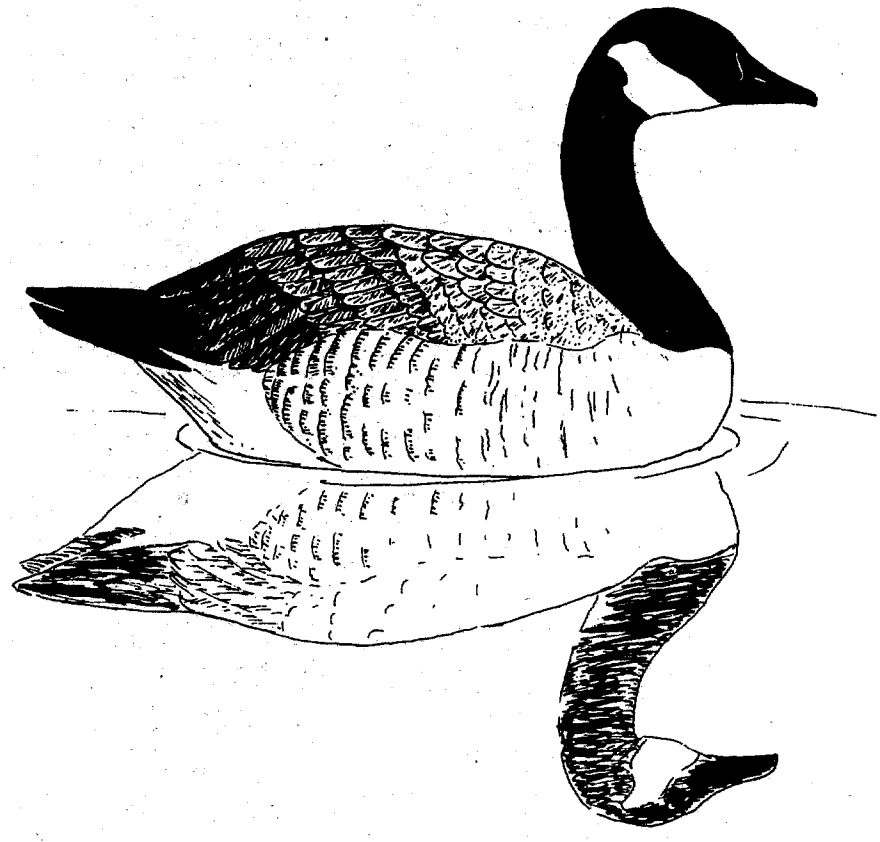

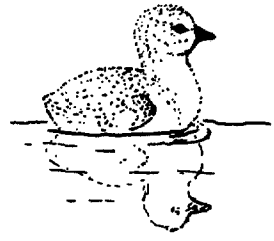

Bay Beach Wildlife Sanctuary

Green Bay, Wisconsin

MASTER PLAN

BAY BEACH WILDLIFE SANCTUARY

MASTER PLAN

Prepared for the City of Green Bay, Park
and Recreation Department

by: John P. Jacobs, Project Manager

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Base Map Drawn by: Joseph A. Brue

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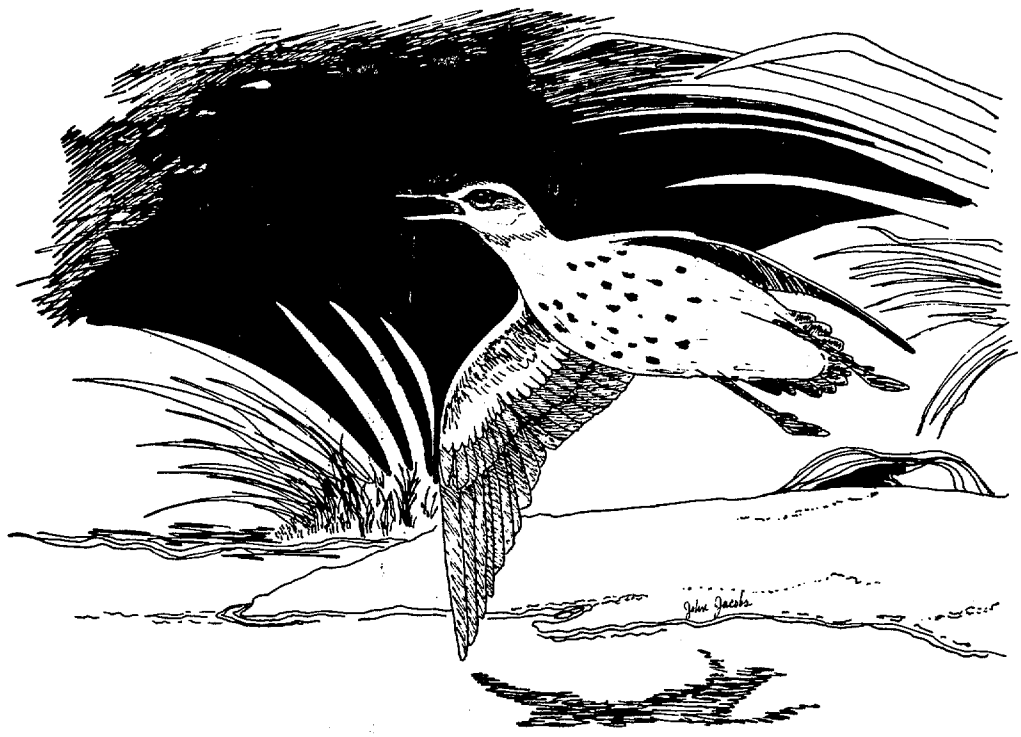
July 1980

FOREWORD

It has been the goals of this master plan to first of all collect and assimilate base line data on the physical-ecological site and the human element; to make sound management alternatives and proposals based on this data; and to make general and specific recommendations which will help the Sanctuary function more efficiently and professionally by considering the human needs and the restrictions inherent in the physical site and allocating those uses to the areas that suit them the most.

J.P.J.



ACKNOWLEDGEMENTS

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Person	Affiliation	Contribution
Dave Ranke	Green Bay Metropolitan Sewerage District	Water Analysis
Joe Nowak	Green Bay Health Department	Water Analysis
Dorothy Heinrich	University of Wisconsin, Green Bay-Special Collections	Literature
Donald VanBeckum	Model Building Instructor Northeast Wisconsin Technical Inst.	Scale Model
Brian Houle	Northeast Wisconsin Technical Institute - student	Scale Model
Kurt Badeau	Boy Scouts of America	Visitor Count
Evelyn & George Stumpf	"Friends of the Bay Beach Wildlife Sanctuary" Organization	Visitor Count
Hank Bredael	President - "Friends of the Bay Beach Wildlife Sanctuary"	Consultation
Donald Quigley	Neville Public Museum	Geological & Historical Information
Sandy Lubow	University of Wisconsin - Green Bay	Computer Programming
Dr. Richard Steihl	Professor - University of Wisconsin-Green Bay	Assistance with small mammal survey
Carol Cutshall	Bay-Lake Regional Planning Commission	Consultation
Dave Such	Bay-Lake Regional Planning Commission	Consultation
Boni Thor	University of Wisconsin - Green Bay, Tech Unit	Sampling Equipment
Dr. James Wiersma	Professor - University of Wisconsin-Green Bay	Consultation
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Entire Staff of the City of Green Bay - Park, Recreation and Forestry Department, especially:

Chet Miller	Director	Administration
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Ty Baumann	Sanctuary Manager	Management Consultation, Project Consultation and Review
Robin Hawley	Assistant Manager	Soil Surveys, Canada Goose Data
Mary Jacobs	Naturalist	Breeding and Migrating Bird Studies
Randy Korb	WCMP-Project Aide	Wildlife Reports
Michael McFarlane	Previous WCMP Project Manager at Sanctuary	

Mark Martell	Previous WCMP Project Aide at Sanctuary	
David Brinker	Dames & Moore Environmental Consultants	Canada Goose Data
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Dave VanLannen	Surplice and Associates	New Education Nature Center Planning
Dr. Joseph Moran	Professor, University of Wisconsin, Green Bay	Geology
Dr. Keith White & Dr. John Reed	Professors, University of Wisconsin, Green Bay	Vegetation Consultation
Joel Trick and Gary Fewless	University of Wisconsin, Green Bay, Herbarium	Vegetation Verification
Austin Straubel Airport Weather Service		Climate and Weather Data

Bay Beach Wildlife Sanctuary Advisory Committee

James Kreiter	Neville Public Museum	Graphic Assistance
Eileen Gillis		Typing Manuscript

TABLE OF CONTENTS

INTRODUCTION

INTRODUCTION

The Bay Beach Wildlife Sanctuary is adjacent to Bay Beach Amusement Park and is located in the north-eastern part of the City of Green Bay, Brown County, Wisconsin (44° 32' Lat. - 087° 58' Long., Congressional Township T24N-R21E). The Sanctuary is bordered on the west by Irwin Avenue, on the north by County Trunk A (Marsch Road-East Shore Drive) and on the south and east by the Interstate 43 right of way. (Maps 1 & 2)

The Sanctuary has a physical connection to the coastal area of Green Bay through the Bay Beach Amusement Park (both the Sanctuary and the Amusement Park are owned by the City of Green Bay and are managed through the City's Park and Recreation Department) which has approximately 1,800 feet of public access shoreline along the bay of Green Bay. The Sanctuary also has a narrow tract of land extending to the Bay. A canal did connect the lagoons directly with the Bay until 1969. During that year the canal was filled to prevent the drastic water level fluctuation caused by the seiche activity of the Bay.

The Bay Beach Wildlife Sanctuary currently consists of approximately 57 acres of ponds and 350 acres of a mixture of wet-low woodlands, landscaped lawn-park, cattail marsh and grass field succession. Most of the animals native to Northeastern Wisconsin can be found at the Sanctuary.

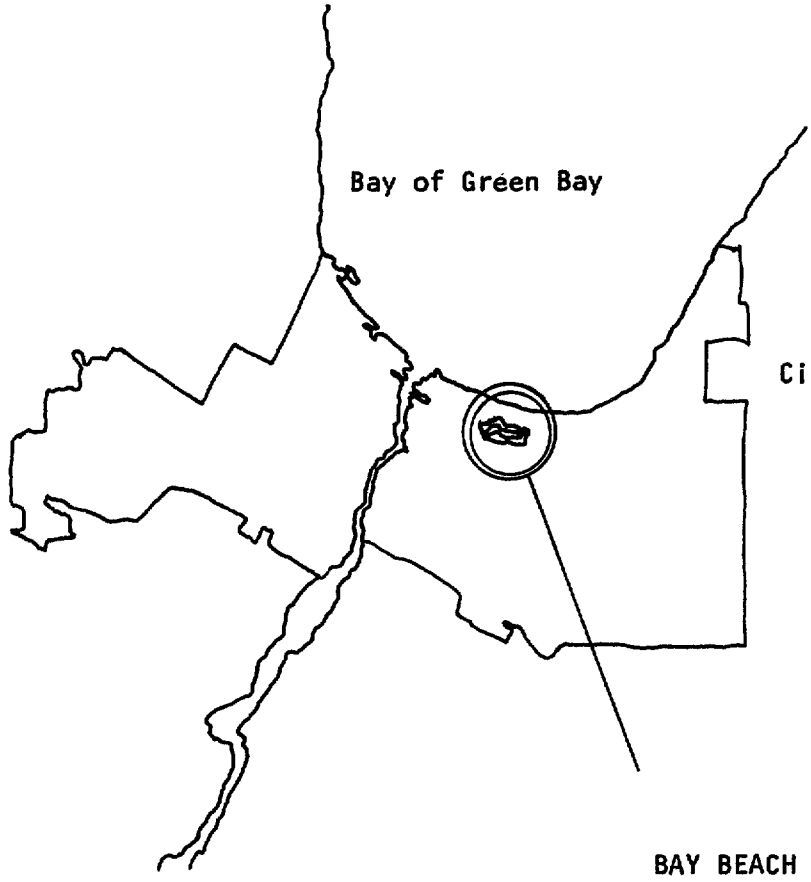
The Sanctuary primarily serves as a waterfowl refuge, mainly for Canada Geese, a local population of about 700; Mallard ducks, summer population about 250 and winter population 2,300; Black ducks, summer population about 20 and winter approximately 400; and many other species of waterfowl in fewer numbers.

The area also serves as an Outdoor Education and multiple-use passive recreation site year-round. No admission fee is charged. Other activities include: waterfowl feeding, viewing native animals both caged and free, hiking, biking, cross-country skiing, fishing for young people under 16 years of age, photography, picnicking and bird watching. Over 230,000 people visited the Sanctuary during 1979. The Sanctuary is a very popular area for local residents and visitors have come from all over the country and world.

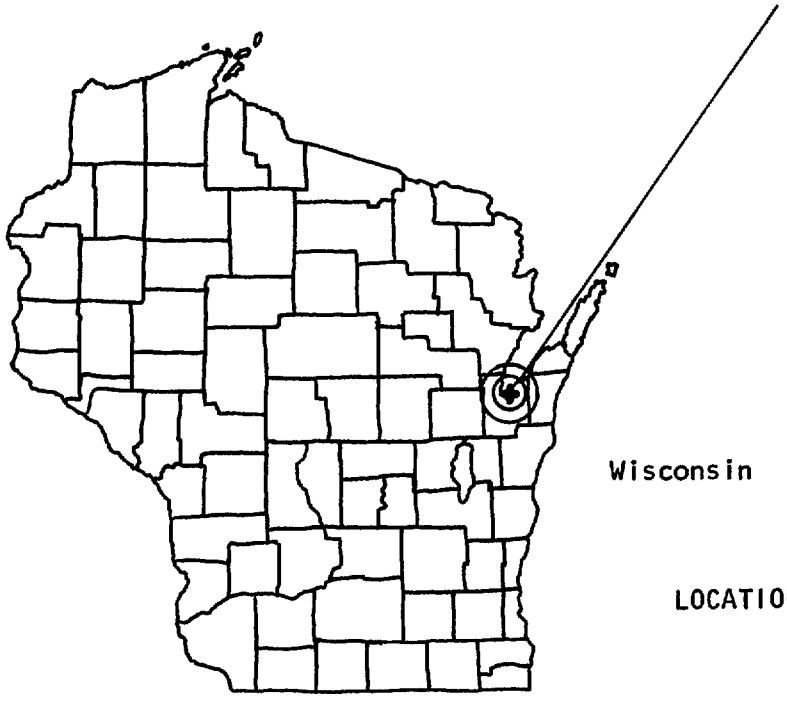
Although no hunting is allowed in the Sanctuary, the ducks and geese fly over much of the Lower Bay and thereby provide sport for many hunters.

The Sanctuary generates sufficient revenue through corn and concession sales to help pay for its expenses.

MAP 1



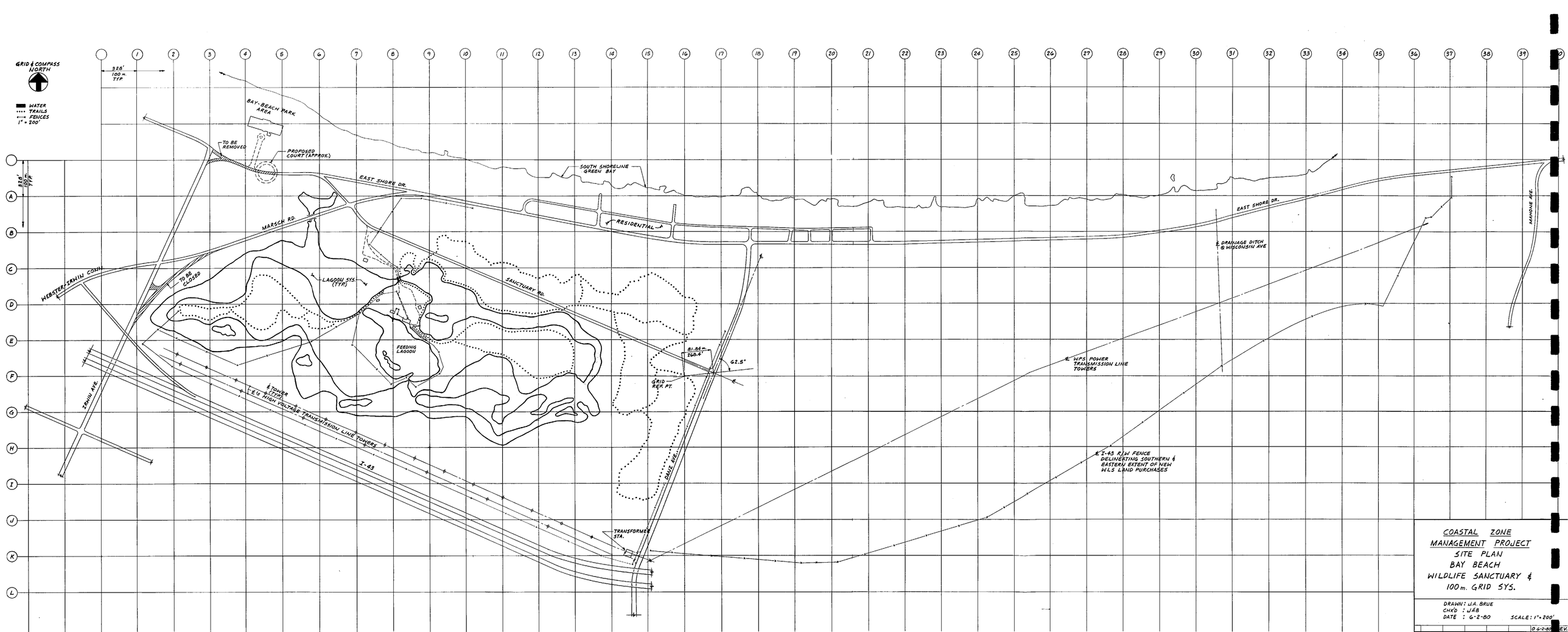
BAY BEACH WILDLIFE SANCTUARY



LOCATION OF WILDLIFE SANCTUARY

Map 2

Base Map for Wildlife Sanctuary



COASTAL ZONE MANAGEMENT PROJECT

SITE PLAN
BAY BEACH WILDLIFE SANCTUARY & 100 m. GRID SYS.

DRAWN: J.A. BRUE
CH'D : JAB
DATE : 6-2-80
SCALE: 1"=200'

6-2-80

PHYSICAL - ECOLOGICAL ASPECTS

PHYSICAL-ECOLOGICAL ASPECTS

Background

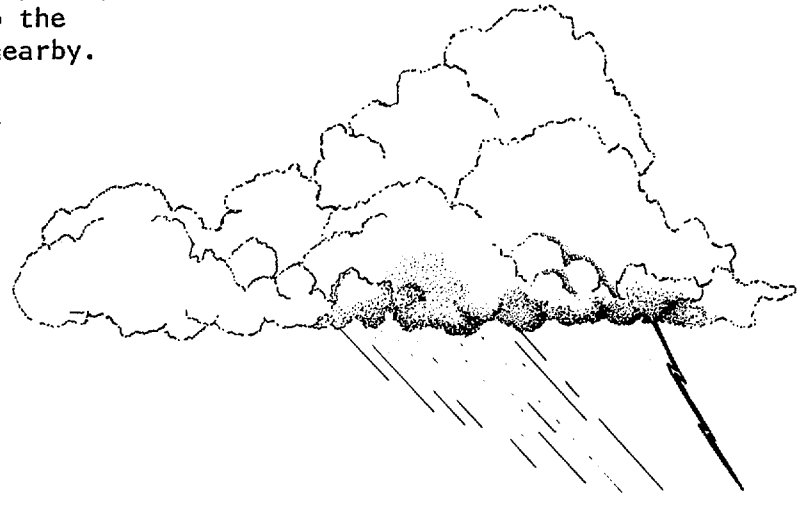
The natural physical aspects of an area including; geology, land forms, topography, soil types, amount of water available, location on continent, local climate and weather, etc., are all important factors in determining what types of plant and animal life are present or can live in that area. It also determines what type of human uses are most appropriate for that area. These factors comprise the foundation the planner has to work with and are an important part of the planning process.

Weather and Climate

The area's climate is modified by surrounding topography and large bodies of water. Predominantly the modification results from the water of Green Bay and Lake Michigan and to some extent Lake Superior and the slightly higher terrain north, south, and west of the general area.

Summer temperatures are temperate with few days of 90° F or above (normally seven) and a rather narrow average daily temperature range. Humidity is fairly high. The average yearly precipitation, including snow values expressed as rain, is 28.38 inches. Most of the annual precipitation (60%) falls within the growing season, (May-September) as thundershowers. Summers are relatively short averaging a 148 frost-free day period each year (May 7 - October 2). Skies are generally cloudy to partly cloudy, probably due to the large bodies of water nearby.

Winters are long with a fairly large number of days of 0° F or below (normally 30 days). Seasonal snowfall is moderate (44.8 inches) for this latitude.



Appendix A contains more complete information on normal weather conditions for the Green Bay area.

Recent Geologic History of the Area

Many of the topographic features and soil conditions of Wisconsin are a direct result of its glacial history. The northern and eastern parts of the state have been covered by various glacial stages that moved down from the north. There have been at least three main substages of glaciation. The earliest substage is believed to have occurred over 30,000 years ago. The area now the Wildlife Sanctuary, has been affected by glacial lake forces. This area has been compressed by ice, flooded, and received glacial lake deposits, several times. The last major movement of ice (glacier) appeared to have occurred about 9,000 - 10,000 years ago. Since the last ice movement the water level of Green Bay has fluctuated drastically several times. Between 4,000 and 9,000 years ago the water level was so low (far below 580 feet mean sea level-MSL, which is the present approximation of the level of the Bay) that most of the area of what is now the bay of Green Bay was dry and had probably gone through several stages of plant succession to a climax forest. About 3,000 - 4,000 years ago, the water level rose to approximately 600 - 605 feet MSL, about 25 feet above the present level of the Bay. The shoreline was one-half to one mile south of its present position (See Map 12). The Sanctuary was under 25 feet of water.

The water level gradually dropped until it reached a level about 596 feet MSL. The Sanctuary was still under about 15 feet of water. The water level remained at this level for a long time until the channels emptying Lake Michigan-Green Bay opened up.

Dry land has been exposed at the Sanctuary site for only about the last 1,500 years. Since this area is in the present flood plain of the Bay, it has been temporarily flooded many times in its recent history. The last flood occurred in 1973, water was 28 inches high inside the present nature center building. A dike was recently constructed along the south-east shore of Green Bay to prevent flooding.

Several small, barely noticeable beach ridges run east-west through the Sanctuary but because of constant flooding, which help level the ridges, and lack of forceful wave and wind action, no definite ridges have been formed (like the ridges along Lake Michigan at Woodland Dunes or Point Beach).

The present site is nearly level, 0 - 2% slope. Natural relief was originally less than three feet. Small mounds two or three feet high have been constructed of dredge material when the lagoons were dry. The Danz Avenue landfill has a hill approximately 20 feet above the surrounding land surface.

Wind, rain, and ice continue to alter the land surface, but man's activities are the most obvious forces shaping the land surface today.

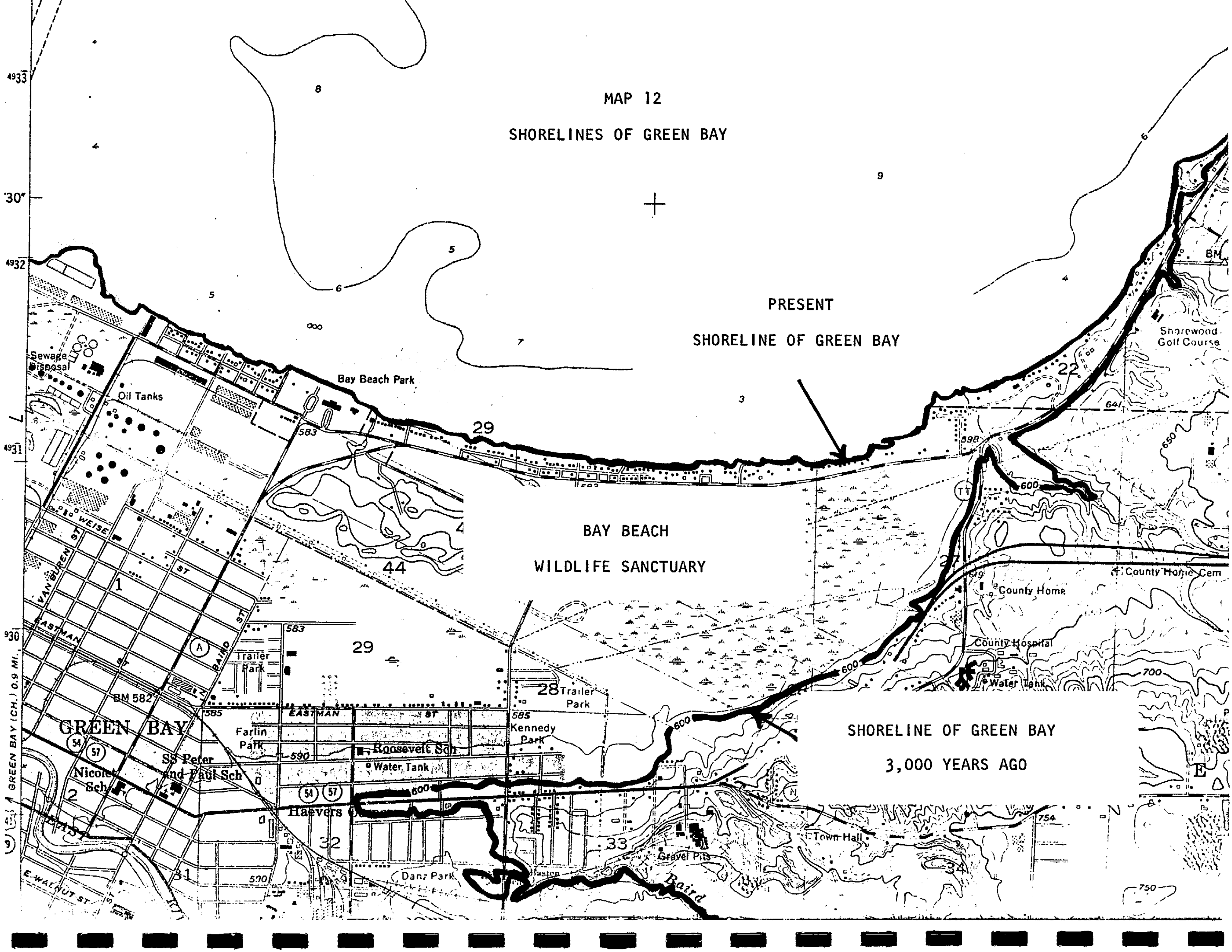
The table on the following page summarizes the recent geological history and shows different theoretic habitats believed to have been at the Sanctuary during each period.

SUMMARY OF RECENT GEOLOGICAL HISTORY IN THE GREEN BAY AREA

Glacial Periods	Ancestral Lakes	Approximate Age in years before present	Level of Lake Michigan & Green Bay above MSL Paull	Hough	Habitat at Sanctuary (Hypothetical)
No Glaciers	Green Bay and Lake Michigan	Present	580		Sedge meadow, cattail, Southern Lowland Forest
	Algoma	2000-3000	590-595	596	Under 15 ft. of water
	Nipissing	3000-4000	600-605	605	Under 25 ft. of water
	Chippewa	4000-9000	<580	230	Various stages of plant succession to Climax Forest
Third glacial period Greatlakean	Algonquin	9000-10,000	600-605	605	Under 20 ft-40 ft of water, and for most periods of time hundreds of feet of ice.
	Toleston	10,000-11,000	600-605 Lake Chicago	Lake Oshkosh	
	Calumet II	11,000-11,800	620	640	
Two Creeks	Bowmanville	11,800-12,500	<580	580	Black Spruce Boreal Forest - Cool, moist climate
Second glacial period Woodfordian (Port Huron)	Calumet I	12,500-13,000	620		Buried under hundreds of feet of ice most of time
	Gleenwood	13,000-14,000	635-640 Lake Chicago	640 Lake Oshkosh	
First glacial period (Cary)		30,000			Buried under glacier

Changes were gradual and took hundreds of years to occur, not in a simple distinct period.

Water levels are approximate and may have varied between Lake Michigan and Green Bay.

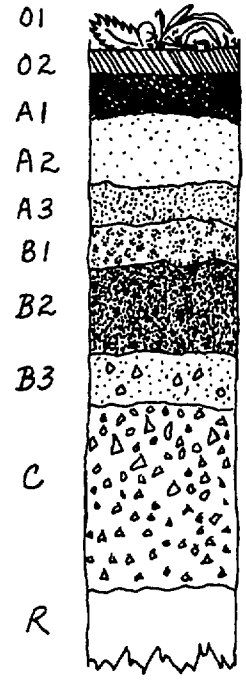


MAP 12
SHORELINES OF GREEN BAY
PRESENT
SHORELINE OF GREEN BAY
BAY BEACH
WILDLIFE SANCTUARY
SHORELINE OF GREEN BAY
3,000 YEARS AGO
Bay Beach Park
Sewage Disposal
Oil Tanks
Shorewood Golf Course
County Home Cem
County Home
County Hospital
Water Tank
Trailer Park
Farlin Park
Kennedy Park
Roosevelt Sch
SS Peter and Paul Sch
Nicolet Sch
GREEN BAY
Town Hall
Gravel Pits
Danz Park
Baird
E WALNUT ST
EASTMAN ST
VAN BUREN ST
WEISE ST
BAIRD ST
BM 582

Soils

The soil studies done at the Sanctuary show changes in water levels. Being located near the mouth of the Fox River, the Sanctuary area was part of the river delta. Sediments deposited are well sorted and layered, indicating fluctuations in water levels. Organic peat layers are common between mineral layers which indicates former marsh type environments. Clay layers are common to indicate low energy deposition environments. Water levels in the lagoons are maintained by clay pans forming perched water tables above the Green Bay lake level. Sands, silts and clays compose the fertile soil in which the rich vegetation of the Southern Lowland Wet Forest is evolving.

GENERALIZED SOIL PROFILE



In general the soils of the Sanctuary are young and developing with the vegetation. Most of these soils are wet or saturated year-round and are limited in use. A major part of the undisturbed land is sandy with a high organic matter content in the "A" horizon. Another lesser portion is silty clay which is developed over clay till.

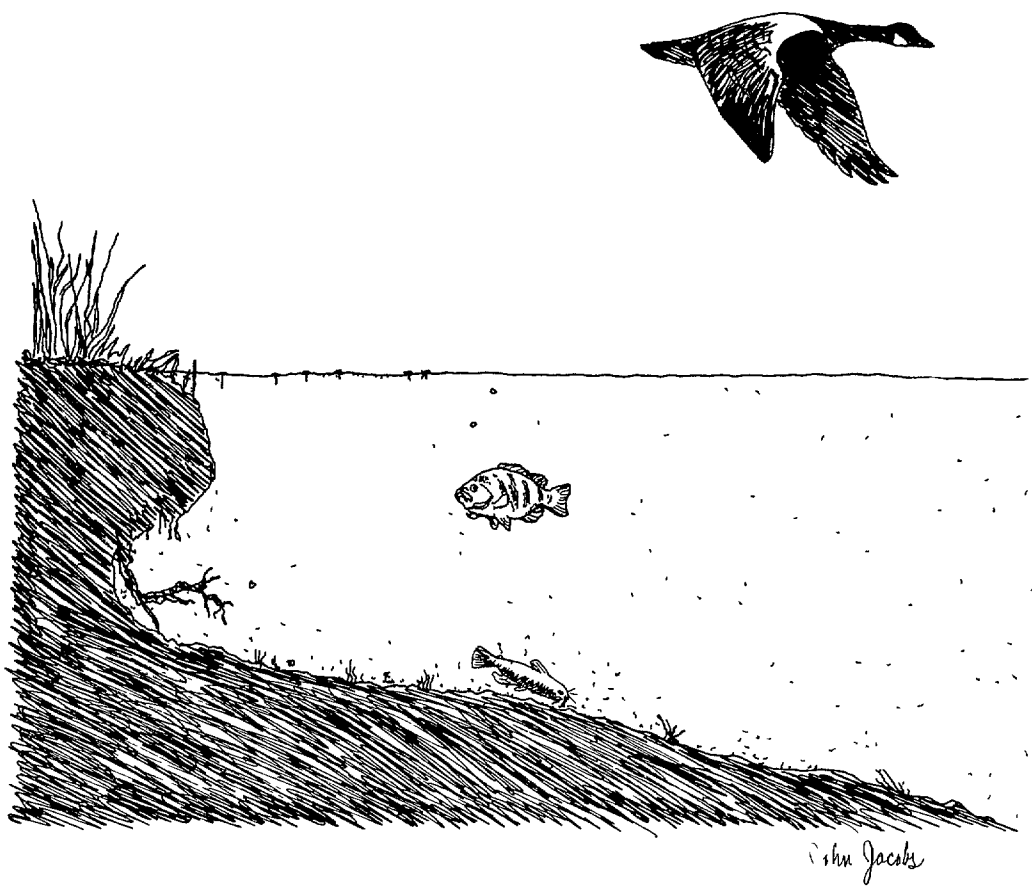
Dredging spoils from the lagoons form some relief on the site and enable more diversity of vegetation to be established. Because they generally are dryer and have good internal drainage they support more upland type species of trees and shrubs.

The soil study shows that a large portion of the Sanctuary has been disturbed by human activity. Much of the original soil has been buried by "chip-dumps" and land fill. The "chip dumps" are dry during the summer and support only hardy plant species. The soil will remain poor in these areas until the chips decompose (10 - 50 years) or additional soil is added.

The landfills have been capped with clay and given time will eventually form a soil which will sustain more diverse vegetation. Intense management of these mounds to prevent erosion is necessary. Once a plant cover is established, a soil will develop along with the plant succession.

Water

The Sanctuary has about 59 surface areas of ponds and lagoons, with an average depth of less than 5 feet. A maximum depth of 15 feet is in the main feeding lagoon which was redredged during the winter of 1972. The source of water supply is annual precipitation, melting snow, run off, and two wells - one pumps water into the main feeding lagoon, the other into the lagoon behind the Manager's residence. Together both wells pump approximately 50 gallons of water per minute. No springs are known of in this area. The lagoon water level can be lowered by a lock system which allows water to flow out of the Sanctuary into a channel draining into the Bay. A serious water quality problem exists at the Wildlife Sanctuary.



Water Quality

The water quality has been a major problem for the Sanctuary for many years. The problem became so great in the main feeding lagoon in the late 1960's, that this lagoon had to be redredged in 1972. The main causes of the poor water quality are: waterfowl excrement, little flushing action, lack of a clean water source, bottom feeding fish such

as carp and bullheads which stir up bottom sediments, bank erosion, and high algal blooms.

During 1979 and 1980 water samples were taken at five sites on the Sanctuary. They were taken as close as possible to sites of previous sampling so results from this study could be compared to those taken in the past. The data is summarized in Appendix C, Tables 1 - 5. The data collected during this study is also compared to samples taken previously at the Sanctuary and to water samples taken off the east shore of Green Bay just north of the Sanctuary (Appendix C, Table 6). Additional water studies done for this master plan include: analysis of water for fecal coliform, water level fluctuations, and a complete depth profile map for all lagoons. The water level records and fecal coliform analysis can be found in Appendix C. The depth profile maps are on file at the Sanctuary Nature Center.

Care must be taken not to over-interpret the results of the water sample studies. It was felt that comparing the range of analysis results was the most appropriate method since there were some biasis: sample sizes were not equal for all studies; time of year varied greatly, most of 1970 and 1971-1973 samples were taken during the summer, samples for 1976 were taken in early fall and in 1979-1980 only one sample was taken during early summer; not all samples were analyzed for the same parameters. Weather conditions also greatly affect water quality at the Sanctuary. A hot dry summer will cause very poor water quality for the shallow lagoons.

However, it appears that some basic generalizations can be made:

1) The overall quality of water in the lagoons generally has not changed significantly in the last seven years. A comparison of results from the study done in 1979-80 to the results from the study done in 1973 for the same time of year, at the same site shows that for: total phosphate, orthophosphate, pH, dissolved oxygen, total nitrogen, and specific conductance, no significant change has occurred.
2) The feeding lagoon continues to be more polluted than the other lagoons. Significant differences were found in total phosphate, orthophosphate, pH, and dissolved oxygen. The high levels of phosphate are a result of the heavy waterfowl use the feeding lagoon receives.

To arrest the main causes of poor water quality, the main management alternatives which have been proposed are:

1) Reduce the number of waterfowl using the Sanctuary
2) Increase inlet of clean water
3) Remove rough fish: replant with minnows and game fish
4) Redredge lagoons
5) Stabilize lagoon banks
6) Aerate water
7) Nutrient inactivation through chemical precipitation
8) Circulation - nutrient assimilation system

Alternative 1 - Reduce the number of waterfowl using the Sanctuary.
A study done in the early 1970's at the Sanctuary by Janet Ladowski showed high concentrations of waterfowl (approximately 3,000) on a small body of water, the main feeding lagoon, can result in a rapid degradation of water quality. Nutrient levels in the main feeding lagoon increased significantly within one year following redredging due to the high waterfowl population. Other studies indicate this also. The close relationship between the water quality and waterfowl population makes it necessary to mention this topic here. However, waterfowl management will be discussed in a later section.

Alternative 2 - Increase the inlet of fresh water.
The sources of water for the lagoons are meling snow, run off, rain, and two wells which together pump approximately 50 gallons of water per minute. These sources barely replace the water lost by evaporation and seepage. An additional deeper well with larger diameter pipe has been proposed as the most feasible method of increasing clean water inlet. If enough additional clean water is added, the outlet lock could be opened more often, thereby increasing the flushing action in the lagoon system. At the present time, the lock is rarely opened, usually only after heavy rains. Restrictions on wells may make it difficult to obtain permits for this use. The waters of Green Bay are cleaning up and presently are probably cleaner than the Sanctuary lagoons (comparison with more recent samples taken from the Bay are needed). The Bay might be a suitable source for "clean" water except that it is high in PCBs and some other chemical pollutants.

Alternative 3 - Remove rough fish such as carp and bullheads and re-plant with gamefish and minnows.
Carp and bullheads stir up bottom sediments, clouding the water. Ridding the lagoons of these fish should increase water clarity and plant growth and keep sediments on bottom. The new fish poisons are reported to be specific for gill-breathers and quickly biodegradable. A 3.0 ppm of Rotenone treatment of Lily Lake, Brown County was very successful and has greatly improved water quality (personal communications with Phil Lapinski, DNR Fish Manager). The feeding lagoon might provide a possible test site for chemical treatment. Cost is estimated at about $1,500 for treatment of the feeding lagoon. The major disadvantage of chemical treatment would be the loss of the invertebrate population which would require two years to recover.

Netting, electric shocking, or sectioning off parts of lagoons, then pumping them partially dry and netting out fish are all possible methods to remove rough fish. These methods would require more labor and might not remove all the rough fish. The lagoons would then be restocked with minnows, perch and large gamefish after rough fish have been removed.

Alternative 4 - Redredge the lagoons.
The main feeding lagoon was redredged in the winter of 1971-72 at a cost of $31,000. This lagoon had deteriorated greatly and was believed to be the cause of the death of 400 ducks and geese in 1969. The cost of dredging the original lagoons was approximately $500,000 in 1938. It would probably cost approximately $5 million to redredge all the lagoons today. Redredging

the lagoons is a costly and time consuming alternative. And in the case of the feeding lagoon, it appears to be only a temporary solution. A water chemistry study done during 1970-1973 by Janet Ladowski showed that by one year after dredging the conditions in the feeding lagoon had again deteriorated significantly in amounts of phosphate and chlorophyll 'a', due to the heavy use by waterfowl on that lagoon. Redredging the feeding lagoon in 1972 was necessary then because conditions were so bad it was the best alternative.

Alternative 5 - Stabilize lagoon banks.
The soil along the edges of the lagoons is easily eroded and the banks break down quickly, filling in the lagoons. Some bank stabilization has been done by placing broken concrete (rip-rap) from sidewalks, streets, etc., along some of the banks. Asphalt has not been used because of possible pollution to lagoons. Gravel or crushed rock could be dumped along the lagoon banks for bank stabilization, but the expense of gravel has prevented its use.

Alternative 6 - Aerate Water
The feeding lagoon has two aerators and two circulation pumps. These devices are kept running 24 hours a day year-round. They keep ice from forming on part of the feeding lagoon in winter and circulate water in summer. Studies done in 1971-73 (Ladowski) and the studies done for this master plan show that the aerators are not able to effectively aerate the water. The aerators might be stirring up bottom sediments keeping them from settling out. This might detract from the water quality or it may help the small flushing action of the outlet remove some of the nutrients. Studies might be done on the feeding lagoon to determine if the aerators are helping or hurting the water quality during the summer months. New, large, more effective aerators might do a significantly better job aerating the water.

Alternative 7 - Nutrient inactivation through chemical precipitation (Peterson, 1973)
Chemicals are added to the water which react with the nutrients and deposit them on the bottom of the lake. This may be a suitable short term method to control the eutrophication of the feeding lagoon but needs more investigation.

Alternative 8 - Circulation - nutrient assimilation system (Peterson, 1974)
This alternative would require the movement of water, possible by pumping, from the feeding lagoon through the other lagoons where nutrients could be utilized by emergent and submergent vegetation. The periodic harvesting of aquatic plants would provide a means of removing some of the nutrients from the system. Just circulating the water from the feeding lagoon into the other lagoons would probably help water quality for the feeding lagoon but at the same time would decrease water quality in the other lagoons. A circulation system which moved the water too rapidly would increase bank erosion.

Recommendations

The poor water quality is a very serious problem for the Sanctuary and will require action in the very near future. The following recommendations are suggested:

1) Reduce winter duck population to a maximum of 1,000 and a maximum goose population of 700. Total winter waterfowl population should not exceed 1,700. Canada geese have priority. Waterfowl management will be discussed in a later section.

