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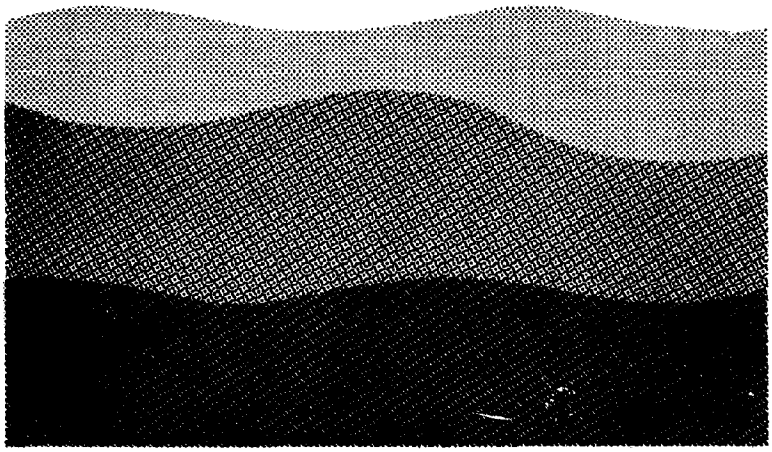

seattle shoreline inventory

office of environmental management

department of community development
city of seattle • april 1973

Washington State, Seattle

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April, 1973
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We are particularly grateful to the following individuals and organizations:

organizations

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introduction

The shoreline is the meeting place of land, water and air. It is important to us because it is an *interface*——a place where systems meet.

The interactions at boundary areas——such as the shoreline——are generally very intense. Boundaries are affected by several forces and bring together in one very narrow zone many diverse natural features and socio-economic uses. Shorelines in general, and in Seattle in particular, are very valuable from several points of view.

Biologically, shoreline areas provide habitat for many species of flora and fauna. The shoreline is also crucial economically. Much of our world economy is based on the fact that it is far cheaper per ton mile to transport goods on the water than it is on the land. The appearance on the horizon of the long hoped for trade agreements with Communist China and the Soviet Union and expected future developments in India and Japan could dramatically increase the need for shoreline space by waterborne commerce. Recreationally, shorelines provide an experience of unique importance for strolling, picnicking, launching boats, and as a window onto large, unbroken open spaces, so rare in our urbanized landscape. Furthermore, the pleasures of dwelling by the water are putting our shorelines under increased pressure, as the price of shoreline homes and land might indicate.

Because shorelines are so valuable, subject to enormous pressures and demands, and also quite fragile from the biological and geological standpoints, the State Legislature enacted and the people of the State ratified a law whose goals, as stated, are: "To provide for the management of the shorelines of the State by planning and fostering all reasonable and appropriate uses. . . This policy contemplates protecting against adverse effects to the public health, the land, its vegetation and its wildlife, and the waters of the state and their aquatic life, while protecting generally public rights of navigation . . . Permitted uses of the shorelines of the state shall be designed and conducted in a manner to minimize, insofar as practical, any resultant damage to the ecology and environment of the shoreline area and any interference with the public use of the water."

This law is the "Shorelines Management Act of 1971," ratified by the people of Seattle by a vote of approximately 2 to 1. The law calls for a three-way approach to the problem of regulating shoreline uses and development:

1. Major responsibility for management lies with the local government.

2. The State Department of Ecology is to provide support, insure that the total management programs for the shorelines of the state is progressing and according to the spirit and letter of the law.

3. A Shorelines Hearing Board is to act as a quasi-judicial body in ajudicating disputes arising from the granting or denying of permits for "substantial developments" on the shorelines of the state.

The City of Seattle has, thus far:

1. Received and processed over 110 applications for "substantial development" on shorelines of the city. This is about 10% of all applications made under the Shorelines Management Act in the entire state since the Act went into effect in June, 1971.

2. Completed an inventory of conditions along the City shorelines.

3. Embarked on the Master Program for the City shorelines with the formation of the Citizens Advisory Committee and the start of intensive staff study of methods of meeting the standards set for us by the Department of Ecology.

This report presents a summary of Seattle's Shoreline Inventory. It is divided into three parts:

1. The natural features——including the basic physical systems and conditions on the City shorelines.

2. Social and economic features——how people use the shoreline environment.

3. The existing Controls——already-existing rules for the use of Seattle's shoreline and water bodies.

the natural features

This section will describe the natural features of Seattle's shoreline and water. Included are:

1. Land form —— topography and bathymetry

2. Beach classifications and descriptions

   —original

   —existing

3. Description of Seattle's Water Bodies

4. Description of Important and Interesting Geologic and Biologic features.

The land forms and water bodies of Seattle give it an interesting and unique location as a city. There is water on two sides and it is divided centrally by other waters. The land is a series of elongated north/south running hills and depressions. The hills generally do not exceed 500′ in elevation and tend to fall rather sharply onto the water. These features are a result of the geologic development of the Puget Sound lowland, a long, varied, and still continuing process.

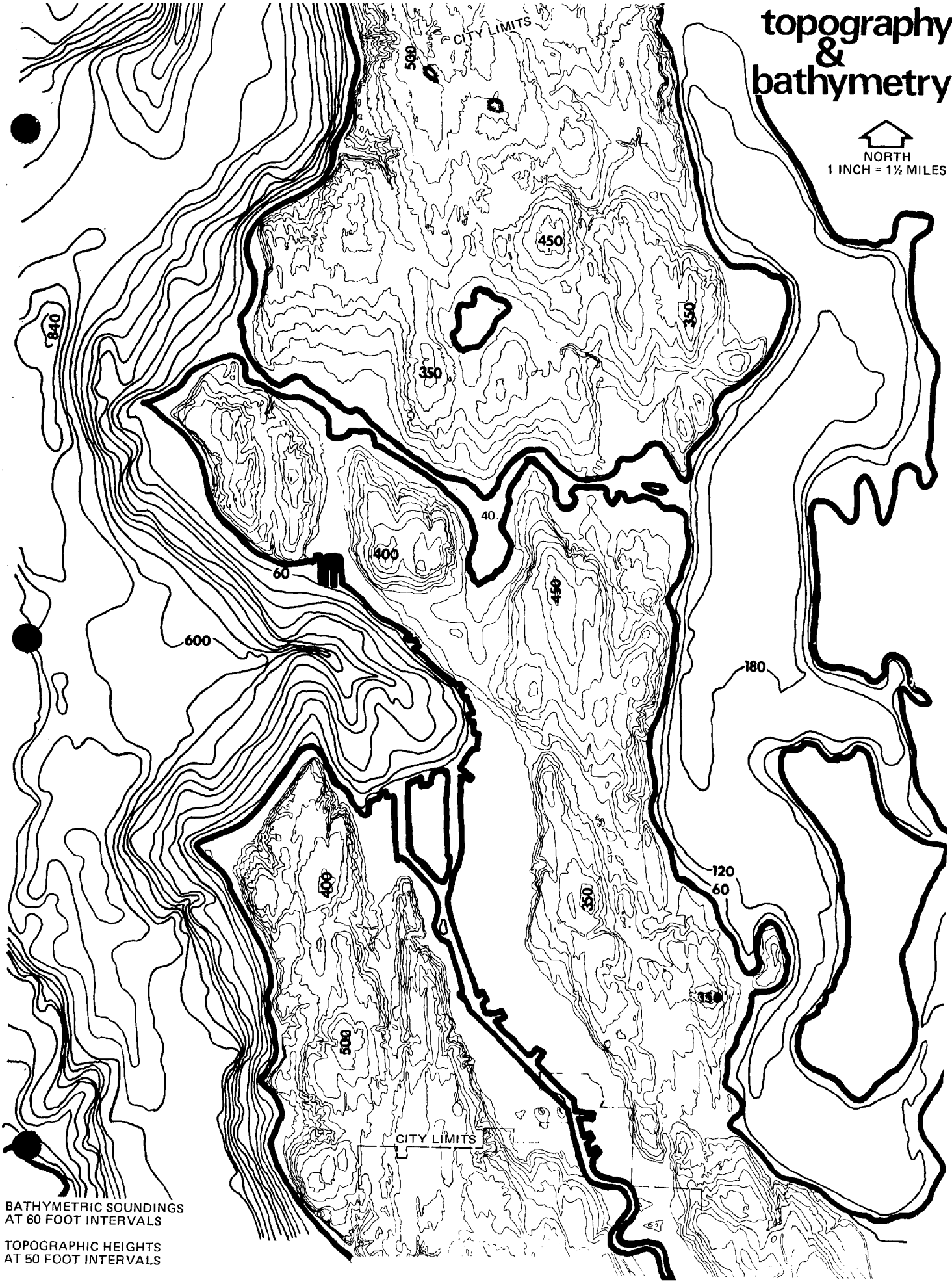
Basically, the Puget lowland in which Seattle is located was formed by "the subsistence of the rocks of the earth's crust along a north/south axis from Oregon to Canada. This depression is accented by mountain ranges on the east and west. During the "ice-age" (Pliestocene) the lowland was occupied at least four times, although the last advance (Fraser Glaciation) had the greatest impact on the Seattle area.

The ice lobe pushed down from Canada and divided, one arm going into the Strait of Juan de Fuca and the other into the Puget lowland. As the ice advanced down toward the site of Seattle there formed a large lake in front of the glacier in which silt and clay accumulated. The lake finally filled with sand by meltwater streams from the advancing glacier. As the glacier advanced over the now filled lake, it cut deeply into its own flat outwash, carving out the Puget Sound trough. Then the climate changed, the ice retreated (13,500 years ago) and salt water was admitted into the deep depression.

Thus, we see Seattle's forms and shapes are a direct result of glacial deposition or erosion. Puget Sound was formed by glacial erosion, the hills were built up by glacial accumulations, lakes (like Green Lake) were formed in depressions over the impervious glacial fill.

Today, geologic activity continues, although much of it has been altered and controlled by man. Rivers, like the Duwamish, erode and deposit materials from further inland. Wave action along Puget Sound shoreline cuts under the base of the slope of the hills creating beaches as the land retreats from the continual wave attack. Evidence of these processes may be seen on the face of Magnolia Bluff where wave action has helped cut a steep face on the hill, revealing layers deposited prior to glacial activity (22,000 years ago).

topography & bathymetry



BATHYMETRIC SOUNDINGS
AT 60 FOOT INTERVALS

TOPOGRAPHIC HEIGHTS
AT 50 FOOT INTERVALS

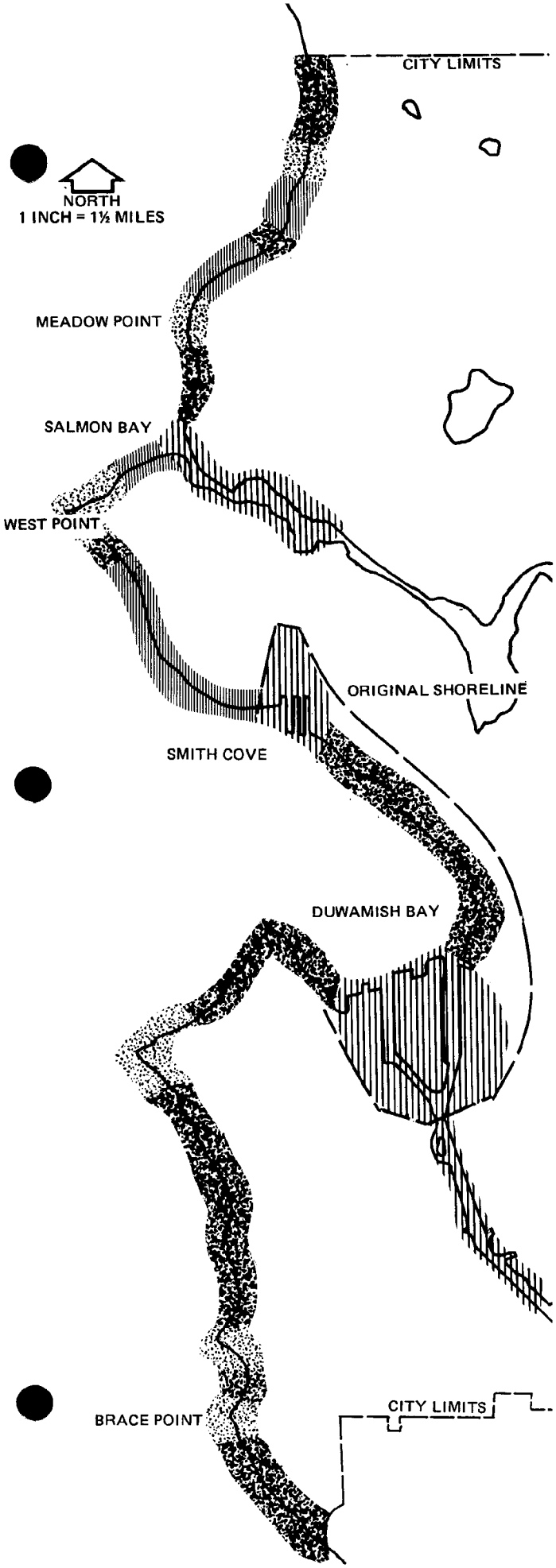
SEATTLE SHORELINE INVENTORY – APRIL 1973

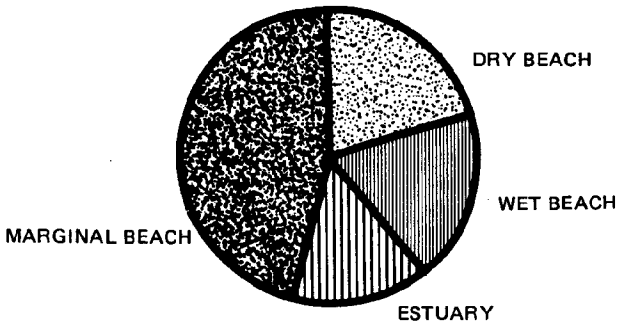
The map opposite is a description of Seattle's beaches as they existed prior to the impact of Western Civilization. As indicated on the map, Elliott Bay was somewhat larger than it exists today and was bordered by tidal lands and beach. Three natural estuarine environments existed along Puget Sound, located at Salmon Bay, Smith Cove, and at the mouth of the Duwamish River. These biologically rich environments combined fresh water with tidal water to provide fragile, but important, relationships of support for various marine life processes.

