FINAL
ENVIRONMENTAL IMPACT STATEMENT

MAINTENANCE DREDGING AND

CONTAINED DISPOSAL OF DREDGED

MATERIALS AT GREEN BAY HARBOR, WISCONSIN

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
219 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60604

MAY 1976

SUMMARY

MAINTENANCE DREDGING AND CONTAINED DISPOSAL OF DREDGE MATERIAL AT GREEN BAY HARBOR, WISCONSIN

( ) Draft

(X) Final Environmental Statement

Responsible Office:

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District Engineer

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1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action

The proposed project includes continued maintenance dredging of the Green Bay Navigation Project and disposal of the approximately 300,000 cubic yards of maintenance dredgings in the established "Green Bay Diked Disposal Area" up to 1977. After 1977, a new site will be used and an EIS on this new site will be prepared. No dredging is scheduled for 1976.

3. (A) Environmental Impacts:

These impacts include: alteration of bottom sediments; disturbance of bottom dwelling organisms; temporary increase of turbidity levels; conversion of a wetland to a terrestrial environment suitable for commercial development; displacement of wildlife and plants; noise. Potential secondary impacts include: industrial effluent, perpetuation of industrial zoning; road construction; change in land values.

(B) Adverse Environmental Impacts :

The adverse impacts include: physical alteration of the sediment-water interface in the channel and adjacent areas; destruction or displacement of pollution-tolerant organisms inhabiting channels and adjacent areas; resuspension of polluted sediments with its resultant impacts; conversion of a disturbed wetland to a terrestrial environment resulting in destruction of habitat and destruction and displacement of wildlife.

4. Alternatives To The Proposed Action:

Potential alternatives to the proposed action include: (A) No action; (B) Dredge to a lesser depth; (C) Discontinue dredging and disposal until other sites are secured; (D) Dredge alternatives; (E) Diking off remaining acreage of established disposal site and securing a new site; (F) Other sites; (G) Open lake disposal of polluted dredgings with or without advanced waste treatment.

5. Comments Received:

Advisory Council on Historic Preservation
Environmental Protection Agency
United States Department of Interior
U.S. Department of Commerce
U.S. Department of Agriculture Soil Conservation Service
U.S. Department of Transportation
United States Coast Guard
State of Wisconsin
Department of Natural Resources
Department of Business Development
State Historical Society of Wisconsin
Green Bay Brown County Planning Commission
City of Green Bay
Industrial Development Authority

6. Draft Statement to CEQ - 18 April 1975

Final Statement to CEQ - 10 November 1976

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OF DREDGE MATERIALS AT GREEN BAY HARBOR, WISCONSIN

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PROJECT DESCRIPTION

GREEN BAY NAVIGATION PROJECT PRIOR TO 1966

1.01 The Federal navigation project for Green Bay, Wisconsin as it existed prior to 1966 was authorized by the Rivers and Harbors Act of 1866 and subsequent acts. It provided for:

a. An outer harbor entrance channel about 10 miles long and 22 feet deep, varying in width from 500 feet at the outer end to 300 feet at Grassy Island. Certain widening and revetment construction was included;

b. A channel in the Fox River 22 feet deep through the City of Green Bay up to the Chicago and North Western Railway bridge at river mile 3.3;

c. A turning basin 22 feet deep at the mouth of the East River which enters the Fox River about a mile above the bay;

d. A turning basin 20 feet deep above the Chicago and North Western Railway bridge; and

e. A channel 3-1/2 miles long in the river 150 feet wide and 18 feet deep, from the Chicago and North Western Railway bridge to DePere, terminating in a turning basin.

PREVIOUS DREDGING AND DISPOSAL METHODS

1.02 Dredging was normally accomplished by a dipper dredge. Disposal was normally accomplished by loading barges with dredgings and towing them to open water areas in the Bay (primarily the dumping ground located approximately 3-1/2 miles northeast of Long Tail Point Light) where the sediments were then dumped.

HISTORY OF THE GREEN BAY NAVIGATION PROJECT FROM 1966 TO PRESENT

1.03 The River and Harbor Act of 1962 authorized improvements to the existing project as follows:

a. Deepening the entrance channel in Green Bay to 26 feet for a distance of about 11-1/4 miles from that depth in the bay to Grassy Island, at channel widths of 500 feet from deep water to Long Tail Point Light, thence 300 feet to Grassy Island;

b. Deepening the entrance channel to 24 feet for a distance of 1.8 miles from Grassy Island to a point in the Fox River 0.5 miles upstream from the mouth, at the presently authorized channel width of 300 feet, thence deepening the Fox River to 24 feet for a distance of 3.2 miles to a point 1,700 feet upstream from the Chicago and North Western Railway bridge, at existing channel widths;

c. Dredging the authorized but inacting turning basin at the mouth of the East River to a depth of 24 feet for a maximum width of 1,000 feet; and

d. Eliminating the item of local cooperation required by the River and Harbor Act of 2 March 1945 for a turning basin 22 feet deep at the mouth of the East River (Appendix B-2).

1.04 The authorization provided that local interests:

a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of dredge materials and necessary retaining dikes, bulkheads, and embankments therefore or the costs of such retaining works;

b. Hold and save the United States free from damages due to the construction and maintenance of the improvements;

c. When and where necessary, provide and maintain depths between the new channel limits and terminal facilities commensurate with related project depths; and

d. Accomplish such alterations as required in sewer, water supply, drainage, and other utilities.

