

OTTAWA NATIONAL WILDLIFE REFUGE COMPLEX
(OTTAWA NWR, CEDAR POINT NWR, WEST SISTER ISLAND NWR)
OAK HARBOR, OHIO

MARSH, WATER, MOIST SOIL MANAGEMENT PLAN

1994

NATIONAL WILDLIFE REFUGE SYSTEM
FISH AND WILDLIFE SERVICE
U.S. DEPARTMENT OF INTERIOR

OTTAWA NATIONAL WILDLIFE REFUGE COMPLEX

MARSH, WATER, MOIST SOIL MANAGEMENT PLAN

REVIEW AND APPROVAL

Approved By: N. Ross Adams June 29, 1994
Project Leader Date

Reviewed By: _____
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REVIEW AND APPROVAL

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	ADMINISTRATION	
	A. Annual water management plan	3
	B. Biological monitoring	3
III.	WATER MANAGEMENT OBJECTIVES	
	A. General	3
	B. Relation to primary refuge objectives	6
	C. Relation to other refuge programs and objectives	7
	D. Water management constraints	8
	E. Physical water management considerations	9
IV.	MARSH MANAGEMENT CONSIDERATION	
	A. General	10
	B. Habitat considerations	10
	C. Wildlife considerations	14
V.	HABITAT ENHANCEMENT	
	A. Rehabilitation of dikes along Crane Creek	16
	B. Metzger's Marsh development and management plan	16
	C. Farm fields, moist soil, greentree reservoirs, reforestation	17
VI.	WATER MANAGEMENT UNITS	
	A. Ottawa Division	21
	Pool 1	23
	Pool 2A	24
	Pool 2B	25
	Pool 2C	26
	Pool 3	27
	Pool 6	28
	Pool 9	29
	Entrance pool	30
	Show pool	31
	Mini-Marsh	32
	MSU 3	33
	MSU 4	34
	MSU 5	35
	MSU 6	36
	MSU 7A	37
	MSU 7B	38
	MSU 8A	39
	MSU 8B	40
	MSU LL	41
	Goose pen	42
	GTR 7	43

B. Darby Marsh Unit	44
Pool 1	46
Pool 2	47
Pool 3	48
Pool 4	49
C. Navarre Marsh Unit	50
Pool 1	51
Pool 2	52
Pool 3	53
D. Cedar Point National Wildlife Refuge	54
Pool 1	56
Pool 2	57
Pheasant farm	58
Attachment 1 - Spring flooded croplands	59
Attachment 2 - Metzger's Marsh Cooperative Agreement	60

I. INTRODUCTION

The Ottawa National Wildlife Refuge Complex is made up of three refuges and five separate units: The Ottawa NWR has three separate units - Ottawa, Navarre, and Darby; Cedar Point NWR; and West Sister Island NWR. The total refuge acreage is 8,318 of which 6,683 acres are either open pools, marsh, or moist soil units. Water levels in 4,155 acres can be controlled by gravity drainage and filling; in 1,745 acres water is uncontrolled; 2,718 acres of marsh are controlled by pumps; and 932 acres of moist soil units water levels are controlled by pumping. The remaining acreage of 2,966 is a mixture of grassland, forest, and cropland.

Ottawa NWR Complex is located adjacent to Lake Erie and is comprised of diked marshes with water control structures to facilitate water management. In the past, most of Ottawa Refuge management capabilities revolved around gravity drainage. In the mid to late 1970's, energy conservation was a factor in the design of water control structures. Dual flap gates on screw gates that faced in opposite directions were installed. Gravity was all the energy needed and the system worked well during those years. The key was to have a water source that periodically fluctuated and wind tides on Lake Erie cooperated with each blow from the southwest and northeast.

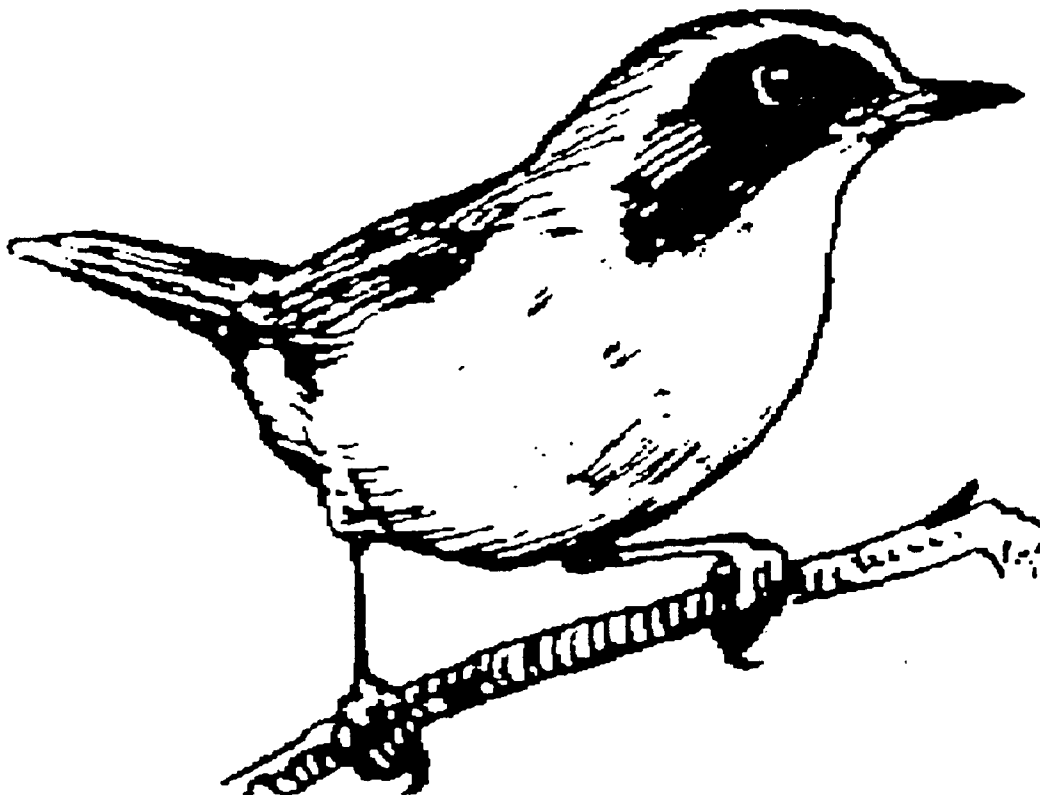
With record high water levels set in 1985, 1986, and early 1987, gravity control structures were no longer adequate. High water levels in pools could not be relieved without a major cost in money and human effort to pump it out with portable Crissifulli pumps. Severe erosion took place on all unprotected dikes in addition to defects in dikes caused by woodchucks and muskrats.

