grande. Needless to say, as the growing consumption of water presses upon the total available supply, other areas will be similarly affected.[3]

Before further discussion of the problem of pollution is undertaken, however, the reader should be warned that it is not possible to establish a single determinate boundary between what constitutes pure water on the one hand and polluted water on the other. In a strict sense, pure H_2O can be obtained only under laboratory conditions. It does not exist in nature. All water supplies are contaminated to some degree, if that term is defined to mean that foreign materials exist in the water. Whether or not water is considered excessively contaminated or polluted depends upon the standards which are applied and these differ widely. Water which is legitimately considered suitable for one purpose may be hopelessly polluted for another and shortage of high-quality water in one region may occasion use of supplies which would be considered excessively polluted for the same purpose in another.

This point can be illustrated by regarding limits established by the U. S. Public Health Service on concentrations of chemical constituents in public supplies. The Service recommends that water for drinking purposes should not contain more than 500 parts per million of dissolved solids and 250 ppm of chloride. Actually, however, some public and rural supplies contain more than 3,500 ppm of dissolved solids and 500 ppm of chloride.

The quality of water used for irrigation also varies widely. Water containing less than 700 ppm of dissolved solids can be used under almost any conditions where a moderately salt tolerant crop is grown, but in certain parts of the Southwest water containing several thousand parts per million is applied with some success. The latter, however, requires salt tolerant crops and the application of methods to reduce the accumulation of salts in soil if damage to soil productivity is to be averted.

Interestingly enough, the quality standards used in some industrial processes are higher than for public and irrigational uses. Industries such as rayon, chemicals, and paper often find it necessary to treat water which would not be considered unsuitable for other purposes.

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[3] *Unfortunately, the effect of high and increasing salinity is doubly pernicious in arid areas. Not only does the quality of water and often of the land also deteriorate but water requirements are increased. This is true because a portion of irrigation water must be used for leaching and dilution purposes in order to maintain a salt balance favorable to crop growth.*

Not only is it illegitimate to classify water into two neat categories – polluted and unpolluted–but the effects of the water quality changes are often subtle and difficult to discern. Unfortunately, pernicious results, if any, are not always immediately evident. This is especially true when one considers the possible effects of the wastes of new industries, such as those producing synthetic detergents, various chemicals and drugs, and atomic energy. There has been only a short period of experience with these pollutants and very little is known about their effects. Also, pollution by a number of the new contaminants does not necessarily involve "use" of the water. Atomic fallout is an obvious case, but the application of substances such as 2,4-D and DDT to large acreages of land causes discernible amounts of these chemicals to be carried into streams by the runoff resulting from rainfall.

Unfortunately, relatively little basic data have been available until recently on the sources, kinds, amounts, and effects of pollution, and the costs and benefits of pollution control.[4] However, one of the provisions of the 1956 Federal Water Pollution Control Act called for a collection of relevant data on water pollution. Accordingly, the Public Health Service has established a program of data collection which includes as one of its most important features a national network of sampling stations (50 thus far) on interstate streams. These stations make regular sample analyses to determine whether water quality is improving or deteriorating and in what respects. Of the 50 stations currently in existence, at least 10 are gathering data within or near the borders of the Tenth District. The following section makes use of data collected at these stations.

[4] *However, the U. S. Geological Survey has produced numerous good studies evaluating the quality of surface waters in the United States.*

Water Quality in the District and Nation

The accompanying map shows the location of a selected group of water quality network stations. The table immediately below summarizes measurements of water quality at the sampling stations indicated. The series of numbers at the extreme left of the table are keyed to locations on the map.

Measurements are indicated for nine different aspects of water quality. Before proceeding to a survey of the sample results achieved, a brief explanation of each of the selected aspects of water quality may be helpful.

The radioactivity measurement presented in the table is carried out in terms of beta particle emission. A natural background radioactivity occurs at all times, but increases may result from various processes associated with the use and development of nuclear energy. Beta activity levels generally reflect variable contamination due to fallout, institutions utilizing radioactive materials, and other man-made sources.

Organic chemicals in the Nation's water resources come predominantly from the discharge of domestic and industrial wastes. Important in this type of pollution are the products of the commercial chemicals industry, many of which are extremely complex. Chemical sales doubled between 1940 and 1950 and are expected to continue to mount rapidly. A variety of results follow from significant concentrations of organic chemicals in water. These include tastes, odors, impairment of quality for industrial uses, fish flesh taint, and possibly other physiological effects in water-consuming organisms.

The biochemical oxygen demand (BOD) indicates the oxygen demand organic pollution places upon a stream. Industrial and domestic sewer wastes are associated with a high BOD. A significant BOD depletes a stream of oxygen and seriously affects desirable aquatic organisms.