NEW WORK AND MAINTENANCE DREDGING

New Work

1.05 Dredging for the new work project commenced in 1966 and was completed in stages. Under the contract which began in 1966, a hydraulic dredge was used from the mouth of the Fox River to Long Tail Point. The contract was completed in 1967. The new work dredging from the river and the channel in the bay to Grassy Island were first bottom dumped into an 18 foot deep sump area which had been excavated east of the land disposal site in the bay, then, a pipeline dredge was used

to pump the dredgings from the sump area to the original 400 acre "Green Bay Diked Disposal Area". This diked disposal site was furnished by the City of Green Bay for dredging disposal as a local cooperation requirement under the new work deepening project authorization. The new work dredgings from Grassy Island to Long Tail Point were used to construct dikes in open water to form the "Grassy Island Disposal Area" although this site was never used for dredge disposal.

Maintenance

1.06 From 1969-1973 the government-owned hopper dredge "Markham" excavated from Long Tail Point bayward to the existing 26 foot depth in the bay, a distance of about eight miles. 1.2 million cubic yards of these dredgings which were unpolluted were disposed of in an established open water disposal area in the bay 7 miles bayward of the then existing entrance light. An additional 2.3 million cubic yards, about half of which were unpolluted were disposed of in the established "Green Bay Diked Disposal Area". The Corps was reimbursed $600,000 by the City of Green Bay for disposing of the unpolluted dredgings on the land disposal area. This was the differential between lake and land disposal. During May to August 1973 the government-owned dipper dredge "Kewaunee" removed high spots along the channel areas. These new work dredgings were disposed of in the established open water disposal area. The new work deepening was essentially completed in August 1973.

1.07 During 1970 some maintenance dredging was done by the dipper dredge "Kewaunee" around the dredge docking facilities at the "Green Bay Diked Disposal Area". The previously used sump area was used to contain these dredgings. During 1973, 1974 and 1975 the hopper dredge "Markham" performed maintenance dredging from the Mouth of the Fox River to Long Tail Point. These maintenance dredgings were disposed of in the established "Green Bay Diked Disposal Area". Under the diked disposal program authorized by PL 91-611, 1970, the City of Green Bay agreed to the continued use of the established site. During the summer of 1973 and early spring 1974, some maintenance dredging was done by contract in the Fox River at the Fort Howard turning basin where shoaling had become critical. Because of the limited amount of dredging required, they were disposed of in a small site along the Fox River. A portion of this contract included the cleaning out of the sump area in the bay where polluted maintenance dredgings had been previously dumped. The dredging performed in 1974 was coordinated with the U. S. Fish and Wildlife Service. During coordination, it was discovered that Forster's terns (Sterna forsteri) were nesting in the disposal area and it was agreed to delay disposal operations until 8 July 1974 and contain the material until 8 August 1974 at which time the terns would be sufficiently developed to escape destruction. In 1975, the dredging was started early enough in the spring so as to discourage the terns from nesting in the disposal area. During the spring of 1975 approximately 200,000 cubic yards of dredgings were removed from the project by a hopper dredge and were disposed of in the manner specified by the Fish and Wildlife Service, to discourage terns from returning to the area.

PROPOSED PROJECT

1.08 The proposed project calls for the continued maintenance dredging of the Green Bay Navigation Project and disposal of the polluted maintenance dredgings in the remaining acreage of the established "Green Bay Diked Disposal Area".

Quantity and Duration of Dredging

1.09 During 1977 an estimated additional total of 300,000 cubic yards of polluted sediments will be dredged and placed within the existing disposal area which should completely fill the low portions of the site and cover the fly-ash previously placed within the disposal site from the Wisconsin Public Service Pulliam Plant. It is expected that the 1977 dredging operation will take one month. After 1977 dredging season, the existing disposal area will be filled and a new site(s) must be utilized. No dredging is scheduled for 1976.

Dredging Method

1.10 It is expected that a government-owned hopper dredge will accomplish the dredging. See Appendix B-1 for description of this dredging method.

Location of Dredging

1.11 Dredging is to take place within the presently existing channels. This channel originates near DePere on the Fox River and continues down river to the mouth, then into Green Bay to a point 7 miles beyond Long Tail Point. The primary work lies inside Long Tail Point to the mouth of the Fox River (Appendix B-2).

Type and Quality of Material to be Dredged

1.12 Dredge sediments to be removed from this area are red to brown clayey silts. These sediments were determined to be heavily polluted with municipal sewage waste and have a sewage odor (FWQA, May 1970), Appendix D.

Dredge Scheduling

1.13 Dredging is normally limited to between April and November and at the present time, is primarily determined by the availability of equipment. All attempts will be made to comply with the Wisconsin DNR and the U. S. Fish and Wildlife Service requests to schedule the 1977 dredgings in early Spring, as was done with the 1975 dredging to discourage Forster's terns from nesting within the site, or late in the summer, as was done with the 1974 dredging, to allow the terns to complete the nesting season. Dredging schedules will also attempt to miss the peak fish spawning and migration periods in late winter and early fall (Personal Communication, Ronald Fassbender, Wisc. DNR, 21 April 1976).

Bayport CDF

DISPOSAL SITE

Location

1.14 The existing diked disposal site is located west of the mouth of the Fox River in the City of Green Bay. The 400-acre diked site, as initially established, is bounded on the southwest by Tower Drive, on the east by the Wisconsin Public Service Corporation Pulliam plant, on the northeast by the waters of Green Bay, and on the northwest by the City of Green Bay's incinerator and landfill area, Appendix B-2. This site will be filled after the 1977 dredging season. A new site selection study is now underway to contain post-1977 dredgings. A new site(s) will be covered by a separate EIS.