2) Eliminate the carp and bullhead fish populations from Sanctuary lagoons.

3) Increase fresh water inlet, hopefully creating some kind of flushing action. A larger pump and deeper well seems to be the best alternative but may not be feasible because of strict well regulations.

4) Continue bank stabilization using waste concrete, but break up concrete into various size pieces, which provides better erosion protection and makes it easier for the ducks to climb onto shore.

5) Pursue circulation - nutrient assimilation system or similar alternatives as a method to remove nutrients from the lagoons.

6) Monitor the water quality. Continue water chemistry analysis of lagoons similar to those done for this report. Samples should be taken in February, April, June, August and late September.

Vegetation at the Wildlife Sanctuary

An inherent part of a practical management master-plan for the Bay Beach Wildlife Sanctuary must be an accurate scientific evaluation of the past, present, and future vegetative development on the site. As the Great Lakes coastal zone, the Sanctuary has traditionally been an area of great importance and activity. Severe disturbance by man in the recent past on the Sanctuary site and then subsequent attempts to manage for floral rehabilitation have made the Sanctuary a living laboratory exemplifying the successional intricacies of plant communities. Present and future scientific analysis of Sanctuary vegetation will surely lead to a great deal of knowledge about coastal reclamation in general. A look at past and present developments in floral patterns will allow this master-plan to suggest sound recommendations for future habitat preservation and enrichment.

In the past, most of Sanctuary acreage has undergone many changes. As stated earlier, most of the Sanctuary land has historically been directly affected by its proximity to both the Fox River and the Bay of Green Bay. River delta activity as well as Bay water level fluctuations have had major impacts on Sanctuary soils and, in turn, plant development. As early as the 1700's exploring Jesuit missionaries recorded extensive forested areas in the general Green Bay area. Along with mammoth White Pines (Pinus strobus) they discovered extensive White Cedar (Thuja accidentalis) swamps and Tamarac (Larix lavicina) bogs as noted features of the area. Along the Bay's shores, particularly on the west shore, extensive growths of Wild Rice (Zizania aquatica) grew. Few openings in the forest were recorded for the area. However, it must be cautioned that forest openings were often unmentioned in timber oriented surveyor's journals. I. P. Lapham, who was the first to attempt a complete listing of Wisconsin's vegetation, recorded, in 1846, much timbered land with few openings in the general vicinity. By this time, however, activities of the areas more agriculturally oriented native Americans like the Winnebagos, the Potawatamis and the Menominees, might have developed large fire cleared and maintained open areas. Also, Bay water level inundations and recessions probably would have developed and maintained large areas of northern sedge-meadow and cattail marsh then just as they do on the west side of Green Bay now. William Finley, in 1951, published a rather specific vegetation cover-type map of the Green Bay area as it was in 1834-1847. He used quite detailed information found in the original land survey records. According to Finley's findings, the Sanctuary properties were entirely contained in an extensive open area termed "wet prairie". This extended from the east shore of the Fox River delta to a point slightly northeast of present Sanctuary land holdings. John T. Curtis' famous map of the major plant communities of Wisconsin ca. 1840 shows the entire area classified as conifer-hardwood forest. So, which records were accurate? Probably all of them were. Further perusal of historical literature as well as a series of personal consultations with faculty and graduate student staff members of the University of Wisconsin-Green Bay, Science/Botany Department, has yielded the following evaluation of Sanctuary vegetative history for the 1800's. Until the early 1900's, the

Sanctuary area was indeed subject to major bay water level fluctuations which created a dynamic spectrum of northern sedge-meadow, cattail marsh and in areas subject to fires wet prairie in the topographically lowest areas. Sprinklings of mixed conifer-northern hardwoods with White Pine, White Cedar, American Elm, Black Ash, Green Ash, and Silver Maple likely occupied higher areas such as old beach ridges. White Cedar swamps, Tamarac bogs and Alder thickets might have occurred in some Sanctuary areas although no evidence of these communities can be found in either the most recent soil or vegetation sampling. Recent soil core samples do indeed reveal soil types which are congruent with and a clear record of both wet prairie and northern sedge-meadow communities. Also, very fibristic organic materials of the A horizons of many core samples positively identify numerous areas of cattail (Typha latifolia and Typha angustifolia) marsh in both the recent and distant Sanctuary past.

So, a community composed of genera from the Compositae (asters and goldenrod), Cyperaceae (sedges), Gramineae (grasses), Rosaceae (cinquefoils) and Labiatae (mints) families most likely dominated the Sanctuary site prior to 1900. Major dominants of this sedge-meadow community were Carex stricta and other sedges, Calamagrostis canadensis, Poa palustris, Scirpus atrovirens and Glyceria canadensis. The most prevalent ground layer species were Aster simplex, Eupatorium maculatum, Iris shrevei, Campanula aparinoides, and Lycopus unifloras. The most closely related communities, according to Curtis, are southern sedge-meadow, wet prairie, shrub-carr, fen and Alder thicket. Wet prairie dominants would have been Calamagrostis canadensis, Spartina pectinata, Andropogon gerardi, and Muhlenbergia racemosa. Any species of the above northern sedge-meadow related communities may have been a minor contributor to recent past Sanctuary flora.

In the early 1900's, local industries, like the paper-making industry, failing to see the value of wetland marsh or sedge meadow, which have since been proven to be some of nature's most productive ecosystems, began using the area as a waste disposal site. Such wastes as wood chips, sawdust, and fly-ash were dumped over acres of wetland and then "capped" with "clean fill" materials like broken concrete, dismantled equipment, and other refuse of various forms. Such dumping persisted for fifty years. Waste often reached ten to twenty feet in depth completely altering the natural topography. Needless to say, this human activity totally devestated the original flora of the Wildlife Sanctuary area. Luckily, in the early 1930's a few Green Bay area citizens who were appalled at the rapid destruction of local native wetland habitat founded the Sanctuary as a refuge. (See III Human Element in this Document). Lagoon systems were excavated later in the 1900's and eventually the City of Green Bay Parks and Recreation Department took permanent ownership of Sanctuary properties.

In the meantime, the once lush vegetation of the past had become a wasteland. Weedy species only suited to pioneering severely disturbed sites invaded just those areas on which some soil development had remained. The acidity of many chip-dump areas prevented any revegetation in those areas for many years. Unnatural leachates entered the runoff and the ground

water systems and destroyed even more of the vegetation that once had been abundant. Also, residential development along the bay shore cut off the former rapport of marsh with open bay waters. Diversity was at an all time low. Slowly, after decades, pioneer species like ragweeds, goldenrods, nettles, milkweeks, Quackgrass, Box Elder, and Cottonwood invaded.

Little planned rehabilitation of the Wildlife Sanctuary areas vegetation took place between 1930 and 1970. At times, a few individuals would donate their own time and money and make some isolated plantings, mostly of exotic species or horticultural varieties. Thus, there was a vague attempt to restore diversity. However, it wasn't until the Green Bay Parks and Recreation Department hired, in 1971, a degreed full-time Manager in residence that some professional management began to be involved in rehabilitating the Wildlife Sanctuary. Although not a botanist, the manager was a wildlife biologist who recognized the need for overall plant diversity and who knew how to manage for specific habitat requirements that were needed by the flock of Giant Canada Geese and other various faunal elements. With the increase of the waterfowl flock, trained naturalist staffing, and public awareness of the areas ecological importance, vegetation management began to be a familiar concept at the Sanctuary.

Since the arrival of professional vegetation management in the mid to late 1970's until now, the floristic composition of the Sanctuary began to be studied, sampled and manipulated. Naturalist staff, well-versed in Botany as it is related to wildlife ecology, realized that with alot of careful professional guidance the Sanctuary could become an extremely diverse and valuable natural area once again. Student projects controlling such aggressive pests as Great Ragweed (Ambrosia trifida) and European Buckthorn (Rhamnus frangula) were begun in cooperation with the University of Wisconsin Science and Environmental Change Department faculty.

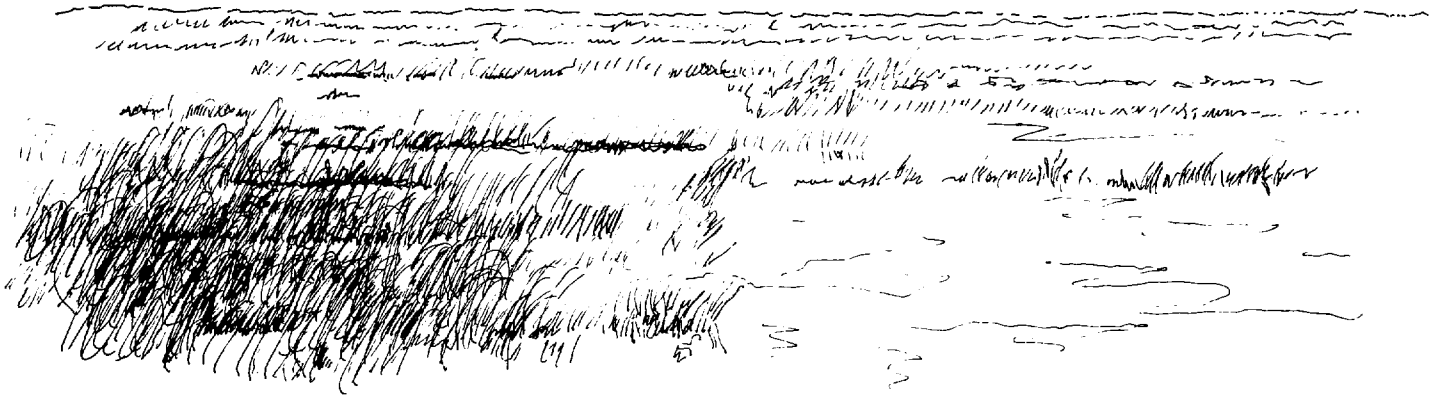
Grazing and loafing areas for geese and goslings are presently being managed for. Shelterbelts near highways or roads are being considered as are plantings along perimeter fencing. All such measures will benefit many game and nongame species. Thus, painstakingly plant diversity and natural succession is being reestablished. As part of the Sanctuary's Outdoor Education Program for youngsters of the Green Bay area schools, acreage for instruction about forest, grassland, and marsh ecology is being maintained.

Evaluation of current floristic composition at the Sanctuary has come mainly through the persistence of the interested and involved Naturalist staff. The most recent analysis of plant life have been much more organized and based on proven scientific methodology (Curtis point-quarter sampling method). As yet, not enough of this sampling has been completed to represent publishable data. But enough sampling and research has been done to create a good picture of the Sanctuary's current community structure and vegetative trends. Due to past disturbances, many communities occur in the seral stage. Soil is slow to develop even under good conditions and many areas of the Sanctuary are still able to support only minimal vegetation cover. (See Appendix D for a complete listing of trees, shrubs, and herbaceous species)

A woody dominant which was introduced and now is vigorously invading is European Buckthorn (Rhamnus frangula). It is taking over nearly all of the wet-mesic areas. This shrub is considered a real threat to future diversity and therefore it is presently being managed for control or eradication. This project includes the possible development of a mycological biotic control agent. Large areas of Sanctuary acreage once dominated by Buckthorn are being converted to frequently mowed lawn grazing area or to park-like loafing area. This will afford the rather large goose and waterfowl flock sufficient habitat for food and rest. It also has altered flock nesting success to some extent. These areas were planted with Kentucky Bluegrass. Landfill site grasslands are mostly dominated by Quackgrass. Other dump areas are completely covered by nettles or Great Ragweed. (See Appendix D for a complete listing of herbaceous species and various exotic plantings)

The future success of vegetation management at the Bay Beach Wildlife Sanctuary will depend on concerted well-documented scientific efforts. It is a goal of this master-plan to guide these efforts. The establishment of the grid coordinate system under this Coastal Management grant will allow great control over any future analysis or experimentation. It is suggested that vegetation sampling data be collected, analyzed, and permanently recorded for each 100 meter grid on the Wildlife Sanctuary site as soon as possible. Acceptable techniques as per J. T. Curtis' Vegetation of Wisconsin should be used. A herbarium collection for the Sanctuary has been started. This collection should be coordinated with the University of Wisconsin-Green Bay herbarium collecting staff. Methods for proper plant collecting and species identification should be strictly standardized in order to eliminate errors.

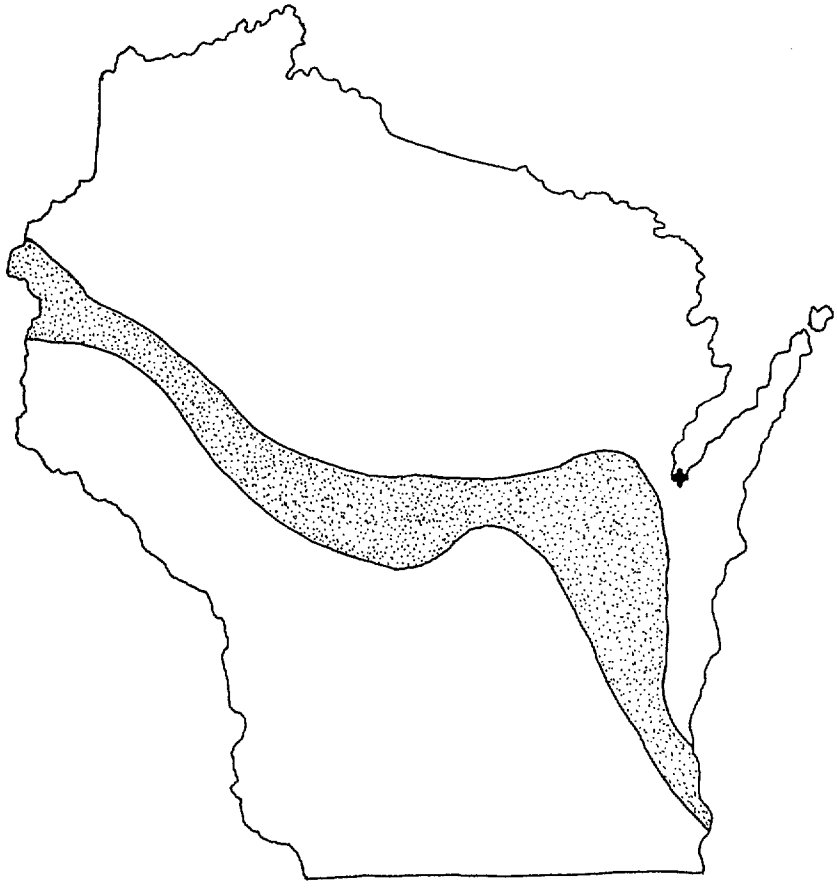
Management decisions should be recorded on such a map and then a documented time schedule for the work required should be drawn up and strictly adhered to during implementation.



Tension Zone

The vegetation of Wisconsin is divided into basically two floristic provinces. The Southern Prairie-Forest Province and the Northern Hardwood Province. Where these two provinces meet, a narrow band called the Tension Zone is formed. The Tension Zone is a boundary marked by the northern and southern range limits of many species of plants. The Tension Zone falls across most of western and southern Brown County. Within Brown County, 42 plant species attain their range limits. Although the northern and southern provinces are quite distinct, the Tension Zone contains species common to both of them. For this reason, the vegetation of Brown County is quite diverse and contains communities which may be classified in the Northern Hardwood Province or Southern Prairie-Forest Province, or Tension Zone.

Although the Sanctuary is not within the Tension Zone, (located just east of the Tension Zone - Map 14) it is close enough to be affected by those climatic factors which delineate the location of this zone.



MAP 14

LOCATION OF TENSION ZONE

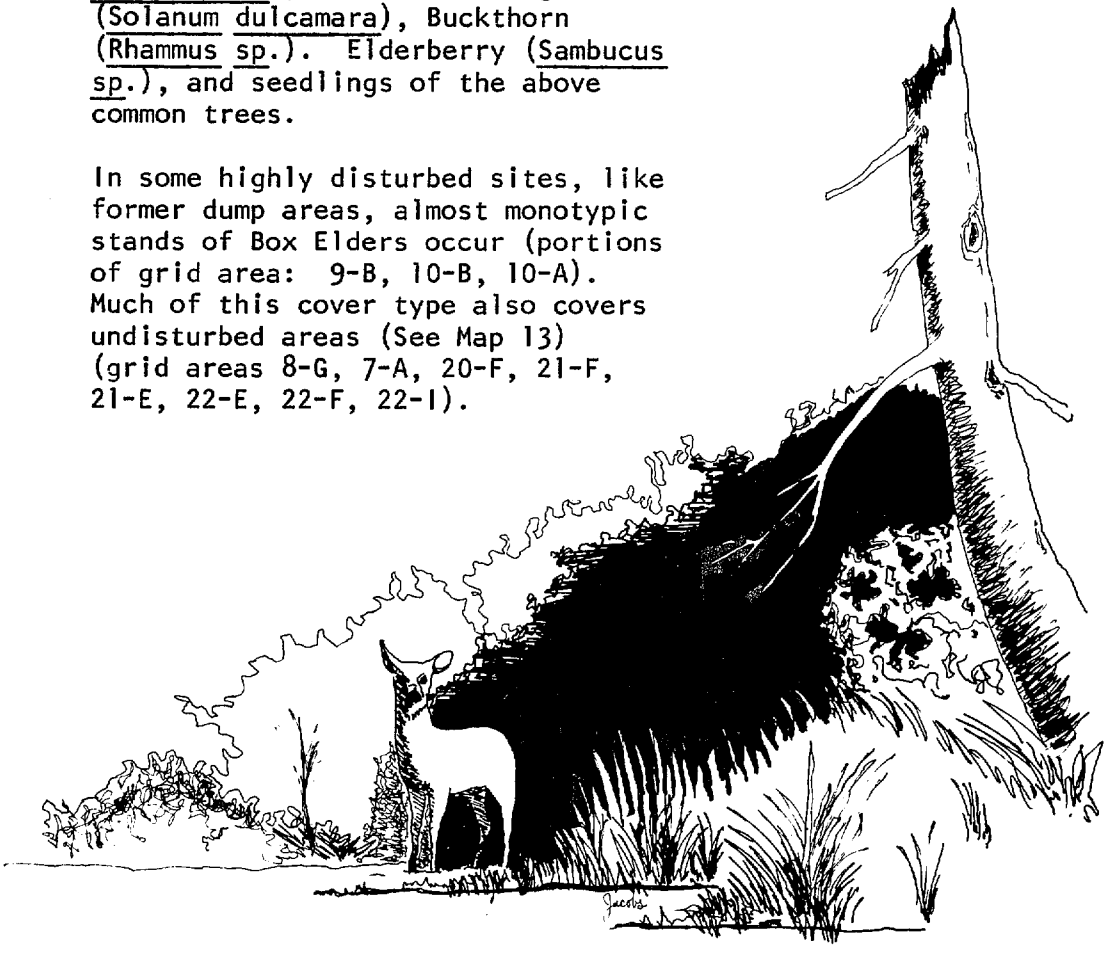
Vegetation Cover Type

The vegetation cover types for the Sanctuary have been categorized into seven types and mapped (Map 5). (For directions on reading grid maps see Appendix S) Not all of these seven types are "pure" plant communities which fall into a specific category described by John Curtis; however, some do fit nicely into his categories.

1. Hardwood Forest

Most of this forest compares favorable to a Southern Lowland Wet Hardwood Forest described by Curtis (Appendix D). The most common trees are: Cotton (Populus deltoides), Black Willow (Salix nigra), Box Elder (Acer negundo), Green Ash (Fraxinus pennsylvanica), Silver Maple (Acer saccharinum). Several cottonwood trees were sampled for age. Growth-ring counts showed most of the cottonwoods (the largest tree) were between 35 and 50 years old. No very old stumps were found. Few, if any, trees are believed to be over fifty years old on the Sanctuary site. The most common plants in the understory are: Red Osier (Cornus stolonifera), Bittersweet Nightshade (Solanum dulcamara), Buckthorn (Rhammus sp.). Elderberry (Sambucus sp.), and seedlings of the above common trees.

In some highly disturbed sites, like former dump areas, almost monotypic stands of Box Elders occur (portions of grid area: 9-B, 10-B, 10-A). Much of this cover type also covers undisturbed areas (See Map 13) (grid areas 8-G, 7-A, 20-F, 21-F, 21-E, 22-E, 22-F, 22-I).



Approximately 51.5 grid areas or 127.21 acres (36.3%) of the Sanctuary's 350 acres are covered with this vegetation cover type.

2. Park Area

This cover type is highly managed by man and is characterized by mowed lawns (Kentucky blue grass) with shade trees of various species planted throughout (Cottonwood, Silver Maple, Linden, (Ash, etc.). Approximately 12 grid areas or 29.64 acres (8.5%) of the Sanctuary are covered with this vegetation cover type (portion of grid areas: 3-B, 6-B, 7-B, 10-C)

3. Evergreens

This cover type consists mostly of planted White Spruce (Picea glauca), Norway Spruce (P. abies), and Blue Spruce (P. pungens), and Red and Austrian Pine (Pinus resinosa and P. nigra). Approximately 1.3 grid areas or 3.21 acres (.9%) of the Sanctuary are covered with this cover type (portions of grid areas: 4-C, 1-D, 12-E).

4. Cattail Marsh

This cover type consists almost entirely of Cattails (mainly narrow-leaved, Typha angustifolia). These remnant cattail areas are one of the few Sanctuary areas that have not been altered by man. Approximately 9.7 grid areas or 23.96 acres (6.8%) of the Sanctuary's 350 acres are covered with cattail marshes (portions of grid areas: 12-H, 13-H, 14-G, 18-E).

5. Invasion Species

In highly disturbed sites with very poor soil (former dump sites and wood chip dumps) only very hardy plants can live. The most common plants growing in this cover type are: Giant Ragweed (Ambrosia trifida), Stinging Nettle (Urtica dioica), Mullein (Verbascum thapsus), White and Yellow Sweet Clover (Melilotus sp.), Bedstraw (Galium sp.) and many non-native "weed" species. Approximately 11 grid areas or 27.17 areas (7.7%) of the Sanctuary are covered with invasion type vegetation (portions of grid areas: 11-B, 12-B, 13-B, 14-C, 15-C, 15-D).

6. Open Fields

The most common plants growing in this cover type are: grasses, Asters (Aster sp.) and Goldenrods (Solidago sp.). Two areas along Danz Avenue have been used as landfill sites and have been capped with clay and planted with grass.

Open field areas cover approximately 25 grid areas or 61.76 acres (17.6%) of the Sanctuary (portions of grid areas: 15-F, 15-G, 15-H, 14-I, 17-G, 17-H, 17-I, 18-G, 18-H, 18-I, 19-G, 19-H, 19-I).

7. Shrub- Carr

This cover type also fits a basic plant community described by Curtis. The most common plants in this cover type are Red Osier (Cornus stolonifera) and Sandbar Willow (Salix interior). Approximately 7.5 grid areas or 18.52 acres (5.3%) of the Sanctuary is covered with this cover type (portions of grid area: 10-H, 11-H, 15-D, 19-E, 20-E).

Water

Water covers approximately 23.7 grid areas or 58.66 acres (16.8%) of the surface area of the Sanctuary. This water is in two "forms": permanent ponds (lagoon system) - 23 grid areas or 56.81 acres (16.3%), and temporary ponds - .7 grid areas or 1.85 acres (.5%) of Sanctuary area. The temporary ponds contain water most of the year but sometimes dry up in late summer. Temporary ponds occupy portions of grid areas: 15-E, 15-F, 14-G, 14-H, and 16-D. The lagoon system occupies much of grid areas: 1-13, B-F.

Undisturbed Areas

Map 13 shows the location of highly disturbed, moderately disturbed, undisturbed and possible undisturbed, sites on Sanctuary land.

1. Highly Disturbed Areas
These are areas that have been used for waste dumps, chip dumps, or landfill sites. They have very poor soil and poor plant diversity. They require extensive management and probably the addition of soil. Specific sites should be left unaltered and monitored carefully to document the time required for a soil to form and natural plant succession to take place (it may require 50 or more years). Most of these areas should be used for demonstration plots, management and topography experimentation, building or other facility sites. There are 47 grid areas or 116.09 acres (33.3%) of the Sanctuary in this type of area.

2. Moderately Disturbed Areas
These are areas that have been altered by man, usually to "improve" them for one reason or another. They include mowed lawns, evergreen plantings, dredged lagoons and ponds, and other areas. These areas should continue to be managed to maintain a diversity of plants and animals. Native plant species should be planted instead of domestic or ornamental plants. There are 55.7 grid areas or 137.62 acres (39.3%) of Sanctuary in this type of area.

3. Undisturbed Areas
These are areas that have not been disturbed or altered by man. They have been allowed to evolve normally. These natural areas are composed mostly of two plant communities; Cattail Marsh and Southern Lowland Forest. It is recommended that these areas, since they are so valuable and relatively uncommon, be allowed

to remain natural and that no management be done to them. Approximately 33 grid areas or 81.47 acres (23.3%) of the Sanctuary are contained in this type of area.

4. Possible Undisturbed or Very Slightly Disturbed Areas
It is difficult to determine if these areas had been disturbed or altered by man. These areas should also be left unaltered or unaffected by man. Approximately 6 grid areas or 14.82 acres (4.2%) of the Sanctuary fall into this category.

Summary

There is both a variety and an abundance of wildlife at the Sanctuary because:

1. Immediate Availability of Water
Water is necessary for all life. The availability of water both in the lagoons and in the adjacent Bay help to attract and retain wildlife in this area. Water also adds another environment for wildlife.

2. Several Different Habitat Types
Diversity of habitat is necessary for diversity of plant and animal life. The Sanctuary has at least six very different habitat types: hardwood forest, flat open fields, evergreens, brush, ponds, and cattail marshes.

3. Extensive Edges
"Edge" is the habitat zone where two ecosystems meet (i.e. shorelines - water meets land, or edge of woods and field). Studies have shown that these edge areas are high in diversity and numbers of wildlife. The Sanctuary has many long, meandering habitat edges.

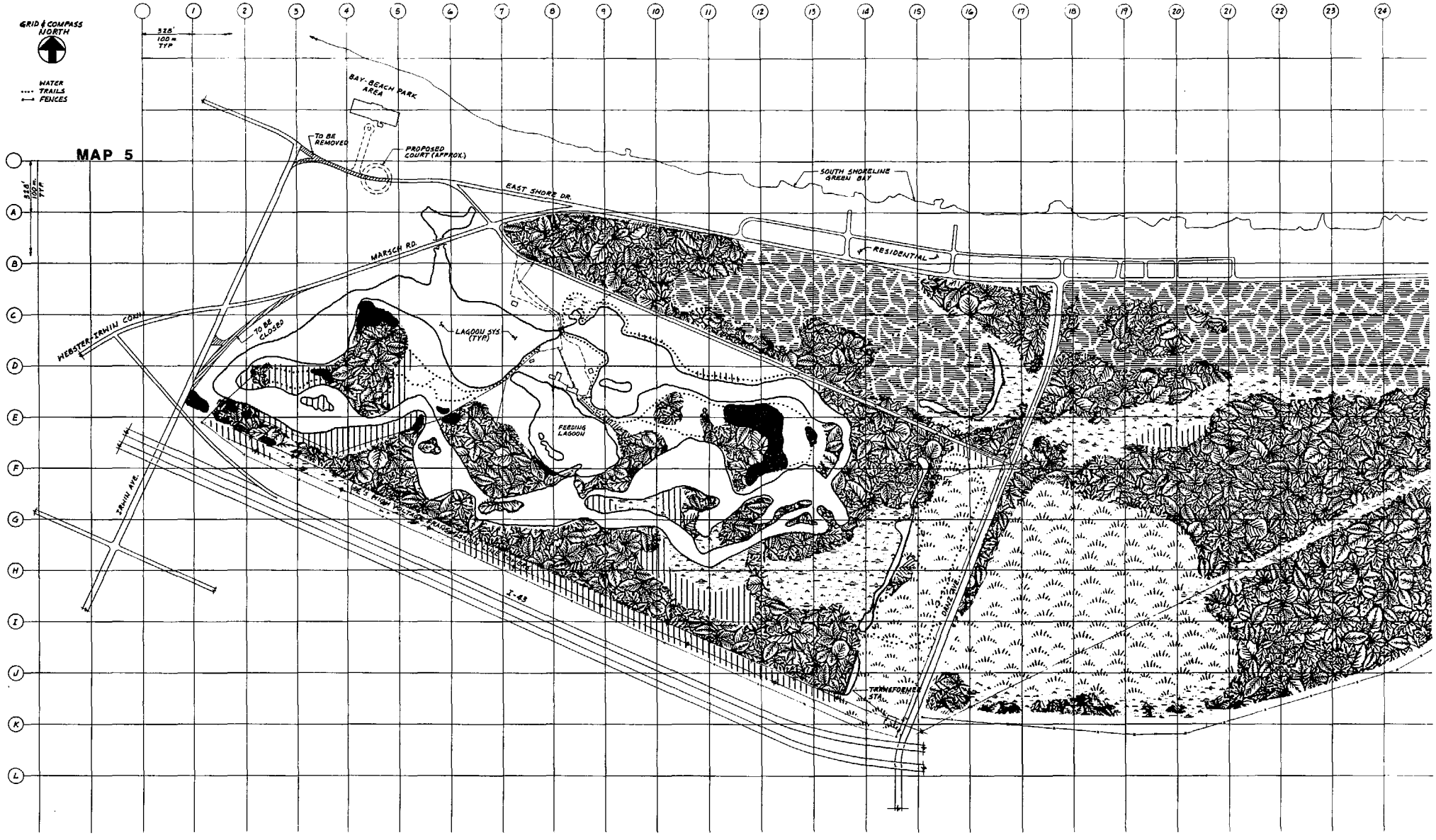
4. Many Plant Habitats In Early Stages Of Succession
Most of the habitats are just developing - going through various stages of succession. Studies have shown that these stages are generally more productive in numbers and diversity of wildlife than "climax" stands.

5. Excellent Location In a Coastal Area Along a Major Migration Route
The bay of Green Bay is a natural leading edge or funnel for migrating birds and insects. Also these travelers often deposit seeds from other areas increasing the diversity of plant life at the Sanctuary. The surrounding urban area helps to channel wildlife into the Sanctuary.

However, the Sanctuary does lack two important factors which help create good habitats:

1. Topography
Most of the Sanctuary is flat with little or no relief. Some of the dump sites might be good areas to landscape and create topography.

2. Rich Soils In Some Areas
Former dump sites will probably require the addition of soil.


GRID & COMPASS NORTH
WATER
TRAILS
FENCES
MAP 5
328' 100 m TYP
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
RESIDENTIAL
MARSH RD.
WEBSTER-TAYLOR CONN
TO BE CLOSED
LAGOON SYS (TYP)
FEEDING LAGOON
TAYLOR AVE.
I-43
TRANSFORMER STA.

Map 5

Vegetation Cover Types (See explanation in text)

Hardwood Forests - 51.5 grids or 127.21 acres, 36.4% of Sanctuary

(no shading)

Park Areas - 12 grids or 29.64 acres, 8.5% of Sanctuary

Evergreens - 1.3 grids or 3.21 acres, .9% of Sanctuary

Cattails - 9.7 grids or 23.96 acres, 6.8% of Sanctuary

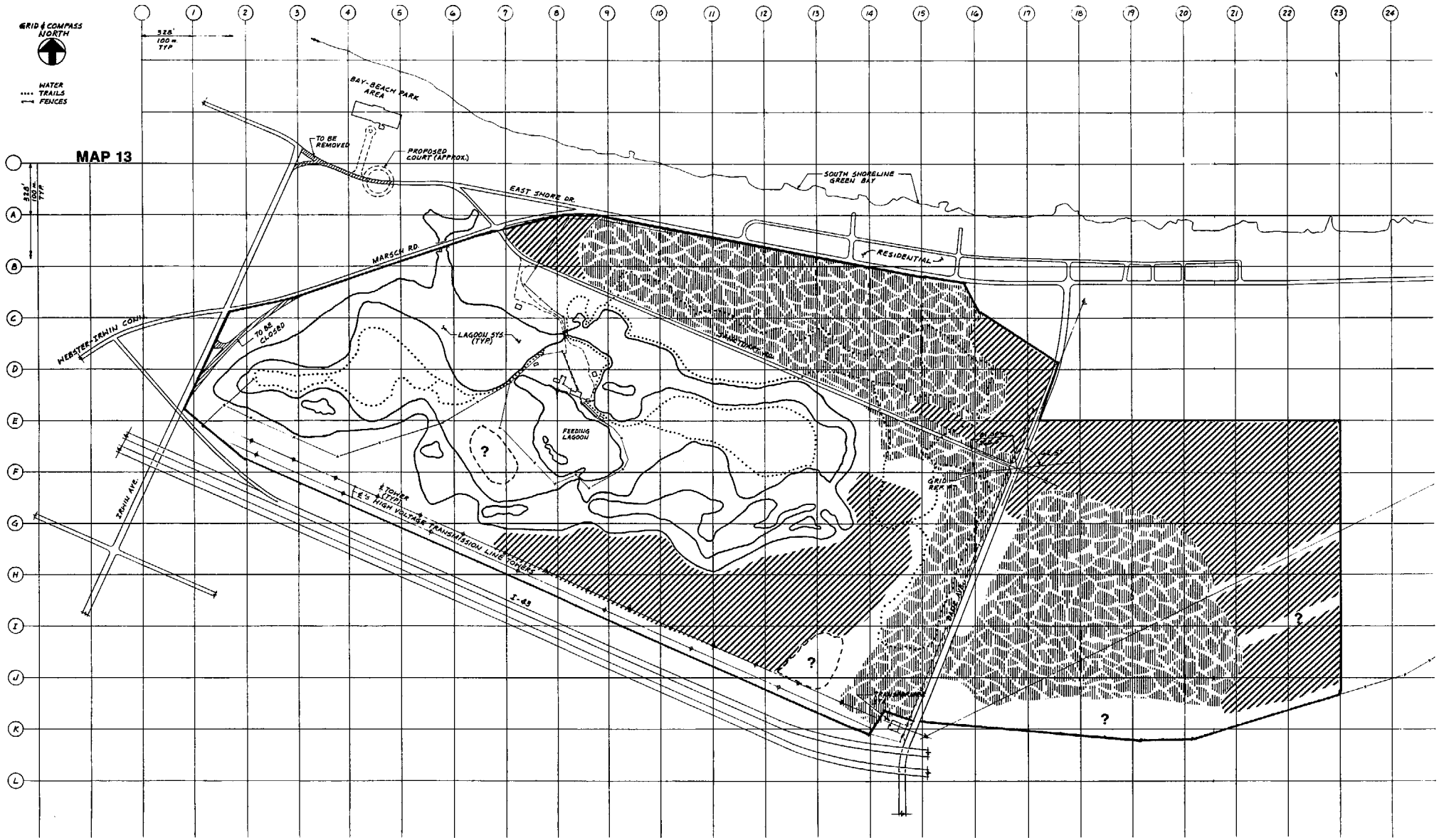
Invasion Species - 11 grids or 27.17 acres 7.7% of Sanctuary

Open Fields - 25 grids or 61.76 acres, 17.6% of Sanctuary

Shrub - Carr - 7.5 grids or 18.52 acres, 5.3% of Sanctuary

Water (ponds - lagoon) - 23.7 grids or 58.66 acres, 16.8% of Sanctuary

Total of 141.7 grids or 350 acres


GRID & COMPASS NORTH
WATER
TRAILS
FENCES
MAP 13
328' 100 m. TYP
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
MARSCH RD.
RESIDENTIAL
WEBSTER-IRWIN CONN.
TO BE CLOSED
LAGOON SYS (TYP)
FEEDING LAGOON
IRWIN AVE.
TOWER
I-43
?

Map 13

Disturbed - Undisturbed Areas on Sanctuary

Key

Extent of Area Covered in Master Plan

Highly disturbed - waste dumps, chip dumps or landfill sites, 47 grid areas or 116 acres, 33.3% of Sanctuary land.

(no shading) Moderately disturbed - lawns, nursery, introduced plantings, dredged areas, 55.7 grid areas or 137.62 acres, 39.3% of Sanctuary land.

Undisturbed - natural vegetation, mostly cattail and southern lowland forest, 33 grid areas or 81.47 acres, 23.3% of Sanctuary land.

? Possible undisturbed or very slightly disturbed - 6 grid areas or 14.82 acres, 4.2% of Sanctuary land.

Animals

Microscopic Organisms and Other Invertebrates

Although microscopic organisms were not studied for this master plan that does not mean they are not important, or that it is not acknowledged that they are important; they are. They provide the basic units which make up the beginning of many food chains.

Among the soil's inhabitants are specialists that decay organic matter, transform nitrogen, build soil tilth, produce antibiotics, and otherwise affect plant welfare.

The open water is a world of minute suspended organisms, the plankton. Dominant are the phytoplankton, among them the diatoms, desmids, and the filamentons green algae. Suspended with the phytoplankton are the animal, or zooplankton organisms, which graze upon the phytoplankton. These animals form an important link in the energy flow in the aquatic habitat. Most characteristic are the rotifers, copepods and cladocerans. Some aquatic invertebrates have been used as indicators of water quality.

Microscopic organisms are very important in recycling nutrients and making them usable to larger animals and plants.

Larger invertebrates such as worms, clams, slugs, snails, crayfish, spiders, mites,centipedes and millipedes are also very important but often overlooked or taken for granted. A partial list of these animals is found in Appendix E.

Insects

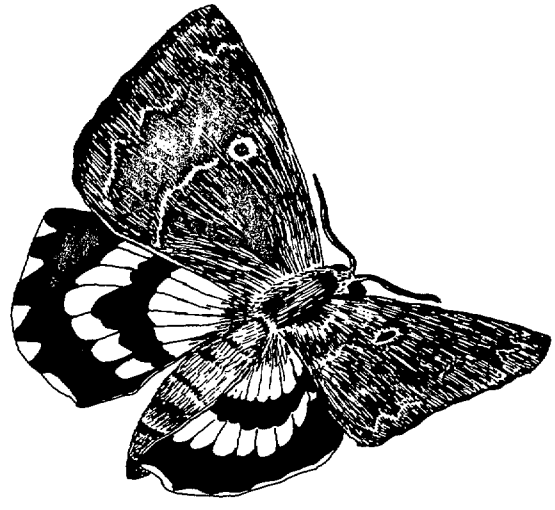
The insects are the dominant group of animals on the earth today. They far surpass all other terrestrial animals in number, and they occur practically everywhere. Several hundred thousand different species have been described throughout the world - three times as many species as there are in the rest of the animal kingdom.

The Sanctuary has its share of insects, 12 orders and 47 families of insects have been identified at the Sanctuary, and this represents only an initial investigation. (This partial list is found in Appendix E.)

Insects also are important and necessary. Besides providing food for many birds and other animals they are an essential element of a balanced ecosystem and should not be destroyed simply because they become a nuisance during some seasons.

Except for some aquatic invertebrate sampling and general insect studies, extensive studies of the invertebrates at the Sanctuary have not been done. It is presumed from general observations and the limited studies mentioned above that in many parts of the Sanctuary there are adequate, stable

microscopic and other invertebrate populations. The notable exceptions would be in highly disturbed areas such as dumps, roads and buildings.



Management Recommendations

Little specific management is necessary to maintain a healthy, stable population of these small animals. Some general recommendations are:

1) Continue to allow natural leaf litter, dead trees, etc. to decay in the areas they fall, avoid trying to "clean up" the woods (of course, dead limbs or dead trees which are a hazard to property or human life should be removed.)

2) Avoid using any insecticides, herbicides or other chemicals. These chemicals destroy the micro habitat that the microscopic and other invertebrates live in. (Even heavy use of road salt should be avoided.) Insect repellents (not insecticides) should be used if mosquitoes become a nuisance.

Fish

Fish are important food for many birds (kingfishers, herons, gulls, and mergansers) and some mammals (raccoons, and the otter). They also provide recreation for young people under the age of sixteen (Sanctuary Policy limits fishings to persons under sixteen years old.) Fish are also an important link in recycling aquatic nutrients and a necessary part of the natural aquatic ecosystem.

Surveys of fishermen (creel censuses) taken in Fall of 1979 and the Spring of 1980 (Appendix E, Table 1) showed that fishing was a popular sport, that perch averaging 6 1/2 inches long were the most common fish caught and that about three fish each hour were caught. Spring and Fall were the best seasons to fish but general observations show many fishermen use the Sanctuary during the Summer also.

On October 19, 1979 a DNR fish shocking crew conducted a survey of two Sanctuary lagoons; the front lagoon where fishing is allowed and the feeding lagoon where no fishing is allowed. (Appendix E, Table 2) Electric shocking will only bring up about 40% of the fish.

Size, type of fish and water depth all influence the results of the shocking. Perch were the most common fish shocked. Carp and bullhead were less common than expected but this was probably because the shocking was done late in the season and many of these fish were in deep water. The smallmouth bass was unexpected. The numbers, sizes, and different species of game fish are indicators that the lagoon systems are supporting a healthy aquatic ecosystem.

In addition to the fish listed in Appendix E, white bass (Roccus chrysops), burbot (hota lota lacustris) crappie (Pomoxis sp.), northern pike (Esox lucius) and largemouth bass (Micropterus salmoides) have been reported in the Sanctuary lagoons in the recent past.

Fish Management

Fish management is closely linked with water quality management and the recommendations made in the water section would also pertain here.

Additional general recommendations would be:

1) Retain present fishing area without expanding it.

2) If rough fish are eliminated, consider planting largemouth bass as a gamefish in the lagoons to keep panfish numbers in check.

Amphibians and Reptiles

A complete list to date of reptiles and amphibians is found in Appendix E.