Selected Measures of Water Quality in the United States

	I Total Beta Radio-activity	II Total Organic Chemical Extractables	III Biochemical Oxygen Demand	IV Chloride Content	V Alka-linity	VI Hard-ness	VII Tur-bidity	VIII Coliform Organisms
1. Colorado River	89.6	—	2.9*	72	141	430	292	557
2. Rio Grande River	142.5	176	1.3	74	151	274	446	17,489
3. Arkansas River	199.2	—	—	112	236	1,116	488	—
4. Arkansas River	393.2	194*	—	212	169	309	564	—
5. Missouri River	33.4	155	1.7	12	146	221	31	211
6. Missouri River	68.9	166	2.1	12	166	225	238	4,420
7. Missouri River	117.6	224	4.0	27	157	209	971	75,337
8. Missouri River	157.7	179	2.5	18	154	214	945	31,445
9. Colorado River	29.0	253	—	99	164	342	25	325
10. Snake River	42.9	202	2.4	5	108	115	50	20,053
11. Columbia River	933.5	96	1.4	—	60	73	5	349
12. Columbia River	337.3	79	1.3	4	63	66*	20	72
13. Mississippi River	31.1	387	6.0	9	141	161	85*	154
14. Mississippi River	73.0	267	—	16	156	206	223	6,994
15. Mississippi River	74.1	119	2.3*	21	103	126	309	1,429
16. Ohio River	35.9	280	—	25	30	111	120	2,801
17. Ohio River	57.3	626	1.9	25	39	117	147	3,919
18. Ohio River	58.6	209*	1.2	16	84	118	172	15,886
19. Tennessee River	65.0	160	1.5	8	54	68	29	164
20. Savannah River	41.7	322	1.0	6	23	19	47	1,807
21. Potomac River	36.4	200	2.7	6	55	78	51	922
22. Lake Erie	9.1	203	.9	26	92	129	9	19*
23. Delaware River	29.7	167*	—	7	35	59	48	9,493
24. Merrimac River	25.2	383	2.7	7	7	17	12	—
25. Detroit River	13.9	132	.6	7	82	99	11	29

* Samplings for less than 5 months.

NOTE: The unit of measurement used in Column I is micro-microcuries per liter; in Column II micrograms per liter; in Columns III, IV, V, and VI milligrams per liter; in Column VII scale units; and in Column VIII number per 100 milliliters.

SOURCE: U. S. Public Health Service, National Water Quality Network Annual Compilation of Data, October 1, 1957 - September 30, 1958.

Mineral content is roughly indicated by chloride, alkalinity, and hardness.[5] The salinity of water has important effects upon the potability and waters of high salinity are generally less desirable and, in extreme cases, even unfit for municipal, industrial, and irrigational uses.

Turbidity of water reflects concentrations of suspended matter such as clay, silt, organic substances, and other materials. It may interfere with basic biological processes and the propagation of fish and other desirable aquatic life.

Coliform organisms originate in the intestinal tract of warm-blooded animals, and the coliform count is a good indicator of the domestic waste load a stream carries.

In order to reduce the problem of presenting information about these various aspects of quality, averages of the observations made during the period October 1, 1957, to September 30, 1958, are shown in the table. Two precautions should be observed in interpretation of these average figures. First, not all of the averages relate to a full year's observations. The data for stations which had taken a particularly small number of monthly samples were usually disregarded but when included are indicated by asterisks. Second, averages obscure variability and many aspects of water quality show very large differences between individual observations during the year. For example, some types of food products firms tend to dump an especially large waste load into streams during periods of unusually low flow. Such practices may result in particularly heavy pollution in late summer and early fall and relatively minor contamination during other seasons of the year. Such situations are of considerable significance since intelligent decisions concerning, among other things, the necessity for treatment and appropriate types of treatment may depend as much upon peaks as upon general levels of pollution.

Keeping these qualifications in mind, what sort of generalizations may be made about the data? One thing that is evident is that pollution is a nationwide phenomenon. The amount of pollution depends upon the degree of treatment and quantities of domestic and industrial wastes expelled into the rivers, but it is also a function of the quantity and regularity of streamflow. Although the eastern portion of the United States has several times the population of the West and has been estimated to generate about 20 times more industrial waste, the greater streamflows found there tend to dilute and transport wastes more effectively than the smaller and less regular flows of typical western streams.

While pollution is a nationwide phenomenon, various aspects of it tend to predominate in particular areas. For example, radiation differs markedly from place to place with a number of the higher concentrations found in District streams. In contrast to the relatively high radioactive content of the Columbia River at Bonneville, Oregon, which is primarily a result of waste dumpage from a nuclear facility, the radioactivity of District streams appears to originate predominantly from fallout.