Present Condition and Proposed Use of Site

1.15 This site was originally offered to the Corps by the City of Green Bay as a local cooperation requirement for the most recent harbor deepening project authorized by the River and Harbor Act of 1962. In the late 1960's the desirability of open-lake disposal of polluted dredgings was being questioned. An interim national policy was established which prescribed that all polluted dredgings be confined to minimize their impact on water resources. The River and Harbor Act of 1970 (Public Law 91-611) provided for the use of confined disposal areas. As part of local requirements, the disposal areas must be provided by local sponsors to contain dredge materials which have been determined as polluted by the Environmental Protection Agency. As the local sponsor, the City of Green Bay offered the Corps continued use of the established disposal site to contain polluted maintenance dredgings from the Green Bay Navigation Project. When the site was originally offered for containing new work dredgings, it was approximately 400 acres. It was predominantly in a wetland condition, however, its exact quality and condition was not very well documented. The entire site has been filled to varying depths obliterating its original condition. The remaining acreage of the established site which has not been totally filled amounts to about 30 acres, approximately 1 acre remains in a ponded condition although it has been filled somewhat by runoff from the rest of the site. An earthen dike encloses the disposal area. The existing dike is 7.0 feet to 9.0 feet above L.W.D. The north-central portion of this site is used by the Wisconsin Public Service Corporation for the disposal of fly ash from the coal-fueled Pulliam plant generating station located on the west shore at the mouth of the Fox River. Fly ash is six feet deep in some areas and is unprotected from the erosive forces of wind such that it is airborne by even the lightest breeze and transported considerable distances before coming to rest in the bay or on local land surfaces. During winter months newly dumped fly ash material is picked up and carried north onto the bay by the wind and deposited in alternating layers of snow and ash on the ice surface. In the spring, the snow and ice melt and the ash is precipitated into the bay water.

Fly ash has also been dumped on portions of the bay shore north of the dike wall where high water and waves have washed the material into the bay. Areas where the ash has been deposited are generally devoid of vegetation and represent a sterile disturbed environment. Six power transmission lines cross this area (Appendix B-4).

1.16 The 300,000 cubic yards of 1977 maintenance dredgings will be less dense in character than the new work dredgings deposited earlier. As the filling of the existing site reaches completion, retention time of the water in the disposal area will become less such that the effluent may be of unsatisfactory quality. The Corps proposes to construct a sand filter in the northwest corner of the site similar to the one constructed at the Milwaukee Harbor Confined Dredge Disposal Area to filter effluent prior to discharge. Should water quality monitoring scheduled for the site detect any further deterioration of water quality, the Corps will cease dredging operations until remedial measures may be designed and implemented (Appendix B-4).

1.17 Sincethe Corps intends to leave the filled existing disposal area as a totally useful terrestrial site, the fly ash areas within the site deposited by Wisconsin Public Service Corporation will be stabilized by diking around them and covering them with about two feet of dredged material. This treatment should prevent fly ash from continuing to blow into the bay where water quality is lowered (Appendix B-4).

SECTION 2
ENVIRONMENTAL SETTING WITHOUT THE PROJECT

GREEN BAY LOCATION

2.01 Green Bay, located near the northwest corner of Lake Michigan, is bounded on the east by Door and Kewaunee Counties, Wisconsin, on the south by Brown County, Wisconsin, on the west by the Wisconsin Counties of Oconto and Marinette. In addition, Menominee County, Michigan also bounds the northwest. The Bay is oriented in a southwest to northeast direction and has a maximum length of about 90 miles and a variable width of 12 to 17 miles, Appendix B-2.

PROJECT LOCATION

2.02 The Green Bay Harbor Navigation Project is located in the southern portion of Green Bay at the mouth of the Fox River. This area constitutes the terminus of an extensive midwestern drainage system. This system is the Fox River watershed, which drains 6,443 square miles, and the Wolf River watershed which drains 3,782 square miles. The approved site for the disposal of dredged material is located in the City of Green Bay west of the mouth of the Fox River and is bounded by Tower Drive, the City of Green Bay, and the west Bay shore wetlands.

WATER FLOW, GREEN BAY - FOX RIVER

2.03 In Green Bay, the general northerly movement of Fox River water is along the east side. Cleaner water moves southerly along the western shore of the bay by a counter-clockwise current, Appendix B-3. This current then sweeps easterly near Long Tail Point and then moves northward within the eastern portion of the bay, (Schroufnagel, 1966), comprising as much as 80 percent of this northerly current. (Modlin and Beeton, 1970). As indicated in the 1968 survey by Modlin and Beeton, 70 percent of the water in the extreme southern end of the bay is river water. In calm periods, pockets in this area of the bay allow little water movement in or out (Schraufnagel, 1966). This is particularly true in the Bay Beach area lying in the section east of a line between Grassy Island and Point Sable and in the area west of the shipping channel and south of Long Tail Point. The area west of the shipping channel is relatively shallow and is fed by Duck Creek. There is a shoal between Point Sable and Grassy Island which generally cuts off circulation from the upper portion of the bay.

2.04 The flow pattern of the water as it moves through southern Green Bay is clearly reflected in the types of bottom sediments and oligochaete organisms found. (Modlin and Beeton, 1970). Oligochaetes are a family of worms found in lake sediments and have long been considered indicators of organic pollution (Howmiller and Beeton, 1970). In the extreme southern end of the bay, sediments are black, semi-fluid muds similar to the Fox River sediments. Howmiller and Beeton (1970), found no oligochaetes present at this end of the bay, due to unstable bottom sediments and very low dissolved oxygen contents. Further lakeward in southern Green Bay exists a species of oligochaete common in all polluted areas of Lake Michigan. Along the western side of the bay, an oligochaete common in moderately polluted areas was found. Another type of oligochaete common in more polluted areas of Lake Michigan was found to increase in abundance lakeward along the eastern side; still another oligochaete common in slightly polluted to nonpolluted areas was found to dominate the northern end of the bay (Modlin and Beeton, 1970). The average flow of the Fox River within the City of Green Bay is 125 m3/Sec. (Howmiller and Beeton, 1971).