Since 1989 new pumps were put in place to enable the manager to manipulate water levels when gravity drainage is not possible. Units which were directly affected by the installation of pumps include: Mini-Marsh, MSU 7A, 8A, 8B, and Cedar Point pool 1. Units indirectly influenced are pools 2A, 2B, 2C, MSU 7B, and Cedar Point pool 2. Darby units 1, 2, 3, and 4 can all be controlled by one centrally located pumping structure. The main moist soil pump at Ottawa Refuge enables manipulation of MSU 3, 4, and 5.

Since the mid 1970's the refuge has been converting its impoundments to moist soil units. With good moist soil management the refuge will be able to reach its objectives and possibly more. Because moist soil management has been directed towards waterfowl, this group will receive the most benefit from moist soil management. However, the basis of moist soil management -- creating shallow areas and mudflats -- will provide value to a majority of wetland dependent species including herons, egrets, gulls, and shorebirds.

This Marsh and Water Management Plan is intended to provide a general overview of the water management capabilities and to guide preparation of the water management on an annual basis and describe needs and improvements at the Ottawa Refuge complex. This plan has been compiled from various sources including literature reviews, refuge studies, annual reports, the experiences of refuge staff members, and the refuge's Vision document of where we want to go. In addition, sections will also address needs to evaluate the current land use and determine the best use of the resource.

This plan will provide guidance on Ottawa Refuge as a whole to ensure diversified habitats are available to meet the needs of a variety of wildlife species throughout the year including the spring and fall waterfowl migration, endangered species habitat, marsh and water bird requirements, and resident mammals.



II. ADMINISTRATION

A. Annual water management plan

The Ottawa NWR Complex water management program is multifarious and very comprehensive with currently 31 individual units to be managed. Each January, a meeting for the upcoming years water management program takes place. The annual plan is written to maintain a diversified habitat base, provide food resources for key species and at specific times, to change management schemes for individual units from year to year. After the plan is written it is submitted to the Regional Office for approval on or before 1 February. The plan reports the current calendar year plan of operations with objectives and potential problems. It also summarizes the previous calendar year operations, results, and construction and maintenance activities.

B. Biological monitoring

The refuge's first biologist entered on duty in 1993. The responsibility of the biologist will be to advise the project leader on biological implications of the water management program as it relates to refuge objectives and wildlife needs. To accomplish these duties the biologist will rely on the stations Wildlife Inventory Plan, refuge research projects, visual inspection of the impoundments, yearly mapping and seed yield estimations in moist soil units, water impoundment history, and review of current published research material.

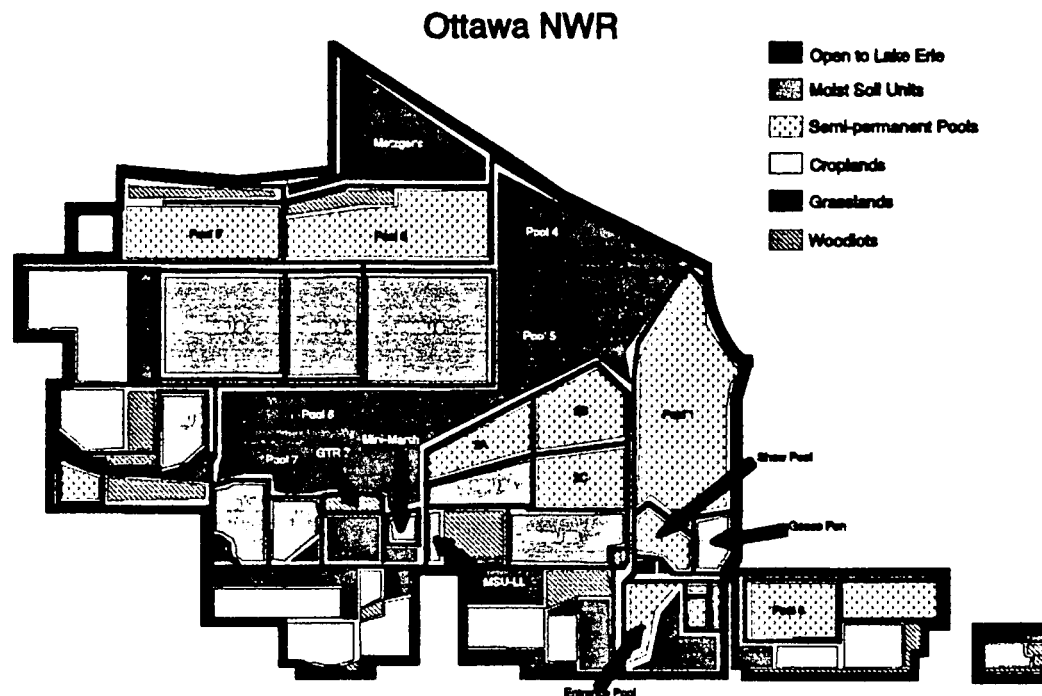
The refuge has many data producing and record keeping applications at its disposal and will use them as much as possible. These application include the Moist Soil Management Advisor System, EPPL7 (GIS), magellan (GPS), and the Moist Soil Seed Estimation software.

III. WATER MANAGEMENT OBJECTIVES

Ottawa's facilities have been greatly improved over the past few years, thereby allowing a wider range in management options to continually produce habitat needed for waterfowl and other wetland oriented species. The numerous diked marshes and moist soil units create a complex of wetlands that can be manipulated differently and separately optimizing resource availability (see Figures 1 and 2). This flexibility in individual unit management allows the refuge manager to institute a dynamic management program to maintain productivity of high energy wildlife foods, provide wetland habitats throughout the year for a variety of wetland dependent wildlife, maintain physical facilities, and reach refuge objectives. The water management objectives should be reached by the following prioritized list.

1. Operate and maintain facilities (i.e., dikes, pumps, and water control structures) in a manner to minimize damage that would reduce management capabilities.
2. Manipulate water levels in moist soil units, permanent marshes, and farm units to optimize food, cover, and breeding habitat for wildlife.