The only reptiles that are really common at the Sanctuary are garter snakes (Thamnophis sp.), and painted turtles (Chrysemys picta). Snapping turtles (Chelydra serpentina) are fairly common. Several Blanding's turtles (Emydoidea blandingi) have been found in recent years but these are probably the ones that have been released on site.

The American toad (Bufo americanus) is the most common amphibian and is found throughout the Sanctuary. Salamanders have been released on site but none have been found. Since they are very secretive they may occur without being noticed.

Management Recommendations

Maintain temporary ponds, decaying logs, brush piles, logs in water, and a deep woods to provide adequate habitat for reptiles and amphibians.

Birds

Probably the most attractive resource at the Wildlife Sanctuary is its birdlife. The general location of the Sanctuary along the shore of Green Bay, which is a good migration route, and the variety of habitats present, attracts many migrant and breeding birds. The Sanctuary's location in the middle region of the state means that occasionally birds are observed which are more typically seen north or south of this area. Spring is the best time of year for birding at the Sanctuary. Appendix G has a complete list of the Sanctuary birds and the status of each.

During May, June, and July of 1980 a detailed study of the migrant birds, breeding birds, and summer residents (birds present but not known to be nesting) was done at the Sanctuary to update the extensive general observations from the last 10 years. The migration study determined birds that migrate through the Sanctuary and areas where they concentrate. For the breeding bird survey the Sanctuary was systematically covered from May 29 through July 12. Early morning surveys of singing territorial males along with general observations of bird activity were compiled to determine birds that nest, and those that are summer residents.

Through the past 10 years the Sanctuary has recorded 218 of 370 bird species that have been recorded as migrants or residents in Wisconsin. Included in the Sanctuary list are several birds rarely seen in Wisconsin. The recent breeding study has established new breeding and summer resident records for the Sanctuary and Brown County.

Management Recommendations

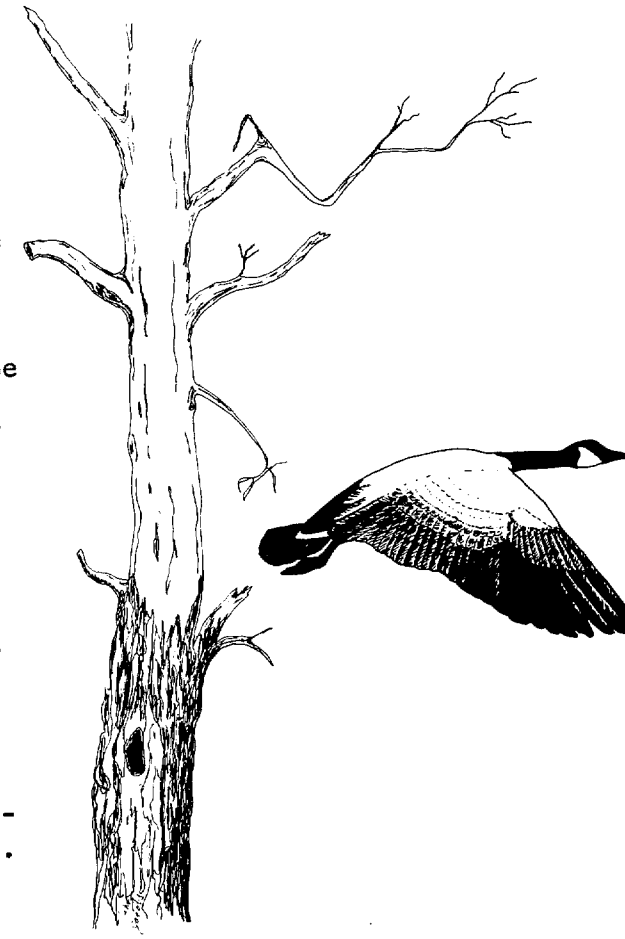
Continue to provide as many different habitat types and "edge" habitats as possible, as recommended in the vegetation section. Maintain refuge or restricted area under present policy.

Waterfowl

The main purpose of the Sanctuary is to provide a waterfowl refuge, and therefore, the waterfowl flock is the most important resource the Sanctuary has. Most Sanctuary visitors come to see and feed the waterfowl. This feeding program draws many people back to the Sanctuary several times a year, year after year.

About 3,000 waterfowl winter at the Sanctuary; 650-700 Canada geese and 2,400 ducks (2,000 mallards, 400 black ducks and about 20 individuals of other species of waterfowl). About 650 Canada geese summer at the Sanctuary along with about 300 mallards. The influx of migrating waterfowl greatly increases these numbers during Fall (Appendix H and I).

The Sanctuary presently has approximately 650 Canada geese as permanent residents. During Fall additional migrants increase the flock to as many as 1,400. The Sanctuary flock is the nucleus for the Canada geese nesting in the lower Bay. In the Summer of 1978, over 105 pairs of Canada geese nested in the lower Bay. Sixty-five pair of geese nested at the Wildlife Sanctuary; twenty pair nested at Barkhausen Game Reserve; and another twenty pair nested on the islands and shore of the lower Bay and in the East River marsh. The lagoon system with its long, irregular shore line and several small islands gives the Sanctuary a large amount of water-land edge. The geese prefer to nest along the shore less than nine feet (3 meters) from the shore. The large amount of "edge" gives the Sanctuary a good number of possible goose nesting sites. Thirty-four artificial nesting platforms called "ganderlanders" provide additional nesting sites. Approximately 65% of these were used by geese in 1978. The population of geese at the Sanctuary has increased significantly each year for the last five years. (Appendix I).



Management of Geese

The most unique wildlife the Sanctuary has is the Giant Canada goose. Only five other areas in Wisconsin have a breeding population of Canada geese, and only three other areas in Wisconsin have wintering populations. Green Bay has the Northernmost wintering Canada goose population in the Midwest. The Sanctuary should strive to maintain a large, healthy flock of Canada geese. But it really does not need to maintain a permanent flock larger than 700 geese. A flock larger than 700 will cause too great of an impact on the limited resources of the Sanctuary, especially the water quality in the lagoons. A flock too small will not provide as large a gene pool and might cause inbreeding problems. It also would not attract as much attention and positive public relations for the Sanctuary.

To stabilize the resident goose population at 700 the following alternatives have been proposed:

1) Alter local hunting season
2) Ration food (corn) during winter
3) Alter management of grazing areas
4) Hazing program

Alternative 1 - Alter hunting season.

The present local hunting regulations are set up to favor the local goose population. Since most of the local geese remain in the Green Bay area year round, a shorter season prevents excessive harvesting of the local population. A longer season would increase the harvest of the Sanctuary Geese. Should a need arise to lower the goose population, lengthening the season is one possible way.

Alternative 2 - Ration food (corn) during winter.

In the past three feeders provided almost an unlimited supply of corn for the geese at the Sanctuary. One method to limit corn available would be to place a predetermined amount of corn in the feeders daily; approximately 300 lbs. per day. The only additional food would be the corn people purchase at the Nature Center. The amount of corn put into the feeders could be reduced appropriately so that the daily amount of corn remains controlled and about the same each day. Limiting food would encourage the geese to forage outside the Sanctuary more and reduce the stress on the limits of the Sanctuary. It may even encourage more to migrate south for the winter.

Alternative 3 - Alter management of grazing areas.

Canada geese are basically grazers. They prefer large, open, short grass areas near water for feeding and resting during spring, summer, and fall. Creating less or more grazing areas may decrease or increase the flock size or it may alter goose habits.

Alternative 4 - hazing program

A careful hazing program may be necessary to reduce the number of geese using the Sanctuary during fall and winter. Walking near the geese with a large object (a pole or board) is sometimes enough to flush them from the area. A canoe or boat used in the lagoon occupied by geese is very effective in flushing them from the area.

Recommendations

Carefully monitoring the flock is essential to sound goose management. The information gained from an ongoing study begun in 1976 has proven invaluable for management proposals, education programs, public relations, etc. This study (weekly counts, nesting studies) should be continued. If any of the alternatives are to be effective they must be applied carefully, gradually, and consistently and their effects carefully measured. Alternative 2 should probably be the first alternative to be applied, followed by alternative 4 if necessary. Lengthening the hunting season would be unnecessary at this time. It took thirty

years to build up the goose population to its present level and over-hunting could drastically reduce it. More information on goose hunting and its impact on the lower Bay is needed before a decision should be made to lengthen the hunting season.

Management of Other Waterfowl

Mallards

During winter, over 2,000 mallard ducks spend most of the day sitting on the ice or in the open water of the main feeding lagoon at the Sanctuary. The large amount of droppings from these ducks has caused a deterioration of this lagoon. Mallard ducks are not unique or special and have greatly exceeded the carrying capacity for this area. The mallard population should be reduced to approximately 800-1,000 for the overall long term good of the waterfowl flock and the lagoons of the Sanctuary. This number (800-1,000 mallards) was chosen because it is a large reduction in the mallard population to lessen the stress on lagoons, but still large enough to "excite" people coming out to feed the waterfowl, and maintain good public relations.

Recommendations

Alternatives 2 and 4 (ration food during winter, and a hazing program) mentioned under Canada goose management should also encourage a large number of mallards to seek other feeding areas during fall and winter. But these management proposals must be carefully implemented to retain the desired number of ducks.

Wood ducks

The present habitat, 15 wood duck boxes and natural cavities should be adequate to maintain and increase the several pair of wood ducks presently breeding at the Sanctuary.

Blue-winged teal

Several pair of blue-winged teal regularly summer at the Sanctuary. Maintenance of present open field upland areas should provide nest sites for these pairs.

Game Birds

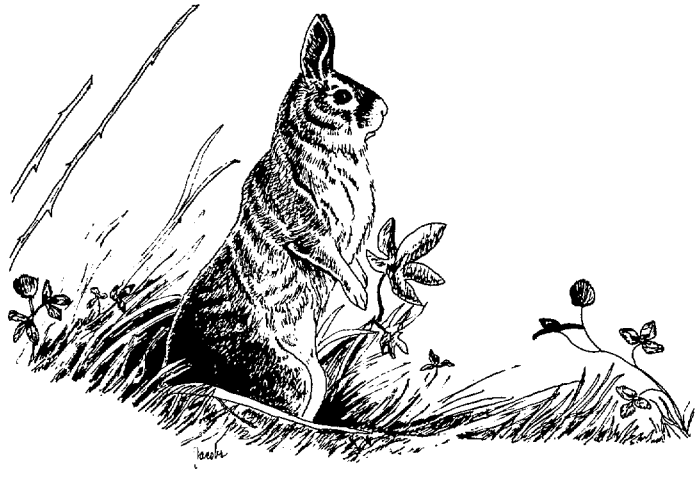
Pheasants, gray partridge,ruffed grouse and woodcock have all been observed at the Sanctuary but except for pheasants, only occasionally. Habitat is the key to maintaining a stable population of any species and there is not enough good habitat for any of the above species. Pheasants may have the most habitat of any of the above at the Sanctuary but it still may not be adequate for maintaining a suitable population. Gray partridge may find suitable habitat in the large open fields on the former Danz Avenue landfill site. More studies need to be done to determine which areas should be modified for game bird habitat.

Mammals

Twenty-eight species of mammals have been identified at the Sanctuary. (Appendix E).

A study of the small mammals was done during the fall of 1979 on most of the Sanctuary habitats (Appendix F and Map 8). This survey involved the use of 50 Sherman live mammal traps set at stations about 10 m. apart (2 traps/station), in a relatively straight line through a habitat area. Traps were baited with peanut butter and trapping was done mainly at night. Most small mammals were trapped alive and released unhurt after being marked. Many mammals were retrapped more than once and raccoons often raided the trap lines in wooded habitats.

Overall the habitats that have been disturbed the least by man's activity had the highest population of native small mammals. Several small mammals such as jumping mice and least weasel were not known to inhabit the Sanctuary before the study was done.



General sight observations and track observations were recorded on medium size mammals such as rabbits, squirrels, woodchucks, muskrat, fox, raccoon and mink. All of the above were found to be common or fairly common. One beaver and one otter (both released on site) inhabited the Sanctuary during 1979-1980. One opposum was found inside a large garbage can at the Sanctuary and released during the Fall of 1979. Occasionally a stray dog or cat becomes a nuisance and is removed by the DNR or City Animal Shelter.

Management

Fox, gray, and red squirrels are all very common at the Sanctuary although there are few oak or other nut trees. Squirrels have not become a serious pest although they do raid bird feeders, and eat small birds and their eggs, especially cavity nesting birds such as woodpeckers and small owls. They have few enemies at the Sanctuary except for great horned owls. No management alternatives have been proposed for squirrels.

Rabbits are a problem from time to time. They reproduce rapidly and can do a lot of damage to the vegetation. Natural predators such as the great horned owl, fox, and weasel have helped to keep them under control.

Recommendations

Natural predators could control most of these game species if allowed to do so. The number of natural predators should be encouraged.

In the past the Sanctuary has released squirrels and rabbits brought in by people who found young or live-trapped adults to protect their flowers or shrubs. But to keep a natural balance, the Sanctuary should continue its present policy of not releasing additional squirrels or rabbits on site.

Deer

A controlled drive to estimate the number of deer on the Sanctuary grounds west of Danz Avenue was conducted on February 7, 1980. The estimated number normally frequenting this area determined by the drive was 18. Deer move back and forth to areas east of Danz Avenue. The perimeter fence somewhat restricts their movements into other areas adjacent to the Sanctuary.

Management

At least seven fawns were known to have been born on the Sanctuary in the Spring of 1980, outside the enclosure containing the exhibit deer. Without natural predators or some method of harvesting, deer will quickly overpopulate an area, consume the food supply and suffer from starvation. Deer have no enemies at the Sanctuary and would quickly overpopulate an area, except

for two factors; illegal poaching and car kills. Poaching has not been a major problem, but approximately two deer were shot in 1978. Car-killed deer are probably the main factor which has kept the deer herd from increasing too rapidly. However, when the Sanctuary completes its 7 foot high, cyclone perimeter fence, car kills will probably not be a factor and the deer will probably overpopulate the Sanctuary very quickly.

Two alternatives for controlling deer at the Sanctuary have been proposed:

1) Shoot some deer each fall
2) Live trap deer and relocate or sell them

Alternative 1 - Shoot some deer each Fall.

Shooting the deer would have adverse public reaction and would involve special permits to shoot them and to discharge a firearm within the city limits.

Alternative 2 - Live trap deer and relocate or sell them.

Deer would be attracted to large corralled areas with apples, salt or some other attractant and then a gate closed on them. The DNR would then be requested to relocate or dispose of some of them.

Recommendations

Alternative 2 is the most feasible and it would probably be necessary to use this method every year or every other year. Maintaining suitable brouse habitat is also recommended so the Sanctuary can support an adequate deer herd.

Predator Control

Three alternatives for predator control have been proposed:

1) Make every attempt to trap, kill or remove all predators from the area.
2) Make no attempt to remove any predators.
3) Selectively remove only problem predators.

Alternative 1 - Make every attempt to trap, kill or remove all predators from the area.

Predators kill ducks and geese and therefore have no place at a refuge or Sanctuary. This has been the policy of most game farms and refuges in the past. The Sanctuary had, in the past, also made an effort to remove most predators.

Alternative 2 - Make no attempt to remove any predator.

The philosophy for this alternative is that predators are a natural part of the ecosystem; they are territorial and limit their numbers naturally; they do not just eat game species but help to keep a balanced ecosystem.

Alternative 3 - Selectively remove only problem predators.

The philosophy for this alternative is similar to the one above. Predators are basically good for the ecosystem but occasionally one becomes a nuisance and must be destroyed, or live trapped and relocated. This is the present Sanctuary policy.

Recommendations

Since the Sanctuary is not a totally natural area undisturbed by man alternative three is probably the most feasible alternative. A problem arises in determining when a predator is a real "problem" and can the "problem" predator be destroyed without destroying "innocent" predators. Live trapping and relocation is recommended over destroying problem predators.

Pests

Mice and rats are a serious pest from time to time at the Sanctuary.

Three methods of control have been proposed:

1) Poisoning
2) Trapping
3) Removing all sources of food.

Alternative 1 and 2 - Poisoning and Trapping.

Poisons and traps are only temporary relief measures. Within a short period of time, the rats and mice learn to avoid the traps and poisons. These two methods get results quickly, but the remaining rodents reproduce quickly and replenish the population. Poisons and traps could occasionally kill non-target animals.

Alternative 3 - Remove all sources of food.

To ensure that no food is available to the rats and mice, the following procedures should be followed:

1) Keep all possible food sources in rodent proof containers or cabinets.
2) Bring in all animal food uneaten by caged animals at the end of the day. Nocturnal feeders might have to adjust their eating habits.
3) Bring in, close, or cover all small bird and goose feeders.
4) All other feeders, such as deer feeders, should be constructed so that rats and mice are unable to climb to the food.
5) Do not place any animal food (apples for deer, etc.) on the ground, except the corn that the public feeds the waterfowl.

Recommendations

The Sanctuary presently uses a combination of poisons, traps, and removing sources of food. This control program is fairly effective, but could be more effective. Additional research is needed to develop a more effective rodent control program at the Sanctuary.

Introducing New Species

Should species not presently living at the Sanctuary be introduced into the area? A number of questions should be considered with D.N.R., Fish and Wildlife Service and other wildlife professionals before any attempt is made to introduce a new organism (plant, animal, virus).

1) Is this organism native to this area?
2) Can the area adequately support this organism?
3) Will it become a pest, overpopulate, compete, or destroy any of the other species at the Sanctuary?
4) Will this organism be a welcome new addition to the Sanctuary? How will the public react to the new species?
5) Have all legal matters been explored?

THE HUMAN ELEMENT

History

The earliest reference to the Green Bay region and its inhabitants is found in Pere Vimont's brief accounts of Jean Nicolet's expedition to the Winnebagoes, found in the "Jesuit Relations" of 1640. But much earlier vague reports had reached Quebec concerning La Baye (Green Bay) and the strange people living on its shores, a tribe not of the Algonquin stock nor speaking any of the various dialects. They were called Puants or Winnepegoes, which was freely translated by the French into "stinkards" or "men of the salt sea". Governer Samuel de Champlain of New France (now Canada) fancied this strange people as being Chinese and hoped to find the passage to China. Thus Jean Nicolet and later many others, including voyaguers and missionaries, were sent to explore the Northwest and take possession of the territory discovered in the name of the King of France, Louis XIII.

Because of the numerous tribal warfares, migrations, and white settlement expansion, various tribes had at one time or another camped along the Bay for indefinite periods of time up until 1800. Many of the Native American tribes were agriculturalists. The area which is now Brown County was heavily populated with these tribes. Remoteness from the Iroquis and Sioux, along with an abundance of food made this area desirable for these more peacefully inclined tribes. Early voyaguers wrote of the richness of the land. Extensive marshes edging the bay and its thick water growth was prime habitat for various animals. Migratory waterfowl used the area extensively. The area was excellent for hunting and fishing.

The Indian women harvested wild rice which grew along the shores of the Fox River and its tributaries.

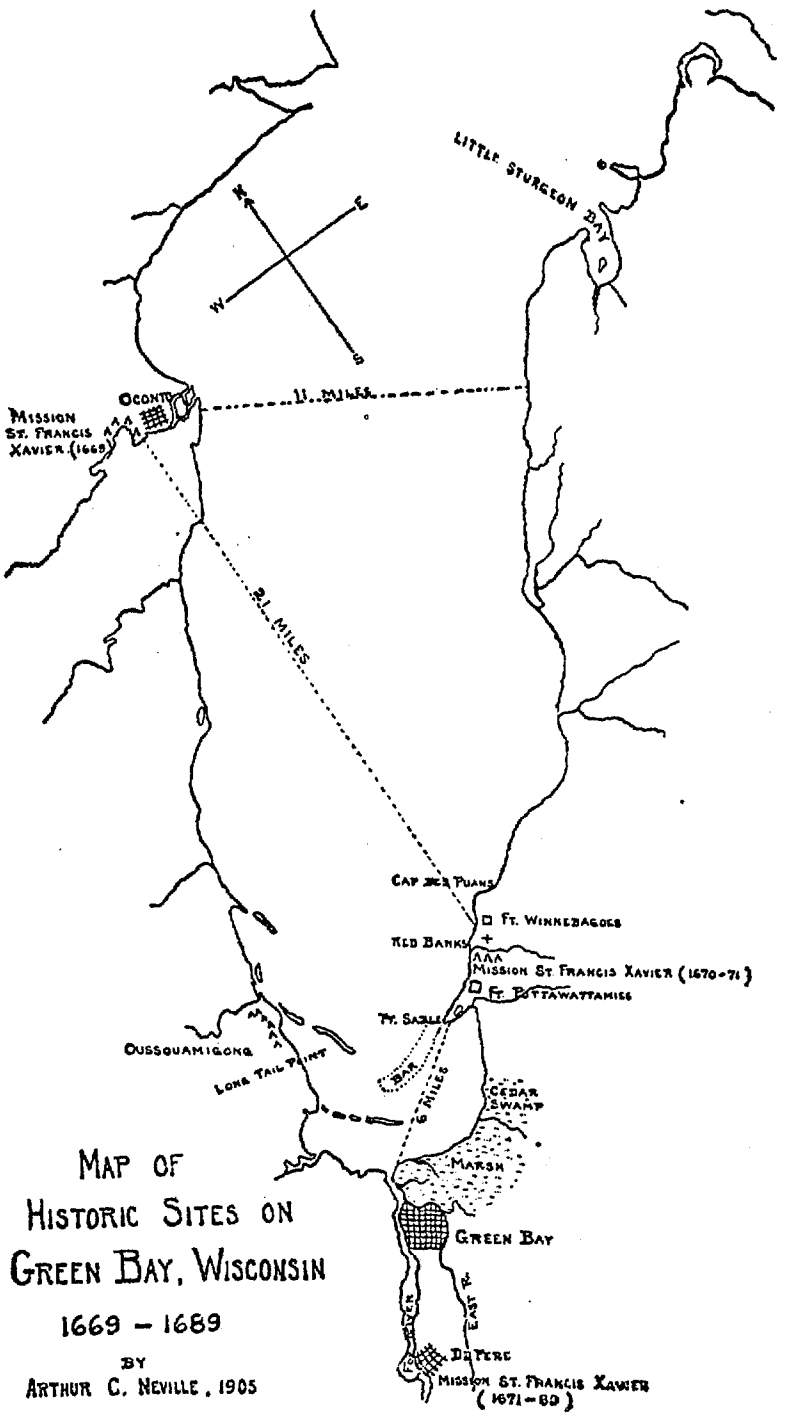
The first definite knowledge of the location of the various tribes along the shores of Green Bay and the Fox River was found in the Journal kept by Father Claude Allouez of his voyage from Sault Sainte Marie to Green Bay in 1669 (Map 4). The earliest records locate the various tribes as follows:

The Pottawatomies occupied the greater part of the east shore of Green Bay. They also had a village at the mouth of the Big Suamico on the west side of the Bay. The Winnebagoes (Paunts) were camped on or near Red Banks and Pointe Au Sable on the east shore of the Bay. On the northwest side of the Bay and on the river of the same name, lived the Menominees. The principal village of the Sauk was on the Fox River.

With the advancement of white settlers in the 1840's, the Indians either dispersed to western territories or were placed on reservations.

The Bay shore just east of the mouth of the Fox River was a very popular swimming beach during the late 1800's and early 1900's (Bay Beach Park). In 1939 the State Board of Health declared the area unsafe for swimming because of the water pollution and closed the beach. During the late 1920's and 1930's, land adjacent to the beach was used by recreationists. A large roller coaster was the main attraction. The land presently the Bay Beach Wildlife Sanctuary was a low wet sedge meadow and was not developed. The entire Sanctuary area is in the flood plain of Green Bay and was therefore susceptible to frequent flooding.

No Archaeological Sites (Indian villages - early settler's cabins, etc.) have been found on Sanctuary Property.



Map 4

(reprinted from Green Bay Historical Bulletin Vol. 2)

The Development of the Sanctuary

The City of Green Bay purchased 200 acres of "marsh" land from John Marsch in 1929. This tract of land was only several hundred yards away from the Bay waters and separated from the Bay by a public road (County Highway A). Plans had been made to develop this area into a lagoon system and golf course but were never carried out. The history of the Bay Beach Wildlife Sanctuary begins in the fall of 1935.

Well situated in the Mississippi Flyway, Green Bay should have seen numerous migratory waterfowl in the late 1920's, but there were few. Much of the natural waterfowl habitat was disappearing at an alarming rate; through years of marshland drainage, over-development, hunting, and a drought in the 1930's. Chester Cole, a local biology teacher and conservationist, was concerned with increasing the scarcity of waterfowl, breeding grounds, natural food and resting sites. Realizing something needed to be done, Mr. Cole contacted a number of conservationists and outdoor enthusiasts who might be interested in developing a wildlife sanctuary. Individual experts on waterfowl and various wildlife agencies were consulted. In 1935, after several meetings with the City Park Board (lawnowners), permission was granted to develop an experimental site with a small lagoon. The property was known as Bay Beach Marsh, which Mr. Cole invisioned eventually as a 200 acre wildlife sanctuary. The area was well situated and would attract not only waterfowl and other wildlife, but provide a place for area residents to study and enjoy wildlife under natural conditions.

During the fall of 1935, Chester Cole, his father C. F. Cole, Lyle Kingston and Judge Henry Grass, dug a small pond by hand and put out feed to see if ducks could be attracted to the site. Waterfowl did use the small pond. Further development was delayed due to lack of funds. It was decided that to organize a club was the best way to promote the program. A club known as the Bay Beach Wildlife Sanctuary, Inc., was organized in 1936. A 50¢ membership was charged to raise initially needed funds. Club members were constantly on the lookout for donations of money, excavating equipment, feed, labor, or anything useful to the development of the project. The first ponds were small and dug with hand tools, but they were enlarged when help came in the form of NYA appropriations (National Youth Administrations). A crew of NYA men, supervised by Blake Posey, began work in 1936. The NYA hand dug a small pond and a meandering stream, planted trees and shrubs, and built a duck coop and tool shed. Later, when ducks began to stop, they cared for sick and wounded waterfowl.

Due to the lack of heavy equipment, the project proceeded slowly. Club members began a new membership drive and solicited funds and donations of heavy equipment. The Brown County Highway Commission sent a caterpillar. Northwest Engineering Company of Green Bay decided the project would be a good testing area for their new equipment. Ed Schuster of Denmark agreed to supply a dragline and operator if the club would pay for gas, oil, and half of the repairs to the equipment.

A small WPA (Work Projects Administration) project was started to assist and handle the trucking and leveling of dirt, resulting in a 280' by 300' pond, 7 feet deep.

Except from a financial standpoint, the Sanctuary at this time was beginning to take shape. In an effort to create more enthusiasm among Green Bay residents, Chester Cole conducted a series of 25 weekly broadcasts on WTAQ Radio about wildlife and conservation, always promoting the Sanctuary.

In 1936 the Green Bay Park Board directed Mr. L. Earl Foglesong, Park Superintendent, to consult Aldo Leopold about developing a waterfowl sanctuary.

In 1937 the Sanctuary was far enough along to enter national competition for the 1937 "National Waterfowl Refuge Contest", sponsored by 'More Game Birds in America, Inc.'. The Sanctuary placed fourth; receiving a silver trophy and $50.00 for their treasury.

In an effort to continue work and pay accumulating debts, a publicity campaign to raise funds was undertaken during 1937, 1938, and 1939. Numerous donations were received, both in terms of money and materials. In connection with Wildlife Restoration Week, the club put on a stamp sale to raise money for development. With the money earned and through donations, the club was able to pay off all excavating costs, fencing, building materials and miscellaneous expenses, which amounted to about $1,800.00.

In order to increase the number of ducks, club members began raising ducklings from eggs. In 1938, Louis Barkhausen gavé six Canada Geese to the Wildlife Sanctuary from his private refuge on the west shore of Green Bay, and in 1939 he gave three more geese to the Sanctuary. In 1941 the Sanctuary produced its first young geese from the birds given by Louis Barkhausen. These are the ancestors of the present Canada goose flock.

The Secretary of Agriculture granted a permit to Chester Cole and Blake Posey to capture sick or wounded waterfowl for the purpose of helping them recover. Many of the birds did recover and remained at the Sanctuary.

Interest by now was running high. More people visited the Sanctuary than ever before. The potential value of the Wildlife Sanctuary to the community was now recognized by the City of Green Bay. In view of this local interest, a full-scale WPA project was set up in October of 1938, amounting to $450,000.00. Marshall Simonds, Supervisor of the Green Bay city parks was put in charge. A system of lagoons was planned to extend throughout the entire 200 acre tract. At least 160 acres were to be set aside as sanctuary, the remaining 40 acres surrounding a stretch of lagoons in the northern portion would

remain open to the public as a park. The WPA furnished a drag-line shovel to excavate the lagoons, and the City supplied an industrial railroad to remove the dirt. Two locomotives and 14 hand pump cars were bought by the Park Department. About 200 men worked on the project for three years, grading dirt and planting vegetation. Excavating work on the lagoons and pond systems was completed in 1941. The total cost to the City was $10,000.00.

The water surface was about 30% of the entire area. The average depth was six feet. Areas around ponds were raised two feet by dredging from the ponds. The lagoons in the refuge area (southeastern portion) were dug shallower than those in the park area.

Since the City could provide for the Sanctuary more effectively than the Club, the Green Bay Park Board was entrusted with the care and management of the area in 1941. The Sanctuary officially became the Bay Beach Wildlife Sanctuary.

In 1942, more trees and shrubs were planted on the islands and more waterfowl were nesting in the Sanctuary. The old heating boiler used to keep the basin open during the winter was replaced by a well and pump.

In 1950, two motor driven water circulators were put in to keep a small area free of ice in winter. The Boiler Room (formerly the WPA blacksmith and locomotive shed) was modified with lumber from the old Green Bay Packer Stadium into a warming and observation building for public use.

By 1956, approximately 3,000 birds over-wintered at the Sanctuary. Shelled corn was sold for 10¢ a bag (same price as today - no inflation here). The money from corn and other concessions paid for food and care for the animals. Geese were first banded at the Sanctuary during the summer of 1965. One hundred and sixty seven geese were banded at this time.

The ponds at the Sanctuary had been gradually deteriorating because of siltation, evaporation, high algal blooms, bank erosion, little or no flushing, excrement from waterfowl, and runoff. Approximately $31,000.00 was raised in 1971 for the main feeding lagoon reclamation. Students sold "Save The Sanctuary" pins. Industries and clubs gave donations and the remainder of the money was provided by the City of Green Bay.

The Bay Beach Wildlife Sanctuary has undergone a number of changes in recent years. The area of land has grown with the acquisition of 47 acres between Sanctuary Road and East Shore Drive and additional acreage east of Danz Avenue. The number of waterfowl continues to increase each year as does the number of visitors touring the area.

The existing Nature Center was remodeled during 1976-1977; with the new addition providing needed space for exhibits and displays. With the renovation completed, the Nature Center is a rustic building blending with the landscape. A support organization, "Friends of the Bay Beach Wildlife Sanctuary", was formed (Appendix J). A perimeter fence was placed around 3/4 of the Sanctuary in 1979. The animal care center was remodeled during the early part of 1980, to better care for the increasing number of young and injured animals brought to the Sanctuary. With the necessary funds supplied by a Community Development Grant, a special trail designed for handicapped persons is underway.

Administration

Goals

The Bay Beach Wildlife Sanctuary was established as a waterfowl refuge to provide an environment where wildlife, plants, people, and other natural elements can come together for mutual experiences. It shall provide activities that promote, enhance, preserve the value of the Wildlife Sanctuary and stimulate community awareness and involvement in the out of doors.

The specific goals of the Bay Beach Wildlife Sanctuary are:

- To preserve and reinforce the Wildlife Sanctuary as a refuge.
- To establish fauna and flora indigenous to Northeastern Wisconsin.
- To encourage diversity of biotic communities for study and research.
- To foster appreciation, understanding and study of nature through outdoor education.
- To coordinate planning with other adjacent ecological and urban areas.
- To allow passive recreation and only those activities that will be in harmony and compatible with the other goals of the Bay Beach Wildlife Sanctuary.
- No hunting, no trapping, no collecting of plants or animals is permitted, except under special circumstances and with the Sanctuary Manager's approval.

Personnel

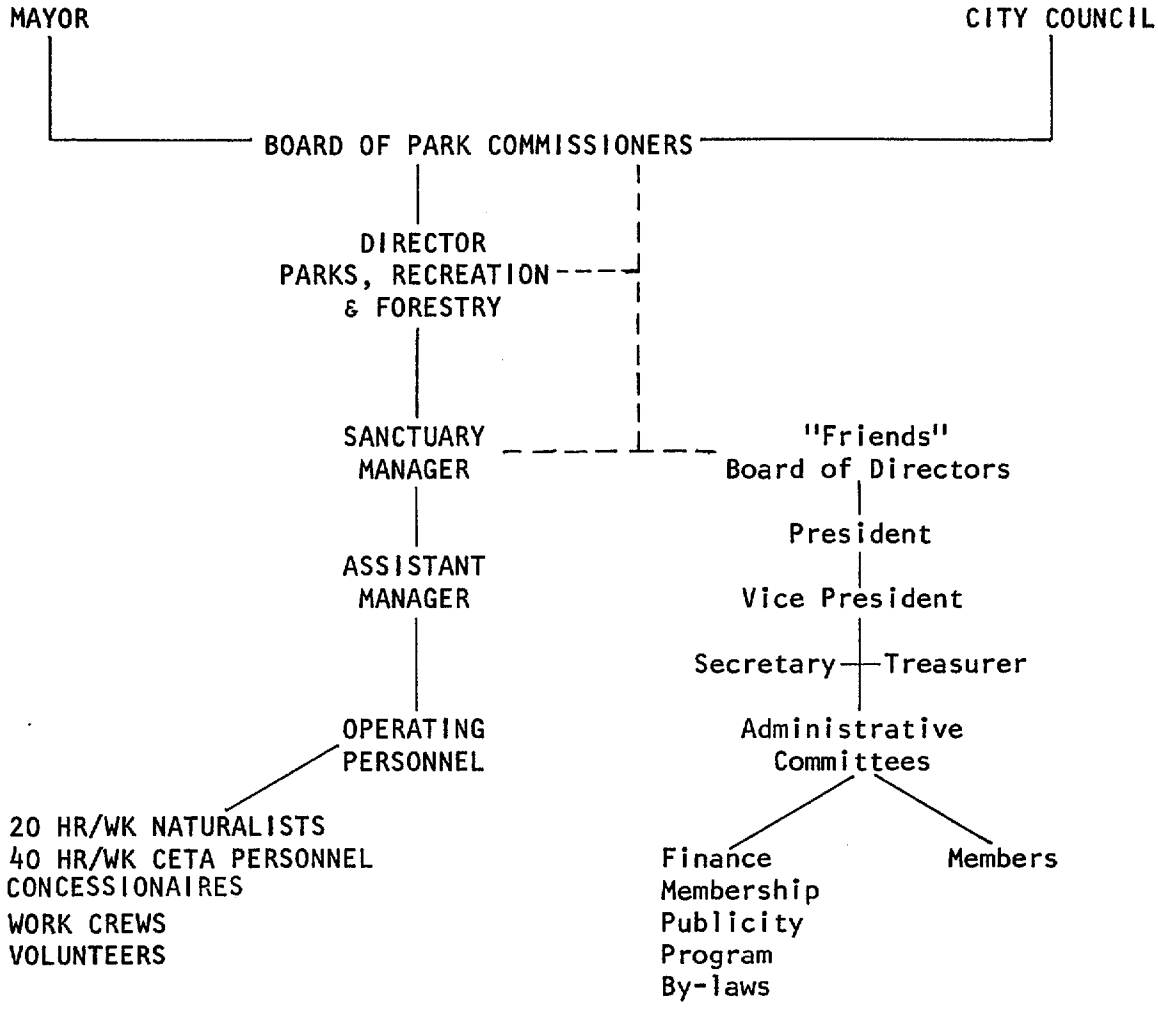
The Wildlife Sanctuary is administered by the City of Green Bay Park and Recreation Department, which is under the direction of the Board of Park Commissioners, the City Council, and the Mayor. (See Flow Chart)

The Sanctuary Manager also seeks advice and support from two segments of the community:

Professional advice on specific problems of wildlife management is sought from personnel in the Wisconsin Department of Natural Resources, the U. S. Fish and Wildlife Service, the University of Wisconsin System - Green Bay and Madison, and other professional organizations.

Advice and support for fund raising, activities and social functions is sought from the "Friends of the Bay Beach Wildlife Sanctuary" organization (Appendix J).

SANCTUARY ADMINISTRATION - FLOW CHART



The Sanctuary Manager carries out duties according to the job description for manager and as assigned by the Director of Parks, Recreation and Forestry and by the Superintendent of Parks. His duties include planning, development, review and recommendation of programs, wildlife management, physical facilities and policies for the improvement of the Wildlife Sanctuary. He also seeks, initiates and coordinates special funding and grants for personnel and facilities. He supervises operating personnel, work programs, volunteer activities, Sanctuary publications and public behavior so that the goals of the Sanctuary are carried out.

The Assistant Manager carries out duties according to his job description and as assigned by the Sanctuary Manager. His main duties include assisting the manager in supervising the overall operation, and he assumes manager's duties in his absence from site (This is an important task since the Sanctuary is open 84 hours per week in spring and summer and 63 hours per week in fall and winter). He also coordinates wildlife research at the Sanctuary.

Operating personnel perform duties as directed by Sanctuary Manager and Assistant Manager, including animal care and cage maintenance, wildlife inventories, developing and performing educational programs, conducting trail tours, designing displays, maintaining records, and promoting Sanctuary goals in a professional manner. Other duties include yard, trail and building maintenance and selling corn.

The Sanctuary Staff for the summer of 1980 consisted of:

A Sanctuary Manager
An Assistant Manager
Six 20 hr/wk Naturalists
Five 40 hr/wk limited term CETA persons
Ten youths working under the "Youth Work Experience" program, for the summer only as concessionaires and yard maintenance personnel.

This is a large staff; however, the need for staffing is great at the Sanctuary. The Sanctuary is open seven days a week, including holidays, year-round and during the spring and summer (April thru September) is open twelve hours a day (8:00 A.M. to 8:00 P.M., a total of 84 hours per week).

The CETA program has provided limited term personnel but might be phased out entirely in the near future and, therefore, cannot be relied upon as a source of personnel.

In a comparison of the Bay Beach Wildlife Sanctuary (Appendix Q) to other nature centers in the United States, the Sanctuary compares very well in all areas except two; staffing and facilities. The size of the building and the number of permanent full-time staff were more adequate at the other nature centers. (Guidelines For Interpretive Building Design). The Wildlife Sanctuary ranks very high in; number of visitors, size of area, professionalism of staff, number and quality of programs provided, trails, environmental education programs, community input, etc.

Recommendations

To adequately respond to the over 200,000 visiting public using the Sanctuary, to care for the animals, and to provide programs, displays and general maintenance for the present facilities and 350 acres of land, the following recommendations are suggested:

1. An increase in full-time permanent staff
2. A new Nature Center and animal facilities

The following staff is recommended:

a. Sanctuary Manager - full-time, permanent - duties as stated earlier under present staff.
b. Assistant Manager - full-time, permanent - duties as stated earlier under present staff.
c. Head Naturalist - full-time, permanent - duties to coordinate and implement programs, displays, school groups, education schedule, publicity, volunteers.
d. Five 20 hr/wk part-time Naturalists to assist Head Naturalist.
e. Animal Caretaker - full-time, permanent - duties - animal care and cage maintenance, rehabilitation of injured animals.
f. Three 20 hr/wk part-time animal care personnel to assist Animal Caretaker.
g. Maintenance Person - full-time, permanent - duties - grounds, building and equipment maintenance, supervise work crew.
h. Work Crew of 2 - 10 - people from various work programs, CETA, etc.
i. Three Concessionaires - 40 hr/wk from various work programs.
j. 5 - 10 dedicated volunteers willing to work 5 - 10 hrs/wk as needed.

It is also suggested that police aides or park police be considered to assist in patroling the Sanctuary during the summer and on weekends.

Pay scale for both part-time and full-time Sanctuary employees should be equal to similar positions on the City-County or other Nature Center - Museum pay scales.

A new Nature Center and animal complex are discussed in the Management Section of this Master Plan and drawings are presented in Appendix R. It is realized that there is a need for new facilities and it is recommended that the plans presented be considered for future construction.

Funding

Funds for the operation of the Wildlife Sanctuary come from four sources:

1. The City Budget - Park and Recreation Department
2. Program fees, sales from corn, concessions, and souveniers
3. Donations from individuals and corporations
4. Federal, State and local funds obtained for special projects or buildings (ex. Coastal Zone Management Grant for Master Plan)

Fund raising is done by the "Friends of the Bay Beach Wildlife Sanctuary" organization.

Personnel are paid through City budget (Manager, Assistant Manager and 20 hr/wk Naturalist) or Federal programs such as CETA, Adult Work Experience, Youth Work Experience, or other work programs.

Visitor Usage

A study of the number of visitors using the Sanctuary during 1979 and 1980 showed approximately 242,400 people use the Sanctuary annually. Approximately 207,000 of these people visit the Nature Center - animal exhibit facilities. Most of the people visited the Sanctuary during the summer (May through August period) and came on weekends (Sunday was the most popular day). Counts showed that on sunny days far more people visited the Sanctuary than on cloudy or rainy days.

The most popular time of the day was between 2:00 P.M. and 4:00 P.M. in the afternoon. The majority of people came by car - averaging just over 3 persons per car and stayed at the Sanctuary about one hour. The heavy weekend use has, at times, severely taxed the limited Nature Center and parking facilities.

Appendix M has complete graphs of Sanctuary usage.

