A. I. Mytelka

INDUSTRIAL WASTE INVENTORY

REPORT No. 1

INTERSTATE SANITATION COMMISSION

INDUSTRIAL WASTE INVENTORY

of the

INTERSTATE SANITATION DISTRICT

A

Progress Report

October, 1949 - June, 1951

INTERSTATE SANITATION COMMISSION
110 William Street
New York 38, N. Y.

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The services of the Engineering and Secretarial Staff of the Interstate Sanitation Commission were made available to the Inventory when needed.

This Industrial Waste Inventory was made possible by the grant of funds from the United States Public Health Service under the terms of Public Law 845, 80th Congress, 1948, and acknowledgement is made of the assistance and cooperation of the Division of Water Pollution Control, United States Public Health Service and its North Atlantic Drainage Basin Office.

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INTRODUCTION

New York Harbor and the adjacent waters of Long Island Sound, the Hudson River and the Atlantic Ocean represent a most valuable natural resource of the Metropolitan New York area. They have been a major factor in the economic well being and comfort of its approximately 11,000,000 inhabitants.

These waters have long served the populations and industries located on the land areas bounding them as an unequalled highway for transportation and stimulus to commerce; as a source of recreational pleasures such as bathing, fishing and boating; as a source of food through the fish and shellfish industries; as a cheap and abundant source of cooling and process water for industry; and finally, as an unlimited reservoir for the disposal of waterborne wastes generated by the inhabitants and industries.

Not until recent years was full recognition given to the problem of the growing incompatibility of the use of the waters as a receptacle for waterborne wastes such as toilet flushings, bath and wash water, kitchen sink garbage, restaurant and laundry washings, etc., with the other indicated uses. It was found that the capacity of the waters to absorb and assimilate these wastes was not limitless. The cumulative effects over the years of increased loads of waterborne wastes discharged coincident with the growth in population and industry was taking its toll.

This inability to adequately assimilate or disperse raw sewage and other domestic wastes manifested itself in the creation of menaces to public health by the contamination of bathing and shellfish waters, making it necessary to close these areas to public use. The variety and distribution of aquatic life was influenced as the result of the depletion of oxygen due to the biochemical decomposition of organic matter in the wastes, and as the result of the blanketing of fish spawning grounds by the settling out of suspended solids. In addition, the general aesthetic value of the waters and the economic value of bordering land areas were decreased by the presence of floating matter and debris, and the creation of objectionable odors.

While processes for treating and reducing these wastes so that they would no longer constitute a threat to the fullest use and

enjoyment of the waters in and around Metropolitan New York City were known for many years, no coordinated program for pollution control was started until 1936. It was then, with an awareness of the interstate nature of the problem, that the Interstate Sanitation Commission was formed for the purpose of controlling pollution in the waters of a tri-state area. These waters, located in the States of New York, New Jersey and Connecticut, were designated the Interstate Sanitation District. (See Figure 1)

In the Tri-State Compact establishing the Commission, provision was made for classifying the waters of the District according to their expected primary uses. The required degrees of treatment of wastes before discharge into the District in order to maintain these uses were defined.

With the Tri-State Compact as the authorizing and guiding instrument, the Commission with the cooperation of the States of New York, New Jersey and Connecticut has stimulated the abatement of pollution from domestic sources to the point where 50% of the domestic sewage now being discharged by a contributing population of approximately 11,000,000 people is receiving treatment which materially reduces or eliminates the pollution load before being discharged into District waters. By 1953, 75% of the domestic flow will meet the standards set by the Compact.

It can thus be seen that the problem of the control of pollution of the Interstate Sanitation District by domestic wastes resulting in economic, health and aesthetic losses is well on its way to solution.

The Commission has long been aware of the large volume of complex wastes that are being discharged into the District by industry in addition to pollution from domestic flows.

Where manufacturing processes or other industrial operations involve the contact of water or other liquids with substances that are soluble or can be held in suspension, the difficult problem is created of disposing of these unwanted liquids or industrial wastes without polluting the waters. Since the waters of the District represent a convenient means of disposal, many industries located on the coast line discharge their waterborne wastes directly into these waters through private sewers. Others dispose their wastes by discharging them to municipal sewerage systems, which may lead to municipal sewage treatment plants, but which eventually discharge into District waters. Many industries provide for some degree of

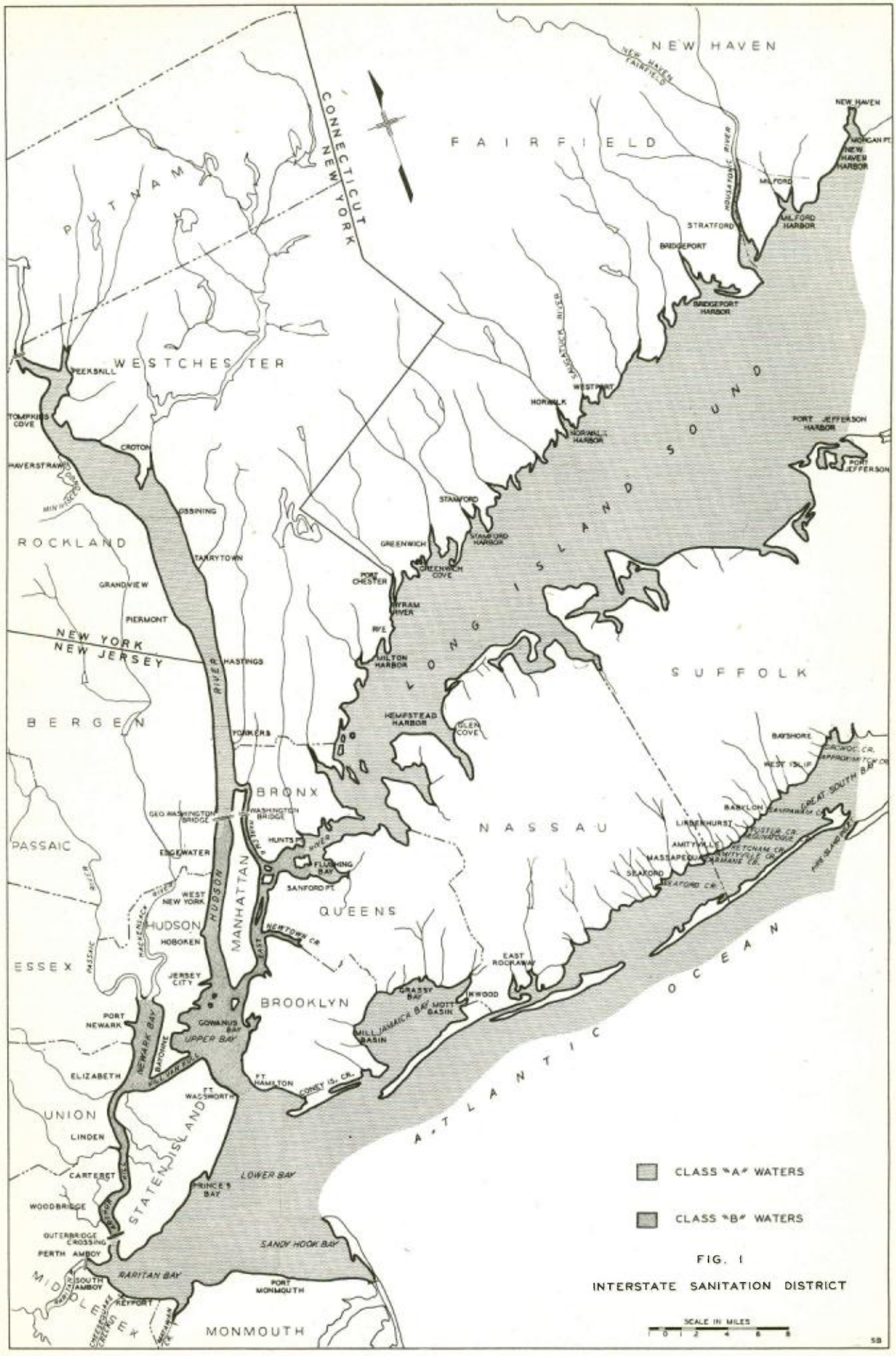


FIG. 1

INTERSTATE SANITATION DISTRICT

treatment before discharging their wastes.

These industrial wastes, as varied and complex as industry itself, may contain oils, acids, chemicals, grease, mineral salts, dissolved metals, and animal and vegetable matter. Whether a given waste will have an obnoxious effect on the receiving waters will depend upon the dilution, dispersion and dissolved oxygen available to these wastes in the receiving waters. Poisoning of aquatic life and wildlife, corrosion of boats and structures, and conditions offensive to sight and smell may result from the indiscriminate and unstudied discharge of industrial wastes. Wastes such as meat packinghouse wastes may have an oxygen depleting effect on the watercourse ten times higher than that of an equal quantity of untreated domestic sewage.

Defilement of waterways by pollution is by no means a problem unique to the Interstate Sanitation District. In recognition of the national scope of stream pollution problems, the 80th Congress in 1948 enacted Public Law 845, the purpose of which was to stimulate and encourage pollution abatement programs by state and interstate agencies throughout the nation. Under one provision of this law, funds are made available to these agencies for "the conduct of investigations, research, surveys and studies related to the prevention and control of water pollution caused by industrial wastes."

Grants from the United States Public Health Service under the terms of Public Law 845 were made available to the Interstate Sanitation Commission for an investigation and survey of industrial waste pollution problems which would provide the basis for a control program.

The formulation of an intelligent industrial waste pollution control program requires that complete answers to several questions be obtained. Since, in general, the state of pollution in a watercourse depends upon the balance between the rate at which pollutants are added and their rate of neutralization by the receiving waters, the following information is required:

1. How much of a pollution load (oxygen depleting substances, poisons, acids, oils, etc.) are industrial waste discharges now imposing on various sections of the District? What are the volumes, characteristics and strengths of the industrial wastes now being discharged into each of the rivers, bays and other bodies of water within the Interstate Sanitation District?

2. Can the receiving waters assimilate these pollution loads without jeopardy to their legitimate or intended uses?

(a) What dilution and dispersion of the wastes is provided by the receiving streams near the points of discharge? Does the natural circulation of the waters remove these wastes, and if so, what are the downstream and/or upstream effects of this removal? Is the dilution and dispersion sufficient to reduce the concentration of objectionable substances to an innocuous level?

(b) Since oxygen is consumed in the decomposition of organic matter, what is the capacity of the waters for assimilating and stabilizing these oxygen depleting substances without reducing its oxygen level below that needed to maintain a varied aquatic life, or below that required to prevent the generation of putrefactive odors?

(c) Are there any interactions between various wastes discharged whether industrial or domestic, which result in neutralization or accentuation of obnoxious characteristics?

3. If various sections of the District are at present able to tolerate the existing industrial pollution load, what excess capacity is there? How much additional pollution can be accepted without impairing or destroying the expected uses of the waters?

4. If the condition of various sections of the District is not now suitable for the expected primary uses what corrective measures must be taken to restore these waters to an acceptable quality? What are the tolerable limits for the wastes now being discharged and therefore, what degrees of treatment are required for these discharges? What consideration is to be given to increases in pollution loads due to location of new industries or expansion of existing plants?

5. Questions three (3) and four (4) can be restated or summarized as follows: since the desire for the achievement of the goal of expected primary uses of the waters of the District imposes limitations on the capacity of these waters to serve as a means of disposal for wastes, what is an equitable distribution of this limited capacity among waste discharges, both present and potential, domestic and industrial?

A stepwise approach to obtaining the answers to question one (1) has been dictated by the dependence of the inventory on limited annual grants and the continued availability of funds. Each step has been organized as an independent study so that discontinuance of funds at the end of a fiscal period would not negate the usefulness of the work accomplished. The order in which each phase is to be undertaken is based upon its relative importance to the overall aims of the survey.

Thus the determination of the sources, volumes, characteristics and strengths of industrial wastes entering the waters of the Interstate Sanitation District has been divided into the following phases:

1. Determination of industrial wastes discharged directly into the District via private sewers.

2. Determination of industrial wastes entering District waters through public sewerage systems.

3. Determination of industrial wastes entering District waters through streams tributary to the District.

It is the intention of this report to present in both summary and detail, the results of the survey to determine the sources, volumes, characteristics and strengths of industrial wastes discharged directly into the District through private sewers.

SUMMARY FINDINGS

Plants Visited

1. Geographical Distribution

Approximately 1500 plants distributed along 1500 miles of coastline bordering the Interstate Sanitation District have been visited during the course of the survey. Of these plants, 306 dispose of their waterborne industrial wastes directly into District waters. The remaining plants either do not generate any waterborne industrial wastes, or dispose of them through public sewers.

In the accompanying map (Figure 2) is shown the distribution in the varous counties of the 306 plants which discharge directly into District waters, and the approximate number of plants discharging to local sections of the District within each county.

From the map it can be seen that the heaviest concentration of these plants is along the relatively short coastline of the counties of Kings (Brooklyn) and Queens. Other areas of concentration border the Arthur Kill, Kill van Kull, and Bridgeport Harbor.

2. Industrial Distribution.

Among the 306 plants which discharge directly into District waters, and which range in size from those employing less than 10 to more than 5,000 employees, are various manufacturing industries such as food, chemical, petroleum refining, primary and fabricated metal, textile, and carburetted and coke oven gas.

The distribution of the 306 plants among the various industries is illustrated in Figure 3.

Most numerous among the plants which discharge their wastes directly are those of the chemical and food industries, which are geographically concentrated in Kings (Brooklyn) and Queens Counties, in New York, and Hudson

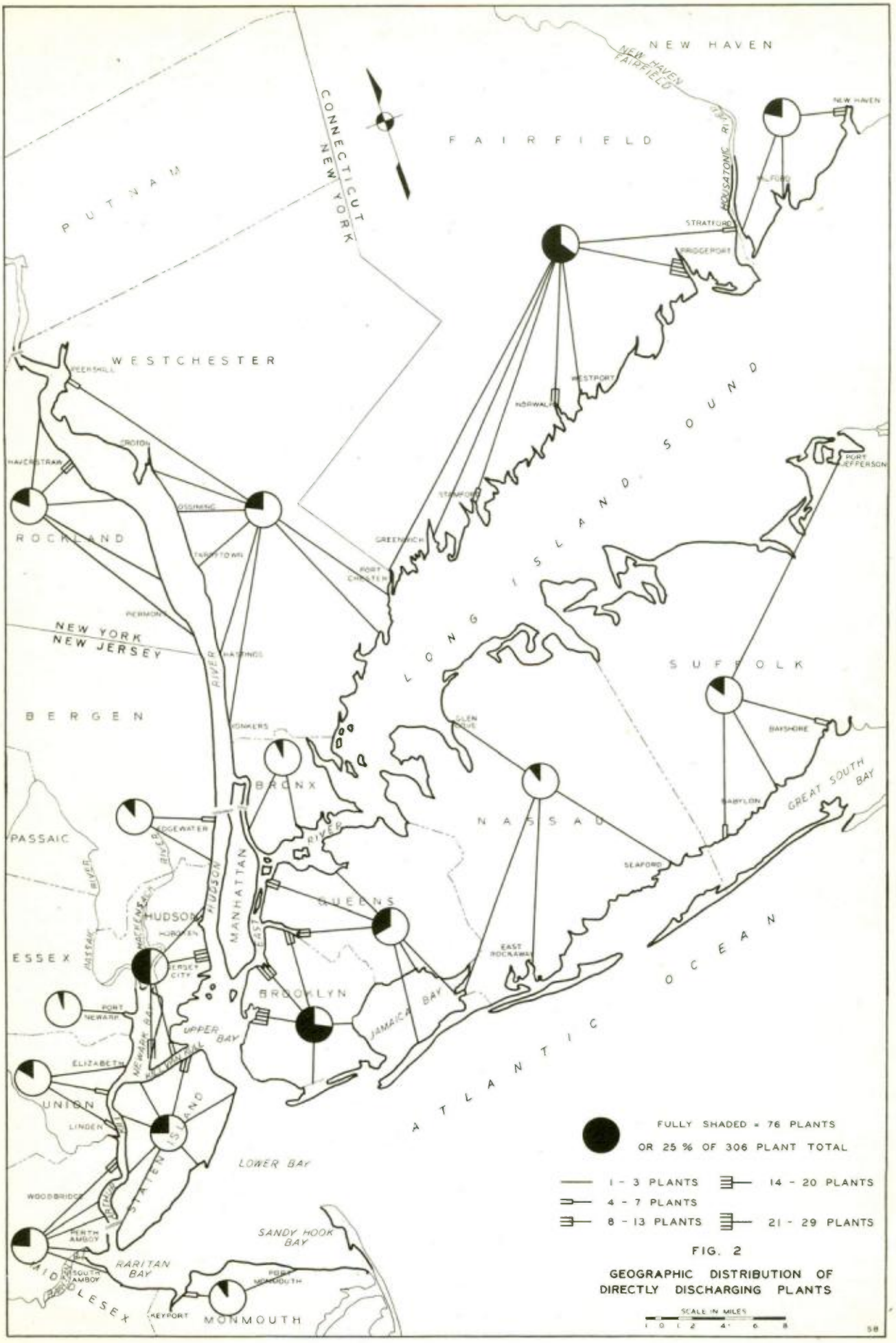
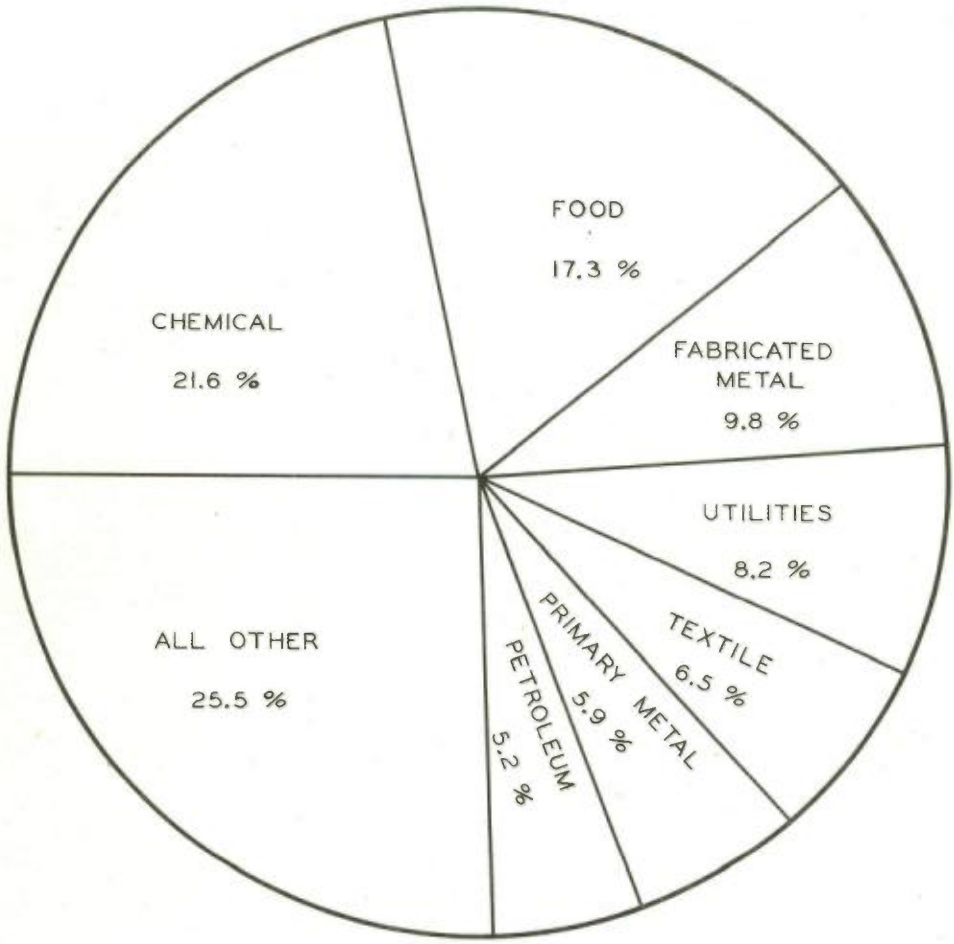


FIG. 2

GEOGRAPHIC DISTRIBUTION OF DIRECTLY DISCHARGING PLANTS



TOTAL PLANTS = 306

INDUSTRIAL DISTRIBUTION OF PLANTS DISCHARGING DIRECTLY INTO DISTRICT WATERS

FIG. 3

SB

and Union Counties in New Jersey. Fabricated and primary metal plants are most heavily concentrated in Fairfield County, Connecticut, while petroleum refining plants are most numerous in Hudson and Union Counties, New Jersey.

Industrial Waste Volumes

1. Geographical Distribution

Approximately 515 million gallons per day of industrial wastes (contaminated discharges) are discharged directly into the District by the 306 plants. Some degree of treatment before discharge is provided by 138 plants for 433 million gallons per day.

The distribution of this volume by county and by local sections of the District is shown in the accompanying map (Figure 4).

It can readily be seen that the Arthur Kill, Newark Bay and Kill van Kull sections receive the greatest daily volume of industrial waste discharges, Union County alone discharging more than 40% of the total 515 mgd. Hudson County is the source of approximately 20% of the industrial waste volumes, while 11% and 8% of the total discharge originates in Suffolk and Kings County respectively. No direct industrial waste discharges are generated in New York County (Manhattan).

2. Industrial Distribution

Of the 515 million gallons per day of industrial waste discharge, approximately 65% is discharged by the petroleum industry. Discharges from the chemical and utility industries are also significant as shown in Figure 5.