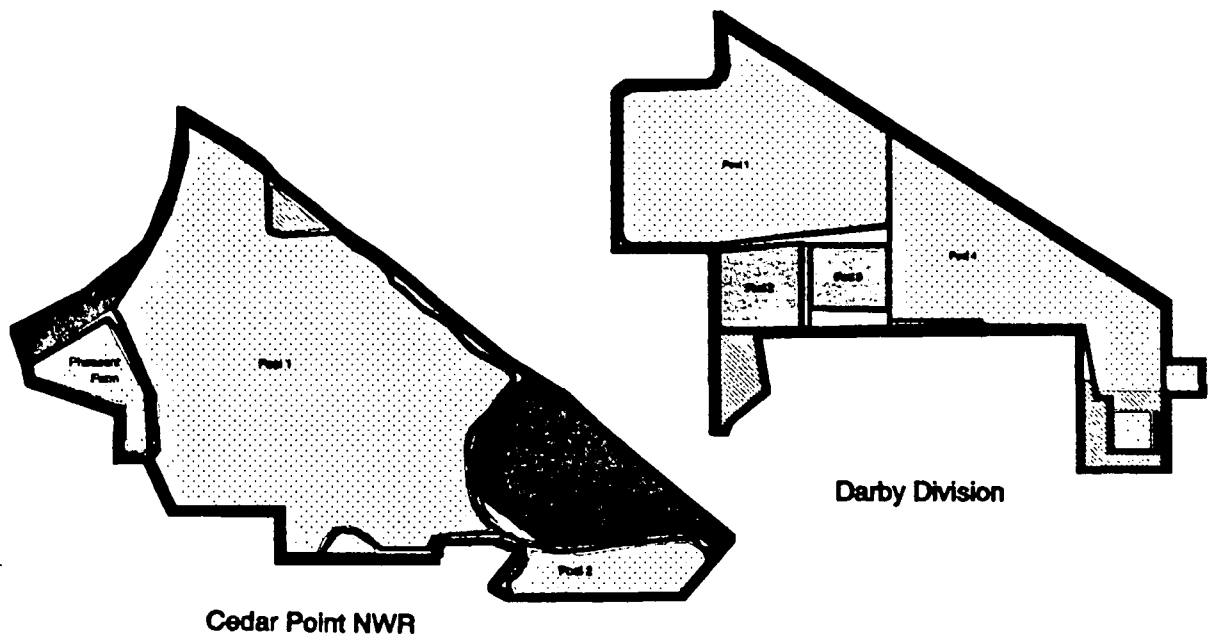
Figure 1. Ottawa NWR Wetland Units.



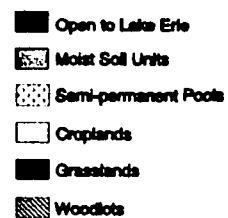
Ottawa:			
Pools	Acreage	Moist Soil Units	Acreage
Pool 1	275	MSU 3	213
Pool 2A	70	MSU 4	106
Pool 2B	95	MSU 5	250
Pool 2C	80	MSU 6	70
Pool 3	260	MSU 7A	49
Pool 6	160	MSU 7B	44
Pool 9	158	MSU 8A	44
Entrance	30	MSU 8B	85
Show	30	MSU LL	20
GTR 7	20	Mini-Marsh	16
Metzger's Marsh*	350	Goose Pen	35
Pools 4,5,7,& 8*	700		
Total	2,228		932

*Areas open to Lake Erie seiche events.

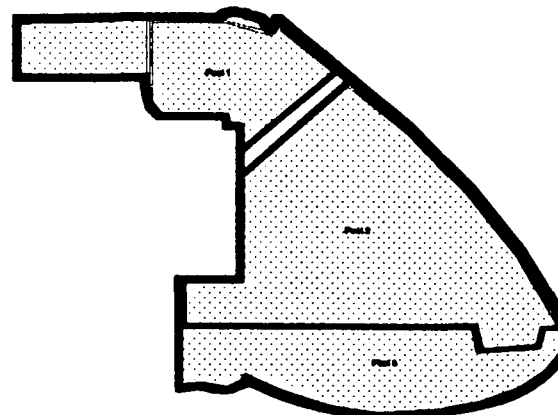
Figure 2. Cedar Point, Darby, and Navarre Wetland Units.



Pools	Acreage
Darby:	
Pool 1	200
Pool 2	25
Pool 3	25
Pool 4	170
Navarre:	
Pool 1	130
Pool 2	340
Pool 3	188
Cedar Point:	
Pool 1	1,460
Pool 2	135
Pheasant Farm	155
Lake Erie	695
Total	3,523



Navarre Division



B. Relation to primary refuge objectives

The refuge was established as a "inviolate sanctuary for migratory birds and other species" and additionally to protect some of the remaining Lake Erie marshes. The primary refuge objectives are stated in the Master Plan developed in 1976 with the main purpose to providing maintenance habitat for migratory birds, with emphasis on the bald eagle and waterfowl. A prioritized list follows:

1. To provide nesting and feeding habitat for the endangered bald eagle.
2. To provide maintenance habitat for migratory waterfowl during the spring and fall migrations.
3. To provide maintenance habitat for other migratory birds (marsh birds, shorebirds, gulls, terns, and raptors).
4. To provide habitat for the maintenance of balanced populations of all wildlife species.
5. To provide the public with wildlife-oriented recreation opportunities when this objective is compatible with the other uses.

Species	Objective Level Use Days (UD)
Bald eagle maintenance	2,880
Waterfowl maintenance	
Canada goose	1,500,000
All ducks	4,200,000
Canada goose peak	25,000
Waterfowl production	
Canada goose	1,930
All ducks	2,100
Shore/marsh/water birds	6,500,000
Special recog. species-raptors	73,000

The above objectives is how the refuge has been judged on work accomplishments. With new focuses and concerns for biological diversity the refuges objective is to stress biological diversity and produce a healthy habitat on annual cycles for the majority of native flora and fauna through an ecosystem management approach, of which water management is one entity, that accents biotic integrity of assemblages at all levels. An ecosystem approach will benefit resident/nesting avifauna, neotropical migrants (warblers, sparrows, shorebirds, etc.), waterfowl, rails, water and marsh birds and other migrants, herptofauna, fishery resource, resident mammals, invertebrates, etc. With this approach refuge objectives have been revised to state:

1. To protect, enhance, and restore habitat for threatened and endangered species.
2. To provide suitable nesting habitat for migratory birds.
3. To provide maintenance habitat for waterfowl and other migratory birds, especially during the spring and fall migration.
4. To provide habitat for native resident flora and fauna.
5. To provide the public with wildlife-oriented recreation and environmental education opportunities.

C. Relation to other refuge programs and objectives

Green Tree Reservoirs - Ottawa NWR is located in the area that was considered the Great Black Swamp that initially comprised 300,000 acres of forested wetland. Forested areas are essentially nonexistent on the refuge. Currently, about 300 acres of woodlands have been inventoried mostly existing as fragmented woodlots ranging in size from 2-20 acres. Some portions of the timbered areas would retain water into the spring and be flooded "naturally." The fall of 1993 marked the first time that Ottawa personnel intentionally flooded a timber area and created a greentree reservoir. The expansion of the water program to flood forested areas increases the resources available to migrants, especially waterfowl, that feed on mast. Flooded forest is also used by breeding wood ducks for nest sites, food, and protection. Ottawa Complex has the potential to increase its forested areas to restore and enhance the vegetation community that this region once supported (See Habitat Enhancement, Section V). Forest restoration projects are identified in the Forest Management Plan.