While the incidence of heavy biochemical oxygen demand, and concentrations of coliforms, which are related to organic sewage pollution in the ways described earlier in this section, are widely distributed, some of the most striking cases occur in the District.

On the other hand, total organic chemical extractables are found in lesser concentration in District rivers than in many others. The worst problems occur in parts of the East and Midwest. This result is perhaps not surprising since the presence of these materials in streams and lakes would tend to be associated with industrial pollution and heavy concentration of population.

[5] *For a detailed discussion of mineral content measures for irrigation water, see U. S. Department of Agriculture Circular No. 969.*

Dissolved minerals in District water resources are particularly high relative to the samples taken at the other points indicated. This is generally to be expected in streams flowing through arid and semi-arid areas. Natural salinity may be considerable in such waters due to the leaching of highly mineralized soils and/or flows from salt water springs, and the salinity content of the streams is increased by irrigation due to the process described earlier. Surface waters may become sufficiently saline to require treatment before beneficial use can be made of them. In addition to the saline surface water found in a number of District streams, large quantities of ground water displaying varying degrees of salinity underlie extensive areas in the District. Because of the prevalence of salinity problems in the District and because of the great promise which many people feel the treatment of saline water holds, the following section of this article is devoted to some aspects of saline water treatment and use.

Aspects of Saline Water Treatment and Use

As previously indicated, no clear line of demarcation can be established between polluted and nonpolluted waters. Rather the content of foreign materials in the Nation's water supplies is better viewed as a continuum, ranging from relatively pure to grossly contaminated with contamination taking a variety of forms. The saline waters of the world are located at various points along this continuum, with the ocean waters located near the extreme in terms of salinity but in less extreme positions in regard to turbidity, organic materials, etc. The conversion of saline waters to reduce their content of dissolved solids and make them usable for various purposes may well be viewed as a rather extreme form of pollution treatment.

Conversion of sea water has sometimes been hailed as the final and comprehensive solution of our water problems and material progress has been made toward improving the requisite technology for tapping this practically inexhaustible stock. In recent times, attention has been directed toward five basic techniques for accomplishing this end: distillation through artificial heat; solar distillation; separation of salt by membrane processes; freezing; and chemical or electrical means of separation. It is difficult to obtain dependable data on the minimum costs of conversion which the best available technology would entail if carried on at an economically significant scale. Some of the most advanced installations are said to be producing fresh water from the sea for a cost of around $1.75 per thousand gallons and it is believed that plants could now be designed and operated to produce fresh water from that source for $1 per thousand gallons. Current laboratory experiments apparently hold out hope of further substantial cost cuts, perhaps by as much as one half. This would be near the current delivered cost of water furnished by the very highest cost public systems depending upon natural sources of fresh water, but a large multiple of the typical cost of undistributed irrigation water.

With continued improvements in technology, it might, therefore, indeed seem that at least the municipal and industrial water supply problem can be solved in the sense that unlimited supplies can be made available at costs competitive with those involved in developing additional marginal supplies in high water cost areas. For the coastal areas of the United States, that point of view could reasonably be argued. For inland areas, however, it is much more problematical. If converted sea water must be transported for any appreciable distance, the cost of transportation outweighs the cost of conversion. In an area such as the Tenth District, located in the center of a huge continental land mass, the low cost conversion of sea water would, as far as can presently be anticipated, have only indirect consequences.[6]

Two points may help to support that conclusion. First, the modern American standard of living requires monstrous quantities of water. It was estimated several years ago that the annual average water use per person in the United States is about 1,500 tons. By contrast, the use of all other materials, such as food, fuel, metals, plastics, lumber, sand and gravel, etc., amounts to a mere 18 tons. Obviously not the entire amount of water indicated must be used at the place of residence of particular segments of the population since the total includes quantities diverted for industrial processes, irrigated agriculture, etc. However, the above figures do give some notion of the magnitude of undertaking involved in transporting the water requirements of a population with modern living standards over vast distances. Second, if the efficient transportation of water over large distances were economically feasible, it would already be done to a great extent. Very large supplies of fresh water, such as the Great Lakes and the Columbia and Mississippi Rivers, are not further from, and in some cases are closer to, areas of chronic water shortage than are the oceans. The fact that fresh water from these sources is not transported over large distances makes one wary of proposals to first convert sea water at considerable expense and then transport it over distances equally as large or larger.