Original, natural beaches along the shoreline have been classified as dry, marginal, or wet beaches. The class depends on the amount of beach covered during high tide. Dry beaches were located on lands which protruded into the Sound. Marginal beaches existed where there was a moderate slope between the beach and land. Wet beaches were those where the beach was backed by steep bluffs, as along Magnolia Bluff and north of Meadow Point. This beach classification system was developed by Wolf Bauer,, a Seattle engineer, and has been modified by this Department for the special case of Seattle.

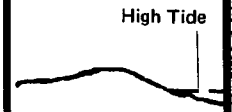
beach descriptions: natural shoreline of puget sound

Definition: Natural Puget Sound Shoreline is the shoreline in its original condition unaltered by human activity.



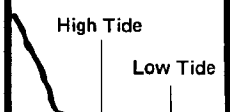


DRY BEACH



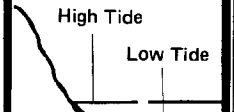
Dry Beaches may be used at all tides. They are found on spits and sand bars and are a scarce resource. The original Seattle Puget Sound shoreline consisted of 22% or 27,700' of Dry Beaches located at West Point, Point Williams, Brace Point and Meadow Point. Today Seattle has 3.4% or 4,200' of shoreline, at Meadow Point which may be classified as a Natural Dry Beach.

MARGINAL BEACH



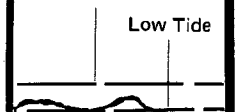
Marginal Beaches may be used at all tides although at high tide the beach is very narrow. Originally 46% or 59,400' of Seattle's Puget Sound shoreline was classified Marginal Beach. Today only 2.5% or 3,100' may be classified as Natural Marginal Beach, located south of West Point and south of Brace Point.

WET BEACH



Wet Beaches are covered by high tide water and may be used only at ebb tides. Originally 19% or 24,800' of Seattle Puget Sound shoreline was classified as Wet Beach. Today 6.3% or 7,700' of Natural Wet Beach exists located south of West Point.

ESTUARY



An Estuary is the place where a fresh water river joins a salt water body. This mixture of tidal and fresh waters create an environment which is biologically and vegetatively rich. Originally estuaries existed at the mouth of the Duwamish River, Smith Cove, and Salmon which was 13% or 16,700' of the original Seattle Puget Sound shoreline. Today there are no places which may be classified as truly estuarine.

The map opposite describes the existing marine shoreline which resulted from Seattle's growth into an important port and population center. Over the years, numerous projects have altered the original shoreline. The shoreline of Elliott Bay was walled and filled during 1920, moving the edge into the bay and providing easier access to the deep water of the Bay.

The estuarine environments at Salmon Bay, Smith Cove, and at the mouth of the Duwamish River were altered, resulting in the loss of their rich biologic environments. The stream leading into Smith Cove was filled to develop the railyard and piers. The Chittenden Locks and the Ship Canal were built in 1914, altering the relationship between fresh water flow and tidal influence. The estuarine environment at the mouth of the Duwamish River was modified to accommodate the increased pressures of industry.

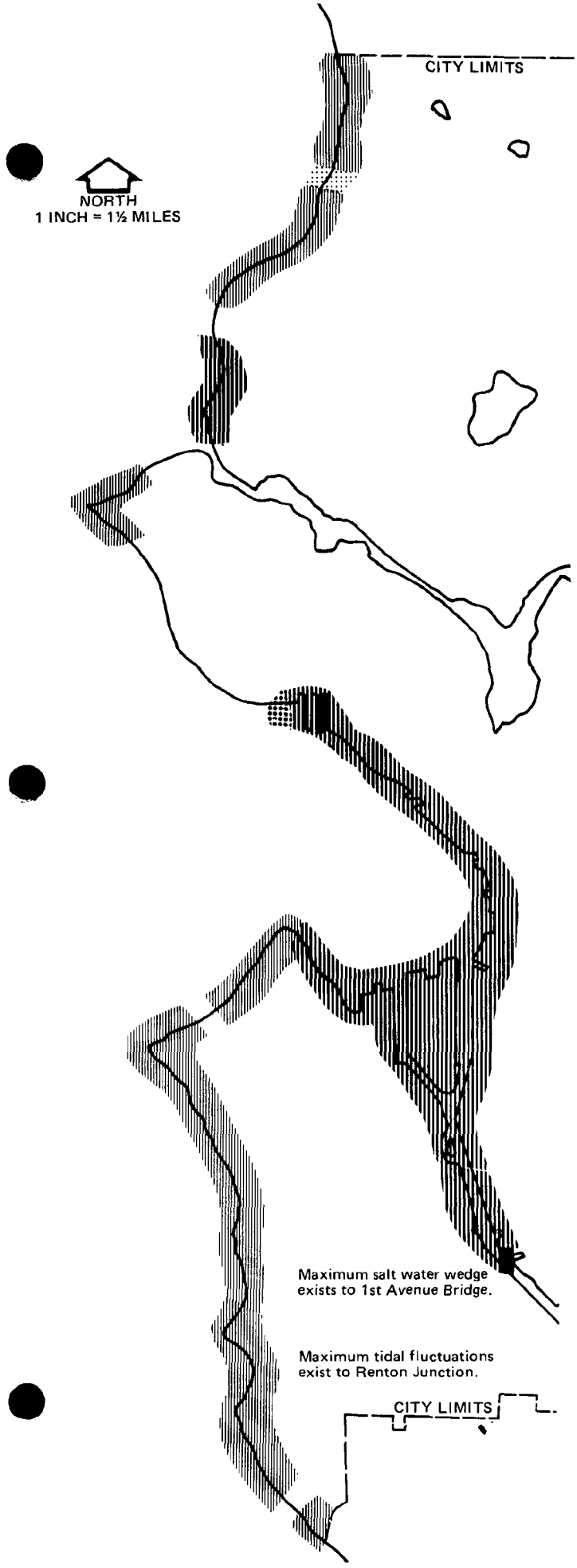
Harbor Island was created by dredging and fill between 1913 and 1918, to complement the industrial activities of Duwamish Bay and the port activities of Elliott Bay. The Duwamish River alignment was straightened by the Corps of Engineers.

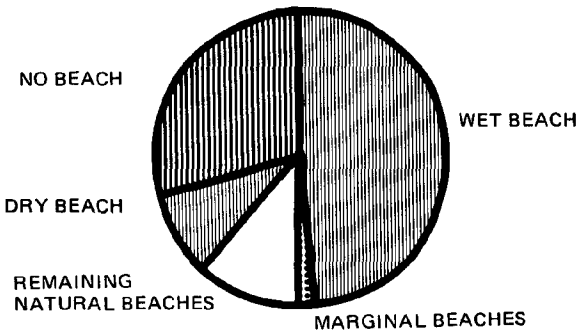
Other, lesser activities, have gradually change; the marine beaches. Shilshole Marina was developed by rip-rapping the shore and building a breakwater. Many original marginal and wet beaches have been bulk-headed to protect the shoreline from normal high tide conditions.

In fact, alterations of Seattle's shoreline are so extensive that there are only five locations of existing natural shoreline remaining. These are located at Meadow Point, the north and southwest sides of Magnolia Bluff, a narrow area north of Alki Point and south of Brace Point.

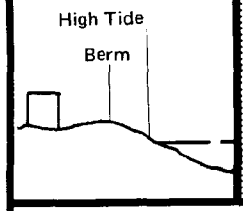
beach descriptions: modified shoreline of puget sound

Definition : Modified Puget Sound Shoreline is the shoreline as it exists today altered by human activity.



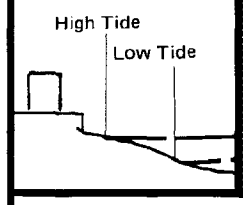


DRY BEACH



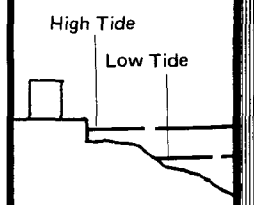
Modified Dry Beaches are accessible at all tides, but the natural cycle of the beach has been changed by altering of the berm. 8.2% or 10,000' of Seattle's Puget Sound shoreline may be classified as Modified Dry Beach.

MARGINAL BEACH



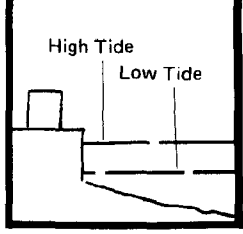
Modified Marginal Beaches are accessible at high tide although the beach is very narrow and the water's edge is close. Due to this proximity of the water's edge, bulkheads are built to protect structures which might be damaged during storms or extreme tidal conditions. Modified Marginal Beaches comprise 0.1% or 100' of Seattle's Puget Sound shoreline.

WET BEACH



Modified Wet Beaches are available for use only at low tides. Bulkheads are built to provide protection from normal high tide conditions and to permit use of an area which would normally be under water at high tide. Modified Wet Beaches comprise 49.3% or 60,400' of Seattle's Puget Sound shoreline.

NO BEACH



No Beach areas are those which are covered by water at both high and low tides as a result of dredging and bulkheading. No Beach areas were once Natural Marginal Beaches. Today 30.1% or 36,900' of Seattle's Puget Sound shoreline is classified as No Beach and is useful for commerce and industry because deep-draft ships may come into the shore.

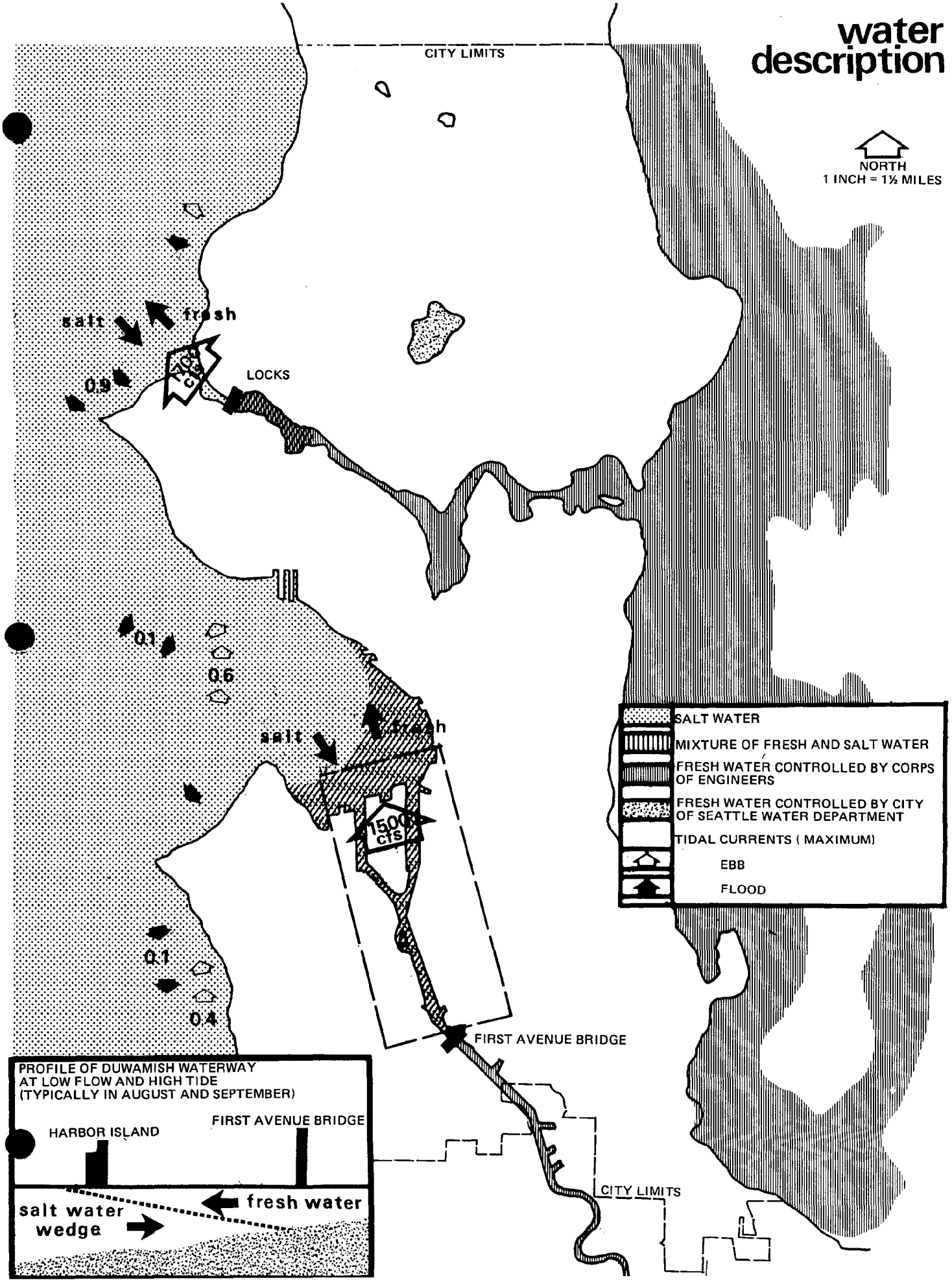
The map opposite describes water bodies which exist within Seattle's boundaries. Seattle is bordered on the east by the fresh waters of Lake Washington and on the west by the salt water of Puget Sound. The level and quality of fresh water, including the Canal, Lake Union, Portage Bay, Montlake Cut and Lake Washington, are controlled by the Corps of Engineers. The level is controlled at the Locks where, from May 16 to November 30, it is held as high as possible to counteract evaporation and increased usage of the Locks which occur during the summer months. During the winter months, the level is held down to approximately 20 feet to permit dock repairs, rising again to near 22 feet in March. The quality of fresh water at the Locks is maintained by a siphon which flushes out the salt water admitted by the opening and closing of the Locks. The salt water is collected in a basin, 2,000 feet by 250 feet by 12 feet, just inside the Locks and flows out back into Shilshole Bay.