Furbearer Management - The refuge does not have specific objective levels set for marsh mammals, however, they play an important part in marsh management. Water level manipulation is a primary management technique. Muskrat populations thrive in early successional marsh stages as long as adequate water depths over-winter are maintained to avoid freeze-out. Due to their adaptiveness to marsh communities and prolificness, muskrats have proven to be an effective and economical way to create openings in dense vegetation for other wildlife. In addition, public trapping is used as a tool to help balance populations of marsh associated mammals like the mink, muskrat, and raccoon.

Croplands Management - The refuge cropland program is aimed at providing supplemental high energy food, like corn or sorghum, to waterfowl, as well as green browse for geese. The croplands are used by waterfowl during the winter months. Farm fields are also temporarily flooded in the spring with sheet water to allow migrants to forage on waste grain and invertebrates (see Attachment 1). In addition, cropping moist soil units, when extensive disking or tillage is required, sets back woody encroachment and hard to control undesirable vegetation. Further, it prepares the unit for moist soil production for subsequent years. Some of the croplands have the potential to be converted to moist soil units or flooded forest with minor improvements (See Habitat Enhancement, Section V).

Wildlife Observation - A portion of Ottawa NWR maintains an area where visitors can walk dikes, roads, and trails through a variety of woodlands, grasslands, marshes, and moist soil units. Interpretive signs are provided. Management within these areas incorporates features to provide a variety of viewing opportunities by attracting different species of waterfowl, shorebirds, marsh and water birds etc. Human disturbance, even from indirect activities, can cause increased energy expenditures as well as deplete energy reserves in waterfowl and other bird species. Documentation of human disturbance, especially in waterfowl, has shown behavioral changes in food habits, increased alertness, sustained flight, loss of weight, and desertion of feeding areas. Disturbance during critical times on the refuge could be detrimental to stated objectives. The public use area is situated around a

variety of habitat types including moist soil units. Activities during the peak migration or peak use of these units will be curtailed and trails diverted to reduce disturbance, and also increase public awareness and appreciation for the wildlife resource through interpretive materials explaining the need for areas free from human disturbance.

D. Water management constraints

Water Resources - Lake Erie is the main supply of water for wetland units in the Ottawa NWR complex. Lake Erie water levels fluctuate widely around the long-term average. Seiches, fluctuations of the lake caused by directional winds, are common since the lake is situated southwest-northeast, the direction of the prevalent winds. High lake levels incur high costs to dike maintenance and renovation, and wetland unit drawdowns, but they reduce costs for wetland unit flooding. Low lake levels reduce dike maintenance and renovation expenses, but they increase costs for flooding and maintaining water levels. Thus, Lake Erie water levels dictate the management options available for most of the wetland units in the Ottawa NWR complex. Cost and feasibility of management actions are influenced by elevations of water control structures and the connecting system of ditches for each unit in relation to the Lake level during the planned period of activity. For example, flooding of a moist soil unit can become impractical if not impossible when water levels fall in the ditches below pump structures.

Additional water resources are available through precipitation and runoff from surrounding watersheds. Annual precipitation averages 34 inches (1964-1991) and the period between June-September receives over an average of 3.5 inches per month. However, evaporation may exceed precipitation for these months, requiring water from a different source mainly through pumping. Runoff from the surrounding agricultural areas flows into Ottawa NWR through Crane Creek, Tank Ditch, Lindsey-Limestone Ditch, and Rader Ditch. These tributaries provide alternative sources of water for flooding, but these ditches are also heavily influenced by Lake Erie water levels. LaCarpe Creek at Darby Division and Toussaint River at Navarre NWR, and West Ditch at Cedar Point NWR all provide alternative seasonal water sources, but are also influenced by Lake Erie. Water quality from these drainages are poor, since they are often contaminated with agricultural residues (i.e., herbicides, insecticides, and fertilizer), but water quality for wetland flooding can be increased by delaying pumping until after high run-off events in spring and summer. Silt deposition from these ditches increases refuge maintenance costs by reducing flows in ditches that supply pump stations and lowers wetland habitat quality through reducing water clarity and contamination from agricultural residues.

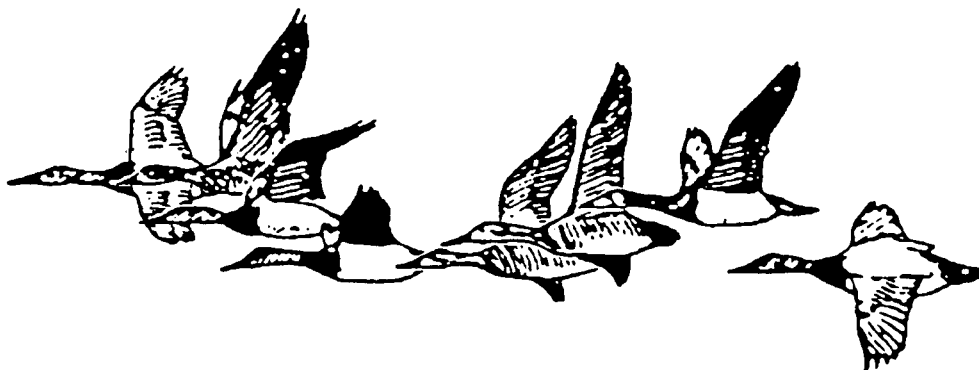
Topography and Soils - Ottawa NWR complex wetland units are generally flat with little relief except from an occasional remnant dike, borrow area, ditch, or natural shallow depression or slough. Individual wetland units could have significant (1-3 feet) elevation differences that influence habitat management through incremental vegetational zonation that occur due to varying water depths or soil moisture. In large wetland units these elevation differences can contribute to vegetational diversity in permanent pools (eg. Cedar Point Pool 1) or woody encroachment in units managed for

moist soil plants (Moist soil Units 3, 4, and 5). Large wetlands could be subdivided into smaller, more diverse parcels through topographic elevations -- manage the deeper areas as deep-water marshes, intermediate elevations as alternating hemi-marshes and moist soil areas, and the higher elevations as wet prairies or forested wetland.

The Toledo soil association comprises the majority of the soil types found in wetland units. These soils are deep, nearly level, and were formed from clay-rich glacial lakebed sediments. Toledo soils are uniformly poorly drained and are often below the water table. Toledo soil can be disturbed through standard agricultural tillage if the soils are adequately drained, but the soils can become compacted and cloddy when worked wet. Several sandy soil types (eg., Algansee, Oakville, and Glendora) formed at the current or former lake shore are sometimes located within wetland units, and if dike construction was not adequate can cause drainage or water seepage in wetland units. Muck soils with high organic content can be formed in wetland units during long-term flooding, and these soils should be consolidated through periodic drying and exposure to improve water clarity and to increase substrate firmness.