Survey Analysis

The purpose of this portion of the study was to obtain preferences from Bay Beach Wildlife Sanctuary users, which might serve as a guideline for decisions affecting management goals and objectives. In essence, this was a two part study; part one dealt with on-site visitors and part two was a random survey of Brown County residents. The intent has been to create a user profile, identify user needs and trends and to identify areas of public interest and concern. This is an initial attempt, and reflects personal preferences of users, but some of the results provide information that may be drawn upon and utilized in a variety of management decisions.

The methods used in both of the following surveys are standard survey methods for social analysis at Parks. These methods were based on a social survey done by the University of Wisconsin, Madison, Recreation Site Planning Class 1978, for a St. Croix River Park.

Chi square (x^2) is a statistical method to help determine if differences between many sets of numerical data are large enough to be significant. That is; do the numerical differences represent real differences or are they caused by sample size, normal random occurrences, etc.

On Site Survey Analysis

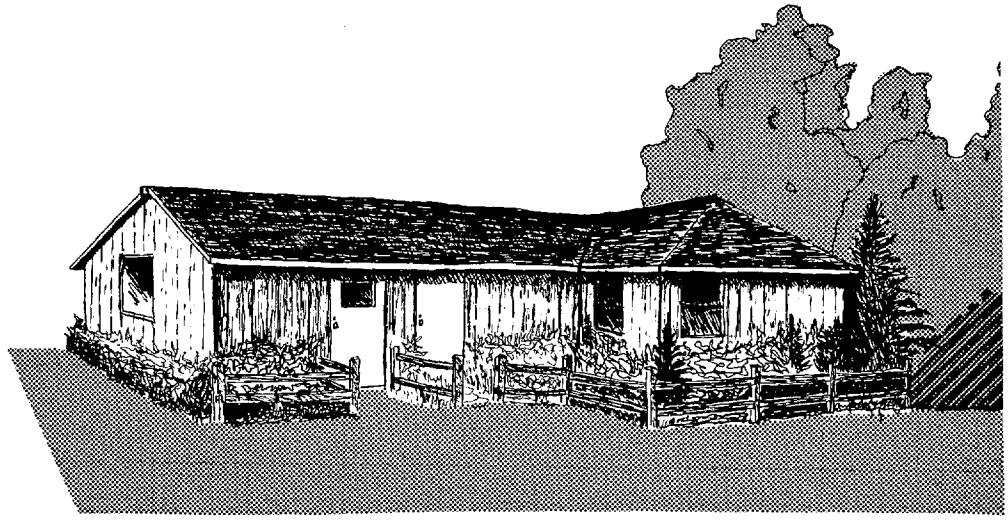
Procedure: Data was obtained through a survey conducted using the questionnaire found in Appendix O. Visitors to the Nature Center (during fall of 1979 and winter and spring of 1980) were asked to complete this short survey. Data was computer coded and analyzed frequencies and percentages were given. Chi square (x^2) was used in testing for significances of differences between two or more sets of responses.

Results: A total of 351 questionnaires were completed. The data obtained from this survey was used to construct a visitor profile. Occupations were categorized into 6 groups; students, professionals, blue collar, white collar, housewives, and retired citizens (Table 1). The majority (28.2%) surveyed were students while the minimum (2.6%) were retired citizens. Of the total surveyed, 24.8% were high school graduates and 14.2% were college graduates (Table 2). Years of education of those surveyed ranged from 4 years to post-graduate studies (21 years).

Sixty seven percent were from the Green Bay area (which includes DePere, Allouez, Ashwaubenon and Howard), while 21.3% resided in or near Brown County. Ten point five percent were from out of state (Table 3). A large proportion said they traveled 0 - 10 miles (the circumference of the metropolitan area). Fourteen point five percent traveled 11 - 30 miles (Table 4). A large number of visitors are from other counties and states. The Sanctuary is an important visitor attraction for the Green Bay area.

The majority (91.5%) of those people surveyed during this span (August, 1979 to April, 1980) came by car (Table 5). Table 6 shows the percent breakdown of distance traveled with type of transportation used. Cars were used most often; even within a 0 - 10 mile distance. This may be due to the fact that 81.2% who visited the Sanctuary came as a group; 50.4% were families while 30.8% were categorized as a mixed group (Table 7). Forty nine point six percent visit the Sanctuary more than 4 times a year (Table 8). A fairly large proportion listed this as being their first visit. Ten point eight percent said they learned of the Sanctuary through word of mouth (Table 9). Television informed 2% of those surveyed while 1.7% came with friends or relatives.

A few questions were directed towards time of use (questions 5 and 6). Sixty two percent of the visitors use the Sanctuary on weekends and weekdays, 26.5% said they visit the Sanctuary on weekends only, 4% come on weekdays only (Table 10). Seasonal use was fairly evenly distributed throughout the year (Table 11).



The more popular activities at the Sanctuary were; waterfowl feeding, observing the caged animals, and hiking the trails (Table 2). The Chi square test determined significant differences in seasonal use and activities. Waterfowl feeding was a main activity during all seasons. Cross-country skiing and observing exhibits and displays were major winter activities. During the summer months observation of wildlife and hiking were popular activities.

The Bay Beach Wildlife Sanctuary was not the only attraction visited by 15.7% of those surveyed. Nineteen point seven percent stopped at the Bay Beach Amusement Park and 16% visited the UWGB Arboretum.

Visitors were asked if they felt the site was crowded during their visit. Fifty nine point eight percent felt it was not a problem (Table 13). A Chi square test was used to determine if there were any significant differences between response to crowding and date of visit. All factors were significant. Therefore, the perception of crowding was related to the date of visit.

Mailout Survey Analysis

Procedure: Data was obtained by mailing a questionnaire (See Appendix N) to seven hundred and eighty randomly selected people residing in the Brown County area. Data from the questionnaires were computer coded and analyzed. Chi square (x^2) was used in determining significance of differences between two or more responses.

Results: Of the 780 questionnaires sent out, 42% were completed and returned. Of those who completed the survey, 24.6% were blue collar workers, 20.6% were white collar workers, 12.9% were retired citizens (Table 14). The remaining 6.4% consisted of housewives and students. Table 15 illustrates the educational background of those surveyed; 36.3% were high school graduates, 13.5% were college graduates, while 5.6% did some post graduate work.

In order to determine the number of people who have visited the Sanctuary, the question, "Have you ever visited the Bay Beach Wildlife Sanctuary?" was asked. Ninty six point six percent replied yes. Only 3.4% or seven persons had not visited the Sanctuary. Those who did visit the Sanctuary were asked how they had learned about it (question 3). Forty nine point two percent said they were life-long residents of Green Bay, 17.8% said through word of mouth, and 11.4% found it when driving by (Table 16).

The majority (94.5%) of people came by cars (Table 17). Forty seven point one percent traveled 6 - 15 miles to the Sanctuary while 43.7% live 16 to 30 miles away (Table 18). The summer season receives the most use (88.3%) and winter receives the least (Table 19). Forty five point five percent of those who completed the survey said they use the Sanctuary on weekends only, while 36.9% use it both weekends and weekdays (Table 20). Afternoon is the peak time of use, 86% said they come during this time (Table 21).

When asked how long they usually stay, 64.9% said they spent one to two hours while 23.7% spent less than an hour on site (Table 22). Thirty seven point six percent said they visit 1 - 2 times a year (Table 23). Seventy one percent said they spent approximately $5.00 or less during their visit to the Sanctuary (including cost of gas, food, fees and purchases made at the Bay Beach Wildlife Sanctuary and surrounding Green Bay area). Table 33 gives a further breakdown of stay and amount spent. Forty three point seven percent said they went to other attractions (Table 23). Of this proportion, 41.2% went to the Bay Beach Amusement Park and 1.4% visited UWGB.

When asked to select one or two reasons for visiting the Sanctuary, relaxation and fun were picked most often (Table 24). All were asked to check those activities they participated in while at the Sanctuary (Table 25). The activities selected most often were; viewing the animal exhibits (78.8%), waterfowl feeding (76.9%) and viewing the Nature Center (44.6%). Chi square was used to test for significance of difference between season (s) of use and activities participated in. None were significant indicating that these activities are the most popular during all seasons.

A few opinion questions were placed on the questionnaire in an effort to determine the likes, dislikes and desires of the people. (Questions 14 - 20) Question 14 dealt with crowding at the Sanctuary. Sixty five point five percent felt the area was slightly to moderately crowded (Table 26) during their time of visit.

In order to understand the attitudes and views of those surveyed, they were asked how they preceive the Sanctuary (Question 15). Most selected one or two answers. The majority (71.4%) felt that the Sanctuary was a natural area where wildlife and forest form a pleasant rustic setting, 45.8% view the Sanctuary as an area where educational and recreational activities are mixed (Table 27). Those surveyed were asked to select and rank the features they considered the most important (1 being the highest). These were given a weighting 1=8 points, 2=7, 3=6, 4=5, etc. The weightings were added; features with the highest totals were most important. The results are found in Table 28. Wildlife, waterfowl, natural areas and the lagoons and ponds were given the highest rankings. Those surveyed were also asked to select and rank the features they felt to be possible problems at the Sanctuary. These were weighted as above and totaled. The results are in Table 29. Litter, water pollution, lack of parking facilities were viewed by visitors as problem areas. Question 18 listed a number of statements reflecting possible practices or preferences; all were asked to check the answer which best reflected their interest or attitudes. Negative responses were given a negative value, positive responses received a positive value. Those uncommitted were omitted. The greater the deviation from zero the stronger the response. All statements reflecting possible practices or preferences were rated favorable (Table 30).

Question 19 dealt with programming and facilities at the Sanctuary. All were asked if they would use any of the listed programs or facilities if

offered. These were weighted and ranked as stated before (Table 31). Drinking fountains, live native Wisconsin animal exhibits, botanical gardens, nature center exhibits, picnic areas, observation decks were given the highest rankings. Snowshoe trails, bait and sport shops, handicapped facilities were ranked the lowest.

Question 20 asked the maximum amount they would be willing to pay if a fee was charged to see a live native animal exhibit. The majority (53.2%) were willing to pay 25¢ - $1.00 to see an exhibit of this type (Table 32).

Conclusion

Both the on-site and mailout survey provide much needed visitor profile data. A wide distribution of occupational types were surveyed. The majority of persons surveyed had completed their high school education. A large proportion had also completed college as well. When asked how they learned of the Sanctuary the majority said through word of mouth (excluding those who said they were life-long residents), newspapers and television played a small role since most people knew about the Sanctuary. The surveys indicated that cars are the main means of transportation to the Sanctuary even within a 0 - 10 mile radius. This is probably due to the fact that those who come to the Sanctuary come either as a family or mixed group. The majority of those who filled out the on-site questionnaire visit the Sanctuary more times per year than those who filled out the mailout survey. A fairly even seasonal use distribution was indicated from the on-site survey. This is probably because this survey was conducted mainly in winter months and that those who visit in the winter also use the site in the more popular months (summer and spring). The mailout survey indicated a higher use during the summer months. A large proportion of people visit the Sanctuary on weekends only, but there is a relatively high number who use the area both weekends and weekdays. The top five activities that visitors participate in are waterfowl feeding, viewing animal exhibits, hiking and viewing the Nature Center. Activities such as picnicking, fishing, skiing and snowshoeing tend to be more seasonal. Some people did visit other areas before or after visiting the Sanctuary. Most of these visit the Bay Beach Amusement Park. Some people felt the Sanctuary was overcrowded, but this may be based upon the time and season of their visit.

The mailout survey provided additional profile information plus helpful public evaluation and opinions of future management goals and policies. A large proportion of visitors prefer to use the Sanctuary during the afternoon. Their length of stay was usually from 1 - 2 hours. The survey supports the fact that the Sanctuary is an inexpensive place where a family or group can spend one to two hours. Seventy one percent of those surveyed said they spent .00¢ - $5.00 at the Sanctuary (Table 33). Brown County residents view the Sanctuary as a natural area which provides the surrounding communities with educational and recreational facilities. With this in mind the area residents recognize the important features of the Sanctuary; wildlife, waterfowl, natural areas, lagoons and ponds. They are strongly supportive of the following ideas: on-site outdoor education and expansion of refuge or Sanctuary lands.

Those surveyed indicated the need for more water fountains, expansion of parking facilities and more picnic areas. They perceive litter and water pollution as main problems at the Sanctuary.

Outdoor Education and Community Programs

Prior to 1970, tours or education programs were not available for groups visiting the Sanctuary. The first Naturalist led family tours began in 1970. The tour was a brief walk through the central facilities, which consisted of an observation building, animal complex and a newly established trail (present Goose Refuge Trail). The exhibits consisted of a few caged exotic and domestic species outdoors and a few displays in the observation building. The following year, general tours were expanded to include scout troops and school groups. One Naturalist was hired for the summer months. By 1972, the first year round Naturalist was employed to work with school groups and community lectures. The number of lectures and tours given grew in the following year, 1973-1974.

Outdoor education programs developed and became an integral part of the Sanctuary's growing educational role in 1975 and 1976. One hour special naturalist led field studies for lower grades were designed. University professors, classes, and individual students began to recognize the educational opportunities the Sanctuary held. Students from UWGB and Stevens Point, using the Sanctuary as a model, designed sensory awareness programs for Environmental Education classes. A series of Outdoor Education activities, which were site specific for the Sanctuary, were created by another group of UWGB students as a class project.

Late 1977 and early 1978 was an expansion period for the Sanctuary. The trail system now stretched for 2½ miles; accompanied by a trail booklet for those interested in a self-guided tour. A series of Sanctuary Saturday classes for families was offered. These lectures were usually conducted by a person with a knowledgable background of the subject. The Wildlife Sanctuary's lecture series continued to grow in popularity among school groups and clubs within the community. This was also a testing period for the first units of 3rd and 4th grade outdoor education programs and a Summer Park Naturalist Program. The Summer Park Naturalist Program was initiated as a nature awareness experience for youngsters in the City Parks.

By 1978 and 1979 a complete set of Outdoor Education units for grades K-6 were available in manual form, containing various group activities for the classroom and on-site. With help from staff, teachers and students participated in a day long program of field activities. This type of program required teachers to attend an on-site inservice training session. Eight part-time Naturalists were needed to accomodate the 10,000 students and groups who visited the Sanctuary that year. Because of the success of the Summer Park Naturalist Program the preceeding summer, two additional people were hired for the summer of 1979.

In the fall of 1979, the Outdoor Education units for K-6 were modified into one-half day field trips, but still contained the same types of

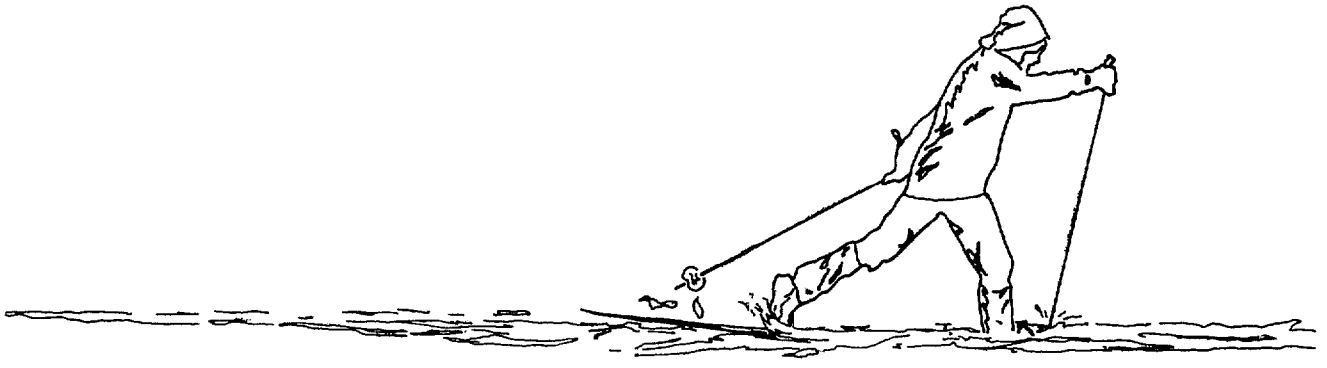
activities, goals and objectives as the original programs. Two additional units have been developed; The Time Tunnel and a 7th and 8th grade Outdoor Education Unit. All units emphasize environmental awareness and ecology. Manuals designed for teachers include a discussion of goals and objectives, pre and post activities and a detailed explanation of the on-site activities. The Time Tunnel, by means of first person interpretation, takes a historical look at the lower Green Bay area around 1800. These programs require on-site teacher in-services.

Other environmental education programs are offered by the Sanctuary which do not require a teacher in-service training session. These include the naturalist's guided nature trail, self-guided nature trail, animal program and lecture series (Appendix L). The Sanctuary encourages the teachers to discuss their choice of programs with a naturalist so that the program can be geared toward the subject area the class is studying. Part of the Sanctuary policy requires the teachers to schedule group trips at least two weeks in advance.

The Sanctuary offers a number of programs for the community as well. In addition to those programs mentioned above (Appendix L) Sunday movies, Saturday classes, waterfowl feeding and nature center exhibits are available to everyone.

Recreation

Besides serving as a wildlife refuge and environmental education site, the Sanctuary also serves as a recreation site. The number of visitors using the Sanctuary has increased steadily over the years and some of these people use the Sanctuary for recreational purposes. This is due to a variety of factors including: greater public awareness of the Sanctuary's facilities and programs, easy accessibility, close proximity to Bay Beach Amusement Park, increasing gas prices, and the overall high demand for recreational areas.



While the Sanctuary is helping to meet public recreation needs, care must be taken to preserve the main goal of the Sanctuary, which is to serve as a wildlife refuge. Therefore, only those activities that are compatible with this main goal can be allowed. It is the continuing responsibility of the Sanctuary Manager and the Park Director to determine compatible activities.

It would be impossible to list all the activities that would be considered compatible or incompatible at the Sanctuary. Below are listed a few examples:

Compatible (in designated areas only)	Incompatible
Hiking	Snowmobiling
Botany	Baseball
Bird Watching	Football
Relaxing and enjoying nature	Ice skating
Photography	Boating
Sketching and painting	Hunting
Fishing	Off road vehicles
Picnicking	Camping
Jogging	Picking plants
Snowshoeing	Loud music
Cross-country skiing	Pets
Viewing wildlife and exhibits	Alcohol

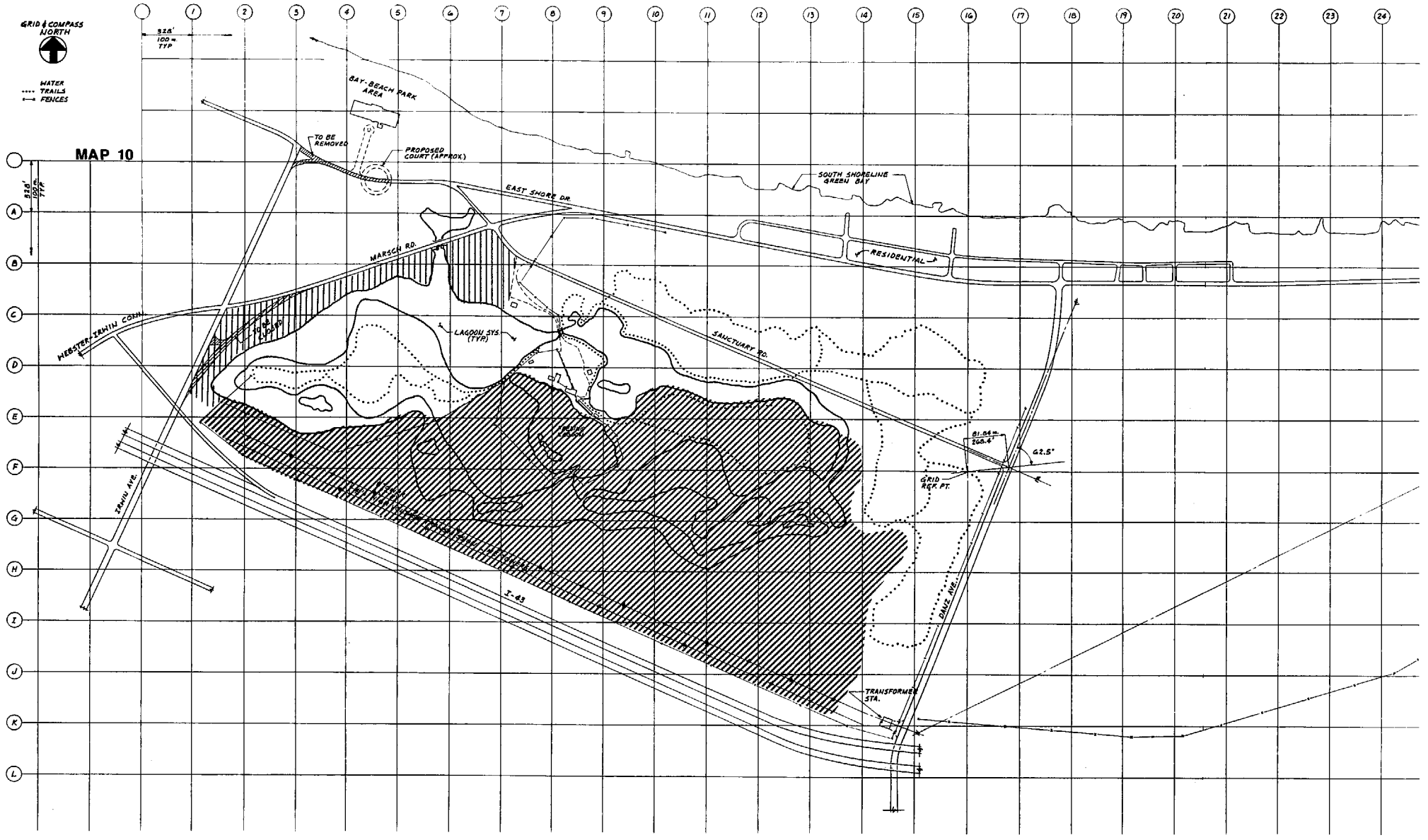
Only a limited amount of Sanctuary area can be used for these compatible activities without interfering with the main purpose of the Sanctuary.

Some questions to be considered when determining if an activity is compatible are:

1. Does the activity deprive the wildlife of needed habitat; resting areas, feeding areas, or nesting areas?
2. Does the activity cause unnecessary stress on the wildlife or habitat?
3. Can the activity be easily monitored or controlled by Sanctuary staff?
4. Does the activity disturb the normal peace and quiet most people expect when they visit a wildlife sanctuary?

At present, snowshoeing is compatible at the Sanctuary because snowshoeing is only allowed on one trail and the group is led by a naturalist. Unlimited showshoeing would cause a great deal of stress on the winter wildlife and therefore is not compatible.

It is recommended that the Sanctuary Management continue the very good job it has done in the past of maintaining a delicate balance between human use and refuge areas. This will ensure that the necessary habitat is preserved for wildlife and the needs of people to enjoy the area are both met.


GRID & COMPASS NORTH
WATER
TRAILS
FENCES
MAP 10
328' 100 m TYP
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
RESIDENTIAL
MARSH RD.
WEBSTER-TRAHN CONN.
TO BE CLOSED
LAGOON SYS. (TYP.)
SANCTUARY RD.
TRAHN AVE.
I-43
DAVIS AVE.
TRANSFORMER STA.
81.84 m 268.4'
62.5°
GRID REF. PT.

Map 10

Passive Recreation Areas at Wildlife Sanctuary

Fishing and Picnicking Areas

Refuge Areas

Trails

MANAGEMENT AREAS

MANAGEMENT BY AREA

Introduction

The Sanctuary has been divided into four main areas for purposes of management discussion (Map 7). The main management concerns for each area of the Sanctuary will be presented and discussed, alternatives will be given and recommendations made. A summary listing of recommendations can be found at the end of this section. Some of the recommendations are already being considered by Sanctuary Management but are presented in this document as a ready reference.

Area A

This is the Park area along Marsch Road, Sanctuary Road, and the Nature Center-Animal Complex. This area is characterized by mowed lawns and shade trees, mostly Silver Maple and Cottonwood (almost all the elms have died and been removed). It presently contains picnic area and fishing area for young people under the age of 16. Two very small parking lots (3 - 4 car capacity) are located along Marsch Road. The manager's residence, a larger parking lot, the Nature Center, restrooms, workshop, storage shed, animal care center, and caged animal complex are all in this area. Area A can withstand heavy, passive human use and gets it; about 70% of the 242,000 annual visitors spend all of their time in this area.

Future changes planned for this area are:

1. Replace present footbridge with a new footbridge
2. Expand restroom facilities
3. Complete new trail (See Appendix K)
4. Remodel animal cages

The main management concerns in this area are:

1. Nature Center Building
2. Caged Animal Complex
3. Animal Rehabilitation
4. Parking areas and replacement of present single-lane car bridge with a double-lane car bridge.
5. Recreation

Nature Center Building

The present Nature Center building is a multi-purpose building which functions as a classroom, exhibit area, auditorium, observation room, offices, museum, environmental education laboratory, pump room, library, staff workroom, lunch room, conference hall, general storage area, concession counter, equipment storage area, etc. Since it is a relatively small building (1500 sq. ft.) many of the areas serve several

purposes. This building was designed as an observation-warming building and the multi-use of the building evolved as the needs for more services by the community and visitors grew. The building was not designed for all the functions it is presently attempting to provide and therefore is very inadequate. The main reasons the present building is inadequate are:

1. Lack of sufficient space
2. Lack of proper design for special uses such as; audio visual programs, meetings, exhibits, museum, library, classrooms, laboratories, etc.
3. Lack of necessary facilities within the Nature Center such as; running water, restrooms, sinks, and drinking fountains.

With over 200,000 people using the Nature Center building; some for specific purposes such as programs, education classes, meetings, etc., there is a great need for a new Nature Center building. One possible new building plan is presented in Appendix R. Area B, along Sanctuary Road is a possible site for a new Nature Center. If a new Nature Center is built, the present Nature Center could be maintained year-round as an observation-warming building for the study of bird life (Ornithological Center).

Caged Animal Complex

The outdoor caged native Animal Complex presently consists of skunk, woodchuck, badger, fox squirrel, porcupine, gray fox, raccoon, coyote, wolf, raven, waterfowl, and crows. Audubon's Caracara and European ferret are also displayed but are not native to Wisconsin. Alternatives to the present outdoor caged Animal Complex are:

1. Dismantle the cages and sell or give the animals to other zoos, or release the animals
2. Enlarge the cages, giving the animals about twice as much room but in the same type of cage
3. Build a completely new, modern complex using the new methods of "cageless" caging
4. Retain the animal complex as is

Alternative 1 - Dismantle the cages, sell or give the animals to other zoos, or release the animals.

Some people feel it is inhumane to keep the animals locked up and would enjoy the opportunity to see animals close up and to show them to their children. Viewing the animal exhibit was one of the most popular activities of the people surveyed. Caged animals can be an effective educational tool to give people a better understanding and appreciation for the animal itself and more respect for animals in general. Some of the caged animals are useful in the environmental education program as an example of a "hands on" animal. Almost all the animals in the Sanctuary cage complex are former wild-pets and would not survive if released.

Alternative 2 - Enlarge the cages, giving the animals about twice as much room but in the same type of cages.

For a cost of between $5,000 and $20,000, the cages could be renovated and enlarged. This would give the animals about twice as much room. The cages could not be enlarged more than twice their present size because of the lack of space at their present site. The laws and regulations governing caging and exhibiting wild animals are becoming stricter, and the present cage system barely meets regulations and possibly would not meet a new code.

Alternative 3 - Build a completely new modern cage complex using the new methods of "cageless" or earthen-moated outdoor animal exhibits (similar to the Milwaukee Zoo).

This method of exhibiting animals is very expensive and requires much more land than is available at the present cage site. The area north of Sanctuary Road (Area B) would be the most likely site. This area has already been highly disturbed by man and is large enough for an exhibit complex.

Alternative 4 - Retain the animal complex as is even though it is an outdated system.

This has been the Sanctuary policy for at least the last five years until more information was gathered. Sanctuary management is presently planning renovation of present cages since any new cage complex possibility is still in the future, and cage modification is urgently needed.

The Sanctuary should still continue to consider the "cageless" or earthen-moated exhibit method for the near future and strive for fewer exhibit animals but more space for each animal in a more natural environment. It should consider those animals that make the most interesting exhibits and adapt easily to confinement (such as otters) for exhibit animals. The Sanctuary should also continue its present policy of exhibiting only native Wisconsin animals and resist requests to exhibit exotic or non-native animals. Exotic animals are expensive, not adapted to this climate, require extra care and do not fit into the overall education program the Sanctuary offers.

Rehabilitation of Sick, Injured, or Orphaned Animals

Animals are often brought to the Sanctuary for care and rehabilitation. Sanctuary Policy (#2.124) for care of injured animals, summarized briefly, states that the Sanctuary will discourage the public from bringing in injured, orphaned, or displaced animals. But animals that are brought in are diagnosed, quarantined, treated and released, or disposed of in a humane, professional manner. The party may not have the animal back, nor does the Sanctuary pick up animals, except in rare cases.

Most animals that are brought in as orphans are not orphans but are recently fledged songbirds, or young rabbits or squirrels and the parent is not seen by the person finding the animal. These animals are better

off left where they are found. Wounded animals have a very small chance of recovering well enough to be returned to the wild. It is a great challenge to tactfully inform the public that young animals should be left alone and that most wounded animals have very little chance of recovery. The Sanctuary does stress this point in its public programs.

The Sanctuary has recently updated and expanded its animal care facilities. It made the necessary contacts with local veterinarians who have donated their time. It also has made arrangements with volunteers, who have animal rehabilitation licenses, to assist in the care for these animals. In 1979, the Sanctuary cared for more than 815 sick, injured, and orphaned animals and each year more animals are brought in. The Sanctuary is continuing to provide this needed service for the community.

The Sanctuary could refuse any orphaned, sick, or wounded animals (let the D.N.R., Fish and Wildlife Service, or Humane Society handle this chore and expense). However, since locally, the Sanctuary is best equipped to handle these animals, and has traditionally done this since 1936, and because of the expected negative public reaction toward the Sanctuary if it did completely refuse to accept injured wildlife, the Sanctuary should retain its current policy.

Parking

Occasionally parking is a problem at the Sanctuary. As visitor usage continues to increase and with the loss of two small parking areas along Marsch Road, the Sanctuary might have to sacrifice some land for additional parking space. Since most of the visitor usage takes place in Area A, especially around the Nature Center and picnic areas, any additional parking lot should be located in this area. The most likely site would be the area immediately northwest of the manager's residence. This area is large and level and would convert into a parking lot easily. It is near the picnic area and Nature Center, and it would be easy to control public access (especially during closed hours).

Several alternative areas along Marsch Road could be used but they do not afford the advantage of nearness to the Nature Center and control of public access that the previously discussed site has.

Not adding needed parking could cause undesirable public behavior such as parking on the lawn, parking along the road, fewer visitors, or negative public feelings. However, one advantage of not enlarging the parking area is that limited parking will limit the number of people using the area at any one time. This may be an effective way of preventing over-use at the Sanctuary.

It is recommended that the area northwest of the manager's residence be considered for a parking lot in the near (1 - 2 years) future.

The present narrow one-lane bridge leading to the Nature Center is very hazardous and is a traffic bottleneck. It is recommended that this present one-lane bridge be replaced by a two-lane bridge.

Recreation

Most of the recreation that takes place at the Sanctuary occurs in Area A since this area was set aside for public use. Recreation was discussed in the previous section (Human Element). It was acknowledged there that the current Sanctuary policy toward recreation is adequate and has done a good job in maintaining the proper balance between recreation and other goals for the Sanctuary. It is also recommended that the Sanctuary maintain its current policy (Sanctuary Policy 3.3) and resist any efforts to convert more land from wildlife habitat into recreational land.

Area B

This is the land north of Sanctuary Road to East Shore Drive. Most of this land was a dump site. This area is the most disturbed site at the Sanctuary and has the poorest wildlife potential of any Sanctuary land. It will also require the most effort and money to upgrade the wildlife habitat.

Management alternatives for this area are:

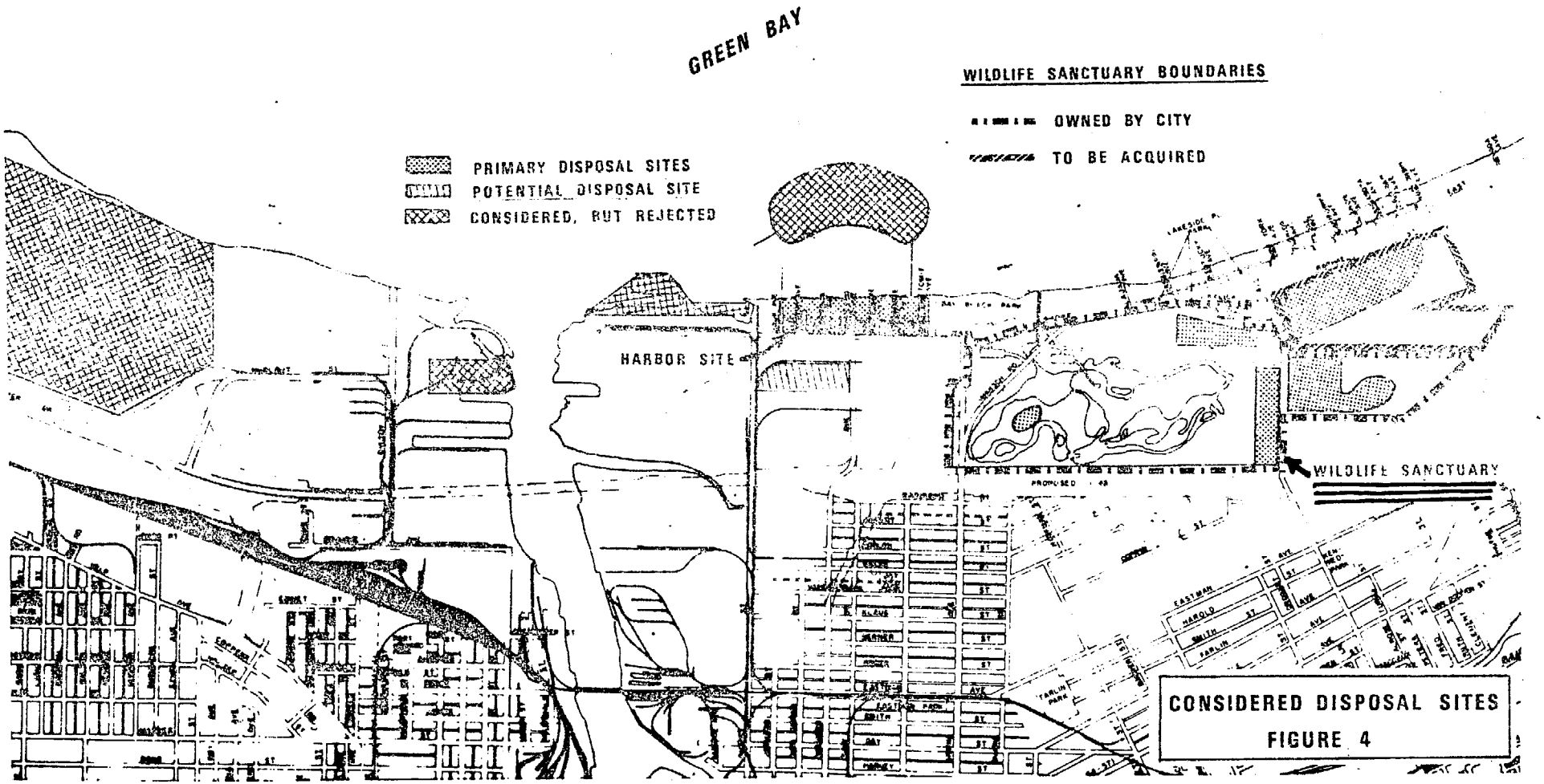
1. Do nothing; let nature reclaim this area at its own rate
2. Attempt to establish plant communities
3. Cover the ground with 4 to 18 inches of soil, landscape, and then establish plant communities
4. A site for new Nature Education Center and a large, modern, live animal exhibit.

Alternative 1 - Do nothing, let nature reclaim this area at her own rate. Due to lack of funds, this is the present Sanctuary management policy. As a result, this area has low plant diversity and little wildlife attraction.

Alternative 2 - Attempt to establish plant communities.
Without proper soil, any attempt to establish plant communities would probably be a waste of time, effort, and money. Invasion - weed type species are the only plants able to grow in the present poor soil.

Alternative 3 - Cover the ground with 4 to 18 inches of soil, landscape, and then establish plant communities referring to The Vegetation of Wisconsin, by John Curtis, as a source. This is a good alternative, but it is also very expensive. There may be fairly cheap, clean dirt fill available which would reduce the cost of this alternative.

For example, the Army Corps is looking for sites to dispose of channel dredgings from the bottom of Green Bay. Several sites on the Sanctuary have been proposed (See map on following page) and Area B is one of those sites. But before the Sanctuary accepts these dredgings, many questions need to be answered: What form will the dredging be in? Will it make suitable soil? How contaminated with pollutants are the dredgings?


GREEN BAY
WILDLIFE SANCTUARY BOUNDARIES
OWNED BY CITY
TO BE ACQUIRED
PRIMARY DISPOSAL SITES
POTENTIAL DISPOSAL SITE
CONSIDERED, BUT REJECTED
HARBOR SITE
WILDLIFE SANCTUARY
CONSIDERED DISPOSAL SITES
FIGURE 4

Map 11

Alternative 4 - A site for a new Nature Education Center and a large modern, live animal exhibit.

This alternative has been mentioned earlier in the management section of Area A. The use of this area for a Nature Center-Animal Complex is probably the most suitable alternative in terms of use of land and location for a Nature Center-Animal Complex. Appendix R contains plans for the Nature Center and Animal Complex.

Area C

Area south and east of present nature center. This area contains the lagoons, the islands and the area bordering Interstate Highway 43.

The main management concerns in this area are:

1. Trails
2. Refuge or restricted area
3. Buffer Zone along I-43
4. Field area along Danz Ave.

Trails

Three of the six trails at the Sanctuary are located in this area - the Hussong Memorial Trail, the Goose Refuge Trail and the Mockingbird Trail. The Hussong Memorial Trail is open to the general public during normal Sanctuary hours and is part of the ski trail during winter. The Goose Refuge Trail is closed during waterfowl nesting season and is used only for special groups at other times of the year. The Mockingbird Trail is used only during winter for snowshoeing with a naturalist as a guide. No new trails are being considered for this area.

It is recommended that no new trails be blazed in this area. The Sanctuary presently contains six trails; four are open to public use, year-round, during normal Sanctuary hours. These four trails are adequate to meet the needs of Sanctuary visitors.

Refuge or Restricted Areas

It was the goal of the founders of the Sanctuary that 160 acres of the original 200 acres be reserved for wildlife. The Sanctuary management has done a good job in preserving and enhancing these 160 acres for wildlife. Most of Area C has generally been closed to public use. This area is reserved for wildlife only; a place where the animals can retreat for resting, nesting, raising young, wintering, etc., with minimal interference by man. From time to time, suggestions are made to allow more human activity into some of this area; a new nature trail, outdoor education program, etc. An observation deck or wildlife blind near the area would enable the public to enjoy this area without infringing on the wildlife.

It is recommended the Sanctuary retain this area as restricted area and post it with the proposed signs.

Buffer Zone Along I-43

It is recommended that a buffer zone of evergreen trees be planted along the I-43 right of way fence to reduce noise and exhaust pollution, and increase the asthetic appearance of the area.

Field Area Along Danz Avenue

It is recommended that the field area along Danz Avenue be maintained as a meadow, field or prairie except for a buffer strip of vines, trees, shrubs, and evergreens along the Danz Avenue fence.

Area D

This area is the new land acquisition east of Danz Avenue. Most of this area was a land-fill site. A cattail marsh and cottonwood-willow forest are also located here. The land-fill site has been covered with layers of clay and woodchip-leaf mulch, and is the highest topography in the Sanctuary.

Management concerns in this area are:

1. Revegetation of land-fill site
2. Mulching area
3. Forested and marsh areas
4. Trails

Revegetation of Land-fill Site

To attract a diversity of wildlife, the Sanctuary must maintain a diversity of cover types. This land-fill area is sparsely vegetated. This area may make a suitable open field, meadow, or prairie area. More detailed studies are needed to determine the feasability of this recommendation.

Mulching Area

This area presently contains a woodchip and leaf mulching area and suggestions have been made that a city-wide mulching area be developed here. The mulch will then be distributed to city residents as it matures. If this area is used for mulching it should be screened with plantings. However, a possible better area would be the former dump area along East Shore Drive east of the corner of Danz and East Shore Drive. This site is more level and the ground beneath it more compacted.

Forested and Marsh Areas

The forested and marsh lands in this area are some of the few examples of the natural areas left in this part of the coastal area of the Bay and should be preserved as is and allowed to proceed through their normal stages of succession.

