# WATERFRONT INDUSTRY

## AROUND SAN FRANCISCO BAY

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FEBRUARY 1968



PREPARED FOR
SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION

# W A T E R F R O N T  I N D U S T R Y

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This volume is one of a series of background reports being prepared for the San Francisco Bay Conservation and Development Commission by the Commission's staff, by various State agencies, and by private consultants. Summaries based on these reports are also being prepared for wide distribution. The summary reports will provide the Commission with the basis for determining policies and criteria upon which to base its plan for the future of the Bay.

Prepared for the

San Francisco Bay Conservation and Development Commission

February, 1968

C O N T E N T S

## A P P E N D I C E S



## M A P S

# CHAPTER I. BASIC PREMISES

This study of the industrial potential and waterfront planning requirements for San Francisco Bay and tributaries was pursued within a framework of four key assumptions:

1. Water-oriented industry is important to the region.
2. The Bay Area has great potential for water-oriented industrial development.
3. Technological advances in water transportation will increase industrial demand for Bayfront land.
4. Water-oriented industry can be compatible with other desired uses of the Bay and shoreline.

These assumptions are based on studies by BCDC and other agencies and on national and worldwide industrial development trends. They constitute the starting point for the projections, site evaluations, and recommendations in this report. This chapter discusses the assumptions and the approach to industrial waterfront planning they suggest.

## The Importance of Water-Oriented Industry

Water-oriented industry merits special attention in a regional planning program. This is due not only to its dependence on the Bay, but also to its unique role in the regional economy. In addition to the employment provided directly by these firms,

their products are usually the raw materials for many other kinds of industry, that in turn provide more employment. Furthermore, major port areas such as the Bay Region are the locations for water-oriented basic industries whose activities are vital to the national economy; thus the Bay Area has a responsibility extending far beyond the limits of the nine counties.

According to the BCDC report on Economic and Population Growth, total employment in the Bay Area is expected to reach 2.9 million by 1990 and 4 million by 2020, compared to 1.7 million today.[1/]

Manufacturing is expected to provide the same proportion of total jobs in the year 2020 as it does today -- 20 per cent.[2/] This means that space must be planned to efficiently and compatibly accommodate an additional half-million jobs in laboratories, factories and processing plants throughout the Bay Area by 2020.

A diverse manufacturing base is both desirable and attainable with the variety of advantages which the San Francisco Bay Region can offer industry. However, achievement of this level of manufacturing employment requires recognition and careful husbandry of all of the region's resources. Among the many assets of the San Francisco Bay Region which can insure economic growth, the navigable waters of the Bay are of primary importance.

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1/ See Table G-1 in Appendix G.

2/ These projections may require further refinement in view of automation trends and possible population and income changes, but these first approximations serve as an index of need for industrial land.

1. Direct Employment

Projections by this consultant indicate that one-fourth of the new manufacturing jobs could be directly water-oriented, located at plants having proximity, and some direct access, to the Bay.[3/]

Although water-oriented industries tend to be highly automated and have low employee densities (number of employees per unit of land area), the wages and capital investment per employee of these industries are among the highest in all manufacturing, and make a significant direct contribution to the regional economy.[4/]

2. Generator of Additional Manufacturing Employment

Most water-oriented industries are basic processors -- petroleum refining, chemicals and primary metals, for example -- that transform raw materials into semi-finished products needed by other manufacturers to fabricate the wide range of goods required for family consumption, for community use and for other industries. These fabricating industries usually are labor-intensive; i.e., they have large numbers of employees per acre of land, in contrast to the low employee density per acre of their suppliers.

As basic industries increase in the region, employment in fabricating industries will increase at a greater rate. Thus, the secondary employment contribution of water-oriented industries is

3/ Table G-3 in Appendix G

4/ Appendix A, Earnings in Chemicals and Selected Industries.

important. Furthermore, water-oriented industries generate substantial employment in new product manufacture. The petro-chemical industry, for example, has led to the use of synthetics in products that were unknown two decades ago.

Thus, a single basic water-oriented industry can be the magnet that attracts dozens of satellite industries, all of whom depend on local suppliers of goods and services. These secondary economic benefits are far greater than the direct employment benefits of the basic industry.

3. The Special Responsibility of Port Areas

The deep-water urban regions of our country have a unique role in the national economy. The increasing dependence of the United States on foreign sources for oil, iron ore and other primary metals makes deep-water sites for basic industry a national need. As gateways for these materials, ocean port regions serve the land-locked interior as well as their own immediate hinterlands. The primary industries in a port area serve large areas of the country. For example, all but two of the nation's major steel mills are located on deep water. (The exceptions are government-built plants located inland during World War II for reasons of national security at that time.) While some petro-chemical processing has developed in the interior, our big capacity is and will continue to be in deep-water urban regions.

This means that the San Francisco Bay Region, with its deep-water harbor, has a responsibility to the welfare of the entire nation. This national need should take precedence over the concern for regional growth problems. The people of the Region have the ability and the power to protect and enhance the Bay's appearance and recreation potential while they plan to utilize this great Bay in the service of the state, the nation, and their neighbors abroad.

The wide-ranging importance of a port region is emphasized by James W. Gulick, acting Administrator of the Maritime Administration in a recent statement[5/]:

> "There has never in the history of man been a time in which international trade meant so much and was so important a factor in determining whether people everywhere on this globe will achieve those aspirations towards which the world is constantly reaching -- a higher standard of living and a more abundant life for all. The great ports that encircle this globe are the nerve centers that guide and control this vast international trade. Ports are economic instrumentalities for the extension of international influence. They are barometers of the standard of living and of the prosperity of nations."

## The Bay Region's Attractions for Water-Oriented Industry

The Bay Area has many characteristics that are attractive to water-oriented industry, ranging from its excellent harbor to an interest in sound regional planning. No other American metropolitan port area has all the assets found in the Bay Region:

. . . excellent harbor

. . . growing population and high-income consumer market

. . . established and expanding manufacturing market

5/ U. S. Department of Commerce, Maritime Administration, Economic Impact of U. S. Ocean Ports, Government Printing Office, 1966.

. . . available waterfront land

. . . established urban resources and services

. . . interest of both government and business in regional planning for water-oriented industrial growth

. . . the opportunity for intra-regional water transport

1. Excellent Harbor

San Francisco Bay with its tributaries is the region's greatest physical asset for industrial development. The natural depths and maintained channels of the Bay enable ocean-going ships to service waterfront industries extending from the South Bay to Antioch. The Bay's harbor potential has fostered development of one of the nation's most rapidly expanding centers for petro-chemicals and primary metals along Carquinez Straits and Suisun Bay. Authorized deepening of the entrance channel to the Golden Gate and the main ship channel to Stockton will permit the Bay to accommodate all but the largest vessels afloat, thereby insuring continued growth in these basic industries.

2. Growing Population and High-Income Consumer Market Area

The people of the Bay Region -- their numbers, skills and buying power -- constitute an important asset for industrial development. For example, the Region's growing population with its higher-than-average proportion of college graduates[6/] assures many water-oriented industries of a qualified labor market -- a significant location factor for those industries which are highly automated.

6/ 9.9 per cent of the population over 25 years of age in California compared to the national average of 7.6 per cent (in 1960). Statistical Abstract of the United States, 1967, Table 157.

An even more important characteristic of the Region's population is its rating as a top bracket consumer market. With almost $9 billion in annual personal income, San Francisco ranks sixth among the nation's metropolitan areas, preceded only by New York, Chicago, Los Angeles, Detroit and Philadelphia.[7/] Consumer markets which have both population volume and high income level attract the types of manufacturing activities, such as paints, office furniture, pre-fabricated housing, which use the materials produced by water-oriented industries, such as refineries, steel plants and building materials producers.

3. Established and Expanding Manufacturing Market

The San Francisco Bay Region has had an established and diversified manufacturing base since World War II. Water-oriented raw materials processors considering a Bay Area location for new plant investment are therefore assured of an existing manufacturing market for their products, and one which also has excellent growth potential. Typically, these water-oriented industries enter a region first with distribution and storage facilities for products manufactured outside the region. As the market grows, final stage processing facilities are built. Finally the company plans and builds a completely integrated plant to serve the region and market area beyond it. Bethlehem Steel is a good example in this region.

7/ National Industrial Conference Board, The 67 Billion-Dollar Metropolitan Markets in the U. S. (Regional total of adjusted gross income of individuals, 1965), Nov. 1967.

4. Available Waterfront Land

Unlike many major urban port regions, the Bay Area still has vacant shoreline and upland sites distributed throughout the region that meet the requirements of water-oriented industries. This is in contrast to port areas such as Philadelphia, Baltimore, or Houston, where few large waterfront sites remain within the metropolitan area. Sizable waterfront tracts are almost non-existent along the metropolitan eastern seaboard, and shortages are developing at increasing distances from urban regions along the Gulf Coast. The large public expenditures at Los Angeles harbor are creating port land, but the large sites required for water-oriented industries are not available.

5. Established Urban Resources and Services

Just as an existing manufacturing customer market is important to water-oriented industries, so is the availability of long-established urban services and resources. Many industries that have built new plant facilities away from major metropolitan centers have experienced serious delays during plant construction because of inadequate local supply of ordinary building materials, or lack of skilled construction workers to assist the major contractor. These problems continue after the plant opens, with annoying delays and inconveniences in servicing office equipment and finding motel accommodations for visiting engineers. Some firms have had to maintain special cars or trucks for frequent runs to the largest

city for supplies, or for the nearest major airport, for parts flown in.

The San Francisco Bay Region has the array of large and competent industrial supply and repair service facilities that major industry needs. Universities of national repute are a nearby source for employee recruitment, in-service training and technical collaboration in research. Experienced banking, insurance, commercial and shipping services are available.

The Bay Area is an urbane community, having a wide range of cultural and recreational resources. This contributes to employee satisfaction, reduces turnover in both operating and administrative personnel. This is yet another reason for maintaining the quality of the environment of the Bay Area.

6. Interest in Regional Waterfront Planning

Although there may be different objectives among the many groups concerned with waterfront land use along the Bay, there is both interest and activity on the part of government, business and civic leaders in a regional approach to planning the Bay shoreline. No other port region in the U. S. is yet attempting a comprehensive analysis of its waterfront problems and potential. This early identification of the location criteria and land needs of water-oriented industry (as well as other uses) is a major step toward efficient and compatible sharing of the shoreline between industry and recreation -- the two prime claimants. Because the approach

to waterfront development is comprehensive and long-range, water-oriented industry will have a better chance to obtain good sites than through piecemeal isolated projects.

7. Opportunity for Intra-Regional Water Transport

There appears to be a great opportunity for the use of efficient and inexpensive water transportation for the distribution of goods and raw material within the region. Nearly every population center in Northern California can be reached via the navigable waters of San Francisco Bay and its tributaries. This configuration makes it possible for industries throughout the region to ship and receive goods by water to and from points outside Northern California, and also to collect and distribute goods within the region. This potential has not yet been fully tapped, but it could be in the future.

Present and emerging technological developments in shallow-draft water transport, including LASH float-on float-off ocean-going barge carriers, United States and British governments and industry experiments in surface-effect cargo vessels, and technical advances in barges and tows, all indicate the possibility of extensive intra-regional water transport of materials and products well within the time period of the BCDC Shoreline Development Plan.

This system could probably get underway after the LASH (Lighter Aboard Ship) vessels enter service in the Bay. The full potential of an intra-regional water delivery system will probably await civilian application of a technological breakthrough already

achieved -- surface effect cargo ships (i.e., air cushion vehicles) discussed in the BCDC Ports report.

A shift of substantial intra-regional shipments of raw materials, products, and over-sized building equipment to movement by water could reduce part of the traffic demand for new shoreline highways or on-the-Bay freeways. Furthermore, all extra-heavy, extra-length or other types of super-sized or hazardous cargo could be required to travel via water for most of its distance in intra-regional shipments, rather than deteriorating the traffic capacity of existing highways, or endangering passenger cars.

## The Effects of Maritime Technological Advances on the Demand for Bay-Oriented Industrial Land

This report assumes that the Bay Region will be ready to benefit from the revolutionary technological advances now occurring in the shipping industry, as discussed in the BCDC report on Ports. Preparing for these water transport innovations will require planning and developing facilities to accommodate the ships of the future, and identifying and reserving prime industrial sites on deep water and along potential shallow-draft channels.

### 1. Deep-Draft Facilities

Trends in maritime commerce are introducing major new economies in water transportation. Port areas capable of accommodating the new ships and handling methods will attract the industries the vessels serve. Among the most important trends are:

a. Deep-draft tankers (over 100,000 dwt.), to service the expanding petro-chemical complex in the North Bay Area;

b. Deep-draft dry bulk and ore carriers, to service the planned expansion of existing steel industries into full fledged integrated steel plants (the region will probably have three within the next 15 years);

c. Nuclear-powered cargo ships (expected to be available in less than a decade), that can carry in excess of 1,000 containers; and

d. Containerships, including the barge-carrying type, that have deeper drafts than ones now operating.

These trends all indicate a need for much larger land areas on and near the shoreline for the industries than have heretofore been needed. This is due to the growing number of industries that are seeking deep-water sites, and also the growing scale of each industry made possible by the use of giant ships.

2. Shallow-Draft Facilities

The number of deep-water industrial sites available in the Bay Region is limited, but more waterfront areas can be made accessible to deep-water sites by providing connections via shallow-draft transport.

Industrial waterfront planning should provide for shallow-draft industrial sites and landing areas served by an intra-regional water-transport system. The system might include large surface-effect

cargo ships and special-purpose barges, including high-pressure vessels, insulated barges for extremely high- or low-temperature cargo, industrial acids and other special chemical barges.

Water-Oriented Industry as a Good Neighbor

It is within the technological and economic capability of the types of industries that require waterfront sites to comply with regional standards for compatibility, i.e., not pollute the air or water, interfere with other public uses of the Bay, or despoil the appearance of the Bay shoreline.

These industries seek waterfront sites in metropolitan regions to achieve major savings in raw materials transport, processing, and product distribution. Their managements are well aware that the costs of operating in metropolitan areas include pollution abatement equipment and well-maintained plants and grounds.

There is now considerable precedent in industrial management decisions on plant and site design to achieve an attractive appearance for public relations purposes. In the last two decades, many consumer-oriented industries, such as auto assembly plants, breweries and soft-drink manufacturers, bakeries, cosmetics and baby products firms, have invited the public to visit their production facilities. Now heavy industries are scheduling visits to new plants. There is also a trend toward sharing industrial sites with the public for enjoyment of views, landscape features and historic buildings.

Installation of pollution abatement equipment can be depended upon for three reasons: (a) industry's increased concern for good community relations, (b) the nationwide action in upgrading air and water quality standards, and (c) the technological advances in pollution abatement equipment and modifications of process methods to reduce pollution potential.

Every industry proposed in this study for waterfront location can be a good neighbor. The presence of industry on the shoreline need not preclude public access, the preservation of scenic views, or maintenance of historic or recreation values. Integrated steel plants, refineries, food processing, and other water-oriented industries can be compatible with shoreline recreation.

The public is within its rights -- and also has a responsibility to industry -- to place performance and site development standards, consistent with technological advance, upon the industries for which it will reserve shoreline sites. At its best, the Bay provides a uniquely beautiful environment. This regional attractiveness is an important asset to industry, for environmental quality ranks high in management's location factors. Industry, like the public in general, has a direct stake in seeing that the Bay's beauty is maintained as its economic potential is developed.

## CHAPTER II. INDUSTRIES SEEKING WATERFRONT SITES

Sites near bodies of water such as San Francisco Bay are actively sought by four types of industry: (1) industries which use water transport; (2) industries requiring large quantities of water; (3) industries attracted to shore-located facilities; and (4) the amentity-seeking industries. Other types of industries sometimes choose waterfront sites, but for reasons unrelated to the presence of the Bay.

### Water Transport-Using Industries

Of the four types of water-oriented industry, the water transport-using group is most critical to BCDC planning. These industries are basic to the regional economy, and their demands for waterfront sites are increasing.