E. Physical water management considerations

Water manipulation is the most important management tool for providing required habitat. Almost all impoundments are connected with Lake Erie via screw/flap gates and depending on the seiche events, water can be moved with gravity flow. Water manipulation should be timed with the lake seiches to minimize pumping efforts, however, water movement will be based on objectives. Water movement that is too fast or not timed properly could actually hinder refuge objectives and/or increase control efforts of undesirables. Many units are controllable with permanent pumping structures or portable pumps so that the refuge water management is not relying on gravity flow. A few units do not have direct access to the lake and some have access through another unit. These variables have to be taken into consideration during the planning process because these units will increase the cost of water management, especially when setting up portable pumps is involved.



IV. MARSH MANAGEMENT CONSIDERATION

A. General

Refuge wetlands are managed to provide an optimum amount of food and cover for migrating waterfowl, shorebirds, wading birds, rails, and other wetland dependent species. Permanent and semi-permanent marshes of cattail, bulrush, and other emergent vegetation as well as a variety of submergent vegetation provides habitat for a variety of avifauna. These marshes provide foods in the form of seeds, roots, tubers, and aquatic invertebrates. Management is directed at keeping these marshes in a highly productive state by simulating the natural cycle of water fluctuation which in turn stimulates good aquatic growth and a variety of plant and animal organisms within these marshes. Many species potentially meet most, if not all, of their resource needs in these marshes during migration. Marshes are managed to provide a maximum amount of edge between open water, submergent, and emergent vegetation communities. This interspersation provides zones that wildlife need for feeding and resting as well as courtship and pairing.

Water levels are fluctuated during the year by lowering levels during the growing season to stimulate plant germination and growth and concentrate invertebrates, then raising levels slowly through the fall to enhance the habitat for wildlife use. Some units that have reduced vegetative growth may be completely drained during the growing season to germinate new growth. Other units that may have excessive vegetative cover may be held at a high water level during the summer to reduce growth and increase open areas. Natural wetlands have water regimes that vary within and between years. Water level manipulation that is scheduled by calendar date tends to produce monocultures and decreases in productivity. Habitat diversity is encouraged through rotational management of wetland complexes that allows control of succession and retaining highly productive wetlands.

B. Habitat considerations

Emergent Vegetation - The goal is to provide units with a hemi-marsh condition to complement other resources on the refuge. Pools will be managed to maintain the emergent vegetation along with open areas to achieve a good interspersation along with productivity. Emergent vegetation, like cattail and bulrush, are adapted for thriving in shallow flooded (1-2 feet) wetlands. However, if flooded to over 4 feet for extended periods plants will tend to die back. Germination of most emergents require mudflat or shallow water (1 inch or less). Units should have excess water removed during the growing season, thereby not destroying emergent vegetation and allowing annual production to occur. Annual growth from other emergents like arrowheads, pickerelweed, etc. need shallower water depths to be viable. Further, depending on vegetation response, units should be drawn down every 4-5 years to mimic natural marsh cycle, for establishment of vegetation in the open areas, and to eliminate exotic species like carp that uproot emergent vegetation.

Submergent Vegetation - Management goal is to provide submergent vegetation as a food source for wildlife including seeds, tubers as well as a substrate for invertebrate species. Again, providing conditions for a hemi-marsh will

support submergent growth and vitality. Submergent vegetation produces well in shallow water depths free of emergent vegetation. Excessive water depths and turbid water greatly reduce submergent growth. Management will coincide with pool management for emergents by partial drawdown to encourage growth and complete drawdowns to remove carp.

Moist Soil Management - Ottawa's moist soil management program started in 1976 as per the FY-76 annual work plan advice and is still growing as completion of dikes and pumping facilities allow areas to be managed for moist soil production. By 1979, approximately 700 acres had been converted to form Moist Soil Units (MSU) 3, 4, 5, 7A, 7B, and 8A. Since then, MSU 8B was converted in 1981, MSU 6 was finished in 1991, MSU Lindsey-Limestone (LL) was first used in 1993, and pools 2 and 3 at Darby Marsh Unit will be brought into a moist soil rotation in 1994.

In the past, moist soil management has consisted of drawing down units in the spring or summer for seed production from annual plants and flooding in the fall for use by waterfowl. However, the timing of the drawdown and extent of drawdown was a factor of Lake Erie water levels and the time and labor involved with removing water with a Crissifulli pump. In addition, high lake levels in the mid-80's not only prevented movement of water from the unit but also eroded dikes to a point of breaching. Since 1989, the refuge has expended a large amount of flood damage monies in rehabilitating dikes and pumping structures. Currently the refuge has 12 moist soil units, ranging from 16 to 250 acres, juxtaposed around semi-permanent and permanent marshes. With the number of units available for moist soil management, the refuge will be able to set them up in different regimes to keep the units in a highly productive state and provide the benefits needed to waterfowl, shorebirds, rails, and other wetland dependent species.

Annual moist soil management strategies have to be based on the following factors: construction/rehabilitation work, species benefiting, objectives of the unit (ie. seed and/or invertebrate production, control problem species), mechanical manipulations needed, prior management regime, and how each individual unit fits into the whole management complex. Yearly evaluation needs to take place to ensure that the refuge meets its objectives, maintain moist soil units in a highly productive state and rehabilitate units a little yearly instead of allowing undesirables to get out of control.

Drawdown and Flooding Strategies - With proper timing and continual monitoring, drawdown and flooding regimes are effective tools for providing food and cover resources needed for wetland dependent species. To manage units according to a calendar date is not as effective as keying in on species movement. The numerous impoundments available at Ottawa Refuge allows for staggering of units to continually provide optimum habitat through both migration periods and summer.

Drawdown - Drawdowns should be gradual usually lasting two or more weeks. The greater the topographic relief the slower the drawdown. The slow drawdown will ensure adequate soil moisture and temperature is provided to stimulate moist soil plant germination. This will increase plant diversity by allowing growing conditions favorable for multiple moist soil plant

species while at the same time reduce the probability of establishment of undesirables like cocklebur. Early and late spring drawdowns are recommended for increased probability of excellent moist soil production and plant establishment before the dry season. Early and late spring drawdowns also coincide with peak migration of most avifauna.

The steady decrease in water will allow wildlife species to maximize use of available resources by creating zones through the impoundment with water depths varying from eighteen inches to mudflats. Further, slow drawdowns provide resources over a longer duration in addition to trapping invertebrates and seeds in higher concentrations so species can reduce foraging effort.