Since it has been previously indicated that petroleum refining plants are concentrated in Hudson and Union Counties bordering on Arthur Kill, Kill van Kull and Newark Bay, and that more than 50% of the total waste discharge empties into these bodies of water, the influence of this industry on the geographical distribution of industrial wastes can readily be seen. The influence of the petroleum refining industry is also emphasized when it is realized that even though only 5% of

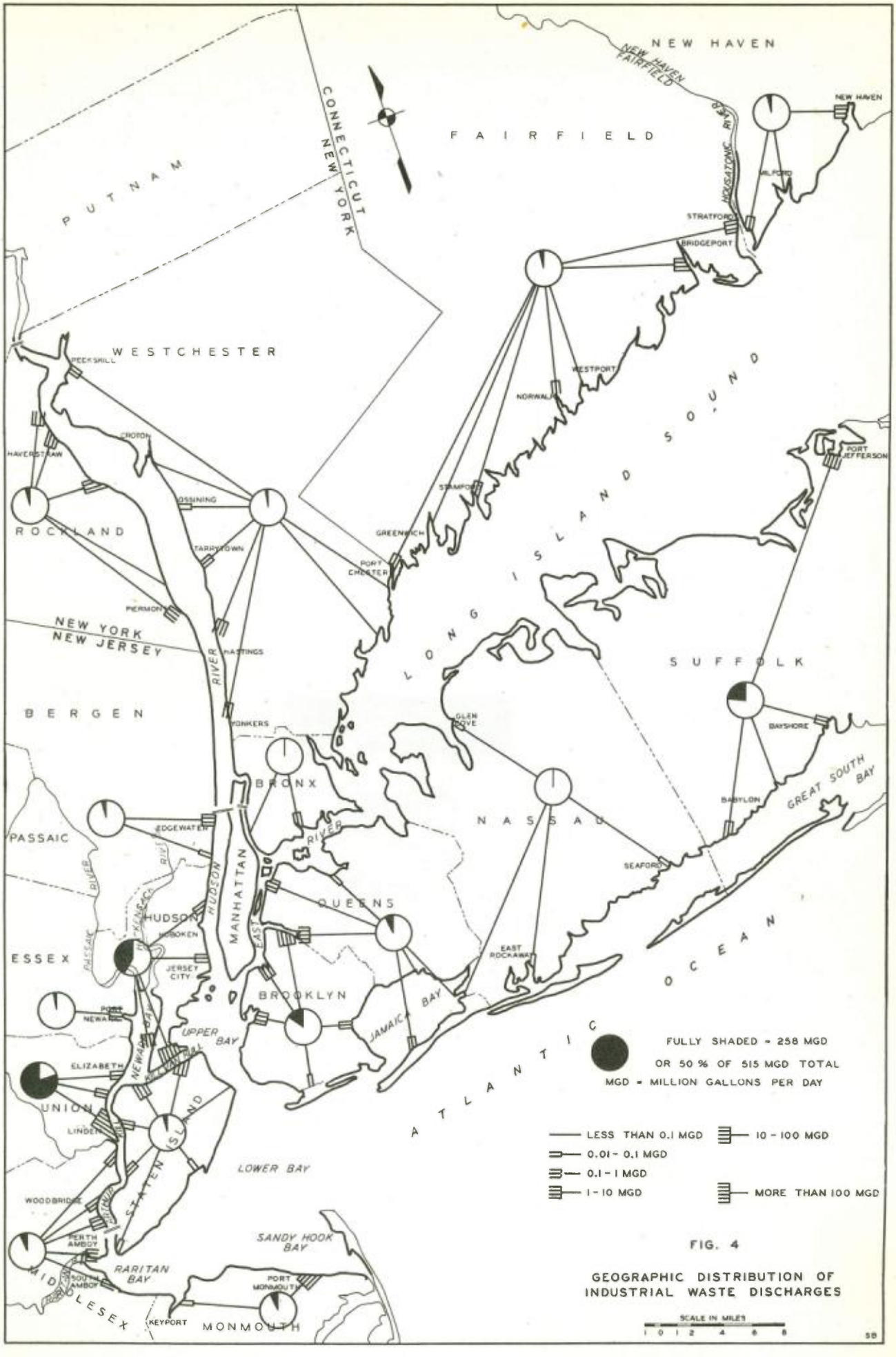
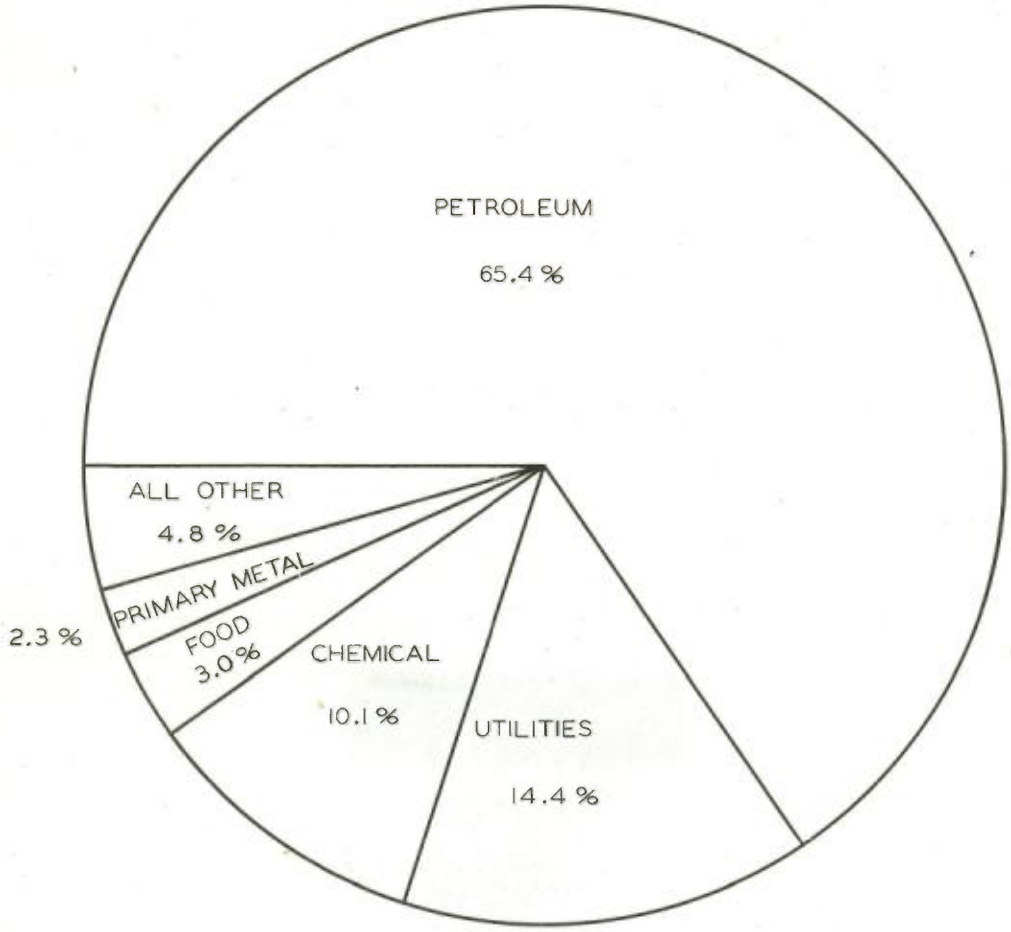


FIG. 4

GEOGRAPHIC DISTRIBUTION OF INDUSTRIAL WASTE DISCHARGES



TOTAL WASTE DISCHARGE = 515 MGD

INDUSTRIAL DISTRIBUTION OF DIRECT WASTE DISCHARGES TO DISTRICT WATERS

FIG. 5

S.B.

the plants belong in this category, they discharge more than 65% of the wastes.

On the other hand, the food industry which constitutes 17% of the 306 directly discharging plants, discharges only 3% of the total waste volume.

One must be cautious concerning conclusions drawn solely upon the criterion of volume of waste. The character and strength of the wastes are of the utmost importance.

Total Industrial Discharges

The previous presentations have been confined to discharges of contaminated flows or industrial wastes. In addition to the 515 million gallons per day of industrial waste discharges, 1160 million gallons per day of uncontaminated flow are discharged directly into the District. Uncontaminated discharges arise from such industrial processing and activity as refrigeration and surface condensing in which no change in the original properties of the water employed occurs other than perhaps an increase in temperature. The potential pollution effects of the discharge of large volumes at elevated temperatures will be made the subject of a separate study.

Thus the 515 million gallons per day of industrial waste plus the 1160 million gallons of uncontaminated discharge results in a total of 1675 million gallons per day being discharged directly into the Interstate Sanitation District.

Some indication of the magnitude of this volume may be visualized when it is realized that a train of 8,000 gallon tank cars approximately 1500 miles in length would be needed to carry away this daily discharge. This volume of 1675 million gallons per day is generated by 110,000 production employees as compared to the daily domestic flow of 1600 million gallons generated by the 11,000,000 inhabitants of the areas draining into the District waters.

It is interesting to note that industries which discharge their waterborne wastes directly into the District utilize the waters of the District as a major source of industrial water supply. More than 90% of the 1675 million gallons per day of industrial discharge is salt water obtained from this source.

Receiving Waters

The waters of the Interstate Sanitation District are classified into two general categories. Class "A" waters are defined as those expected to be used primarily for recreational purposes, shellfish culture or the development of fish life. Class "B" waters are those not expected to be used primarily for these purposes.

Of the total contaminated discharge of 515 million gallons per day, approximately 79% enter Class "B" waters and 21% is disposed of in Class "A" waters.

In Figure 6 is shown the distribution of both contaminated and uncontaminated discharges into Class "A" and "B" waters.

Industrial Waste Characteristics

On the basis of past experience, it is known that certain characteristics of industrial discharges may, if present in sufficient quantities, create objectionable conditions in the receiving waters.

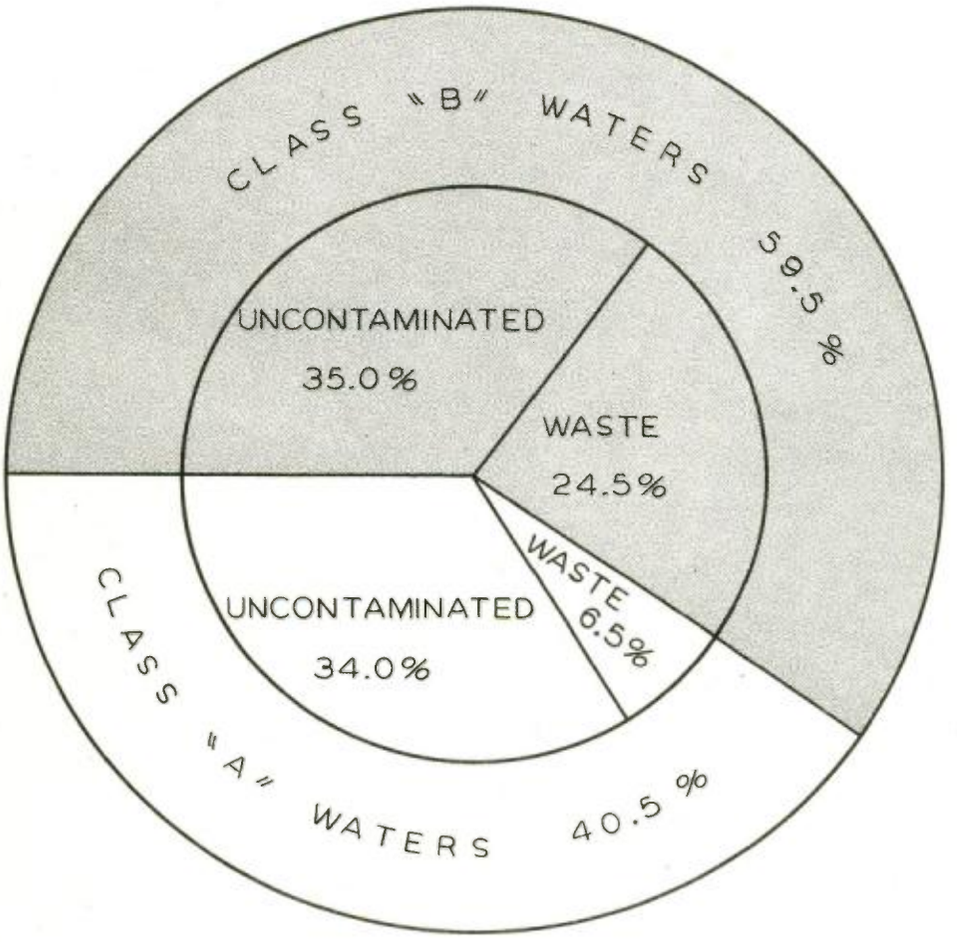
These effects are not always immediately or directly discernible to the senses, but may manifest themselves as relatively long term changes in stream characteristics such as sludge bank formation, oxygen depletion and toxicity to the extent of producing an environment unfavorable to the propagation of aquatic life.

In the accompanying table (Table 1) are shown the general characteristics of the waterborne wastes generated by the various industries surveyed, and the potential impact of these wastes upon the receiving waters.

Estimated Pollution Loads

The extent to which potentially polluting substances are being discharged daily into the Interstate Sanitation District is shown in Figure 7.

These loadings represent only the quantities generated by plants which discharge their wastes directly into the waters of the District. They do not include the thousands of plants which discharge their wastes into public sewers. Nor do they reflect the influence of treatment which is provided for the wastes before their discharge by



TOTAL INDUSTRIAL DISCHARGE

1,675,000,000 GALLONS PER DAY

DISTRIBUTION OF INDUSTRIAL DISCHARGES IN CLASS "A" & "B" WATERS

FIG. 6

SB

Table 1
CHARACTERISTICS OF WASTES
Discharged by
EACH INDUSTRY

INDUSTRY	WASTE CHARACTERISTICS	POTENTIAL EFFECT ON STREAM
Food	Dissolved and suspended animal and vegetable matter, fats and oils and grease	Oxygen depletion, solids, grease
Tobacco	Dissolved vegetable matter	Oxygen depletion
Textile	Dissolved organic and inorganic chemicals	Oxygen depletion, color
Lumber	Dissolved organic and inorganic chemicals	Toxic
Paper	Suspended and dissolved vegetable and mineral matter	Oxygen depletion, solids
Chemicals	Dissolved and suspended organic and inorganic chemicals, oils, acids, phenols	Oxygen depletion, toxic, solids, color, oils, acidity
Petroleum	Dissolved organics, suspended solids, mineral oils, phenols	Oxygen depletion, solids, toxic, oils
Rubber	Dissolved and suspended organics	Oxygen depletion
Leather	Dissolved and suspended animal matter, dissolved organic and inorganic chemicals	Oxygen depletion, solids, grease
Stone	Suspended mineral matter	Solids
Primary metals	Dissolved and suspended metals, inorganic acids	Toxic, solids, acidity
Fabricated metals	Dissolved metals, cyanides, inorganic acids, grease and oil	Toxic, acidity, grease and oils
Machinery	Dissolved metals, cyanides, inorganic acids, grease and oil	Toxic, acidity, grease and oils
Electrical machinery	Dissolved metals, cyanides, inorganic acids, grease and oil	Toxic, acidity, grease and oils
Transportation	Dissolved metals, inorganic acids, grease and oil	Toxic, acidity, grease and oils
Instruments	Dissolved metals, cyanides, grease and oils	Toxic, grease and oil
Misc. manufacturing	Varied	Varied
Utilities	Dissolved and suspended organics, cyanides tar and oil, phenols	Oxygen depletion, toxic, oil, solids
Service	Dissolved and suspended organic, grease	Oxygen depletion, solids, grease

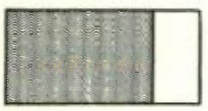
OXYGEN DEMAND

348,000 LB/DAY

SUSPENDED SOLIDS

358,000 LB/DAY

ACIDS

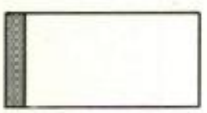


95,000 LB/DAY

POISONS

66,000 LB/DAY

GREASE & OIL



101,000 LB/DAY

TO CLASS "A" WATERS

TO CLASS "B" WATERS

ESTIMATED MAXIMUM POTENTIAL DAILY POLLUTION LOAD
DOES NOT REFLECT TREATMENT AT SOURCE

FIG. 7

S.B.

some of the plants. Of the 515 million gallons per day of industrial waste discharged directly into the District approximately 433 million gallons per day or 85% receive some degree of treatment at source. This treatment is provided by 138 of the 306 plants involved. Unfortunately the nature of the survey to date does not permit the estimation of the reduction in pollutant loading accomplished by this treatment.

Practical considerations in the conduct of the survey have dictated the use of maximum potential pollution loads which when interpreted on the basis of the dilutions and dispersions available in the receiving waters, will point to those sections of the District where more extensive studies are required. In this fashion it is hoped that the amount of detailed investigation required will be materially reduced by eliminating from further consideration those sections of the District where even under the most critical conditions of maximum waste loading and minimum dilution and dispersion, obnoxious conditions are not created by the discharge of industrial wastes. For those sections where this is not the case, additional intensive studies will quantitatively reflect the effect of treatment at source.

Oxygen depleting substances consist primarily of putrescible organic matter. To reduce this matter to an innocuous state requires oxygen which is normally present in solution in receiving waters. If large enough quantities of putrescible matter are present, oxygen is consumed at a faster rate than the water is able to absorb additional oxygen from the atmosphere. The result is a reduction of the oxygen level in the water below that necessary to maintain fish life or below that needed to prevent the release of objectionable odors. All of the oxygen from approximately 5 billion gallons of normal unpolluted water is needed to satisfy the maximum potential daily requirements of 348,000 pounds (Figure 7) exerted by the oxygen depleting substances. In order to maintain an adequate oxygen residual necessary to maintain most fish life, 14 billion gallons of normal unpolluted water is needed each day or a quantity roughly equivalent to the average daily discharge of the Hudson River into New York Harbor.

It is customary to equate the oxygen depleting effect of industrial wastes with that of untreated domestic sewage. The daily per capita contribution of oxygen depleting substances in terms of the oxygen demand of these substances is approximately 0.17 pounds per day. On this basis, the maximum potential impact of the industrial waste discharge upon the District in terms of oxygen required to stabilize the

organic or putrescible matter is equal to that of the raw sanitary sewage discharged by 2,100,000 people, roughly the population of Manhattan Island or a city the size of Philadelphia.

The results of the survey indicate that the food, utilities, chemical and petroleum industries are the major sources of oxygen depleting wastes.

A maximum potential of 358,000 pounds of suspended solids carried in industrial wastes are discharged into the District each day. During the course of a year, sufficient solids may be discharged to fill a 100 square foot hole to a depth of more than two miles. The petroleum, food, chemical, stone, utilities, and paper industries are the primary source of this type of waste.

The maximum potential loads of poisonous or toxic wastes discharged directly into the District are approximately 10 tons of nonferrous metals, 18 tons of ferrous metals, 48 tons of acids, 3600 pounds of cyanides and 6000 pounds of phenolic compounds. In addition approximately 50 tons of fats, grease, and oils may be discharged each day. The dollar value of these discarded materials is approximately $4,000,000 per year though it may not at present be economically or technically feasible to recover these materials. In addition to this economic loss must be added the somewhat intangible losses resulting from the potential degradation of the receiving waters and adjoining shore areas both aesthetically and as a source of recreational pleasure.

Metallic and acid wastes originate in the primary and fabricated metals industries while cyanides and phenolic wastes are most common to the petroleum refining and utilities industries. Grease and oils are carried in the discharge of practically all industries though the petroleum refining, utilities and food industries are the greatest contributors.

The major portion of the acid and poison burden is imposed on the Bridgeport and New Haven Harbor areas primarily due to a concentration of metal working industries. The heaviest loadings of oxygen depleting substances, suspended solids, and greases and oils occur in the Arthur Kill, Newark Bay, Kill van Kull and the East River sections.

Particularly in reference to poisonous and acid wastes, the impact upon a stream is a function of the concentration of these substances in the stream rather than of the absolute quantities discharged

as expressed in pounds per day. In this respect, some difficulty arises out of the general lack of familiarity with the magnitude of concentrations which may create pollution.

As an example it is a common practice in many industries to consider solutions containing concentrations of materials of from 0.1% to 1% as negligible. Expressed in the language of stream pollution these would be equal to the concentrations of 1000 parts per million and 10,000 parts per million respectively. When it is realized that a concentration of 1 part per million of cyanide or 2 parts per million of copper in the stream may be toxic to aquatic life, the importance of grasping this concept of concentration can readily be seen.

The concentration of these substances in the stream is primary in evaluating potential pollutional effects and makes the determination of dilution and dispersion factors as well as the pollution load an essential part of a stream pollution study.

In so far as industrial waste discharges are concerned, examples of the geographical concentrations of the wastes and waste volumes have been cited above. Other areas may receive no industrial discharges.

In effect, the final analysis and interpretation of pollution data must be based upon consideration of local rather than District-wide conditions.

Summary

All waters are contaminated to varying degrees, the degree of contamination in conjunction with the established or expected uses of the water being the determining factors in indicating the need for corrective or preventive measures.

The degree or state of pollution in turn depends upon the balance between the rate at which pollutants are added and their neutralization by assimilation or dispersion in the stream.

The summary results presented offer an indication of the maximum potential rate at which pollutants are being added directly to the Interstate Sanitation District. However, much work remains to be done before the rate at which these pollutants are being removed or neutralized can be determined.

The solution to this problem will depend upon analyses and interpretations of conditions in local areas rather than on a District-wide basis. A detailed and technical presentation of the results appears under "Detailed Findings".

Survey Methods and Acknowledgements

The results summarized in this report represent approximately one and one half years of field work conducted by a full time staff of three technical men (chemist and two engineers). The project has been financed by an annual grant from the U. S. Public Health Service under the terms of Public Law 845; 80th Congress.