Trails

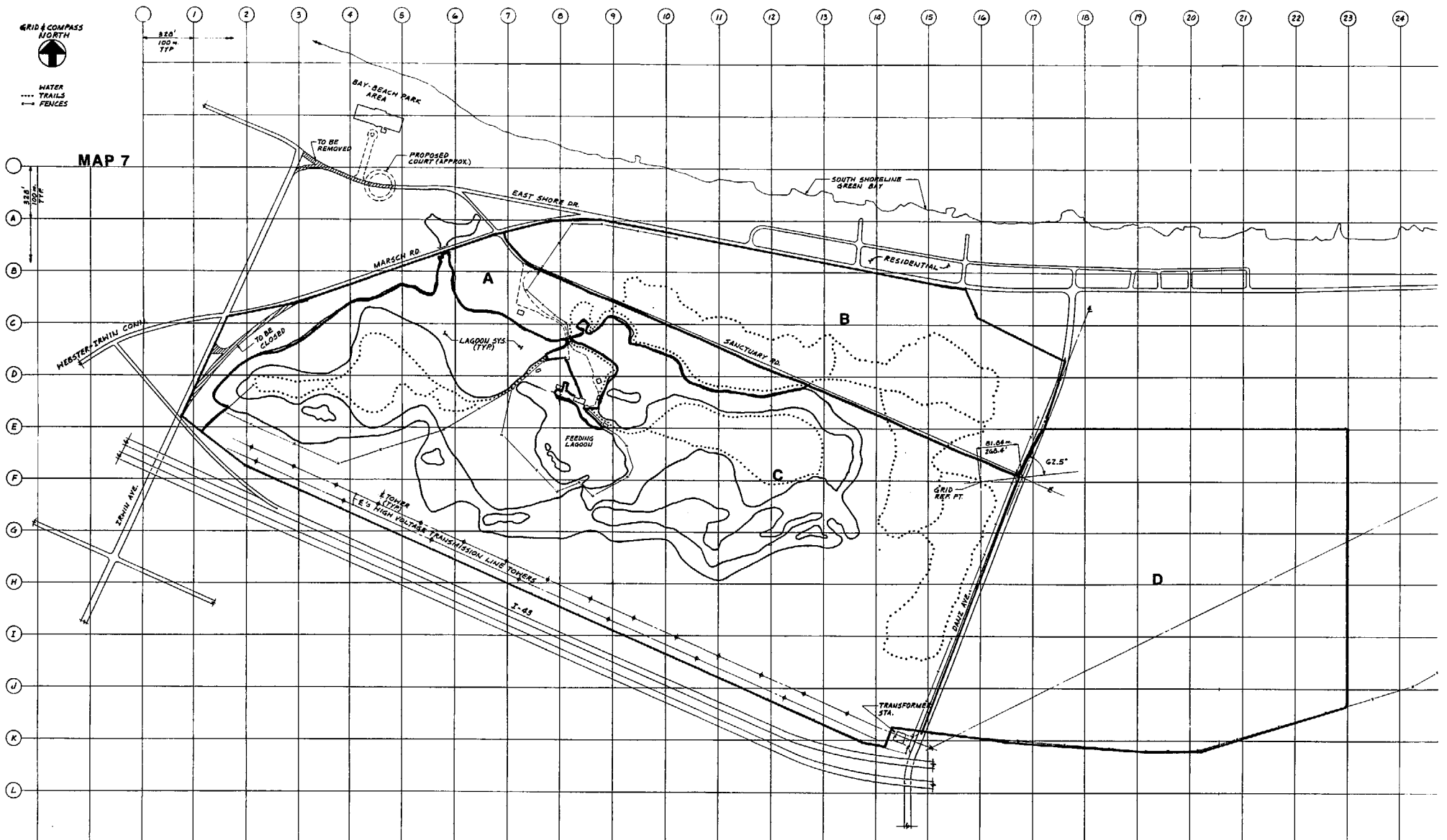
Trails considered for this area should not be blazed until a study of the resources has been completed for the entire area east of Danz Avenue and the total amount to be acquired by the Sanctuary is known. The City of Green Bay is attempting to purchase as much of the undeveloped land as is available east of Danz Avenue and north of I-43 (as recommended in the Comprehensive Plan - B5,7-2). A sound management plan for this area cannot be made until the entire land area is studied and the amount the City will be acquiring is known.

Conclusion

In this section recommendations have been made which seem the most sensible for each area considering Sanctuary goals, wildlife needs, human needs and the physical aspects of the area. Other alternatives are possible and more detailed studies are necessary before any final decisions are made.

Summary of General Recommendations for Management Areas:

1. A new Nature Center (15,000 - 30,000 sq. ft.)
2. A new "cageless type" earthen-moated animal complex
3. Continue policy of exhibiting only native Wisconsin animals
4. Exhibit animals that are interesting and adapt to confinement easily
5. Retain current policy on rehabilitating injured animals
6. Create parking area northwest of Manager's residence
7. Expand the one-lane bridge leading to the Nature Center into two lanes
8. Maintain current policy towards recreation and resist efforts to convert wildlife habitat into recreational land
9. Not blaze any additional trails on the Sanctuary west of Danz Avenue
10. Retain present Restricted Area for wildlife only
11. Plant Buffer strip along I-43 fence
12. Maintain the present field areas as open field, meadow, or prairie sites along Danz Avenue
13. Preserve natural vegetation areas on east side of Danz Avenue
14. Consider former dump area along East Shore Drive east of Danz Avenue as a possible mulching area.
15. New trails east of Danz Avenue should consider entire area management.


GRID & COMPASS NORTH
320' 100m TYP
WATER
TRAILS
FENCES
MAP 7
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
MARSH RD.
RESIDENTIAL
A
B
C
D
WEBSTER-IRWIN CONN.
TO BE CLOSED
LAGOON SYS. (TYP.)
SANCTUARY RD.
FEEDING LAGOON
81.64m 268.4'
62.5°
GRID REF PT.
IRWIN AVE.
TOWER
138 KV H.E.'s HIGH VOLTAGE TRANSMISSION LINE TOWERS
I-43
DAVIS AVE.
TRANSFORMER STA.

Map 7

Management Areas at Wildlife Sanctuary

Area A - Park Area

Area B - North of Sanctuary Road

Area C - South and East of Present Nature Center to Danz Avenue

Area D - New Acquisition East of Danz Avenue

APPENDICIES

APPENDIX A

CLIMATOLOGY OF GREEN BAY AREA

Normal weather conditions for the Green Bay Area - recorded at Austin Straubel Airfield - National Weather Service Office.
Elevation 682 feet above Mean Sea Level.
Lat. 44° 29' North, Long. 88° 08' West (about 8 miles SW of Sanctuary)

Normal Weather Conditions:

Temperatures	Normal average temperature for Jan. (coldest month)	15.9° F
	Average maximum (=day) temperature for January	23.8° F
	Average Minimum (=night) temperature for January	7.9° F
	Normal average temperature for July (warmest month)	70.3° F
	Average maximum (=day) temperature for July	80.7° F
	Average minimum (=night) temperature for July	59.8° F
	Maximum extremes: 104° F, July, 1936 and -36° F, January 21, 1888	
	Normal yearly average temperature of	44.2° F
	Average maximum (=day) temperature	53.2° F
	Average minimum (=night) temperature	35.2° F
Frost	Data from last 8 years - average of 148 frost free days. Last frost normally around May 7 - First frost normally around October 2 (many local frosts occur not recorded at Airfield).	
Precipitation	Average yearly precipitation 28.38 inches (includes snow values expressed as rain). Most rain falls in June - average 3.42" Average seasonal snowfall 44.8"	
Wind	Average speed of 10.2 mph - Prevailing direction is Southwest. Record: 109 mph from NE in 1950.	
Cloud Cover	Percent of possible sunshine 54	
	Average sky cover in tenths 6.4	
	Average number of days each year:	
	Clear	89
	Partly Cloudy	103
	Cloudy	173
	With Heavy Fog	26
	With Precipitation, .01 inch or more	121
	With Snow, 1 inch or more	14
	With Thunderstorms	35
	With Temperatures 90° F and above	7
	With Temperatures 0° F and below	30

APPENDIX B

SOIL ANALYSIS

The soil analysis was not complete at the time of printing and will be added later as a supplement.

APPENDIX C

WATER STUDIES OF SANCTUARY LAGOON SYSTEM

Water Chemistry

Five water samples, one at each of five different locations were taken during the fall of 1979 and spring and early summer of 1980 (Map 6). Samples were taken on five dates (total of 25 samples). Water temperature, air temperature, Secchi disk readings and water level readings were taken at the time of sampling. All water chemistry analysis was done by the Green Bay Metropolitan Sewerage District as per normal water analysis methods, except for the dissolved oxygen test on the samples taken November 14, and the pH test on the samples taken November 14 and March 19. These tests were done by the Coastal Management staff (authors) using water sampling kits (Hach Kits). Tables 1 - 5 summarize the results from all water samples. Table 6 compares these results to test results from previous years, and to water samples taken along the east shore of Green Bay near the Sanctuary.

Fecal Coliform Tests

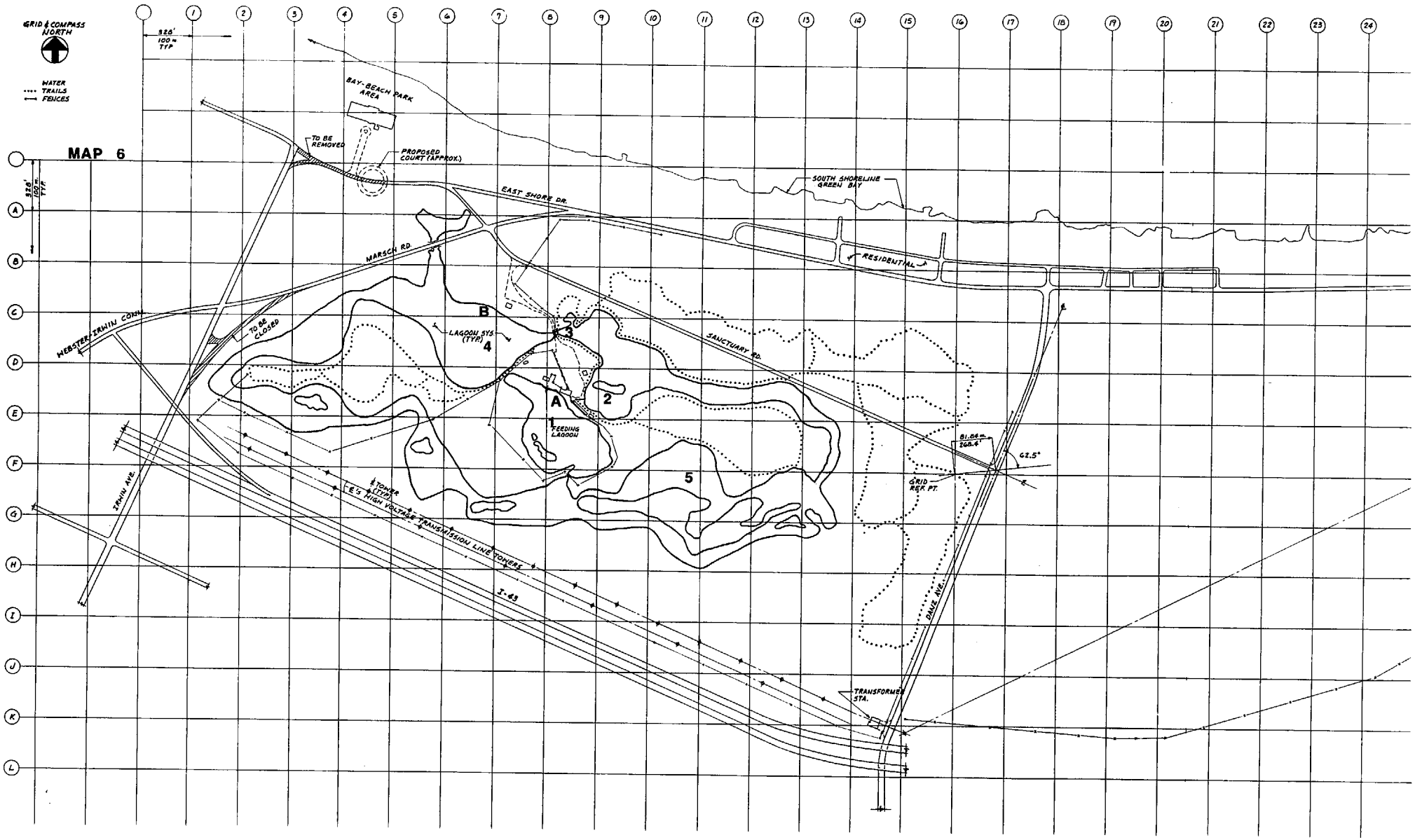
Samples were taken by the Green Bay Health Department for fecal coliform at two sites; the feeding lagoon, and the front lagoon by the manager's residence (Map 6). Samples were taken at the water surface on two dates; November 19, 1979 and June 5, 1980. Sample results are shown on Table 7 and indicate strong evidence of waterfowl wastes as cause of pollution in lagoons.

Water Levels

Graph 1 shows the normal seasonal fluctuation of the Sanctuary lagoons during 1979-1980. Water levels at the Sanctuary depend mainly on precipitation, spring snow melt, rainfall and runoff. Two wells add water at the total rate of approximately 50 gallons per minute.

Water level measurement is relative. Two permanent gauges divided into 30 cm graduations and subdivided into 3 cm graduations were used to measure water level fluctuations. The gauge in the feeding lagoon is at a different level than the gauge in the lagoon across the parking lot from which the level of the other lagoons was measured. The feeding lagoon water level is always higher than the level in the other lagoons. A pump adds 25 gal./min. of water to the feeding lagoon. This lagoon has a clay lining so no seepage occurs. Water flows from the feeding lagoon into the back lagoons through a small overflow outlet. The level of the other lagoons is lower and fluctuates greater than the feeding lagoon.

Occasionally debris (sticks, leaves, etc.) temporarily block the outlet causing the level of the feeding lagoon to rise while the other lagoon levels decline. After the blockage has cleared the water level in the feeding lagoon will decrease and the level in the other lagoons will increase. This is probably what occurred during late October and early November, 1979.


GRID & COMPASS NORTH
WATER
TRAILS
FENCES
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BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
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SOUTH SHORELINE GREEN BAY
RESIDENTIAL
MARSCH RD.
WEBSTER IRWIN CONN.
TO BE CLOSED
LAGOON SYS (TYP)
SANCTUARY RD.
FEEDING LAGOON
IRWIN AVE.
TOWER
345 KV HIGH VOLTAGE TRANSMISSION LINE TOWERS
DAVIS AVE.
TRANSFORMER STA.
GRID REF PT.
81.66 m
268.4'
42.5°

Map 6

Location of Water Samples Taken at Wildlife Sanctuary

Key

A, B Health Department Sample Sites

1 - 5 Metropolitan Sewerage District Sample Sites

SITE #1, FEEDING LAGOON

TABLE 1

SANCTUARY WATER MEASUREMENTS

Parameters	SAMPLE DATE Nov. 14, 1979	Mar. 19, 1980	April 10, 1980	April 15, 1980	June 5, 1980
Air Temp. (C^0)	4	13	9	--	16
Water Temp. (C^0)	4	4	7	--	19
Secchi Disk (CM)	47	64	43	--	23
Dissolved Oxygen (mg/1)	13.0	--	--	8.8	5.3
pH	9.3	9.6	--	8.1	6.7
Biological Oxygen Demand (5 day)	6	10	8	6	11
Orthophosphate	.100	.280	.378	--	.800
Total Phosphate	.10	.51	.58	.70	1.10
Ammonia Nitrogen	0	1	0	0	.05
Total Nitrogen	2.80	4.00	1.90	2.78	3.47
Specific Conductance	422	410	--	--	550
Water Level	1.56	--	1.99	1.93	1.70

SITE #2, LAGOON EAST OF PARKING LOT

TABLE 2

SANCTUARY WATER MEASUREMENTS

Parameters	SAMPLE DATE Nov. 14, 1979	Mar. 19, 1980	April 10, 1980	April 15, 1980	June 5, 1980
Air Temp. (C^0)	4	13	9	--	16
Water Temp. (C^0)	4	4	7	--	19
Secchi Disk (CM)	100	--	--	--	43
Dissolved Oxygen mg/l	10	--	--	15.1	7.2
pH	8.3	8.7	--	8.8	7.7
Biological Oxygen Demand (5 day)	5	14	11	12	8
Orthophosphate	.100	.120	.004	.050	.020
Total Phosphate	.100	.290	.127	.100	.300
Ammonia Nitrogen	2.5	1	0	0	0
Total Nitrogen	3.10	5	2.10	1.94	2.43
Specific Conductance	465	270	--	--	545
Water Level	1.90	--	2.30	2.33	2.02

SITE #3, MAIN BRIDGE

TABLE 3

SANCTUARY WATER MEASUREMENTS

Parameters	SAMPLE DATE Nov. 14, 1979	Mar. 19, 1980	April 10, 1980	April 15, 1980	June 5, 1980
Air Temp. (C^0)	4	13	9	--	16
Water Temp. (C^0)	4	4	7	--	19
Secchi Disk (CM)	65	--	59	--	48
Dissolved Oxygen mg/l	12	--	--	15.5	7.4
pH	8.5	8.8	--	8.9	7.7
Biological Oxygen Demand (5 day)	3	10	7	16	8
Orthophosphate	.1	.004	.001	.100	.04
Total Phosphate	.100	.16	.097	.100	.200
Ammonia Nitrogen	.8	1	0	0	0
Total Nitrogen	5.60	1	1.70	1.94	2.43
Specific Conductance	440	400	--	460	545
Water Level	1.90	--	2.30	2.33	2.02

SITE #4, LAGOON SOUTH OF MANAGER'S RESIDENCE

TABLE 4

SANCTUARY WATER MEASUREMENTS

Parameters	SAMPLE DATE Nov. 14, 1979	Mar. 19, 1980	April 10, 1980	April 15, 1980	June 5, 1980
Air Temp. (C^0)	4	13	9	--	16
Water Temp. (C^0)	4	5	7	--	19
Secchi Disk (CM)	86	65	59	--	62
Dissolved Oxygen mg/l	10	--	--	13.9	7.4
pH	8.5	9.1	8.8	8.8	7.85
Biological Oxygen Demand (5 day)	7	6	10	14	6
Orthophosphate	.1	.01	0	.02	.01
Total Phosphate	.1	.09	.11	.10	.30
Ammonia Nitrogen	.8	1	0	0	0
Total Nitrogen	2.8	1	2.1	1.94	2.08
Specific Conductance	432	380	--	480	535
Water Level	1.90	--	2.30	2.33	2.02

SITE #5, LAGOON S.E. OF GOOSE REFUGE TRAIL

TABLE 5

SANCTUARY WATER MEASUREMENTS

Parameters	SAMPLE DATE Nov. 14, 1979	Mar. 19, 1980	April 10, 1980	April 15, 1980	June 5, 1980
Air Temp. (C^0)	4	13	9	--	16
Water Temp. (C^0)	4	5	8	--	19
Secchi Disk (CM)	110	--	42	--	53
Dissolved Oxygen (mg/l)	8.4	--	--	15	8.5
pH	8.6	8.7	--	8.8	8.1
Biological Oxygen Demand (5 day)	7	12	12	16	6
Orthophosphate	.1	0	0	.03	.03
Total Phosphate	.1	.13	.139	.2	.3
Ammonia Nitrogen	1.7	1	0	0	0
Total Nitrogen	2.8	1	2.8	1.94	2.08
Specific Conductance	478	260	--	440	540
Water Level	1.90	--	2.30	2.33	2.02

APPENDIX C

TABLE 6
COMPARISON OF WATER SAMPLES TAKEN AT WILDLIFE SANCTUARY 1970-1980

The Range of Sample Results Over the Study Period is Shown

Year	Site #	Secchi Disk (CM)	Dissolved Oxygen (mg/l)	pH	BOD_5	Ortho-Phosphate	Total Phosphate	Ammonia Nitrogen	Total Nitrogen	Specific Conductance (μ moks/cm)
				PARAMETERS						
1970[a]	1			8.3-9.2	20-37	.04-.72	.38-1.43	1.49-19.8		
	4			7.7-9.1	9-18	0-.03	.13-.59	2.24-16.4		
1971 -	1	20-98	4-15	7.44-9.91		0-1.5	.03-5.62	0-12.3		380-640
1973[b]	3	20-95	0-15	7.23-8.94		.002-.213	.06-.82	0-9.0		350-525
	5	22-95	0-15	7.23-9.23		0-.068	.06-.92	0-4.0		360-525
1976[c]	1					.215	.455	.231	2.3	
	3					.009	.214	.160	4.5	
1979 -	1	23-64	5.3-13.0	6.7-9.6	6-11	.1-.8	.1-1.1	0-1	1.9-4.00	410-550
	2	43-100	7.2-15.1	7.7-8.8	5-14	.004-.12	.1-.3	0-2.5	1.94-5	270-545
1980[d]	3	48-65	7.4-15.5	7.7-8.9	3-16	.001-.1	.097-.2	0-1	1-5.6	400-545
	4	59-86	7.4-13.9	7.85-9.1	6-14	0-.1	.09-.3	0-1	1-2.8	380-535
	5	42-110	8.4-15.0	8.1-8.8	6-16	0-.1	.1-.3	0-1.7	1-2.8	260-540
Green Bay[e] 1972			0.0-12.0	7.7-8.3	1.7-	0.0-.272	.04-1.79	.00-.92	1.2-1.68	225-455

Sources: [a]Metropolitan Sewerage District, 1970 - Personal letters of Communication to Chet Miller, Director, Park & Recreation Dept.
[b]Janet Ladowski - Effects of Waterfowl Population and Sludge Removal on Water Quality of Bay Beach Wildlife Sanctuary, 1974, unpublished report.
[c]James Wiersma, Dave Brinker - letter communication to Ty Baumann Sanctuary Manager, 1976.
[d]Wisconsin Coastal Management Project and Metropolitan Sewerage District, Water Studies, 1980.
[e]Paul Sager, James Wiersma - Water Quality data for east shore of Green Bay 1972, Baseline Information for Proposed Dike Along East Shore of Green Bay.

*Site numbers correspond to Sites on Tables 1-5. Values are mg/l except pH, Secchi disk reading and specific conductance.

Appendix C

Table 7

Fecal Coliform Analysis of Sanctuary Water by City Health Department

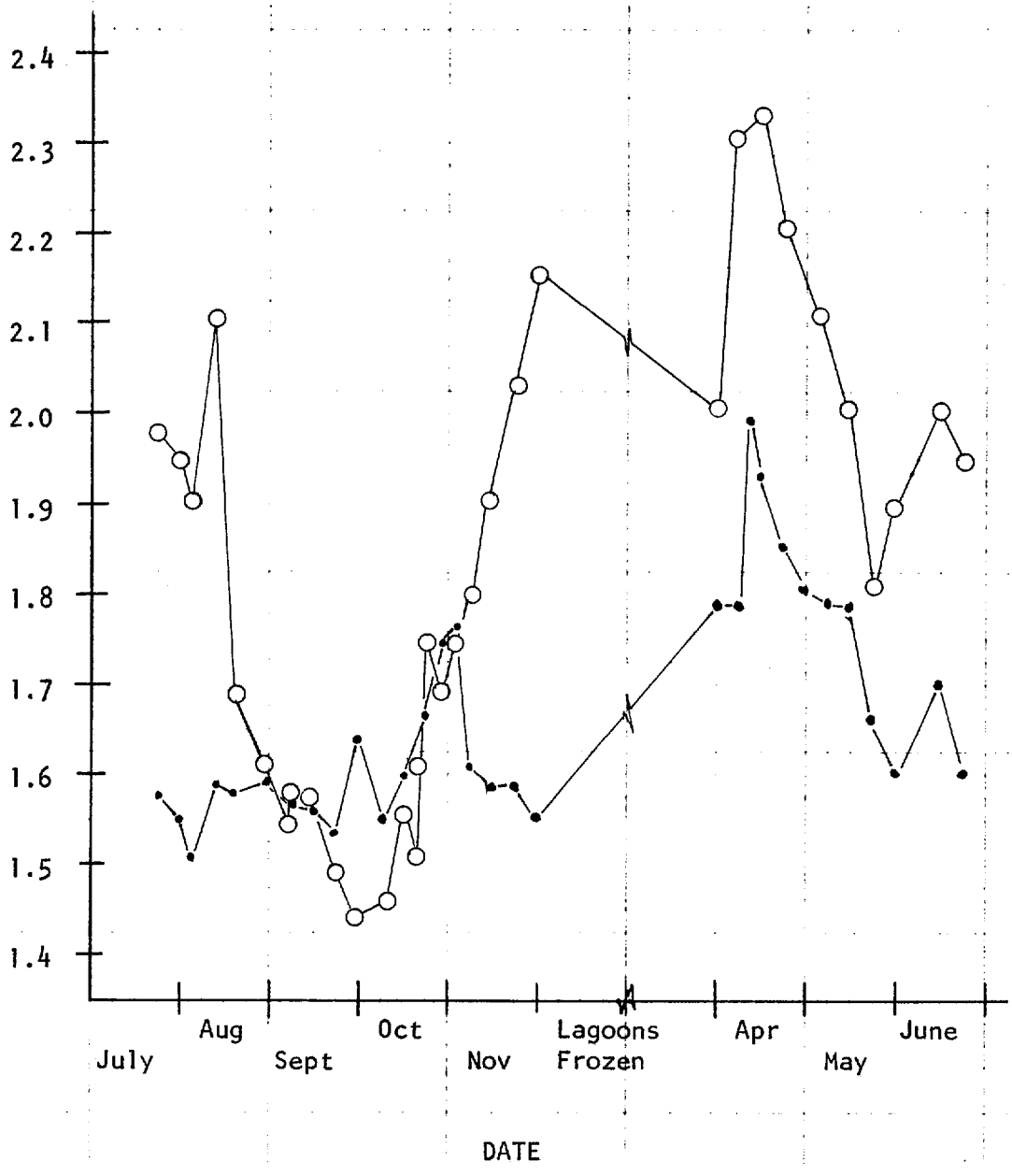
Date	Site*	pH	SPC/ml Plate Count	Total Coli. Per 100 ml	Fecal Strep Per 100 ml	Fecal Coli Per 100 ml	Ratio $\frac{\text{F. Coli}}{\text{F. Strep}}$	Interpretation of Ratio
Nov. 19, 1979	A		<1,000	200	300	130	$\frac{130}{300} = .4$	Strong evidence of livestock or poultry waste (waterfowl)
	B		2,000	<100	500	260	$\frac{260}{500} = .5$	
June 5, 1980	A	7.4	1,200	3,800	3,100	1,600	$\frac{1600}{3100} = .5$	Strong evidence that pollution is derived from livestock or poultry waste
	B	7.8	3,100	5,000	5,100	4,400	$\frac{4400}{5100} = .86$	Predominance of livestock or poultry wastes in mixed pollution

*Site A, feeding Lagoon by Nature Center

Site B, Front Lagoon by Manager's Residence

APPENDIX C Graph 1

WATER LEVEL FLUCTUATIONS OF
SANCTUARY LAGOONS 1979-1980



Symbols: ○ Other lagoons

• Feeding lagoon

APPENDIX D

VASCULAR PLANTS OF THE BAY BEACH WILDLIFE SANCTUARY

HERBACEOUS SPECIES

Achillea millefolium
Yarrow

Agastache scrophulariaefolia
Purple Giant Hyssop

Ajuga reptans
Bugle

Ambrosia artemisiifolia
Common Ragweed

Ambrosia trifida
Great Ragweed

Amaranthus hybridus
Slender Amaranth

Anemone canadensis
Canada Anemone

Anemone quinquefolia
Wood Anemone

Antennaria neglecta
Pussy Toes

Anthemis cotula
Mayweed

Apocynum androsaemifolium
Spreading Dogbane

Aquilegia canadensis
Columbine

Arctium minustarctium sp.
Common Burrdock

Arissaema atrorubens
Jack-in-the-pulpit

Asarum canadense
Wild Ginger

Asclepias incarnata
Marsh Milkweed (Swamp)

Asclepias syriaca
Common Milkweed

Asclepias variegata
White Milkweed

Asparagus sp.
Common Asparagus

Aster dumosus
Bushy Aster

Aster cricoides
Many Flowered Aster (Heath Aster)

Aster lateriflorus
Calico Aster

Aster macrophyllus
Large Leaved Aster

Aster novae-angliae
New England Aster

Aster pilosus
Heath Aster

Aster simplex
Panicled Aster

Aster spectabilis
Showy Aster

Aster vimineus
Small White Aster

Barbarea vulgaris
Winter Cress

Berteroa incana
Hoary Alyssum

Bidens frondosa
Beggar-tick (Sticktight)

Blephelia ciliata
Downy-Wood-Mint

Boehmeria cylindrica
False Nettle (Bog Hemp)

Campanula americana
Tall Bellflower

Campanula aparinoides
Bedstraw Bellflower

Capsella bursa-pastoris
Shepherd's Purse

Centaurea maculosa
Spotted Knapweed

Cerastium vulgatum
Mouse-eared Chickweed

Chenopodium album
Lambs Quarters (Pigweed)

Chenopodium hybridum
Maple Leaved Goosefoot (Sowbane)

Chrysanthemum leucanthemum
Ox-eye Daisy

Cichorium intybus
Chicory

Cirsium arvense
Canada Thistle

Cirsium vulgare
Bull Thistle

Claytonia virginica
Spring Beauty

Convolvulus arvensis
Field Bindweed

Convolvulus sepium
Hedge Bindweed

Crepis sp.
Hawksbeard

Cuscuta gronovii
Dodder

Cyperus esculentus
Sedge

Daucus carota
Queen Ann's Lace - Wild Carrot

Echinocystis lobata
Wild Cucumber

Epilobium glandulosum
Northern Willow Herb

Erigeron annuus
Daisy Fleabane

Erigeron canadensis
Horseweed

Erigeron philadelphicus
Common Fleabane

Erythronium americanum
Yellow Trout Lily

Eupatorium fistulosum
Hollow-Joe-Pye-Weed

Eupatorium perfoliatum
Boneset

Eupatorium maculatum
Spotted-Joe-Weed

Eupatorium rugosum
White Snakeroot

Fagopyrum sagittatum
Buckwheat

Fragaria sp.
Strawberry sp.

Fragaria vesca
Wood Strawberry

Galinsoga ciliata
Galinsoga (Quickweed)

Galeopsis tetrahit
Hemp Nettle

Galium aparine
Cleavers

Galium asprellum
Rough Bedstraw

Galium triflorum
Fragrant Bedstraw

Gentiana andrewsii
Closed Gentian

Gerardia tenuifolia
Slender Gerardia

Geum virginianum
Rough Avens

Glechoma hederacea
Creeping Charlie,

Helianthus divaricatus
Woodland Sunflower

Hemerocallis fulva
Day Lily

Heracleum maximum
Cow Parsnip

Hieracium aurantiacum
Orange Hawkweed (Devils Paintbrush)

Hordeum jubateum
Foxtail Barley

Hypericum perforatum
Common St. John's Wort

Impatiens capensis
Jewelweed (Spotted Touch Me Not)

Iris prismatica
Slender Blue Flag

Iris versicolor
Larger Blue Flag

Lactuca scariola
Prickly Lettuce

Lathyrus palustris
Marsh Vetchling

Leonurus cardiaca
Motherwort

Lepidium virginicum
Wild Peppergrass

Linum usitatissimum
Flax

Lobelia siphilitica
Great Lobelia

Lychnis alba
Evening Lychnis

Lycopus americanus
Cut-Leaved Water Horehound

Lycopus virginicus
Bugleweed

Lysimachia terrestris
Yellow Loosestrife (Swamp Candles)

Lysimachia thrysiflora
Bunched Loosestrife

Lythrum salicaria
Spiked Purple Loosestrife

Malva sp.
Mallow sp.

Matricaria maritima
Scentless Chamomile

Medicago lupulina
Black Medick

Medicago sativa
Alfalfa

Melilotus alba
White Sweet Clover

Melilotus officinalis
Yellow Sweet Clover

Mentha aquatica
Water Mint

Mentha arvensis
Wild Mint

Mertensia virginica
Mertensia (Bluebells)

Mimulus alatus
Sharp-Winged Monkey Flower

Mimulus ringens
Square-Stemmed Monkeyflower

Mirabilis nyctaginea
Four-O-Clocks

Monarda fistulosa
Wild Bergamot

Myosotis scorpioides
True Forget Me Not

Nepeta cataria
Catnip

Nuphar advena
Spatterdock

Nymphaea odorata
Fragrant Water Lily

Oenothera biennis
Evening Primrose

Oxalis europaea
Yellow Wood Sorrel (European)

Oxalis montana
Common Wood Sorrel

Oxalis stricta
Yellow Wood Sorrel (two species)

Pedicularis lanceolata
Swamp Housewort

Phlox divaricata
Blue Phlox

Pilea pumila
Clearweed (Richweed)

Plantago major
Common Plantain

Podophyllum peltatum
May Apple

Polemonium van-bruntiae
Jacob's Ladder

Polygala lutea
Yellow Milkwort

Polygonatum biflorum
Solomon's Seal

Polygonum amphibium
Water Smartweed

Polygonum coccineum
Swamp Smartweed

Polygonum hydropiper
Waterpepper

Polygonum hydropiperoides
Mild Waterpepper

Polygonum lapathifolium
Pale Smartweed (Nodding Smt.)

Polygonum pennsylvanicum
Pennsylvania Smartweed

Polygonum persicaria
Lady's Thumb - Redleg

Polygonum scandens
Climbing False Buckwheat

Potentilla anserina
Silverweed

Potentilla norvegica
Rough Cinquefoil

Prenanthes alba
Rattlesnake Root (White Lettuce)

Prunella vulgaris
Heal-All (Self-Heal)

Ranunculus acris
Common Buttercup (Tall)

Ranunculus septentrionalis
Swamp Buttercup

Rosa blanda
Smooth Rose

Rudbeckia hirta
Black-Eyed Susan

Rumex crispus
Curled Dock

Saponaria officinalis
Bouncing Bet

Scilla sibirica
Scilla

Scirpus americanus
Sedge

Scutellaria lateriflora
Mad-Dog Skullcap

Scutellaria epilobifolia
Common Skullcap (Marsh)

Scutellaria parvula
Smaller Skullcap

Silene cucubalus
Bladder Campion

Sisymbrium altissimum
Tumble Mustard

Smilacina racemosa
False Solomon's Seal

Smilacina stellata
Starry False Solomon's Seal

Smilax herbacea
Carrion Flower

Solanum carolinense
Horse Nettle

Solanum dulcamara
Bittersweet Nightshade

Solanum nigrum
Common Nightshade

Solidago altissima
Tall Goldenrod

Solidago canadensis
Canada Goldenrod

Solidago gigantea
Late Goldenrod

Solidago graminifolia
Lance-Leaved Goldenrod

Sonchus asper
Spiny-Leaved Sow Thistle

Sonchus oleraceus
Common Sowthistle

Stachys tenuifolia
Rough Hedge-Nettle

Stellaria media
Common Chickweed

Stellaria pubera
Star Chickweed

Tanacetum vulgare
Common Tansy

Taraxacum officinale
Common Dandelion

Teucrium canadense
American Germander (Wood Sage)

Thalictrum dioicum
Early Meadow Rue

Thalictrum polygamum
Tall Meadow Rue

Tradescantia virginiana
Spiderwort

Trifolium procumbens
Smaller Hop Clover

Typha angustifolia
Narrow-Leaved Cattail

Typha latifolia
Common Cattail (Broad-Leaved)

Urtica dioica
Stinging Nettle

Urtica sp.

Verbascum thapsus
Common Mullein

Verbena hastata
Blue Vervain

Verbena sp.

Vicia americana
Purple Vetch

Viola blanda
Sweet White Violet

Viola canadensis
Canada Violet

Viola conspersa
Dog Violet

Viola pubescens
Downy Yellow Violet

Viola sororia
Wooly Blue Violet

Xanthium chinense
Cocklebur (Clotbur)

NATIVE TREES SPECIES NATURAL TO WILDLIFE SANCTUARY SITE

Acer saccharinum
Silver Maple

Acer negundo
Box Elder

Betula papyrifera
White Birch

Fraxinus nigra
Black Ash

Populus deltoides
Cottonwood

Populus grandidentata
Big-toothed Aspen

Populus tremuloides
Trembling Aspen

Quercus borealis
Red Oak

Quercus macrocarpa
Burr Oak

Salix nigra
Black Willow

Salix discolor
Pussy Willow

Salix interior
Sandbar Willow

Thuja occidentalis
White Cedar

Ulmus americana
American Elm

NATIVE TREES REINTRODUCED

Acer saccharum
Sugar Maple

Betula lutea
Yellow Birch

Carpinus caroliniana
Ironwood

Celtis occidentalis
Hackberry

Crataegus sp.
Hawthorn

Fraxinus pennsylvanica
Green Ash

Gleditsia triacanthos
Honey Locust

Juglans nigra
Black Walnut

Larix laricina
Tamarack

Picea glauca
White Spruce

Picea pungens
Blue Spruce

Pinus resinosa
Red Pine

Pinus strobus
White Pine

Prunus americana
Wild Plum

Prunus virginiana
Chokecherry

Tilia americana
Basswood

INTRODUCED OR EXOTIC TREES

Acer platinoides
Norway Maple

Betula nigra
River Birch

Catalpa sp.
Catalpa

Elaeagnus angustifolia
Russian Olive

Gymnocladus dioica
Kentucky Coffee Tree

Pyrus sp.
Flowering Crab Apple

Morus alba
White Mulberry

Picea abies
Norway Spruce

Pinus nigra
Austrian Pine

Ulmus pumila
Siberian Elm

SHRUBS & VINES NATIVE, REINTRODUCED, OR INTRODUCED

Amelanchier sp.
Juneberry

Berberis canadensis
Barberry

Cephalanthus occidentalis
Buttonbush

Cornus stolonifera
Red Osier Dogwood

Cornus racemosa
Gray Dogwood

Corylus americana
Hazelnut

Euonymus americanus
American Strawberry Bush

Euonymus atropurpureus
Burning Bush (Wahoo)

Euonymus europaeus
European Spindletree

Lonicera tatarica
Tartarian Honeysuckle

Parthenocissus inserta
Virginia Creeper

Philadelphus coronarius
Mock Orange

Physocarpus opulifolius
Ninebark

Rhamnus cathartica
Common Buckthorn

Rhamnus frangula
European Buckthorn

Rhus radicans
Poison Ivy

Rhus typhina
Staghorn Sumac

Ribes sp.
Currant (Gooseberry)

Rosa blanda
Wild Rose

Rosa multiflora
Multiflora Rose

Rubus sp.
Raspberry sp.

Syringa vulgaris
Lilac

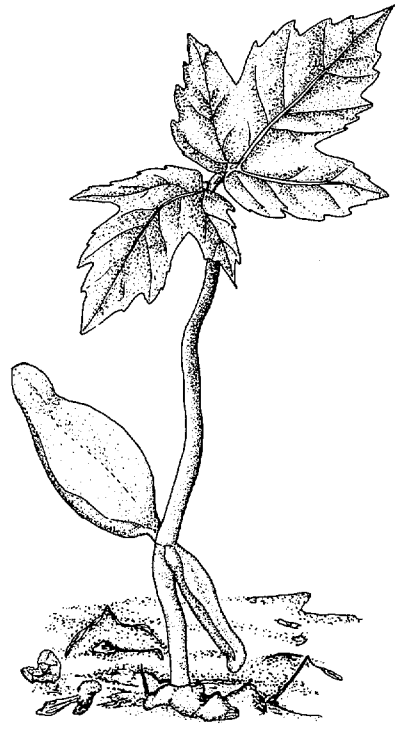
Vitis riparia
Wild Grape

Sambucus canadensis
Black Elderberry

Sambucus pubens
Red Elderberry

Viburnum lentago
Nannyberry

Viburnum trilobum
Highbush Cranberry



APPENDIX D_1

COMPARISON OF THE FOREST AT THE SANCTUARY
TO TYPICAL SOUTHERN LOWLAND
FOREST

Tree Composition (In order of relative dominance)

Sanctuary[1] Forest Species	Curtis[2] Southern Lowland Species	Forest Av. I.V.	Forest Constancy	GB-BCPC[3] Southern Wet Successional Forest
Cottonwood	Silver Maple	81.6	81.5%	Black Willow
Black Willow	Black Willow	64.0	70.3	Cottonwood
Boxelder	Cottonwood	54.5	70.4	Red Osier
Green Ash	American Elm	26.5	66.7	Gray Dogwood
Red Osier	River Birch	24.4	51.8	Box Elder
Silver Maple	White Swamp Oak	15.2	29.6	
	Green Ash	8.2	51.9	
	Bur Oak	5.8	3.7	
	Boxelder	3.0	22.2	
	Black Ash	2.9	18.5	

SOURCES:

[1]Sanctuary Studies, general observations and point-quarter plant sampling
[2]Curtis, John T., The Vegetation of Wisconsin, pg. 529.
[3]Green Bay - Brown County Planning Commission, Environmentally Significant Areas Report #48, 1979, pg. 43.

APPENDIX D_1

STRUCTURE OF A TYPICAL STAND OF SOUTHERN LOWLAND FORESTS

Species	Less than 1" d.b.h.		More than 1" d. b. h.			
	less than 1' tall	More than 1' tall	1-4"	4-10"	10-20"	20-30"
Wet forest in Dane County[1]						
Boxelder	154	0	4	13	0	0
Silver Maple	422	158	0	0	0	0
Green Ash	154	0	3	0	0	0
Cottonwood	0	0	2	78	66	2
Black Willow	0	212	16	20	22	0
American Elm	212	78	2	0	0	0

[1]Curtis, John T., The Vegetation of Wisconsin, pg. 530.