The mouth of the Duwamish River is another location where salt and fresh water mix. Here the river meets tidal fluctuations. The results are a fresh water layer over the salt water of Elliott Bay and a salt water "wedge" which reaches to the First Avenue Bridge over the Duwamish River. This mixture of salt and fresh water provides an oxygenated water level which is crucial for migrating salmon.

Green Lake, located in north Seattle, is a fresh water lake whose water quality is maintained by dilution. The City of Seattle pumps 3-1/2 million gallons of water per day into the lake, thereby increasing the life of the lake, slowing down the eutrophication process and minimizing its algae blooms.

The small arrows on the map give an indication of the direction and velocity, in knots, of the tidal currents. Generally, it may be stated that these currents have a weak flow, especially in Elliott Bay, which creates a problem of accumulated debris.

water description



SEATTLE SHORELINE INVENTORY – APRIL 1973

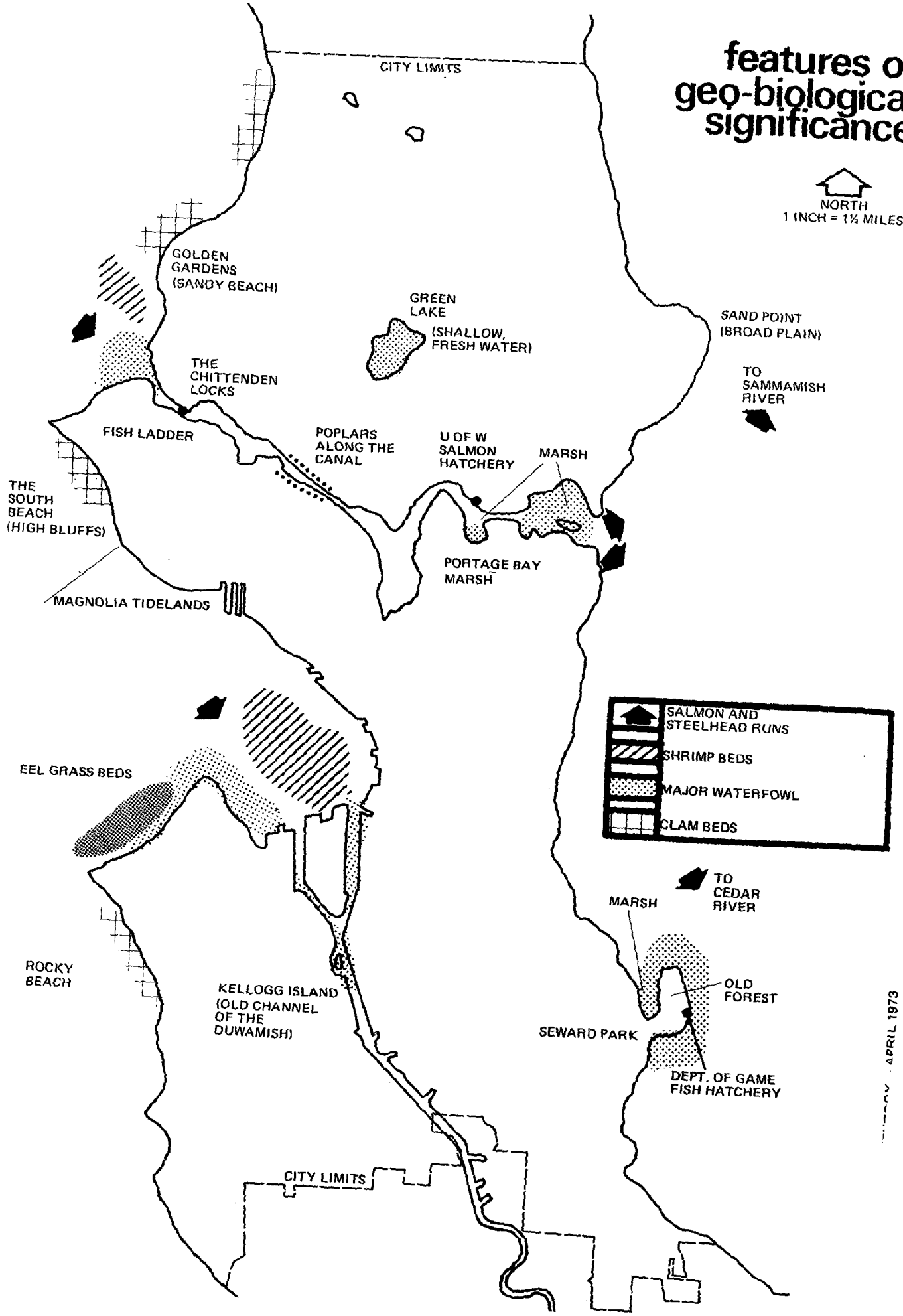
The map opposite gives an indication of the types and extent of important biological and geological features which exist along the Seattle shoreline.

As may be seen, Seattle still possesses a rich variety of marine life, including marine habitats for clams, shrimp, marsh environments for various water fowl, and human created systems which support existing biological processes. These include the fish hatcheries at Portage Bay and Seward Park and the fish ladder at Chittenden Locks.

Unique vegetation, marine and land, are also present within Seattle. There are eel grass beds (which function to stablize sediments and oxygenate water), virgin forest at Seward Park, and exotic plantings including the poplars along the Canal, the Chittenden Lock gardens, and the marsh area at the Arboretum and Foster Island.

Seattle shoreline's geologic history is highlighted by the Puget Sound and Lake Washington glacial troughs. Other geologic features of interest are the bluffs on South Beach, Kellogg Island, as the last evidence of the old course of the Duwamish River, and the on-going water and wave depositions at Golden Gardens and the rocky beaches south of Alki.

features of geo-biological significance



APRIL 1973

the uses

An understanding of the uses of the shoreline resource is based on a knowledge of how and why the land along the shoreline and water are used. This information is organized and here presented as follows:

1. General Shoreline descriptions
2. Water dependent uses:
   - —Recreation
   - —Industry
   - —Shippers
3. Water related uses:
   - —Shoreline apartments
4. Water uses

Though the scale of the map limits the extent of detail, the broad picture of current uses can be seen if we divide social activities into those involving working, playing and dwelling. A basic classification of uses along Seattle shorelines can be made if we utilize this system.

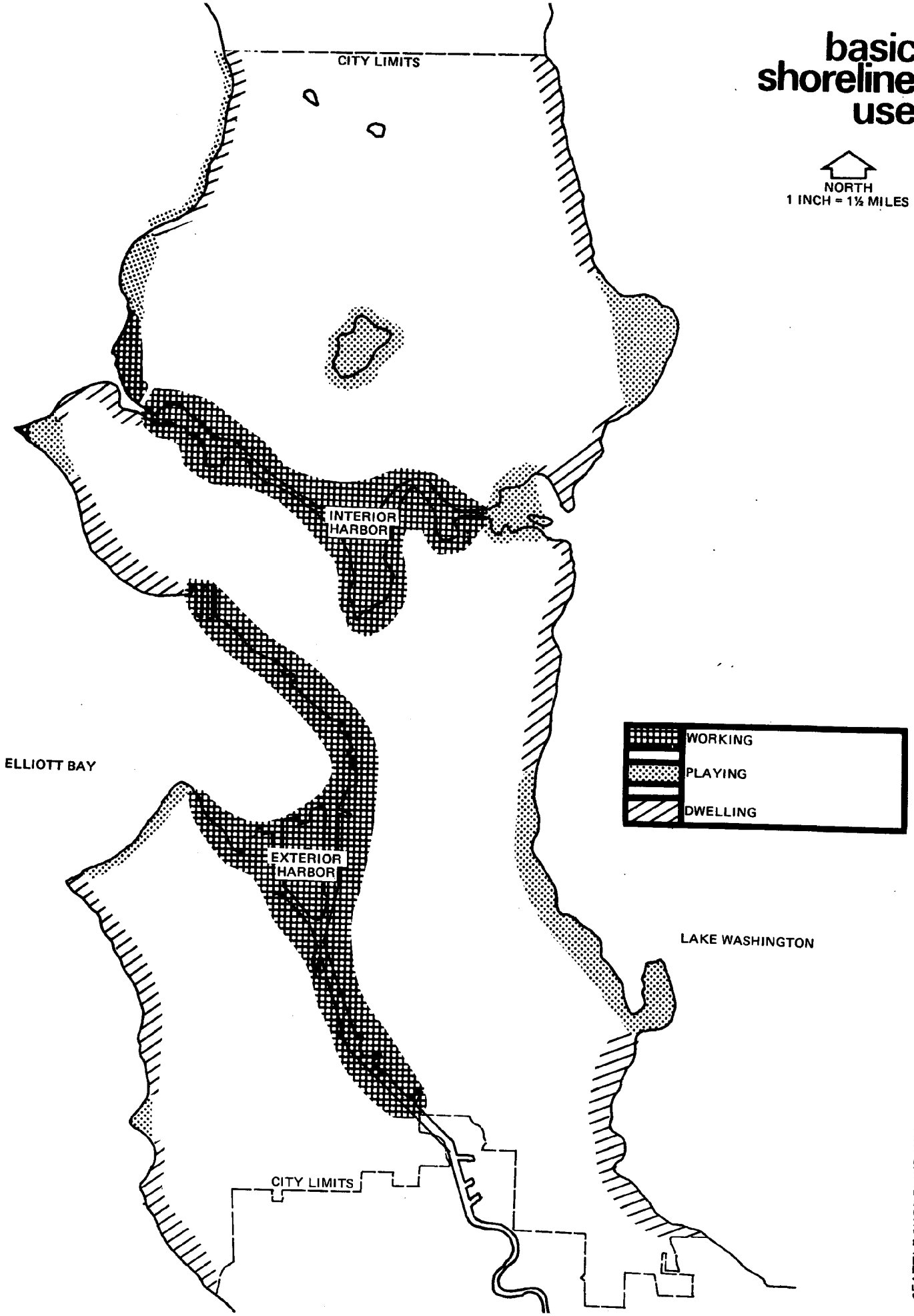
Protected by hills and with relatively large amounts of flat land, the exterior harbor (Elliott Bay and Duwamish) and the interior harbor are places of intense commercial and industrial activity. The map indicates business and industry that use the shoreline as an integral part of their operations.

The shorelines of Washington and Puget Sound are typically used for playing and dwelling. This is a natural outgrowth of the physical conditions——exposure to wind travelling over long stretches of open water and narrow wave-cut beaches which leaves little room for large commercial and industrial activity. This situation is also the result of the distance from the historical origins of the city and its development pattern, over time.

The chart below provides a numerical breakdown of Seattle's shoreline by use:

Use	Shoreline front footage	% of total
—residential (single & multi-family)	117,000'	28%
—parks	104,700'	25%
—industrial	52,000'	13%
—commercial	45,800'	11%
—port uses	34,500'	8.6%
—circulation (bridges, rail, etc.)	29,100'	7%
—public service (schools, hospitals,etc.)	16,100'	3.9%
—undeveloped	9,500'	2.3%
—utilities	5,100'	1.2%
TOTAL	413,800' or approx. 78.4 miles	100%

basic shoreline use



SEATTLE SHORELINE INVENTORY – APRIL 1973

This map shows publicly owned water related recreation facilities along Seattle's shoreline. Because of Seattle's unique shoreline resource and the ease of access to both salt and fresh water, a wide range of recreation opportunities exist in the city.