In the absence of foreknowledge as to which plants discharge their wastes directly into the Interstate Sanitation District, approximately 1500 plants have been visited in order to obtain the necessary information concerning the 306 plants with direct industrial waste discharges. Data obtained from those plants which discharge their wastes to public sewers will be the subject of further investigation.

In no instances have discharges from individual plants been sampled for purposes of anlysis and determination of waste strengths, since it is felt that adequate accuracy in such a procedure can be obtained only by long range sampling which would reflect hourly, daily, and seasonal variations, as well as variations in industrial processes or activities. Such a program applied to the large area under study would require so much time and personnel as to be impractical. Recourse has therefore been made to the published literature for information pertaining to strengths of wastes.

The States of New Jersey and Connecticut and the City of New York have graciously made available to the Commission the records of industrial waste inventories which they have conducted in areas draining into District waters. These records, where applicable, have been incorporated into this report. Acknowledgement is also made to the other municipal, state and federal agencies which have supplied information pertinent to the inventory, and especially to the management of the plants visited, without whose wonderful cooperation the inventory would not have been possible.

No less gratifying than the cooperation accorded the inventory by industry, has been the beneficial effect of the information brought before management concerning the purpose of the survey, factors contributing to stream and harbor pollution, methods of abatement and control, and similar matters.

DETAILED FINDINGS

Scope of Survey

According to the 1947 Census of Manufacturers published by the United States Department of Commerce, Bureau of the Census, there are approximately 29,000 industrial plants located in areas which drain into the waters of the Interstate Sanitation District. These installations are distributed along and inland from the 1,500 miles of shoreline which border the District.

From these figures, it is apparent that a task of considerable magnitude is involved in determining:

1. The location of each source of industrial waste.

2. The quantities, characters and strengths of such wastes.

3. Whether on the basis of 1 and 2, and in conjunction with data to be determined on dilution, dispersion and self purification, an industrial waste pollution problem requiring corrective measures exists either for

   a. The entire District, or

   b. Any specific localities within the District.

It was felt that a division of the project into several relatively independent studies, to be undertaken in a predetermined order based upon their importance, would assure the achievement of useful results should curtailment of funds or other exigencies bring a halt to the program at the end of a fiscal period. Therefore the overall program was divided into the following phases:

1. The determination of pollutional contributions of industries discharging directly into District waters via private sewers. This would involve an inventory of all industries located along the shoreline of the District.

2. The determination of pollutional contributions of industries discharging to public sewerage systems and thence to District waters, whether or not

passing through a sewage treatment plant. This would require an inventory of all industries located in areas draining into the Interstate Sanitation District; or the sampling and analysis of the effluents from each of the public outfalls into the District.

3. The determination of the industrial pollution loads being carried into District waters by streams tributary to the District, such as the Raritan, Passaic, Hackensack and Hudson Rivers. This would involve analysis of the streams at the points where they enter District waters.

4. An evaluation of the dilutions available in the District waters receiving industrial waste discharges, as well as a determination of the circulation patterns in these waters. On the basis of this evaluation the industrial waste data would then be interpreted to indicate those areas of the District where potentially obnoxious conditions exist due to the discharge of industrial wastes.

The intention of this report is to present in detail the results of the inventory of industries which discharge their wastes directly into the waters of the Interstate Sanitation District via private sewers. If finances permit the continuation of the survey subsequent reports will deal with the other phases outlined above.

No attempt has here been made to interpret these results to define the degree to which the District is polluted but rather these results will be used to indicate those areas which require more detailed study to determine the need for corrective action.

Sources of Information and Inventory Methods

Information on industrial wastes pertinent to the inventory has been obtained from several sources, including government agencies, private agencies, industries and the literature.

Various local and state agencies have generously made their files available to the Commission. The cooperation of private agencies such as chambers of commerce and various trade associations is gratefully acknowledged. Industrial directories published by public and private organizations have been useful in locating and enumerating the various industries with which we are concerned. The 1947 Census of Manufacturers for each of the States of New York, New Jersey and

Connecticut has served as an important source of information concerning the number of plants and their production employees. The literature has been used to obtain information concerning the strengths and characteristics of various trade wastes.

The basic information on industrial wastes has been obtained from industry by personal contact with management. Initially, careful consideration was given to the use of a mail questionnaire technique for obtaining the required data from industry. A pilot study was made to test the efficiency of this method and to determine the percentage of returns to be expected. The results of the study and the experience of the Connecticut State Water Commission, as well as that of various public and private agencies, led to the abandonment of this technique.

Instead, personal interviews with the management of each of the plants visited have been used to obtain the desired information. The educational rather than the coercive approach has been successfully employed to persuade management where they have been reluctant to supply needed data. Assurance that all information was to be treated confidentially to the extent that the names of individual plants would not be included in the published compilations and results has been of considerable help in this respect.

The excellent relationship that has been established with industry is most gratifying. Without this splendid cooperation progress would have been seriously delayed. Furthermore, the educational value of the survey in acquainting industry with industrial wastes problems with a resulting display of its interest, is a most significant gain derived from the inventory program.

To some degree this successful collaboration with industry can be attributed to the policy of providing for an indoctrination period prior to assignment to field work for each of the men who have worked on the survey. During this period the field men have been made familiar with the aims and methods of the survey. Stress has been placed on the fact that their contact with industrial management is not in the capacity of an inspector attempting to pry out secrets or violations, but rather in the capacity of a census taker working in cooperation with management to obtain the data necessary to achieve the goals of the survey. As a final step each new field man has accompanied an experienced worker in the field for approximately a week before going out on his own.

The staff assigned to the inventory has consisted of three technical men and a secretary. Of the staff, two of the men have been occupied full time in visiting plants and otherwise carrying on the required field work.

The third technical member of the staff has organized and directed the program under the general supervision of the Chief Engineer of the Commission. In addition the part time services of the permanent staff of the Interstate Sanitation Commission have been made available when needed.

The wide diversity of industries to be inventoried made necessary the use of a general questionnaire form adaptable to any industry. (See Figure 8 - Inventory Form). Information has been sought relating to the volumes and characteristics of the wastes without specifically measuring and analyzing effluent flows. The futility of depending upon a short term sampling program to determine accurately the volumes and characteristics of trade wastes is well recognized. With the limited personnel and time available, it was felt, therefore, that a satisfactory description of waste volumes and characteristics could be obtained by achieving an accounting of water consumption and water use in each of the plants visited. Likewise it was felt that a more satisfactory estimate of the waste strengths could be obtained through the use of the literature than from any spot sampling techniques that might be employed. Should subsequent evaluation of local conditions so dictate, it may be necessary, at a future date, to conduct detailed samplings at certain installations.

The specific procedure followed by the field men in any locality has been to first visit the municipal engineer and chamber of commerce and other industry associations to obtain all the information and available maps of locations of industry and sewerage systems in the community. All industrial plants located along the shoreline are visited, since no predetermination is possible as to whether wastes are being generated and discharged by a given plant. At each plant visited information is sought concerning water consumption (water bill in case of public water supply, and pump capacities where private supply or surface waters are utilized) and an analysis of the water usage. In addition information is sought as to any provision for waste treatment. Descriptions, both qualitative and quantitative, of raw materials, products and industrial processes are obtained to provide indications of the physical, chemical and biological characteristics of the waste flows.

Definition of Terms and General Remarks

The following definitions apply to terms used in this report:

1. Waste contributing plant- any plant whose effluent, other than sanitary sewage, is different in either

INTERSTATE SANITATION COMMISSION
110 William Street, N.Y. 7, N.Y.
Barclay 7-8443

INDUSTRIAL WASTE INVENTORY

STATE:_____ DATE:_____

COUNTY:_____ TYPE OF INDUSTRY:_____

MUNICIPALITY:_____ LOCATION ON MAP:_____

NAME OF COMPANY:_____

ADDRESS:_____ PHONE:_____

PERSON INTERVIEWED:_____

TOTAL EMPLOYEES:____ PRODUCTION EMPLOYEES:____ SHIFTS:____ DAYS:_____

PRODUCTS:_____

PRODUCTION:_____
(Units per Time)

RAW MATERIALS:_____
(Type & Quantity)

CHEMICALS:_____
(Type & Quantity)

WATER USAGE	FRESH	SALT	PLACE OF DISCHARGE	NATURE OF INDUSTRIAL WASTE
PRODUCT WATER				
SANITARY SEWAGE				
CLEAN DISCHARGE				
INDUSTRIAL WASTE				
TOTAL WATER				

WASTE TREATMENT_____

ANALYSES_____

REPORT BY:_____

INDUSTRIAL WASTE INVENTORY
Page 2

WATER SUPPLY

SOURCE	METERED	VOLUME	SOURCE	METERED	VOLUME
PUBLIC			STREAM		
WELL		(Units)			(Units)
		(Units)			(Units)

WATER USAGE IN G.P.D.

SANITARY SEWAGE:
(Includes cafeteria)

COOLING WATER:
LOSS TO ATMOSPHERE:
CLEAN DISCHARGE:
CONTAMINATED DISCHARGE:

BOILER WATER:
LOSS TO ATMOSPHERE:
CLEAN DISCHARGE:
CONTAMINATED DISCHARGE:

PROCESS WATER:
INCORPORATED IN PRODUCT:
EVAPORATED TO ATMOSPHERE:
INDUSTRIAL WASTE:

EQUIPMENT AND FLOOR CLEANUP WATER:

DESCRIPTION OF PROCESSES
PRODUCING INDUSTRIAL WASTE AND CONTAMINATED DISCHARGE

Figure 8 - INDUSTRIAL WASTE INVENTORY FORM

chemical, biological or physical characteristics from the plant influent. For the purpose of this report, temperature is not considered to be a physical characteristic. Commercial laundries, frequently considered as generating a domestic type of waste, are herein classified as industrial waste contributors.

2. Non-waste contributing plant- any plant whose effluent, other than sanitary sewage, is unchanged in chemical, biological, or physical (except for temperature) characteristics from the influent.

3. Industrial waste discharge- contaminated discharges from waste contributing plants emanating from industrial processes, cleaning operations, boiler blowdowns, etc.

4. Clean discharge- uncontaminated discharges from waste contributing plants emanating from such units as surface condensers and compressors, or steam condensate, etc. The sum of the industrial waste discharge and the clean discharge is equal to the industrial discharge.

5. Employees- production personnel. In general this is equivalent to hourly employees.

6. Treatment at source- refers to those plants which provide some degree of treatment before wastes are discharged. It does not reflect the adequacy or inadequacy of such treatment.

7. Waste disposal- method by which effluent is discharged to the Interstate Sanitation District.

8. Direct waste discharge- industrial waste discharge into the District via private sewers.

9. Indirect waste discharge- industrial waste discharge into the District via a public sewerage system with or without passage through a sewage treatment plant.

In evaluating the results to be presented, the following considerations should be kept in mind:

1. The data upon which these results are based were obtained during the period from January 1950 to June 1951.

2. While the tabulations represent the results of an approximately complete industrial waste inventory of the water front areas of the Interstate Sanitation District, some industrial sources of direct waste discharges such as oil storage depots, coal yards and concrete manufactories, as well as direct discharges from shipping, have not been included in the report. Industrial wastes from these sources are of an intermittent nature and may be made the subject of a special study. In addition plants such as power generating installations which discharge effluents unchanged except for increases in temperature are not included as waste contributors. These too may be made the subject of a separate study.

3. All quantitative information concerning the volumes of industrial discharges are based upon an analysis of water consumption (water bills and pumping rates) and water usage rather than upon actual waste flow measurements. For purposes of simplicity and uniformity these flows have all been expressed in terms of daily discharge. Most of the plants surveyed operate during an eight hour, five day week period, and it is during this operating period that the waste discharges are generated. However, those installations which account for the largest portion of the total discharge volume discharge their water twenty four hours per day and seven days per week.

4. Descriptions of waste characteristics are based upon qualitative information, while estimates of waste strengths have been derived through the use of the literature, no waste having been sampled for purposes of quantitative analysis. Though many of the plants provide at least a minimum degree of treatment before discharging their wastes, it has not been possible to estimate the effect of this treatment on the waste. Therefore the estimates of waste strengths shown in this report characterize the untreated or raw industrial waste.

Methods of Presentation of Results

Wherever possible results have been tabulated on both a geographical and an industrial basis, and where the data have been conducive to such treatment, the results have been presented graphically for simplicity and ease of interpretation.

For the geographical basis, summary results are presented by state, county, and according to the receiving body of water. Detailed results for each municipality and receiving body of water are given in the Appendix.

For the industrial basis, Volume 1 (Manufacturing Industries) of the Standard Industrial Classification Manual, (Nov. 1945) issued by the Bureau of the Budget has been used as a guide. Only major industrial classifications have been used in this report. The order in which these major industrial classifications are listed in the tables and illustrations follows that of the numerical codes which have been assigned to them by the Classification Manual. It should be understood that each major industrial classification covers a great variety of specific industries. Thus the food industry, as a major industrial classification, encompasses such specific industrial groups as manufacturers of meat products; diary products; canned and preserved vegetables, fruits and seafood; bakery products; beverages (soft drinks, malt, liquors, wines); and many miscellaneous food products. Likewise, the chemical industry major classification includes industrial organic and inorganic chemicals, soaps and glycerines and oils, paints and varnishes and inorganic colors, gum and wood chemicals, vegetable and animal oils and fats, etc.

Since the Standard Industrial Classification Manual does not include public utilities and the service industries (laundries, etc.) these groups which are significant waste contributors have been added.

Results

1. Plants visited.

The industrial waste inventory of 1,500 miles of shoreline of the Interstate Sanitation District has involved visiting approximately 1,500 plants.

Among these plants are represented industries of all types ranging from food processing to public utilities. The most frequently encountered in these coastal areas are chemical plants, fabricated metals plants, food plants and apparel plants. Along the coastlines of the counties which border the District the number of plants range from 5 along the shoreline of Essex County to 285 along the shore of Kings County (Brooklyn).

There appears to be a tendency for particular industries to be concentrated in certain coastal localities. Thus, chemical

plants are most numerous in Kings and Hudson Counties with secondary concentrations occurring in Westchester and Fairfield Counties. Fabricated metals plants are concentrated in Fairfield County. Kings County (Brooklyn) has the greatest number of food plants, followed by Hudson, Westchester and Queens Counties.

A summary of the plants visited classified according to industry and location is shown in Table 2. In addition Table 2 shows the number of plants visited which discharge waterborne industrial wastes.

Of all the plants visited 742 or 49.5% are waste contributors. From the tabulation it can be seen that none of the 123 apparel plants visited discharges an industrial waste. At the other extreme, of the 62 service plants (laundries, dry cleaners, etc.) visited, 98% are waste contributors. Figure 9 illustrates the percentage of plants visited which are waste contributors in each industrial classification.

Data obtained from the 742 waste contributing plants are shown in Tables 3 and 4, Table 3 indicating the geographical and industrial distributions of the waste contributing plants and the wastes discharged, while Table 4 indicates similar distributions for the methods of disposal of the wastes discharged.

These results represent approximately complete coverage of plants which discharge directly into the waters of the District, but less than 5% of the plants which discharge indirectly. The vast majority of plants which discharge their wastes into municipal sewerage systems are located inland from District waters and therefore were not surveyed in this phase of the inventory.

It is with the results obtained from the plants discharging directly into the District waters that this report is primarily concerned. It is hoped that the inventory of inland areas draining into District waters will be completed so that data pertaining to directly discharging plants can be made the subject of subsequent reports.

The incomplete data on plants discharging indirectly, however, does offer a tentative basis for comparison of the

TABLE 2 - PLANTS VISITED

Industry	NEW YORK STATE										NEW JERSEY							CONN.			Total
	Total N.Y.	Bronx	Kings	Nassau	New York	Queens	Richmond	Rockland	Suffolk	Westchester	Total N.J.	Bergen	Essex	Hudson	Middlesex	Monmouth	Union	Total Conn	Fairfield	New Haven	
Food-Plants visited	141	22	55	3	7	15	6	4	6	23	29	1	1	25	0	0	2	6	5	1	176
Waste contrib. plants	121	19	43	3	6	15	6	3	5	21	23	1	1	19	0	0	2	4	3	1	148
Tobacco-Plants visited	1	0	1	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3
Waste contrib. plants	1	0	1	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3
Textiles-Plants visited	46	7	15	0	0	4	2	9	1	8	3	0	0	1	1	0	1	14	11	3	63
Waste contrib. plants	28	3	11	0	0	1	1	5	1	6	2	0	0	1	0	0	1	9	7	2	39
Apparel-Plants visited	91	15	25	3	20	8	5	0	0	15	13	0	0	10	3	0	0	19	12	7	123
Waste contrib. plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lumber-Plants visited	2	1	0	0	0	1	0	0	0	0	3	0	2	0	1	0	0	1	1	0	6
Waste contrib. plants	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	2
Furniture-Plants visited	39	14	5	6	1	2	1	0	2	8	3	0	0	1	0	1	1	3	3	0	45
Waste contrib. plants	5	1	2	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	6
Paper-Plants visited	46	9	31	0	0	1	1	1	0	3	8	0	0	7	0	0	1	3	1	2	57
Waste contrib. plants	19	2	14	0	0	0	1	1	0	1	5	0	0	5	0	0	0	2	0	2	26
Printing-Plants visited	36	6	12	1	2	1	0	0	1	13	1	0	0	1	0	0	0	6	6	0	43
Waste contrib. plants	15	1	5	0	2	1	0	0	1	5	1	0	0	1	0	0	0	3	3	0	19
Chemicals-Plants visited	142	21	42	1	6	17	16	1	2	36	75	5	2	38	13	2	15	27	25	2	244
Waste contrib. plants	73	9	21	1	4	8	13	1	0	16	57	5	2	23	12	2	13	13	12	1	143
Petroleum-Plants visited	7	0	4	0	0	1	1	1	0	0	13	0	0	5	4	0	4	2	1	1	22
Waste contrib. plants	5	0	2	0	0	1	1	1	0	0	12	0	0	4	4	0	4	2	1	1	19
Rubber-Plants visited	6	1	2	0	0	1	1	0	0	1	0	0	0	0	0	0	0	9	5	4	15
Waste contrib. plants	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Leather-Plants visited	4	0	4	0	0	0	0	0	0	0	1	0	0	1	0	0	0	4	4	0	9
Waste contrib. plants	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
Stone-Plants visited	35	9	7	1	0	7	4	2	0	5	4	0	0	1	0	2	1	9	3	6	48
Waste contrib. plants	17	5	2	0	0	2	2	2	0	4	3	0	0	1	0	2	0	4	3	1	24
Primary Met.-Plants visited	27	5	8	3	0	2	1	0	0	8	11	1	0	4	4	0	2	18	13	5	56
Waste contrib. plants	14	2	4	1	0	2	1	0	0	4	6	1	0	0	4	0	1	7	6	1	27
Fabric.Met.-Plants visited	111	30	29	6	2	10	2	1	6	25	17	0	0	12	4	0	1	60	48	12	188
Waste contrib. plants	45	6	13	3	1	4	0	1	5	12	6	0	0	4	2	0	0	25	20	5	76
Machinery-Plants visited	52	14	6	3	0	3	5	1	3	17	6	0	0	4	0	0	2	29	26	3	87
Waste contrib. plants	8	1	2	1	0	1	0	1	0	2	3	0	0	2	0	0	1	16	16	0	27
Elect. Mach.-Plants visited	43	7	10	2	1	1	0	1	0	21	5	0	0	3	0	1	1	12	11	1	60
Waste contrib. plants	12	2	5	1	0	0	0	0	0	4	2	0	0	1	0	0	1	8	7	1	22
Transportation-Plants visited	19	3	4	1	0	1	1	1	2	6	3	1	0	0	1	1	0	5	3	2	27
Waste contrib. plants	7	1	1	1	0	0	0	0	1	3	2	1	0	0	1	0	0	4	2	2	13
Instruments-Plants visited	22	2	5	0	0	1	1	0	2	11	0	0	0	0	0	0	0	6	5	1	28
Waste contrib. plants	9	0	1	0	0	1	1	0	0	6	0	0	0	0	0	0	0	3	3	0	12
Misc. Mfg.-Plants visited	83	25	13	10	0	9	6	1	4	15	11	0	0	9	0	2	0	15	14	1	109
Waste contrib. plants	29	7	5	3	0	5	1	1	3	4	9	0	0	8	0	1	0	5	5	0	43
Utilities-Plants visited	20	1	4	2	0	4	2	2	3	2	4	0	0	2	1	0	1	6	4	2	30
Waste contrib. plants	17	1	4	0	0	4	2	2	2	2	4	0	0	2	1	0	1	6	4	2	27
Service-Plants visited	56	16	3	7	1	2	4	3	3	17	5	0	0	4	0	1	0	1	1	0	62
Waste contrib. plants	55	16	3	7	1	2	4	3	3	16	5	0	0	4	0	1	0	1	1	0	61
Totals-Plants visited	1,029	208	285	49	40	91	59	28	35	234	217	8	5	130	32	10	32	255	202	53	1,501
Waste contrib. plants	483	76	140	22	14	48	34	21	21	107	146	8	4	78	25	6	25	113	93	20	742