Flooding - Areas drawn down for plant production should be irrigated as soon as plant height allows. During normal climatic conditions inundating a unit during the summer will give the plants the water needed to maximize seed production. Once again keying in on wildlife movements should be used to determine flooding strategies. Flooding of units will be staggered, providing assorted water depths and resource availability continuously through the late summer and fall time period.

Units should be gradually flooded with optimum flooding to coincide with peak migration in the fall thereby allowing wildlife species to forage along the waters edges and consume the resources as units are flooded. Gradual inundation is desirable to provide access to available resources over a longer duration and decrease the amount of time seeds are covered with water. Waterfowl Management Handbook Leaflet Number 13.1.1 shows deterioration rates of seeds once covered and much of the food value is lost if resources are covered a month or more before arrival of birds.

Management Manipulation - With the multitude of wetland impoundments the refuge is able to apply a variety of techniques to set back succession, maintain highly productive wetlands, and control undesirable vegetation. These methods include timing of drawdowns and flooding, deep disking, shallow disking, stress flooding, mowing, agricultural practices, keeping a unit dry for extended periods of time, or a combination of techniques. It should be kept in mind that manipulations conducted are for moist soil production the following calendar year. However, some moist soil production could occur during the same year depending on the manipulation and time of year.

Timing of Drawdowns and Flooding - Timing of drawdowns and flooding can also be used as a method for vegetation change. Late drawdowns and shallow flooding would preclude establishment of woody vegetation at northern latitudes because perennial seeds are generally produced early in the growing season. Flooding a unit after moist soil plants are well established and not overtopping the plants, will be enough to sufficiently kill undesirables such as cocklebur and velvetleaf if present and add vigor to millets and smartweeds.

Deep Disking - Deep disking should be used for areas where problem plants are robust, contain a massive underground root system, and are difficult to control like reed-canarygrass, willow, and cattail. The disking will turn

the soil over exposing the root system and with dry conditions destroy the root system.

Shallow Disking - Shallow disking disturbs the soil and sets back plants that are less dense. Disrupting the soil lightly and flooding early in the year should produce a moderate stand of moist soil plants and also prepare the site for the next season. Shallow disking during late summer and early fall will disrupt the area for next year and provide mudflats and sparse vegetated areas for shorebirds when flooded.

Stress Flooding - Control of undesirable vegetation can be achieved by flooding the unit while the plants are in early development. This will not only set back the undesirables requiring drier soil conditions, but also irrigate moist soil plants. Care must be taken not to overtop the moist soil plants for an extended time period. For more persistent species, this technique may only work if flooded during the growing season, or for a longer period of time (e.g. 1-2 years). This semi-permanent condition should then produce excellent moist soil plants when drawn down in addition to providing wildlife benefits while flooded.

Mowing - Mowing is an effective technique if undesirable plants are taller and over shadow the moist soil plants. Removing the over story and irrigating the unit will stimulate moist soil plants. Mowing is an effective means to control small woody vegetation if the stumps are immediately overtopped with water and the water depth maintained during the growing season.

Keep Dry - Control of robust plants associated with semi-permanent conditions can be achieved by keeping the unit dry for prolonged periods. Establishment of semi-permanent plants like cattail, bulrush, and lotus can be severely hindered by keeping the units dry. These plants lose their energy when water is not present during the growing season. In units with low topography that collects precipitation readily, this method may not be effective unless pumping is implemented to ensure xeric conditions. However, control of these species may take 1-2 years to achieve through this method and few wildlife benefits accrue during drawdown.

Herbicide Application - For extreme problem areas herbicide could be used, but only as a last resort method. Herbicide will be on the pre-approved list and all precautions adhered to when applying. An example of a good technique with this method is applying herbicide with a wick applicator to a sparse stand of cattail containing an understory of moist soil plants. The wick applicator would only touch and kill the tall cattail, while allowing moist soil plants to continue their growth.

Agricultural Practices - Another control for severe problems would be to farm the area for one year. The heavy disking and dry conditions would destroy the problem plant community and prepare the area for subsequent years in moist soil production. This method should only be used in extreme cases because of the removal of resources available to wildlife. Also, precautions must be taken with/if any herbicide is used which could hinder moist soil production.

Combination - For best results for moist soil production, wildlife benefits, and control of undesirable species, a combination of manipulations is recommended. Example: spot treatment by light disking problem species and shallow flooding in early fall, will disturb the soil for production next growing season, impede the problem plant, provide substrate for invertebrates, and create openings for foraging wildlife especially shorebirds and dabbling ducks. There is a multitude of combinations that will work based on goals wanted to attain and management of the units as a whole.

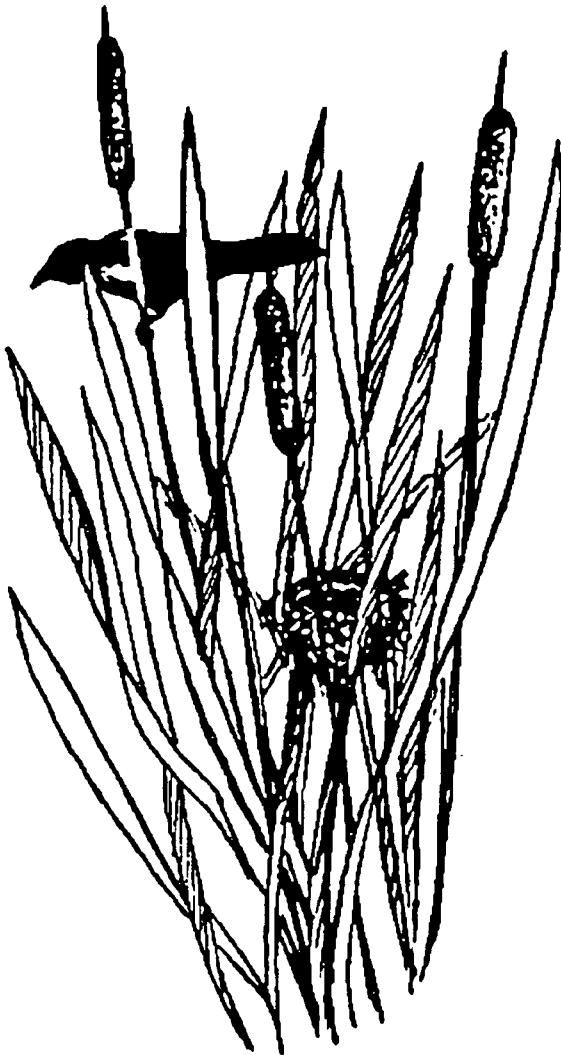
C. Wildlife considerations

Diversity - Diversity of wildlife has been proven to correlate directly with habitat structure. The wetlands, in conjunction with the grasslands and forest areas, maintain and support a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization similar to that of the natural habitat of the region. Management of the impoundments will be directed around continued vegetation diversity with the consideration to proportion of vegetation types (single species and/or plant communities), interspersation with open water, and juxtaposition with upland plant communities.