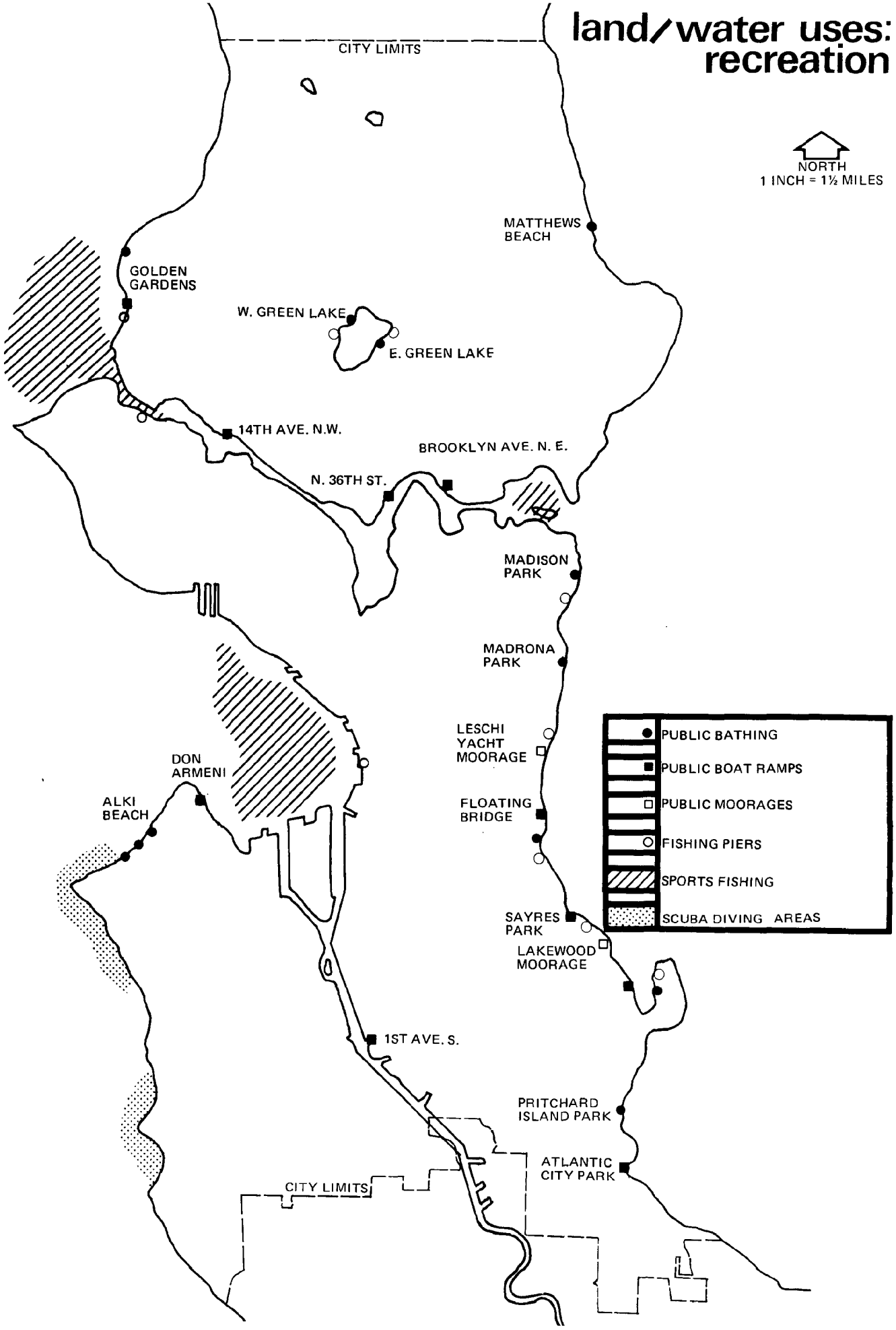
Summer brings out the greatest demand and use of water related facilities. Supervised swimming is available at Alki Beach and Golden Gardens if one prefers salt water bathing. Numerous sites are available along Lake Washington and at Green Lake for fresh water bathing.

Boating is very popular as one might expect in Seattle. There are 8 public boat ramps along Seattle's shoreline, two public moorage sites, and numerous private moorages and yacht clubs. Popular complementary activities include water-skiing, sailing, kiyaking.

Sports fishing, for salmon, in Puget Sound water is open year around with certain limitations as to size and number of catch. Salmon fishing is also open year round in Lake Washington, the Ship Canal and Lake Union, again with limitations as to amount and size. Fishing for other food fish and shell fish in these waters is also available but subjected to regulations of the Washington Department of Fisheries.

Finally, another water using sport is scuba diving, enjoyed by increasing numbers of people at salt water locations along Seattle's shoreline. Interesting observable sea life include fish, eels, octopus and other bottom life which are found wherever some form of barrier or reef is present.

land/water uses: recreation

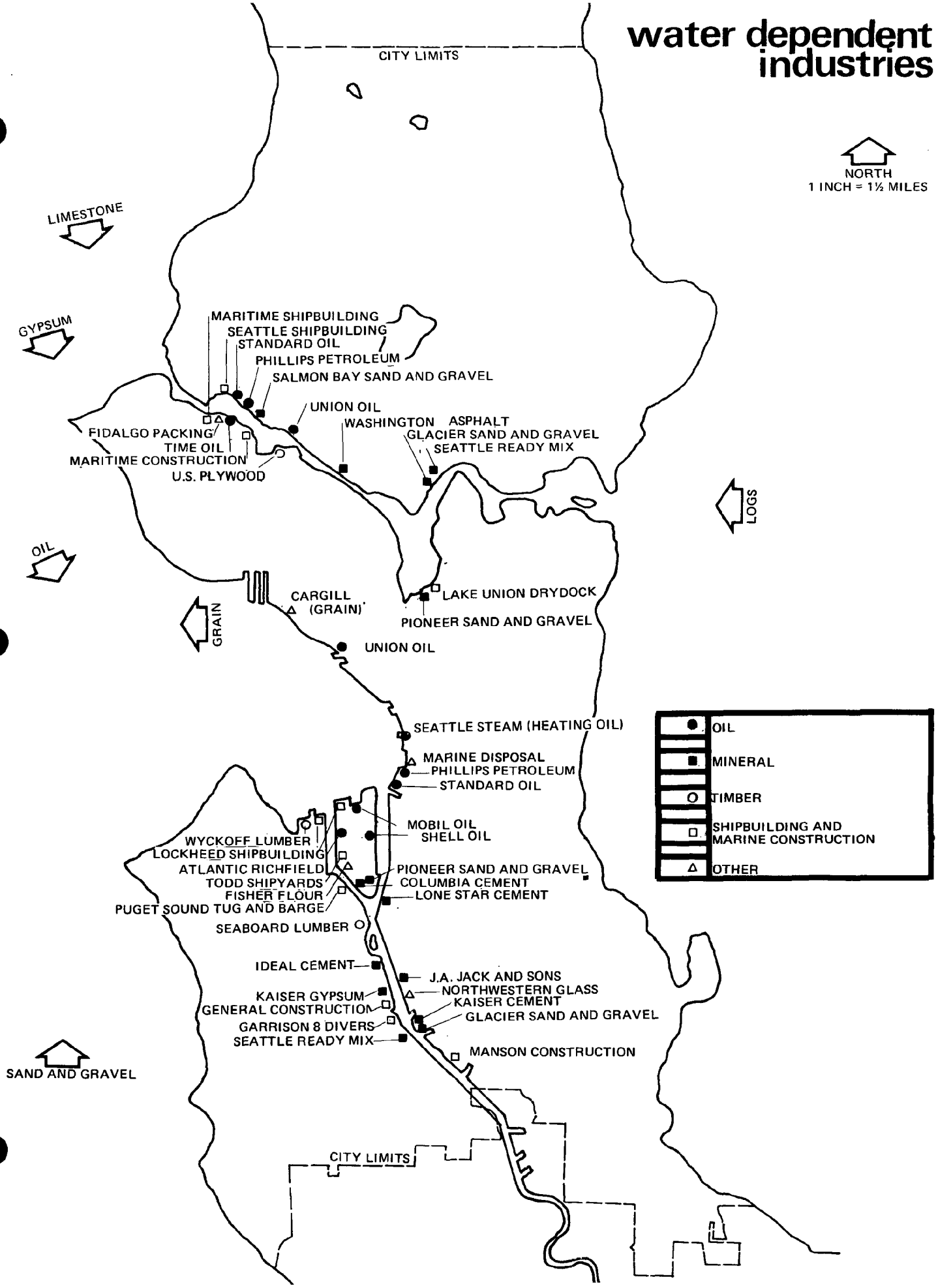


SEATTLE SHORELINE INVENTORY – APRIL 1973

The key to efficient, economic transport is to move materials in quantities which are as large as possible, and water transport offers the greatest opportunity to achieve this efficiency. This map locates important industries in Seattle, which depend on water to transport either the raw product to them, as processors, or the finished product to the distributor. For example, refined oil is transported by tankers from refineries north of Seattle to locations along Seattle's shorelines, where it is distributed to individual dealers. Sand and gravel are brought by barge from Maury Island and Shelton, in south Puget Sound, to Seattle where it is delivered to projects inland. Limestone is brought to Seattle from Texada Island, British Columbia. Timber and forest industries use water to transport and store logs for lumber production. Ship-building industries locate by water for easy launching and ship repair.

All of these industries and others depend on water transport to keep down the cost of the products, although it is apparent that further research is necessary to understand exactly how these industries use water transportation and to what degree their function is dependent on a shoreline location.

water dependent industries



SEATTLE SHORELINE INVENTORY - APRIL 1973

Water uses begin to show how the water bodies of Seattle are used for a diverse range of activities in meeting the needs of recreation, industry, transportation, and utilities. Because this resource is used by so many and in such a variety of ways, it is of critical importance to understand what these demands are and plan for an effective balance of demand and resource.

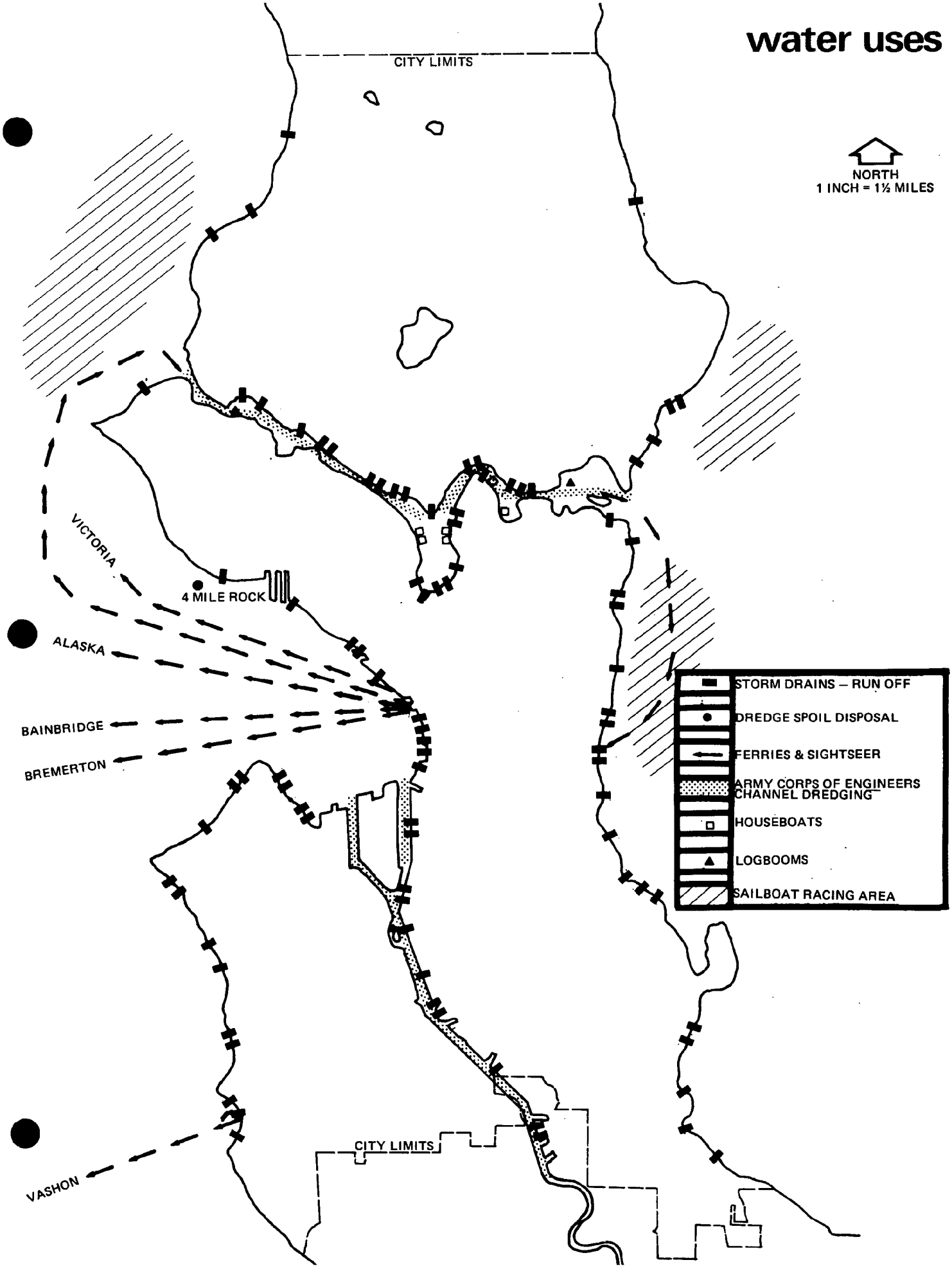
Sailboat racing, houseboats, and log booms are examples of uses which depend on water to give reason for their existence. The exact location of these activities depends on climatic and topographical conditions and on complementary land use activities. Log booms are floated near lumber mills, sailboat racing requires exposed, unobstructed locations, while houseboats require protected and relatively calm waters.

Ferries and sightseers also depend on water for their function and use and, as Seattle is bounded on two sides by water, their use would be expected. On Puget Sound there are ferries locally to Vashon Island, Bremerton, and Bainbridge Island. More exotic passages are available to Victoria, British Columbia, and Alaska. Ferries once existed on Lake Washington, connecting Kirkland with Madison Park and Laurelhurst, but their function has been replaced by two floating bridges. Today, the only public water transportation available on the lake is the sightseer which also operates along Puget Sound through the Locks, Canal, and Lake Union.

Dredging activities through the Canal and Montlake Cut and through the Duwamish Waterway are a result of increased accumulations of silt (as a result of increased runoff due to loss of permeable surfaces on land and additional development of activities along the shoreline) and the need to maintain channel depths for navigation. Dredging activities, by the United States Corps of Engineers produce about 300,000 cubic yards every three years for both the Lake Washington Ship Canal and the Duwamish Waterway. Historically, much of dredge spoil material has been used for fill. However, lack of acceptable sites and the pollution level found in the dredge material has forced the Corps of Engineers, other agencies, and private firms involved in dredging to turn to disposal of these wate materials in the water. (See map for locations of dumping sites.) Concerns for the destructive effects of dredging are currently being considered, and the Corps of Engineers has initiated a research project to determine if there are any uses for dredge spoil.