#### 1. Economic Importance

Water transport industries are important to both the region and the nation. The United States has become increasingly dependent upon foreign sources of raw materials. Landsberg, Fischman and Fisher, say in Resources in America's Future:

> "For some resource products, consumption has outrun domestic production. Around 1930 the historical position of the United States as a net exporter of resource products shifted to that of net importer. This country continues to export basic agricultural commodities, such as wheat and cotton, and to import non-competing products such as coffee, cocoa and natural rubber. But especially since the Second World War, the United States has become a fairly

> large net importer of such basic items as crude oil and iron ore, and has increased its imports of copper, lead, zinc and certain other metals, which were already considerable. ...From a national self-sufficiency standpoint, certain basic resources have become scarcer....1/

The water transport industries are usually the basic processors of raw materials -- the first stage of manufacturing upon which many other industries depend. When these basic industries are large users of imported raw materials, the deep-water plant is the first location in a series of transformation facilities, each of which is an essential operation to achieve a final product for the consumer.

Basic industries require large quantities of raw materials. Since transportation is a major element of total cost for these industries, the relatively low cost of water transport is especially critical to them. The traditional theory of industrial location holds that basic industries tend to locate close to the source of raw materials, because of the weight loss (in the raw materials) in early stages of processing. However, changes in industrial and transportation technology have led many of these industries to establish processing plants convenient to market centers, i.e., in major metropolitan areas. The customer for the product may be another manufacturer as in the case of petro-chemicals, primary metals, and paper containers; or the customer may be the public, as in the case of food, building materials, and gasoline. Thus these basic industries are becoming part of the normal array of activities in major port regions.

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1/ Published for Resources for the Future, Inc., by the Johns Hopkins Press, Baltimore, Md., 1963, p. 12.

2. Examples of Water-Transport Industries

Principal water-transport industries include chemical plants; petroleum refineries; primary metal industries such as blast furnaces, steel works, rolling and finishing mills; smelting, refining, rolling, drawing and extruding of non-ferrous metals; cement distribution facilities; brick and structural clay tile; clay refractories; gypsum products; concrete products; certain food processors such as meat packing, canned sea foods, fresh or frozen packaged fish, flour and other grain mill products, prepared feeds, and sugar refineries; paper and allied products, such as pulp mills, paper mills, paperboard mills, and building paper and building board mills; and ship and boat building. Most of these industries seek locations on deep water, with the possible exception of some building materials and some food processing plants.

3. Commodities Shipped by Water

The 1963 U. S. Census of Transportation gives an indication of the importance of water transport to American industry. According to the Census report, 25 per cent of all tonnage transported within the United States, and 44 per cent of the total ton-miles traveled were accounted for by water transport.[2/] This Census reported only on shipments outbound from factories or other

2/ "Water transport includes all shipments transported by ship, boat, barge and the like between two points in the United States. Shipments destined for foreign ports were coded "water" only if the major distance to the port of exit was negotiated by water. Otherwise, the means used to transport the shipment to the port of exit was coded." Definition from 1963 Census of Transportation, Vol. III, Bureau of the Census, Washington, 1966.

sources by mode of transport within the United States; ocean shipping of imports or exports at major ports of entry in the United States were not included.

As illustration of the importance of water transportation in U. S. foreign trade, a recent Bay Area study found that less than 0.1 per cent of the total tonnage shipped through the San Francisco Customs District in 1964 moved by air; i.e., more than 999 out of every 1,000 tons of foreign cargo through the district moved by water.[3/]

The basic industries realize major savings by bringing raw and semi-finished materials by water to their processing plants. However, many industrial plants with sites on navigable waters also use water transport for outbound shipment of varying proportions of their products. Appendix B illustrates the wide range of goods being transported by water in the United States. As was to be expected, products of petroleum rate exceptionally high in per cent of total tons shipped by water. Next in importance are chemical products including acyclic chemicals, ammonia, solvents and alcohols.

A great variety of other products are water transported such as processed fruits and vegetables, lumber, paper products, a wide range of chemicals, steel mill products, fabricated metals including valves, conveyors, typewriter parts, vending machines, and metal scrap.

3/ Arthur D. Little, Inc., The Port of San Francisco, 1966. p. 111.

The detailed commodity-transport mode statistics cannot be broken down from the national totals into port regions compared to non-water transport regions; however, they do indicate the wide range of industries that make use of water transportation.

4. Effects of Water Transport Trends on Shoreline Planning

The advance of technology is a critical factor in the increase in industry's land needs. Most advances in water transport technology, as discussed in BCDC's Port report, will increase the size of waterfront sites needed for industry. But changes in industrial and land requirements do not occur suddenly: there is always a time lag between the introduction of a technological change and its widespread adoption by industry. This "technological lag" provides the community with sufficient time to plan for the effects of the changes.

a. Impact of Big Ships on Shoreline Planning

The giant tankers and bulk carriers that serve the basic industries have an impact on land planning far beyond the docks, cargo areas and rail holding yards of public ports. Dr. F. Posthuma, an outstanding leader in port development and Director of the Port of Rotterdam Authority, warns that "where big ships can come, big industries will follow." Because of the economies of scale made possible by the big tankers, oil companies have been seeking larger sites to build their refineries and petro-chemical plants. Dr. Posthuma cautions that, in planning for an industrial waterfront development, it should be noted that many of the industries related to oil processing do not require the expensive facilities and access to deep water. Therefore, he recommends that adjacent or inland sites be found for these plants.

Big ships offer great cost savings to users and, therefore tend to generate new industrial and port facilities at places where the ships can be accommodated. In some cases, industries distribute raw materials from such a deepwater port over a large area to other ports where only smaller vessels can come. The proposal in the BCDC Port report for an offshore mooring facility for the unloading of crude oil from the supertankers for pipeline delivery to refineries is analogous.

The older ports where general and bulk cargo have been handled do not have enough space around them to realize such a development. To satisfy the growing demand for industrial sites within or near the area of the port, satellite ports and industrial areas must be developed.

Trends in the steel industry illustrate the effects of the large ships--ore carriers in this case. It is expected that many ore carriers of the future will be as large as 150,000 deadweight tons. For maximum economies, these will be serving steel plants with sites in excess of 1000 acres. With the trend of increasing draft on new ore carriers, the steel industries on the Carquinez Straits and Suisun Bay will need the channel deepening proposed in the "Big Ditch" project. Ore handling facilities that were modern 10 to 15 years ago which covered just a few acres have been replaced by huge industrial sites covering hundreds of acres. For the rapid unloading of such large carriers, new shore-based installations with powerful unloading towers and very deep water at wharfside will be needed. Because of the size of the ships and the speed of modern unloaders, it has become almost impossible to discharge ore directly from ships to barges or railway cars; therefore, huge stockpilings areas equipped with stackers and reclaimers are needed. It may well be in the future that pelletizing plants or even blast furnaces will have to be built on the

waterfront where the ore is handled to supply steel plants not only with ore but with pellets or ingots.

Big ships also tend to increase land requirements for industries linked to the basic processors. For example, petroleum refineries often need large quantities of electricity, so power plants have to be built nearby. As the scale of the basic industry increases, so does the number and scale of related industries. For example, large refineries attract large petro-chemical plants. The total industrial complex can become very large, unless a system of pipelines and barges enables the product-linked plants to disperse, but remain unified by this specialized system of transport.

Water Using Industries

Many industries use water in their manufacturing process. Industrial water use far exceeds household water use. Only a small portion of the industrial water intake is actually consumed, however; most is used for cooling purposes.

The waters of San Francisco Bay are used by several industries. According to the BCDC report, Salt, Sand, Shells and Water:

> "The waters of the Bay are extensively used for industrial purposes, especially cooling. Average annual use (1960-1963) was 655 billion gallons of Bay water. The current water users alone estimate they will eventually need 776 billion gallons per year.

"The bulk of the water, 638 billion gallons, is used for industrial cooling purposes. Another 16 billion gallons are used in recovering salts and chemicals, and one billion gallons are used for treating or diluting wastes in controlled ponds.

"The water used for cooling is returned to the Bay, with its temperature increased. The only potential harm to the Bay might be excessive heating of the waters. This is a form of pollution that could adversely affect marine life if extensive enough, but it has not yet been considered a problem.

"Using Bay water for industrial purposes relieves the demand for fresh water that must either be brought into the area by aqueduct or must be pumped from underground sources (which are already in short supply). Industrial use of Bay waters will undoubtedly increase as new water-using industries come into the Bay Area."

Because of the anticipated increase in industrial use of Bay waters, it is important to identify the water-using industries and to examine the technological trends in industrial use of water that could affect industrial land needs.

1. Examples of Water-Using Industries

The largest industrial water users are power plants and four major manufacturing groups. According to the Census of Manufactures, Water Use in Manufacturing, 85% of the 14.1 trillion gallons of intake water by manufacturing establishments in 1964 was accounted for by:

| | |
|---|---|
| Primary metals | 32.6% |
| Chemicals and allied products | 27.7 |
| Paper and paper products | 14.7 |
| Petroleum and coal products | 10.0 |
| | 85.0% |

The intake of water by manufacturing establishments increased 21% between 1954 and 1964. Almost all of the increase can be attributed to these four major industry groups. Other manufacturing industries using large quantities of water are food, stone, clay and glass, transportation equipment, and machinery. In Appendix C, statistics for water intake by selected groups of manufacturing industries for 1954 and 1964 are given for total water intake, fresh and brackish (salt).

Existing industries that use estuarial waters in the San Francisco Bay Area are listed below by type of industry and predicted annual rate of use:[4/]

| Type of Industry | Number of Plants Reporting | Predicted Annual Intake Billions of Gallons | Predicted Annual Intake Per Cent |
|---|---|---|---|
| Power plants | 5 | 534.4 | 68.8 |
| Steel | 1 | 100.0 | 12.9 |
| Refineries | 3 | 77.9 | 10.0 |
| Food processing | 2 | 21.6 | 2.8 |
| Chemicals | 9 | 34.9 | 4.5 |
| Cement, other bldg. materials | 3 | 5.7 | 0.7 |
| Others | 3 | 1.7 | 0.2 |
| Total | 26 | 776.2 | 100.0% |

4/ "Beneficial Water Uses to be Protected...in Tidal Waters...with S. F. Bay Region". San Francisco Bay Regional Water Quality Control Board, State of California Resources Agency, Table IV-3. December 1965.

Brackish (saline) water is satisfactory for many industrial purposes. Approximately 20% of the water used by U. S. industries in 1964 was brackish (saline), and this percentage is rising each year. The abundant supply of water in the Bay is thus an attraction for industry.

2. Specific Manufactures with Large Brackish Water Requirements

Appendix D lists thirty-five manufacturing industries identified by 3 or 4-digit Standard Industrial Code, with the total and brackish water intake for each. All of these industries have a growth potential in the San Francisco Bay Area, and most will seek waterfront sites.

The largest users of brackish water are those industries with large cooling and condensing water requirements. Miscellaneous Industrial Organic Chemicals (S.I.C. 2818), the largest, includes non-cyclic organic chemicals, such as acids and metallic salts; solvents such as alcohols, acetates, ethers, acetone and chlorinated solvents; synthetic perfume and flavoring materials; rubber processing chemicals; plasticizers. Many are derivitives of petroleum refining. Ninety per cent of the total water intake is used for cooling and condensing, and brackish water represents 51% of the total water intake.

The second largest user of brackish water is Petroleum Refining (S.I.C. 2911). Blast furnaces and steel mills (S.I.C. 3312) are third.

The fourth largest is another chemical industry, Alkalies and Chlorine (S.I.C. 2812), and the fifth is Paperboard Mills (S.I.C. 2631).

Other chemical industries using substantial quantities of brackish water are inorganic pigments, industrial inorganic chemicals, plastic materials and resins, drugs and fertilizers. Manufacturers of engines and turbines, of aircraft engines and parts, and cane sugar refineries also use brackish water as a large per cent of their total water intake.

3. Industrial Use of Brackish Waters in Coastal States

Use of brackish water in Coastal states is shown on Appendix E. Texas has the largest industrial use of brackish water, both in volume and in per cent of total intake--attributable primarily to chemical industries, which use six times the quantity of water used by Texas petroleum refineries.

In Maryland, second in rank order, the principal user is an integrated steel mill. In Louisiana, which ranked third, use was almost evenly divided between chemical plants and petroleum refineries. In New Jersey petroleum refineries used almost half the brackish water intake, and chemical plants used 36%.

California ranked fifth in industrial use of brackish water, with an intake of 162 billion gallons, distributed as follows:

| | Billion Gallons |
|---|---|
| Food and kindred products | 14 |
| Lumber and wood products | 1 |
| Paper and allied products | 6 |
| Chemicals and allied products | 13 |
| Petroleum and coal products | 110 |
| Stone, clay and glass | 13 |
| Primary metals | 6 |

## 4. Factors Affecting Industrial Water Requirements 5/

Technological changes in production processes and effluent controls are important factors affecting industrial water requirements. The effects of new production methods can be illustrated by developments in the petroleum and steel industries. Rising standards of effluent control generally result in increased industrial water intake as well as land requirements.

The nature of petroleum refineries has changed significantly in the last two decades. Not only has size increased, but the number of products prepared at a single installation has increased as well. Modern refineries have hydrogen treating units, reforming units, alkylation units, and facilities for producing entire range of lubricants. This increasing refining complexity appears to increase both cooling load and gross water intake per barrel of crude processed, and probably increases the amount and complexity of waste load.

5/ Most of this section is summarized from Economics of Industrial Water Utilization, Blair T. Bower, Associate Director, Quality Environment Program, Resources for the Future, Inc.

However, one technological development -- integration -- has tended to reduce gross water application per refinery unit. In a conventional refinery, the units are separated by intermediate storage. In the integrated refinery, however, refining facilities are located adjacent to one another, and the stock is run directly from one unit as the charge to the next unit. The adoption of integration at the Sohio Toledo refinery saved about 10,000 gallons per minute of cooling water capacity.

In steel mills, the major technological changes in recent years have been introduction of the basic oxygen process, continuous casting and automation (including computer-controlled production). The basic oxygen process has reduced the gross water applied per unit, but slightly increased the water consumption per unit. Some industry representatives think continuous casting will reduce both gross water applied and consumptive use per ton of product. Automatic control presumably will result in over-all improvement in production efficiency, reducing gross water applied per unit.

As a general rule, the higher the standard of effluent control, the greater the consumptive use of water per unit of product. Some industries have been able to minimize water needs, however, through such methods as by-product or factor input recovery, process modification, recirculation of water, and use of stabilization ponds or lagoons. Sulfuric acid

recovery process and conversion of cottage-cheese whey into salable protein food supplements are examples of profitable by-product recovery. Some chemical plants have been able to reduce waste loads as much as 90% by relatively minor process modification. Among the advantages of recirculation of water are (1) reduction in intake water costs; (2) reduction in chemical, thermal and biological pollution; (3) increased flexibility for plant expansion without necessity of providing larger water mains and sewers; (4) relative simplicity in treating and handling concentrated waste water; (5) maximum freedom from water pollution by upstream users because quantity of intake water is reduced; and (6) reduced cost of corrosion control in a closed system. Use of stabilization lagoons can be a relatively inexpensive method for handling wastes, if land is available. For industries on shorelines, pond areas must sometimes be created by diking off shallow water areas.

The planning goal for compatible, multiple-use of the San Francisco Bay shoreline, however, requires the imposition of stringent effluent disposal standards. This would increase the water consumption and, possibly, the land required for treatment and disposal of wastes. Hopefully, the current State Bay-Delta Water Quality Control Program will provide a method of regional waste disposal that eliminates the requirement for treatment at each industrial plant. For example, a regional system of piping or barging wastes to open ocean, or of waste-water reclamation, could save substantial industrial acreage for construction of production plants

and avoid diking and filling of the Bay necessitated by ponds or lagoons. Such a system may also be less expensive to industry also.

5. Shoreline Requirements

Industries which have large water intake and outlet requirements but do not require water transport facilities do not need to locate on the shoreline. These can be built upland from the Bay or river in order to provide recreational use of the shoreline. As distance from shoreline increases, so does the cost of intake and outlet pipelines, but these are not major expenditures in comparison with total plant cost.