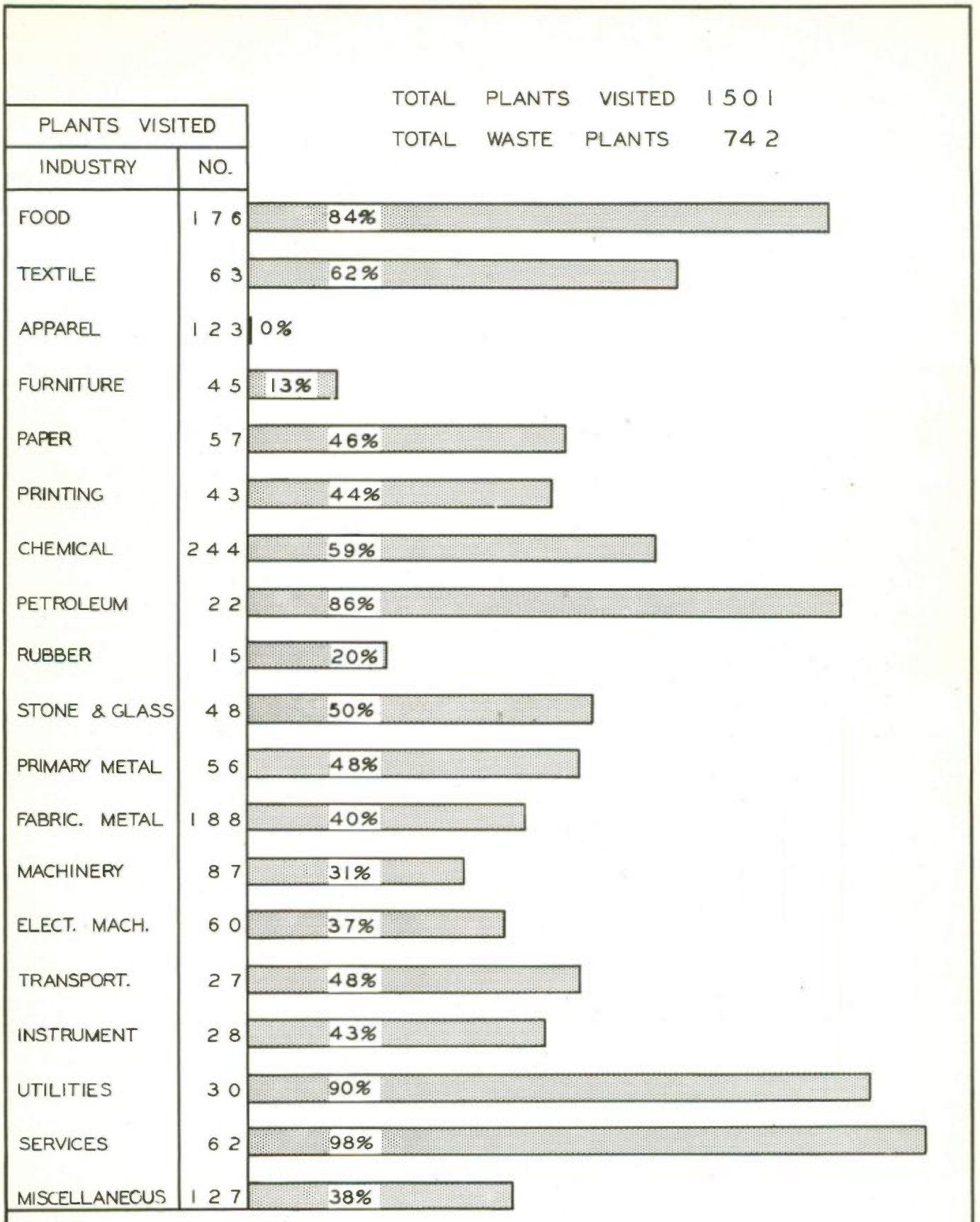


FIG. 9 WASTE CONTRIBUTING PLANTS IN EACH INDUSTRY

SB

TABLE 3 - DISTRIBUTION OF PLANTS VISITED [1] & WASTES DISCHARGED

	No. of Plants [2]	Production Employees	Discharge - MGD [2] Waste	Clean	Discharge - GPD Per Employee Waste	Clean	Waste Disposal - Number of Plants To Stream Priv. Sewer	To Stream Pub. Sewer	To Sewage Treat. Plant	Treatment [2] at Source
A. GEOGRAPHICAL DISTRIBUTION										
Bronx County	76	6,853	1.38	22.22	205	3,270	4	30	41	6
Kings County	140	31,141	42.26	58.88	1,360	1,875	55	79	6	24
Nassau County	22	955	.21	.03	220	31	6	0	10	12
New York County	14	3,837	.67	.72	175	188	0	12	2	1
Queens County	48	11,763	18.65	128.22	1,585	10,900	27	11	7	20
Richmond County	34	4,149	10.59	320.84	2,550	77,200	19	14	0	7
Rockland County	21	2,231	8.89	36.58	3,985	16,400	15	0	6	3
Suffolk County	21	926	57.89	.31	62,500	335	12	0	4	13
Westchester County	107	13,939	5.32	47.38	380	3,400	17	14	73	23
Total New York State	483	75,794	145.84	615.18	1,920	8,125	155	160	149	109
Bergen County	8	7,345	10.34	29.03	1,410	3,960	7	1	0	6
Essex County	4	250	5.48	1.47	21,900	5,850	2	1	0	4
Hudson County	78	25,562	120.76	16.85	4,725	660	38	40	0	25
Middlesex County	25	7,993	14.83	175.33	1,860	21,000	18	2	8	13
Monmouth County	6	611	14.67	2.34	24,000	3,820	5	0	1	4
Union County	25	16,473	209.23	58.93	12,700	3,580	13	11	0	19
Total New Jersey	146	58,234	375.31	283.95	6,440	4,890	83	55	9	71
Fairfield County	93	42,674	17.60	22.60	415	530	52	7	32	42
New Haven County	20	7,841	10.38	261.19	1,325	33,300	16	2	3	11
Total Connecticut	113	50,515	27.98	283.79	555	5,610	68	9	35	53
Total	742	184,543	549.13	1,182.92	2,975	6,420	306	224	193	233
B. INDUSTRIAL DISTRIBUTION										
Food	148	25,950	18.96	57.04	730	2,200	53	59	35	35
Tobacco	3	1,070	.02	.09	19	84	3	0	0	0
Textile	39	5,822	4.89	.24	840	41	20	9	10	5
Lumber	2	103	.01	0	97	0	1	1	0	1
Furniture	6	1,833	.01	.15	5	82	2	2	1	2
Paper	26	7,708	14.08	.48	1,825	62	8	16	3	2
Printing	19	4,120	.14	.16	34	39	1	10	7	2
Chemicals	143	21,073	62.34	92.41	2,960	4,380	66	47	26	53
Petroleum	19	12,272	337.77	18.36	27,800	1,495	16	3	1	16
Rubber	3	1,691	.38	.12	225	71	2	0	1	2
Leather	2	285	.14	.01	490	35	1	1	0	1
Stone, clay & glass	24	3,038	6.45	.71	2,120	234	15	4	3	12
Primary metals	27	17,424	12.84	81.58	740	4,675	18	2	7	11
Fabricated metals	76	15,678	10.97	4.71	700	300	30	19	25	26
Machinery	27	20,839	1.17	1.76	56	84	13	6	7	10
Electrical Machinery	22	10,492	1.18	2.63	113	250	3	9	8	6
Transportation	13	18,634	.79	1.13	42	61	11	1	1	5
Instruments	12	2,440	.16	.75	66	310	4	1	7	4
Miscellaneous Mfg.	43	6,784	.49	.66	72	98	11	13	13	17
Utilities	27	5,043	74.34	919.83	14,750	182,000	25	1	1	20
Service	61	2,866	2.02	.02	705	7	3	20	37	3
Totals	742	185,165	549.15	1,182.84	2,975	6,420	306	224	193	233

(1) Waste contributing plants only

(2) Includes 24 plants discharging to earthen basins .09 MGD waste and .28 MGD clean. All of these plants are considered as having treatment at source.

TABLE 4 - METHODS OF DISPOSAL OF WASTES

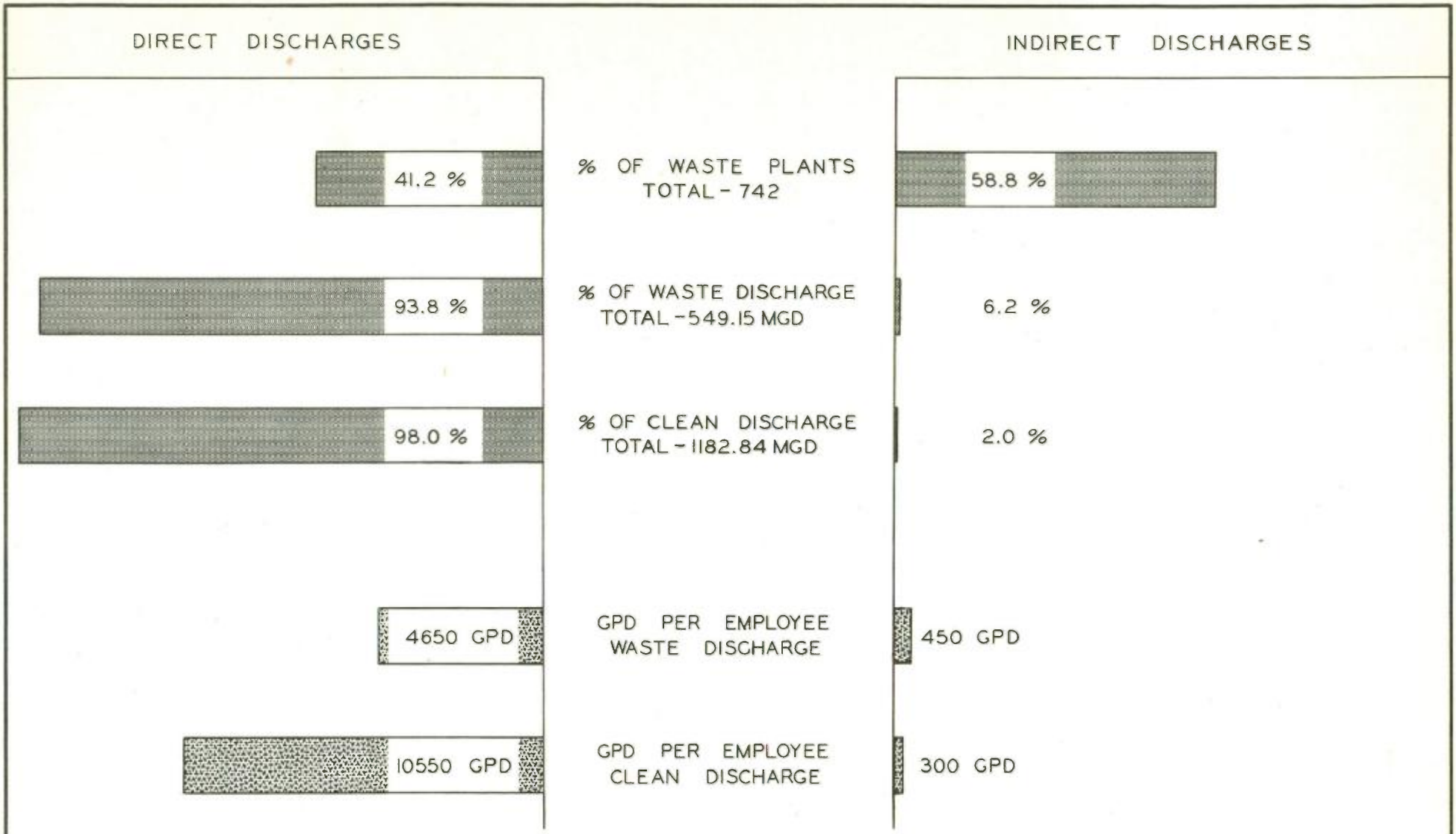
	Private Sewer to Stream					Public Sewer to Stream					Public Sewer to Treatment Plant				
	No. of Plants	Discharges-MGD Waste	Clean	Treatment at Source Plants	Vol. MGD	No. of Plants	Discharges-MGD Waste	Clean	Treatment at Source Plants	Vol. MGD	No. of Plants	Discharges-MGD Waste	Clean	Treatment at Source Plants	Vol. MGD
A. GEOGRAPHICAL DISTRIBUTION															
Bronx County	4	0.70	22.00	3	0.69	30	0.22	0.04	2	0.01	41	0.47	0.18	0	0
Kings County	55	39.88	54.41	13	33.23	79	2.25	4.41	11	0.50	6	0.14	*	0	0
Nassau County	6	0.07	0	4	0.04	0					10	0.14	0.03	2	0.06
New York County						12	0.27	0.31	1	0.10	2	0.40	0.41	0	0
Queens County	27	18.12	126.81	14	17.31	11	0.39	1.37	2	0.22	7	0.14	0	1	0.01
Richmond County	19	9.14	320.74	5	6.39	14	1.45	0.09	1	0.71	0				
Rockland County	15	8.86	36.55	3	3.54	0					6	0.04	0.04	0	0
Suffolk County	12	57.72	0.30	8	0.51	0					4	0.16	0	0	0
Westchester County	17	4.19	46.75	7	2.74	14	0.10	0.23	1	0.05	73	1.03	0.39	12	0.23
Total New York State	155	138.68	607.56	57	64.45	160	4.68	6.45	18	1.59	149	2.52	1.05	15	0.30
Bergen County	7	9.56	26.38	5	7.81	1	0.78	2.65	1	0.78	0				
Essex County	2	5.48	1.41	2	5.48	1	*	0	1	*	0				
Hudson County	38	104.50	9.72	15	103.95	40	16.26	7.13	10	7.97	0				
Middlesex County	18	13.72	174.81	10	12.92	2	0.01	0.02	1	0.01	8	1.10	0.50	3	0.18
Monmouth County	5	14.66	2.34	4	14.66	0					1	0.01	0	0	0
Union County	13	208.19	58.73	11	205.75	11	1.03	0.19	7	0.31	0				
Total New Jersey	83	356.11	273.39	47	350.57	55	18.08	9.99	20	9.07	9	1.11	0.50	3	0.18
Fairfield County	52	9.93	18.10	24	7.84	7	0.93	0.29	3	0.74	32	6.68	4.03	12	5.57
New Haven County	16	10.32	261.15	10	9.74	2	0.01	0.01	1	0.01	3	0.05	0.03	0	0
Total Connecticut	68	20.25	279.25	34	17.58	9	0.94	0.30	4	0.75	35	6.73	4.06	12	5.57
Total	306	515.04	1160.20	138	432.60	224	23.70	16.74	42	11.41	193	10.36	5.61	30	6.05
B. INDUSTRIAL DISTRIBUTION															
Food	53	15.34	54.21	17	11.51	59	2.82	2.19	10	1.36	35	0.81	0.62	7	0.16
Tobacco	3	0.02	0.09	0	0	0					0				
Textile	20	4.29	0.22	4	0.67	9	.10	0.01	0	0	10	0.50	0.01	1	0.08
Lumber	1	0.01	0	0	0	1	*	0	1	*	0				
Furniture	2	0.01	0.15	1	*	2	0.01	0	0	0	1	*	0	0	0
Paper	8	6.66	0.01	2	4.62	16	7.39	0.46	0	0	3	0.03	0	0	0
Printing	1	*	0.04	1	*	10	0.11	0.07	0	0	7	0.03	0.04	0	0
Chemicals	66	51.91	79.57	30	44.15	47	10.11	12.50	14	8.92	26	0.28	0.27	4	0.09
Petroleum	16	336.97	18.24	13	336.92	3	0.72	0.13	2	0.05	1	0.09	0	1	0.09
Rubber	2	0.30	0.12	2	0.30	0					1	0.08	0	0	0
Leather	1	0.14	*	1	0.14	1	*	0.01	0	0	0				
Stone, clay and glass	15	6.39	0.52	9	4.45	4	0.04	0.19	0	0	3	0.02	*	1	0.01
Primary metals	18	12.03	81.12	9	9.93	2	0.02	0.02	1	*	7	0.80	0.45	1	0.02
Fabricated metals	30	4.79	3.03	13	2.46	19	0.78	0.12	6	0.70	25	5.40	1.57	4	5.25
Machinery	13	0.68	0.44	5	0.54	6	0.27	0.78	3	0.26	7	0.22	0.53	1	0.20
Electrical machinery	3	0.06	0.62	0	0	9	0.32	0.12	0	0	8	0.78	1.79	4	0.07
Transportation	11	0.75	1.12	5	0.19	1	*	0	0	0	1	0.03	*	0	0
Instruments	4	0.14	0.73	3	0.08	1	*	0	0	0	7	0.02	0.01	1	*
Miscellaneous	11	0.10	0.19	3	0.01	13	0.22	0.11	4	0.08	13	0.15	0.31	4	0.06
Utilities	25	74.32	919.78	19	16.62	1	0.02	0.05	0	0	1	0.01	0	1	0.01
Service	3	0.12	0	1	0.02	20	0.82	*	1	0.05	37	1.10	0.01	0	0
Total	306	515.03	1160.20	138	432.62	224	23.77	16.76	42	11.43	193	10.35	5.62	30	6.04

* Less than 5,000 gallons per day

characteristics of plants with different methods of waste disposal. From Table 3 it can be seen that of the 742 waste contributing plants visited, 306 or 41.2% discharge directly into the District via private sewers, while the remaining 436 or 58.2% dispose of their wastes by discharging to public sewerage systems or earthen basins. Though accounting for only 41.2% of the waste contributing plants visited Table 4 shows that directly discharging plants discharge 515 million gallons per day of industrial waste or 93.8% of the total, as against 34 million gallons per day, or 6.2% of the total, discharged by the remaining 436 plants. Similarly for clean discharges, plants discharging directly into the District account for 1,160 mgd or 98% of the total clean discharge, whereas all other plants discharge 23 mgd or 2% of the total. Expressed in terms of production employees 4,650 gallons of waste per employee per day are generated in directly discharging plants, as against 450 gallons per employee per day for indirectly discharging plants. For clean discharges the respective figures are 10,550 and 300. These comparisons are illustrated in Figure 10 and serve to emphasize the uniqueness of the plants which discharge their waste directly into the Interstate Sanitation District.

On a much broader base, these comparisons may be further substantiated by the following considerations. Since more than 90% of the industrial discharge of 1,675 mgd (515 mgd waste and 1,160 mgd clean) by the 306 plants disposing directly into the District is salt water originally pumped from the District, this flow is not reflected in the value of 1,600 mgd which represents the total "domestic flow" in the areas draining into District waters and which is based upon public water supply and well water consumption. However, the 1,600 mgd of "domestic flow" does include the discharges of almost all industries which dispose of their wastes via public sewers. On the assumption that the proportion of waste producing plants to non- waste producing plants among the 29,000 plants located in areas draining into the District waters is approximately 50%, as indicated in Figure 9, then there are some 14,000 plants located inland from the waters of the District which dispose of their industrial wastes via public sewers, and whose discharge volumes are reflected in the "domestic flow" figure.

Thus, even if sanitary wastes are ignored, and the total "domestic flow" is assigned to industry, 14,000 plants with



COMPARISON OF PLANTS DISCHARGING WASTES DIRECTLY INTO I.S.D. WITH PLANTS DISCHARGING TO MUNICIPAL SEWER SYSTEMS

FIG. 10

S.B.

indirect methods of disposal are discharging 1,600 mgd as against 1,675 mgd for the 306 directly discharging plants.

2. Direct Discharges

a. Geographical and Industrial Distribution of Directly Discharging Plants

The 306 plants discharging their industrial wastes directly into the Interstate Sanitation District are found along the shoreline of the District in concentrations ranging from no directly discharging plants in New York County (Manhattan) to 52 in Fairfield County and 55 in Kings County (see Figure 2). Industrially, each of the lumber, printing and leather industries has only one plant discharging directly into the District, whereas there are 66 chemical plants and 53 food plants with direct discharges.

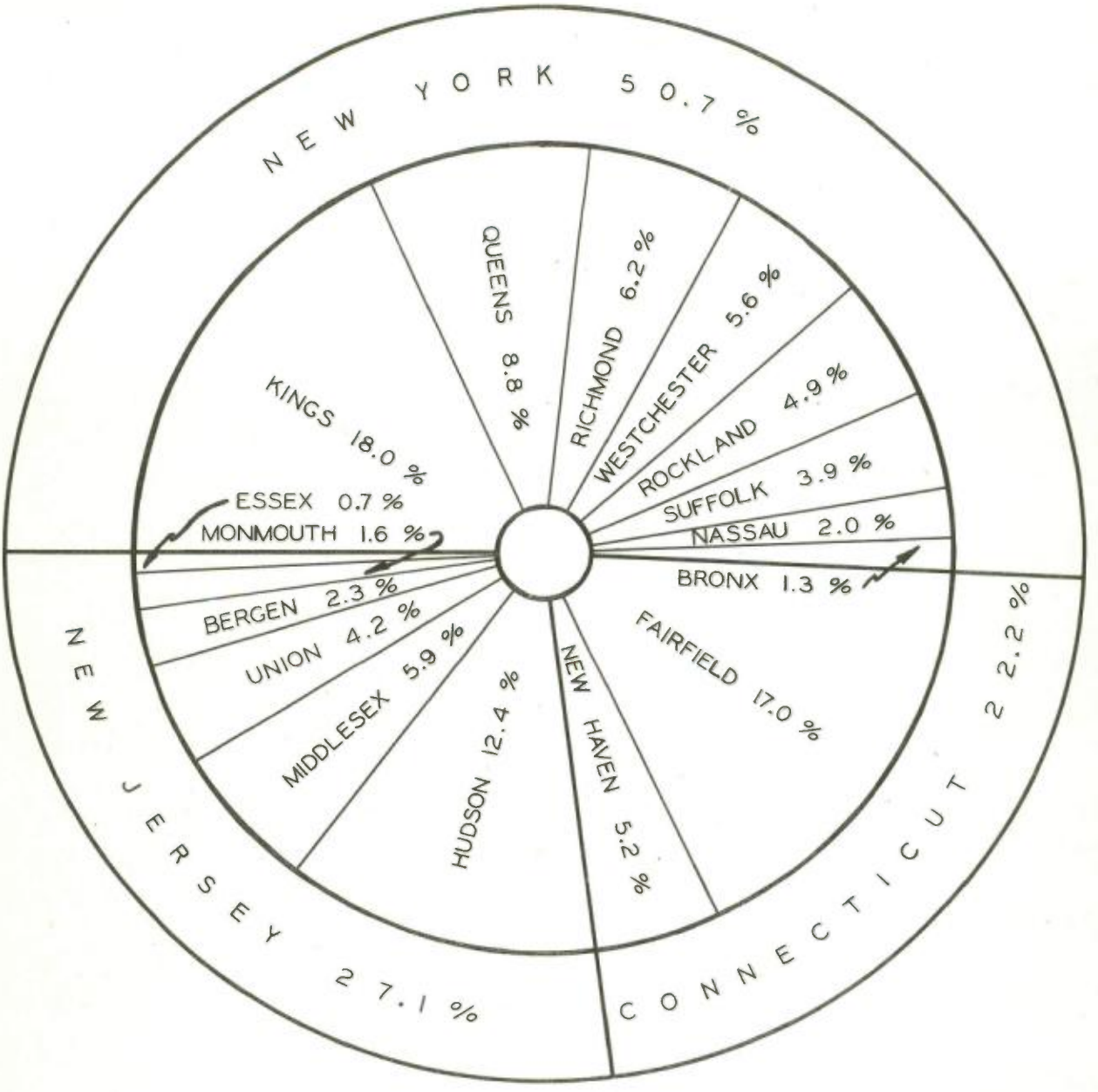
A summary of the geographical and industrial distribution of these plants is shown in Table 5 while Figures 3 and 11 illustrate the percentage distributions. Located on that portion of the New York State coastline which borders the District are 155 plants or 55.7% of the total. In New Jersey there are 83 plants and in Connecticut 68, or 27.1% and 22.2% respectively.