WATER QUALITY

2.05 The water quality of southern Green Bay is substantially degraded, largely due to the pollutant sources discharging into the Fox River, a major tributary of Green Bay. Although the lower 39 mile segment of the river from Lake Winnebago to Green Bay includes less than 7 percent of the total Fox-Wolf Drainage Basin, it is lined by a concentrated municipal-industrial complex whose discharges profoundly alter the quality of the river water. (Sager and Wiersma, 1972). In addition to the domestic and industrial pollutant problems in the lower Fox, pollution is also caused by algae which flourish in Lake Winnebago and then die and decompose in the Fox River or in Green Bay. The area in the southern bay south of a line from Long Tail Point to Point Sable is dominated by water from the Fox River (Modlin and Beeton, 1970, and Sager and Wiersma 1972). The river water has an adverse effect on biota

because it is often devoid of dissolved oxygen, even before it enters the Bay. The disappearance of the Wisconsin State Green Bay Mayfly has been attributed to the low dissolved oxygen concentrations (Schraufnagel, et al. 1968). Changes in the bottom fauna populations over the years from 1952 to 1969 suggest that the bay environment has deteriorated (Howmiller and Beeton 1971). According to Schraufnagel et al. (1968), the dissolved oxygen content of the river water approaches 0 mg/liter during the summer months.

2.06 Due in large part to the pollutional influence of the Fox River, the composition of the life forms existing on the bottom of Green Bay differs greatly from area to area. In the northern less fertile and less polluted section there are more intolerant organisms and other life forms representative of clean, oligotrophic water. The southern end of the bay however, is a "grossly polluted area with black foul-smelling sediments" (Schraufnagel, 1966). Conditions improve with the dilution and biological assimilation of the lower bay water and a continuum of healthier aquatic environments exist further out from the mouth of the Fox River (Howmiller and Beeton, 1970). Substantial amounts of effort and money are being expended to improve the accentuated deterioration of the lower Fox River by industries and municipalities. If pollution abatement and responsible shoreland zoning evolve, beneficial changes should occur in the affected aquatic environs.

SOIL TYPE, DISPOSAL SITE

2.07 The Green Bay dredge disposal site is underlain by various depths of organic materials such as peat and organic silt which grades into a layer of glacial lake sediments, i.e. clayey silts and silty clays. At a depth of approximately 16 feet beneath the present lake level, harder clayey silts and silty clays begin. At a depth of about 23 feet the sediments grade into softer silty clays which extend to as much as 60 feet (Soil Testing Services of Wisconsin, Inc., 1972).

SEDIMENT ANALYSIS

2.08 The diked disposal area contains various types of material. The main portion of the materials placed in the site have been relatively unpolluted sand and clay excavated during new work dredging in the navigation project which began in 1966 and was completed in 1973. More polluted sediments of a finer texture than the new work dredgings have also been placed within the site. Additionally, fly ash from the Wisconsin Public Service Corporation has also been placed within the site.

PROJECT CHANNEL

2.09 Sediments sampled within the project were determined to be polluted and not suitable for open lake disposal (FWQA, 1970). Sediments located

approximately north of a line from Long Tail Point were moderately polluted while all project sediments south of this point were heavily polluted. Sediments from the community of DePere to the mouth of the river contained largely industrial wastes, while those sediments located between the Fox River mouth and Long Tail Point were heavily polluted with sewage discharge wastes (FWQA, 1970).

WASTE DISPOSAL FACILITIES

2.10 The Green Bay metropolitan area is currently served by the recently expanded Green Bay Sewage Disposal Plant located near the mouth of the Fox River. This facility is presently handling 52 million gallons per day of raw sewage including the pulping wastes of American Can Company and the Charmin Paper Company. The Green Bay facility serves a population of approximately 130,000 in the communities of Allouez, Ashwaubenon, Scott, Howard, Bellevue, Hobart, and Green Bay. The treated effluent outfall from the sewage treatment plant is located near the mouth of the Fox River.

WETLAND HABITAT

2.11 A substantial section of the shoreline bounding Green Bay is wetland habitat which serves many types of wildlife. Wetlands provide high quality fish and wildlife habitat and form an important link between the land and water environment. Between the plant and animal life forms of the marsh, complex interdependencies are developed.

2.12 Wetlands also serve to improve water quality by recovering and recycling nutrients. (Department of the Interior Personal Communications, 1974). The marshland areas of the southern Bay function as water clarification systems. Fluctuating water levels, resulting from strong northerly winds, changing Fox River flows, or changes in barometric pressure cause nutrient and silt-laden water to inundate the marsh areas. The beneficial effects of marshes on water quality are primarily associated with the storage of aquatic plant nutrients, such as phosphorus and nitrogen, within the marsh and the transformation of certain forms of chemicals in the marsh system to forms which have a less deleterious effect on water quality (Lee, G.F., 1971).

2.13 Because of the high degree of biological activity which occurs in a marsh ecosystem, much of the nutrients are metabolized and incorporated into plant systems (Bently, 1969). Certain higher aquatic plants, i.e. bulrushes (Scirpus spp.), can metabolize toxic materials into completely harmless substances. Others can remove organic and inorganic pollutants resulting from municipal wastewater (Seidel, 1967).