## Non-Water-Oriented Industries Seeking Waterfront Sites

In addition to industries that make direct use of water in their operations (and are, therefore, water-oriented), many other industries may seek sites near the water for indirect reasons. These include (1) industries that rely on facilities such as airports, railroads and freeways that are often located in waterfront areas; (2) industries seeking an attractive setting and amenities such as marine views; and (3) marginal and nuisance industries that find the low rents and lack of performance standards in some run-down waterfront areas suitable for their activities. Although these activities are not Bay-related, their existence and needs must be considered in the BCDC plan.

Industries Attracted to Shore-Located Facilities: Airports, Freeways and Railroads

The presence of airports, freeways and railroads along the shores of San Francisco Bay poses a serious challenge to the concept of preserving Bayfront industrial sites for water-oriented industries. Industries that seek locations in the vicinity of airports and freeways have no requirement for waterfront sites, but their need for sites adjacent to these shore-located facilities is undeniable. A 1966 survey by the Association of Bay Area Governments found that nearly half of the shoreline in industrial use is occupied by non-water-oriented industries.[6/]

Waterfront sites are sought for airports because of the safety factor in unobstructed approaches over water. Land in the vicinity of airports is an important resource for regional industrial growth. Unless this land has usable shoreline for water-transport industries, BCDC should consider the need to reserve this land for the sole use of (1) industries which have large quantities or frequent shipping by air cargo, (2) industries which have large service staffs who fly to customer plants, (3) flight testing or other demonstrably airport-related uses. There is little evidence that the privately-owned industrial land near the two major airports in the Bay Area is getting the careful husbandry that it deserves as a regional asset in short supply.

6/ See discussion in Chapter III.

A wide range of industries are attracted to freeway sites. For the customer service-oriented industry, the freeway provides quick distribution of products or services throughout the region, including soft drinks, parts depots, special food preparations. For the public relations-conscious industry, an attractive, landscaped plant with freeway frontage provides prominent location advertising without billboards. Pharmaceuticals, beauty preparations, and electronics are in this group. The freeway also provides access to a wider labor market for these industries.

Several locations along the Bay shoreline are now developing as planned industrial parks having proximity to freeways, railroads and airports. When these industrial areas meet the shoreline (and several are almost to the shoreline now), public observation areas and public access to the shoreline should be provided. For example, the Cabot, Cabot and Forbes Industrial Park in South San Francisco has developed a small park on a high point that affords fine views of the Bay, and have ornamented the hilltop with a large metal sculpture. This concept of sharing Bay views with the public should be applied in appropriate ways throughout the region's shoreline.

Because of the very great pressure that will develop for more industrial sites near freeways, it is not enough to just deny bay fill for these industrial uses that have no direct need for the Bay. In the interest of regional economic

well-being, BCDC should include in its Shoreline Development Plan policy statements emphasizing the need for radial freeways, rather than Bay-occupying freeways. The policy statement should also recommend the need to reserve choice locations for future industrial sites and industrial park area along these radial freeways. Some routes will be located in valleys, other roads will have to go into the hills. These new locations can offer special amenities to light industries, if carefully planned and properly controlled. Experience in other areas, such as Boston and Washington, has demonstrated the desire of many industries to move to outlying locations that are well tied to the rest of the region by good radial and circumferential freeways.

Since additional railroads are not likely to be built except possibly in the Collinsville area, such a freeway policy would reduce pressure on rail sites near the Bay. A corollary policy should be to reserve sites near railroads and freeways in and around the Bay Area for industries that require combined rail and freeway access.

The Amenity-Seekers

Because they require highly skilled technical and managerial personnel, and are not dependent on special transport facilities or raw materials, research laboratories, headquarters offices and similar establishments have been amenity-seekers for some time. At first, these industries sought prominent

sites on freeways or parkways, and now seek prestige locations adjacent to quality residential areas or next to universities. Stanford Industrial Park in Palo Alto is a nationally-known example of this type of development, and there are many others. The next site selection trend may well favor waterfront locations. The Cabot, Cabot and Forbes industrial park on the Bay front in South San Francisco is a prime example in the Bay Area. Several can be found in Florida and southern California.

The BCDC Report on Waterfront Housing concluded that shoreline housing should not be allowed to displace uses that must of necessity be located on the waterfront, such as water-oriented industry, marine terminals, water-related utilities, or water-oriented recreation. It further concluded that housing should not be allowed to interfere with other uses of regional importance, such as airports, that may have to be located on the shoreline for lack of other suitable sites. These criteria appear equally applicable to non-water oriented industrial parks. It is therefore recommended that industrial parks that provide public access to the shore and are to be developed to the highest prevailing amenity standards should be placed at least in the same priority category as waterfront housing, and the choice of which these two uses of the appropriate shoreline areas should be left to local governments, based on their own evaluation of which is most appropriate in their area of jurisdiction.

Other Non-User Waterfront Industries

Every waterfront has non-water oriented industries. Some occupy low-rent incubator space in old, often deteriorated structures once used by a water-oriented industry. These should be evaluated for potential clearance and redevelopment of the land for water-oriented industry or other appropriate uses. Marsh areas of the shoreline are sometimes used as cheap dumping areas for auto graveyards and other junk fill. The BCDC plan should either propose the removal of these operations or establish standards for temporary use to prevent nuisance.

# CHAPTER III. GUIDELINES

San Francisco Bay is a unique and irreplaceable resource. Its contributions to the people of the region range from helping to maintain the climate to the economic benefits of maritime commerce and industry. While performing these functions, the Bay is the focus for scenic views and the enjoyment of a wide range of recreational activities. These functions are compatible with one another to a degree, but careful planning is needed to avoid conflicts between them and to establish priorities among competing activities in specific areas.

The purpose of this chapter is to suggest a priority system for selecting waterfront industrial sites and a set of design principles for guiding their development. These suggestions are based on the premises that water-oriented industry is important to regional development and must of necessity use the Bay shoreline; but that industrial development should not unnecessarily inhibit public enjoyment and other important uses of the Bay.

## Priorities: The Important Water-Oriented Industries

Because of the scarcity of sites in the Bay Area for water-oriented industrial use, these sites should be reserved for plants that need them most. This section lists the types of industries that require sites having certain characteristics. These industries

should have priority over others for such sites. All of the industries listed are considered to be desired activities in the Bay Area.

1. Deep-Water Shoreline

The most significant characteristic of the Bay, from an industrial development point of view, is its use for deep-water navigation. Therefore, top priority for use of shoreline areas fronting on or within one nautical mile of a deep-water channel should go to port facilities, shipbuilding, and to industries requiring deep-water ship berths for dry-bulk carriers, such as:

a. primary metals - steel and non-ferrous mills

b. chemicals - dry bulk, such as potassium and other salts, compounds, potash

c. food processors - sugar, rice mills, coffee, cocoa, fish

d. paper and board mills

e. cement, asbestos, gypsum, fluorspar processors

For petroleum refineries and chemical industries served by deep-draft tankers, pipeline access to the shoreline should have top priority, but location of new plant facilities need not be at the shoreline itself.

2. Uplands Contiguous to Deep-Water Industrial Sites

Top priority for uplands contiguous to deep-water industrial sites should go to those manufacturers linked by product or process to the deep-water industries listed above.

The objective of the upland priority system is to encourage the development of industrial complexes where manufacturers can benefit from close proximity to their basic suppliers. For example, steel plants could deliver inside the industrial complex to pipe and tube mills, wire drawing, foundries, forging plants, and large quantity users of mill products such as structural steel and plate fabricators. Materials handling costs and on-site storage requirements would be reduced; deliveries would be faster; and, most important from the public's point of view, heavy industrial traffic on the public roads would be reduced.

Inasmuch as petroleum refineries and chemical industries served by deep-draft tankers were recommended only for pipeline access at the shoreline, these should have prior consideration for upland plant sites close to their most efficient pipeline access.

The modern industrial complex originated with the petro-chemical industries. The Houston Ship Channel for most of its length is criss-crossed by many underwater pipelines connecting refineries to petro-chemical processors, which in turn are linked by underground pipelines paralleling the industrial shoreline development.

Although upland sites contiguous to deep-water shoreline of the Bay have been recommended for petroleum refineries, petro-chemical industries should not share this priority. Petro-chemical plants using feedstock from the refineries may have to locate

their processing facilities for plastics, synthetic fibers, rubber and other petroleum-based products inland.

Pipelines add to the construction costs of these plants. Thus it would be logical to construct short pipelines from the shoreline to the refinery for the economical delivery of the large quantities of crude oil, and longer pipelines for those smaller portions of high-value (per unit of volume) refined byproducts which go on for further conversion.

3. Shallow-Draft Shoreline

Barge-using industries should have first preference for shoreline areas suitable for shallow-draft navigation. Since an increasing proportion of gasoline and other petroleum products are now being piped from refineries to distribution terminals, petroleum product tank farms need not be given high priority for shallow-draft shoreline or upland. The barging of crushed stone, riprap, sand and gravel, cement, and lumber and other building materials will continue and, therefore, these industries warrant priority at shallow-draft shoreline. Provided they make intensive use of water transportation, priority should also be given to:

a. concrete products

b. ready mix

c. pre-stressed concrete products, particularly oversize items

d. structural steel fabricators of oversize products

e. transmission tower fabricators

f. general building contractors

g. highway and street construction contractors

h. heavy construction contractors

In lieu of deep-water upland sites, some metal fabricators, such as plumbing fixtures, bolts and nuts, barrels and drums, heating equipment, door-rail-frame manufacture, and some chemical plants and paving and roofing materials could use shallow-draft shoreline sites, and be connected with their basic material sources by a barge system.

If an intra-regional water transport system discussed previously in this report is realized, then wholesale facilities, distribution centers, and warehouses can build on shallow-draft shoreline sites. Wholesale building supply centers and distribution centers for retail food, drug, auto, and machine parts are possible users. Rail and highway access to these facilities will be essential.

Design Principles

Bayfront industrial development can be compatible with preservation of the visual, historic and recreation values of the Bay through joint planning by public agencies and industry. The application of modern technology to industrial facility construction and operation can prevent environmental pollution, and a clear framework

of planning guidelines by public agencies can provide complementary facilities for industry and protect the public interest.

Public policy for Bayfront industrial development should require design elements in industrial facilities that save shoreline for public use, and that preserve or enhance visual values and the environmental quality of the Bay and its uplands.

All industrial shorefront development, whether new plant or expansion of existing facilities and whether or not involving fill, dredging, or alteration of terrain, should conform to approved performance standards and should be required to have its site plan approved by an authorized public body. It is recommended that the planning agency designate Waterfront Industrial Development Areas at appropriate locations along the shoreline, within which priorities should be given to the uses in the previous section, and the design principles in this section should be applied.

The following protective design principles are suggested as feasible guidelines in this approval process. They are not intended as rigid standards, but as guides for designers of industrial facilities and for the agency reviewing the plans.

1. Necessary Uses of Shoreline

Shoreline use in industrial and port areas should be limited to those facilities that must of necessity be at the shoreline, such as:

a. docks, wharves, terminals, essential dockside materials-handling equipment, access roads and rail;

b. intake and outlet areas for water supply, drainage and treated effluent;

c. pipeline access for gas, liquids and flotation bulk materials systems;

d. conveyor systems;

e. utilities access or crossings (preferably buried);

f. airport approach and takeoff areas;

g. viewing areas or historic areas or structures, accessible to public; and

h. recreation uses for employees and/or public

2. Storage Areas

Storage at the shoreline of raw materials, fuel, products or waste disposal -- whether in open piles or in tank, silo, shed or other above-ground structure -- should not be permitted on a permanent or long-term basis. The shoreline is too scarce and valuable to be given over to storage, even within industrial plant sites.

Generally, permanent storage areas should either be at right angles to main direction of shoreline or, if parallel to shoreline, at least 200 feet inland (distance is dependent upon future ship berth requirements, potential terrain modification, and type of shoreline recreation potential -- path, beach, marina; the intent is to avoid blocking shoreline with uses that could be located even just a few hundred feet inland).

If the shoreline thus freed is put to public use, the industry should be compensated for its added costs for longer pipelines and conveyor systems.

3. Sharing of Shoreline

In locations where large acreage is available for industry, site planning should aim for shoreline access for all future plants in a water-oriented industrial area via road, rail, and via free rights of way for pipelines, utilities and conveyor facilities. Thus no single plant could usurp all shoreline access in a prime location, to the detriment of future upland water-oriented industries. The longest dimension of plant sites should tend to be at right angles to rather than parallel with the shoreline.

Dock or wharf facilities at waterfront industrial concentrations should be shared as much as possible among industries and also with public agencies if appropriate. Not only might this save some shoreline for recreation use (by using the facilities more efficiently), but both public and private costs for constructing shipping facilities and for maintaining harbor depths might be reduced. A recent example of this type of joint planning is the harbor facility at Burns Harbor, Indiana. Two steel companies have separate deep-harbor berthing areas for ore carriers on Lake Michigan. In the area between these ore carrier berths, the State of Indiana is constructing a public port facility. The concept of shared berths is not new in port planning. In this instance, two

industries with very large shipping requirements have their private requirements satisfied, a new public facility was created, and the major dredging costs for the harbor could be shared.

4. Waste Disposal

The use of extensive waste treatment and tailing ponds by waterfront industries should be avoided as much as possible. These facilities require large land areas for many waterfront industries such as refineries, chemical plants, food processing plants, and paperboard mills. In addition to normal plant requirements, additional pond capacity is needed to hold extra effluent if treatment plant breaks down. Sub-regional systems for piping waste to central treatment facilities, or barging or piping untreated or partially treated wastes out to sea, or other methods of treatment (where feasible) should be encouraged so as to avoid unnecessary Bay fill and shoreline use.

5. Public Access and Scenic Areas

Overlook points, historic areas and structures, and desired points of public access to the waterfront should be designated by the planning agency within each Waterfront Industrial Development Area where applicable. The plan for each area should protect and enhance these special public interest features. Such areas of public interest need not serve as boundary lines to limit industrial waterfront districts, but can become focal points within a comprehensively planned waterfront industrial area.

Shoreline vantage points designated for public view areas need not be accessible to the public directly by private auto.

(Public parking areas required at passenger ship and airport terminals are an exception.) To provide acres of non-industrial parking at shoreline points of spectacular beauty or historic interest within industrial areas would be extremely wasteful of this unique land resource.

Hiking paths served by inland auto parking lots or public transit, funiculars, aerial tramways or other modes of personnel transport not requiring large land areas at the vantage point are preferable. This concept may be applicable at many industrial shorefront locations, such as Point San Bruno, Point San Pablo, and, particularly, at Pinole Point, where a part of the forested area and the Point should be reserved within the Bethlehem Steel property for a public observation area, but none of it should be wasted on public auto parking.

Some attempt should be made toward linking sections of hiking trails and observation points together as part of a regional public access system to the Bay and its tributaries.

Many industrial site plans now include facilities for public visitors. A few nationally known companies have always welcomed the public as visitors to their industrial plants. In recent years a growing number of firms have established programs for public visits to their plants. Today, more than 5,000 industrial plants have regular days each week for public visits.1/ At first

1/ U. S. Dept. of Commerce, U. S. Travel Service. Plant Tours for International Visitors to the U.S., 1967-8 Edition, Government Printing Office.

this was a goodwill gesture to the people who lived in the city or nearby region; but now many industrial plants find themselves national (instead of local) hosts, especially those located in regions which attract tourists. As a tourist attraction, the Bay Area could generate similar visitor interest in major new industries located on the Bay.

Perhaps the most spectacular of industrial "tourist attractions" are the Anhauser Busch breweries in Tampa and Los Angeles, where the plant tours and the adjacent gardens, zoos and hospitality house facilities attract millions of visitors annually. The Anhauser Busch brewery, gardens and zoo in Tampa is reputed to be the third most popular tourist attraction in Florida, surpassed only by the Kennedy Space Center and the underwater gardens at Silver Springs.