Nesting and Brood Rearing - Optimal nesting and brood rearing habitat provides food, water, and shelter all within close proximity. An individual wetland may not contribute all requirements needed, however, with different management strategies within the complex of wetlands, life history requirements will be met. Open areas will provide fishing opportunities for nesting bald eagles and feeding and protection for diving ducks (hooded merganser), grebes, terns, gulls, and coots. Cattail and bulrush areas support nests of muskrat, bitterns, marsh wrens, red-winged blackbird, swamp sparrow, common yellowthroat etc. and provides cover for a multitude of species. The shallower sedge and spikerush areas furnishes nesting and brood rearing habitat for rails, sedge wrens, and shorebirds. These areas also supply amphibians, minnows, fish, frogs, invertebrates, and plant seeds and tubers for herons, egrets, rails, dabbling ducks, grebes, wetland dependent passerines, and mammals (muskrat, mink etc.).

Migration - Migration periods are critical times of the year to provide food resources required by migrating wildlife. The objectives of Ottawa's water management is to send migrating wildlife to the breeding grounds in the high energetic state needed for reproduction and supply foraging areas during fall so that southbound migrants can reach wintering grounds. Migrants moving from wintering areas to the breeding grounds require high energy carbohydrates along with proteinaceous aquatic invertebrates. The practice of drawdowns and flooding is to "set the table" for wildlife during the migration periods. Spring drawdowns will concentrate foods, induce invertebrate response (shallower areas will warm up quicker), and create shallow foraging areas. In the fall, migrants need high carbohydrate foods which can be provided through seeds, roots, and tubers. Fall flooding will proceed at a slow rate to gradually inundate food resources. Units will be staggered to achieve greatest utilization of the resources. Units that have plants with smaller producing seeds should be inundated first for early migrants like shorebirds, teals, and pintails. Other units will then be

flooded to increase foraging areas as the waterfowl numbers build during the fall. The slow rate of flooding will maximize foraging areas and provide optimum water levels by the peak of waterfowl migration.



V. HABITAT ENHANCEMENT

The refuge has lost some of its emergent marshes due to the forces of Lake Erie. These areas are open to the lake and water levels fluctuate according to the wind direction. The refuge has potential to increase its wetland base and improve its existing areas by providing flooded timber units, spring flooding croplands, and restoration of degraded estuaries like Metzger's Marsh.

A. Rehabilitation of Dikes Along Crane Creek

Pools 4, 5, 7, and 8 (Figure 3) are not included in the management plan because the refuge cannot control water levels in these pools. These pools are situated along Crane Creek and were in poor condition when turned over to the refuge. Without money available to repair the dikes when acquired the dikes have deteriorated further. Only remnant portions of the dikes occur today, with an estimated cost of \$7.0 million dollars to reclaim approximately 700 acres. Or there may be potential for developing a structure at the mouth of Crane Creek to control the seiche events to improve habitat in Crane Creek.

Water levels in these units fluctuate with the changes in Lake Erie. Pools are essentially devoid of vegetation, except for small composites scattered through out the area. Wildlife use is limited, but not non-existent. Seiche events by Lake Erie create shallow water and mudflat areas that are exploited by shorebirds, dabbling ducks, cormorants, and other marsh and water birds. The exposed sandbars provide resting/roosting areas for gulls, terns, and cormorants.

In 1993, Ottawa's refuge biologist initiated the study "Avian Use of Estuary Versus Moist Soil Impoundments at Ottawa NWR." The three year study will look at avian use and behavior within the above mentioned pools and determine the importance of these impoundments as they are. The information will allow for determination of the best use of this habitat to the avian communities.

B. Metzger's Marsh Development and Management Plan

An Environmental Assessment (EA) was completed in 1993 for Metzger's Marsh Coastal Wetland Restoration Project (Figure 3). The project is going to restore, protect, and manage 908 acres (350 acres USFWS) as a lacustrine, emergent wetland to provide benefits for a diversity of wildlife.

Once the construction phase has been completed the marsh will be managed in cooperation with the Ohio Division of Wildlife. Marsh management will take on a holistic approach by maintaining optimum wetland functions with no single species or objective weighted higher than any other. The EA states that the area could be drawn down for two years to re-establish emergent vegetation. Once the vegetation has been established, water control structures with fish control devices will be open and the marsh allowed to fluctuate with Lake Erie. Allowing the marsh to fluctuate with lake levels will emulate natural coastal marshes, however, the water control structures will inhibit any large seiche events from destroying vegetation. Based on

results of vegetation and wildlife response from opening Metzger's Marsh to the seiche events of Lake Erie, refuge staff will determine if its feasible to open other refuge units to the same forces.

The Service and Ohio Division of Wildlife have signed a Cooperative Management Agreement for Metzger's Marsh and is included as Attachment 2 to this management plan. Research will be conducted to monitor wildlife response to the development of the marsh prior to, during, and after construction. This research involves sampling, censusing, mapping, and determining the management strategies for most floral and fauna taxa.

C. Farm Fields, Moist Soil Units, Greentree Reservoirs, and Reforestation

Figure 3 highlights areas that have potential for habitat improvements over the long term (20-30 years) to increase biological diversity and make better use of the land base for wildlife. Improvements in these areas, if developed, will require some dike development, removal of drainage tile, installation/conversion of pumping facilities, and surveying of land. Improvements will proceed based on expenditures required, habitat needed, and as annual work plans allow. The following is a list of areas and suggestions for potential improvements.

Areas A and B - Area A is pool 9 and B is farm unit 1, both of which are designated borrow area for the Metzger's Marsh Restoration Project. Development of these two units will take place when the project is completed. Depending on how borrow is removed, both areas have potential to be moist soil units or a combination of moist soil/wet meadow/forested wetland.

Area C - This area is designated cropland with a small field of switchgrass located on the east side. The north, east, and south sides are diked and a 8" pump structure is located on the north dike. This unit is easily converted to a moist soil unit/forested wetland. Depending on survey results, the lower areas would be moist soil and the higher ground planted to hardwood trees, with the transition zone becoming a wet meadow. The west boundary may need to be diked and drainage tile removed. The pump structure present is already capable of pumping into or out of the unit and water is available throughout the year.

Area D - This area is high ground in MSU 3. This area is best suited for something other than moist soil because if flooded, water depths are too deep over the rest of the unit to be used by wildlife. Currently, part of the area contains cottonwood trees. Recommendations are to plant hardwood trees and create some mast production within the moist soil unit.