Even though converted sea water may not be very promising as an augmentation to the District fresh water supply, this by no means indicates that the possibility of saline water conversion is not relevant for the area. Actually the conversion of saline ground water for municipal and industrial uses appears to hold considerable promise for areas short of fresh water and which are underlaid with deposits of brackish water. Besides the fact that these deposits are located inland and therefore conceivably close to the point of use, saline ground waters have other advantages over sea water for the purpose of demineralization. Such waters are ordinarily free of turbidity and suspended materials which reduces initial treatment costs. In addition, temperature and chemical qualities of ground water are extremely stable. However, the most important advantage is that the content of dissolved solids is usually quite low as compared with ocean water. This reduces the cost of some conversion processes appreciably. For example, the cost of converting ground water containing 3,500 ppm of dissolved solids by the ion-exchange membrane process is estimated to be only about 20 per cent of the cost of converting ocean water by the same process.[7] While this process does not appear to be competitive with distillation techniques for the conversion of sea water, it seems to be well suited for the demineralization of brackish waters of relatively low salinity. However, one problem which is common to all techniques of inland saline water conversion is the disposal of residual brines.

[6] *It is conceivable that one of these indirect effects would be to relieve water shortage in inland areas by means of a substitution effect, i.e., water demands at downstream points might be alleviated as converted ocean water is substituted for fresh water withdrawn from a stream, thus leaving a larger portion of the total flow available to upstream users. The practical importance of this possibility is probably nil, however, since it is difficult to visualize a sufficient fall in the price of conversion so that downstream points would be willing to relinquish water rights on a stream. Actually, when and if converted sea water comes to be used in other than extremely unusual circumstances, it will almost certainly be used as a supplement to rather than a substitute for fresh water supplies.*

[7] *See Miller, David W., "Development and Utilization of Saline Ground-water Resources,"* Third Annual Water Conference, *New Mexico State University, November 6 and 7, 1958.*

The Tenth District contains large amounts of naturally saline water. Both the Dakota sandstone and Ogallala formations of the Great Plains contain large deposits of mineralized water. In other parts of the District sizable quantities of moderately saline waters are available from Paleozoic, Permian, and Triassic formations. These waters are an important part of the District's resources, both because they are suitable subjects for conversion to fresh water, should less expensive alternative sources be unavailable, and also because large quantities of the more moderately saline water can be and are being used for certain purposes by agriculture and industry without conversion.

Nevertheless, saline ground waters, as other ground waters, are dependent upon rainfall for their recharge and usually the rate of recharge is somewhat more gradual than is true of fresh water aquifers. Therefore, limitations on sustained withdrawal similar to those for fresh water aquifers exist in regard to saline ground water sources.

Also located within the District are considerable amounts of slightly to moderately saline surface waters resulting both from natural and man-made processes. Whereas many of these saline surface water sources are already intensively used, they nevertheless represent a potential source of high-quality water by means of conversion. However, as the foregoing discussion of ground water conversion implies, surface waters generally lack several features which make ground water suitable for some conversion techniques.

BANKING IN THE TENTH DISTRICT

District and States	Loans				Deposits			
	Reserve City Member Banks		Country Member Banks		Reserve City Member Banks		Country Member Banks	
	August 1959 Percentage Change From							
	July 1959	Aug. 1958	July 1959	Aug. 1958	July 1959	Aug. 1958	July 1959	Aug. 1958
Tenth F. R. Dist.	+1	+13	†	+11	+1	−2	†	+5
Colorado	†	+18	+1	+14	+1	+4	+2	+7
Kansas	+4	+13	−2	+3	†	−1	−1	+5
Missouri*	+1	+11	†	+21	−1	−4	†	+2
Nebraska	+2	+23	+1	+20	+3	−3	+1	+2
New Mexico*	**	**	+3	+22	**	**	−6	+7
Oklahoma*	−1	+6	†	+5	+3	−4	†	+5
Wyoming	**	**	†	+11	**	**	+2	+7

*Tenth District portion only.
†Less than 0.5 per cent.
**No reserve cities in this state.

PRICE INDEXES, UNITED STATES

Index		Aug. 1959	July 1959	Aug. 1958
Consumer Price Index	(1947-49=100)	124.8	124.9	123.7
Wholesale Price Index	(1947-49=100)	119.1	119.5	119.1
Prices Rec'd by Farmers	(1910-14=100)	239	240	248 r
Prices Paid by Farmers	(1910-14=100)	297	298	293 r

r Revised.

TENTH DISTRICT BUSINESS INDICATORS

District and Principal Metropolitan Areas	Value of Check Payments		Value of Department Store Sales	
	Percentage change—1959 from 1958			
	Aug.	Year to date	Aug.	Year to date
Tenth F. R. Dist.	+10	+11	+4	+8
Denver	+16	+14	+12	+9
Wichita	0	+4	−4	+1
Kansas City	+12	+12	+2	+9
Omaha	+11	+12	+2	+6
Oklahoma City	+13	+11	+5	+9
Tulsa	0	+7	+2	+8