The 66 chemical plants referred to above account for 21.6% of all directly discharging plants, and the 53 food plants represent 17.3% of the total. Thirty, or 9.8%, are fabricated metals plants and 25, or 8.2%, are public utilities plants.

Of the 66 chemical plants the greatest concentration is in New Jersey, particularly along the shorelines of Hudson, Union and Middlesex Counties. Food plants are centered in New York State, chiefly in Kings County with a secondary concentration in Hudson County, New Jersey. Fabricated metal plants are most frequent in Fairfield County, Connecticut, while public utility plants are most numerous in New York State with a fairly uniform distribution among the counties other than New York.

Table 5 - GEOGRAPHICAL AND INDUSTRIAL DISTRIBUTION OF PLANTS discharging directly into the INTERSTATE SANITATION DISTRICT

			New York State								New Jersey State							Connecticut		
		TOTAL	Total N.Y.	Bronx	Kings	Nassau	Queens	Richmond	Rockland	Suffolk	Westchester	Total N.J.	Bergen	Essex	Hudson	Middlesex	Monmouth	Union	Total Conn.	Fairfield	New Haven
Food -	No. of Plants	53	35	0	21	0	6	0	1	5	2	17	1	1	15	0	0	0	1	1	0
	Employees	15,135	8,495	0	5,535	0	1,380	0	5	175	1,400	6,630	450	130	6,050	0	0	0	10	10	0
Tobacco -	No. of Plants	3	1	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0
	Employees	1,070	90	0	90	0	0	0	0	0	0	980	0	0	980	0	0	0	0	0	0
Textiles -	No. of Plants	20	15	0	6	0	1	1	5	0	2	0	0	0	0	0	0	0	5	4	1
	Employees	2,050	1,440	0	215	0	300	60	560	0	305	0	0	0	0	0	0	0	610	555	55
Lumber -	No. of Plants	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
	Employees	75	0	0	0	0	0	0	0	0	0	75	0	0	0	75	0	0	0	0	0
Furniture -	No. of Plants	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
	Employees	1,630	30	0	30	0	0	0	0	0	0	1,600	0	0	0	0	0	1,600	0	0	0
Paper -	No. of Plants	8	5	0	4	0	0	0	1	0	0	1	0	0	1	0	0	0	2	0	2
	Employees	3,120	1,425	0	425	0	0	0	1,000	0	0	150	0	0	150	0	0	0	1,545	0	1,545
Printing -	No. of Plants	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
	Employees	1,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,500	1,500	0
Chemicals -	No. of Plants	66	27	0	8	1	5	9	1	0	3	33	4	1	11	9	2	6	6	5	1
	Employees	8,490	2,355	0	260	10	735	1,125	70	0	155	5,520	870	70	1,350	1,280	125	1,825	615	580	35
Petroleum -	No. of Plants	16	5	0	2	0	1	1	1	0	0	9	0	0	2	4	0	3	2	1	1
	Employees	11,795	1,250	0	755	0	300	185	10	0	0	9,955	0	0	4,470	1,070	0	4,415	590	250	340
Rubber -	No. of Plants	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1
	Employees	1,070	120	0	0	0	0	120	0	0	0	0	0	0	0	0	0	0	950	0	950
Leather -	No. of Plants	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
	Employees	220	0	0	0	0	0	0	0	0	0	220	0	0	220	0	0	0	0	0	0
Stone -	No. of Plants	15	9	1	1	0	1	2	2	0	2	2	0	0	0	0	2	0	4	3	1
	Employees	2,490	820	25	25	0	30	415	220	0	105	275	0	0	0	0	275	0	1,395	1,340	55
Primary Met.	No. of Plants	18	7	0	1	1	2	1	0	0	2	4	1	0	0	2	0	1	7	6	1
	Employees	14,840	2,350	0	10	170	1,005	450	0	0	715	6,100	2,400	0	0	2,500	0	1,200	6,390	5,460	930
Fabric Met.	No. of Plants	30	13	1	3	1	4	0	1	2	1	2	0	0	1	1	0	0	15	12	3
	Employees	9,170	1,100	5	250	75	625	0	55	85	5	85	0	0	80	5	0	0	7,985	5,790	2,195
Machinery -	No. of Plants	13	3	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	9	9	0
	Employees	9,560	190	0	100	0	55	0	0	0	35	4,170	0	0	0	0	0	4,170	5,200	5,200	0
Elec.Mach. -	No. of Plants	3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	1	1
	Employees	1,320	0	0	0	0	0	0	0	0	0	200	0	0	200	0	0	0	1,120	750	370
Trans-	No. of Plants	11	6	0	1	1	0	0	0	1	3	1	1	0	0	0	0	0	4	2	2
portation -	Employees	18,295	13,365	0	10,000	5	0	0	0	40	3,320	3,400	3,400	0	0	0	0	0	1,530	1,000	530
Instruments	No. of Plants	4	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	2	0
	Employees	1,500	1,100	0	350	0	0	750	0	0	0	0	0	0	0	0	0	0	400	400	0
Misc. Mfg. -	No. of Plants	11	6	1	0	0	2	1	1	1	0	4	0	0	3	0	1	0	1	1	0
	Employees	1,595	955	250	0	0	615	5	20	65	0	590	0	0	390	0	200	0	50	50	0
Utilities -	No. of Plants	25	16	1	4	0	4	2	2	2	1	3	0	0	1	1	0	1	6	4	2
	Employees	5,020	4,035	880	1,275	0	1,540	110	40	100	90	410	0	0	225	100	0	85	575	360	215
Service -	No. of Plants	3	3	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Employees	95	95	0	0	60	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0
Totals -	No. of Plants	306	155	4	55	6	27	19	15	12	17	83	7	2	38	18	5	13	68	52	16
	Employees	110,040	39,215	1,160	19,320	320	6,585	3,220	1,980	500	6,130	40,360	7,120	200	14,115	5,030	600	13,295	30,465	23,245	7,220



TOTAL PLANTS = 306

GEOGRAPHICAL DISTRIBUTION OF WASTE PRODUCING PLANTS

DISCHARGING DIRECTLY INTO DISTRICT WATERS

FIG. 11

S.B.

b. Direct Discharge Volumes

Directly discharging plants generate 515 million gallons per day of waterborne wastes and 1,160 million gallons per day of clean effluent. The geographical and industrial distribution of these discharges are shown in Table 6 and Figures 4, 5 and 12.

Examination of these tables and figures reveals that 69.2% of the total waste discharge of 515 million gallons per day is generated in the State of New Jersey, particularly in Hudson and Union Counties. For clean discharges New York State accounts for 52.5% of the total of 1,160 million gallons per day, Richmond County alone accounting for 321 mgd or 27.7%.

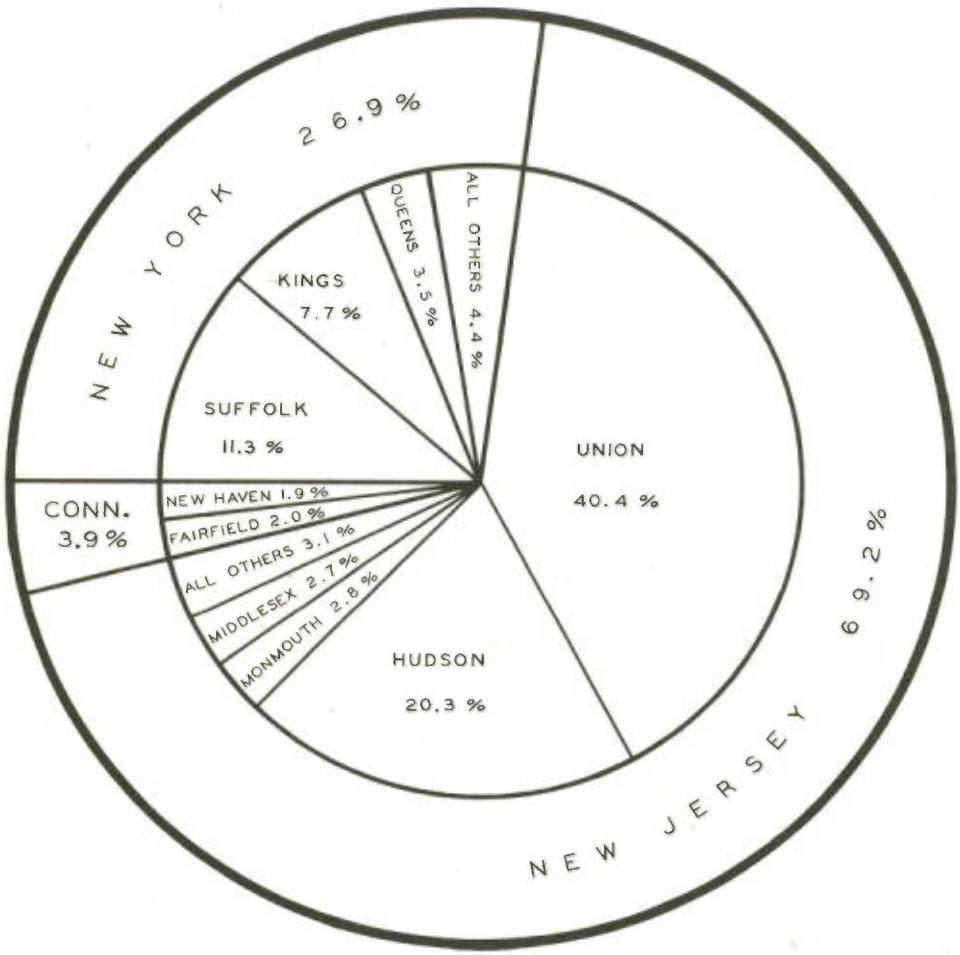
On the basis of industrial distribution, the petroleum industry discharges 65.4% of the total discharge of 515 mgd, while public utilities generate 79% of the total clean discharge of 1,160 mgd. This would indicate either a large number of such plants or the presence of a very large (in terms of volume discharged) installations of the petroleum industry in Hudson and Union Counties, and of public utilities in Richmond County. The detailed data corroborates the presence of a relatively few large installations in each of these counties.

As a further illustration that the major sources of discharges are the petroleum and public utility industries and to indicate the relative waste and clean discharges of the other industries, Table 7 has been prepared showing the average discharge per plant for each industry, as well as the gallons per employee per day discharge for each industry. The 16 petroleum industry plants with direct discharge have an average waste discharge per plant of 21 mgd and an average clean discharge of better than 1 mgd. This is equivalent to a discharge in terms of gallons per employee per day of 28,400 waste and 1,550 clean. For the 25 public utility plants, the average discharge is approximately 3 mgd waste and 37 mgd clean, while the daily employee contribution amounts to 14,850 gallons of waste and 184,000 gallons of clean. The high clean discharge values in utility plants reflect the use of very large volumes of water for cooling purposes in power generating plants. In the

Table 6
SUMMARY OF DATA OF PLANTS
discharging directly into the
INTERSTATE SANITATION DISTRICT

A - Location	No. of Plants	Production Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source Plants	Treatment at Source Vol. MGD
Bronx	4	1,160	0.70	22.00	3	0.69
Kings	55	19,320	39.88	54.41	13	33.23
Nassau	6	320	0.07	0	4	0.04
New York	0	0	0	0	0	0
Queens	27	6,585	18.12	126.81	14	17.31
Richmond	19	3,220	9.14	320.74	5	6.39
Rockland	15	1,980	8.86	36.55	3	3.54
Suffolk	12	500	57.72	0.30	8	0.51
Westchester	17	6,130	4.19	46.75	7	2.74
Total New York State	155	39,215	138.68	607.56	57	64.45
Bergen	7	7,120	9.56	26.38	5	7.81
Essex	2	200	5.48	1.41	2	5.48
Hudson	38	14,115	104.50	9.72	15	103.95
Middlesex	18	5,030	13.72	174.81	10	12.92
Monmouth	5	600	14.66	2.34	4	14.66
Union	13	13,295	208.19	58.73	11	205.75
Total New Jersey	83	40,360	356.11	273.39	47	350.57
Fairfield	52	23,245	9.93	18.10	24	7.84
New Haven	16	7,220	10.32	261.15	10	9.74
Total Connecticut	68	30,465	20.25	279.25	34	17.58
Total	306	110,040	515.04	1,160.20	138	432.60
B - Industry						
Food	53	15,135	15.34	54.21	17	11.51
Tobacco	3	1,070	0.02	0.09	0	0
Textile	20	2,050	4.29	0.22	4	0.67
Lumber	1	75	0.01	0	0	0
Furniture	2	1,630	0.01	0.15	1	*
Paper	8	3,120	6.66	0.01	2	4.62
Printing	1	1,500	*	0.04	1	*
Chemicals	66	8,490	51.91	79.57	30	44.15
Petroleum	16	11,795	336.97	18.24	13	336.92
Rubber	2	1,070	0.30	0.12	2	0.30
Leather	1	220	0.14	*	1	0.14
Stone, clay	15	2,490	6.39	0.52	9	4.45
Primary metals	18	14,840	12.03	81.12	9	9.93
Fabric. metals	30	9,170	4.79	3.03	13	2.46
Machinery	13	9,560	0.68	0.44	5	0.54
Electric Mach.	3	1,320	0.06	0.62	0	0
Transportation	11	18,295	0.75	1.12	5	0.19
Instruments	4	1,500	0.14	0.73	3	0.08
Misc. manufacturing	11	1,595	0.10	0.19	3	0.01
Utilities	25	5,020	74.32	919.78	19	16.62
Service	3	95	0.12	0	1	0.02
Totals	306	110,040	515.03	1,160.20	138	432.62

* less than 5,000 gpd



TOTAL WASTE DISCHARGE = 515 MGD

GEOGRAPHIC DISTRIBUTION OF WASTES
DISCHARGED DIRECTLY INTO DISTRICT WATERS

FIG. 12

SB

Table 7
D i s c h a r g e s
D a i l y
PER PLANT AND PER EMPLOYEE
BY INDUSTRY

Industry	No. of Plants	Discharges per Plant MGD			Employees Per Plant	Discharge per Employee GPD		
		Waste	Clean	Total		Waste	Clean	Total
Food	53	.29	1.02	1.31	285	1,015	3,590	4,605
Tobacco	3	.01	.03	.04	357	28	84	112
Textile	20	.21	.01	.22	103	2,040	98	2,138
Lumber	1	.01	0	.01	75	133	0	133
Furniture	2	.01	.07	.08	815	1	86	87
Paper	8	.83	*	.83	390	2,140	13	2,153
Printing	1	*	.04	.04	1,500	3	27	30
Chemical	66	.79	1.21	2.00	128	6,150	9,450	15,600
Petroleum	16	21.00	1.14	22.14	740	28,400	1,550	29,950
Rubber	2	.15	.06	.21	535	280	112	392
Leather	1	.14	*	.14	220	635	2	637
Stone	15	.42	.03	.45	166	2,530	180	2,710
Primary Metal	18	.67	4.50	5.17	825	815	5,450	6,265
Fabricated Metal	30	.16	.10	.26	306	525	325	850
Machinery	13	.05	.03	.08	735	68	41	109
Electrical Machinery	3	.02	.21	.23	440	46	479	525
Transportation	11	.07	.10	.17	1,663	42	61	103
Instrument	4	.04	.18	.22	375	107	480	597
Misc. Manufacturing	11	.01	.02	.03	145	69	138	217
Utility	25	2.97	36.80	39.77	200	14,850	184,000	198,850
Service	3	.04	0	.04	32	125	0	125
All Industries	306	1.68	3.80	5.47	360	4,650	10,550	15,200

* less than 5000 gallons per day

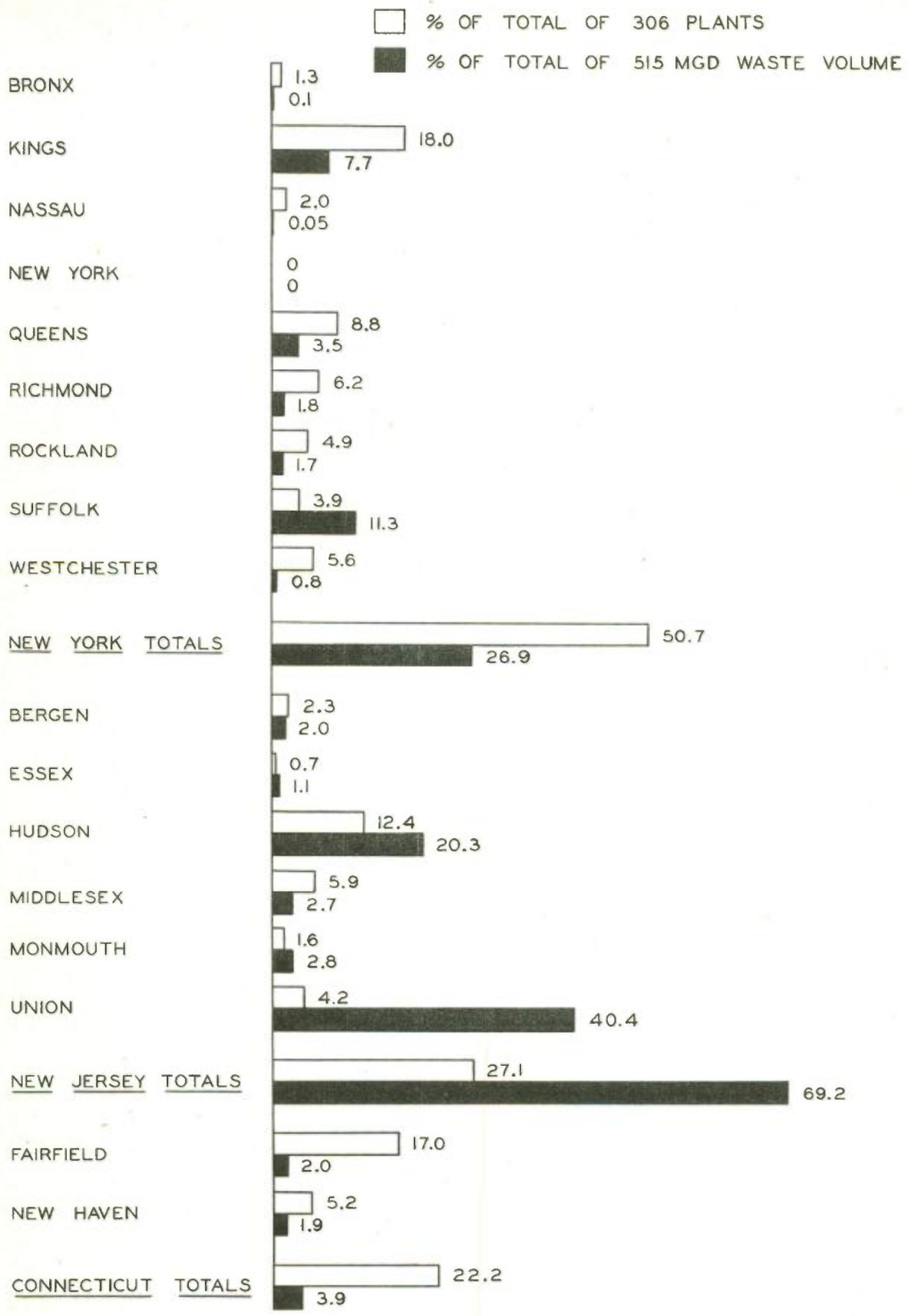
petroleum industry, particularly petroleum refining plants, large waste volumes result from the contamination of cooling waters by oil. None of the remaining industries averages more than 1 mgd of waste per plant, while the primary metal, chemical and food industries all discharge in excess of 1 mgd of clean effluent per plant. Other industries which have high values for gallons per employee per day waste discharges are the chemical, stone, paper and textile industries.

c. Distribution of Plants Compared to Distribution of Volumes

On the basis of the preceding data, a comparison of the distribution (geographical and industrial) of plants discharging directly into the District can be made with the distribution of the volumes discharged by these plants. In Figure 13 is shown the geographical distribution of waste plants and waste volumes. Although 50.7% of the plants are located in New York State they discharge only 26.9% of the total waste volume. On the other hand, the 83 plants (27.1% of the total) located in New Jersey account for 69.2% of the total waste volume. Hudson and Union Counties together discharge 60.7% of the total waste volume, though only 16.6% of the plants are located therein. The remaining 22.2% of the plants, which are located along the Connecticut coastline, discharge only 3.9% of the total waste volume.