APPENDIX E

ANIMALS OF THE BAY BEACH WILDLIFE SANCTUARY

Invertebrates

Protozoans

Porifera - Fresh water Sponges

Rotatoria - Rotifers

Molluska
- Pelecypoda - clams
- Gastropoda - snails
  - Pulmonata - Lymnaeidae
    Pysidae (*Physa sp.*)
  - Ctenobranchiata

Nematoda - Roundworms (*Tubifex tubifex*)
Earthworms (*Lumbricus sp.*)

Arthropoda
- Crustacea
  - Anostraca - Fairy Shrimp
  - Cladocera - Water Fleas (*Daphnia sp.*)
  - Eucopepoda - Copepods (*Cyclops sp.*)
  - Isopoda - Aquatic Sow bugs
  - Amphipoda - Scuds & Sideswimmers - talitridae (*Hyalella azteca*)
  - Decapoda - Crayfish (*Procambarus sp.*)
- Arachnida
  - Hydracarina - Water Mites
  - Araneida - Spiders
- Diplopoda - Millipedes
- Chilopoda - Centipedes
- Insecta
  - Collembola - Spring Tails
  - Ephemeroptera - Mayflies - Caenidae (*Caenis sp.*)
  - Odonata - Dragonflies - Aeshnidae - darners (*Anex sp.*)
    Libellulidae - skimmers (*Ladona sp.*)
    Damselflies - Zygoptera - Coenagrionidae (*Lestes sp.*)
    (*Enallagma sp.*)
  - Orthoptera - Grasshoppers
    Crickets
    Katydids
  - Mallophaga - Feather lice on birds

Hemiptera - Bugs
- Corixidae - Water boatmen
- Notonectidae - Backswimmers (Buenoa sp.)
- Belostomatidae - Giant Water bugs (Belostoma sp.)
- Gerridae - Water Striders (Trepobates sp.)
- Phymatidae - Ambush bugs
- Hygaeidae - Milkweed and Box Elder bugs
- Pentatomidae - Stink bugs
- Mesovetiidae - Water treaders (Mesovella sp.)
- Veliidae (Rhagovilia sp.)

Homoptera
- Cicadidae - Cicadas
- Cercopidae - Spittle bugs
- Aphididae - Aphids

Coleoptera - Beetles
- Carabidae - Ground beetles
- Silphidae - Carrion beetles
- Elateridae - Click beetles
- Coccinellidae - Ladybird beetles
- Dermestidae - Dermestid beetles
- Scarabacidae - June beetles
- Halipidae - Crawling water beetles (Peltodytes sp.)
- Elmidae - Riffle beetles
- Dytiscidae - Predaceous diving beetles (Dytiscus sp.)

Lepidoptera - Butterflies and Moths
- Pieridae - Whites and Sulfers
- Danaidae - Monarchs
- Nymphalidae - Mourning Cloaks
- Sphingidae - Hawk Moths
- Noctuidae - Noctuid Moths
- Lasiocampidae - Tent Caterpillars

Diptera - Flies
- Tipulidae - Crane flies
- Culicidae - Mosquitoes
- Chironomidae - Midges
- Syrphidae - Syrphid flies
- Muscidae - House flies
- Tephritidae - Goldenrod Gall fly
- Tabanidae - Horse and Deer flies

Siphonaptera - Fleas

Hymenoptera - Ants, Wasps, Bees
- Ichneumonidae - Ichneumid Wasps
- Formicidae - Ants
- Vespidae - Paper Wasps
- Apidae - Bumble Bees

Vertebrates

Fish

- Black Bullhead (*Ictalurus melas*)
- Carp (*Cyprinus carpis*)
- Yellow Perch (*Perca flavescens*)
- Smallmouth Bass (*Micropterus dolomieni*)
- Pumpkinseed (*Lepomis gibbosus*)
- Bullhead Minnow (*Pimephales vigilax*)
- Emerald Shiner (*Notropis atherinoids*)
- Golden Shiner (*Notemigonus crysoleucas*)
- Common Shiner (*Notropis cornutus*)

Reptiles

(R) = Species may naturally occur but specimens were known to have been released on site.

- Blanding's Turtle (*Emydoidea blandingi*) (R)
- Common Snapper (*Chelydra serpentina*)
- Painted Turtle (*Chrysemys picta*)
- Stinkpot (*Stenotherus odoratus*) (R)
- Wood Turtle (R)
- Smooth Scaled Green Snake (*Opheodcrys vernalis*) (R)
- Fox Snake (*Elphe vulpina*) (R)
- Garter Snake (*Thamnophis suritus*)
- Red-Bellied Snake (*Storeria occipitomaculata*) (R)
- Hog-nosed Snake (*Heterodon platyrhinos*) (R)
- Milk Snake (*Lampropeltis getulus*) (R)

Amphibians

- American Toad (*Bufo americanus*)
- Chorus Frog (*Pseudacris sp.*)
- Bullfrog (*Rana catesbeiana*) (R)
- Blue Spotted Salamander (*Ambystoma sp.*) (R)
- Spotted Salamander (*Ambystoma maculatum*) (R)
- Mudpuppy (*Necturus sp.*) (R)

Mammals

- Opossum (*Didelphis marsupaillis*)
- Shorttail Shrew (*Blarina brevicauda*)
- Little Brown Bat (*Myotis lucifugus*)
- Masked Shrew (*Sorex cinereus*)
- Raccoon (*Procyon lotor*)
- Shorttail Weasel (*Mustela ermina*)
- Least Weasel (*Mustela rixosa*)
- Mink (*Mustela vison*)
- Striped Skunk (*Mephitis mephitis*)
- Red Fox (*Vulpes fulva*)
- Gray Fox (*Urocyon cinereoargenteus*)
- Woodchuck (*Marmota monax*)
- Thirteen-Lined Ground Squirrel (*Citellus tridecemlineatus*)
- Eastern Chipmunk (*Tamias striatus*)
- Red Squirrel (*Tamiasciurus hudsonicus*)
- Gray Squirrel (*Sciurus carolinensis*)

Fox Squirrel (Sciurus niger)
Deer Mouse (Peromyscus maniculatus)
White-footed Mouse (Peromyscus lencopus)
Meadow Vole (Microtus pennsylvanicus)
Muskrat (Ondatra zibethica)
Norway Rat (Rattus norvegicus)
House Mouse (Mus musculus)
Cottontail Rabbit (Syllilagus floridanus)
Whitetail Deer (Odocoileus virginianus)
Beaver (Castor canadensis) (R)
River Otter (Lutra canadensis) (R)
Meadow Jumping Mouse (Zapus hudsonius)

Birds are listed in Appendix G.

APPENDIX E_1

FISH SURVEYS OF SANCTUARY

TABLE 1

Summary of Sanctuary Fishing Surveys, Fall 1979 and Spring 1980

	Fall 1979	Spring 1980	TOTAL
Number of fishermen surveyed	50	161	211
Total hours fished	151	87	238
Average hours fished	3	.54	1.13

Type of Fish	Average Size Length in Inches	Fall 1979	Spring 1980	TOTAL
Bullhead	4.7	317	16	333
Carp	7.3	3	0	3
Sunfish	3.1	12	0	12
Perch	6.6	169	227	396
Bass	4	1	0	1
Northern Pike	--	0	0	0

APPENDIX E_1

TABLE 2

Results of Electric Fish Shocking October 19, 1979

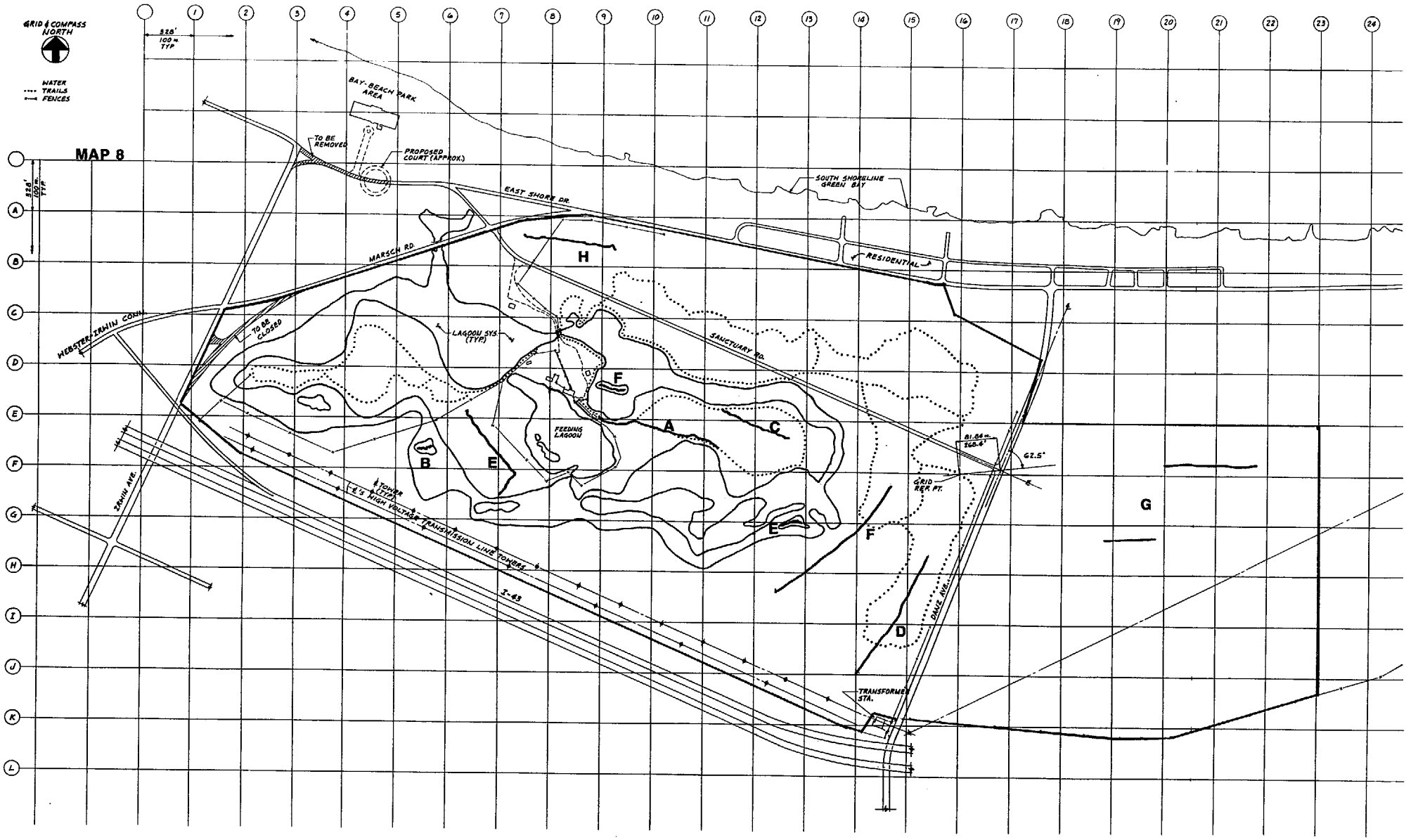
Type of Fish	Size Length in Inches	Number of Fish Shocked Front Lagoon	Feeding Lagoon	Total
Perch	1-4	1		1
	4-6	19		19
	6-8	178		178
	8-10	27	1	28
	10-12	5	1	6
				232
Carp	1-10	2	2	4
	10-20	11	20	31
	20-30	5	6	11
				46
Pumpkinseed	1-4	4		4
	4-6	4		4
				8
Bullhead	6-9	11		11
Smallmouth Bass	12	1		1
Golden Shiner	2-6	2		2
Common Shiner		X		
Emerald Shiner		X		
Bullhead Minnow		X		

X indicates several were shocked but no counts made.

APPENDIX F

SMALL MAMMAL SURVEY, BAY BEACH WILDLIFE SANCTUARY - FALL 1979

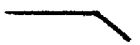
Area, Habitat			Total Trap Nights	# Of Individuals/ # Of Species	Field Vole	Deer Mouse	White-footed Mouse	Red Squirrel	Gray Squirrel	Shorttail Shrew	Eastern Chipmunk	Least Weasel	Shorttail Weasel	Meadow Jumping Mouse
AREA A	1)	Mature Hardwood Forest-Cottonwood	220	29/6	7		4			3	8			7
	2)	Mowed Lawn	30	0/0										
ISLAND F		Small Island Grasses-Large Tree	18	1/1	1									
ISLAND B		Small Island Nettle, Trees, Shrubs	12	3/1	3									
AREA C	1)	Mowed Lawn	30	2/2			1	1						
	2)	Evergreens	130	9/3			7		1					1
ISLAND E		Small Island Cottonwood, Red-osier	12	0/0										
AREA D		Old Landfill - Unkept Fields	182	6/2	5							1		
AREA E		Cottonwood-Buckthorn, Small Opening	168	29/2	2		27							
AREA F	1)	Box Elder-Cottonwood	48	2/1			2							
	2)	Cattail	48	5/4	1	1	2						1	
AREA G	1)	Landfill-Field	24	0/0										
	2)	Cottonwood-Willow	24	8/2		1	7							
AREA H	1)	Maple-Elderberry	10	3/1			3							
	2)	Box Elder-Cottonwood Nettle	14	1/1		1								


GRID & COMPASS NORTH
WATER
TRAILS
FENCES
MAP 8
326' 100 m TYP
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
MARSH RD.
RESIDENTIAL
WEBSTER-IRWIN CONN.
TO BE CLOSED
LAGOON SYS. (TYP.)
SANCTUARY RD.
FEEDING LAGOON
IRWIN AVE.
TOWER (TYP.)
345 KV HIGH VOLTAGE TRANSMISSION LINE TOWERS
S-49
81.64 m 268.4'
62.5°
GRID REF. PT.
DIKE NO.1
TRANSFORMER STA.
A
B
C
D
E
F
G
H

Map 8

Trap Areas for Small Mammal Study

(Trap results in table, Appendix F)



Extent of Area Covered in Master Plan

Trap Lines

APPENDIX G

BIRDS OF THE BAY BEACH WILDLIFE SANCTUARY

Method For Breeding Bird Census

The census technique used was based on the Williams Spot Mapping Method (Williams, 1936) which is commonly used in the United States as a way to measure bird populations during the breeding season. For the census, the Sanctuary was divided into four areas which were systematically covered once a week for four consecutive weeks during the last week of May and most of June.

Territorial males (which are used to determine the population) were censused by plotting the position of each singing male on a map. A different map was used on each census. If male birds were observed, but were not singing, they were recorded on the map with a dot after their name. Most singing is done right before dawn and during early morning. Censuses were done early in the morning, usually 5:00 A.M. until 7:30 A.M., and there was only enough time to cover one area each morning.

Additional information taken on each census includes the beginning and ending time, weather conditions (rainy or windy days were avoided), temperature and any additional notes on birds besides the recorded singing males.

The same route was used on each census trip. (See Map 6) Routes were selected that would cover the area well enough to enable the observer to hear any singing males within that area. Walking was done at a casual pace with stops every 50 meters to aid in detecting all singing males.

The breeding bird census was supplemented with general observations made of each area during the study period. These either added new information or affirmed previous sightings. General observations were kept separate but the information was included in the final report. This breeding bird study was used to determine the breeding and summer resident birds at the Sanctuary.

Census Areas

Census Area A — Included the Gray Fox Trail, Hussong Trail, the clay dike on the south side of the Hussong Marsh and the Wood Chuck Trail. The total length of the route is about 2500 meters.

Census Area B — Included the Goose Refuge Trail, the Mockingbird Trail, and the area south of the deer yard - grid area 6-E. The total length of the route is about 2300 meters.

Census Area C — Starting at Danz Avenue walking west along the High line - transmission towers on the south border of the Sanctuary and then north along Marsch Road through the park to the manager's residence. The total length of the route is about 2150 meters.

Census Area D — A canoe was used to cover the back lagoons up to the fence in grid area 5-E. The total length of the route is about 2840 meters.

Census Area E — East of Danz Avenue, was covered only 3 times, starting at the landfill site, following the transmission towers east to the drainage ditch, then south along the ditch to the I-43 fence and then west back to the landfill staying about 75 meters north of the fence. The total length of the route is about 3000 meters.

Key To Status Symbols

PR — Permanent Resident; present all seasons.

SR — Summer Resident; present throughout the summer.

WR — Winter Resident; present throughout the winter.

TV — Transient Visitor; present during normal migration period.

SV — Summer Visitor; present in summer, but not necessarily throughout the period.

WV — Winter Visitor; present in winter, but not necessarily throughout the period.

* — Breeder; has been known to breed at the Sanctuary.

A — Abundant; species that stand out as being visibly most numerous in their preferred, or many types of habitat.

C — Common; species of each family that appear most numerous in their preferred habitat, except for those termed "abundant".

FC — Fairly Common; "middle-of-the-road" species for each family group.

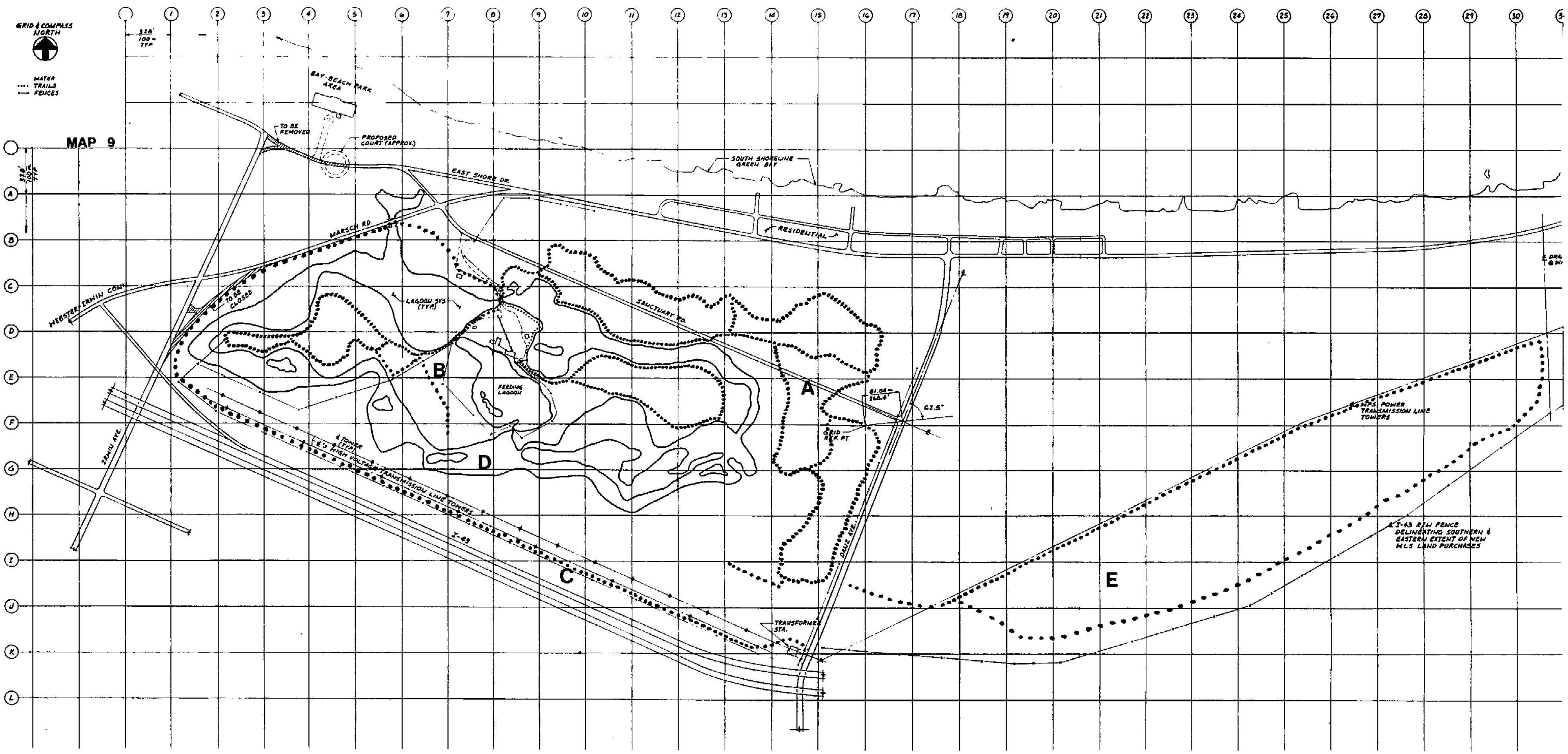
U — Uncommon; the least common species of each family group that occur regularly in some numbers.

R — Rare; likely to be seen at the Sanctuary five or less times per year; missed entirely some years.

VR — Very Rare; likely to be seen at the Sanctuary no more than once every three years.

ACC — Accidental; so far removed from normal range as to be of "once-in-a-lifetime" occurrence.

HYP — Hypothetical; recorded by reputable observers in the field, but no specimens or photographs.



GRID & COMPASS NORTH
WATER
TRAILS
FENCES
MAP 9
BAY-BEACH PARK AREA
TO BE REMOVED
PROPOSED COURT (APPROX.)
EAST SHORE DR.
SOUTH SHORELINE GREEN BAY
RESIDENTIAL
MARSCH RD.
WEBSTER-IRWIN CONN.
TO BE CLOSED
LAGOON SYS. (TYP.)
SANCTUARY RD.
FEEDING LAGOON
IRWIN AVE.
DANZ AVE.
TRANSFORMER STA.
I-43
WPS POWER TRANSMISSION LINE TOWERS
I-43 R/W FENCE DELINEATING SOUTHERN & EASTERN EXTENT OF NEW WLS LAND PURCHASES
A
B
C
D
E

Map 9

Bird Census Areas and Routes for Breeding Bird Study

Census Routes

Birds Of The Bay Beach Wildlife Sanctuary

SPECIES	STATUS	HABITAT
Common Loon *Gavia immer*	VRTV	Lagoons
Horned Grebe *Podiceps grisegena*	UTV	Lagoons
Pied-billed Grebe *Podilymbus podiceps*	FCSR	Lagoons
White Pelican *Pelecanus erythorhynchos*	VRTV	Lagoons
Double-crested Cormorant *Phalacrocorax auritus*	RTV	Flying over area
Great Blue Heron *Ardea herodias*	USR	Lagoon shoreline
Green Heron * *Butorides virescens*	CSR	Lagoon shoreline
Cattle Egret *Bubulcus ibis*	RTV	Lagoon shoreline
Common Egret *Casmerodius albus*	VRTV	Lagoon shoreline
Black-crowned Night Heron *Nycticorax nycticorax*	CSR	Lagoon shoreline
Least Bittern *Ixobrychus exilis*	RSR	Lagoon shoreline
American Bittern *Botaurus lentiginosus*	RTV	Lagoon shoreline
Whistling Swan *Cygnus columbianus*	RTV	Lagoons
Canada Goose * *Branta canadensis*	CPR	Lagoons & lawn area
Snow Goose *Chen hyperborea*	UTV	Lagoons & lawn area
White-fronted Goose *Anser albifrons*	VRTV	Lagoons & lawn area

Mallard * *Anus platyrhynchos*	APR	All areas
Black Duck *Anas rubripes*	CWR, FCSR	Lagoons
Gadwall *Anas strepera*	USR	Lagoons
Pintail *Anas acuta*	UTV	Lagoons
Green-winged Teal *Anas carolinensis*	UTV	Lagoons
Blue-winged Teal * *Anas discors*	FCSR	Lagoons
American Widgeon *Mareca americana*	UTV	Lagoons
Shoveler *Spatula clypeata*	UTV	Lagoons
Wood Duck * *Aix sponsa*	USR	Lagoons
Redhead *Aythya americana*	UTV	Lagoons
Ring-necked Duck *Aythya collaris*	UTV	Lagoons
Canvasback *Aythya valisineria*	RTV	Lagoons
Greater Scaup *Aythya marila*	UTV	Lagoons
Lesser Scaup *Aythya affinis*	FCTV	Lagoons
Com. Goldeneye *Bucephala clangula*	UTV	Lagoons
Bufflehead *Bucephala albeola*	UTV	Lagoons
Oldsquaw *Clangula hyemalis*	RTV	Lagoons
Ruddy Duck *Erismatura jamaicensis*	UTV, RSV	Lagoons

Hooded Merganser *Lophodytes cucullatus*	UTV	Lagoons
Common Merganser *Mergus merganser*	UTV	Lagoons
Red-br. Merganser *Mergus serrator*	RTV	Lagoons
Turkey Vulture *Cathartes aura*	UTV	Soaring overhead
N. Goshawk *Accipiter gentilis*	RTV	In woods or flying overhead
Sharp-shinned Hawk *Accipiter striatus*	CTV	In woods or flying overhead
Cooper's Hawk *Accipiter cooperii*	RTV	In woods or flying overhead
Red-tailed Hawk *Buteo jamaicensis*	UPR	In woods or flying overhead
Broad-winged Hawk *Buteo platypterus*	CTV	In woods or flying overhead
Rough-legged Hawk *Buteo lagopus*	FCWR	Open country or flying overhead
Northern Harrier *Circus cyaneus*	RTV	Flying overhead
Bald Eagle *Haliaetus leucocephalus*	RTV	Lagoon edge in trees; soaring overhead
Osprey *Pandion haliaetus*	RTV	Soaring overhead
American Kestrel * *Falco sparverius*	CSR, UWR	Fields with a few trees
Ruffed Grouse *Bonasa umbellus*	RPR	Thick woods, brushy areas
Ring-necked Pheasant * *Phasianus colchicus*	UPR	Marsh edges, grassy or shrubby cover
Gray Partridge *Perdix perdix*	RPR	Fields
Sandhill Crane *Grus canadensis*	RTV	Migrant flocks overhead
Virginia Rail * *Rallus limicola*	RSR	Marshes & open water

Sora Rail * *Porzana carolina*	USR	Marshes & open water
Common Gallinule *Gallinula chloropus*	VRTV	Marshes & open water
American Coot *Fulica americana*	FCSR	Marshes & open water
Semipalmated Plover *Charadrius hiaticula*	UTV	Lagoon shore, mud flats, open areas
Killdeer * *Charadrius vociferus*	FCSR	Lagoon shore, mud flats, open areas
Greater Yellowlegs *Totanus melanoleucus*	RTV	Lagoon shore, mud flats, open areas
Lesser Yellowlegs *Totanus flavipes*	UTV	Lagoon shore, mud flats, open areas
Solitary Sandpiper *Tringa solitaria*	RTV	Lagoon shore, mud flats, open areas
Willet *Catoptrophorus semipalmatus*	RTV	Lagoon shore, mud flats, open areas
Spotted Sandpiper * *Actitis macularia*	FCSR	Lagoon shore, mud flats, open areas
American Woodcock * *Philohela minor*	FCTV, USR	Thickets in low places
Common Snipe *Capella gallinago*	UTV	Good cover in marsh
Least Sandpiper *Erolia minutilla*	RTV	Lagoon shore, mud flat
Pectoral Sandpiper *Erolia melanotos*	RTV	Lagoon shore, mud flat
Stilt Sandpiper *Micropalama himantopus*	RTV	Lagoon shore, mud flat
Herring Gull *Larus argentatus*	CSR, UWV	Lagoons
Ring-billed Gull *Larus delawarensis*	CSR	Lagoons
Bonaparte's Gull *Larus philadelphia*	RTV	Lagoons

Forster's Tern *Sterna forsteri*	FCSV	Lagoons
Common Tern *Sterna hirundo*	FCSV	Lagoons
Black Tern *Chlidonias nigra*	FCSV	Lagoons
Rock Dove *Columba livia*	CPR	Open areas
Mourning Dove * *Zenaidura macroura*	CPR	All areas
Yellow-billed Cuckoo *Coccyzus americanus*	USR	Woodland & brushy areas
Black-billed Cuckoo *Coccyzus erythrophthalmus*	USR	Woodland & brushy areas
Screech Owl * *Otus asio*	CPR	Woodlands
Great Horned Owl * *Bubo virginianus*	CPR	Woodlands
Snowy Owl *Nyctea scandiaca*	UWV	Open areas
Barred Owl *Strix varia*	VRTV	Woodlands
Long-eared Owl *Asio otus*	UWV	Evergreens
Short-eared Owl *Asio flammeus*	UWV	Open areas
Saw-whet Owl *Aegolius acadica*	UTV	Woodlands
Whip-poor-will *Caprimulgus vociferus*	RTV	Open woodlands
C. Nighthawk *Chordeiles minor*	CSR	Seen catching insects in flight before sunrise & after sunset
Chimney Swift *Chaetura pelagica*	CSR	Seen catching insects in flight
Ruby-throated Hummingbird *Archilochus colubris*	UTV	Near flowering plants

Belted Kingfisher *Megaceryle alcyon*	CSR	Near lagoons
Common Flicker * *Colaptes auratus*	CSR	Woodlands
Red-bellied Woodpecker *Centurus carolinus*	UTV	Woodlands
Red-headed Woodpecker * *Melanerpes erythrocephalus*	FCSR	Woodlands
Yellow-bellied Sapsucker *Sphyrapicus varius*	CTV	Woodlands
Hairy Woodpecker * *Dendrocopus villosus*	FCPR	Woodlands
Downy Woodpecker * *Dendrocopus pubescens*	CPR	Woodlands
Eastern Kingbird * *Tyrannus tyrannus*	CSR	All areas
Western Kingbird *Tyrannus verticalis*	VRTV-1974	Open areas with scattered trees
Great Crested Flycatcher * *Myiarchus crinitus*	CSR	Open woodlands
Eastern Phoebe *Sayornis phoebe*	UTV	Lagoon edge, open woodlands
Yellow-bellied Flycatcher *Empidonax flaviventris*	RTV	Low woodlands
Willow Flycatcher * *Empidonax sp.*	USR	Wet thickets
Alder Flycatcher *Empidonax sp.*	UTV	Brushy wooded areas
Least Flycatcher * *Empidonax minimus*	FCSR, CTV	Open woods
Eastern Pewee * *Contopus virens*	FCSR	Woodlands
Olive-sided Flycatcher *Nuttallornis borealis*	RTV	Woodlands
Horned Lark *Eremophila alpestris*	VRTV	Fields

Tree Swallow * *Iridoprocne bicolor*	CSR	Open areas, catching insects in flight
Bank Swallow *Riparia riparia*	FCTV	Open areas, catching insects in flight
Rough-winged Swallow *Stelgidopteryx ruficollis*	USR, FCTV	Open areas, catching insects in flight
Barn Swallow *Hirundo rustica*	FCSR	Open areas, catching insects in flight
Cliff Swallow *Petrochelidon pyrrhonota*	FCTV	Open areas, catching insects in flight
Purple Martin * *Progne subis*	CSR	Open areas, catching insects in flight
Blue Jay * *Cyanocitta cristata*	CPR	Woodlands & open fields
Northern Raven *Corvus corax*	VRTV	Woodlands & open fields
American Crow * *Corvus brachyrhynchos*	CPR	Woodlands & open fields
Bl.-cap. Chickadee *Parus atricapillus*	CWR, FCSR	Woods & evergreens
White-breasted Nuthatch * *Sitta carolinensis*	FCPR	Woods & evergreens
Red-breasted Nuthatch *Sitta canadensis*	VRWR	Woods & evergreens
Brown Creeper *Certhia familiaris*	UTV, RSV	Woods & evergreens
House Wren * *Troglodytes aedon*	FCSR	Woods & brushy areas
Winter Wren *Troglodytes troglodytes*	RTV	Woods & brushy areas
Carolina Wren *Thryothorus ludovicianus*	VRTV-1973	Woods & brushy areas
Northern Mockingbird *Mimus polyglottos*	VRWV-1980	Woodland edge, brush
Gray Catbird * *Dumetella carolinensis*	CSR	Thickets

Brown Thrasher * *Toxostoma rufum*	FCSR	Woods & thickets
American Robin * *Turdus migratorius*	UWR, CSR, CTV	Lawns, woods
Varied Thrush *Ixoreus naevius*	VRWV-1980	Woods, evergreens
Wood Thrush *Hylocichla mustelina*	USR, FCTV	Woodlands
Hermit Thrush *Hylocichla guttata*	FCTV	Woodlands
Swainson's Thrush *Hylocichla ustulata*	CTV	Woodlands
Gray-cheeked Thrush *Hylocichla minima*	FCTV	Woodlands
Veery *Hylocichla fuscescens*	FCTV, USR	Low woods
Eastern Bluebird *Sialia sialis*	RTV	Fields, wood edge
Blue-gray Gnatcatcher * *Polioptila caerulea*	RTV, RSR	Open woods & thickets
Golden-crowned Kinglet *Regulus satrapa*	CTV	Evergreens & wood edges
Ruby-crowned Kinglet *Regulus calendula*	CTV	Evergreens & wood edges
Bohemian Waxwing *Bombycilla garrulus*	RTV	Seed bearing trees
Cedar Waxwing * *Bombycilla cedrorum*	CPR	Seed bearing trees
Northern Shrike *Lanius excubitor*	UWV	Open country with woody growth
European Starling * *Sturnus vulgaris*	CPR	Buildings & open woods
Yellow-throated Vireo *Vireo flavifrons*	UTV, RSV	Open woods & clearings
Solitary Vireo *Vireo solitarius*	FCTV	Wood edge

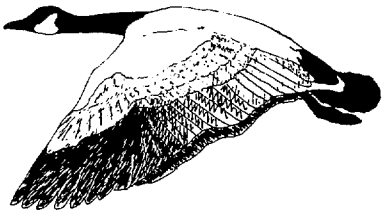
Red-eyed Vireo * *Vireo olivaceus*	FCSR, CTV	Woods
Philadelphia Vireo *Vireo philadelphicus*	UTV	Woods & edge
Warbling Vireo * *Vireo gilvus*	CSR, CTV	Open woods
Black & White Warbler *Mniotilta varia*	CTV	Woods
Prothonotary Warbler *Protonotaria citrea*	UTV	Swampy woodlands
Worm-eating Warbler *Helmitheros vermivorus*	VRTV	Brushy edge
Golden-winged Warbler *Vermivora chrysoptera*	FCTV	Woodland openings
Blue-winged Warbler *Vermivora pinus*	UTV	Brushland
Tennessee Warbler *Vermivora peregrina*	CTV	Woodlands
Orange-crowned Warbler *Vermivora celata*	FCTV	Woodland openings with undergrowth
Nashville Warbler *Vermivora ruficapilla*	CTV	Woodland edge
N. Parula Warbler *Parula americana*	UTV	Woodland
Yellow Warbler * *Dendroica petechia*	CSR, CTV	Open, brushy areas
Magnolia Warbler *Dendroica magnolia*	FCTV	Woodland edge
Cape May Warbler *Dendroica tigrina*	CTV	High bushes & small trees
Black-throated Blue Warbler *Dendroica caerulescens*	UTV	Woodland
Yellow-rumped Warbler *Dendroica coronata*	ATV	Woodlands, marshes
Black-throated Green Warbler *Dendroica virens*	CTV	Woodlands

Cerulean Warbler *Dendroica cerulea*	RTV	Open woodlands
Blackburnian Warbler *Dendroica fusca*	FCTV	Woodlands
Chestnut-sided Warbler *Dendroica pensylvanica*	FCTV	Young woodlands
Bay-breasted Warbler *Dendroica castanea*	CTV	Young woodlands
Blackpoll Warbler *Dendroica striata*	CTV	Woodlands
Pine Warbler *Dendroica pinus*	RTV	Woodlands
Palm Warbler *Dendroica palmarum*	CTV	Usually on ground or low shrubs
Ovenbird *Seiurus aurocapillus*	RSV, CTV	On ground in woodlands
Northern Waterthrush *Seiurus noveboracensis*	CTV	Lagoon edge
Kentucky Warbler *Oporornis formosus*	RTV	Low woodlands
Connecticut Warbler *Oporornis agilis*	UTV	Low woodlands, shrubs
Mourning Warbler * *Oporornis philadelphia*	USR, UTV	Dense shrubs
C. Yellowthroat * *Geothlypis trichas*	FCSR, CTV	Marshy areas
Yellow-breasted Chat *Icteria virens*	RTV	Thickets
Wilson's Warbler *Wilsonia pusilla*	FCTV	Swampy thickets or roadside brush
Canada Warbler *Wilsonia canadensis*	FCTV	Young woodlands
American Redstart *Setophaga ruticilla*	USV, CTV	Brush, wet woodlands
House Sparrow * *Passer domesticus*	APR	Usually near buildings

Eastern Meadowlark * *Sturnella magna*	USR, UTV	Grassy fields
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	USR, UTV	Marshes
Red-winged Blackbird * *Agelaius phoeniceus*	ASR, ATV	All areas
Northern Oriole * *Icterus galbula*	CSR, CTV	Open woodlands
Rusty Blackbird *Euphagus carolinus*	FCTV	Low woodlands, marshes
Brewer's Blackbird *Euphagus cyanocephalus*	FCTV	Low woodlands, marshes, fields
Common Grackle * *Quiscalus quiscalus*	ASR, ATV	All areas
Brown-headed Cowbird * *Molothrus ater*	CSR, CTV	Open areas
Scarlet Tanager *Piranga olivacea*	RTV	Woodlands
Western Tanager *Piranga ludoviciana*	HYP-5/10/76	
Summer Tanager *Piranga rubra*	ACC-5/16/80	
Northern Cardinal * *Richmondena cardinalis*	CPR	Woodland, shrubs
Rose-breasted Grosbeak * *Pheucticus ludocicianus*	RCSR, CTV	Woodlands with brush
Indigo Bunting * *Passerina cyanea*	FCSR, CTV	Brushy areas with trees
Dickcissel *Spiza americana*	VRTV	Grassy fields
Evening Grosbeak *Hesperiphona vespertina*	FCWV	Seed trees, feeders
Purple Finch *Carpodacus purpureus*	FCWV, FCTV, VRSR	Seed trees, feeders
Pine Grosbeak *Pinicola enucleator*	RWV	Seed trees, feeders

Common Redpoll *Acanthus flammea*	UWV	Feeders, evergreens, shrubs
Pine Siskin *Spinus pinus*	FCWR, FCTV	Conifers, weedy fields
American Goldfinch * *Spinus tristis*	CPR	Shrubs, open areas with weedy growth
Red Crossbill *Loxia curvirostra*	VRWV	Conifers, box elders, apple trees
White-winged Crossbill *Loxia leucoptera*	VRWV	Conifers, box elders, apple trees
Rufus-sided Towhee *Pipilo erythrophthalmus*	FCTV	Thickets
Savannah Sparrow *Passerculus sandwichensis*	UTV	Grassy fields
Grasshopper Sparrow *Ammodramus savannarum*	RTV	Grassy fields
Vesper Sparrow *Pooectetes gramimeus*	RTV	Grassy fields
Northern Junco *Junco hyemalis*	CWR, ATV	On ground, shrubby areas
American Tree Sparrow *Spizella arborea*	CWR, CTV	Wood edge, openings
Chipping Sparrow * *Spizella passerina*	USR, CTV	Lawns, woodland clearings
Clay-colored Sparrow *Spizella pallida*	RTV	Brushy woodland openings
Field Sparrow *Spizella pusilla*	FCTV	Grassy fields
White-crowned Sparrow *Zonotrichia leucophrys*	FCTV	On ground under shrubs
White-throated Sparrow *Zonotrichia albicollis*	ATV, RWV	On ground under shrubs
Fox Sparrow *Passerella iliaca*	FCTV	Woodland thickets
Lincoln's Sparrow *Melospiza lincolnii*	VRTV	Marshy land

Swamp Sparrow *Melospiza georgiana*	UTV	Marshy land
Song Sparrow * *Melospiza melodia*	CSR, CTV	Brushy cover
Snow Bunting *Plectrophenax nivalis*	RWV	Open areas, fields



APPENDIX H

DUCK POPULATION STUDIES AT BAY BEACH WILDLIFE SANCTUARY

Duck counts were obtained by one or two staff members counting the ducks individually in the water areas adjacent to: the Nature Center, Parking Lot, Manager's residence, Marsch Road, and Sanctuary Road. Male and female mallards and black ducks were counted separately except during molt period. 10x50X and 7x35X binoculars were used. All of the counts fell between the hours of 9:30 a.m. and 3:30 p.m. with about 83% occurring between 11 a.m. and 2 p.m. Counts were made twice a month throughout the year except during the summer months when only one count was taken per month.

Highest concentrations of ducks were reached during the Winter months (late November through March). Gradual increases in September, October, and early November lead up to the high winter numbers. Lowest numbers occur in the summer months (April through August). A sudden decrease occurs during March. This decrease seems to be mainly caused by two factors:

1) An increase in daylight which brings about normal hormonal changes in waterfowl, initiating pair bonding and subsequent nesting activities.

2) Warmer weather and Spring rains melting the snow cover and creating puddles in many other areas, dispersing the flock out of the Sanctuary.