Another activity related to the water are sewage overflow outfalls. They are one aspect of the City of Seattle's sewage and storm drain separation program. METRO (Municipality of Metropolitan Seattle) was established to "clean up" Lake Washington and, as a result of this objective, sewage drains and treatment plants were developed to control sewage disposal. Part of the operation includes separating storm drains from sewage disposal. Part of the operation includes separating storm drains from sewage lines. However, the Metro Sewer lines and treatment plants were not engineered to handle the additional storm drainage and untreated sewage overflows into public waters when the flows exceed the capacity of the trunk sewers. Some of these conditions are being remedied by the sewer separation program which is scheduled for completion by the end of 1973.

water uses



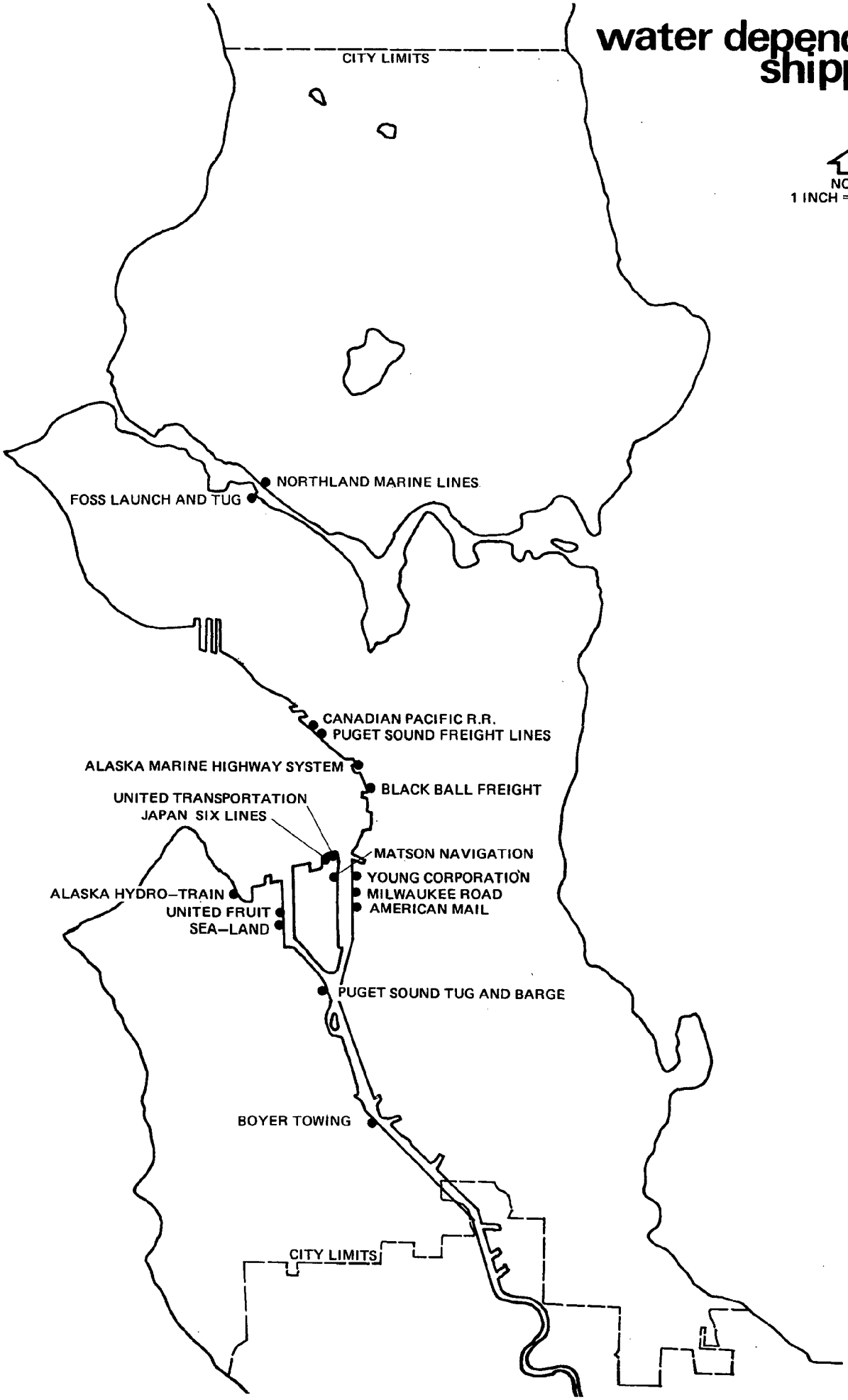
SEATTLE SHORELINE INVENTORY – APRIL 1973

The function of a port is to move goods from one mode of transport to another. This map locates companies whose function is to provide means of transportation for goods ranging from raw materials to finished products. Such service is dependent on the existence of a protected, deep water bay, on-land transportation systems, railroad, highways and air, plus systems whose function coordinates these elements to provide effective transportation. Seattle has all of these elements and the potential to increase its trade volume and economic base.

Two trends support this projection. First, increased containerization seems to be inevitable as a method for easy, rapid and inexpensive transport. Modern containerization is a high-capital, low-labor method of moving cargo. It is the cheapest way to ship certain types of high-valued, small bulk unit manufacture goods. Because it is so highly mechanized, container ships can unload, load, and be "turned around" in as little as 24—36 hours. Shippers like this because money is made only when ships are moving. Ports like it because it means that more cargo can move across their piers than could otherwise.

The second trend changing the nature of transporting is the potential increase of trade with Communist China, Japan, and other Eastern countries. Seattle, along with other Pacific Coast seaports will be competing for a share of this trade.

water dependent shippers

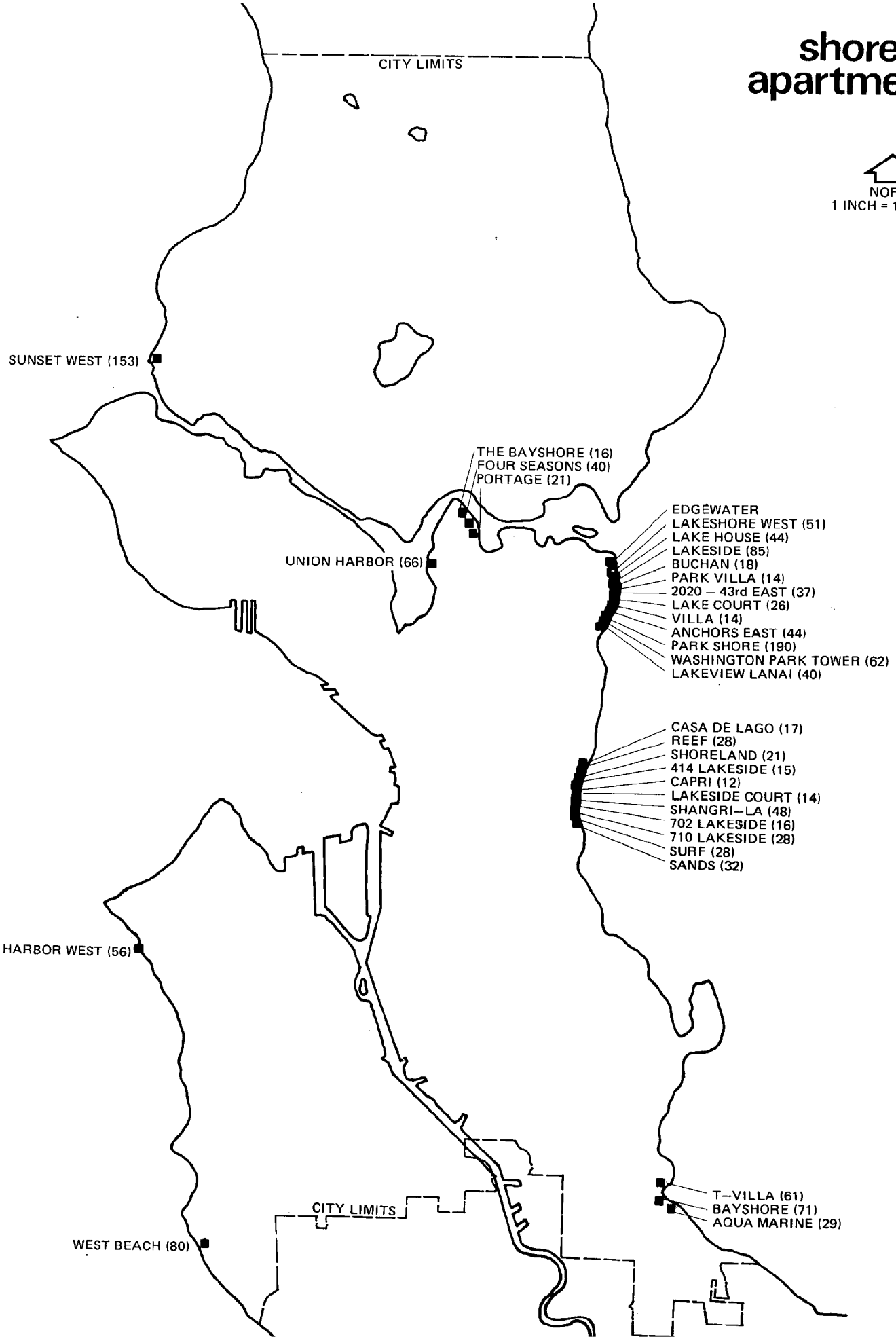


SEATTLE SHORELINE INVENTORY — APRIL 1973

Seattle devotes approximately 117,000 feet, or 28%, of shoreline to residences of all types. About 110,000 feet (25%) is used by single family residences, multi-unit dwellings occupy 7,300 feet (or 1.5%).

The majority of multi-family units are on Lake Washington, in clusters at Madison Park, Leschi, and Rainier Beach.

shoreline apartments



SEATTLE SHORELINE INVENTORY – APRIL 1973

the controls

The text and illustrations in this section deal with the different ways in which society organizes the space it occupies. This organization is reflected in the distribution and form of the artifacts which support a culture's activities and in the development of laws to regulate use of the environment.

Controls of Seattle's shoreline and water include:

1. Ownership Map – showing how and to whom we allocate the shoreline resource. (Included here is a map of the street ends and waterways.)

2. Water Control Map & Profile – showing controls placed on water-using activities.

The ownership map describes the locations and owners of Seattle's shoreline and indicates the percentage owned by various groups or agencies.

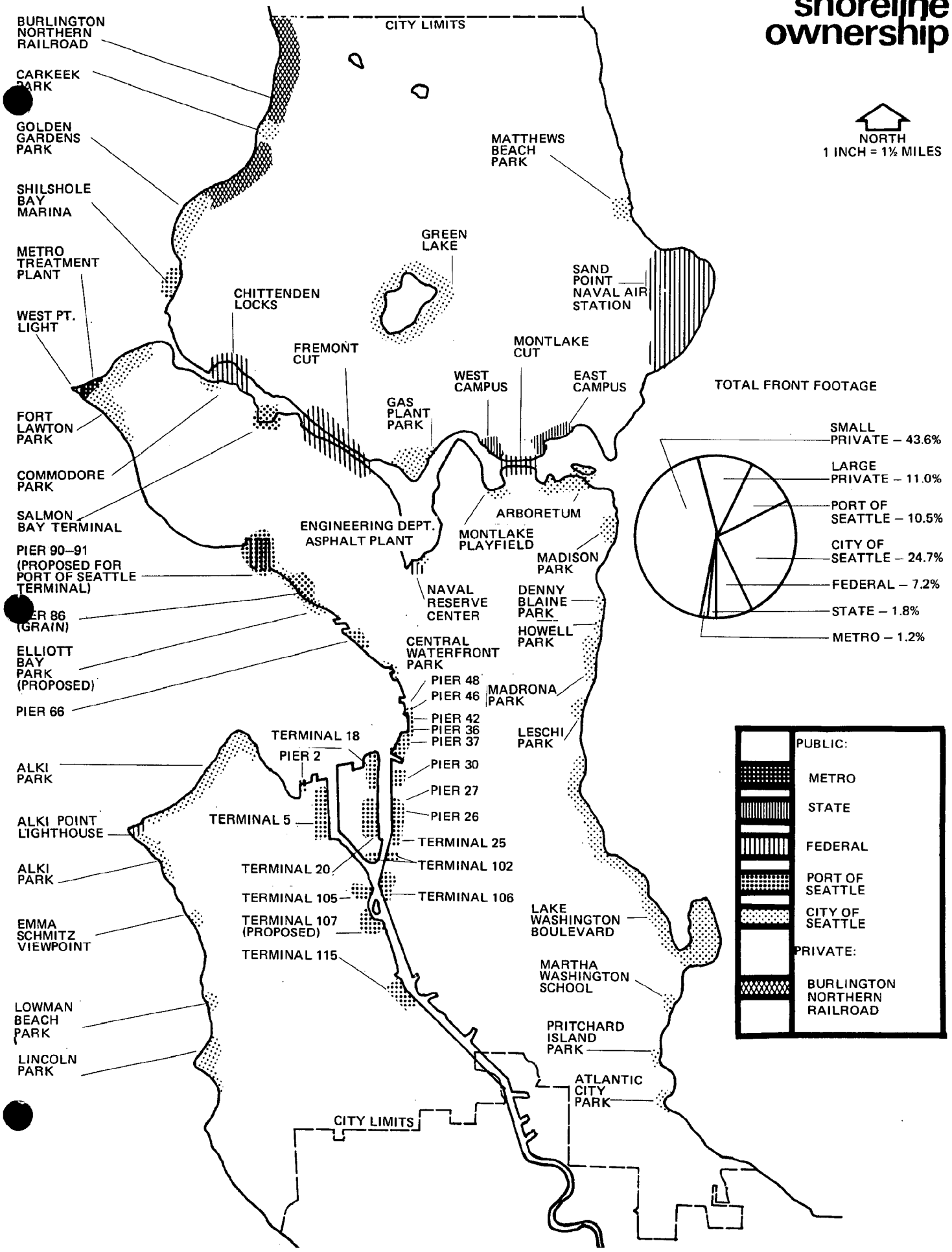
As may be seen on the map, public agencies (the Federal Government to the Port of Seattle) "own" 45% of the shoreline although much of this land is devoted to economic or government purposes and is not accessible to the public. Publicly owned shorelines which are accessible are generally parks.