The public enjoys but does not expect these added features. The public is genuinely attracted to modern industrial operations. Heavy basic industry and port operations now scheduling visitors tours or providing observation areas have much to show their guests. The public is especially interested in observing materials handling equipment in operation. There are many scenes and outdoor industrial activities which interest the lay observer: the giant clamshell cranes unloading ore carriers, coal tipplers in action, the docking of a ship, the sight of a jumbo petroleum tanker, the traveling cranes in structural steel supply yards, the mammoth

container-loading equipment. However, activity isn't always required. The scale and the intricate pipelines of refineries, and the patterns of huge stock piles and conveyor belts also provide enjoyable viewing to the public.

P.G.& E. Power Plant Site

The Pacific Gas and Electric power plant, to be built on the Sacramento River at Collinsville, Solano County, can become a major visitor attraction in the Bay Region. The potential of sharing the two miles of this riverfront location with the public can be illustrated by the development of the nuclear plant begun by Con Edison in 1956 on the east bank of the Hudson River at Indian Point, in the Village of Buchanan, northern Westchester County, New York, 25 miles north of New York City. The 250-acre site has been open to the public for several years, with a Nuclear Information Center, visitors' parking area, a pond and woodland trail. Indian Point Unit #1 began operations in 1962. Now a second nuclear power unit--the world's largest--is to be completed in mid-1969 on the same site. A comprehensive program of conservation and restoration will maintain and supplement the natural beauty of the site. Lake Iroquois, a small lake on the site will be surrounded by a picnic area with tables, water outlets, comfort facilities and parking lots. New rustic trails will have signs identifying significant floral, arboreal and geological specimens. One trail will lead to an overlook area for a view of the Hudson

River. "Nuclear House", a large exhibit hall, will be built with observation terraces providing dramatic views of the Hudson and the entire plant site. Indian Point #2 station will also include a viewing gallery so that visitors may see the huge generating room.

Open space and structural density requirements in the site development standards of the zoning or industrial subdivision ordinance should be sufficiently flexible to credit public access areas as part of the open space requirements of the site. The joint planning by industry and public agencies for appropriate public view and access areas should also include a search for land in the vicinity of the industrial plant that would be suitable replacement to the industry for areas given over to public use.

6. Pollution Controls

All locations recommended for Bay-oriented industrial uses should be subject to regional air and water pollution controls. The standards set should be high enough to permit appropriate recreational use of the environs. Although many water-oriented industries are in the "heavy industrial" class, technological advances have made possible standards of plant operations that are compatible with urban living requirements. Installation of pollution control equipment during new plant construction is simpler and less expensive than adding the equipment to an existing plant at a later date. Air pollution control requirements should be expanded to require such equipment in new plants. The economic importance of metropolitan

locations to these industries warrants the expenditure for process control equipment. These pollution controls should apply equally to all other waterfront development -- port, airport, recreation, and government facilities.

7. Highway Planning in Waterfront Industrial Areas

In order to avoid cutting industry off from the waterfront, new highways in existing or future industrial areas should be located away from the waterfront, and should not be constructed parallel to the shoreline except as approaches to approved Bay or river crossings.

The serious shortage of land for water-oriented industry makes highways an undesirable use when these would intrude between dock or wharf facilities and the plant. If the shoreline site is designated for a port facility or for an industry that received or shipped heavy cargo, such highway intrusion would destroy the development potential of the site. Even industries served by dry bulk carriers or tankers would be handicapped; overhead structures for pipelines, conveyors, personnel and trucks would be required to connect waterside dock or wharf with the plant proper.

New access roads will be needed in water-oriented industrial areas, but the orientation should be approximately at right angle to the shoreline, topography permitting.

Roads within waterfront industrial areas which must parallel shoreline to connect several industrial plants, should be inland not less than 500 feet and preferably 1,000 feet or more.

Rights of way and interchanges should be designed with heavy industrial traffic in mind.

8. Railroads and Transit Lines

New railways or rapid transit lines in shoreline areas should be located to avoid unnecessary blocking off of the shoreline. Where possible, the land between shoreline and railroad should have sufficient depth for either industrial or recreational use.

9. Landscaping and Terracing

Where Bayfront hills are identified for water-oriented industries, regionwide development regulations should require terracing rather than complete leveling. An example in the Bay Area is Stanford Industrial Park, where a few of the early buildings and most of the recent plants have been terraced on the hills. Long processing lines in steel mills or metal fabricating plants will require large level sites for each building, but the complete site does not need to be level. In a multi-building installation, offices and laboratories are now adapted to rolling terrain and new warehouses are utilizing terrain for two levels of entrance. Terracing, diking and landscaping of areas for petroleum and chemical products tanks is already being done in the Bay Area.

## The Public's Reciprocal Obligation

The "good neighbor" role to protect public access to the shoreline and the visual appearance of the Bay in industrial areas is reciprocal. Like industry, the public agencies should consider

the approval of a development plan an agreement to abide by the conditions. Once industry and public agencies agree on site development and design plans, the industry should be able to proceed with the certainty and confidence that the public agencies will (1) construct the agreed-upon improvements such as roads, parks, etc.; (2) enact and enforce the necessary development controls to prevent encroachment of incompatible uses into the industrial area; and (3) refrain from making unreasonable demands on the industry that were not included in the original plan approval.

# CHAPTER IV. EXISTING INDUSTRIAL USE OF THE BAY SHORELINE

This chapter describes existing land use conditions around the Bay as they relate to industrial development. Its purpose is to illustrate some of the principal problems and opportunities for industrial development in the Bay Area. The emphasis is on the way that the shoreline is used by industry and how this compares to the guidelines suggested in Chapter III.

## Shoreline Land Use

The planning staff of the Association of Bay Area Governments conducted a survey of shoreline land use in 1966 as part of its regional planning program. The ABAG survey found that of the 345 miles of shoreline in the nine counties (including some river areas outside BCDC jurisdiction) marshes are the predominant shoreline use, with approximately 127 miles, almost 37 per cent of the total shoreline. Marshland is probably over-emphasized, since in a number of areas there are strips of marsh waterward of more intensive use. Salt ponds and agriculture are probably under-reported for this reason.

Residential use is second, with 37 miles, followed by 36 miles of vacant shoreline, and 34 miles of transportation uses. Industry

is in fifth place, with a total of 33 miles, of which 14 miles is occupied by non-water related industry.

Generalized Shoreline Land Use[1/]
July 1966

| Use | Rank order | Miles | Per cent Total | Per cent occupied |
|---|---|---|---|---|
| Residential | 2 | 36.97 | 10.7 | 20.3 |
| Commercial | 12 | 7.35 | 2.1 | 4.0 |
| Services | 15 | 1.61 | 0.5 | 0.9 |
| Parking | 16 | 0.11 | -- | -- |
| Water-related industry[2/] | 5 | 19.05 | 5.5 | 10.5 |
| Other industry | 7 | 14.08 | 4.1 | 7.7 |
| Utilities | 11 | 7.87 | 2.3 | 4.3 |
| Transportation[2/] | 4 | 34.28 | 9.9 | 18.8 |
| Institutional[2/] | 9 | 13.07 | 3.8 | 7.2 |
| Recreation | 6 | 17.33 | 5.0 | 9.5 |
| Marinas and related | 14 | 1.75 | 0.5 | 1.0 |
| Salt evaporators | 10 | 9.88 | 2.9 | 5.4 |
| Agriculture | 8 | 13.57 | 3.9 | 7.4 |
| Forestry and related | 13 | 5.42 | 1.6 | 3.0 |
| Subtotal occupied | | 182.34 | 52.8 | 100.0 |
| Marsh | 1 | 126.95 | 36.8 | |
| Vacant | 3 | 35.97 | 10.4 | |
| Total miles shoreline | | 345.26[3/] | 100.0 | |

1/ Source: Association of Bay Area Governments.

2/ Military use of the San Francisco shoreline for depots, maintenance centers, bases and airfields totaled 31.81 miles, representing 17.4 per cent of the developed shoreline. These military measurements were distributed in the ABAG totals among water-related industry, transportation and institutional uses.

3/ Includes river areas outside the Bay proper. The total mileage of Bay shore is approximately 276 miles.

By regrouping the ABAG statistics on urban uses at the shoreline, the under-utilization of the Bayfront becomes more apparent:

Urban Uses of San Francisco Bay Shoreline

| | Miles | |
|---|---|---|
| Water-oriented | | |
| Industry: | | |
| water-related | 19.05 | |
| transportation (including 1.7 miles of highways) | 34.28 | |
| utilities | 7.87 | |
| Total water-oriented industry | 61.20 | |
| Recreation | | |
| marinas | 1.75 | |
| other recreation | 17.33 | |
| Total recreation | 19.08 | |
| Total water-oriented | | 80.28 |
| Non-water oriented: | | |
| Residence | 36.97 | |
| Commercial | 7.35 | |
| Services | 1.61 | |
| Parking | .11 | |
| Non-water oriented industry | 14.08 | |
| Institutional | 13.07 | |
| Total non-water oriented | | 73.19 |

While a more detailed survey might alter these statistics somewhat, these figures clearly indicate that an inordinate proportion of the shoreline is occupied by uses not dependent upon the major functions of the Bay. Continuation of past development trends

would be profligate misuse of the 191 miles of this major natural resource that are now in open use or vacant.

Industry's Use of the Shoreline

Most water-transport oriented industries require large water-front sites, but many do not need long, uninterrupted shoreline for their operations. It is possible, therefore, for portions of the Bay industrial shoreline to be used for some type of public access and recreation after industry's needs for shipping facilities and water intakes and outlets at the shoreline are met.

The longest lengths of shoreline for future industrial uses will be for such functions as shipbuilding, passenger ship terminals, general and special cargo terminals (particularly containership terminals), and possibly airports. The extensive shoreline needs of general cargo terminals are illustrated at Port Newark and partially-completed Port Elizabeth, marine terminal facilities of the Port of New York Authority. These facilities have a total shoreline of approximately 2.4 miles on Newark Bay. This 2.4 miles of shoreline serves the 703-acre Port Newark and the world's largest containerport -- 905-acre Elizabethport. All of this shoreline is required for docks.

In contrast to the 2.4-mile shoreline needed for 1,600 acres of cargo-handling port facilities, is an example of an extremely economical use of shoreline: Bayport, the industrial development now underway by Friendswood Development Company, subsidiary of Humble Oil, adjacent to the Houston Ship Channel and Clear Lake City,

where NASA's Manned Spacecraft Center is located. The gross area of Bayport is approximately 10,000 acres; of this 6,500 acres are being developed for water-transport and pipeline-oriented industries; the remaining 3,500 acres includes services, pipeline, roads and a 720-acre port facility. The shoreline for this large industrial center is only 2,000 feet.

In the Bay Region, the Standard Oil refinery and chemical plant at Richmond has a potential site of 2,600 acres and approximately 10,000 feet of shoreline on San Pablo and San Francisco Bays; but only two T-shaped wharves for shipping. The Long Wharf is approximately 2,400 feet in length and the Point Orient Wharf is approximately 500 feet, for a total length of less than 3,000 feet parallel to but some distance out from the shoreline. This is less than one-third of the site's total shoreline. As the refineries come to be served by larger tankers, these wharves may be lengthened, or more dock facilities added. However, the shoreline requirement for receipt and shipment of primarily liquid bulk is quite small.

The Bethlehem Steel Company site on Point Pinole has about 1,200 acres of upland, 700 acres of tidelands, and a present shoreline of approximately 4.1 miles. The unloading area with conveyor and crane facilities for ore, coal and other water-shipped materials and products will require only a small portion of this shoreline. The storage area to be served by conveyors may require between 1,200 and 1,800 feet in the narrow dimension. Probably only 15 to 20 per cent of the shoreline of the site will be required for transportation.

The following table summarizes the shoreline use by a number of industries in Contra Costa County having large waterfront plants. The table shows that substantial parts of these waterfronts are not being used for directly Bay-oriented purposes.

LENGTH OF PLANT SITE SHORELINE, AND SHORELINE LENGTH OF SHIPPING FACILITIES AT SELECTED WATERFRONT INDUSTRIES, CONTRA COSTA COUNTY

| Industry | Total Shoreline | Shoreline Length of Shipping Facilities |
|---|---|---|
| Kaiser Gypsum | 1,760 feet | 973 feet |
| C and H Sugar | 4,000 | says mostly docks |
| U. S. Steel | 11,600 | 800 feet |
| Shell Oil | 1,350 | approximately 800 ft. width at end of T wharf |
| Port Costa Clay Products | 3,000 | none now |
| Shell Chemical | 2,600 | 500 feet |
| Phillips Petroleum: | | |
| Avon refinery | 1,900 | County map shows 1,000 ft. width at end of T wharf |
| Amorco | 4,000 | says mostly wharf |
| Port Costa | 1,000 | not presently in use |
| Union Oil | 2,800 | approximately 950 ft. width at end of T wharf |

Sources: Company replies to inquiries
Site plans
County maps
U. S. Coast and Geodetic charts

The conclusion should not be drawn that these existing industries can necessarily spare all or a major part of their unused shoreline for public use if the land immediately adjacent is now buildable. Such land may be needed for future plant expansion, or may be unusable in its present form. But if fill or dredging is required at the shoreline in connection with plant expansion or modification, the possibilities of shared use of the shoreline by industry and the public should be explored.

Recreational Use at Shoreline Industrial Sites

Some waterfront industries in the Bay Area already have some recreation uses at their shoreline.

Standard Oil has at its shoreline two recreation uses: the San Pablo Yacht Harbor and the Standard Rod and Gun Club. The latter is a particularly attractive employee recreational facility which includes picnic areas, club houses, swimming pools and wading pools, and tot lots with extensive playground equipment.

The C and H Sugar refinery at Crockett subleases part of its tideland lease for a fishing pier and small-boat berthing facilities. This company conducts plant tours for the public. The tour always includes on overlook stop so that visitors can observe raw sugar unloading and receiving facilities.

Port Costa Clay Products reported they have some waterfront recreation now, and anticipate improvement.

Benicia Industries in Solano County has many restored structures of historic interest now open for public visits and include fine vantage points for viewing the Bay and the Contra Costa shoreline. The Humble Oil refinery under construction at Benicia will have observation platforms from which visitors can view the refinery operations.

Public access to the water at some industrial sites is difficult or impossible to achieve in many cases. In Contra Costa County, for example, many plants are themselves cut off from the waterfront by railroads; subsidence and flooding problems are also present in some areas. In other cases, the waterfront is a long distance from public roads and the industry cannot provide the parking areas needed. This indicates the need for regional public leadership, and a cooperative local government working with industry for imaginative local planning of the waterfront.

## CHAPTER V. FUTURE WATERFRONT INDUSTRIAL LAND NEEDS

In the general outline of this report, as prepared by this consultant and the BCDC staff, Chapter V was to present an estimate of future land needs for waterfront industry. This estimate was to have been based on the projections of industrial employment that were being made by other planning agencies in the Bay Area. It was the intention of this consultant to use these planning projections, modifying them as necessary to reflect trends in water transportation, water-oriented industries, and particularly new concepts in compatible land-use planning that would affect land requirements. It was never intended that the BCDC, with a small staff and budget, would undertake a regional economic base study, much as one may be desirable for all regional planning programs in the Bay Area.

This chapter has been delayed until late in the BCDC planning program in the hope that additional data from other regional agencies would become available--particularly data on employment (present and projected by type of manufacturing) and on the amount of land used by different types of industry. Unfortunately, the data is still not available at this writing.

Therefore, this chapter could only set up the method by which future waterfront industrial land needs can be estimated

more precisely once the proper data becomes available. To illustrate the use of the method and give a first approximation of how much industrial land may be required by the year 2020 in the Bay Area, existing data were used in a "trial run."

A basic estimating procedure for use when adequate data becomes available is recorded in Appendix G. The "trial run" is also recorded in Appendix G in a series of tables.

The "trial run" suggests that from 27,000 to 44,000 acres of land will be needed for water-oriented industries over and beyond the land used for that purpose at the present time (data is not available on current acreage). While these estimates are only first approximations, to be refined when anticipated employment projections become available, they give an indication of the amounts of land that may have to be considered in adequately planning for future waterfront industrial employment in the Bay Area.