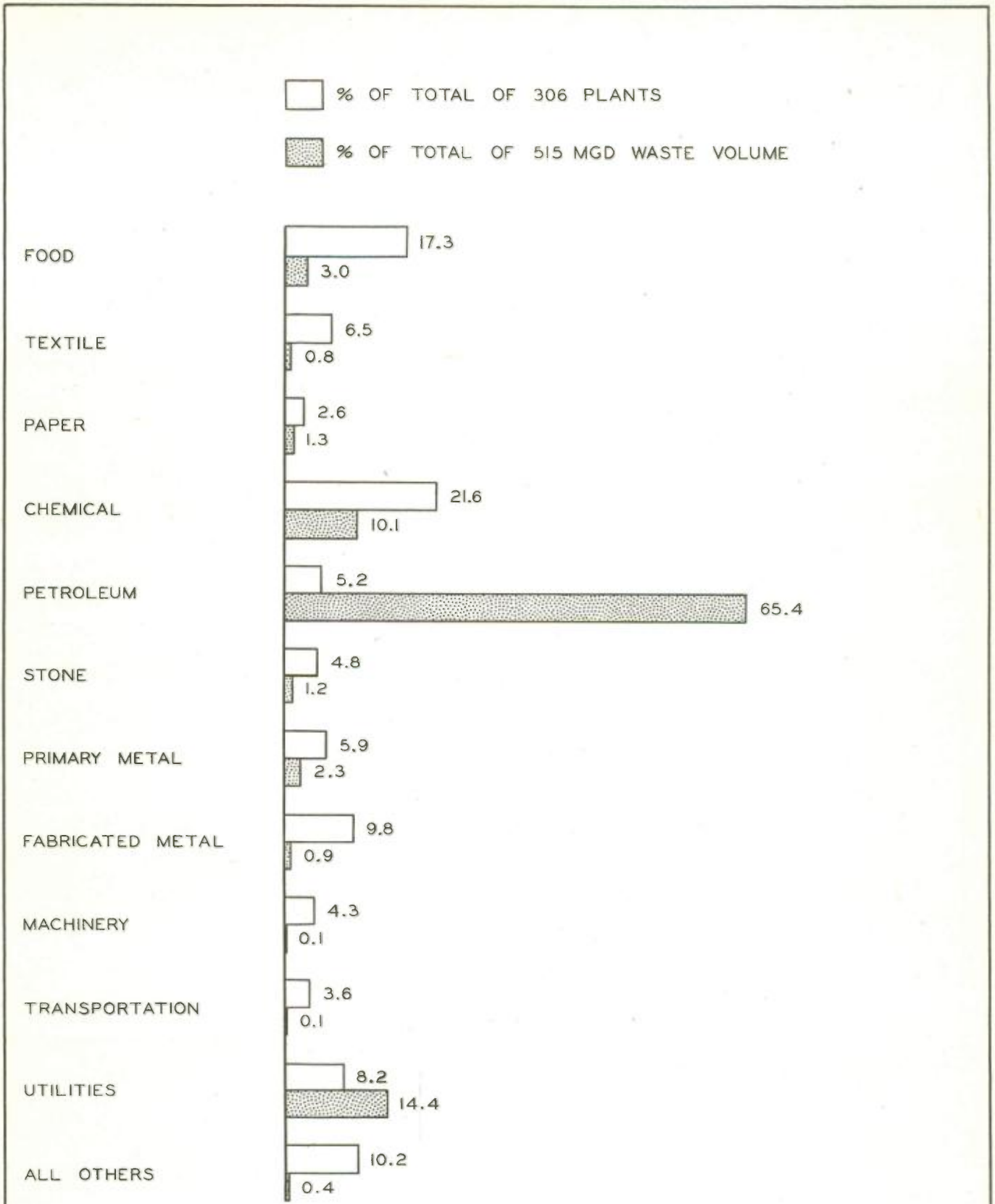
These comparisons reveal that the major portion of the waste volume is being discharged by a relatively few plants located in Union, Hudson and Suffolk Counties. The industrial nature of these plants is indicated by an examination of Figure 14 which shows that the petroleum industry accounts for 65.4% of the total waste volume though it represents but 5.2% of the total number of plants. Public utilities is the only other significant industrial classification in which the proportion of the total waste volume exceeds the proportion of the total number of plants, the respective values being 14.4% and 8.2%.

To fully demonstrate the influence of plants discharging large volumes of waste, the 306 directly discharging plants were classified according to volumes of waste discharged, independently of their industrial classifications



GEOGRAPHIC DISTRIBUTION OF WASTE PRODUCING PLANTS AND WASTE VOLUMES

FIG. 13



INDUSTRIAL DISTRIBUTION OF WASTE PRODUCING PLANTS AND WASTE VOLUMES

FIG. 14

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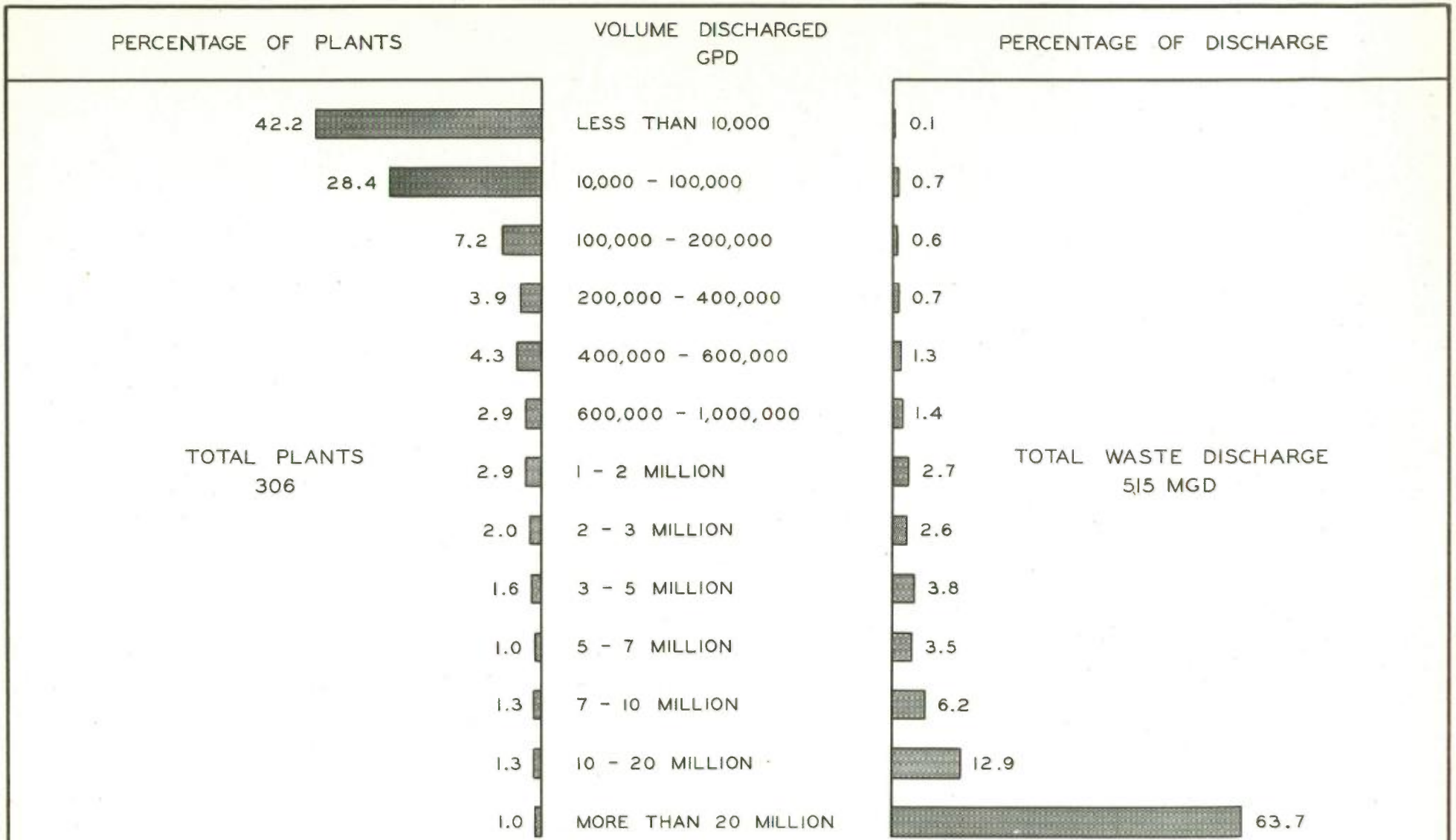
and their locations. The frequency distributions so obtained is shown in Figure 15. It can readily be seen that 11.1% of the plants, (those discharging 1 mgd or more) discharge 95.4% of the waste volume. Plants discharging more than 10 mgd of waste account for only 2.3% of the total of 306 plants while discharging more than 75% of the total waste discharge of 515 mgds.

It may be noted at this point that the feasibility of accepting industrial discharges into municipal sewers and sewage treatment plants depends in part on the volumes of discharge. It is unlikely that plants discharging more than 1 mgd can be adequately handled by most sewage treatment facilities, regardless of the strength of the waste, unless specifically provided for in the design capacity. Even were these volumes compatible with efficient sewage treatment plant operation, the fact (as will be shortly developed) that almost 90% of the waste flow is sea water would probably make these discharges inimical to efficient operation. Actually, of the 34 plants which discharge 1 mgd or more of waste only 11 do not make use of the waters of the District as a source of supply. Of the approximately 490 mgd discharged by these 34 plants approximately 465 mgd are sea water. Thus, should it be established that these plants are creating a pollution problem in the receiving waters of the District, the solution would have to lie in the direction of adequate treatment at the source.

d. Surface Water Usage and Discharge

Of the 306 plants which make use of the District for the disposal of their industrial discharges, approximately 100 also utilize District waters as their major source of industrial water supply. Of the 515 mgd of waste directly discharged, approximately 90% is originally drawn from the District, the remainder coming from public water supplies and private wells. For clean discharges, the percentage originating in the District is even higher. Most of the surface waters drawn on as a source of supply and which are subsequently discharged into the District are saline (approximately 5,000-15,000 ppm Cl), only 3 mgd of the 463 being fresh. Table 8 indicates the withdrawal and discharge of surface waters according to location and industrial classification. The locations and



FREQUENCY DISTRIBUTION OF PLANTS BY WASTE DISCHARGE VOLUMES

FIG. 15

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Table 8 - SURFACE WATER USAGE

	Salt Water				Fresh Water				Total Surface Water			
	No. of Plants#	Volume Used MGD	Discharge MGD Waste	Clean	No. of Plants#	Volume Used MGD	Discharge MGD Waste	Clean	No. of Plants#	Volume Used MGD	Discharge MGD Waste	Clean
A. GEOGRAPHICAL DISTRIBUTION												
Bronx County	1	22.00		22.00					1	22.00		22.00
Kings County	10	86.04	35.60	50.44					10	86.04	35.60	50.44
Nassau County	1	288.00		288.00					1	288.00		288.00
Queens County	11	139.22	7.75	131.47					11	139.22	7.75	131.47
Richmond County	8	329.16	4.65	324.51					8	329.16	4.65	324.51
Rockland County	4	39.97	3.57	36.40	2	2.21	2.21		6	42.18	5.78	36.40
Suffolk County	2	108.00	57.60	50.40					2	108.00	57.60	50.40
Westchester County	6	48.14	1.50	46.64	2	0.13	0.03	0.10	8	48.27	1.53	46.74
Total New York State	43	1,060.53	110.67	949.86	4	2.34	2.24	0.10	47	1,062.87	112.91	949.96
Bergen County	7	36.51	9.16	27.33					7	36.51	9.16	27.33
Essex County	2	6.19	4.93	1.26					2	6.19	4.93	1.26
Hudson County	10	180.34	109.70	70.63					10	180.34	109.70	70.63
Middlesex County	10	185.53	5.73	179.81					10	185.53	5.73	179.81
Monmouth County	1	14.52	14.52		1	0.86		0.86	2	15.38	14.52	0.86
Union County	10	258.75	204.30	54.31					10	258.75	204.30	54.31
Total New Jersey	40	681.84	348.34	333.34	1	0.86		0.86	41	682.70	348.34	334.20
Fairfield County	7	14.54		14.54	5	2.11	0.99	1.12	12	16.64	0.99	15.66
New Haven County	4	260.32	0.74	259.51					4	260.32	0.74	259.51
Total Connecticut	11	274.86	0.74	274.05	5	2.11	0.99	1.12	16	276.96	1.73	275.17
Total	94	2,017.23	459.75	1,557.25	10	5.31	3.23	2.08	104	2,022.53	462.98	1,559.33
B. INDUSTRIAL DISTRIBUTION												
Food	11	60.38	10.19	50.19					11	60.38	10.19	50.19
Textiles					4	0.62	0.52	0.10	4	0.62	0.52	0.10
Paper					1	2.04	2.04	0.00	1	2.04	2.04	0.00
Chemicals	29	134.56	46.61	87.93	1	0.86	0.00	0.86	30	135.42	46.61	88.80
Petroleum	11	341.58	319.82	21.76					11	341.58	319.82	21.76
Rubber	1	0.11	0.00	0.11					1	0.11	0.00	0.11
Stone, clay, glass	3	5.34	5.34	0.00	1	0.38	0.38	0.00	4	5.72	5.72	0.00
Primary metals	9	84.49	6.54	77.92	1	0.13	0.12	0.01	10	84.61	6.65	77.93
Fabricated metals	1	2.40	0.00	2.40	1	0.17	0.17	0.00	2	2.57	0.17	2.40
Machinery	1	0.45	0.00	0.31					1	0.45	0.00	0.31
Electrical machinery	1	0.32	0.00	0.32	1	1.11	0.00	1.11	2	1.43	0.00	1.43
Transportation	1	0.36	0.36	0.00					1	0.36	0.36	0.00
Instruments	1	0.72	0.00	0.72					1	0.72	0.00	0.72
Utilities	25	1,386.54	70.87	1,315.59					25	1,386.54	70.87	1,315.59
Total	94	2,017.25	459.73	1,557.25	10	5.31	3.23	2.08	104	2,022.53	462.95	1,559.34

#Includes plants which have only clean discharges and therefore are excluded from all other tabulations of waste contributing plants.

industries with the greatest salt water discharges coincide with the locations and industries having the greatest volumes of waste and clean discharges as previously described. Of the 337 mgd of direct waste discharges by the petroleum industry, approximately 95% is salt water, as is about 95% of the 74 mgd clean water discharges. For the chemical industry, salt water accounts for approximately 90% of the 52 mgd of direct waste discharges. Similarly in Suffolk, Hudson and Union Counties more than 90% of the direct waste discharge is carried by salt water.

The availability and use of the unlimited surface supplies provided by District waters make coastally located plants discharging directly into the District unique in certain characteristics with which we are concerned. Interior located plants or plants discharging to public sewerage systems very rarely are able to utilize the waters of the District, with the results that their waste discharge volumes are considerably smaller. It is true that plants of certain types must of necessity locate themselves near adequate and cheap sources of water, but it is also likely that some plants, locating themselves coastally because of convenient transportation facilities, make liberal use of the unlimited water supplies they find literally in their backyard.

To illustrate, to some degree,the influence of a cheap and unlimited water supply on water usage, a comparison may be made of the average industrial discharge (waste and clean) from the seven petroleum refining plants which discharge directly into District waters, all of which use the District as a major source of supply, with the average data from 41 refineries in the Ohio River Basin as reported by the United States Public Health Service. The plants discharging into District waters have an average industrial discharge of approximately 1,100 gallons per barrel of oil processed, whereas the Public Health Service average is 770 gallons per barrel.

Unfortunately, two factors prevent further comparisons of this nature. First, industries in general were reluctant to reveal production data and the issue was not pressed in order to assure success in obtaining all the other desired information. Second, the literature on this subject is confusing in that it fails to make clear whether cited values represent waste discharge volumes only, or combined waste and clean discharge volumes.

The great extent to which the District waters are used as a source of supply raises the question of what the effect of industrial and domestic wastes is on the usability of these waters by industry. Though it would appear that suspended solids, greases and oils and organic wastes can be detrimental to pumps and pipelines, at least one large user of salt water has indicated preference for a polluted surface supply because of the inhibitory effect on biological growths which tend to foul the pumps and pipelines. On the other hand, several large users of the District waters as a source of cooling water have found it necessary to screen and chlorinate influent salt waters. A determination of the influence of pollution on the usability of the District waters as a coolant by industry would be of considerable value to both industry and the Commission.

e. Treatment at Source

One of the questions asked of the management of the plants visited pertained to whether the waterborne wastes generated were treated for any purpose whatsoever before being discharged from the plant. Where such treatment was provided, a general description of the process was obtained, though information concerning the efficiency of treatment or the quality of the effluent from treatment was not available except in a few instances.

Among the plants which discharge their industrial wastes directly into the District the degree of treatment at source ranges from none, to simple screening, to complete chemical treatment.

While the question was not specifically put to management, the general impression obtained is that minimum degrees of treatment (screening, grease traps) are applied in most instances to avoid plugging of pipes. In almost all instances where oil is a pollutant separators, or catch basins employed as separators, are present, probably due to the requirement of the Supervisor of New York Harbor that no oil be discharged into navigable waters. In rare instances, complete chemical treatment has been provided specifically for abating pollution. In several cases, recovery of valuable byproducts has served as the inspiration for installation of treatment or recovery facilities.

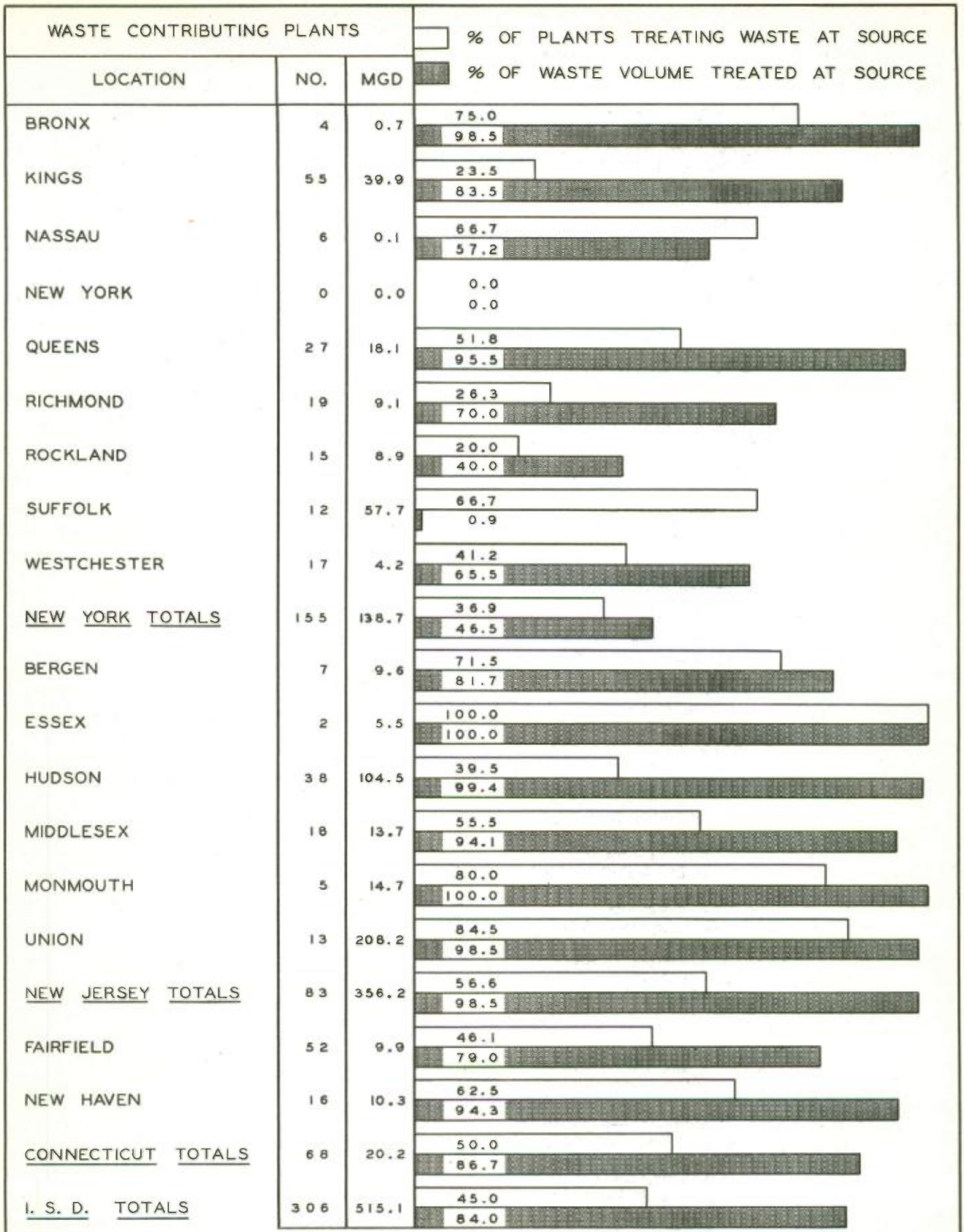
Table 6 indicates the number of plants providing some degree of treatment and the volumes so treated in each county and industry. Of a total of 515 mgd of industrial waste discharged directly into the District by 306 plants, 138 plants, or 45%, provide some degree of treatment before discharge for 433 mgd or 83% of the total waste discharge. This indicates a greater tendency on the part of industries discharging large volumes of wastes to treat their wastes at least to a minimum degree before discharge than do those plants generating small waste volumes. Figures 16 and 17 show the percentage of directly discharging plants in each county and each industry respectively which treat wastes at the source and the percentage of waste volumes so treated.