Small, private ownership (less than 1000' waterfront) controls 43.6% of Seattle's shoreline and is located along Lake Washington, south of West Point and Alki Point on Puget Sound and along Lake Union. As the demand for shoreline increases, it becomes more and more important to understand the ownership pattern. For example, it has been estimated that approximately one percent of Seattle's total population is fortunate enough to live in a single family residence along the water's edge. However, single family residences occupy 22 miles of Seattle's total 78.4 miles of shoreline.

Further clarification of land ownership in linear feet and miles is indicated in the chart below:

Ownership Type	Shoreline Footage	% of Total
small, private (less than 1000')	180,600	43.6
large, private (1000' or greater)	44,500	11.0
City	102,700	24.7
Port	43,600	10.5
Federal	30,000	7.2
State	7,300	1.8
METRO	5,100	1.2
TOTALS	413,800 or approx. 78.4 miles	100%

shoreline ownership



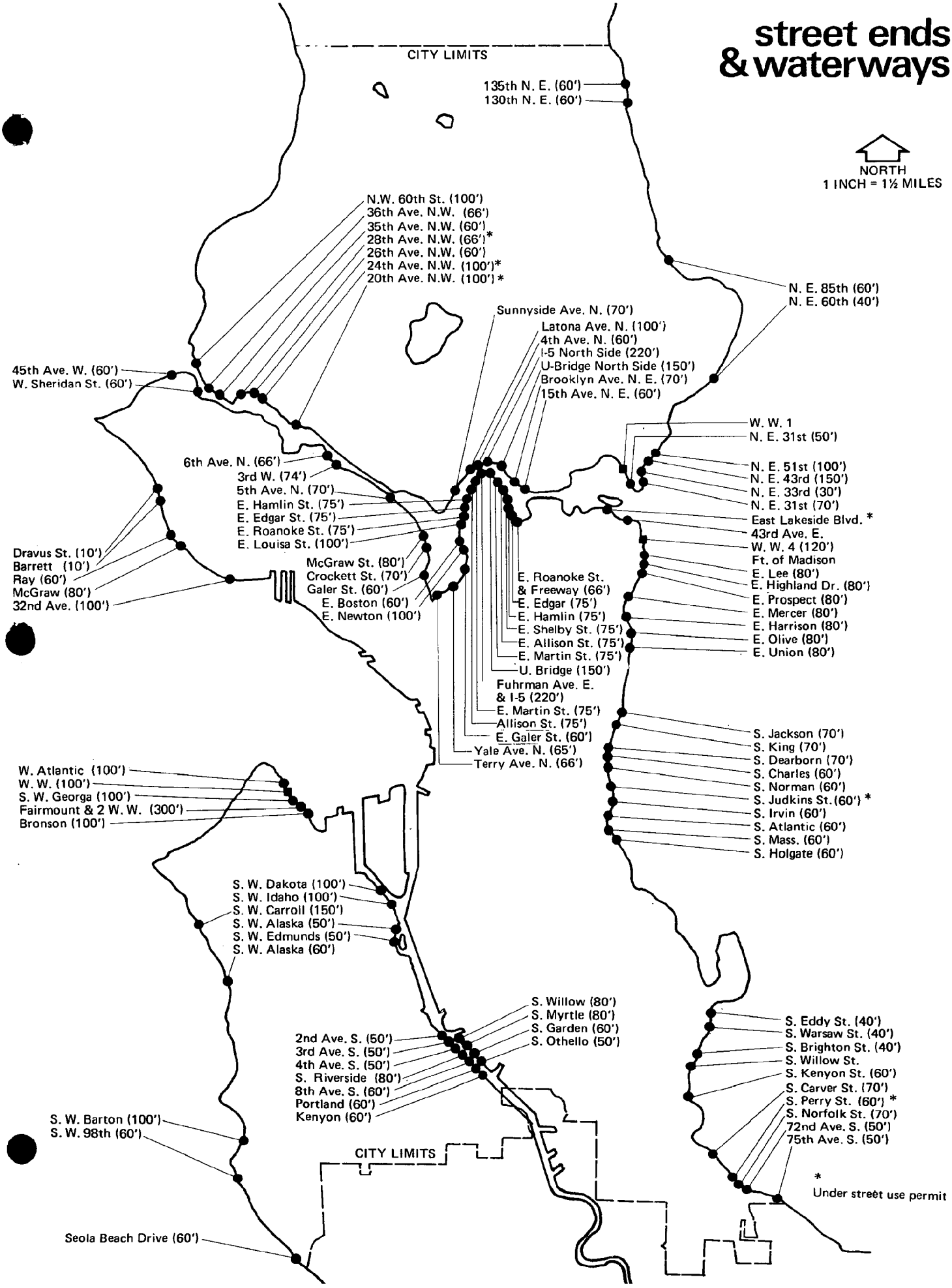
SEATTLE SHORELINE INVENTORY – APRIL 1973

Street ends are the places where the City's streets open onto the water. The City government does not own the street ends, but hold them by perpetual easement. As with all city streets, they can be used by private parties upon obtaining a street use permit from the Engineering Department; and, in industrial areas, street ends fronting on water can be vacated, which is the process by which the City gives up its stewardship of the property in return for a portion of the property's fair market value. (RCW 35.79) "Waterways" are under the jurisdiction of the Department of Natural Resources of the State of Washington. Their purpose is to ensure that the public has access to the water for commercial purposes. (Article 15, Washington State Constitution)

There are over 9,000 linear feet of street end waterfront and waterways in the City of Seattle. Were such an amount of shoreline to be obtained on the open market, it would cost, conservatively, several millions of dollars.

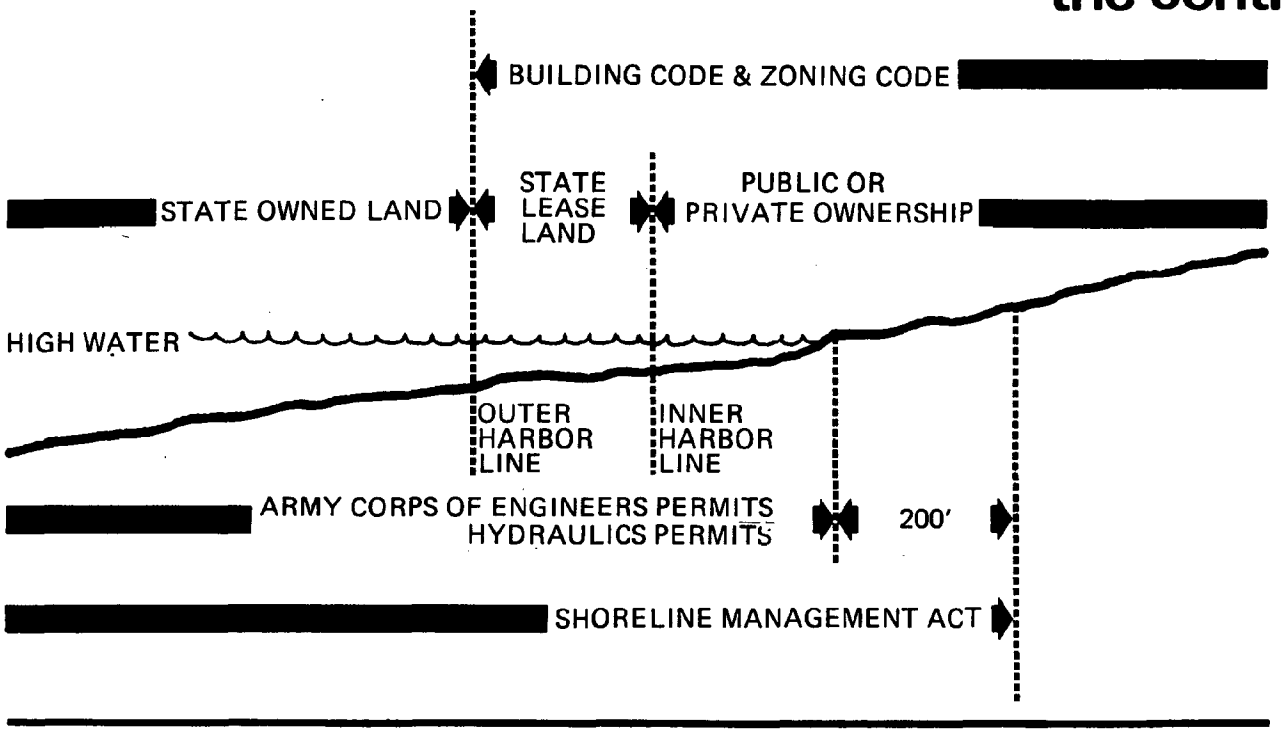
Street ends and waterways provide an excellent means of expanding public access to the shore. Any contemplated improvements should be consistent with the character of the surrounding neighborhood.

street ends & waterways



SEATTLE SHORELINE INVENTORY – APRIL 1973

the controls



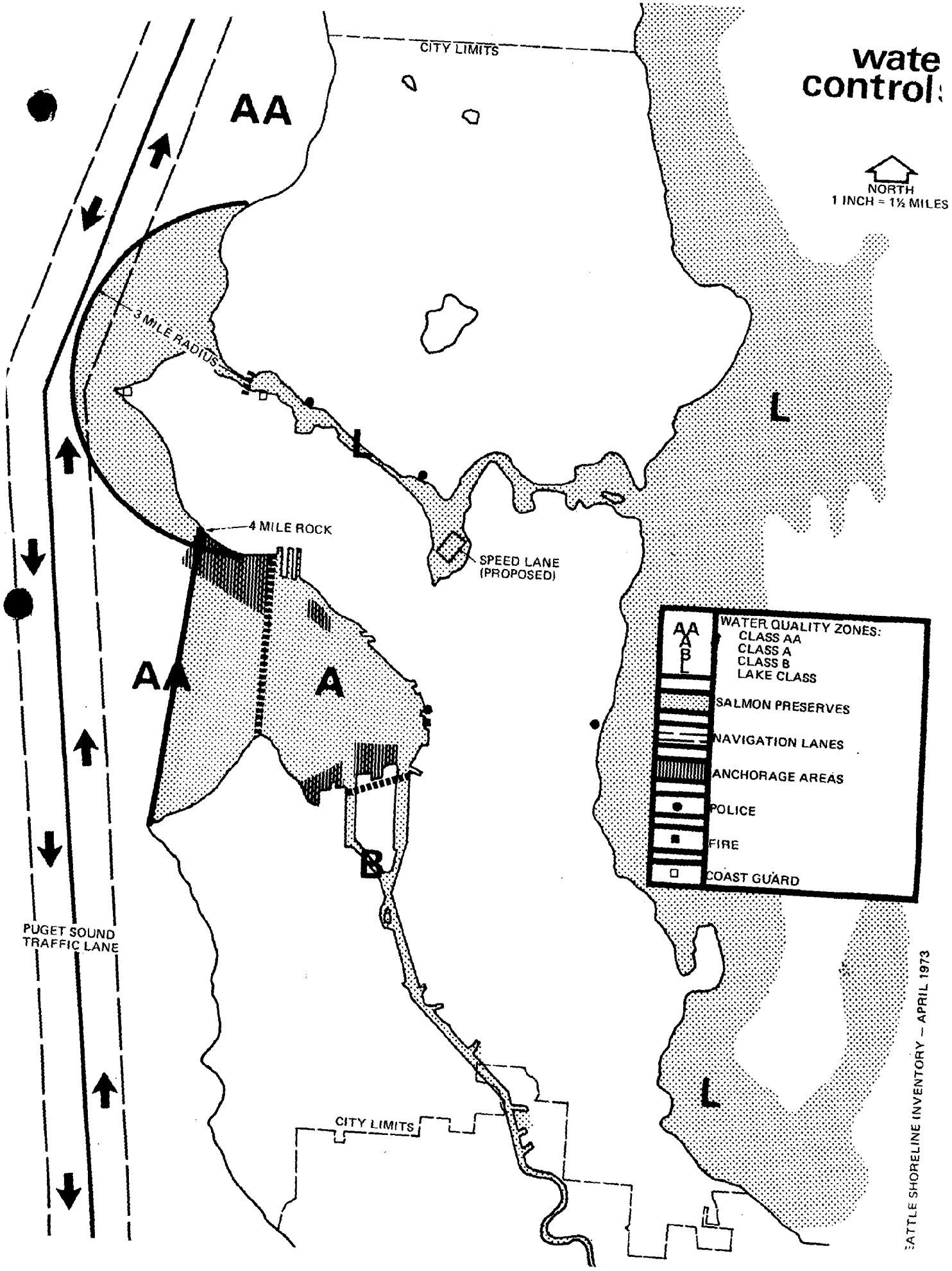
THE PROFILE (above) indicates the jurisdiction of different Government agencies over the shoreline, showing overlapping authority and control. Private ownership exists to the inner harbor line, and is regulated by the State's Shoreline Management Act, by the City's Building Department and Zoning Code, and by the U.S. Army Corps of Engineers. Shorelines are controlled by the Shoreline Management Act and by the Corps of Engineers.