# CHAPTER VI. POTENTIAL LOCATIONS FOR WATER-ORIENTED INDUSTRY

Given the importance of water-oriented industry to the region, the potential demand for industrial sites and the many other pressures for development around San Francisco Bay, it is important to identify and reserve soon those areas most suitable for water-oriented industry. This chapter suggests an approach to site selection and indicates which areas, on the basis of a limited survey, should be reserved for industry in the BCDC plan. This preliminary survey indicates that prime sites for water-oriented industry in the Bay Area are in short supply.

## Approach to Site Identification

Three types of water-oriented industry have been identified in this report: water transport industries requiring deep-water sites; water transport industries requiring shallow-draft sites; and water-supply industries requiring access to the Bay for intake and outlet pipes. Of the three, the deep-water industries are most important to the regional economy and most exacting in their site requirements. Therefore, the BCDC should give these top priority in its plan.

The criteria in the following table have been developed by this consultant for evaluating potential sites for the water-transport industries. The point count is intended to illustrate the relative importance of each factor. Summary and detailed versions of the criteria are shown.

SUMMARY OF POINT VALUES FOR POTENTIAL INDUSTRIAL SITES

| | Maximum points |
|---|---|
| Channel (or Pipeline Access) | 20 |
| Rail | 10 |
| Freeway | 10 |
| Major highway | 5 |
| Land Area | 15 |
| Grade | 10 |
| Foundation | 15 |
| Ownership | 5 |
| Present Use | 10 |
| Highest count | 100 |

## CRITERIA FOR IDENTIFYING POTENTIAL INDUSTRIAL AREAS ORIENTED TO SAN FRANCISCO BAY AND TRIBUTARIES

| | Range of Points |
|---|---|
| **TRANSPORT FACTORS:** | |
| Channel, proximity to | |
| Existing | 20 |
| Potential entrance | 19 to 10 |
| Potential channel (distance) | 10 to 4 |
| (Alternate for Shallow Draft Industries | ) |
| (Pipeline Access | ) |
| ( Distance and topography | 20 to 10) |
| Rail, proximity to | |
| Existing | 10 |
| Within 2 to 5 miles | 8 to 5 |
| Freeway, proximity and access to | |
| Existing | |
| frontage or near | 10 to 5 |
| distance from access | 8 to 0 |
| Proposed | |
| frontage or near | 7 to 5 |
| distance from access | 5 to 0 |
| Major road, proximity to | |
| Existing | 5 |
| Potential (distance) | 4 to 1 |
| **LAND AREA FACTORS:** (evaluate only 1 acreage factor for each location) | |
| New sites, potential acreage | |
| 1,000 acres and over | 15 |
| 500 to 1,000 acres | 14 to 13 |
| 100 to 500 acres | 12 to 10 |
| Under 100 acres | 9 to 5 |
| (Alternate for Shallow Draft Industries | ) |
| (New sites, potential acreage | ) |
| ( 1,000 acres and over | 15 ) |
| ( 500 to 1,000 acres | 15 ) |
| ( 100 to 500 acres | 14 to 12) |
| ( Under 100 acres | 12 to 5 ) |

| | Range of Points |
|---|---|
| Expansion for existing industries | |
| 100 acres and over | 15 |
| 50 to 100 acres | 14 |
| 25 to 50 acres | 13 |
| Under 25 acres | 12 |
| **BUILDING POTENTIAL:** | |
| Grade | |
| Under 5 per cent | 10 |
| 5 to 10 per cent | 9 to 8 |
| 10 to 25 per cent | 8 to 5 |
| Over 25 per cent | 4 to 0 |
| Foundation | |
| Above flood level | 15 |
| Behind levee | 12 |
| Marsh | 10 to 5 |
| Mud | 10 to 5 |
| Subsidence | 5 |
| **LAND ASSEMBLY FACTORS:** | |
| Ownership | |
| Public | 5 |
| Private - few | 5 |
| Private - many | 5 to 1 |
| Use, present | |
| Vacant | 10 |
| Low density | 9 to 6 |
| residential | 7 to 6 |
| industrial | 9 to 7 |
| other | 9 to 7 |
| High density | 5 to 0 |
| residential | 3 to 0 |
| industrial | 5 to 3 |
| other | 4 to 2 |

The criteria in the table deal only with the geographic and physical characteristics of the site: such factors as the effects on the ecology of the Bay and the possible priority of other uses

are not included. The weight to be given these factors in specific cases should be determined by BCDC when its plan is formulated.

The criteria also omit land price, for two reasons. First, the proportion of land cost to total capital investment in a new industrial plant is generally quite low for most major water-oriented industries; therefore, it is relatively unimportant. For example, land cost can be as little as one per cent of total cost for a major oil refinery or steel mill. Second, land prices are changeable over a 40 - 50 year period, and can be affected by public tax and land use policy.

## Survey of Potential Locations

The suggested criteria are designed to be applied to the Bay shoreline. As was the case with the projections of industrial land needs, the necessary data were not available to conduct a detailed survey for this report. However, a preliminary survey of potential sites for water transport industry was conducted, using the information available. The purposes of the survey were (1) to indicate the number and extent of suitable locations of 100 acres or more in the Bay Area, and (2) to illustrate how the criteria can be applied to specific areas.

Locations that meet the criteria are shown in Figures 1-7 and described in the accompanying chart. Point values of the three ratings shown are Prime, 90-100; good, 80-89; and fair, 60-79.

Source materials for this survey included U. S. Coast and Geodetic charts, U. S. Geological Survey quadrangles (7.5 minute series) and, for Contra Costa County, maps showing property boundaries and owners. Conferences with industrial development representatives of local governments, chambers of commerce, utility companies were most helpful in identifying potential sites and locations known to be under consideration for development by major industrial firms. Interviews with several large water-oriented manufacturing firms in the region, and additional source material provided by them to Contra Costa County Industrial Development Association assisted in identification of expansion and site problems, and estimations of land owned by industry and being held for future use.

Field trips to the shoreline areas in every county were made and all proposed locations were inspected. Information on local community plans affecting the general locations proposed for future industry was obtained from published studies, interviews, and consultation with the BCDC planning staff.

The area studied included the entire Bay shoreline and riverfronts of the nine Bay Area counties, not just the area within the legal jurisdiction of BCDC.

The survey found that as many as 49,000 acres of shoreline and contiguous uplands in the Bay Region were potentially suitable for water transport industry, including 34,000 acres of potential deep-draft sites. Potential sites for water supply industries that do not also utilize water transport were not identified. As indicated on the maps in Figures 1-7,

most of the sites are located on what is now dry or diked-off land (and hence are outside the legal jurisdiction of BCDC), although some Bay fill would be needed in certain cases to make the site usable by industry.

## POTENTIAL LOCATIONS FOR WATER-ORIENTED INDUSTRY

| Location - Assets - Problems | Total acres | Acreage: Prime | Acreage: Good | Acreage: Fair | Water user: Deep-draft | Water user: Shallow-draft |
|---|---|---|---|---|---|---|
| **CONTRA COSTA COUNTY** | | | | | | |
| CC-1 - Richmond<br>Assets: large acreage; few major owners; major rail classification yard; 45' channel; 14,000' shoreline<br>Problems: need redevelopment plan and some fill; new housing begun on deep channel | 1,800-2,000 | 2,000 | | | X | |
| CC-2 - San Pablo Point<br>Assets: land needed for plant expansion and treatment, Standard Oil<br>Problems: need fill permit for 575 acres | 575-600 | 600 | | | | |
| CC-3 - San Pablo<br>Assets: rail (2), proximity to Bethlehem Steel<br>Problems: long-range plan needed for steel-oriented industry; needs better road access to freeway | 900-1,100 | 1,100 | | | | |
| CC-4 - Pinole Point<br>Assets: Bethlehem Steel - part in use<br>Problems: preservation of promontory; fill needed (recommend fill on N. side only and preservation of promontory as public observation area) | 1,000-1,500 | 1,000 | | | X | |
| CC-5 - Hercules<br>Assets: --<br>Problems: 250 acres tidelands | 1,650-1,880 | 1,650 | | 230 | X | |

| Location - Assets - Problems | Total acres | Acreage: Prime | Good | Fair | Water user: Deep-draft | Shallow-draft |
|---|---|---|---|---|---|---|
| CONTRA COSTA COUNTY [continued] | | | | | | |
| CC-6 - Oleum | 400 | | | 400 | | |
| Assets: Union Oil - part not used<br>Problems: topographic problem | | | | | | |
| CC-7 - Selby | 150 | | | 150 | X | |
| Assets: zinc refinery - part not used<br>Problems: topographic problem | | | | | | |
| CC-8 - Martinez | 150 | | | 150 | | |
| Assets: Shell - unused | | | | | | |
| CC-9 - Martinez | 250-1,100 | | 250 | 850 | X | |
| Assets: vacant<br>Problems: mostly marsh | | | | | | |
| CC-10 - Avon | 1,000 | | 1,000 | | X | |
| Assets: Phillips - vacant | | | | | | |
| CC-11 - Avon (vacant shore) | 775 | | | 775 | X | |
| Assets: --<br>Problems: marsh | | | | | | |
| CC-12 - Nichols | 500 | | 500 | | X | |
| CC-13 - Pittsburg | 1,500 | | 1,500 | | | |
| Assets: --<br>Problems: uplands | | | | | | |

| Location - Assets - Problems | Total acres | Acreage | | | Water user | |
|---|---|---|---|---|---|---|
| | | Prime | Good | Fair | Deep-draft | Shallow-draft |
| **CONTRA COSTA COUNTY [continued]** | | | | | | |
| CC-14 - Pittsburg | 350 | | 150 | 200 | X | |
| Assets: -- | | | | | | |
| Problems: marsh - 200 acres | | | | | | |
| CC-15 - Big Break | 450-2,200 | | 450 | 1,750 | P | X |
| Assets: rail | | | | | | |
| Problems: drainage; improved highway access | | | | | | |
| **MARIN COUNTY** | | | | | | |
| M-1 - San Quentin | 125-160 | | 125+ | 40 | | X |
| Assets: Route 101; rail; creek; 3-4,000' shoreline (creek) | | | | | | |
| Problems: 3' draft; rail may be abandoned | | | | | | |
| M-2 - Gallinas Creek | 500-1,000 | | | 1,000 | | X |
| Assets: rail; AF channel; Gallinas Creek; 3-4,000' shoreline (creek) | | | | | | |
| Problems: foundation?; access road; creek 6' draft; AF may own some of site; general plan is housing; rail may be abandoned | | | | | | |
| M-3 - Black John Slough | 800-900 | | | 800 | | X |
| Assets: Route 101; rail; river; potential riverfront 10,000' | | | | | | |
| Problems: foundation? | | | | | | |

| Location - Assets - Problems | Total acres | Acreage: Prime | Good | Fair | Water user: Deep-draft | Shallow-draft |
|---|---|---|---|---|---|---|
| **SOLANO COUNTY** | | | | | | |
| SOL-1 - Collinsville | 7,200-10,800 | 7,200 | 1,700 | 1,900 | X | |
| Assets: future crossing; deep water; 5-1/2 mi. shoreline; rail; future power (PG&E); possible future airport; shallow-draft possible on slough<br>Problems: topographic problems; access roads | | | | | | |
| SOL-2 - Benicia, vicinity | 2,300-2,700 | 2,300 | 400 | | X | |
| Assets: deep water; 3.3 mi. shoreline; rail; Interstate 680; Route 21; potential port; bridge; single management<br>Problems: reserve fleet; topographic problems | | | | | | |
| SOL-3 - Vallejo | 50-100 | | 100 | | X | |
| Assets: Interstate 680; deep water; rail<br>Problems: topographic problems | | | | | | |
| SOL-4 - Slaughterhouse Point | 500-700 | | | 700 | | X |
| Assets: river; 1.7 mi. shoreline<br>Problems: mud; extend rail and access road; nearby housing | | | | | | |
| SOL-5 - Turning Basin, Chipps Island | 1,000-2,000 | | | 2,000 | X | |
| Assets: future turning basin; rail; deep water; 4.2 mi. shoreline<br>Problems: fill; flyway; drainage | | | | | | |
| SOL-6 - Potrero Hills | 2,000-4,000 | | | 4,000 | P | X |
| Assets: shallow draft; land area; 1 mi. shoreline<br>Problems: distance to Suisun Bay; conservation area; needs rail | | | | | | |

| Location - Assets - Problems | Total acres | Acreage | | | Water user | |
|---|---|---|---|---|---|---|
| | | Prime | Good | Fair | Deep-draft | Shallow-draft |
| **SONOMA COUNTY** | | | | | | |
| SON-1 - Petaluma (2 sites) | 500-600 | 500 | | 100 | | X |
| Assets: river; 6-9,000' riverfront: rail<br>Problems: foundation?; levee and drainage; bend in river | 100-150 | 150 | | | | X |
| SON-2 - Mouth, Petaluma River | 500-650 | | | 650 | | X |
| Assets: river; rail<br>Problems: foundation - levee and drainage; marsh at shoreline 1,000' deep | | | | | | |
| **ALAMEDA COUNTY** | | | | | | |
| A-1 - Dumbarton Point (Fremont-Newark) | 1,100-1,600 | 700 | 400 | 500 | X | |
| Assets: bridge crossing; rail; 10,000' shoreline potential; shoreline freeway<br>Problems: split by relocating Dumbarton Bridge approach; 500 acres marsh; 1,100 acres salt ponds; separated by Newark Slough, some subsidence | | | | | | |
| A-2 - Bay Farms | 1,500-1,600 | 1,600 | | | X | |
| Assets: 14,500' shoreline; 1,600 ac.; rail; being filled now; Southern Crossing; new shoreline freeway<br>Problems: Bay Farms housing; relocate freeway from shoreline to airport channel | | | | | | |
| A-3 - San Leandro Channel | 500-650 | | | 650 | P | X |
| Assets: potential rail; Nimitz Freeway; shoreline freeway; 11,000' shoreline<br>Problems: narrow entrance channel; distance to deep water; land will go for freeway-oriented industry; filled area; foundation? | | | | | | |

| Location - Assets - Problems | Total acres | Acreage | | | Water user | |
|---|---|---|---|---|---|---|
| | | Prime | Good | Fair | Deep-draft | Shallow-draft |
| **SAN MATEO COUNTY** | | | | | | |
| SM-1 - San Bruno Channel | 150-175 | | | 150 | P | X |
| Assets: potential land<br>Problems: no rail; mostly area to be filled; channel needs deepening; competing demand for industrial park | | | | | | |
| SM-2 - Brewer Island - Foster City | 175-250 | | 250 | | P | X |
| Assets: bridge; new freeway; deep water - 3,000'; 8,500' shoreline<br>Problems: no rail; 250 acres marsh; some fill necessary; foundation? | | | | | | |
| SM-3 - Redwood Point - Bair Island | 2,000-2,400 | | 2,400 | | X | |
| Assets: port channel; Bayshore Freeway; rail potential; 225 acres proposed industrial; 13,000'shoreline on channel<br>Problems: Fill marsh; foundation? | | | | | | |
| SM-4 - Ravenswood | 2,800-3,200 | | 3,200 | | X | |
| Assets: 2,400' from channel; rail potential; bridge; freeway; 15,000' shoreline | | | | | | |

FIGURE 1

Possible
New Sites
for
Waterfront
Industry:

Carquinez Strait
and
Suisun Bay

FIGURE 2

Possible
New Sites
for
Waterfront
Industry:

San Pablo Bay
(north portion)

FIGURE 3

Possible New Sites for Waterfront Industry:

San Pablo Bay (south portion)

FIGURE 4

Possible New Sites for Waterfront Industry:

Central Bay

FIGURE 5

Possible New Sites for Waterfront Industry:

South Bay (north portion)

FIGURE 6

Possible New Sites for Waterfront Industry:

South Bay (center portion)

FIGURE 7

Possible New Sites for Waterfront Industry:

South Bay (south portion)

## CHAPTER VII. PRESERVING THE INDUSTRIAL LAND SUPPLY

As indicated at the beginning of this study, waterfront industry is one of the basic foundations of the economy of the San Francisco Bay region. It was further indicated that San Francisco is one of the few water "gateways" to the western United States and thus must help meet the waterfront industrial needs that are basic to the economy of most of the Western United States.