2.14 The vegetation of the marsh also acts to reduce turbidity. Silts and other suspended materials which normally have an adverse effect on water quality are removed from the water (Lee, 1971). When bay water levels recede and return to the bay system, water quality is improved because of this purification process. Research on the extent of purification which occurs as a result of the extensive marshlands in the southern bay is lacking. Although it is an established fact that marshes serve a water clarification function, a more comprehensive understanding of the extent to which the southern bay marshes improve water quality can only be achieved by research into the nutrient budget of the local aquatic and marsh environments.

DISPOSAL SITE

2.15 The proposed disposal site consists of 30 acres of an existing 400 acre fill site owned by the City of Green Bay. Twenty nine of the 30 acres are almost filled, while the remaining 1 acres is in a wetland condition. with polluted water but partially filled. Those involved in filling this site include the Federal government, the Wisconsin Public Service Corporation, and others permitted by the City of Green Bay.

Fly Ash Disposal

2.16 The northcentral portion of the disposal site is used by the Wisconsin Public Service Corporation, as permitted by the City of Green Bay and Wisconsin D.N.R. for the disposal of fly ash from the coal-fueled Pulliam plant generating station located on the west shore at the mouth of the Fox River. Fly ash is six feet deep in some areas (Soil Testing Services of Wisconsin, Inc. 1972). The ash is unprotected from the erosive forces of wind and is airborne by even the lightest breeze and transported considerable distances before coming to rest in the bay or on local land surfaces. During winter months newly dumped fly ash material is picked up and carried north onto the bay by the wind and deposited in alternating layers of snow and ash on the ice surface. In the spring, the snow and ice melt and the ash is precipitated into the bay water. Fly ash has also been dumped on portions of the bay shore north of the dike wall where high water and waves have washed the material into the bay. Areas where the ash has been deposited are generally devoid of vegetation and represent a sterile disturbed environment.

New Work Excavation Disposal

2.17 A substantial portion of the original disposal site (approximately 300 acres) was totally filled with polluted and unpolluted new work excavation material from the navigation channel deepening. That portion of the site, because of its coarser nature, has consolidated fairly well and has

been revegetated by some pioneer marsh plants such as sedges (Cyperaceae), arrowheads (Sagittaria spp.), Smartweed (Polygonum spp.), grasses (Gramineae), willows (Salix spp.) and alders (Alnus spp.) on wetter sites and some weedy plants in drier sites.

Maintenance Dredging Disposal

2.18 Recent maintenance dredging disposal has filled or partially filled the remaining 100 acres of the existing site. Even in the totally filled portions of this 100 acres total consolidation of the finer maintenance dredging material has not yet occurred. Pioneer marsh plants such as cattails, (Typha spp.), smartweed, sedges, and arrowheads, and also some willows and alders have invaded 70 totally filled acres of this site and 29 of the 30 partially filled acres of the site. Approximately one acre of the site still remains in a ponded condition. This ponded area would be considered as a type 3 wetland habitat and has only been partially filled by runoff from dredging disposal. A type 3 wetland is one which is characteristically water logged during the growing season and is often covered with as much as 6" or more of water. (U. S. Dept. of the Interior, 1968). This type of habitat is used extensively as a waterfowl nesting and feeding habitat and in connection with deep fresh marshes, they constitute the principal production areas for waterfowl. Vegetation on a type 3 habitat includes grasses, and various marsh plants, such as cattails, arrowheads, and smartweed.

AREAS ADJACENT TO THE DISPOSAL SITE

2.19 The West Bay Shore from the periphery of the diked disposal area to beyond Long Tail Point is predominantly wetlands and marshes with cattails and reeds as the dominant plant species. Long Tail Point was proposed in 1960, but never adopted, by the Department of the Interior as a National Wildlife Refuge. This area, named Long Tail Point Wildlife Area, is presently owned by the Wisconsin DNR and is open to public hunting. The shorelands abutting the bay are flat, low, sandy, and poorly drained. The area south of the Suamico River is covered with trees and brush which are usually flooded in early spring and during periods of above-average precipitation and high lake levels. The ground water is close to the surface and easily exposed by development. The main species of trees found in these moist areas are white birch (Betula papyrifera), cottonwood (Populus deltoides), quaking aspen (Populus tremuloides), and black ash (Fraxinus nigra). The brush is mostly red osier dogwood (Cornus stolonifera) and willow. On the drier sites, big tooth aspen (Populus grandidentata), silver maple (Acer saccharinum), and elm (Ulmus americana) are the most common tree species along with an occasional oak (Quercus spp). Chokecherry (Prunus virginiana) and hazel brush (Corylus spp.) are common types of upland brush (U. S. Dept. of the Interior 1968). Wild flowers in the marshes of the west bay shore include the marsh marigold (Tagetes sp.), blue

flag (Iris virginica), spadderdock (Nuphar luteum), marsh, milkweed (Ascelepias incarnata) white waterlily (Nymphaea tuberosa), turks cap lily (Lilium superbum) marsh bluebell (Campanula aparinoides), Swamp aster (Aster sp.), blue gentian (Gentiana sp.) and ladies tresses orchid (Orchidaceae) (Kleinert 1970). This ponded area still serves as a habitat for waterfowl and shorebirds, such as coots (Fulica americana) and teal (Anas discors and A. crecca). Avian fauna also inhabit other portions of the site. However, the site has not been specifically inventoried.

2.20 Immediately to the west of the diked disposal site is a 40 acre refuse landfill utilized by the City of Green Bay. This land was once a marshland. Now an incinerator facility occupies a portion of the filled area.