APPENDIX H

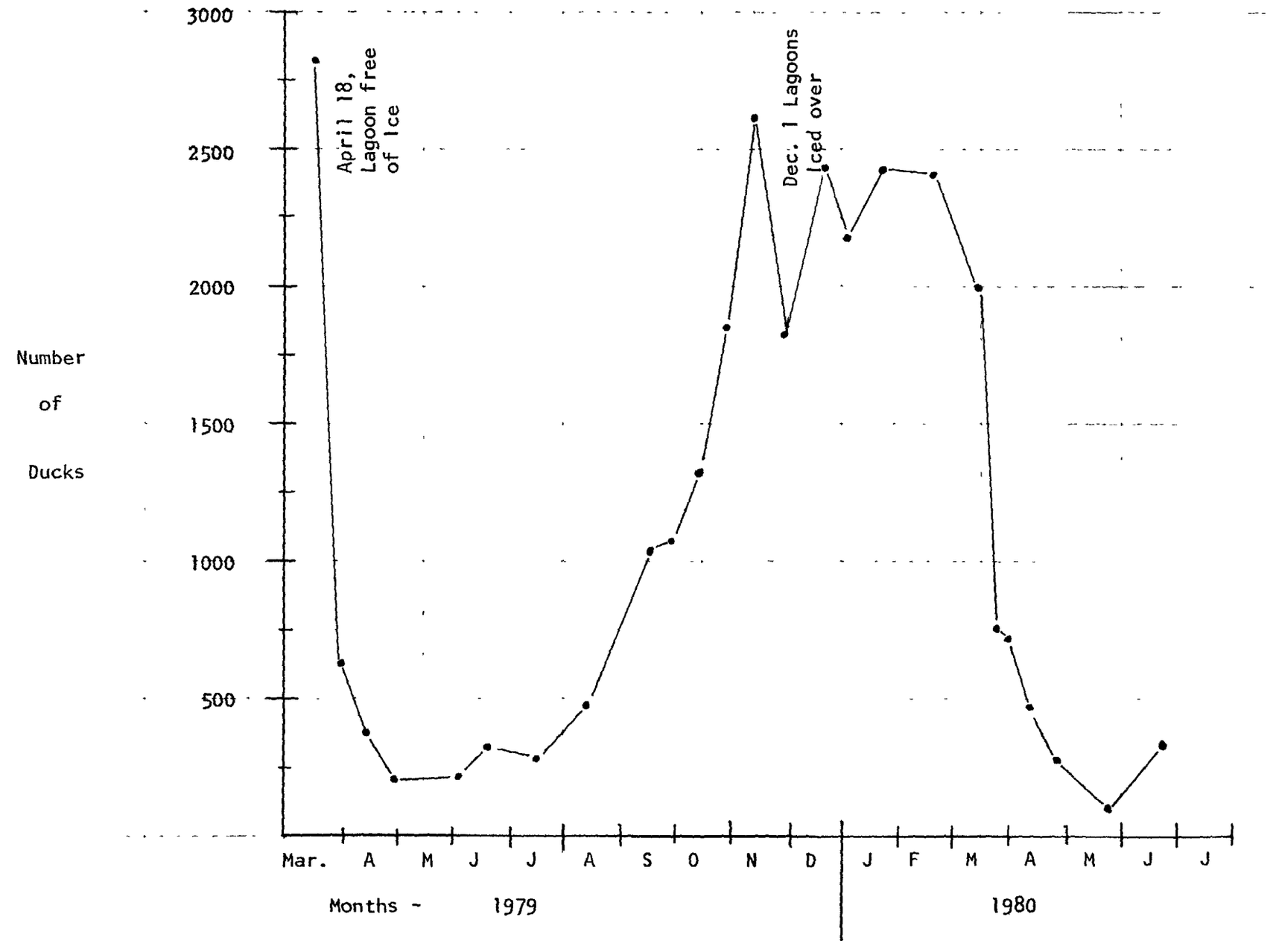
DUCK POPULATION STUDIES AT BAY BEACH WILDLIFE SANCTUARY

Duck Count Summary Sheet - 25 Total Counts From 3/16/79 To 6/21/80

DATE TAKEN	MALLARD MALES	MALLARD FEMALES	BLACK DUCKS	TOTAL DUCKS
3-16-79	1429	774	611	2814
3-31-79	273	135	229	637
4-13-79	188	62	112	362
4-28-79	181	14	5	200
6- 2-79	193	7	11	211
6-17-79	267	17	30	314
7-14-79		FLIGHTLESS PERIOD		267
8-11-79				462
9-15-79		MOLT		1049
9-29-79				1063
10-13-79				1329
10-27-79	920	592	338	1850
11-12-79	1194	948	460	2602
11-29-79	934	568	313	1815
12-19-79	1303	763	368	2434
1-3-80	1095	734	348	2177
1-21-80	1097	877	466	2440
2-18-80	1338	694	370	2402
3-13-80	982	636	379	1997
3-20-80	388	147	220	755
3-28-80	312	187	209	708
4-10-80	231	91	146	468
4-24-80	188	49	37	274
5-22-80	88	7	8	103
6-21-80	288	16	19	323

APPENDIX H Graph 1

DUCK POPULATIONS FOR THE SANCTUARY 1979-1980



APPENDIX I

BACKGROUND INFORMATION ON THE CANADA GEESE AT WILDLIFE SANCTUARY

History of Sanctuary Geese

Prior to the settlement of the Lower Green Bay the Canada Goose was a fairly common breeder in this area. However, due to habitat destruction, egg gathering and year-round hunting, the Canada Goose was extirpated as a local breeder by 1900.

In 1932 Louis Barkhausen bought 3 pair of Giant Canada Geese (*Branta canadensis maxima*) from the Jack Miner Game Sanctuary in Kingsville, Ontario and shipped them to his refuge on the west Shore of Green Bay.

In 1938 Barkhausen gave 6 geese to the Wildlife Sanctuary, and in 1939 he gave 3 more. The Sanctuary produced its first young geese in 1941. Geese were first banded at the Sanctuary during the summer of 1965; 167 were banded at this time. The Sanctuary flock has continued to increase dramatically and presently contains about 670 geese.

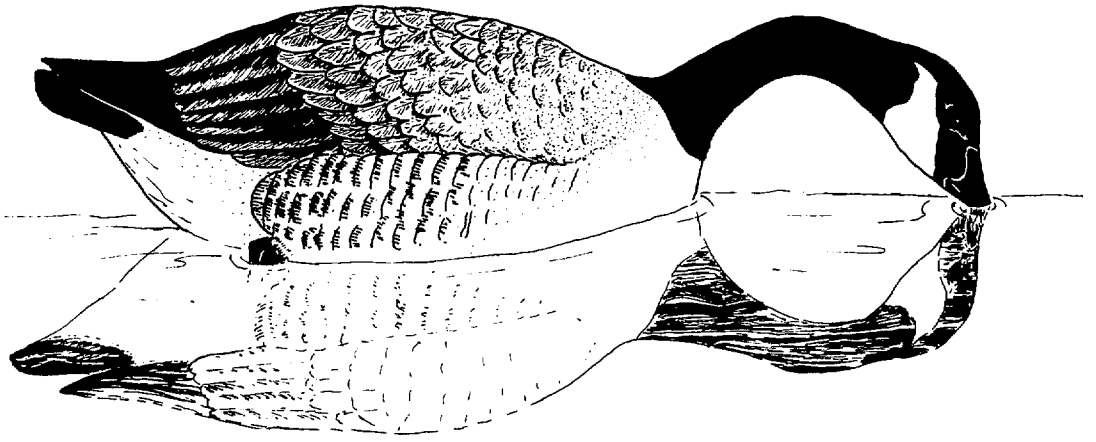


TABLE 1

NESTING SUCCESS OF CANADA GEESE AT THE WILDLIFE SANCTUARY 1976-1980[1]

	Number of Nests			Number of Successful Nests			Number of Young Produced		
Year	Gander-Landers	Ground	Total	Gander-Landers	Ground	Total	Gander-Landers	Ground	Total
1976	18	23	41	12	16	28	48	76	124
1977	22	30	52	13	16	29	46	81	127
1978	23	47	70	8	29+	37+	36	151+	187+
1979	26	29	55	19	24	43			176
1980	22	30	52	20	27	47			165+

Average brood/successful nest = 5.23 young

[1]Source: D. F. Brinker, R. C. Hawley unpublished data

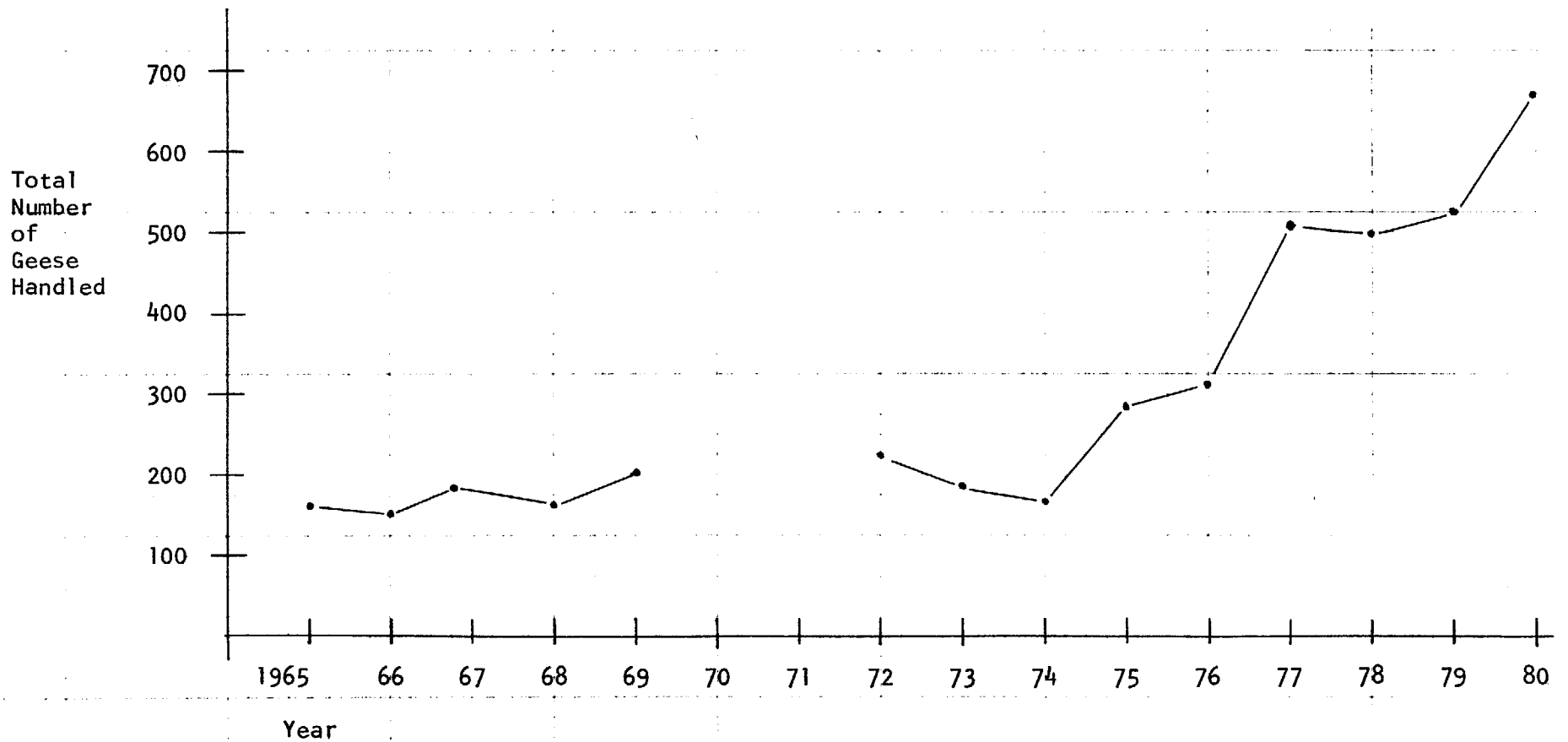
TABLE 2

CANADA GEESE BANDED AT BAY BEACH WILDLIFE SANCTUARY (1965-1980)

Year	No. Young Banded	No. Adults Banded	Total Geese Banded	Retraps	Total Geese Handled	Cumulative Total Banded
1965	53	114	167	0	167	0
1966	78	29	107	44	151	151
1967	64	24	88	98	186	337
1968	64	28	92	70	162	499
1969	81	44	125	75	200	699
1972	66	95	161	63	224	923
1973	72	36	108	80	188	1,111
1974	90	24	114	56	170	1,281
1975	89	69	158	125	283	1,564
1976	129	72	201	134	335	1,899
1977	125	145	270	245	515	2,414
1978	141	112	253	245	498	2,911
1979	158	138	296	286	582	3,493
1980	181	225	406	264	670	4,163
TOTALS	1,391	1,155	2,546	1,785	4,331	4,163

APPENDIX I Graph 1

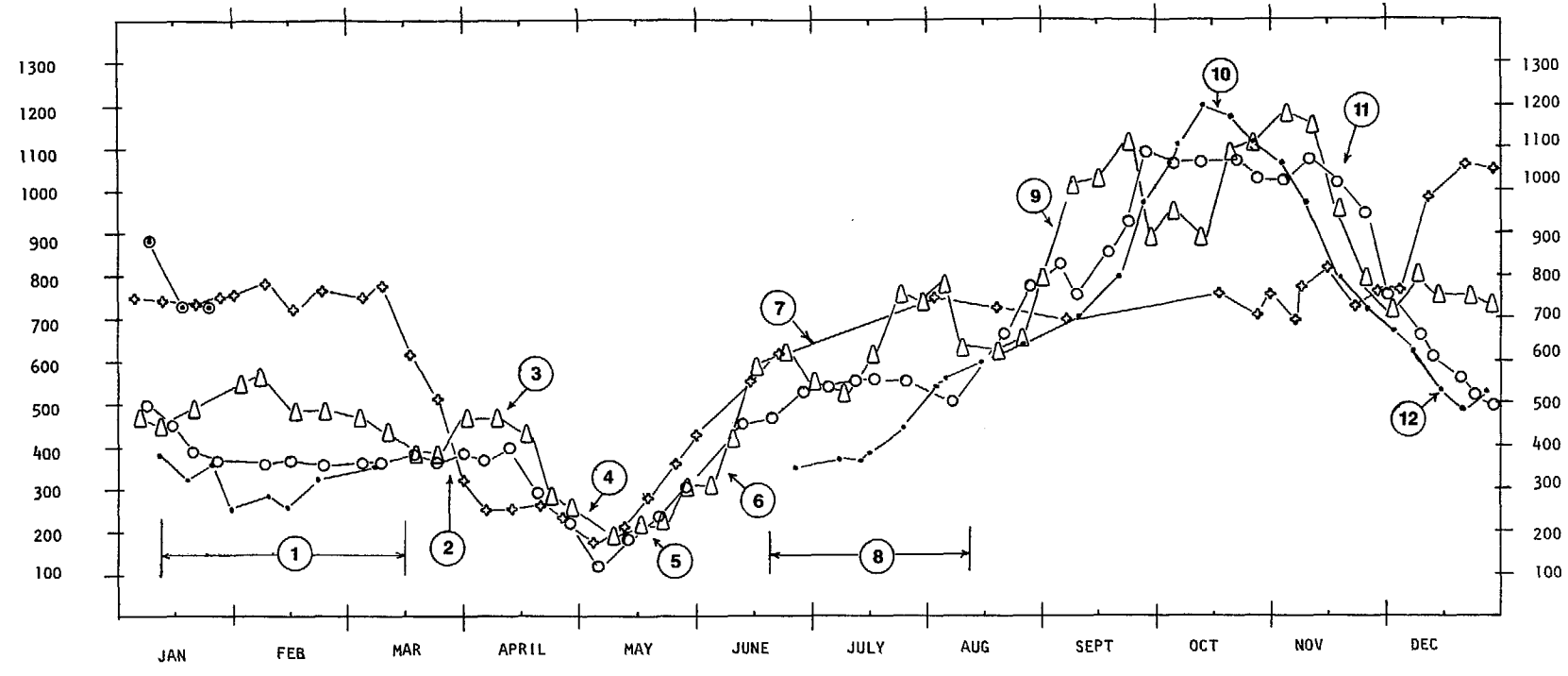
TOTAL NUMBER OF CANADA GEESE HANDLED AT
BAY BEACH WILDLIFE SANCTUARY DURING SUMMER BANDING



APPENDIX I

GRAPH 2

Yearly Cycle and Populations of Canada Geese at the Wildlife Sanctuary 1976-1980*



KEY TO SYMBOLS: • 1976 ○ 1977 △ 1978 ◇ 1979 ⊙ 1980

*Graph explained on following pages, adapted from D. Brinker 1976-1979, and R. Hawley 1979-1980, unpublished notes

Interpretation of Graph 2

Yearly Cycle and Populations of Canada Geese at the Wildlife Sanctuary 1976-1980.

Three Count Moving Average. The data graphed is not the actual counts taken but each point represents an average of 3 counts; the count taken one week prior to that point, the count taken on the date of that point and the count taken one week after the date of that point. It is believed that this method more accurately shows the actual number of geese in the area during the count period by reducing extreme fluctuations due to bias. It is also believed that this graph shows trends which can be more easily interpreted and understood than if the actual counts themselves were graphed.

1) The Winter Population is relatively stable from mid-January to mid-March. It very closely represents the total Sanctuary population which is less migratory than northern populations (Also see Table 4.)

2) Nesting initiated; geese disperse over Sanctuary and lower Bay to set up breeding territories, counts do not cover back areas of Sanctuary and Bay, therefore, the numbers on the graph drop.

3) Slight peak due to a small influx of geese migrating North from wintering grounds in southern Illinois.

4) Most of the geese are on nests at this time except for a non-breeding flock of about 150.

5) Most of the broods appear at this time, many geese bring their broods back into main feeding area - gang broods form.

6) Population counts increase as more geese bring their broods into Sanctuary from the surrounding lower Bay area.

7) Banding - about 90% of the Sanctuary Geese and many from the lower Bay which are at the Sanctuary are banded. The significant increase in the total number of geese handled each year at this time shows the increase in the local population through nesting success.

8) The Summer flightless period. This is due to the molt of all flight feathers at once.

9) The population increases sharply as Fall migration begins. Weather has a great effect on the size of the population during Fall, and the time of peak numbers.

10) Peak Fall migration usually occurs during late October or early November. The Fall of 1979 was very mild with no snow cover. This might be one reason so many geese remained until early

January. Few counts taken during September and October of 1979 may have caused curve to be low for Fall of 1979. A peak count of 1180 was recorded on October 25. (Table 3).

11) The Sanctuary lagoons freeze over, except an area in the feeding lagoon which is aerated. Most of the Bay freezes about one week later except for an area near the mouth of the Fox River which remains open throughout the Winter. Most of the Sanctuary's waterfowl roost here each evening. Most of the migrant geese leave during this period causing a sharp drop in the population.

12) Some of the local geese from Green Bay migrate South during late December. The Winter of 1979-1980 was not typical due to the mild weather with very little snow cover.

TABLE 3
AVERAGE NUMBER OF GEESE USING SANCTUARY EACH MONTH

MONTH	1976	1977	1978	1979	1980
January		416 (4)	486 (4)	727 (4)	778 (4)
February		355 (4)	479 (3)	753 (4)	
March		375 (5)	372 (5)	615 (5)	
April		323 (4) 90*	301 (4) 126*	222 (4)	
May		265 (4)	198 (4)	223 (4) 121*	
June	337 (2) 337*	462 (3)	594 (4)	482 (2)	
July	371 (5)	542 (4)	665 (4)	(0)	
August	578 (4)	587 (4)	609 (4)	779 (2)	
September	734 (4)	901 (5)	1,026 (4)	608 (1)	
October	1,186 (4) 1,286*	1,040 (4)	1,101 (3)	885 (2) 1,180*	
November	852 (4)	1,008 (4) 1,166*	971 (5) 1,259*	730 (4)	
December	576 (5)	590 (5)	740 (4)	997 (4)	

( ) Number of Counts taken during month

*Extreme high or low counts for year

TABLE 4
WINTER POPULATIONS OF CANADA GEESE USING THE SANCTUARY 1977-1980

YEAR	POPULATION JAN. & FEB.	# OF COUNTS
1977	396	8
1978	478	8
1979	737	8
1980	778	4

APPENDIX J

FRIENDS OF THE BAY BEACH WILDLIFE SANCTUARY ORGANIZATION

Friends of the Wildlife Sanctuary
Sanctuary Road, PO Box 945
Green Bay, Wisconsin 54305

The first organizational meeting of the "Friends of the Bay Beach Wildlife Sanctuary Inc." was held in December of 1978; a Board of Directors was elected and the organization's goals and objectives were outlined.

The "Friends" organization was established to help preserve and enhance the Bay Beach Wildlife Sanctuary through public involvement. Membership is open to all persons. The principal officers are President, Vice President, Secretary and Treasurer. The business affairs of the Corporation are managed by its Board of Directors. A complete set of "Friends" By-laws can be found in the Sanctuary Policy.

The "Friends" have been an extremely helpful organization. Activities such as the Art and Craft Fair, Trout Boil, and Bird Seed Sale, have created more public support and have raised money for many items not available through the normal Sanctuary budget.

APPENDIX K

TRAILS OF THE BAY BEACH WILDLIFE SANCTUARY

Goose Refuge Trail	This trail is a 3/4 mile loop, located on an island. It is available to small groups during the winter, fall and summer months and requires a naturalist guide. This was the first trail established at the Sanctuary (completed in 1970). The trail offers waterfowl management areas, nesting sites (gander landers), diverse vegetation, a deer yard and our Indian site used in the "Time Tunnel" program.
Gray Fox Trail	This trail is a 1 mile loop constructed in 1977, and named after the gray fox which resides at the Sanctuary. Starting at the nature center, this trail crosses the footbridge, continues along the lagoon, passes a cattail pocket, meanders through a park like area into a partially forested area and eventually winds back to the Nature Center. A guide booklet is available for this trail. Large numbers of students use this site for hiking, outdoor education and other environmental studies. In the winter months it is used as part of the cross-country ski trail. A variety of animal and plant life can be observed along this trail, including deer, gray fox, warblers, sumac, cattails, tamarack, and mulberry.
Hussong Memorial Trail	Established in 1978 as a memorial to the late environmentalist, Clara Hussong, by the Green Bay Bird Club and the Northeastern Wisconsin Audubon Chapter. A guide booklet is also available for this trail, pointing out the four plant communities present; forest, marsh, old field and pond. This is an excellent study and exploration area for outdoor education programs. Wildflowers, birds, aquatic life and mammals are found along this trail. This trail is also part of the cross-country ski route.
Woodchuck Trail	This trail illustrates the re-vegetation process and plant succession found on a disturbed site. Numerous pioneer species adapted to stress areas are present. This 3/4 mile trail is a testimony to man's impact on the environment. Animal life present includes woodchucks, deer, pheasant, and cavity-nesting birds. The cross-country ski route includes the Woodchuck Trail.

Mockingbird Trail	This 1/2 mile trail is the newest and most specialized trail. Used only for snowshoeing, it requires a naturalist guide at all times. The trail was called Mockingbird Trail because of an unusual mockingbird sighted in the winter of 1979-80. Habitat management, Sanctuary history, winter twig identification and wildlife signs are items of discussion when snowshoeing. Snowshoes are available for a nominal fee at the Nature Center.
New Trail	In the construction stages now, this trail will be located near the Nature Center and will include special landscaping effects, a stream, footbridge, amphitheater, fire circle, special plant material, handrails, braille guides and signage. A Community Development Grant has supplied the necessary funds to develop this trail, designed as a trail for the handicapped, but will be available to all visitors.

APPENDIX L

SANCTUARY EDUCATIONAL PROGRAMS

Naturalist's Guided Nature Trail	Is an informal walk along the Sanctuary trail system. The naturalist encourages everyone to actively participate in topics of discussion which include wildlife management, vegetation management, fauna and flora.
Self-Guided Nature Trail	Consists of a trail guided by means of a booklet that follows a series of numbered posts. Emphasis has been placed on habitat and management practices. Group leaders have the freedom to modify this program to fit their needs. An area orientation by a naturalist precedes the hike.
Animal Program	Has been designed for small children and scout troops. This program consists of a brief area orientation and a short "live animal" presentation.
Lecture Series	Entails a variety of slide programs on various subjects. These are available on site or in the classroom. In addition, naturalists are available for answering questions.
Nature Series	There are many exhibits, both live animals and nature displays available in the Nature Center. Naturalists are available for interpretation.
Waterfowl Feeding	Cans of corn can be purchased to help feed the waterfowl population.
Saturday Classes	Naturalists and volunteers from the community offer a wide selection of topics on various Saturdays during the year. Examples are: cross country skiing, photography, edible plants, backpacking, beekeeping, star gazing, maple sugaring, birds of prey, and more.
Sunday Movies	In an effort to continue to carry out our growing role as an environmental educator, the Sanctuary initiated a new program in January, 1980. With the cooperation of the Brown Co. Library, DNR, and UWGB Interlibrary Loan Department, the Sanctuary offers a series of movies to the public each Sunday. Movie selection has been based on a number of criteria: quality, educational value, and public interest.
Summer Park Naturalist Program	Through the Summer Park Naturalist program, youngsters participate in games, role playing, show and tell and other activities at the city parks. The climax to the program is a field trip to the Sanctuary where they play games, hike, explore and help with various work projects. It has provided a hands-on experience for the children. In addition, it exposes them to the total Sanctuary program.

APPENDIX M

VISITOR COUNTS FOR 1979-80 AT THE BAY BEACH WILDLIFE SANCTUARY

Visitor counts were taken by three methods:

1. By Volunteers, Coastal Management Personnel, or Sanctuary Naturalists - Counts taken by these people were the most accurate and dependable and formed the main basis for visitor estimates.

2. By Concessionaires - Counts taken of people who entered the Nature Center Building by the personnel selling corn and other concessions. These counts were generally good on "slow" days, poor on busy days. Many counts were unreliable and inaccurate and were discarded. Some individuals were more responsible in taking counts than others.

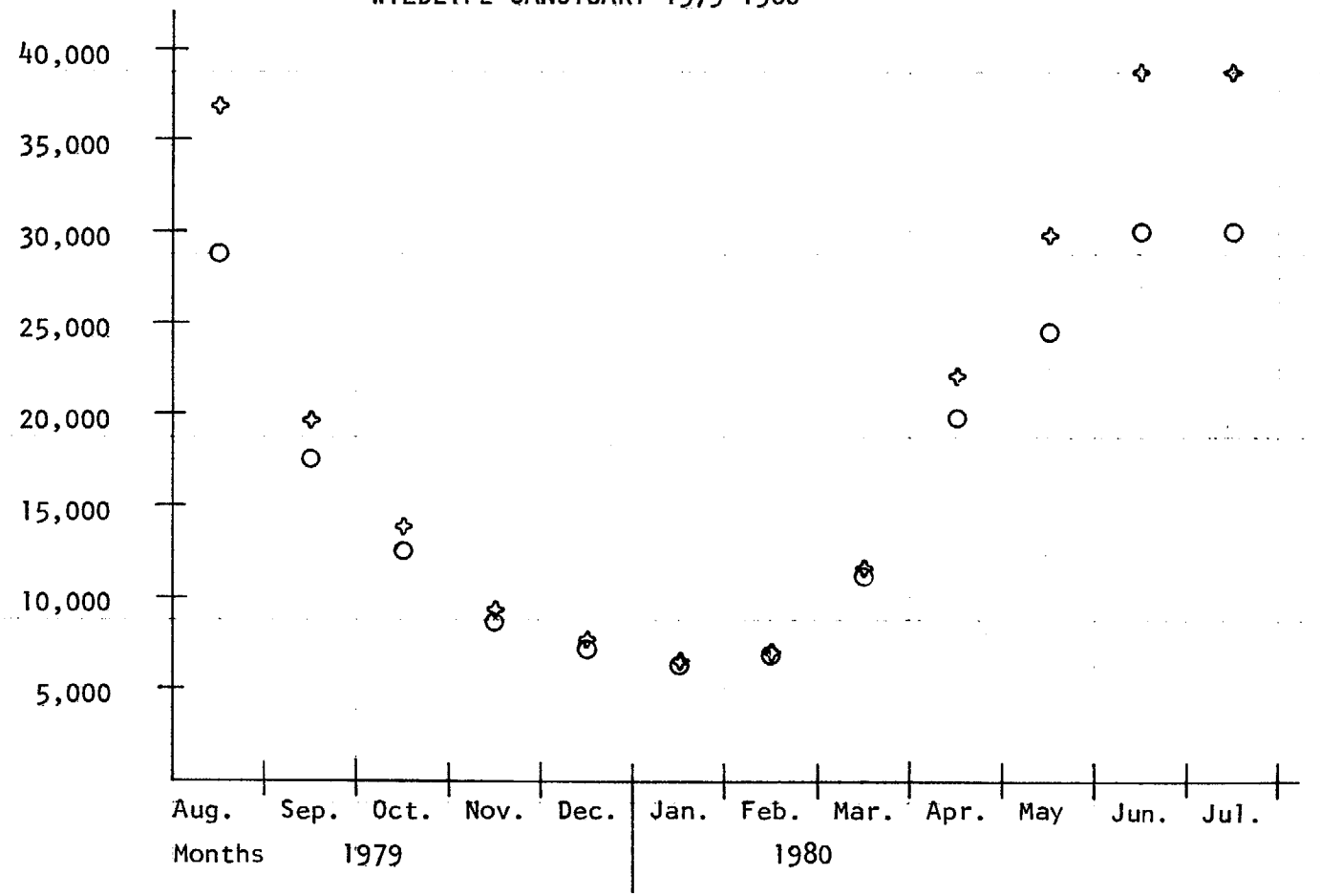
3. Automatic car counter - Counter located at entrance to Nature Center Parking Lot. Generally good counts but only indicated number of vehicles using parking lot; needed to be checked daily for malfunction.

The following graphs show typical visitor usage at the Sanctuary for year, seasons, days, and parking lot use.

APPENDIX M Graph 1

NUMBER OF MONTHLY VISITORS AT THE

WILDLIFE SANCTUARY 1979-1980



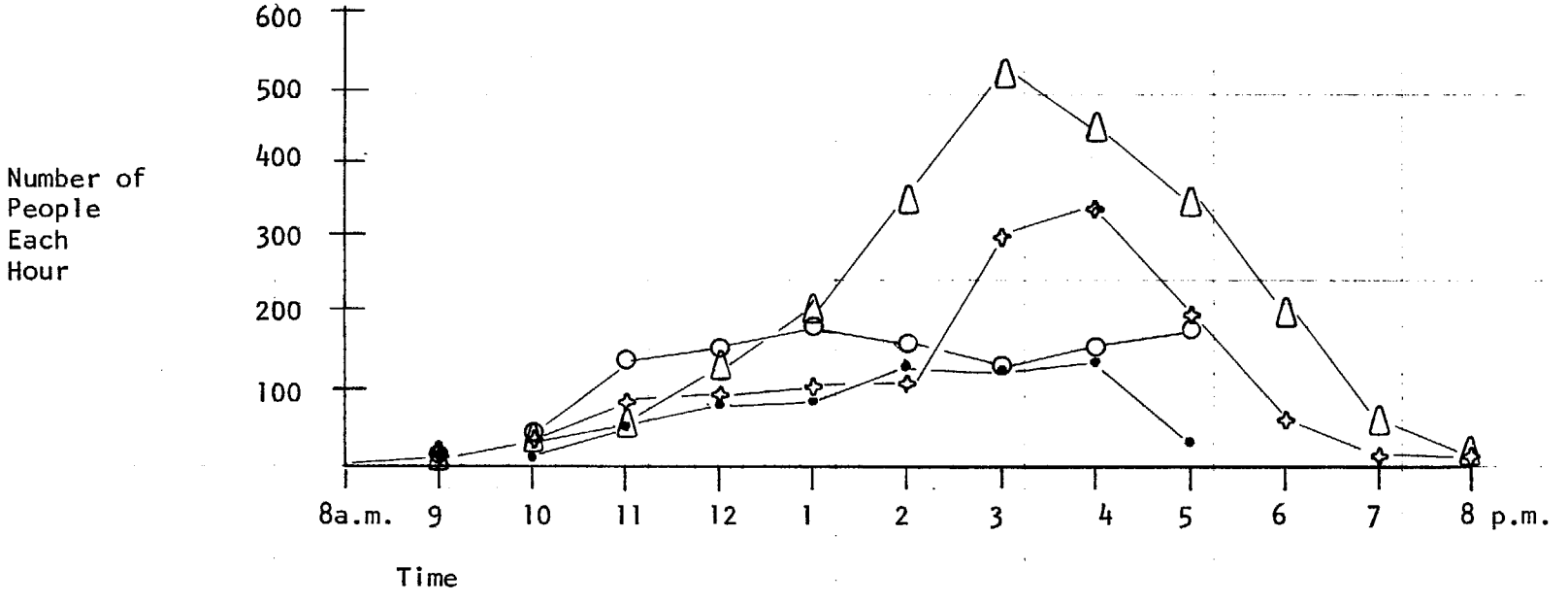
○ Number of people using Nature Center Facilities (total for year 207, 209)

✧ Number of people using entire Sanctuary Area (total for year 242,400)

June and July are estimates based on May and August counts.

APPENDIX M Graph 2

EXAMPLE OF TYPICAL NUMBER OF SUNDAY VISITORS AT SANCTUARY DURING EACH SEASON

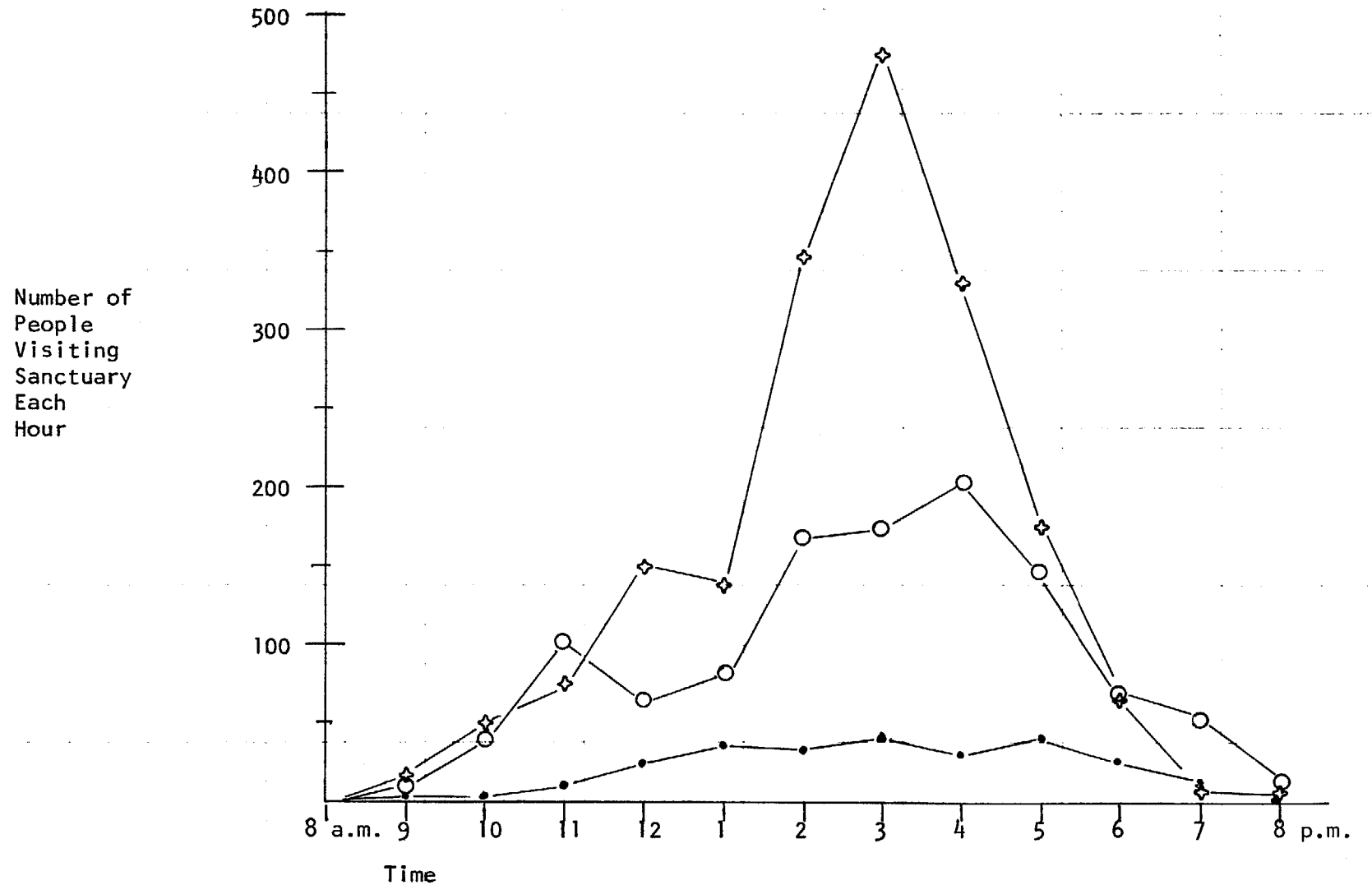


Symbols:
- △ Aug. (total for day 2,373)
- ○ Oct. (total for day 1,189)
- • Jan. (total for day 679)
- ✧ April (total for day 1,374)

Sanctuary closes at 5 p.m. Fall and Winter Location Symbols indicate number of people who entered Sanctuary during each one hour interval.

APPENDIX M Graph 3

COMPARISON OF NUMBERS OF SANCTUARY VISITORS ON A WEEKDAY, A SATURDAY, A SUNDAY DURING APRIL 1980

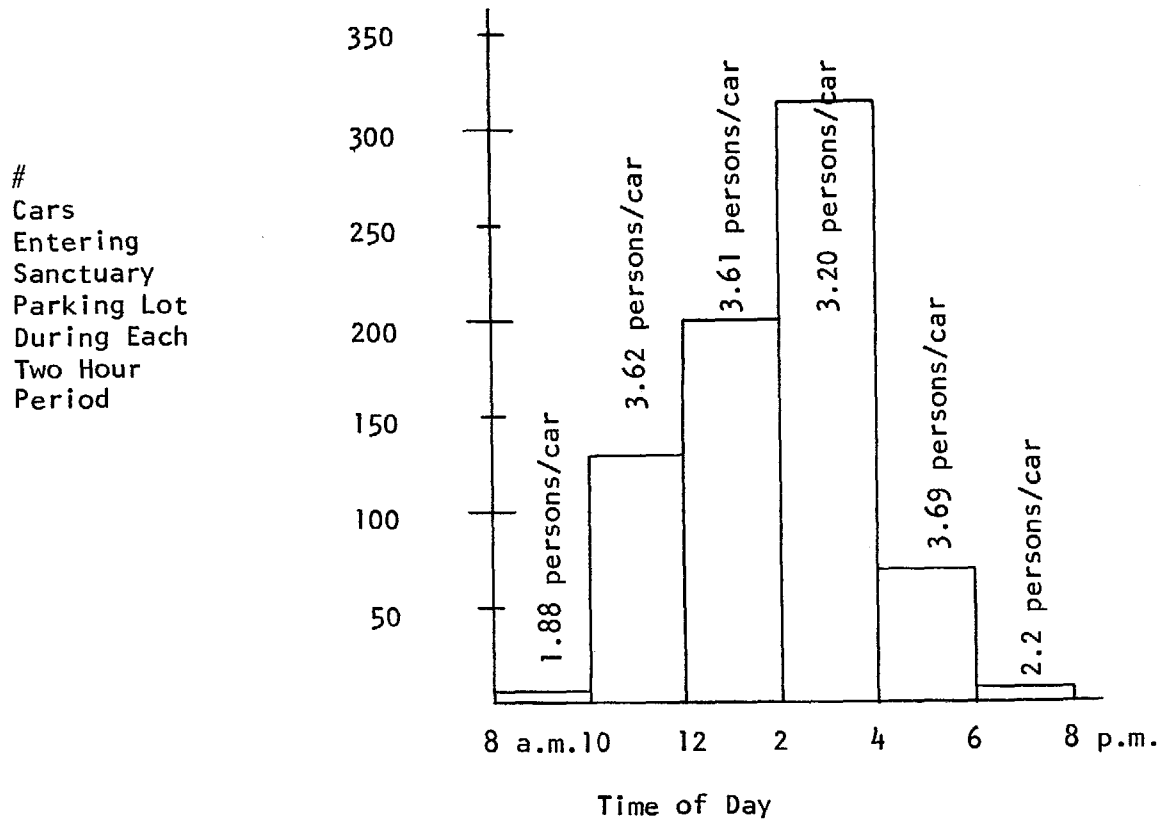


Symbols: • Weekday (total 274), ○ Saturday (total 1136), ✧ Sunday (total 1846)

APPENDIX M

Graph 4

Number of Cars Using Sanctuary Parking Lot, April 20, 1980



Total people 2,481; total cars 727; average # persons/car 3.41

APPENDIX N

An Example of the Questionnaire Mailed to a Random Sample of Brown County Residents

THIS PROJECT IS SPONSERED BY THE WISCONSIN COASTAL MANAGEMENT PROGRAM

1. Have you ever visited the Bay Beach Wildlife Sanctuary?
   _____ Yes _____ No

   If No, do you plan on visiting the Wildlife Sanctuary in the near future?
   _____ Yes _____ No

   Do you know where the Wildlife Sanctuary is located?
   _____ Yes _____ No _____ Not sure

   IF YOUR ANSWER TO QUESTION 1 IS NO, PLEASE GO TO QUESTION NUMBER 18

2. How often do you visit the Bay Beach Wildlife Sanctuary?
   _____ Once every few years
   _____ 1-2 times a year
   _____ 3-4 times a year
   _____ More than four times a year

3. How did you learn of the Bay Beach Wildlife Sanctuary? (Please list)
   _____
   _____

4. During what season (s) have you visited the Wildlife Sanctuary?
   _____ Spring _____ Fall
   _____ Summer _____ Winter

5. On what days do you usually visit the Wildlife Sanctuary?
   _____ Weekends _____ Weekdays _____ Both

6. During what time of day were most of your visits?
   _____ Mornings _____ Afternoons _____ Evenings

7. What is the average length of your visits to the Wildlife Sanctuary?
   _____ Less than one hour _____ 2-3 hours
   _____ 1-2 hours _____ More than three hours

8. When coming to the Wildlife Sanctuary did you take a . . .
   _____ Bicycle _____ Walk
   _____ Automobile _____ Bus
   _____ Motor bike _____ Other

9. How far did you travel to visit the Bay Beach Wildlife Sanctuary?
   _____ 0-5 miles _____ 16-30 miles
   _____ 6-15 miles _____ More than 30 miles

10. On the average, approximately how much did you spend during the day of your visit to the Bay Beach Wildlife Sanctuary? (Include cost of gas, food, fees, and any purchases made at the Wildlife Sanctuary or surrounding Green Bay area)
    _____ 0-$5.00 _____ $16-$20
    _____ $6-$10 _____ More than $20
    _____ $11-$15

11. Did you visit any other attractions in the Green Bay area the day (s) of your visit to the Wildlife Sanctuary?
    _____ Yes _____ No
    IF YES, PLEASE LIST THEM _____
    _____
    _____

12. What were your reason (s) for visiting the Wildlife Sanctuary?

_____ Fun
_____ Relaxation
_____ Curiosity
_____ Educational
_____ Other
PLEASE SPECIFY _____

13. What activities did you participate in on your last visit to the Wildlife Sanctuary?

_____ Picnic
_____ Fish
_____ Hike the Nature Trails
_____ Feed the Waterfowl
_____ View the Animal Exhibits
_____ Participate in a Class
_____ Take a Guided Tour
_____ Ski or Snowshoe
_____ View the Nature Center
_____ Other
PLEASE SPECIFY _____

14. Was the area crowded at the time of your visit (s)?

_____ Not at all _____ Slightly _____ Moderately _____ Very

15. I consider the Bay Beach Wildlife Sanctuary . . .

_____ A natural area where the wildlife and forest form a pleasant rustic setting.
_____ A recreational area where I can enjoy vigorous outdoor activities.
_____ An area where educational and recreational activities are mixed.
_____ An area where too many conflicting activities are taking place.