The supply of land in the Bay Area that is specifically suited for waterfront industry is limited. Because it is limited it therefore becomes an economic resource that must be husbanded and allowed to be used only for industries that specifically require water frontage.

In determining how much land should be reserved for waterfront industry, projections were made 50 years ahead to 2020 -- the longest range that it is feasible to project. To project needs a shorter time would run the risk of not reserving enough land for the eventual need. Therefore, all of the land that is identified as likely to be needed in the next 50 years, according to the best available estimates, should be reserved for that purpose. It is important to emphasize that all the land will not be used right away, however. Therefore, land now in other uses can continue in those uses for up to 40 years -- also land now vacant can be used for other temporary purposes until it is needed for industrial use.

Land required for waterfront industry thus can be considered a regional "reserve." This industrial land reserve should be managed on a regional basis; determining precisely the type of regional agency for this purpose is beyond the scope of this report, but detailed discussions of Bay Area regional organization are contained in the BCDC report on Government. Presumably, if a limited regional government were created for the Bay Area, it could be given responsibility for administering the region's industrial land reserve.

A current and detailed inventory of shoreline and upland industrial land -- both occupied and vacant should be maintained on a regional basis. The regional agency would be responsible for adding land to, or removing it from, the inventory as total land requirements are revised on the basis of later studies and analyses.

The total industrial land will need to include four specific categories:

1. Deep-water sites.
2. Shallow-draft sites.
3. Contiguous uplands.
4. Sites for industries requiring water for process purposes only.

A priority system for allocating industries to the four categories is required:

1. Deep-water sites should be reserved only for ports and industries requiring use of deep-draft vessels.
2. Shallow-draft sites should be reserved only for ports and industries requiring or able to use shallow-draft vessels, e.g., barges.
3. Contiguous uplands should be reserved only for industries that are linked by process, by product, or critical service to basic shoreline industries.
4. Sites for industries requiring water for process purposes only should be restricted to shoreline locations or uplands not required for the preceding three categories. Use of such sites should, of course, be reserved only for industries requiring large amounts of water for process purposes.

While a regional agency would have to approve additions to and subtractions from the industrial land inventory, basic administration of the industrial reserves could be accomplished by local governments; the regional agency could prepare site development and performance standards for application by the local governments.

As long as the industrial reserve is well mapped and all regulations and policies are clearly spelled out, the role of the regional agency in administration of the reserves could be well in the background. It would need to come into action only when additions or deletions to the inventory were needed and if violation of the use limitations, design controls or performance standards were attempted.

One problem that often arises when private land is firmly identified for specified high-value uses is that the owners are given a speculative advantage over all other land owners if the allowable supply of land for the use is sharply limited. The owners thereupon tend to defeat the intent of the reserve by pricing the land beyond the feasible limit for the use. It must be emphasized that this would not be the case in the instance of this proposed industrial land reserve, because a 50-year supply of land is proposed to be reserved. In the initial decades, the owners would have no speculative advantage whatever because of the wide range of choice available to new industries. In the later decades, much more sophisticated legal devices will presumably be available to curb land speculation that is not in the public interest.

# CHAPTER VIII. RECOMMENDATIONS

## BCDC Industrial Planning Role

1. The navigable deep waters of the Bay are critical to the continued economic health and well-being of the San Francisco Bay region. The tankers, bulk carriers and cargo ships that sail into the Bay form a life-line maintaining the flow of materials to refineries, chemical plants, food processors, building materials plants, and other manufacturing facilities located along its shores. These water transport-dependent industries are major employers in the region; they supply products used by the region's families, and by-products needed by other San Francisco manufacturers. These water-oriented basic industries help the Bay Area fill a role vital in the national economy. BCDC should therefore give top priority to the fill and dredging requirements of water-front industry.

2. The availability of an excellent harbor, the high-income consumer market, and the materials demand of expanding local industries will attract new water-transport manufacturers to the Bay shore. The remaining deep-water sites in the Bay Area therefore are a unique resource, to be carefully husbanded and planned specifically for the use of only those industries requiring deep water locations. BCDC should state the need for reserving land for

specific types of industries, and should request that this be done as an essential part of carrying out a plan for the development of the Bay shoreline.

3. BCDC should strongly support the Corps of Engineers and the region's Congressional delegates in obtaining early funds for the deepening of the Bar Channel and the shipping channels in the Bay -- the "Big Ditch" project. The existing industries and the planned expansions in the steel and petrochemical industries from Richmond to Collinsville will require a 45-foot channel to accommodate the deep draft of modern tankers and dry-bulk carriers. Spoils should be used where feasible to provide fill for approved water-oriented industrial sites. Any spoils not suitable for this fill should be disposed of at sea, on dry land, or in designated areas of the Bay where the maximum possible amount will be carried out to sea by the tides.

4. Regional planning for waterfront industry should cover at least the full length of the shoreline in the nine Bay Area counties, including the tributary rivers, creeks, sloughs, estuaries, and harbors.

5. The regional agency empowered to continue planning for the industrial shoreline development of the Bay and its tributaries should also study the long-range, water-oriented industrial potential of shoreland on the Sacramento and San Joaquin Rivers. This would not alter the principal responsibility of the agency to

identify and protect prime sites in the nine-county area, but clearly the industrial shoreline planning in the next region inland should be coordinated with the nine-county Bay region. Also, the utilization of waterfront sites may proceed at a faster rate than now anticipated, and the shoreline of the Sacramento and San Joaquin Rivers should be studied for possible industrial sites.

6. The regional agency should be specifically empowered to assess the water-oriented industrial potential of shoreline and uplands now occupied primarily by deteriorating industrial, commercial, or residential structures in the vicinity of maintained channels, both deep and shallow draft, or of areas with natural depths or designated for channels, and to designate such underutilized shoreline areas for renewal for proper industrial reuse.

7. The agency should be empowered to designate areas for the sole use of water-oriented industries and demonstrably related services, and for deep-draft and shallow-draft port areas, and to set site development and performance standards:

(a) to protect appearance of the world-famous Bay,

(b) to provide public access to the waters of the Bay, to preserve historic areas, to reserve overlook points to view the Bay, and to visit or observe waterfront port and industrial activities.

8. Regional air and water quality standards should be sufficiently high to protect the environment, the well-being of the region's residents and visitors, and the recreational potential of the shoreline, and should apply to all waterfront development: port, industry, recreation and government facilities.

9. The regional agency should maintain a current and detailed inventory of occupied and of potential industrial shoreline and upland areas, and should be responsible for adding to and removing from the land inventory.

10. The regional agency should prepare site development and performance standards for water-oriented industries, with these standards to be administered by local governments.

11. A priority system of shoreline use is required. Deep-water sites should be reserved only for ports and industries using deep-draft vessels. Locations suitable for shallow-draft shipping should be preserved only for ports and industries requiring such shipping. Contiguous uplands should be preserved only for industries linked by process, by-product, or critical service to basic shoreline industries. Industries requiring water only for process purposes should be restricted to shoreline locations or to uplands not required for the preceding purposes.

12. Preservation of and access to waterfront historic areas and uniquely beautiful vantage viewpoints can and should be accomplished within as well as adjacent to shoreline industrial areas.

13. The regional agency should coordinate advance planning activities of Federal, State and local governments and industrial management, insofar as these affect compatible and efficient development of an industrial waterfront site and its environs. When the regional agency achieves an agreement of these groups on major design and performance aspects of the industry, its site and immediate environs, this agreement should constitute an enforceable guideline plan for development and should be binding on all parties concerned. Good neighbor obligations are reciprocal. After providing for suitable public access to and enjoyment of the Bay, industry should be able to develop its site as agreed upon with certainty and confidence.

14. The regional agency should initiate studies and encourage agreements between government and industry to guide, aid, and reward compatible industrial development through tax relief and other incentives in such matters as: types of development to be permitted adjacent to an industry's site; assistance in acquiring nearby land for expansion or replacement of land made accessible to public use; scheduling of road and other public improvements in environs of the plant; and tax relief on major expenditures by industry for pollution control equipment, additional landscaping, screening, or fencing, and facilities and land provided by industry for public use.

APPENDIX A

EARNINGS IN CHEMICALS AND SELECTED INDUSTRIES

| | Weekly Earnings1/ 1964 | Weekly Earnings1/ 1967 |
|---|---|---|
| ALL MANUFACTURING | $102.97 | $114.50 |
| Durable goods | 112.19 | 123.00 |
| Nondurable goods | 90.91 | 101.00 |
| *Chemicals and allied products | 116.48 | 129.00 |
| Industrial chemicals | 131.04 | 144.50 |
| Alkalies and chlorine | 129.48 | 140.00 |
| Industrial organic chemicals | 138.44 | 152.50 |
| Industrial inorganic chemicals | 128.44 | 138.00 |
| Plastics materials and synthetics | 116.89 | 128.00 |
| Plastics materials and resins | 126.56 | 138.50 |
| Synthetic fibers | 105.75 | 114.00 |
| Drugs | 102.77 | 118.00 |
| Soap, cleaners, and toilet goods | 108.68 | 125.50 |
| Soap and detergents | 132.29 | 150.00 |
| Toilet preparations | 86.24 | 102.50 |
| Paints, varnishes, and allied products | 109.03 | 118.50 |
| Agricultural chemicals | 97.63 | 106.00 |
| Other chemical products | 112.98 | 123.50 |
| *Petroleum refining and related industries | 133.76 | 152.50 |
| Petroleum refining | 139.52 | 159.50 |
| Other petroleum and coal products | 112.49 | 124.00 |
| Rubber and miscellaneous plastic products | 104.90 | 113.50 |
| *Paper and allied products | 109.57 | 121.50 |
| Leather and leather products | 68.98 | 77.00 |
| *Stone, clay, and glass products | 105.50 | 117.00 |
| *Primary metal industries | 130.00 | 138.00 |
| Instruments and related products | 103.63 | 115.50 |
| Engineering and scientific instruments | 119.66 | 136.00 |
| Textile mill products | 73.39 | 82.50 |
| *Food and kindred products | 97.17 | 107.50 |

Source: Chemical and Engineering News, September 4, 1967, Page 21A.

* Water-Oriented Industry

1/ Production Workers, Average Dollars Per Worker

APPENDIX B

MAJOR COMMODITIES SHIPPED BY WATER IN UNITED STATES[1/]

| S.I.C.: | Commodities | :% Total : Tons :Shipped :By Water: In U.S. | : % Total :Ton-Miles : Shipped : By Water : In U.S. |
|---|---|---|---|
| Total Commodities Transported in U.S. | | 24.5% | 44.0% |
| A. Commodities with 10% or more shipped by water: | | | |
| 20872 | Beverage bases, flavoring syrups | 11.1% | 11.2% |
| 26211 | Newsprint | 13.0 | 8.9 |
| 28122 | Sodium alkalies | 21.4 | 30.7 |
| 28181 | Acyclic organic chemicals | 28.8 | 47.8 |
| 28183 | Misc. acyclic chemical products | 50.8 | 79.6 |
| 28184 | Alcohols | 13.2 | 8.6 |
| 28191 | Ammonia and ammonium compounds | 13.2 | 42.7 |
| 28194 | Sulphuric acid | 33.9 | 46.1 |
| 28196 | Aluminum compounds | 36.1 | 46.6 |
| 28512 | Solvents, thinners, paint oils and driers, and related products | 16.2 | 17.3 |
| 28999 | Chemical products, n.e.c. | 23.8 | 19.1 |
| 29111 | Gasoline, jet fuels, other high volatile petrol fuels | 84.0 | 98.0 |
| 29113 | Distillate fuel oil | 90.6 | 98.4 |
| 29114 | Lubricating oils, similar light oils and derivatives | 30.0 | 33.5 |

1/ Source: Commodity Transportation Survey: 1963 Census, Water Transport Statistics of Selected Commodities in U.S.

| S.I.C. | Commodites | :% Total : Tons :Shipped :By Water: In U. S.: | : % Total :Ton-Miles : Shipped : By Water : In U. S. |
|---|---|---|---|
| 29115 | Lubricating greases | 10.2% | 21.0% |
| 29116 | Asphalt, tar and pitches, petrol. (including coke-oven & coal tar) | 21.5% | 50.5% |
| 29117 | Residual fuel oil & other low volatile petrol. fuels | 78.0% | 95.3% |
| 29119 | Products of petrol. refining, n.e.c. | 44.9% | 60.9% |
| 29120 | Liquified petrol. & coal gases | 11.2% | 41.1% |
| 32411 | Cement, hydraulic, portland, natural, masonry | 17.3% | 29.7% |
| 3299 | Misc. nonmetallic mineral products | 10.5% | 7.7% |
| 3636 | Sewing machines and parts | 15.9% | 8.3% |

B. Commodites with 2.5% to 9.9% shipped by water:

| | | | |
|---|---|---|---|
| 20311 | Canned fish and other seafood | 4.5% | 7.3% |
| 20334 | Canned fruit juices | 6.2% | 7.4% |
| 20339 | Canned fruits and vegetables and by products n.e.c. | 4.0% | 5.6% |
| 20340 | Dried or dehydrated fruits and vegetables & soup mix | 7.0% | 11.3% |
| 20621 | Sugar, dry forms | 3.9% | 5.8% |
| 20851 | Distilled, rectified and blended liquors | 3.5% | 10.4% |
| 20999 | Food preparations n.e.c. | 3.9% | 1.6% |
| 24211 | Lumber | 3.6% | 4.0% |
| 2429 | Misc. sawmill & planing mill products | 3.5% | 6.3% |
| 24999 | Wood products n.e.c. | 2.7% | 6.7% |

| S.I.C. | Commodities | % Total Tons Shipped By Water In U. S. | % Total Ton-Miles Shipped By Water In U. S. |
|---|---|---|---|
| 26111 | Pulp | 6.4% | 3.3% |
| 26215 | Fine, thin and book paper, uncoated | 4.6% | 9.6% |
| 263 | Paperboard, fiberboard, & pulpboard | 2.9% | 2.3% |
| 28121 | Chlorine & other inorganic bleaching compounds | 7.9% | 6.5% |
| 28194 | Inorganic acids & phosphorus compounds | 5.0% | 1.1% |
| 28199 | Industrial inorganic chemicals n.e.c. | 3.2% | 4.0% |
| 286 | Gum and wood chemicals | 5.8% | 8.0% |
| 2871 | Fertilizers | 4.7% | 7.2% |
| 28911 | Glues, adhesives, sizes & sizings | 4.2% | 28.9% |
| 28996 | Black and charcoals | 4.4% | 3.0% |
| 299 | Misc. petroleum & coal products | 2.6% | 2.8% |
| 3264 | Porcelain, steatite & other ceramic electrical supplies | 4.1% | 4.9% |
| 331 | Steel works & rolling mill products | 6.0% | 11.0% |
| 3311 | Coke oven & blast furnace products | 3.4% | 3.8% |
| 33121 | Steel ingot & semifinished shapes | 3.0% | 3.6% |
| 33122 | Plates, iron and steel | 3.2% | 8.0% |
| 33123 | Sheet & strip, iron and steel | 8.2% | 20.0% |
| 33124 | Bars, bar shapes and rods | 5.2% | 14.3% |
| 33126 | Steel pipes, tubes & fittings | 4.3% | 5.7% |
| 33311 | Copper & copper base alloys, pig, slab or ingots | 5.2% | 0.2% |
| 34411 | Structural metal products, iron & steel | 3.5% | 5.8% |
| 348 | Misc. fabricated wire products | 2.5% | 5.5% |

| S.I.C. | Commodities | :% Total : Tons :Shipped :By Water: In U. S.: | : % Total :Ton-Miles : Shipped : By Water : In U. S. |
|---|---|---|---|
| 34941 | Metal valves for piping, plumbing and heating systems | 2.9% | 4.4% |
| 35352 | Parts, attachments & accessories for conveyors and conveyor systems | 7.2% | 14.2% |
| 3572 | Typewriters and parts | 7.3% | 15.1% |
| 3581 | Automatic merchandising machines, coin operated | 6.7% | 13.1% |
| 36449 | Noncurrent carrying wiring devices n.e.c. | 4.5% | 1.2% |
| 39813 | Brushes | 4.8% | 8.6% |
| 39999 | Misc. mfg. products n.e.c. | 4.6% | 6.6% |
| 40211 | Iron & steel scrap, wastes & tailings | 6.2% | 12.4% |