In addition, the City of Seattle has established a Construction Limit Line (Ordinance No. 92887) (50–150 feet outboard of the Bulkhead-Pierhead Line) on Lake Union, resulting from the 1963 Lake Union Plan. This line is intended to clarify the situation created by the absence of inner and outer harbor lines and prevents construction beyond this line. The area between the Bulkhead-Pierhead Line and the Construction Limit Line is administered and leased by the Department of Natural Resources, and the revenue generated by these leases goes to the Port of Seattle.

This map gives an indication of the existing controls imposed by various governing bodies over the waters of Seattle.

The State has designated Elliott Bay, the Duwamish River, a three-mile radius from Meadow Point around Magnolia Bluff, and all of the waters leading into and including Lake Washington as Salmon Preserve (closed to commercial fishing).

Water standards have also been established by the State to insure that quality and minimum salinity levels of "inter and intra" state water are maintained (waters entirely within the boundaries of Washington). The classes range from AA (extraordinary) to C (fair) (waters shared with other states). These standards establish minimum acceptable levels for total coliform organisms, dissolved oxygen, dissolved nitrogen, temperature, ph, turbidity and deleterious material concentrations within each class. Also included are descriptions of characteristic uses and aesthetic values. Other controls include designated anchorage areas where ships are permitted to anchor for 30 days and navigation lanes for inter-Sound travel (33 C.F.R. 110.220) Navigation lanes have been designated to minimize collision, especially those involving oil transport. City police and fire stations which help control water-using activities are also shown.


wate
control
NORTH
1 INCH = 1½ MILES
CITY LIMITS
AA
3 MILE RADIUS
L
4 MILE ROCK
SPEED LANE
(PROPOSED)
AA
A
B
L
WATER QUALITY ZONES:
CLASS AA
CLASS A
CLASS B
LAKE CLASS
SALMON PRESERVES
NAVIGATION LANES
ANCHORAGE AREAS
POLICE
FIRE
COAST GUARD
PUGET SOUND
TRAFFIC LANE
CITY LIMITS
SEATTLE SHORELINE INVENTORY — APRIL 1973

plans, projects and on-going activities affecting the shorelines of seattle

CORPS OF ENGINEERS

The Corps of Engineers is relevant to Seattle shorelines through several studies and projects:

Duwamish Waterway. The Corps is studying how best to improve navigation on the Duwamish Waterway. Presently, it is making a detailed study of an alternative which widens and deepens the Waterway as far as the 1st Avenue South Bridge.

Shilshole Small Boat Harbor Multiple Use Study. The Corps is conducting a study of the potential for multiple use at this facility.

Ship Canal Improvements. The Corps is undertaking a program to improve the functioning of the fish ladder at the Chittenden Locks. They are also planning to beautify their holdings at the Montlake Cut and Fremont Cut.

Dredging. In order to maintain the minimum channel depth as authorized by Congress, the Corps is required to dredge in the Duwamish Waterway (about every 3 years) and in the Lake Washington Ship Canal (at much longer intervals because siltation is slower).

Salt Water Barrier. In order to prevent salt water from contaminating the fresh water of the Ship Canal (and to meet the Department of Ecology's salinity standard for that body of water), the Corps of Engineers has a siphon which flushes the salt water back out into Shilshole Bay after it has come through the locks. This works on the principle that salt water is denser (and thus heavier) than fresh water. The salt water is collected in a basin 2,000 feet by 250 feet deep just inside the locks and flows out back into Shishole Bay.

Environmental Inventory. The purpose of this project is to prepare an atlas which identifies environmental resources and problems in the State of Washington. Through the Institute for Environmental Studies at the University of Washington, the Corps has sought public comments on their first draft.

PORT OF SEATTLE

The Port is a major factor on Seattle's shorelines. Besides leasing numerous terminals as shown on the map of SHORELINE OWNERSHIP, it is planning new developments in at least 3 locations:

Kellogg Island, (on the Duwamish);
Piers 37-48;
Piers 90-91.

Each of these projects involves dredging and filling to create new terminals.

The Port of Seattle is also sponsoring, along with the City of Seattle and King County, a study of the potential of the Duwamish Valley which will isolate those industries which could locate here, considering Seattle's population characteristics, environmental goals, land available, and trends in world economics.

DEPARTMENT OF NATURAL RESOURCES

This State agency is important to Seattle's shorelines because of its ownership of all State owned submerged and tidal lands. It is this Department's responsibility to lease lands between the inner and outer harbor lines (see map of SHORELINE CONTROLS). The Department is developing a plan for the allocation of these submerged and tidal lands.

COAST GUARD

In addition to responsibility for safety of boats and ships on the waters, the Coast Guard is also responsible for enforcing laws dealing with waste discharges from ships and is developing an oil spill contingency plan.

RIBCO

The River Basin Coordinating Committee is an offshoot of METRO. It is trying to develop computer models of the Cedar and Green River basins, taking into account hydrology, land, urban runoff, and solid and liquid waste management. These models will enable decision-makers to view "alternative futures" which could result in different policies.

CITY OF SEATTLE

Burke-Gilman Trail. The Burlington-Northern R.R. has abandoned its line from Kenmore to the University Bridge and the City of Seattle is now planning a pedestrian-bicycle trail for the right of way.

Fort Lawton Park. The City has acquired a portion of the former Army base for park purposes. Development will be restricted to shoreline preservation and improvement of public access.

Commodore Park. This 5.3 acre site has been acquired and will be developed to provide a passive park, including a fishing pier.

Alki Avenue Improvement. The Seattle Park Department has contracted for a Master Plan for the entire length of the Alki facility from Duwamish Head to Alki Point.

Matthews Beach Park Expansion. The City of Seattle has acquired lots on the shoreline south of the existing park at Matthews Beach and these will be developed as waterfront park.

Leschi Park Expansion. Land south of the existing park is being considered for acquisition and may be developed as waterfront park.

Lake Union Park. Old gas plant has been acquired by the City for a park. The park will incorporate elements of the old gasworks.

South Lake Union Park. The City owns a small parcel of property and hopes to expand the areas and devote it to park purposes.

North and South Shore Viewpoints. On Interstate highway land, the City of Seattle Park Department will develop areas for passive recreation and viewing of the waterfront scene.

Woodland Park and Seattle Zoo. Though not directly related to Green Lake, the study for Woodland Park Zoo makes some suggestions for the lake, including alternative uses for the Aqua Theatre.

Don Armeni Boat Ramp. The Department of Parks plans to improve and upgrade this site.

I-90 Boat Ramp. Under I-90, the Park Department plans to develop a boat ramp.

Green Lake Dilution Program. In order to retard the eutrophication of the lake, the City Department of Water adds water from the City system (about 2 million gallons per day, when capacity is availabe).

Lake Union Action Plan, Phase II. This program is in the process of being implemented by the Department of Community Development. Emphasis is on maintaining a "working lake" and preventing incompatible development.

West Seattle Freeway. This project is designed to relieve present vehicular congestion on the Spokane Street Corridor and construct a high bridge to eliminate draw bridges and provide the opportunity to widen the Duwamish Channel and develop the upper Duwamish for Port of Seattle facilities.

Seacrest Marina. The City of Seattle is currently studying this site for its marina and recreational potential.

Central Waterfront Park and Aquarium. This funded project by the Seattle Department of Parks and Recreation will create an urban park between Piers 55 and 61 and will begin construction of Phase I in July, 1973.

Sand Point. The Navy is surplusing Sand Point Naval Air Station (regulations require the property to be disposed of through G.S.A.) and the National Oceanographic and Atmospheric Administration has requested 100 acres to enable location of its regional headquarters (including moorage of up to 20 ships). The balance of the site (200 acres) is planned for public park and recreation use.

Elliott Bay Park. The City of Seattle plans to develop this recently filled segment into a linear park and waterfront trail.

Sewer Separation Program. The City Engineering Department is in the midst of separating many of the storm and sanitary sewers in the city.

Seattle 2000. This citizen task force will develop long-range goals and policies for the City. The task force on environment and land use will address some of the choices faced in shoreline management, and is scheduled to finish in May, 1973.

City of Seattle Comprehensive Plan. The City's major planning guidelines, which will be updated following establishment of goals by the Seattle 2000 Commission.

METRO

The environmental protection agency has ordered METRO to cease dumping sludge in the waters of Puget Sound by January 1, 1973; METRO's permit to dump sludge in holding basins on the beach expires in two years. METRO must develop an alternative method of sludge disposal.

OTHER STATE OF WASHINGTON AGENCIES

State Fish Hatcheries. The State Department of Game maintains a fish hatchery at Seward Park.

Green Lake Poisoning. In order to make the lake more desirable for fishermen, the State Department of Game poisons the trash fish in the lake about every 5 years and then restocks it with trout. This was most recently done in October, 1972.

University of Washington Fish Hatchery. The University has developed an artificial run of salmon into its hatchery at the School of Fisheries on Portage Bay. The salmon run in October and November of each year.

University East Campus. A joint faculty-student-staff committee has developed a program for the University's Montlake dump on Union Bay. The plan is for active recreation (boathouse, climbing rock, picnic area, beach) at the Ship Canal end of the property with passive recreation and an "ecological demonstration area" towards Laurelhurst. To discourage uses incompatible with the natural area (for example, jogging), the trails will be back about 150 feet from the shore. Access to the shore itself will be by dead-end trails.

University of Washington Arboretum. The University proposes to protect the Arboretum from overuse by park goers by building a fence around a portion of it to control public access. This may transfer more use to the unrestricted part of the Arboretum, including the shoreline segment.

I–90. A Shoreline Management Act substantial development permit will be considered for the I-90 Bridge following submission of an adequate environmental impact statement as required by the Shoreline Hearings Board.

glossary

A familiarity with the following terms will be invaluable in understanding the development of Seattle's shoreline management program.

Water Department Use. All uses that cannot exist in any other location but on the water.

Water Oriented Use. A use that by locating on or near the waterfront will facilitate its operation.

Inner Harbor Line. The line designated by the State that determines the extent of private ownership in tide or shoreland areas (often corresponds to the U.S. Bulkhead Line).

Outer Harbor Line. The line designated by the State that determines the extent of water area that may be leased to private interests (often corresponds to the U.S. Pierhead Line).

Harbor Area. That area between the Inner and Outer Harbor Lines that may be leased but never sold by the State and must be used for purposes of navigation and commerce and established by Section 1 of Article 15 of the State Constitution.

U.S. Pierhead Line. The channelward limit to which open pile work may be constructed.

U.S. Pierhead Line. The line that establishes the channelward limit to which land fills or bulkheading may extend.

Extreme Low Tide. The lowest line on the land reached by a receding tide.

Ordinary High-water Mark. The mark on all lakes, streams, and tidal waters, which will be found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation, as that condition exists on the effective date of this chapter, or as it may naturally change thereafter: PROVIDED, That in any area where the ordinary high-water mark cannot be found, the ordinary high-water mark adjoining salt water shall be the line of mean higher high tide and the ordinary highwater mark adjoining fresh water shall be the line of mean high water.

Shorelines. All of the water areas of the state including reservoirs and their associated wetlands, together with the lands underlying them, except:

(a) Shorelines of state-wide significance;

(b) Shorelines on segments of streams upstream of a point where the mean flow is 20 cubic feet per second or less, and the wetlands associated with such upstream segments; and

(c) Shorelines on lakes less than 20 acres in size and wetlands associated with such small lakes.

Shorelines of State-wide Significance. The following shorelines of the state:

(a) The area between the ordinary high-water mark and the western boundary of the state from Cape Disappointment on the south to Cape Flattery on the north, including harbors, bays, estuaries, and inlets;

(b) Those areas of Puget Sound and adjacent saltwaters and the Strait of Juan de Fuca between the ordinary high-water mark and the line of extreme low tide as follows:

(i) Nisqually Delta — from DeWolf Bight to Tatsolo Point;
(ii) Birch Bay — from Point Whitehorn to Birch Point;
(iii) Hood Canal — from Tala Point to Foulweather Bluff;
(iv) Skagit Bay and adjacent area — from Brown Point to Yokeko Point; and
(v) Padilla Bay — from March Point to William Point.

(c) Those areas of Puget Sound and the Strait of Juan de Fuca and adjacent saltwaters north to the Canadian line and lying seaward from the line of extreme low tide;

(d) Those lakes, whether natural, artificial or a combination thereof, with a surface acreage of 1,000 acres, or more, measured at the ordinary high-water mark;

(e) Those natural rivers or segments thereof, as follows:

(i) Any west of the crest of the Cascade Range downstream of a point where the mean annual flow is measured at 1,000 cubic feet per second, or more;

(ii) Any east of the crest of the Cascade Range downstream of a point where the annual flow is measured at 200 cubic feet per second, or more, or those portions of rivers east of the crest of the Cascade Range downstream from the first 300 square miles of drainage area, whichever is longer;

(f) Those wetlands associated with (a) through (e) above.

Shorelines of the State. The total of all "shorelines" and "shorelines of state-wide significance" within the state.

State Master Program. The cumulative total of all Master Programs approved or adopted by the Department of Ecology.