16. In your opinion, which of the following characteristics are the most important features of the Wildlife Sanctuary? PLEASE RANK ALL OF THEM WITH #1 BEING THE MOST IMPORTANT AND #8 THE LEAST.

_____ Different plant communities
_____ Trails, boardwalks, and oberservation decks
_____ Waterfowl
_____ Wildlife
_____ Natural areas
_____ Lagoons and ponds
_____ Size of the Sanctuary
_____ Other (PLEASE SPECIFY)

17. The following items have been mentioned by users in previous interviews as possible problems at the Bay Beach Wildlife Sanctuary. Please rank all of these with #1 being the one you feel is most important and #8 being the least.

_____ Litter
_____ Noise
_____ Water pollution
_____ Area too crowded
_____ Facilities lacking or out of date
_____ Too many birds
_____ Lack of parking space
_____ Other (PLEASE SPECIFY)

18. The following statements reflect possible practices or preferences. Please read each statement carefully and check each answer to your interest or preference.

A. It is important to have large areas set aside which are not availiable to the public for wildlife and nesting birds.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

B. There should be more naturalist led hikes and programs.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

C. Additional recreational facilities(trails, buildings, picnic areas) would harm the Wildlife Sanctuary.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

D. It is important to have caged exhibit animals on display.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

E. It is important to hold outdoor education classes for area school children at the Bay Beach Wildlife Sanctuary.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

F. A nominal fee should be charged to cover the costs of special programs and activities.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

G. Programs and facilities should be updated and enlarged to better accomodate present and future visitors.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

H. Public monies, bonds, and tax revenues should be used for program expansion at the Bay Beach Wildlife Sanctuary.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

I. Private funds and donations should be used for program expansion at the Bay Beach Wildlife Sanctuary.

STRONGLY DISAGREE	DISAGREE	DON'T KNOW	AGREE	STRONGLY AGREE
/	/	/	/	/

19. Which of the following programs and facilities would you use or participate in if they were offered at the Bay Beach Wildlife Sanctuary. PLEASE CIRCLE THE NUMBER THAT IS BEST SUITED TO YOUR OPINION FOR EACH ITEM.

	DEFINITELY WOULD NOT USE		DON'T KNOW		DEFINITELY WOULD USE
Naturalist guided nature programs and hikes	1	2	3	4	5
Historical programs	1	2	3	4	5
Special programs (fish boils, arts and crafts fair, etc.)	1	2	3	4	5
Family oriented programs	1	2	3	4	5
Saturday morning nature classes	1	2	3	4	5
Junior naturalist programs	1	2	3	4	5

#19 CONTINUED ON OTHER SIDE

#19 CONTINUED

	DEFINITELY WOULD NOT USE		DON'T KNOW		DEFINITELY WOULD USE
Bicycle trails	1	2	3	4	5
Self-guided nature trails	1	2	3	4	5
Cross country ski trails	1	2	3	4	5
Snowshoe trails	1	2	3	4	5
Observation decks	1	2	3	4	5
Wildlife observation blinds	1	2	3	4	5
Drinking fountains	1	2	3	4	5
Picnic areas	1	2	3	4	5
Rest areas along the trails	1	2	3	4	5
Grills and fire rings in the picnic areas	1	2	3	4	5
Areas for fishing	1	2	3	4	5
Bait and sport shop	1	2	3	4	5
Nature center exhibits	1	2	3	4	5
Guided boat tours	1	2	3	4	5
Live native Wisconsin animal exhibit	1	2	3	4	5
Handicapped facilities	1	2	3	4	5
Small boat rental	1	2	3	4	5
Childrens zoo	1	2	3	4	5
Domed botanical gardens	1	2	3	4	5

20. If an admission fee was charged to see a native live animal exhibit at the Wildlife Sanctuary, what would be the maximum you would be willing to pay?
$___._____

21. What is your occupation (OPTIONAL)

_____

22. What is the last year of school you completed? (OPTIONAL) _____

THE FOLLOWING SPACE HAS BEEN PROVIDED FOR ANY ADDITIONAL COMMENTS YOU MAY LIKE TO MAKE REARDING THE BAY BEACH WILDLIFE SANCTUARY OR THIS SURVEY. THANK YOU FOR YOUR TIME AND CONSIDERATION.

APPENDIX O

An Example of the Questionnaire Used on Site at the Sanctuary to Inventory User Preferences.

BAY BEACH WILDLIFE SANCTUARY ON SITE SURVEY
SPONSORED BY THE WISCONSIN COASTAL MANAGEMENT PROGRAM

_____ Date _____

1. Where do you live? Town _____ State _____

2. How far did you travel to visit the WLS?

___ 0 - 10 miles
___ 11 - 30 miles
___ 30 - 60 miles
___ more than 60 miles

3. When coming here, did you take a

___ car
___ bicycle
___ bus
___ motor bike
___ walk
___ other

4. How often do you visit the WLS?

___ this is the first time
___ 1 - 2 times a year
___ 3 - 4 times a year
___ more than 4 times a year

If this is your first visit, how did you learn of the WLS?

_____

5. When do you use the WLS on

___ weekends only
___ weekdays only
___ both weekends and weekdays

6. During what season(s) have you visited the WLS?

___ spring
___ summer
___ fall
___ winter

7. Did you come as a

___ family
___ couple
___ mixed group
___ single

8. What activities do you plan on participating in while here at the Sanctuary?
***
_____

_____

9. Did you or do you plan on visiting any other attractions in the Green Bay area today?

___ yes ___ no If yes where? _____

The Bay Beach Amusement Park ___ yes ___ no

The UWGB Cofrin Arboretum ___ yes ___ no

10. Do you feel the area is crowded?

___ not at all
___ slightly
___ moderately
___ very

11. What is your occupation? _____

12. What was the last year of school you completed? _____

APPENDIX P

SURVEY RESULTS

TABLE 1

OCCUPATION	PERCENT
Student	28.2
Blue Collar	17.7
Professional	15.4
White Collar	14.5
Housewife	12.0
Retired	2.6

TABLE 2

YEARS OF SCHOOL COMPLETED	PERCENT
Four	.6
Five	.3
Six	2.3
Seven	1.4
Eight	1.7
Nine	.6
Ten	3.1
Eleven	4.3
Twelve	24.8
Thirteen	5.4
Fourteen	7.4
Fifteen	1.7
Sixteen	14.2
Seventeen	1.4
Eighteen	2.3
Nineteen	.6
Twenty	.0
Twenty One	2.3
No Response	24.9

TABLE 3

PLACE OF RESIDENCE	PERCENT
Green Bay	67.0
Outside of Brown County	18.5
Out of State	10.5
Brown County	2.8

TABLE 4

DISTANCE (MILES) TRAVELED TO SITE	PERCENT
0 - 10	64.1
11 - 30	14.5
30 - 60	6.6
More Than 60	14.2

TABLE 5

TYPE OF TRANSPORTATION	PERCENT
Car	91.5
Bike	4.0
Walk	2.8
Bus	1.1
Other	.6
Motor Bike	.0

TABLE 6

PER CENT BREAKDOWN OF DISTANCE TRAVELED WITH TYPE OF TRANSPORTATION

MILES	CAR	BIKE	BUS	MOTOR BIKE	WALK	OTHER
0 - 10	57.31	3.72	.57	.00	2.58	.29
11 - 30	13.75	.29	.29	.00	.00	.29
30 - 60	6.59	.00	.00	.00	.00	.00
Over 60	13.75	.00	.29	.00	.00	.00

TABLE 7

TYPE OF GROUP (USER GROUPS)	PERCENT
Family	50.4
Mixed Group	30.8
Couple	12.3
Single	5.4
No Response	1.1

TABLE 8

NUMBER OF VISITS TO SANCTUARY/YEAR	PERCENT
First Visit	17.7
1 to 2 Times/Year	15.4
3 to 4 Times/Year	16.0
More Than 4 Times/Year	49.6

TABLE 9

SOURCE OF INFORMATION	PERCENT
Through Friends or Relatives	10.8
Television	2,0
Came with Friends or Relatives	1.7
Area Residents	1.1
Brochures	.6
Former Resident	.3

TABLE 10

DAY USE	PERCENT
Both Weekends and Weekdays	62.1
Weekends	26.5
Weekdays	4.0

TABLE 11

SEASONAL USE	PERCENT
Spring	72.1
Summer	72.1
Fall	77.2
Winter	62.4

TABLE 12

ACTIVITIES PARTICIPATED IN	PERCENT
Feeding Waterfowl	45.9
Observing Wildlife	20.5
Hiking Trails	16.2
Observing Exhibits	6.8
Cross Country Skiing	4.6
Bird Watching	3.1
Programs, Saturday Classes, etc.	3.1
Take Pictures	2.6
Picnicking	1.7

TABLE 13

CROWDING	PERCENT
Not Crowded at all	39.0
Slightly Crowded	20.8
Moderately Crowded	11.1
Very Crowded	2.6
No Response	26.5

TABLE 14

OCCUPATION	PERCENT
Blue Collar Worker	24.6
White Collar Worker	20.6
Professional	13.5
Retired	12.9
Housewife	5.8
Student	.6

TABLE 15

EDUCATIONAL BACKGROUND (YEARS)	PERCENT
Eight	3.1
Nine	.9
Ten	1.2
Eleven	1.5
Twelve	36.3
Thirteen	6.2
Fourteen	8.9
Fifteen	1.5
Sixteen	13.5
Seventeen	2.2
Eighteen	2.8
Nineteen	.0
Twenty	.0
Twenty One	.3
Twenty Two	.3

TABLE 16

SOURCE OF INFORMATION	PERCENT
Resident	49.2
Word of Mouth	17.8
Drove By It	11.4
Newspaper	4.3
Television	.9
Brochure	.9
Came With Relative or Friend	.3

TABLE 17

TYPE OF TRANSPORTATION	PERCENT
Car	94.5
Bike	11.7
Walk	4.6
Motor Bike	2.5
Bus	1.6
Other	.6

TABLE 18

DISTANCE (MILES) TRAVELED TO SANCTUARY	PERCENT
0 - 5	4.3
6 - 15	47.1
16 - 30	43.7
More Than 30	4.9

TABLE 19

SEASONAL USE	PERCENT
Spring	60.9
Summer	88.3
Fall	59.7
Winter	30.2

TABLE 20

DAY USE	PERCENT
Weekends	45.5
Weekdays	12.3
Both	36.9

TABLE 21

TIME OF VISIT	PERCENT
Morning	12.3
Afternoon	86.5
Evenings	9.4

TABLE 22

LENGTH OF VISIT	PERCENT
Less Than 1 Hour	23.7
1 - 2 Hours	64.9
2 - 3 Hours	7.1
Over 3 Hours	.0

TABLE 23

NUMBER OF VISITS TO SANCTUARY	PERCENT
Once a Year	20.6
1 - 2 Times Per Year	37.6
3 - 4 Times Per Year	20.0
Over 4 Times Per Year	16.9

TABLE 24

REASON FOR VISITING THE SANCTUARY	PERCENT
Relaxation	68.0
Fun	57.2
Education	48.3
Curiosity	21.5

TABLE 25

ACTIVITIES PARTICIPATED IN	PERCENT
View Animal Exhibits	78.8
Feed Waterfowl	76.9
View Nature Center	44.6
Picnicking	21.2
Hiking Trails	18.5
Fishing	6.8
Skiing or Snowshoeing	3.7
Participating in Classes or Programs	1.5
Guided Tours	1.2

TABLE 26

CROWDING	PERCENT
Not At All	19.1
Slightly	25.5
Moderately	40.0
Very Crowded	7.1

TABLE 27

VISITOR'S PERCEPTION OF SANCTUARY	PERCENT
Natural Area With a Rustic Setting	71.4
Recreation Area	8.6
Educational and Recreation Area	45.8
An Area Where There Is Too Many Conflicting Activities	1.5

TABLE 28

IMPORTANT FEATURES

FEATURES	WEIGHTINGS								TOTALS
	8	7	6	5	4	3	2	1	
Wildlife	768	1008	180	136	44	3	8	--	2147
Waterfowl	1152	602	192	30	20	27	--	--	2023
Natural Areas	408	168	534	316	116	36	12	8	1598
Lagoons and Ponds	152	217	366	425	200	78	10	1	1449
Trails, Boardwalks, & Observation Decks	136	91	168	160	244	213	80	5	1097
Different Plant Communities	16	14	84	160	176	252	152	12	866
Size of The Sanctuary	88	49	60	85	200	144	224	10	860

TABLE 29

PROBLEM AREAS PERCEIVED BY VISITORS

FEATURES	WEIGHTINGS								TOTALS
	8	7	6	5	4	3	2	1	
Litter	536	378	228	120	88	39	12	5	1406
Water Pollution	456	371	198	185	120	48	8	6	1392
Lack of Parking Facilities	496	231	150	100	116	81	56	12	1242
Facilities Lacking or Out of Date	344	175	192	180	68	141	50	7	1157
Area Too Crowded	144	182	180	180	180	111	34	10	1021
Noise	96	182	234	180	152	90	52	8	994
Too Many Birds	72	70	84	96	76	78	180	29	685

TABLE 30

POSSIBLE FUTURE PRACTICES AND/OR POLICIES

SUBJECT	VALUES -2	-1	1	2	TOTAL
Outdoor Education Class at Wildlife Sanctuary	-2	-8	189	178	357
More Sanctuary Lands Should Be Set Aside	-20	-19	138	204	303
Private Funds & Donations Should Be Used For Sanctuary Expansion	-2	-19	198	42	219
Programs & Facilities Should Be Updated & Enlarged	-16	-26	166	62	186
Fees Should Be Charged For Programs, etc.	-28	-37	192	40	167
Public Monies, Taxes & Bonds Should Be Used For Expansion Purposes	-26	-36	152	60	150
Important To Have Caged Exhibits Of Educational Purposes	-26	-57	166	56	139
Should Have More Naturalist Led Hikes & Programs	-8	-31	116	36	113
Additional Recreational Facilities Would Harm the Sanctuary	-18	-81	92	74	67

TABLE 31

POSSIBLE PROGRAMS AND FACILITIES

SUBJECT	VALUES -2	-1	1	2	TOTAL
Drinking Fountains	-14	-10	128	244	348
Live Native Wisconsin Animals	-34	-9	124	224	305
Domed Botanical Gardens	-44	-14	104	236	282
Nature Center Exhibits	-20	-11	135	166	270
Picnic Areas	-42	-14	112	196	252
Observation Decks	-38	-10	137	154	243
Rest Areas Along Trails	-44	-16	106	192	238
Childrens Zoo	-78	-15	99	206	212
Self Guided Nature Trails	-60	-14	129	152	207
Wildlife Observation Blinds	-62	-12	96	164	186
Special Programs	-74	-19	99	132	138
Grills in Picnic Areas	-90	-27	82	152	117
Family Orientated Programs	-76	-32	91	102	85
Guide Boat Tours	-106	-22	79	108	59
Naturalist Guided Nature Programs & Hikes	-88	-28	87	76	47
Historical Programs	-62	-33	90	48	43
Fishing Areas	-144	-29	85	88	0
Bike Trails	-172	-29	76	78	-47
Ski Trails	-188	-43	45	106	-80
Small Boat Rentals	-186	-26	70	62	-80
Saturday Classes	-142	-48	55	42	-93
Junior Naturalist Program	-146	-50	53	38	-105
Bait & Sport Shop	-210	-42	50	30	-172
Handicapped Facilities	-250	-25	31	80	-164
Snowshoe Trails	-230	-52	34	44	-204

TABLE 32

ADMISSIONS CHARGE	PERCENT
No Charge	5.8
51¢ - $1.00	24.0
$1.25 - $1.50	4.6
$1.75 - $2.00	10.5
More Than $2.00	4.9
Family Rate	2.8
Whatever Asked	.6

TABLE 33

DOLLAR AMOUNT SPENT	PERCENT
0 - 5	71.1
6 - 10	18.8
11 - 15	3.1
16 - 20	1.2
More Than 20	1.5

APPENDIX Q

COMPARISON OF FACILITIES AT THE BAY BEACH WILDLIFE SANCTUARY TO SEVERAL OTHER NATURE CENTERS

BAY BEACH WILDLIFE SANCTUARY

Background Information

Address: Sanctuary Road, Green Bay, WI 54302
Sponsoring Agency: City of Green Bay, Park and Recreation Department
Acreage of Nature Center: 350
Number of Staff: Full time permanent: 2; Full time temporary - 6 months: 4; Part time: 7; Volunteer: 2 - 6 for short periods of time
Annual Visitation at Nature Center Bldg.: 207,000
Total Usable Square Footage of Buildings (4): 3,125 sq. ft.

a) Workshop-Bathroom Bldg: Total 546 sq. ft.
   Workshop: 396 sq. ft.
   Bathrooms: 150 sq. ft.
b) Butler Bldg. (Storage): Total 360 sq. ft.
c) Animal Care Center: Total 819 sq. ft.
   Office & Workroom: 380 sq. ft.
   Indoor cages and walk-in freezer: 439 sq. ft.
d) Nature Center Interpretive Building: Total 1400 sq. ft.
   Offices: 210 sq. ft.
   Exhibit and Multi-purpose areas: 1190 sq. ft.

BERGEN COUNTY WILDLIFE CENTER

Background Information

Address: Crescent Avenue, Wyckoff, New Jersey 07481
Sponsoring Agency: Bergen County Park Commission
Acreage of Nature Center: 81
Number of Staff: Permanent: 18; Part-time: 5; Volunteer: 3
Annual Visitation: 280,000
Date Interpretive Building Opened: June 1967
Usable Square Footage in Building: 4,200

ROGERS ENVIRONMENTAL EDUCATION CENTER

Background Information

Address: Box Q, Sherburne, New York 13460
Sponsoring Agency: New York State Department of Environmental Conservation
Acreage of Nature Center: 580
Number of Staff: Permanent: 5; Part time: 17 - 20 (summer); Volunteer: 6 - 8 (short periods of time)
Annual Visitation: 200,000 plus
Date Interpretive Building Opened: June 11, 1968
Usable Square Footage in Building: 4,500

WOOD LAKE NATURE INTERPRETIVE CENTER

Background Information

Address: 735 Lake Shore Drive, Richfield, Minnesota 55423
Sponsoring Agency: City of Richfield
Acreage of Nature Center: 150
Number of Staff: Permanent: 6; Part time: 7; Volunteers and interns: 50
Annual Visitation: 70,000
Date Interpretive Building Opened: May 1971
Usable Square Footage in Building: 4,656

ROCKY RIVER TRAILSIDE INTERPRETIVE CENTER

Background Information

Address: Rocky River Reservation, Cleveland Metroparks
Valley Park Drive, North Olmsted, Ohio 44070
Sponsoring Agency: Cleveland Metropark System
Acreage of Nature Center: 100 within 4,000-acre regional park
Number of Staff: Permanent: 6; Part time: 3 - 4; Volunteer: 60 - 80 in training
Annual Visitation: 116,250
Date Interpretive Building Opened: October 1971
Usable Square Footage in Building: 6,000

LOWRY NATURE CENTER

Background Information

Address: Route 1, Box 690, Excelsior, Minnesota 55331
Sponsoring Agency: Interpretive building constructed with private funds; operational costs met by Hennepin County Park Reserve District
Acreage of Nature Center: 400 within 3,800-acre Carver Park Reserve
Number of Staff: Permanent: 9; Part time: 3; Volunteer: 2 - 4
Annual Visitation: 60,000
Date Interpretive Building Opened: February 1969
Usable Square Footage in Building: 10,000

SCHLITZ AUDUBON CENTER

Background Information

Address: 1111 East Brown Deer Road, Milwaukee, WI 53217
Sponsoring Agency: National Audubon Society
Acreage of Nature Center: 186
Number of Staff: Permanent: 5; Part time: 0; Volunteer: 100
Annual Visitation: 50,000
Date Interpretive Building Opened: June 1974
Usable Square Footage in Building: 13,000

SCHUYLKILL VALLEY NATURE CENTER

Background Information

Address: 8480 Hagy's Mill Road, Philadelphia, Pennsylvania 19128
Sponsoring Agency: Schuylkill Valley Nature Center, Inc. (private, nonprofit corporation)
Acreage of Nature Center: 550
Number of Staff: Permanent: 16; Part time: 8; Volunteer: 60
Annual Visitation: 65,000
Date Interpretive Building Opened: October 1968
Usable Square Footage in Building: 16,336

APPENDIX R

PLANS FOR FUTURE EXPANSION AT
BAY BEACH WILDLIFE SANCTUARY[1]

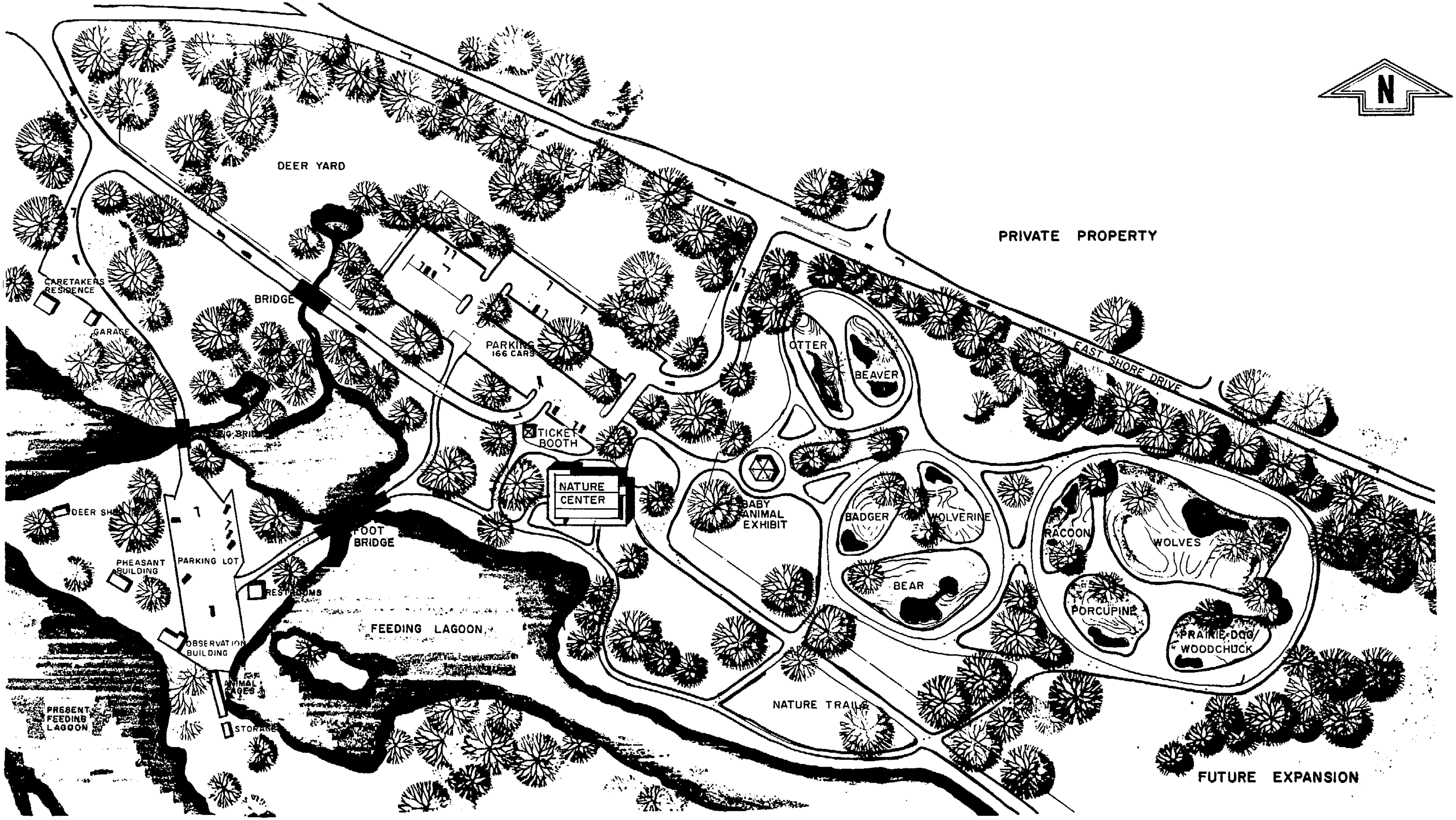
1) Live Mammal Exhibit Complex and New Nature Center Location.

2) Artist's Rendering of New Nature Center

3) First Floor Plan

4) Second Floor Plan

([1]Plans designed by Surplice Associates, Inc.)



Bay Beach Wildlife Sanctuary

Green Bay, Wisconsin

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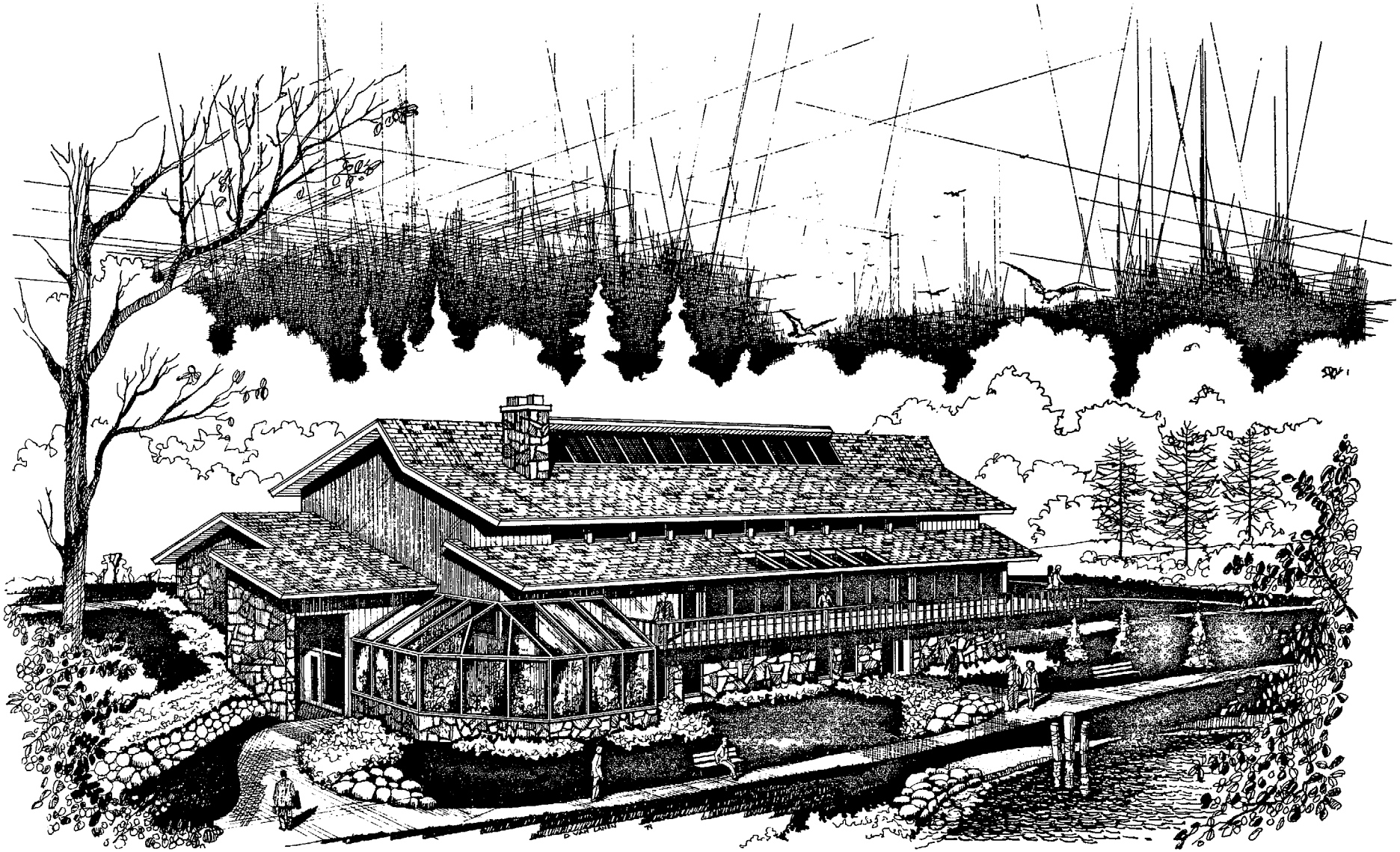

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Green Bay, Wisconsin

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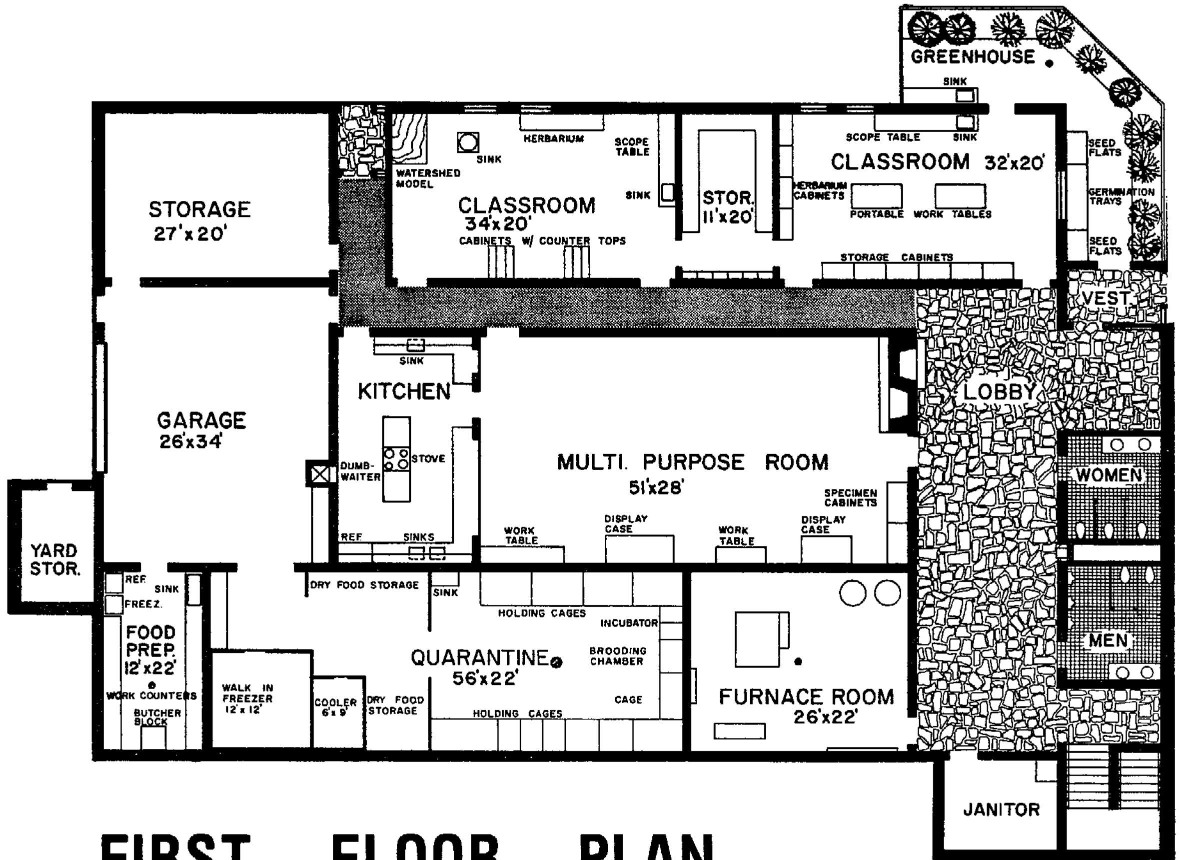
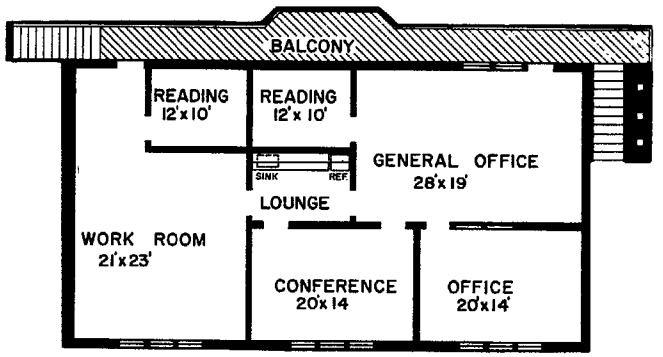


FIRST FLOOR PLAN

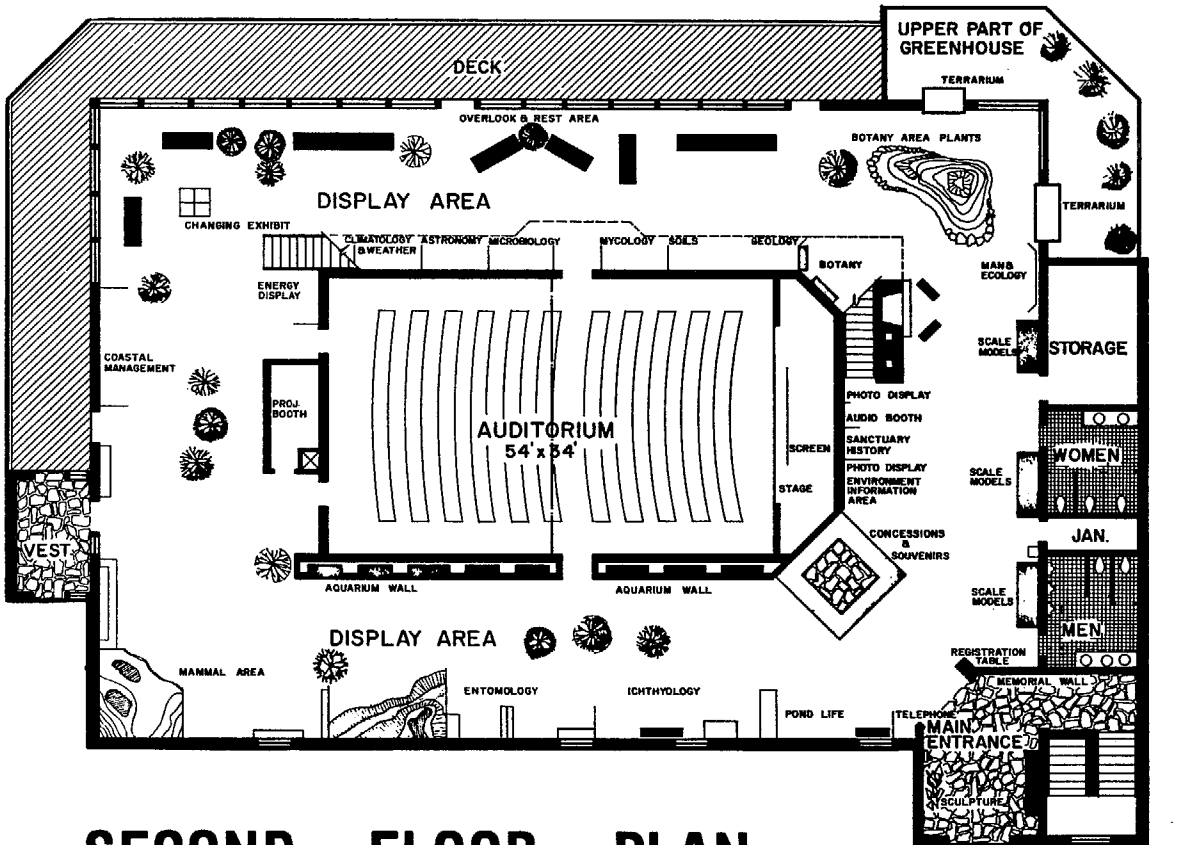
Bay Beach Wildlife Sanctuary

Green Bay, Wisconsin

SURPLICE ASSOCIATES, INC.
SAI
ARCHITECTS & ENGINEERS



MEZZANINE FLOOR PLAN



SECOND FLOOR PLAN

Bay Beach Wildlife Sanctuary

Green Bay, Wisconsin

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APPENDIX S

COASTAL MANAGEMENT PROJECT MAPPING

Previous maps of the Bay Beach Wildlife Sanctuary had not been accurate enough for detailed plant and wildlife studies. The establishment of a measured grid-coordinated system had been a goal of Sanctuary Management for several years. As part of the Coastal Management Project, the area owned by the Sanctuary, as of 1979, was field surveyed using a level-transet, sight pole and measuring tape scored in meters. A 100 meter x 100 meter grid-coordinate system was measured and metal poles were driven into the ground at the corners of the grid areas (grid points).

The map entitled Site Plan - Bay Beach Wildlife Sanctuary and 100 m Grid System has been designed as a working, rather than final map of the Sanctuary site. It represents a composite of information accumulated from earlier maps, Department of Transportation maps for I-43 Highway, and measurements taken in the field from grid points to key landmarks such as lagoon shorelines, existing trails, fences and roads, recorded in a field survey journal. Future ground proofing for additional revisions will insure a more accurate final map.

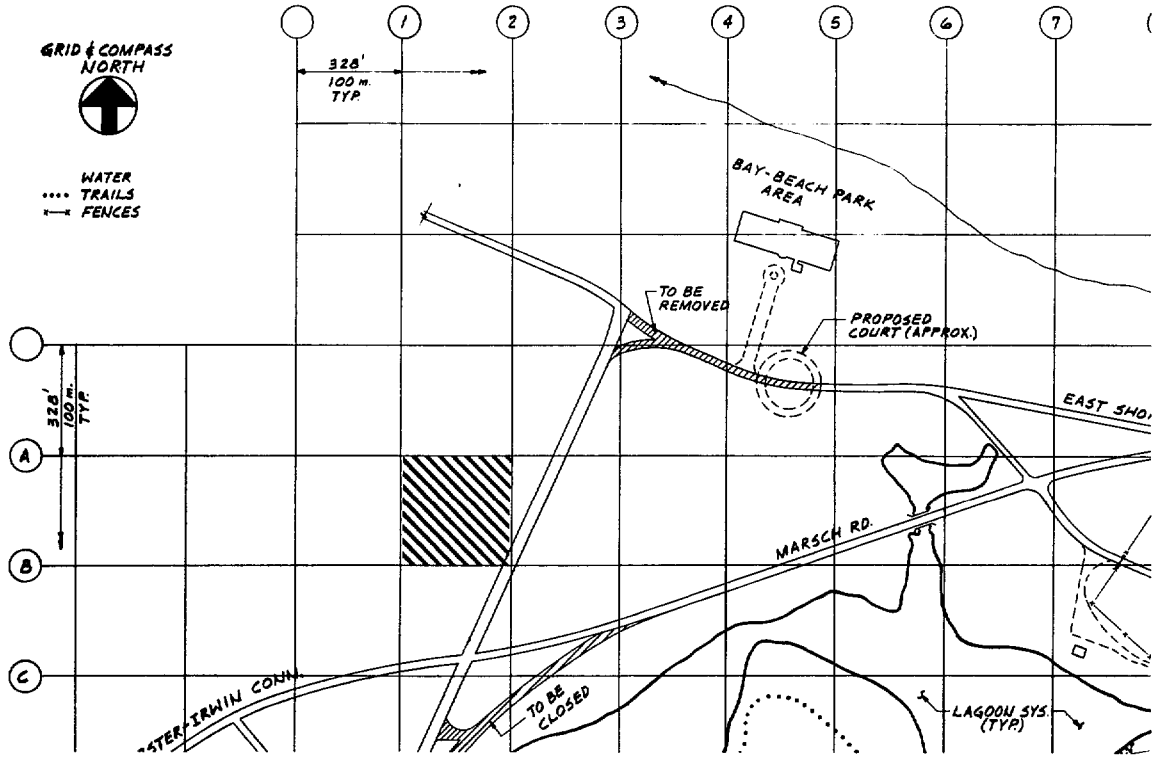
Generally, the grid coordinated mapping of the Wildlife Sanctuary site will enable the Sanctuary's staff to do a much better and more professional job of managing the Sanctuary as the very valuable coastal zone area that it truly is. Out of such mapping should come detailed documentation of all future management proposals concerning such vital interests as: rehabilitation of severely disturbed areas; controlling vegetative succession; evaluating resident and migratory wildlife populations; or improving lagoon circulation and water quality. Each new map developed from the Coastal Management Project basic site map will enrich and enhance the Wildlife Sanctuary as a unique urban wildlife sanctuary and as an extremely valuable scientific study site.

How To Read Map and Use the Grid System

Each area is 100m x 100m (10,000 sq. meters). To determine grid points (grid posts) and grid areas: Read down (south) letters A, B, C, etc., and Right (east) numbers 1, 2, 3, etc.

EXAMPLE: To locate Grid point A-1
On the map follow the north-south line from the number one (1) at the top of map, down (south), until it crosses the east-west line running east from the capital letter A on the left hand edge of the map. At the intersection of these two lines is grid point A-1. At this point in the field a metal pole was driven into the ground to a height of 1.5 feet above the surface of the ground, in the park area these poles were driven flush with the ground.

Grid Area A-1 is the area (10,000 sq. meters) immediately southeast of grid post A-1 (The shaded area in the example).



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