C. Other Commodites shipped by water in U.S.

| | | |
|---|---|---|
| 20139 | Meat products n.e.c. | 4.9% |
| 2016 | Dressed poultry & small game | 2.7% |
| 20331 | Canned fruits | 5.6% |
| 20352 | Pickles & other pickled products | 4.5% |
| 24215 | Flooring | 2.3% |
| 28123 | Sodium compounds | 3.9% |
| 28211 | Plastic materials & plasticized synthetic resins, nonvulcanizable elastomers | 4.3% |
| 28212 | Synthetic rubber | 4.1% |
| 2841 | Soap and other detergents | 6.0% |
| 2844 | Perfumes, cosmetics & other toilet preparations | 3.2% |
| 28511 | Paints, varnishes, lacquers, enamels and shellacs | 3.7% |

| S.I.C. | Commodities | % Total Ton-Miles Shipped By Water In U. S. |
|---|---|---|
| 32297 | Table, kitchen art, novelty glassware | 2.3% |
| 33341 | Alum. & alum. base alloys: pig, slab, ingots, billets, blooms, etc. | 2.7% |
| 33572 | Bare copper & copper nose alloy | 5.4% |
| 33574 | Wire & cable insulated, enameled or covered | 5.8% |
| 3432 | Plumbing fixture fittings (brass goods) & trim | 4.0% |
| 34512 | Bolts, nuts, screws, rivets & washers | 3.0% |
| 3534 | Elevators, moving stairways, equipt. & parts | 5.6% |
| 3621 | Motors and generators | 2.3% |
| 36292 | Rectifying apparatus and parts | 2.3% |
| 36421 | Lighting fixtures: residential, commercial, institutional & industrial types | 5.6% |
| 373 | Ships and boats | 3.2% |
| 37999 | Transp. equipment, parts & accessories n.e.c. | 2.3% |
| 38411 | Surgical & medical instruments & apparatus | 2.6% |

APPENDIX C

WATER INTAKE BY MANUFACTURING INDUSTRIES
BY SELECTED MAJOR GROUPS: 1954 and 1964

| S.I.C. | Industry | Year | Total | % Increase | Fresh | % Increase | Brackish | % Increase |
|---|---|---|---|---|---|---|---|---|
| | All industries | 1954 | 11,570 | | 9,948 | | 1,622 | |
| | | 1964 | 14,045 | 21% | 11,209 | 13% | 2,836 | 75% |
| 20 | Food and kindred products | 1954 | 616 | | 556 | | 60 | |
| | | 1964 | 760 | 23% | 681 | 22% | 79 | 13% |
| 26 | Paper and allied products | 1954 | 1,786 | | 1,651 | | 135 | |
| | | 1964 | 2,071 | 16% | 1,918 | 16% | 152 | 13% |
| 28 | Chemicals and allied products | 1954 | 2,685 | | 2,172 | | 513 | |
| | | 1964 | 3,888 | 14% | 2,548 | 17% | 1,340 | 161% |
| 29 | Petroleum and coal products | 1954 | 1,245 | | 637 | | 608 | |
| | | 1964 | 1,398 | 12% | 710 | 11% | 688 | 13% |
| 32 | Stone, clay and glas products | 1954 | 279 | | 258 | | 21 | |
| | | 1964 | 249 | -11% | 209 | -19% | 39 | 19% |
| 33 | Primary metal industries | 1954 | 3,842 | | 3,621 | | 221 | |
| | | 1964 | 4,578 | 19% | 4,150 | 15% | 428 | 19% |
| 35 | Machinery, except electrical | 1954 | 114 | | 111 | | 3 | |
| | | 1964 | 157 | 14% | 129 | 16% | 27 | 800% |
| 37 | Transportation equipment | 1954 | 231 | | 222 | | 9 | |
| | | 1964 | 247 | 7% | 193 | -13% | 54 | 500% |

Source: 1963 Census of Manufactures, Water Use in Manufacturing, Table 1.

APPENDIX D

USE OF BRACKISH WATER IN 1964 BY SELECTED MANUFACTURING INDUSTRIES, AS PER CENT OF TOTAL WATER INTAKE

| S.I.C. | Industry | Total Water Intake (billion gallons) | Brackish Water | Brackish as Per Cent of Total Intake |
|---|---|---|---|---|
| 20 | Food and kindred products | | | |
| 2061 | Raw cane sugar | 123 | 19 | 15% |
| 2062 | Cane sugar refining | 65 | 26 | 40 |
| 2096 | Shortening, cooking oils | 17 | 3 | 18 |
| 2099 | Food preparations, n.e.c. | 16 | 7 | 44 |
| 24 | Lumber, wood products | | | |
| 2432 | Veneer and plywood plants | 11 | 5 | 45 |
| 26 | Paper and allied products | | | |
| 2631 | Paperboard mills | 577 | 93 | 16 |
| 2661 | Building paper, board mills | 31 | 1 | 3 |
| 28 | Chemicals, allied products | | | |
| 281 | Basic chemicals | | | |
| 2812 | Alkalies and chlorine | 528 | 229 | 43 |
| 2815 | Intermediate coal tar products | 108 | 34 | 31 |
| 2816 | Inorganic pigments | 91 | 49 | 54 |
| 2818 | Industrial organic chemicals,n.e.c. | 1,708 | 863 | 51 |
| 2819 | Industrial inorganic chemicals,n.e.c. | 499 | 44 | 9 |
| 2821 | Plastics materials, resins | 218 | 28 | 13 |
| 2822 | Synthetic rubber | 61 | 3 | 5 |
| 283 | Drugs | 65 | 22 | 34 |
| 2841 | Soap, other detergents | 19 | 7 | 37 |
| 2871 | Fertilizers | 113 | 45 | 40 |
| 2879 | Agric. chemicals, n.e.c. | 2 | 1 | 50 |

| S.I.C. | Industry | Total Water Intake (billion gallons) | Brackish Water | Brackish as Per Cent of Total Intake |
|---|---|---|---|---|
| 29 | Petroleum and coal products | | | |
| 2911 | Petroleum refining | 1,388 | 687 | 49% |
| 32 | Stone, clay, glass products | | | |
| 3295 | Minerals, ground or treated | 25 | 19 | 76 |
| 3297 | Nonclay refractories | 4 | 3 | 75 |
| 33 | Primary metal industries | | | |
| 3312 | Blast furnaces and steel mills | 3,815 | 285 | 7 |
| 3351 | Copper rolling, drawing | 36 | 1 | 3 |
| 3352 | Aluminum rolling, drawing | 22 | 2 | 9 |
| 3357 | Nonferrous castings, n.e.c. | 10 | 1 | 10 |
| 336 | Nonferrous foundries | 8 | 1 | 12 |
| 339 | Primary metal industries, n.e.c. | 20 | 13 | 65 |
| 34 | Fabricated metals | | | |
| 342 | Cutlery, hand tools, hardware | 14 | 2 | 14 |
| 35 | Machinery, except elec. | | | |
| 351 | Engines and turbines | 56 | 23 | 41 |
| 3522 | Farm machinery and equip. | 38 | 2 | 5 |
| 3545 | Machine tool accessories | 2 | 1 | 50 |
| 3559 | Special industry machines, n.e.c. | 3 | 2 | 66 |
| 37 | Transportation equipment | | | |
| 3722 | Aircraft engines and parts | 60 | 41 | 68 |
| 3731 | Shipbuilding and repair | 16 | 10 | 63 |

Source: 1963 Census of Manufactures, Water Use in Manufacturing, Table 3.

APPENDIX E

INDUSTRIAL USE OF BRACKISH WATER BY
MANUFACTURING INDUSTRIES IN COASTAL STATES, 1964

| Coastal State | Total Water Intake (billion gallons) | Brackish Water | Brackish as Per Cent of Total Intake |
|---|---|---|---|
| PACIFIC | | | |
| California | 342 | 162 | 47% |
| Oregon | 163 | 9 | 6 |
| Washington | 360 | 31 | 9 |
| GULF | | | |
| Texas | 1,583 | 1,213 | 77 |
| Louisiana | 870 | 252 | 29 |
| Mississippi | 71 | 9 | 13 |
| Alabama | 284 | 32 | 11 |
| SOUTH-EAST COASTAL | | | |
| Florida | 265 | 81 | 31 |
| Georgia | 228 | 44 | 19 |
| South Carolina | 109 | 12 | 11 |
| North Carolina | 152 | 1 | under 1% |
| CHESAPEAKE BAY | | | |
| Virginia | 278 | 32 | 12 |
| Maryland | 433 | 305 | 70 |
| DELAWARE-MID-ATLANTIC | | | |
| Pennsylvania | 1,551 | 9 | under 1% |
| New York | 629 | 69 | 11 |
| New Jersey | 416 | 234 | 56 |
| Delaware | 170 | 121 | 71 |

| Coastal State | Total Water Intake (billion gallons) | Brackish Water | Brackish as Per Cent of Total Intake |
|---|---|---|---|
| NEW ENGLAND | | | |
| Connecticut | 145 | 68 | 47 |
| Rhode Island | 17 | 3 | 18 |
| Massachusetts | 154 | 41 | 27 |
| New Hampshire | 36 | (under 500 million gallons) | |
| Maine | 173 | 13 | 8 |
| Totals | 8,429 | 2,741 | 32.5% |

APPENDIX F

SPECIFIC LIST OF WATER TRANSPORT-ORIENTED AND WATER-USING INDUSTRIES

| S.I.C. | Description | Use of Shoreline: Deep Draft: Berth | Deep Draft: Pipeline | Deep Draft: Bulk Unload | Shallow Draft: Barge | Shallow Draft: Surface Effect | Safety | Water Supply: Intake | Water Supply: Outlet | Upland Location: Contiguous | Upland Location: Proximity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 091 | Fisheries | x | | | | | | | | x | |
| 142 | Crushed stone and riprap | | | | x | | | x | x | | |
| 144 | Sand and gravel | | | | x | | | x | x | | |
| 145 | Clay, ceramic and refractory minerals | | | | x | | | x | x | x | |
| 1474 | Potash, soda and borate minerals | | | | x | | | x | x | | |
| 151 | General building contractors | | | | x | x | | | | x | |
| 161 | Highway and street construction | | | | x | x | | | | x | |
| 162 | Heavy construction | | | | x | x | | | | x | |
| | Manufacturing | | | | | | | | | | |
| | Armaments | | | | | | | | | | |
| 1921 | Artillery | x | | | | | x | x | x | x | |
| 1922 | Ammunition loading and assembly | x | | | | | x | | | | |
| 1925 | Guided missile and space vehicles | | | | x | | | x | x | x | |
| | Food | | | | | | | | | | |
| 2011 | Meat packing | x | | | | | | | x | x | |
| 2031 | Canned, cured sea foods | x | | | | | | x | x | x | |
| 2032 | Canned specialties | | | | | | | | x | | x |
| 2033 | Canned fruits, vegetables, preserves, jams, jellies | | | | x | | | | x | x | |
| 2036 | Fresh or frozen packaged fish | x | | | | | | x | x | x | |
| 2037 | Frozen fruits, fruit juices, vegetables, specialties | | | | x | | | x | x | x | |
| 2041 | Flour and other grain mill products | x | | x | | | | | x | x | |
| 2044 | Rice milling | | | x | | | | | x | x | |
| 2045 | Blended and prepared flour | x | | x | | | | | x | | |
| 2061 | Cane sugar | x | | x | | | | | x | x | |
| 2062 | Cane sugar refining | x | | x | | | | | x | x | |

| S.I.C. | Description | Use of Shoreline: Deep Draft: Berth | Deep Draft: Pipeline | Deep Draft: Bulk Unload | Shallow Draft: Barge | Shallow Draft: Surface Effect | Shallow Draft: Safety | Water Supply: Intake | Water Supply: Outlet | Upland Location: Contiguous | Upland Location: Proximity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2072 | Chocolate and cocoa products | x | | | | | | | x | x | |
| 2087 | Flavoring extracts | | | | | | | | x | | |
| 2099 | Food preparations n.e.c., coffee | | | | | | | | | | |
| | **Paper Products** | | | | | | | | | | |
| 2621 | Paper mills | | | x | | | | x | x | x | |
| 2631 | Paperboard mills | | | x | | | | x | x | x | |
| 2653 | Corrugated, solid fiber boxes | | | | | | | | x | | x |
| 2654 | Sanitary food containers | | | | | | | | x | | x |
| 2655 | Fiber cans, tubes, drums, etc. | | | | | | | | x | | x |
| 2661 | Building paper and building board mills | | | x | | | | x | x | x | |
| | **Chemicals** | | | | | | | | | | |
| 281 | Industrial inorganic, organic chemicals | | x | x | | | | x | x | | x |
| 282 | Plastics materials, synthetic resins, synthetic rubber | | x | x | | | | x | x | | x |
| 285 | Paints, varnishes, lacquers, enamels | | x | x | | | | x | x | x | |
| 287 | Agricultural chemicals | | x | x | | | | x | x | x | |
| 289 | Misc. chemical products | | x | x | | | | x | x | | x |
| | **Petroleum** | | | | | | | | | | |
| 2911 | Petroleum refining | | x | | | | | x | x | | x |
| 295 | Paving and roofing materials | | x | x | | | | x | x | | |
| 299 | Misc. products of petroleum | | x | | | | | x | x | | x |
| | **Stone, Clay and Glass** | | | | | | | | | | |
| 325 | Structural clay products | | | x | x | | | x | x | | x |
| 3271 | Concrete brick and block | | | x | x | | | x | x | x | |
| 3272 | Concrete products, except brick and block | | | x | x | x | | x | x | x | x |

| S.I.C. | Description | Use of Shoreline: Deep Draft: Berth | Deep Draft: Pipeline | Deep Draft: Bulk Unload | Shallow Draft: Barge | Shallow Draft: Surface Effect | Safety | Water Supply: Intake | Water Supply: Outlet | Upland Location: Contiguous | Upland Location: Proximity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3273 | Ready mixed concrete | | | | x | x | | x | x | x | |
| 3275 | Gypsum products | x | | x | | | | x | x | x | x |
| 3297 | Nonclay refractories | | | | x | | | x | x | x | x |
| | Primary Metals | | | | | | | | | | |
| 3312 | Blast furnaces, steel works and rolling mills | x | | x | x | | | x | x | x | x |
| 3313 | Electrometallurgical products | x | | x | x | | | x | x | x | x |
| 3315 | Steel wire drawing, nails and spikes | | | | | | | x | x | | x |
| 3316 | Cold rolled sheet, strip, bars | x | | | | | | x | x | | x |
| 3317 | Steel pipe and tubes | x | | | x | x | | | x | | x |
| 332 | Iron and steel foundries | | | x | x | | | x | x | | x |
| 333 | Primary smelting, refining nonferrous metals | x | x | x | | | | x | x | x | |
| 334 | Secondary smelting, refining nonferrous metals | x | x | x | x | | | x | x | x | |
| 3351 | Rolling, drawing, extruding copper | | | x | | | | x | x | x | |
| 3352 | Rolling, drawing, extruding aluminum | | | x | | | | x | x | x | |
| 3356 | Rolling, drawing, extruding nonferrous metals, other | | | x | | | | x | x | x | |
| 3357 | Drawing and insulating nonferrous wire | | | | x | x | | x | x | | x |
| 336 | Nonferrous foundries | | | | x | x | | x | x | x | x |
| 3391 | Iron and steel forgings | | | | x | x | | x | x | x | x |
| 3392 | Nonferrous forgings | | | | x | x | | x | x | x | x |
| | Fabricated Metals | | | | | | | | | | |
| 3441 | Fabricated structural steel | | | | x | | | | | | x |
| 3443 | Fabricated plate work | | | | x | | | | | | x |
| 3444 | Sheet metal work | | | | x | | | | | | x |
| 3619 | Electric transmission and distribution equipment n.e.c. (towers) | | x | | | | | x | x | | x |