From these graphs it can be seen that in each of the counties where large volumes of waste are discharged, such as Kings, Hudson and Union, the percentage of the waste volumes which is treated at the source is much greater than the percentage of plants which provide for such treatment. One notable exception is in Suffolk County where a plant discharging more than 50 mgd does not treat its industrial waste before disposing of it directly into District waters.

The industrial distribution reveals that 99.9% of the wastes discharged directly by the petroleum industry is treated at the source, though only 81.2% of the plants in this industry provide treatment. In the chemical industry 85% of the waste is treated by only 45.5% of the plants, while in the fabricated metal industry 43.3% of the plants provide treatment for 51.4% of the waste. Among the public utility installations the reverse relations between percentage of plants and percentage of volumes holds, primarily due to the influence of the one plant in Suffolk County referred to above. In this industry 76% of the plants treat only 22.4% of the waste. In the textile industry a similar situation obtains, with 20% of the plants treating 15.6% of the waste volume.

f. District Waters Receiving Direct Discharge

All of the preceding presentation of results has concerned itself with the sources of industrial wastes discharged directly into District waters. Of more direct



GEOGRAPHICAL DISTRIBUTION OF
INDUSTRIAL WASTE TREATMENT AT SOURCE

FIG. 16

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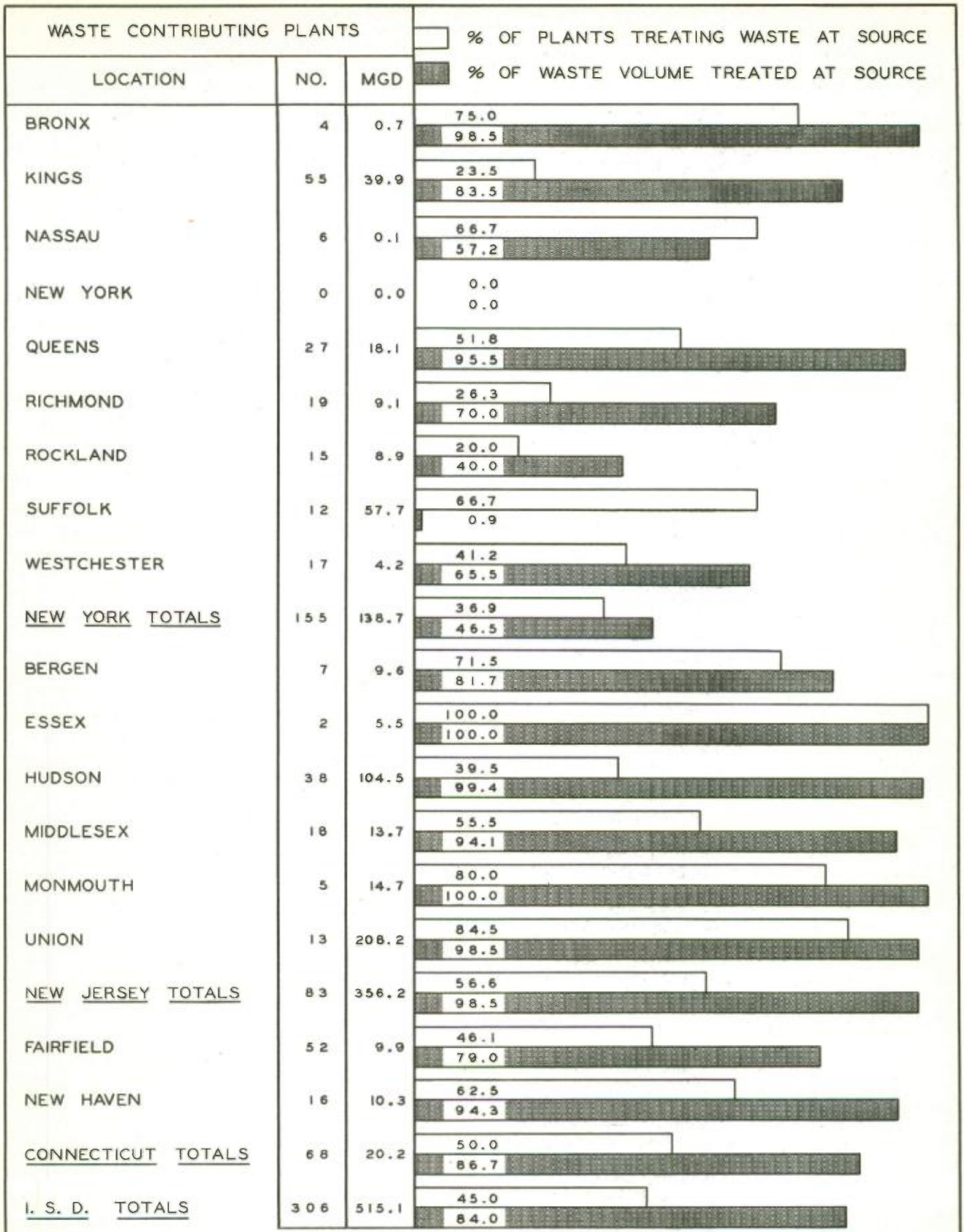

GEOGRAPHICAL DISTRIBUTION OF
INDUSTRIAL WASTE TREATMENT AT SOURCE

FIG. 16

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interest to the accomplishment of one of the aims of the survey, namely the determination of whether an industrial waste pollution problem requiring corrective measures exists in any of the sections of the District, is a knowledge of the distribution of industrial discharges in terms of the receiving waters of the District.

In Table 9 is shown the grouping of data according to the section of the Interstate Sanitation District into which the industrial wastes are discharged. The division of the District into these sections is generally arbitrary, but the detailed information upon which it is based is shown in the Appendix.

Northern Long Island Sound and the East River-Upper New York Bay sections receive direct discharges from the greatest number of plants, but the Arthur Kill and Kill van Kull sections receive the greatest volumes. These two bodies of water receive 62.5% of the total volume of wastes discharged into the District. Newtown Creek which is a small, relatively stagnant body of water, deserves special mention since it receives approximately 50 mgd or 10% of the total direct waste discharge.

Of additional interest is the fact that of the total of the 515 mgd of industrial waste discharged directly 110 mgd or 21.4% is discharged into Class "A" waters, the remainder entering Class "B" waters (see Figure 6).

The Tri-State Compact defines Class "A" waters as those intended primarily for recreational purposes, shellfish culturing and the development of fish life. Class "B" waters are those not expected to be used primarily for these purposes.

Of the 110 mgd of industrial waste discharged directly into Class "A" waters, 43.5 mgd or 39.5% is treated at the source, whereas 389 mgd or 96% of the 405 mgd entering Class "B" waters is pretreated. The low percentage of pretreatment for wastes discharged into Class "A" waters is explained by the activities of one plant which discharges more than 50 mgd of waste containing 2 ppm of chlorine. By definition and in view of British investigations and experiences indicating the toxic nature of chlorine to fish life an effluent of this type is considered a waste discharge.

Table 9

S e c t i o n s

of the

INTERSTATE SANITATION DISTRICT

Receiving Direct Discharges

Receiving Waters	Water Classification	Contributing Areas	No. Plts.	Produc. Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source No. of Plants	Treatment at Source Volume MGD
Northern Long Island Sound	Class A	New Haven, West Haven, Milford, Stratford, Bridgeport, Fairfield, Westport, Norwalk, Stamford, Greenwich, Port Chester, Rye	70	30,500	20.26	279.00	35	17.59
Southern Long Island Sound	Class A	Glen Cove, Port Jefferson	2	215	57.02	0.00	1	0.02
East River - Upper N.Y.Bay	Class B	Brooklyn, Queens, Bronx	55	18,665	4.37	70.72	17	1.99
Harlem River	Class B	Bronx	1	6	*	*	0	0
Newtown Creek	Class B	Brooklyn, Queens	23	5,500	49.76	46.68	9	48.79
Gowanus Canal	Class B	Brooklyn	2	405	4.21	2.74	1	.11
Lower New York Bay	Class A	Brooklyn, Staten Island	2	225	.05	.92	2	.05
Jamaica Bay	Class A	Brooklyn, Queens, Inwood	5	315	.32	82.05	3	.30
Great South Bay	Class A	East Rockaway, Seaford Massapequa, Amityville, Lindenhurst, Babylon, West Islip, Bayshore, Islip	15	580	.76	.30	10	.53
Sandy Hook Bay	Class A	Port Monmouth	1	115	14.63	1.44	1	14.63
Raritan Bay	Class A	Keyport, South Amboy, Perth Amboy, Staten Island	11	2,930	3.71	121.65	8	3.69
Arthur Kill	Class B	Staten Island, Barber, Woodbridge, Carteret, Linden, Elizabeth	29	15,000	218.83	145.50	17	214.95
Newark Bay	Class B	Staten Island, Elizabeth, Newark, Jersey City, Bayonne	16	7,435	13.80	6.45	9	13.42
Kill van Kull	Class B	Staten Island, Bayonne	13	5,350	103.65	290.00	4	101.64
Hudson River - West Shore	Class A	Tomkins Cove, Haverstraw Grandview, Piermont	15	2,000	8.84	36.44	3	3.54
Hudson River - West Shore	Class B	Edgewater, West New York Hoboken, Jersey City	31	14,800	10.63	29.57	12	8.61
Hudson River - East Shore	Class A	Peekskill, Croton, Ossining Tarrytown, Hastings, Yonkers	15	6,000	4.19	46.74	6	2.74
Total			306	110,041	515.03	1160.20	138	432.60

* less than 5000 gallons per day

g. Characteristics and Strengths of Waste Discharges

The composition of industrial wastes varies not only with the type of industry but with the processes within the industry. It may vary widely within a plant in a short time interval. Therefore a description of industrial waste characteristics must be more or less general. For true values, each plant must be made the subject of a careful and intensive study sometimes extending over long periods in order to account for seasonal variations and other factors that may affect the composition and volume of the waste.

Since no sampling program for detailed examinations and analyses of waste flows was feasible in the survey, a substitute method for estimating the strengths and characteristics of the wastes has been employed.

Based upon the qualitative information obtained from the waste producing plants concerning their operations and processes, a general description of the characteristics of the wastes generated by each industry has been determined. This is shown in Table 1, along with the potential impact upon the receiving waters of wastes of this type when present in sufficient concentration. Emphasis must here be placed upon the term "general description" since the information in the table cannot be applied to an individual plant, but rather represents the most salient characteristics of the variety of plants which comprise each major industrial classification.

With the assistance of the literature, previous surveys, the information concerning production and raw material consumption obtained from the waste generating plants, and the information concerning employees and the gallons per employee per day discharge values derived from the data, a crude estimate can be made of the strengths of the waterborne wastes generated at plants directly discharging into the Interstate Sanitation District. Because little or no information is available concerning the reduction in waste strengths accomplished by treatment at the source where such treatment is provided, the values presented for waste loadings imposed on District waters by industry reflect the strengths

of the raw or untreated wastes, and as such indicate the maximum potential load.

Before presenting the waste loads being generated by industry, and the distribution of these loads in the various sections of the District, a brief review of the aims and methodology of the survey is necessary to avoid the danger of misinterpretation of the data.

As has been previously described, the end objective of the inventory is to identify those areas of the Interstate Sanitation District where the discharge of industrial wastes is creating obnoxious conditions. In order to utilize this information in a pollution abatement program, it is necessary to determine each of the sources from which industrial wastes are discharged into the District, as well as the strengths and characteristics of these wastes.

A pollution survey of the Interstate Sanitation District involving detailed sampling and analysis of its waters would provide a direct means of determining those areas which are polluted. However, a survey of the approximately 1,000 square miles of the District waters would require more money, time and personnel than are available, and would still leave undone the task of determining the sources of the wastes creating the pollutional conditions. Therefore this approach was judged uneconomical. Any approach involving the analysis of effluent from each source of industrial waste was likewise deamed infeasible.

The method considered to be most consistent with the budgetary and time limitations involved the estimation of maximum waste strengths from survey data without analyzing effluent flows, and interpreting these estimates in the light of the most critical receiving water conditions. It was felt that this would indicate those areas of the District where a more detailed investigation, including the sampling of waste effluents, would be required to more specifically define the extent of pollution.

Thus the procedure that is being followed in the survey is as follows:

1) Determine each of the sources of industrial waste by a census of all industrial plants

located in areas which drain into District waters.

2) On the basis of information obtained from the plants visited, determine the volumes and characteristics of the wastes, and, through the use of the literature and any other source estimate the maximum strength of the wastes.

3) Determine the most critical receiving water conditions such as minimum dilution and dispersion factors, maximum detention times, etc.

4) Calculate, on the basis of 2) and 3) the maximum potential concentration of the waste in the receiving waters.

5) Interpret the calculations in 4) in terms of established standards to determine those sections of the District in which an obnoxious condition might be created.

6) For each of the sections determined in 5) make a more intensive study of those plants which contribute wastes of the type which are present in potentially obnoxious concentrations in order to more accurately define actual conditions.

It can be seen from this outline that our present inability to estimate the effectiveness of treatment at source which may be provided by an industry does not handicap us in our attempt to arrive at an estimate of the maximum waste loads received by District water, nor should it deter us from crediting qualitatively those plants which are now providing at least some degree of treatment to their wastes.

In the light of the foregoing review, it should be understood that the crude estimates of waste loadings imposed upon the District by industry which are given in this report represent maximum potential loadings in that they do not reflect any treatment at source. Furthermore, the determination of the potential pollutional effects of these maximum loadings must await an analysis of dilution, dispersion and self purification factors for the receiving waters of the District.

Table 10 shows the maximum potential loads imposed on District waters by each industry. The potential impact of the total waste discharge upon the District in terms of oxygen required to stabilize the organic or putrescible matter (5 day BOD) is equal to that of the raw sanitary sewage discharged by approximately 2,100,000 people or roughly the population of Manhattan or Philadelphia. In addition to putrescible matter an oxygen demand is also exerted by ferrous iron discharged by pickling mills.

In terms of suspended solids the maximum potential load carried into District waters by industrial discharges is equal to the raw sanitary sewage discharged by a population of 1,800,000 or 360,000 pounds of suspended solids per day.

From Table 10 it can be seen that the food industry is the major potential contributor of oxygen depleting wastes with the utility, chemical and petroleum industries also generating wastes whose maximum oxygen demand values are high. The petroleum and food industries also contribute the greatest portion of suspended solids. As has been previously shown the geographic centers for these industries are Kings and Hudson Counties for food, Queens County for utility; Hudson, Union and Middlesex Counties for chemical, and Hudson and Union Counties for petroleum.

Approximately 10 tons of nonferrous metals, 18 tons of iron, 48 tons of acid and 50 tons of grease and oil are the maximum potential loads discharged into District waters each day, as well as 3,600 pounds of cyanides and thiocyanates, and 6,350 pounds of phenols.

Metallic and acid wastes originate mainly in the primary and fabricated metals industries which are centered in the Bridgeport and New Haven areas. Cyanides and phenols are generated in the petroleum and utility industries whose geographical distribution has been described above, as well as the electroplating industry.

Fats, oils and grease are common to the wastes of practically all industries, though the petroleum and utility plants are the greatest generators.

Table 10 - ESTIMATED MAXIMUM POTENTIAL[1] DAILY POLLUTION LOAD

	Water Classification	No. of Plants	Discharges MGD		Pounds Per Day Generated					
			Waste	Clean	Oxygen Demand[2]	Suspended Solids	Acids as H_2SO_4	Metals[3]	Toxic Substances[4]	Grease and Oil
A. DISTRIBUTION IN RECEIVING WATERS										
Northern Long Island Sound	Class A	70	20.26	279.00	11,500	17,000	69,000	43,500	7,100	3,100
Southern Long Island Sound	A	2	57.02	0		100	200	250	600	
East River - Upper N.Y. Bay	B	55	4.37	70.72	81,500	36,000	15	80	1,125	1,155
Harlem River	B	1	*	*						
Gowanus Canal	B	2	4.21	2.74	15,000					50
Newtown Creek	B	23	49.76	46.68	29,500	33,000	6,000	3,250	1,375	11,000
Lower New York Bay	A	2	.05	.92	1,750	100				50
Jamaica Bay	A	5	.32	82.05	4,250	50		10		100
Great South Bay	A	15	.76	.30	11,500	3,350		10		1,150
Sandy Hook Bay	A	1	14.63	1.44	700					2,000
Raritan Bay	A	11	3.71	121.65	75	5,000	1,000	600	5	50
Arthur Kill	A&B	29	218.83	145.50	47,000	95,000	16,000	6,700	75	60,000
Newark Bay	B	16	13.80	6.45	37,000	29,000		200	20	3,800
Kill Van Kull	B	13	103.65	290.00	10,000	31,000				15,000
West Shore-Hudson River	A&B	46	19.47	66.01	49,000	80,000	50	250	220	4,300
East Shore-Hudson River	A	15	4.19	46,74	49,000	31,000	3,000	700		
Total		306	515.03	1,160.26	347,775	360,600	95,265	55,550	10,520	101,755
B. INDUSTRIAL DISTRIBUTION										
Food		53	15.34	54.21	124,000	90,000				5,000
Textile		20	4.29	0.22	19,000	1,200				125
Paper		8	6.66	0.01	5,000	24,000				
Chemical		66	51.91	79.57	69,000	56,000	850	150	275	6,100
Petroleum		16	336.97	18.24	47,500	102,000			6,900	80,000
Leather		1	0.14	*	1.700	4,200				100
Stone		15	6.39	0.52		44,000				100
Primary Metal		18	12.03	81.12		4,400	92,000	51,000		400
Fabric Metal		30	4.79	3.03		70	1,900	3,650	170	550
Machinery		13	0.68	0.44			50	100	5	20
Electric Machinery		3	0.06	0.62				400	40	110
Transportation		11	0.75	1.12	50	80	400	270		300
Utility		25	74.32	919.78	78,000	31,000			3,100	7,500
Service		3	0.12	0	2,600	2,400				1,000
All Others		24	.58	1.32	800	650		180	10	360
Total		306	515.03	1,160.20	347,650	360,000	95,200	55,750	10,500	101,665

1 Does not reflect treatment at source
2 5 day, 20°C biochemical oxygen demand
3 Ferrous and non ferrous metals
4 Includes cyanides, thiocyanates, phenols, etc.
* Less than 5,000 gallons per day

From the point of view of impact upon the receiving waters, the primary significance of metallic and chemical wastes lies in their potential toxicity to fish life. Greases and oils are objectionable from an aesthetic point of view and because they represent a potential fire hazard, may interfere with reaeration and light penetration, and may destroy fish spawning grounds when they settle. Suspended solids tend to settle out and form shoals, blanket fish spawning grounds, and also prevent light penetration.

While it is not the intention of this report to interpret the data on maximum potential pollution loads in terms of actual impact on the receiving waters, some indication of the minimum dilutions needed to render toxic wastes innocuous can be calculated.

If it is assumed that metals, acids, cyanides and phenols are uniformly distributed in the total daily industrial discharges of 1,675 milion gallons, and this discharge is confined to the New York Harbor area, then the concentrations of these wastes in the flow, based upon the crude estimates of maximum potential loads, would be approximately 1.5 ppm non-ferrous metals, 7 ppm acids, 0.3 ppm cyanides and 0.5 ppm of phenols. Wastes bearing 1.5 ppm of non-ferrous metals in solution would require three parts of dilution water to two parts of waste water to reduce the concentration below the toxic level, assuming the critical concentration for most non-ferrous metals to be approximately 1 ppm. Cyanides in concentrations greater than 0.1 ppm are considered toxic to fish life. Therefore a threefold dilution would be needed to reduce the concentration of cyanides below the toxic level. For phenols, a dilution of approximately 1,000 to 1 would be required.