Substantial Development. Any development of which the total cost, or fair market value, exceeds $1,000, or any development which materially interferes with normal public use of the water of shorelines of the state except that the following shall not be considered substantial developments:

(a) Normal maintenance or repair of existing structures or developments, including damage by fire, accident, or elements;

(b) Construction of the normal protective bulkhead common to single-family residences;

(c) Emergency construction necessary to protect property from damage by the elements;

(d) Construction of a barn or similar agricultural structure on wetlands;

(e) Construction or modification of navigational aids, such as channel markers and anchor buoys;

(f) Construction on wetlands by an owner, lessee, or contract purchase, of a single-family residence, for his own use or for the use of his family, which residence does not exceed a height of 35 feet above average grade level and which meets all requirements of the state agency or local government having jurisdiction thereof.

Wetlands or Wetland Areas. Those lands extending landward for 200 feet in all directions, as measured on a horizontal plane from the ordinary high-water mark and all marshes, bogs, swamps, floodways, river deltas, and flood plains associated with the streams, lakes and tidal waters which are subject to the provisions of the act.

Navigability. The State of Washington considers all bodies of water meandered by government surveyors as navigable unless otherwise declared by a court. Navigable waters are waters navigable for general purposes of commerce and not those waters which are public highways merely for floating logs. (Watkins vs. David, 24 Wash. 636). A body of water is navigable in law if it is capable of being navigated in fact and the fact that its small size renders it of little use for that purpose is not determinative. (Brace and Hergert Mill Co. vs. State, 40 Wash. 326). Tidal water is navigable in law if in fact it is navigable though only at high tide. (Dawson vs. McMillan 34 Wash. 269). Streams or lakes are navigable in fact if their natural ordinary condition affords a channel for useful commerce.

Beds of Navigable Waters. Those submerged lands lying below the line of extreme low tide in navigable tidal waters and below the line of navigability of navigable lakes, rivers, and streams. Under the laws of the United States, the navigable waters have always been and shall forever remain common highways. The term, bedlands, used in this report is synonymous with beds or navigable waters.

First Class Tidelands. The lands lying within, or in front of, the corporate limits of any city or within one mile thereof, upon either side and between the line of ordinary high tide and the inner harbor line, and within two miles of the corporate limits on either side and between the line of ordinary high tide and the line of extreme low tide.

Second Class Tidelands. The area outside of and more than two miles from the corporate limits of an incorporated city or town, extending from the ordinary high tide line to the line of extreme low before statehood, before November 11, 1889, the upland ownership will extend to whichever line is the further out, the line of ordinary high tide or the government meander line.

Guidelines. Those standards adopted to implement the policy of this chapter for regulation of use of the shorelines of the state prior to adoption of master programs. Such standards shall also provide criteria to local governments and the department in developing master programs.

Hearings Board. The Shorelines Hearings Board established by the Shoreline Management Act of 1971.

Local Government. Any county, incorporated city, or town which contains within its boundaries any lands or waters subject to the Shoreline Act of 1971.

Master Program. The comprehensive use plan for a described area, and the use regulations, together with maps, diagrams, charts or other descriptive material and text, a statement of desired goals and standards developed in accordance with the policies enunciated in Section 2 of the Act.

Development. A use, consisting of the construction of exterior alteration of structures; dredging; drilling; dumping; filling; removal of any sand, gravel or minerals; bulkheading; driving of piling; placing of obstructions; or any project of a permanent or temporary nature which interferes with the normal public use of the surface of the waters overlying lands subject to the act at any state of water level.

Permit. That required by the act for substantial development on shorelines, to be issued by the local government entity having administrative jurisdiction and subject to review by the Department of Ecology and the Attorney General.

Construction Limit Line. The line established on Lake Union and Portage Bay outward from the combined bulkhead—pierhead line beyond which there can be no construction.

information sources

bibliographies

Annotated Bibliography on the Ecology of the Lake Washington Drainage, Richard S. Wydoski, Nov. 1972, $2.00, available from Coniferous Forest Biome, University of Washington, AR-10, Seattle, 98195.

Bibliography of Literature Puget Sound Marine Environment, Eugene Collias and Alyn Duxbury, Dec. 1971, available from Division of Marine Resources, University of Washington, Seattle 98195.

general

Coastal Zone Management: Multiple Use with Conservation, J. F. P. Brahtz, Wiley, 1972.

Estuaries, ed. G. H. Lauft, 1967, AAA's Publication No. 83.

Wildlife Management Techniques, Robert Giles, Jr., Wildlife Society, 1971.

Shore Protection, Planning and Design 3rd Edition, Beach Erosion Board, Washington, D.C. 1966, $3.00.

Disposal of Dredge Spoil – M. B. Boys, et al, Technical Report H-72, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss.

Water Pollution Aspects of Urban Runoff, Federal Water Pollution Control Administration, Jan. 1969.

pertaining to seattle

Plan of Seattle, Virgil Bogue, 1911.

Woodland Park and Seattle Zoo Long Range Master Plan, G. R. Bartholick, 1971.

An Ecological Survey of Seahurst County Park, Allan Cohn, June, 1971. Prepared for King County Design Commission. Available Seattle Municipal Reference Library.

An Engineering and Ecological Study for the Rehabilitation of Green Lake, R. O. Sylvester and G. C. Andersen, February 1960.

Glacial Geology of the City of Seattle, James Stark and D. R. Mullineaux, Master's Thesis, 1950, University of Washington.

Magnolia Bluff Field Trip, 4 page, mimeo, available from Don Tubbs, Department of Geological Sciences, University of Washington.

Geology and Ground Water Resources of Northwest King County, Water Supply Bulletin No. 20, 1963, $2.00, Division of Water Resources, Olympia.

Geology and Mineral Resources of King County, Bulletin No. 63, 1971, $4.50, Department of Natural Resources.

Landslides of Seattle, Don Tubbs, U.S. Geological Survey, in process of publication.

Factors Initiating Phytoplankton Blooms and Resulting Effects on Dissolved Oxygen in Duwamish River Estuary, U.S. Geological Survey, Water Supply Paper 1873–A, 1969.

Effects of Dredging on Water Quality and Sediment Transport in Duwamish River Estuary, Sterns, Thompson and Runyan, Seattle, 1972.

Physical, Chemical, and Biological Aspects of the Duwamish River Estuary – 1963–1967, U.S. Geological Supply Paper 1873–C, 1972, $.40.

Fishes of the Green–Duwamish River, Water Quality Report No. 4, METRO, 410 West Harrison Street, Seattle.

Studies on Lake Washington Ship Canal. G. R. Seckel and M. Rattray, 1953, Technical Report No. 15, Department of Oceanography, University of Washington.

Lake Union 1972: The Promise and the Potential, Clayton and Jean Young, 1972.

Lake Union Preliminary Comprehensive Plan and Action Program, Joyce, Copeland and Vaughan, 1971.

Lake Union Study, Seattle Planning Commission, 1963.

Lake Union Action Plan, Seattle Department of Community Development, 1972.

East Campus Development, Report of the Ad Hoc Study Committee for East Campus Development, Department of Facilities Planning and Construction, University of Washington, 1972.

Shoreline Utilization in the Greater Seattle Area, Management and Economics Research, Inc., Washington, D.C. 1968.

Harbor Island Study, Tippetts, Abbett, McCarthy, Stratton, Consulting Engineers, 1969.

Environmental Impact Assessment on Sludge Dewatering Facilities at West Point Treatment Plant, METRO, March 1972.

Draft Environmental Statement for North Greenwood West Storm Drains, Seattle Department of Engineering, February, 1972.

Myrtle Edwards Park — A Study of the Surface and Subsurface Soil Materials, Dale Cole and Peter Machno, December 1972.

Duwamish River, Proposed East Channel Closure, Committee on Tidal Hydraulics, U.S. Army Corps of Engineers, Seattle District, May 1967.

Preliminary Survey of Invertebrates and Algae Along the Intertidal Beaches of West Point, Kenneth Chew et al, METRO, 1971.

Fort Lawton Park, Dan Kiley and Partners, 1973, $2.00, available from Seattle Parks and Recreation Department.

Seattle Central Waterfront, Rockrise, Odermatt, Mountjoy, Amis, 1972.

Sewer Separation Program, Draft Environmental Impact Statement, Seattle Department of Engineering, 1972.

Central Waterfront Park Environmental Impact Statement, Seattle Department of Parks and Recreation, 1972.

Public Brochure on Small Boat Harbor for Elliott Bay, U.S. Army Corps of Engineers, Seattle District, May 1972.

"Seawall of Novel Design for Seattle Waterfront", *Engineering News-Record,* November 8, 1934.

Public Brochure on East, West, Duwamish Waterways, U.S. Army Corps of Engineers, Seattle District, October 1972.

Decade of Growth, Paul Chilcote, Port of Seattle, 1971.

LASH Prospects for Puget Sound. Department of Planning and Research, Port of Seattle.

Determinants of City Form, Seattle Department of Community Development, 1971.

pertaining to puget sound/washington

Common Seashore Life of the Pacific N.W., Lynwood Smith, 1962.

Marine Shorelines in the Puget Sound Region, Puget Sound Governmental Conference, Report No. 8 in Project Open Space, 1964.

Protecting America's Estuaries: Puget Sound and the Straits of Juan de Fuca, House Committee on Government Operations, Washington, D.C. 1972.

Effect of Dredging on Water Quality in the Northwest, Environmental Protection Agency, Region X, July 1971.

Seattle Coastal Region Oil and Hazardous Materials Contingency Plan, U.S. Coast Guard, Seattle Office, Dec. 1970.

Oil on Puget Sound, June Vagners and Paul Mar, University of Washington Press, Seattle, 1972.

Intrastate Water Quality Standards, Dept of Ecology, Olympia, Washington.

"Puget Sound Sulphite Mills and the Tragedy of the Commons", R. W. Fonda, in *Biological Conservation,* Vol. 4, No. 1 (October, 1971).

Oceanographic Resources of Washington, Oceanographic Commission of Washington, (June 1971).

Description and Evaluation of Coastal and Estuary Zone Management Problems: Puget Sound, A Case Study, Dennis Lee Derickson, Dept. of Urban Planning, University of Washington, 1971.

Environmental Management for Puget Sound, Wallace H. Spencer, November, 1971, Sea Grant Publication, Division of Marine Resources, University of Washington.

Salt Water System of Washington State, Eugene Collias, February 1972, WSG - TA 72–3, available from Division of Marine Resources, University of Washington.

Economics and Politics of Estuarine Management: The Puget Sound Case, James A. Crutchfield, WSG–TA 72–25, Division of Marine Resources, University of Washington.

Landforms of Washington (The Geologic Environment), Don J. Easterbrook and David A. Rahm. Western Washington State College, Bellingham, Washington 1970.

A Report to the 43rd Legislature of The State of Washington, by the Harbor Line Commission, the Attorney General, the Department of Ecology of the State of Washington, Dec. 1972

Log Storage and Rafting in Public Waters, August, 1971, from Department of Ecology, Olympia,

Final Guidelines, Shoreline Management Act of 1971, Washington State Department of Ecology, June 1972.

Permit Procedures, U.S. Army Corps of Engineers, August 1972, available from Seattle District office.

Criteria Governing the Design of Bulkheads, Land Fills, and Marinas in Puget Sound, Hood Canal, and Strait of Juan de Fuca for Protection of Fish and Shellfish Resources, Washington State Department of Fisheries, February, 1971.

Port Expansion in the Puget Sound Region: 1970–2000, Stewart Borland and Martha Oliver, WSG–MP 72–1, October 1972, Division of Marine Resources, University of Washington.

Shore Resource Manual, Wolf Bauer, (in process of publication).

Land Use Allocation Plan for State-Owned Aquatic Land, July, 1972, Department of Natural Resources, Olympia.

History and Powers of Port Districts in Washington State, Kathy Coombs, May, 1970, Department of Revenue, Research and Information Division, Olympia.

periodicals

Sea Grant Newsletter, Texas A & M Sea Grant Program, College Station, Texas 77843, no charge.

Port of Seattle Reporter, Port of Seattle, Pier 66, Seattle Monthly, no charge.

Pacific Northwest Sea, Oceanographic Commission of Washington, 312 - 1st Ave. N., Seattle, quarterly, no charge.

Shore and Beach, $4/yr., American Shore and Beach Preservation Association, P.O. Box 1246, Rockville, Md. 20850.

Metro Moniter, Metro, 410 W. Harrison St., Seattle, Monthly, no charge.

maps, charts, and aerial photos

METRO Comprehensive Plan Map – 17" x 11" – METRO, 410 West Harrison, Street, Seattle.

Preliminary Geologic Map of Seattle and Vicinity, I-345, $1.50, U.S. Geological Survey, Washington, D.C.

Aerial Photographs, 1" = 200' of Duwamish Waterway (1972) and Lake Washington Ship Canal (1966), Seattle District Office, Corps of Engineers.

Washington Marine Atlas, in 2 volumes, Division of Surveys and Marine Land Management, Department of Natural Resources, Olympia, Washington.

Tidal Currents Charts, Puget Sound – Ninth Part, U.S. Coast and Geodetic Survey, available at most marine supply stores.

Seattle Harbor Pier Directory, Duwamish Waterway Pier Directory Port of Seattle, Pier 66, no charge.

note

As this inventory is part of the City of Seattle's continuing program of shoreline management, this booklet has been produced so that it may be included in a ring binder. Future communications concerning the shoreline management program will be similarly produced for ease of storage and access.

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Seattle's nearly 80 miles of fresh and salt water shoreline are a unique resource. To manage them to meet the spirit of the Shoreline Management Act of 1971 will not be an easy task, but one whose rewards will be worthwhile. This inventory will, I hope, provide the public with the information necessary to participate effectively in the planning process that we are now starting.

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