WILDLIFE

Avian Fauna

2.21 The diversity of the birdlife exhibited along the west bayshore up to and including Duck Creek is unmatched in most other areas of the State, Appendix C-1. Since 1970 about 174 different bird species have been sighted in the Atkinson Marsh area, (Cleary, 1972). The west shore of the bay is traditional feeding and resting grounds for migrating whistling swans (Olor columbianus), Canada geese (Branta canadensis), and a variety of duck species. The first swans arrive in late March and reach peak populations during April. Most of them are gone by the first of May, returning in November after the majority of ducks and geese have left for the south. It is not unusual to have a concentration of 3,000 swans in the spring migration and sometimes many more. In the fall, their numbers are much less and their stay is shorter (Green Bay Press-Gazette, 1971). In addition this is one of the few remaining nesting sites of Forster's terns in Wisconsin. The little gull (Larus minutus) has also been observed nesting here. The bird is a European straggler and has not been reported anywhere else in Wisconsin.

2.22 Many birds which migrate from as far north as the Arctic Circle south to Central America, stop in southern Green Bay and its wetlands to rest and feed. Significant numbers of migrating birds using the Mississippi Flyway are funneled down Green Bay and are concentrated along the West bay shore marshes. Numerous duck species depend upon the Atkinson Marsh for feeding and reproduction. Numbers in excess of 15,000 ducks have been observed in the bay during April. Mallard (Anas platyrhynchos), black (Anas rubripes), common merganser (Mergus merganser), bufflehead (Bucephala albeola), coot, canvasback (Aythya valisineria), redhead (Aythya americana), ringneck (Aythya collaris), scaup (Aythya marila and A. affinis), goldeneye (Bucephala clangula) and geese are representative of the diverse abundance of waterfowl. In past autumns, the lower bay has held concentrations of Blue-winged Teal numbering as high as 10,000 for several weeks (Department of the Interior, 1968).

2.23 Shorebirds of the Green Bay wetlands include the less common sandpipers such as the stilt sandpiper (Micropalama himantopus), the Hudsonian (Limosa haemastica) and marbled godwits (Limosa fedoa), Knot (Calidris canutus) and dowitches (Limnodromus griseus and L. scolopaceus), the solitary sandpiper (Tringa solitaria), and the willet (Catoptrophorus semipalmatus). Other birds common to this area are the greater (Tringa melanoleucus) and lesser yellow legs (Tringa flavipes), least bittern (Ixobrychus exilis), purple martin (Progne subis) and several species of terns and gulls. Occasionally, Hungarian partridge (Perdix perdix) utilize the marsh and sometimes plovers are seen. The Snowy owl (Nyctea scandiaca), uncommon to most of Wisconsin, often concentrates in the area to the extent that its numbers encourage bird banding (Dept. of the Interior 1974; Personal Communication). The marshy areas of the southern bay are also habitat for some bird species, that are becoming uncommon locally such as bluebirds (Sialia sialia), kingfisher (Megaceryle alcyon), great blue (Ardea herodias) and black crowned night herons (Nycticorax nycticorax) (Hussong, 1971). In 1971, a burrowing owl (Speotyto cunicularia) was captured and banded on the west bay shore near the mouth of the Fox River far from its native habitat on the Great Plains. This was only the fifth confirmed sighting of this owl in Wisconsin. In recent years, the yellow-headed blackbird (Xanthocephalus xanthocephalus) has become relatively abundant in the west bay shore area. The present day trend, however, is for the disappearance of this bird from the State in direct proportion to loss of wetlands. The yellow-headed blackbird normally lives in the western half of North America and builds its nests a foot or two up from the water or ground in reeds and cattails, using marsh foliage for building material. In the fall, it leaves the local marshes for its winter home in the extreme southwestern states and across the border in Mexico (Hussong, 1971). No rare or endangered species which are included or submitted for inclusion on the Federal list of threatened and endangered wildlife will be affected by this project. The double-crested cormorant (Phalacrocorax auritus), considered endangered by the Wisconsin DNR, nests in the waters of Green Bay but does not utilize the site.

Fish Resources

2.24 The aquatic environment of the project area has been continually converting from a clean water species composition to more pollution tolerant species. This change is due to many factors which have contributed to increasing turbidity in southern Green Bay. For example, Dead Horse Bay, the area in which only a decade ago yellow perch (Perca flavescens), walleye (Stizostedion vitreum), bass (Micropterus dolomieui and M. salmoides), crappie (Pomoxis annularis and P. nigromaculatus) and northern pike (Esox lucius) flourished, is now dominated by pollution tolerant species such as bullheads (Ictalurus spp.), carp (Cyprinus carpio) and suckers (Catostomidae). The previous species have not entirely disappeared, however, they have diminished considerably. In recent years, trout species such as the brown (Salmo trutta), and rainbow (Salmo gairdnerii) along with coho salmon (Oncorhynchus kisutch) have been making spawning runs up Duck Creek, but have been unsuccessful at reproduction (Wisconsin DNR 1972, Personal

Communication). The quality of the creek bottom is not suitable to allow for reproduction since it is so heavily sedimented. As water quality in the lower Fox River improves as a result of pollution abatement programs and if marshland enhancement programs are followed, the southern bay and its tributaries could become prolific spawning areas for many species of fish.

Mammals

2.25 In the natural wetland area immediately north of the diked disposal site, many types of mammals occur. Examples of such include: whitetail deer (Odocoileus virginianus), cottontail rabbit (Sylvilagus floridanus), foxes (Vulpes fulva and Urocyon cinereoargenteus) and especially muskrats (Ondatra zibethica). These mammals are all relatively common and are harvested seasonally. (Department of the Interior, Personal Communication, 1974). Muskrat houses are common throughout the western bay shore. These houses are constructed of mud and vegetation. These houses are subject to severe storms with heavy wave action and are occasionally destroyed. The primary food source of muskrats are cattails although they do eat other types of aquatic plants.