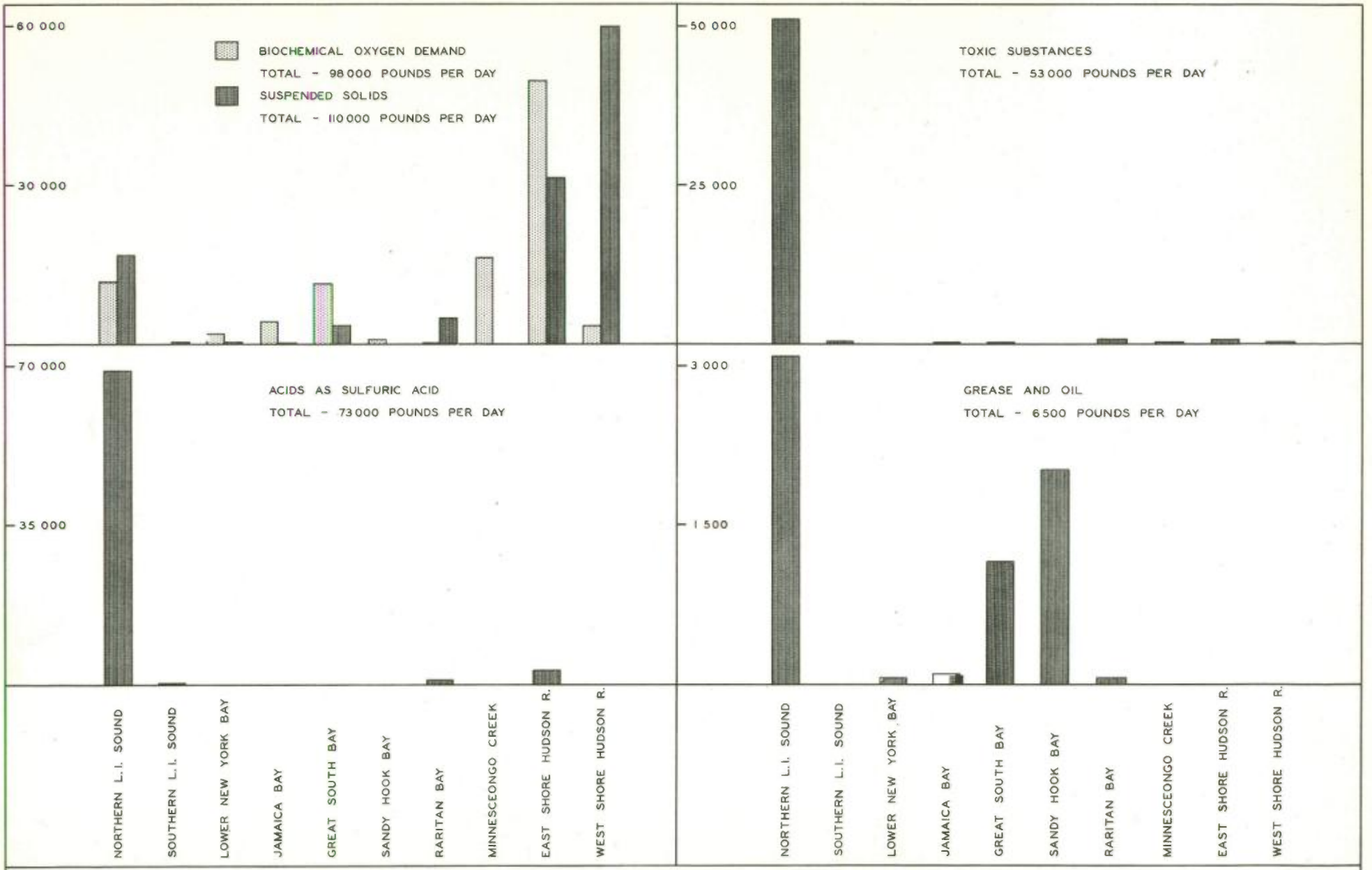
The daily flow of new water from the rivers tributary to New York Harbor is roughly 16 billion gallons. Assuming that this flow does not contain any of the pollutants referred to above, a dilution of approximately nine to one is available for the industrial discharges.

Actually, however, these wastes are not uniformly distributed in the industrial discharges, nor is this discharge confined to the New York Harbor area. The degrees

of dilution available in the various sections of the District are not presently known, in some areas probably being less and in other areas greater than the values indicated above. In addition these diluting waters may already contain pollutants. This serves to emphasize the need for analyzing and interpreting the data on a local basis so as to account for local variations in dilution and dispersion.

In Table 10 is shown the maximum potential pollution loads imposed on the various sections of the District, while Figures 18 and 19 illustrate the distribution of the wastes in Class "A" and Class "B" waters. From these figures, it can be seen that the heaviest maximum potential oxygen demand load exists in the East River-Upper New York Bay area, while the heaviest suspended solids loading is in Arthur Kill. The Northern Long Island Sound sections of the District receives the heaviest maximum potential load of metals and acids, with the Arthur Kill section receiving the next heaviest load. The heaviest loadings of phenols, cyanides and the cyanates is also in the Northern Long Island Sound section. In this section it is primarily in the New Haven and Bridgeport Harbor areas that the bulk of the metallic, acid and chemical waste is discharged. Grease and oil loadings are heaviest in the Arthur Kill section with nearby Newark Bay and Kill van Kull also receiving large quantities.

Once again it should be borne in mind that these are maximum values which do not reflect the effect of treatment at the source which is provided by some industries.



ESTIMATED MAXIMUM POTENTIAL DAILY INDUSTRIAL WASTE LOADING ON CLASS "A" WATERS

DOES NOT REFLECT TREATMENT AT SOURCE

FIG. 18

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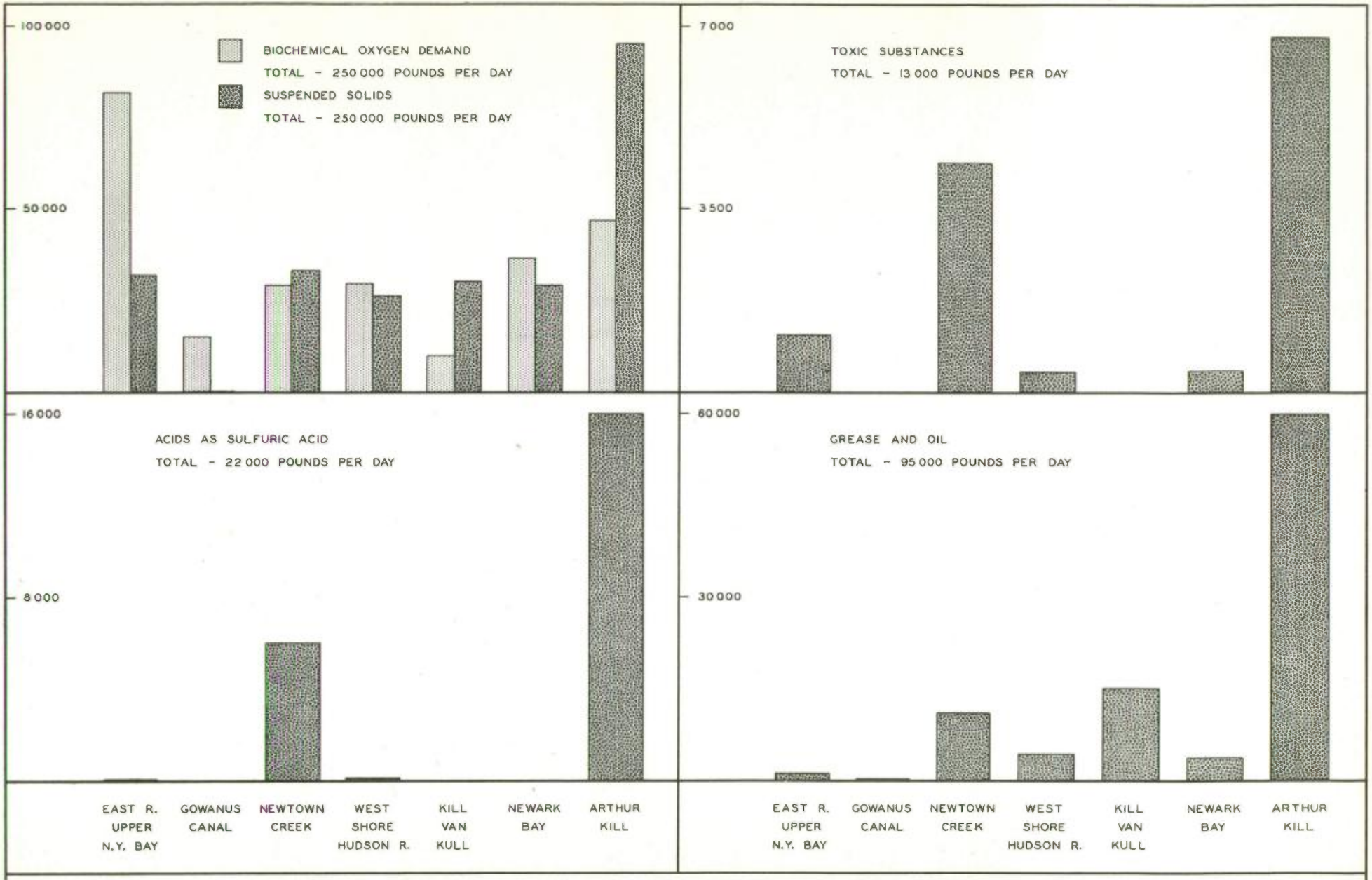

ESTIMATED MAXIMUM POTENTIAL DAILY INDUSTRIAL WASTE LOADING ON CLASS "B" WATERS

DOES NOT REFLECT TREATMENT AT SOURCE

FIG. 19

SB

APPENDIX

Receiving Waters	Contributing Municipalities	No. of Plants	Production Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source Plants	Treatment at Source Vol. MGD	Estimated Maximum Potential Pounds per day Generated B.O.D.	Suspended Solids	Acids	Metals	Toxic Substances	Grease and Oil
A. CLASS "A" WATERS													
New Haven Harbor													
Quinnipiac River	New Haven	2	980	.13	.10	1	*		50	8,750	6,000		
Mill River	New Haven	4	1,945	4.65	1.16	3	4.65	2,900	8,000		1		20
West River	West Haven	2	225	.35	.06	2	.35	80		320	260		25
New Haven	New Haven	5	3,345	4.64	9.55	3	4.20	4,000	3,500		265	7,000	2,000
Total		13	6,495	9.77	10.87	9	9.20	6,980	11,550	9,070	6,526	7,000	2,045
Milford Harbor													
Indian River	Milford	1	370	*	.01	0	0						1
Milford Harbor	Milford	1	195	.01	.03	0	0				4	1	1
Total		2	565	.01	.04	0	0				4	1	2
Housatonic River	Milford	1	156	.54	250.25	1	.54		800				
	Stratford	4	1,825	3.00	.49	2	2.90	270	550		1,500	100	290
Total		5	1,981	3.54	250.74	3	3.44	270	1,350		1,500	100	290
Bridgeport Harbor													
Johnson Creek	Stratford	1	135	.16	.01	1	.16			475	270		25
Yellow Mill Pond	Bridgeport	1	750	.06	.60	0	0				37		
Pequonnock River	Bridgeport	5	7,030	3.68	4.64	2	2.42		40	9,000	5,425	2	310
Cedar Creek	Bridgeport	6	2,610	.64	2.69	3	.15	1,900		2	385	45	30
Ash Creek	Bridgeport	5	1,776	.36	.04	5	.36	210	15	410	395	20	160
	Fairfield	5	726	.06	.02	1	.03						
Bridgeport Harbor	Bridgeport	4	1,620	.89	6.41	1	.85	20	325	50,000	29,000	2	10
Total		27	14,647	5.85	14.41	13	3.97	2,130	380	59,887	35,512	69	535
Saugatuck River	Westport	3	81	*	0	0	0	10					
Norwalk Harbor													
Norwalk River	Norwalk	8	550	.50	.14	4	.40	545	3,100		2		150
Norwalk Harbor	Norwalk	2	93	*	.01	0	0				1		
Total		10	643	.50	.15	4	.40	545	3,100		3		150
West Norwalk Harbor	Norwalk	1	400	.01	.02	0	0						2
Stamford Harbor													
Noroton River	Stamford	1	700	.01	.06	0	0			20	11		1
East Branch	Stamford	2	3,025	.10	2.73	2	.10				65	2	20
West Branch	Stamford	1	40	.02	.20	1	.02	600					50
Total		4	3,765	.13	2.99	3	.12	600		20	76	2	71
Greenwich Cove	Greenwich	1	1,500	*	.04	1	*				1		
Byram River	Greenwich	2	375	.46	.01	1	.46	1,000	800				
	Port Chester	1	200	*	.01	1	*		5				
Total		3	575	.46	.02	2	.46	1,000	805				
Milton Harbor	Rye	1	18	*	0	0	0						5
Total Northern L.I.Sound		70	30,670	20.27	279.28	35	17.59	11,535	17,185	68,977	43,622	7,172	3,100

Receiving Waters	Contributing Municipalities	No. of Plants	Production Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source Plants	Treatment at Source Vol. MGD	Estimated Maximum Potential Pounds per day Generated B.O.D.	Suspended Solids	Acids	Metals	Toxic Substances	Grease and Oil
A. CLASS "A" WATERS (cont'd)													
Hempstead Bay													
Glen Cove Creek	Glen Cove	1	170	.02	0	1	.02		100	200	250		
Total		1	170	.02	0	1	.02		100	200	250		
Port Jefferson Harbor	Port Jefferson	1	45	57.00	0	0	0					600	
Total Southern L.I. Sound		2	215	57.02	0	1	.02		100	200	250	600	
Orowoc Creek	Islip	3	53	.21	.05	0	0	1,000	1,000				100
Approximitch Creek	Bay Shore	1	56	.19	.13	1	.19	8,000					50
Sampawam's Creek	West Islip	1	50	.01	0	1	.01				7	1	
Foster Creek	Babylon	1	80	*	0	1	*	10					
Negunatogue Creek	Lindenhurst	3	135	.12	.12	3	.12	15	10				12
Amityville Creek	Amityville	1	40	.17	0	1	.17	70	40				50
Ketcham's Creek	Amityville	1	40	.02	0	1	.02		25				
Carman River	Massapequa	2	102	.02	0	1	*	400	400				250
Seaford Creek	Seaford	1	6	*	0	0	0	5					
East Rockaway Channel	East Rockaway	1	30	.02	0	1	.02	2,000	1,900				700
Total Great South Bay		15	592	.76	.30	10	.53	11,500	3,375		7	1	1,162
Mott Basin	Inwood	1	8	*	0	1	*		20				
	Far Rockaway	1	56	.01	75.68	0	0		40				
Grassy Bay	Queens	1	54	.01	0	0	0				10		2
Beach Channel	Rockaway Park	1	126	.10	6.43	1	.10	3,850					100
Mill Basin	Brooklyn	1	70	.20	0	1	.20	330					
Total Jamaica Bay		5	314	.32	82.11	3	.30	4,180	60		10		102
Narrows-West Shore	Staten Island	1	120	.01	.11	1	.01	100	100				
Gravesend Bay													
Coney Island Creek	Coney Island	1	105	.04	.81	1	.04	1,700					50
Total		1	105	.04	.81	1	.04	1,700					50
Raritan Bay													
Arthur Kill-East Shore	Staten Island	1	450	.04	0	0	0		500				
Raritan River	Perth Amboy	3	1,525	3.10	4.15	1	3.08	20	4,000	1,000	500		
South Amboy Area	South Amboy	3	166	.50	115.90	3	.50		600		80		
Prince's Bay	Staten Island	1	750	.08	.72	1	.08				50	5	
Lawrence Harbor	Keyport	4	487	.03	.90	3	.03	50	170				50
Total		12	3,378	3.75	121.67	8	3.69	70	5,270	1,000	630	5	50
Sandy Hook Bay	Port Monmouth	1	115	14.63	1.44	1	14.63	670					2,000
Total Lower N.Y. Bay		15	3,718	18.43	124.03	11	18.37	2,540	5,370	1,000	630	5	2,100
Hudson River-East Shore													
Yonkers Area	Yonkers	2	592	.32	37.85	0	0	2,500	3,000				
Hastings Area	Hastings	2	720	2.69	4.28	2	2.69	2,500	3,000	2,700	500		
Tarrytown Area	Tarrytown	1	90	*	0	0	0		10				
	North Tarrytown	2	3,300	.22	0	1	.05		100		12		
Ossining Area	Ossining	3	150	.02	.13	1	.01	100		300	160	1	5
Croton River	Croton	1	6	*	0	1	*				2	1	

Receiving Waters	Contributing Municipalities	No. of Plants	Production Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source Plants	Treatment at Source Vol. MGD	Estimated Maximum Potential Pounds per day Generated B.O.D.	Suspended Solids	Acids	Metals	Toxic Substances	Grease and Oil
A. CLASS "A" WATERS (cont'd)													
Hudson River-East Shore (cont'd)													
Peekskill Area	Peekskill	3	1,204	.94	4.48	1	*	44,500	20,000				25
Annsville Creek	Peekskill	1	14	*	0	0	0		25				
Total		15	6,076	4.19	46.74	6	2.75	49,600	26,135	3,000	674	2	30
Hudson River-West Shore													
Tomkins Cove	Tomkins Cove	2	130	2.04	36.00	2	2.04		25,000				
Minnesceonga Creek	West Haverstraw	9	714	3.28	.54	0	0	16,000			108	5	
Haverstraw Area	Haverstraw	2	127	1.50	*	1	1.50		19,000				
Grandview Area	Grandview	1	3	*	*	0	0	10	5				
Piermont Area	Piermont	1	1,000	2.04	0	0	0	3,400	15,000				
Total		15	1,974	8.86	36.54	3	3.54	19,410	59,005		108	5	
Total Hudson River		30	8,050	13.05	83.28	9	6.29	69,010	85,140	3,000	782	7	30
TOTAL CLASS "A" WATERS		138	43,559	109.85	569.00	69	43.10	98,765	111,230	73,177	45,301	7,785	6,494
B. CLASS "B" WATERS													
Hudson River-West Shore													
Edgewater Area	Edgewater	7	7,120	9.56	26.38	5	7.81	19,000	15,000	50	140	225	3,600
West New York Area	West New York	1	35	.02	.01	1	.01	60					20
Hoboken Area	Hoboken	7	4,810	.28	.61	2	.19	2,200	4,400				150
Jersey City Area	Jersey City	16	2,832	.75	2.57	4	.59	8,200	6,500				510
Total Hudson River		31	14,797	10.61	29.57	12	8.60	29,460	25,900	50	140	225	4,280
East River-West Shore													
Westchester Creek	Bronx	2	275	*	0	2	*		10		2		
East River	Bronx	1	877	.69	22.00	1	.69	6,000	7,000			1,125	300
Total		3	1,152	.69	22.00	3	.69	6,000	7,010		2	1,125	300
Harlem River	Bronx	1	6	*	*	0	0				1	1	
East River-East Shore													
Queens Coast	Queens	12	2,541	1.27	22.83	9	1.24	38,000	300		17	1	600
Newtown Creek	Queens	12	3,810	16.74	21.87	4	15.97	19,250	18,100	6,000	3,250		1,500
	Brooklyn	11	1,678	33.02	24.80	5	32.82	10,000	15,000			1,370	9,350
Brooklyn Coast	Brooklyn	18	11,297	2.03	24.40	1	*	30,000	24,300	15	25	3	300
Total		53	19,326	53.06	93.90	19	50.03	97,250	57,700	6,015	3,042	1,374	11,750
Gowanus Bay													
Gowanus Canal	Brooklyn	2	405	4.21	2.74	1	.11	15,000					50
Gowanus Bay	Brooklyn	22	3,664	.38	1.65	4	.06	7,500	4,200		13		80
Total		24	4,069	4.59	4.39	5	.17	22,500	4,200		13		130
Total East River-Upper N.Y. Bay		81	24,553	58.34	120.29	27	50.89	125,750	68,910	6,015	3,308	2,500	12,180
Newark Bay-East Shore													
Jersey City Coast	Jersey City	3	515	.12	1.77	2	.07	2,500	260		1		50
Bayonne Coast	Bayonne	6	1,185	1.68	2.75	3	1.44	5,375	2,600				1,200
Total		9	1,700	1.80	4.52	5	1.51	7,875	2,860		1		1,250

Receiving Waters	Contributing Municipalities	No. of Plants	Production Employees	Discharge MGD Waste	Discharge MGD Clean	Treatment at Source Plants	Treatment at Source Vol. MGD	Estimated Maximum Potential Pounds per day Generated B.O.D.	Suspended Solids	Acids	Metals	Toxic Substances	Grease and Oil
B. CLASS "B" WATERS (cont'd)													
Newark Bay-West Shore													
Newark Coast	Newark	2	200	5.48	1.41	2	5.48	14,000	11,600				1,600
Elizabeth Coast	Elizabeth	2	4,455	.33	.31	1	.32				200	20	
Total		4	4,655	5.81	1.72	3	5.80	14,000	11,600		200	20	1,600
Newark Bay-South Shore	Staten Island	3	1,000	6.19	.24	1	6.18	15,000	14,600				1,000
Total Newark Bay		16	7,355	13.80	6.48	9	13.49	36,875	29,060		201	20	3,850
Kill Van Kull-North Shore	Bayonne	5	4,737	101.64	2.01	3	101.64	9,700	23,000				15,000
Kill Van Kull-South Shore	Staten Island	8	614	2.02	288.03	1	*	300	8,000				50
Total Kill Van Kull		13	5,351	103.66	290.04	4	101.64	10,000	31,000				15,050
Arthur Kill-West Shore													
Elizabeth River	Elizabeth	2	112	.08	4.30	2	.08	1,700	20				100
Elizabeth Coast	Elizabeth	4	2,876	.37	1.24	4	.37	60	20	10,000	6,500		150
Linden Coast	Linden	5	8,039	207.42	52.88	4	204.99	35,000	66,000	5,000		48	33,000
Carteret Coast	Carteret	8	2,334	.95	27.56	3	.18		1,150	800	60		300
Woodbridge Coast	Woodbridge	3	501	.19	1.45	2	.18	40	80			1	100
Perth Amboy Coast	Barber	1	500	8.97	26.48	1	8.97	6,700	16,000			3	26,000
Total		23	14,362	217.98	113.91	16	214.77	43,500	83,270	15,800	6,560	52	60,150
Arthur Kill-East Shore	Staten Island	5	281	.80	31.64	1	.11	3,375	11,500				400
Total Arthur Kill		28	14,643	218.78	145.55	17	214.88	46,875	94,770	15,800	6,560	52	60,450
TOTAL CLASS "B" WATERS		168	66,699	405.19	591.93	69	389.50	248,960	249,640	21,865	10,209	2,797	95,410
TOTAL I.S.D.		306	110,258	515.04	1,160.93	138	432.60	347,725	360,870	95,042	55,510	10,582	101,904