| S.I.C. | Description | Use of Shoreline: Deep Draft: Berth | Deep Draft: Pipeline | Deep Draft: Bulk Unload | Shallow Draft: Barge | Shallow Draft: Surface Effect | Safety | Water Supply: Intake | Water Supply: Outlet | Upland Location: Contiguous | Upland Location: Proximity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Transportation** | | | | | | | | | | |
| 3731 | Ship building, repairing | x | | | | | | x | x | x | |
| 3732 | Boat building, repairing | | | | x | | | | x | x | |
| 3799 | Surface effect vehicles | | | | x | | | | x | | x |
| 4119 | Local passenger transportation, n.e.c. surface effect vehicles | | | | x | x | | | | x | |
| 421 | Trucking, local and long distance | | | | | | | | | | x |
| 422 | Public warehousing | | | | | | | | | | x |
| 423 | Terminal and joint terminal maintenance facilities motor freight | | | | | | | | | | x |
| 441 | Deep sea foreign transportation | | x | x | | | | | | x | |
| 442 | Deep sea domestic transportation | | x | x | | | | | | x | |
| 444 | Transportation on rivers and canals | | | | x | x | | | | x | |
| 4453 | Lighterage | | | | x | x | | | | x | |
| 4454 | Towing and tugboat service | | | | | x | | | | x | |
| 4459 | Local water transportation, n.e.c. including surface effect cargo | | | | | | | | | x | |
| 4452 | Ferries (includes intraport transp.) | | | | | x | | | | x | |
| 4463 | Marine cargo handling | x | | x | | | | | | x | |
| 4469 | Water transportation services, n.e.c. | x | | | | | | | | | x |
| 4511 | Air transportation, certificated carriers, passengers, cargo, freight | | | | | | | | | | x |
| 4521 | Air transportation, noncertificated carriers, passengers, cargo | | | | | | x | | | x | |
| 4582 | Airports and flying fields | | | | | | | | | | x |
| 4583 | Airport terminal services | | | | | | | | | | x |
| 4612 | Crude petroleum pipelines | | x | | | | | | | x | x |
| 4613 | Refined petroleum pipelines | | x | | | | | | | x | x |
| 4619 | Pipelines, n.e.c.(coal, slurry) | | x | | | | | | | x | x |
| 4712 | Freight forwarding | | | | | | | | | | x |
| 4721 | Arrangement of transportation | | | | | | | | | | x |

| S.I.C. | Description | Use of Shoreline: Deep Draft: Berth | Deep Draft: Pipeline | Deep Draft: Bulk Unload | Shallow Draft: Barge | Shallow Draft: Surface Effect | Shallow Draft: Safety | Water Supply: Intake | Water Supply: Outlet | Upland Location: Contiguous | Upland Location: Proximity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4762 | Rental of railroad cars, with care of lading | | | | | | | | | | x |
| 4782 | Inspection, weighing services, connected with transportation | | | | | | | | | | x |
| 4783 | Packing and crating | | | | | | | | | | x |
| 4911 | Electric generation | x | x | x | | | | x | x | | x |
| | Wholesale Trade | | | | | | | | | | |
| 5022 | Drugs, sundries | | | | x | x | | | | x | |
| 5029 | Chemicals, allied products, n.e.c. industrial heavy chemicals, etc. | x | x | x | x | x | | x | x | x | |
| 5092 | Petroleum bulk stations, terminals | | x | | x | | | | | | x |
| 5093 | Scrap and waste materials | x | | x | x | x | | x | x | x | |
| 5098 | Lumber and construction materials | x | | x | x | x | | x | x | x | |

APPENDIX G

## BASIC PROCEDURE FOR ESTIMATING FUTURE WATERFRONT INDUSTRIAL LAND NEEDS

### The Estimating Procedure

1. Obtain past and projected employment in manufacturing from a reliable projection of total population and total employment for the nine-county Bay Area. The manufacturing employment data must include breakdowns for the following two-digit SIC (Standard Industrial Classification) Groups which include all water-oriented industries:

    20 Food
    26 Paper
    28 Chemicals
    29 Petroleum
    32 Stone, Clay, Glass
    33 Primary Metals
    34 Fabricated Metals
    35 Machinery
    37 Transportation

2. If the data does not extend to the year 2020, evaluate the basis reported for the projection of each industrial group, hypothesize therefrom the possible future growth of each employment group beyond the original projection date and extend the curve of the data accordingly to the year 2020.

3. Obtain the best available data on the amount of employment in each industrial group that is now employed in water-oriented industries on the shores of San Francisco Bay. Cast the data for water-oriented employment as a percentage of the total for each industry group. From the preceding evaluation of the basis of expected growth in each industry group, estimate the future expected percentage of each group that will be in water-oriented industries. From this calculate the estimated number of workers in each group that will be employed in water-oriented industries.

    Because the Bay Area is just beginning to experience a resurgence in water-oriented industry, evidenced by the major plant investments being made principally in Contra

Costa County and beginning in Solano County, the details of this growth should be added to the employment data taken from most public sources. Before using these as a reliable ratio to estimate future water-oriented employment, analysis of other urban regions with significant growth in water-oriented industry is also required.

4. From BATSC land use and employment data, if adequate, or otherwise from the best available substitute source, estimate the present number of employees in each industry group per acre of land now used by the industry group. The existing plant densities should be evaluated in terms of age of existing plant, expansion area included in total plant site acreage, extent of employee recreation area, open areas available to occasional or regular public visits, and changes anticipated in plant facilities which would decrease or increase land requirements. On the basis of the best available information on trends in employees per acre in each group (taking into account the effects of automation, etc.), project the likely employee density for each group in 1980, 2000, and 2020. Evaluation of trends should include studies of recently constructed new facilities in each type of industry and evaluation of space requirements needed to achieve design objectives discussed in Chapter III - Guidelines.

5. Apply the employment density estimate for each estimate date to the estimated water-oriented employment on that date to determine the amount of land estimated to be needed for water-oriented industries in each planning period.

Illustrative Application of the Projection Method

In the absence of the necessary local data, the following estimates have been compiled to illustrate the method and yield a very crude idea of how much industrial land may be required in the Bay Area by the year 2020.

Table G-1 reproduces the population and employment estimates adopted by the BCDC in its report on Economic and Population Growth. The estimates were prepared by the Association of Bay Area Governments (to 1990) and were extended to 2020 by BCDC. The data were

preliminary and the manufacturing estimates have been particularly criticized as probably too high. Furthermore, the manufacturing estimate was not broken down into subcategories. The estimates are, nevertheless, the best currently available.

Comparisons of the projections in Table G-1 were made with other sources including the National Planning Association projections for 1975 total and manufacturing employment in the Bay region; the Urban Land Institute population projection for the urbanized portions of the nine-county Bay region for the year 2000; and the Bureau of Labor Statistics projection of labor force participation rate for 1980. Although the ABAG projections differed in some respects from these, there was sufficient agreement in trend to warrant the use of ABAG-BCDC projections for a first approximation or trial run of industrial water-oriented land needs for a 50-year period. Even with the most refined regional employment data, judgment and awareness of trends, which may not be reflected in the new projections, must be used as modifiers.

Table G-2 establishes trial estimates of numbers of employees per acre in the principal industry groups. An upper and lower figure was compiled for each group on the basis of the consultant's study of new industrial plants in major urban regions. The reasonableness of the densities were compared to employee density studies of other investigators, e.g., a University of Pennsylvania study and the estimates used in the Year 2020 study by the U. S. Department of Commerce. A few data from Bay Area industries are

also included. Unless actual data on employees per acre are made available from BATSC studies now under way, these estimates, refined to reflect probable changes in employee density over the next 50 years, may have to suffice for BCDC estimating purposes. These data are employed in the next table.

Table G-3 is a summary table applying the acreage estimating procedure to the entire 1966-2020 projection period at one time. In actual practice, separate tabulations would be prepared for 1980, 2000, and 2020. The table lists the nine industry groups that have some water-oriented manufacturing industries within them.

Col. 1 estimates the per cent of the total manufacturing employment that would be in each industry group for the projection period. In this illustration, the only existing data are used. Originally compiled for the Corps of Engineers report on the Future Development of the San Francisco Bay Area, it is now out-of-date because the 1963 Census of Manufactures, while not directly comparable, indicates serious discrepancies in a number of these categories. Furthermore, the data were projected for a much larger population (14 million in 2020) than is now estimated (10 million in 2020) based on more recent data, so it is not statistically compatible with the employment data being used in this trial exercise.

Col. 2 applies the percentages in column 1 to the ABAG-BCDC total manufacturing estimate for 2020 in Table G-1. The total in column 2 is less than the total for all manufacturing because only selected industry groups are included in Table G-3.

Col. 3 is the actual reported employment in each industry group in 1966.

Col. 4 is the new employment estimated to be added during the projection period (column 2 less column 3).

Col. 5 is the percentage of the new employment that is estimated to be employed in water-oriented industries. These water-oriented employment factors were derived from a number of sources including census statistics on manufacturing employment for other water-transport regions, and unpublished studies in port area. No attempt was made for an in-depth statistical study; only a reasonable indicator was sought. Local data was not sufficiently detailed to enable comparison.

Col. 6 is the additional employment in water-oriented industries over present employment (column 5 times column 4).

Col. 7 is the two ranges of employee densities for each industry group from Table G-2.

Col. 8 is the estimated additional acreage required for water-oriented industries (column 7 times column 6).

The estimates derived in Table G-3 are first approximations. However, they give a concept of the amounts of land that may have to be considered in adequately planning for future waterfront industrial employment in the Bay Area.

When the BCDC staff undertakes the refinement of these preliminary estimates, the test of reasonableness is important. For example, in the trial run tables, Primary Metals appears to have almost 12,000 new employees between 1966 and 1980. If it is assumed that Bethlehem and U. S. Steel continue to expand (and this consultant does assume this), and that the third steel plant, announced for Collinsville, may not be under way until the late '70s and will therefore represent only a small portion of this increase, then the estimated employment is reasonable. The less

than 1,000 increase in water-oriented transportation equipment, however, does not seem reasonable even now, given the rapidly expanding market for small boats, and the national policy emphasis on modernizing the U. S. merchant marine vessels. The employment growth estimate which could be too high is the 13,000 for new water-oriented chemical employees. Given the existing petroleum refinery industries in the Bay Area and their recent petro-chemical expansions, plus new refinery facilities in both Solano and Contra Costa Counties, and the added advantages of deep water, a major high income consumer market employment growth should be expected. However, this industry's plants are highly automated. If this employment is overestimated, the land need estimate could be 2,000 to 3,000 acres over. This is a relatively small margin for possible underestimates on the other industries, and is best retained as a cushion since petro-chemicals is one of the most rapidly growing and changing industries in the country.

TABLE G-1

PROJECTIONS FOR POPULATION, TOTAL EMPLOYMENT & MANUFACTURING EMPLOYMENT IN 9-COUNTY SAN FRANCISCO BAY REGION, 1960-2020

| | 1960[a] | | 1966[b] | | 1980[a] | | 2000[a] | | 2020[a] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number (000) | Per Cent | Number (000) | Per Cent | Number (000) | Per Cent | Number (000) | Per Cent | Number (000) | Per Cent |
| Population | 3,639 | | n.a. | | 6,071 | | 8,205 | | 9,800 | |
| Total Employment | 1,427 | | 1,522 | | 2,455 | | 3,364 | | 4,018 | |
| Employment as % of Population | | 39.2 | | n.a. | | 40.4 | | 41.0 | | 41.0 |
| Manufacturing | 284 | | 319 | | 489 | | 690 | | 824 | |
| Manufacturing as % of Total Employment | | 19.9 | | 20.9 | | 19.9 | | 20.5 | | 20.5 |

a/ BCDC Economic and Population Growth
b/ California Statistical Abstract, 1967

TABLE G-2

COMPARISON OF EMPLOYEE DENSITY (EMPLOYEES PER ACRE) RATIOS

| SIC Major Group | Industry: Land Use: Group [1] | Employee Densities: Univ. Pa. Study Employee/Acre [1] | S.F. 2020 Study-USDC-Corps of Engineers [2]: 1960-1970 Employee/Acre | 2000-2020 Employee/Acre | BCDC Study: (Muncy) [3] | Modern Bay Area Plants |
|---|---|---|---|---|---|---|
| 20. Food | III | 11 | 10.2 | 10.6 | 10 | |
| 26. Paper | III | 11 | 10.2 | 10.6 | 8 | |
| 28. Chemicals | III | 11 | 1 .2 | 10.6 | 3 | 1 |
| 29. Petroleum | IV | 2.7 | 2.4 | 2.5 | 3 | 1 |
| 32. Stone, Clay, Glass | IV | 2.7 | 2.4 | 2.5 | 8 | 4 |
| 33. Primary Metal | III | 11 | 10.2 | 10.6 | 4 | 2 |
| 34. Fabricated Metal | III | 11 | 10.2 | 10.6 | 8 | |
| 35. Machinery | III | 11 | 10.2 | 10.6 | 10 | |
| 37. Transportation Equip. | II | 25 | 23.0 | 23.9 | 8 | |

1/ Future Development of S.F. Bay Area 1960-2020, U. S. Dept. Commerce for U.S. Army Corps of Engineers, U.S. Govt. Printing Office, Washington, D.C. 1959, Appendix D-5, Table D-3.

2/ Ibid, Appendix D-6, Table D-5.

3/ Space for Industry, D.A. Muncy, Urban Land Institute, Wash., 1954; and unpublished space characteristics of industrial plants visited by Muncy.

TABLE G-3

SAN FRANCISCO BAY REGION EMPLOYMENT IN WATER-ORIENTED MANUFACTURING INDUSTRIES AND LAND AREA NEEDS
Summary 1966-2020

| Selected Major Industry Groups, Manufacturing | 1 Per Cent Total Mfg. Employment 2020 a/ | 2 BCDC Mfg. Employment 2020* (000) b/ | 3 1966 Mfg. Employment (000) c/ | 4 New Employment 1966-2020 (000) | 5 Per Cent New Employment Water-Oriented | 6 New Water-Oriented Employment 2020 (000) | 7 Employment Density E/Acre A | 7 Employment Density E/Acre B | 8 New Industrial Water-Oriented Acres 1960-2020 A | 8 New Industrial Water-Oriented Acres 1960-2020 B |
|---|---|---|---|---|---|---|---|---|---|---|
| 20. Food | 11.8 | 97.2 | 53.3 | 43.9 | 20 | 8.7 | 10 | 8 | 870 | 1,090 |
| 26. Paper | 3.6 | 29.7 | 10.4 | 19.3 | 35 | 6.7 | 8 | 5 | 840 | 1,340 |
| 28. Chemicals | 7.0 | 57.7 | 14.5 | 43.2 | 75 | 32.5 | 3 | 2 | 10,840 | 16,250 |
| 29. Petroleum | 2.4 | 19.8 | 10.2 | 9.6 | 100 | 9.6 | 3 | 2 | 3,200 | 4,800 |
| 32. Stone, Clay, Glass | 4.2 | 34.6 | 10.8 | 23.8 | 30 | 7.1 | 8 | 5 | 890 | 1,420 |
| 33. Primary Metals | 4.5 | 37.0 | 13.1 | 23.9 | 100 | 23.9 | 4 | 2 | 5,980 | 11,950 |
| 34. Fabricated Metals | 14.3 | 117.8 | 25.0 | 92.8 | 20 | 18.5 | 8 | 5 | 2,310 | 3,700 |
| 35. Machinery | 14.4 | 118.7 | 26.5 | 92.2 | 20 | 18.4 | 10 | 6 | 1,840 | 3,060 |
| 37. Transportation | 6.4 | 52.8 | 38.1 | 14.7 | 15 | 2.2 | 8 | 5 | 280 | 440 |
| | | 565.3 | 201.9 | 363.4 | | 127.6 | | | 27,050 | 44,050 |

* See Methodology

a/ U.S. Dept. Commerce, Corps Engineers, Future Development of the San Francisco Bay Area, 1960-2020, Table 21, p. 48.
b/ BCDC Projected Mfg. Employment, Year 2020 - 824,000. (See Table 1)
c/ Calif. Statistical Abstract, 1967.