2.26 The harvesting of these marshland animals is an important activity in the Green Bay area. Many of the fur bearing animals pursued by trappers, are found within the marsh environ. The more notable fur species include: mink (Mustela vison), otter (Lutra cana densis), muskrat, beaver (Castor canadensis), raccoons (Procyon lotor), weasels (Mustela rixosa; M. erminea and M. frenata), skunk (Mephitis mephitis) and oppossum (Didelphis marsupialis).

HUMAN ACTIVITIES OF STUDY AREA

Population

2.27 According to the 1970 U. S. Census Bureau figures, there were 87,809 people in the city of Green Bay. In the Brown County area based upon the same report there were 158,244 people residing. According to the Brown County Planning Commission, the county's population could expand to 229,000 by the year 1985 (Brown County Regional Planning Commission, 1967).

Port Activity

2.28 The total tonnage moving through Green Bay Harbor has been relatively stable from 1962 to 1973. The highest tonnage during this 12-year period was 2,875,000 tons recorded in 1967, the lowest was 2,366,000 tons in 1963, and the average was about 2,650,000 tons. A pipeline completed in 1962 reduced the 1962-1973 petroleum tonnage by 700,000 tons, from the levels recorded during the period from 1951-1961. Growth in limestone and cement tonnage, for the most part, has offset slight decreases in other

traffic. The 1973 tonnage composition was as follows: (1) coal, 62 percent; (2) petroleum products, 14 percent; (3) cement, 11 percent; (4) limestone, 6 percent; and (5) other, 7 percent.

2.29 In 1973 about 210 inbound deep draft vessels had drafts of 19 feet to 25 feet and over one-half of these vessels had drafts exceeding 22 feet. As over 95 percent of the tonnage moving through the harbor is inbound, the empty outbound vessels had drafts 2 to 4 feet less. Therefore, the vessels presently servicing the harbor require the channel depths up to those noted in the authorized project.

Industry

2.30 The residents of the Brown County area earn their living within a broad range of enterprises. Major employment industries of this area are: paper and paper related products, paper mill machinery, foundry products, office equipment production, cheese and other dairy related products, vegetable processing, various retailing and wholesaling operations, trucking firms, and lumbering activities.

Land Use

2.31 Land use along the Fox River is composed primarily of paper industries, petroleum firms, and coal companies. Wisconsin Public Service Corporation has a coal-fueled electric power generating facility at the mouth of the Fox River on the western bank. To the west of the generating station is the proposed disposal site and the City of Green Bay land fill and incinerator. The remainder of the west bay shore south of Long Tail Point is primarily marshland. The east shore south of Point Sable is primarily residential in character, although several substantial sections of the shoreline are in public ownership. The University of Green Bay-Wisconsin owns a wooded tract of shoreland, the city manages the Bay Beach Park and Bay Beach Wildlife Sanctuary. The entire Bay Beach area, including an amusement park, encompasses some 240 acres with approximately 200 of these acres comprising the Bay Beach Wildlife Sanctuary, of which approximately 65 acres are permanently under water.

2.32 The West Shore Wildlands Committee, sponsored by the Green Bay Conservation Alliance, is soliciting both private and public funds for the acquisition of west shore wildlife habitat areas. Approximately 1,125 acres of land are already in public ownership and designated for the preservation and restoration of valuable wetland areas for wildlife habitat, outdoor recreation, tourism and recreation.

SECTION 3
RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.01 The proposed dredging and disposal action is consistent with local land use plans and objectives. Subsequent land use plans for the completed marsh fill site consist of an industrial park and expanded port facility. These plans have been developed by the city and local planning agency. The 40 acre land fill area to the west of the diked disposal area is proposed to eventually be used to complement development in the disposal site.

3.02 The trend for future shoreland use is for the west shore of the Bay to become an expanded conservancy area (Brown County Regional Planning Commission, 1967). Wildlife habitats will be promoted and enhanced. Present plans of the Planning Commission call for the areas at the mouth of the Fox River to be used as an expanded port facility and industrial park. The east shore of the bay will probably continue to become more residential in character.

SECTION 4
THE PROBABLE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

GENERAL

4.01 The environmental impacts associated with maintaining the Green Bay Harbor Project are the result of dredging sediments from the bay and river bottom and by disposing the sediments in the established Green Bay disposal site. The magnitude of these impacts is not known because the consequences of releasing pollutants during the dredging and disposal operations are not sufficiently understood. The U. S. Army Corps of Engineers Waterways Experimental Station at Vicksburg, Mississippi is currently studying the effects of various types of dredging and disposal techniques to develop those most compatible with the environment.

IMMEDIATE EFFECT OF DREDGING

4.02 An immediate impact of excavating sediment from the channels and harbor areas is the physical alteration of the sediment-water interface in the channel and adjacent areas. Hopper dredges vacuum sediments from the channel bottom and expose the older underlying sediments to the water. In the process the organisms which are unable to escape are destroyed. The original sediment-water interface may have been in a state of relative chemical equilibrium with the overlying water. The newly exposed strata, however, must interact with the water before reaching a relative state of balance. In this process adsorbed toxic metal and biostimulants may be released into the aquatic environs. Organic material at the new interface and within the resuspended sediments will tend to oxidize and increase the biochemical oxygen demand over the previous background levels. Suspended oxidizable material may increase biological oxygen demand.

TURBIDITY

Effects of Turbidity on Aquatic Life

4.03 When a hopper dredge is used, sediment-laden water is discharged behind the dredge in the process of obtaining an economical load. A dipper dredge draws an excavating bucket through the water and also creates sediment-laden water which is uncontained. In both processes the turbidity, or amount of suspended solids, is increased in the aquatic areas surrounding the dredging vessels. Associated with the accentuated turbidity is a decrease in available oxygen utilized by many aquatic organisms. Nutrients, such as phosphorus and nitrogen, are released into the aquatic system and tend to accelerate growths of algae and other aquatic plants (Biggs, 1968). Turbidity may also effect temperature relations (Bartsch, 1960). It also changes the aquatic environment by rapidly absorbing radiant energy in the upper layers of the water which reduces the depth of effective photosynthesis and consequently limits basic productivity. Submergent vegetation is also inhibited by reduced sunlight. In the spring these rooted plant species initiate growth; and are hindered from continued growth if enough light does not reach the bottom of the bay. In the early stages of vegetative development it is critical that enough radiant energy is available at the bottom so that plants can grow tall enough to be in the areas of effective photosythesis.

Smothering Associated With Turbidity

4.04 The resuspension of organic compounds causes a temporary lowering of the dissolved oxygen. Southern Green Bay often has critically low dissolved oxygen levels during the summer months. Increased turbidity delays the self-purification of water and can allow the distant transport of organic wastes (Tarzwell and Gaufin, 1953). The organisms living in the area adjacent to the dredging operation can be smothered by turbidity increases and the subsequent precipitation of suspended solids. More mobile aquatic species, especially young fishes through the fry and fingerling stages, could also be adversely effected if the intensity and duration of the turbidity exceeds the tolerable limits of specific species (Gustafson, 1972). The degree of adverse response varies from species to species and for different overall aquatic conditions.

CURRENT OPINIONS ON SOME EFFECTS OF DREDGING

4.05 There are a multitude of factors which can, together or singly, modify the effects of dredging. Within the scientific community there are differences of opinion regarding the effects of dredging. The removal of polluted sediment from the aquatic system is perceived by some investigators as a beneficial waste management function (U.S.A.C.E., 1972). This positive step may be negated if, in the process, dredging releases

pollutional material back into the lake system which had attained chemical equilibrium with the aquatic environment. In any case the proportion of sediment which is removed by dredging is minimal when compared to total sediment loading of the Bay system.

HABITAT DESTRUCTION

4.06 The proposed project will totally fill the remaining disposal area (30 partially filled acres). This area has already been seriously disturbed by partial filling. The proposed project will complete the action of altering the disposal area from a wetland to a terrestrial condition. The proposed project will therefore result in the destruction of any remaining vegetation and wildlife on the site which are unable to migrate to adjacent areas or which are affected by competition for survival factors in their new environment.

SECONDARY IMPACTS

4.07 While the primary effect of using the established disposal site will be a further loss of marshland, the secondary effects of this disposal will be associated with the future use of the new terrestrial land as an industrial complex. The potential problems associated with industrial development on the marsh ecosystem would be noise; possible leakage of industrial associated effluent into the marsh, pressure to develop more of the marsh; and the construction of access roads to this area requiring additional disturbances to this system. These secondary impacts of disposal could be even more damaging to the remaining marsh area than the primary impacts of disposal.

Noise

4.08 Increased noise levels in the area will be associated with the construction and operational phases of the proposed complex. These noises along with the presence of humans could force certain birds and mammals to utilize a smaller portion of the marsh in order to avoid these impacts. Both sudden and periodic noise may effect animals behaviorally and physiologically. High levels of noise for short duration (pile driver) have produced significant effects on sexual function, blood chemistry, auditory function and susceptibility to seizures. Since acoustics signals play a major role in survival, acceptable behavior and resultant maintenance of population dynamics maybe disturbed if communication is obscured by background noise. In experimental situations a single startling noise has caused stoppage of reproductive functioning in wild game birds (Report to Congress and the President on Noise, 1972).

Industrial Effluent

4.09 Associated with the City's plans for an industrial complex on the disposal site are waste products which could potentially seep into the

surrounding aquatic system. These substances could be transferred through the ecosystem and become available to numerous organisms which might be adversely effected.

Development Pressure

4.10 The proposed development of the disposal site will put increased pressures upon the remaining West Bay shore natural areas to be developed. Control of development is a local responsibility.

Road Construction

4.11 Presently the area designated as industrial is well transsected by roads and railroads. Additional construction of roads within the adjacent marsh area could destroy its function as a marshland habitat.

Land Value

4.12 The filling of the disposal site will result in higher assessed value for the land, and these benefits would accrue directly to the industrial park. The region might also benefit by having industrial development concentrated instead of dispersed throughout the city. The highway, railway, and water transportation networks are ideally situated with respect to the disposal site. Efficient transfer of commerce could be expected from such an industrial and port facility. The monetary land value will increase with or without the dredging because the city intends to fill the site regardless of whether the Corps does or not. However, the ultimate "overall" value of the site may, however, not be increased.

Job Opportunities

4.13 An increasing regional population will be seeking job opportunities and the development of the water-oriented industrial park could generate employment. Green Bay has the potential for becoming a regional center for regional shipyards and the industrial hinterland (DeLeuw, Cather and Company, 1971).

HISTORICAL OR ARCHAEOLOGICAL IMPACTS

4.14 The State Historical Society has been contacted and the National Register of Historic Places has been consulted to determine the possible locations of affected sites. A letter from Mr. John M. Smith, State Historic Preservation Officer (page E-12) has indicated that no sites have been identified in the vicinity of the project area.