Area E - Area E is also cropland with a small grove of trees, mainly cottonwoods. With recent improvements, rehabilitating surrounding dike and installing a water control structure into the moist soil ditch, this unit is also easily converted to a moist soil unit. Survey results have shown that most of the area can be inundated with 12" or less of water. The unit can be flooded with the moist soil pump. Adding an additional water control structure connecting the impoundment with Crane Creek, most of the water would be drainable by gravity flow.

Area F - This area is a diked impoundment with 3-4 feet of topographic relief. The unit is self-contained and a portable pump is needed to dewater it. Access is through a neighboring landowners property. Dikes along the Crane Creek area are in need of improvement. Recommendation would be to plant the higher areas to hardwood trees and install a stop log structure with a flap gate for water control. The stop log structure would lessen the time running back and forth and the flap gate would prevent water running back into the unit if Crane Creek were to rise up.

Area G - Area G is a composite of woodlots, switchgrass fields, fescue fields, and croplands. The majority of the area is higher ground with water removed through drainage ditches. To manage these areas as moist soil units a lot of dikes would have to be built and water control structures with pumps installed. This area is better suited for hardwoods and grassy areas. Farm ditches could be plugged and possibly provide water creating a wet meadow or seasonally flooded woodlands.

Area H - This area is a strip of grassland and is best suited to be planted to hardwood trees. This would increase the tract of hardwoods that already exist just to the north of it.

Area I - This area is high ground in MSU 8A. This area is better suited for hardwood trees or a grassy/wet meadow. Natural recruitment of pin and white swamp oak has already taken place. The amount of water required to inundate this area is extensive and raises the water depth to make a large portion of the unit unusable to wildlife, except for a loafing/roosting area.

Area J - This area is a composite of croplands, woodlots, grassy fields, wet meadows. The majority of the area is high ground and improvements including dikes and water control structures would have to be constructed to convert this area into moist soil units. However, some areas could easily be flooded by plugging drainage ditches and adding stop log or some other water control structure. Land surveys would have to be conducted to determine improvements needed.

Area K - Area K is a fescue field with a wet meadow area along the western side. This area is scheduled to be planted to trees in 1995. The hardwoods would complement the trees already planted to the south and provide habitat up to the edge of entrance pool.

Areas L and M - These areas are a combination of croplands, wet meadow, fallow fields, and brushy areas. With pool 6 and Magee Marsh just to the north of these areas, enhancing the vegetation type to trees would be recommended.

Potter's Pond - Potter's Pond (see Figure 4) along the eastern side of Cedar Point NWR has been open to the seiche event of Lake Erie and is degraded and void of vegetation much like Metzger's Marsh. Restoration of this estuary would be a multi-million dollar project, however, the benefits to wildlife would be increased.

Figure 3. Habitat Enhancement Areas - Ottawa Division

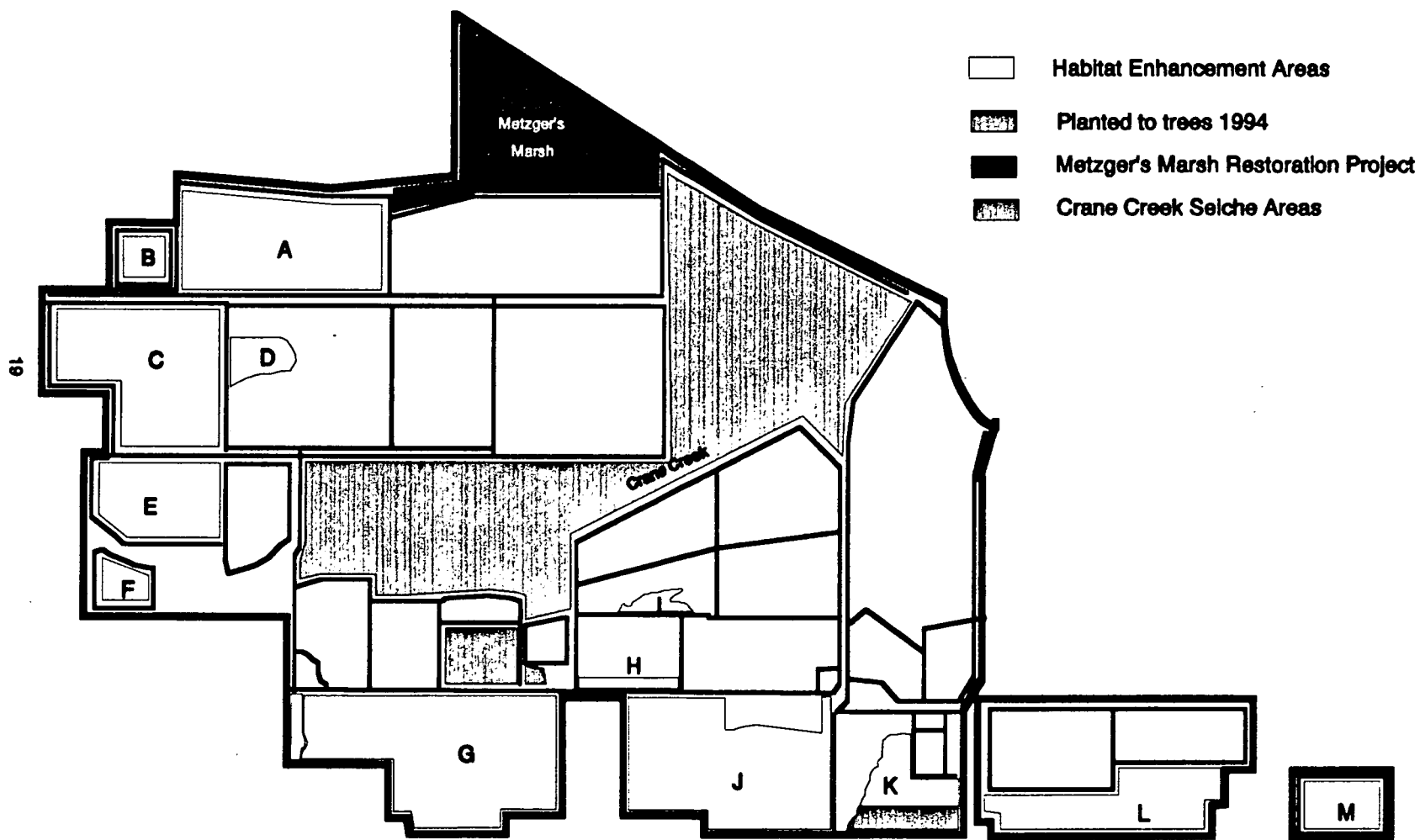
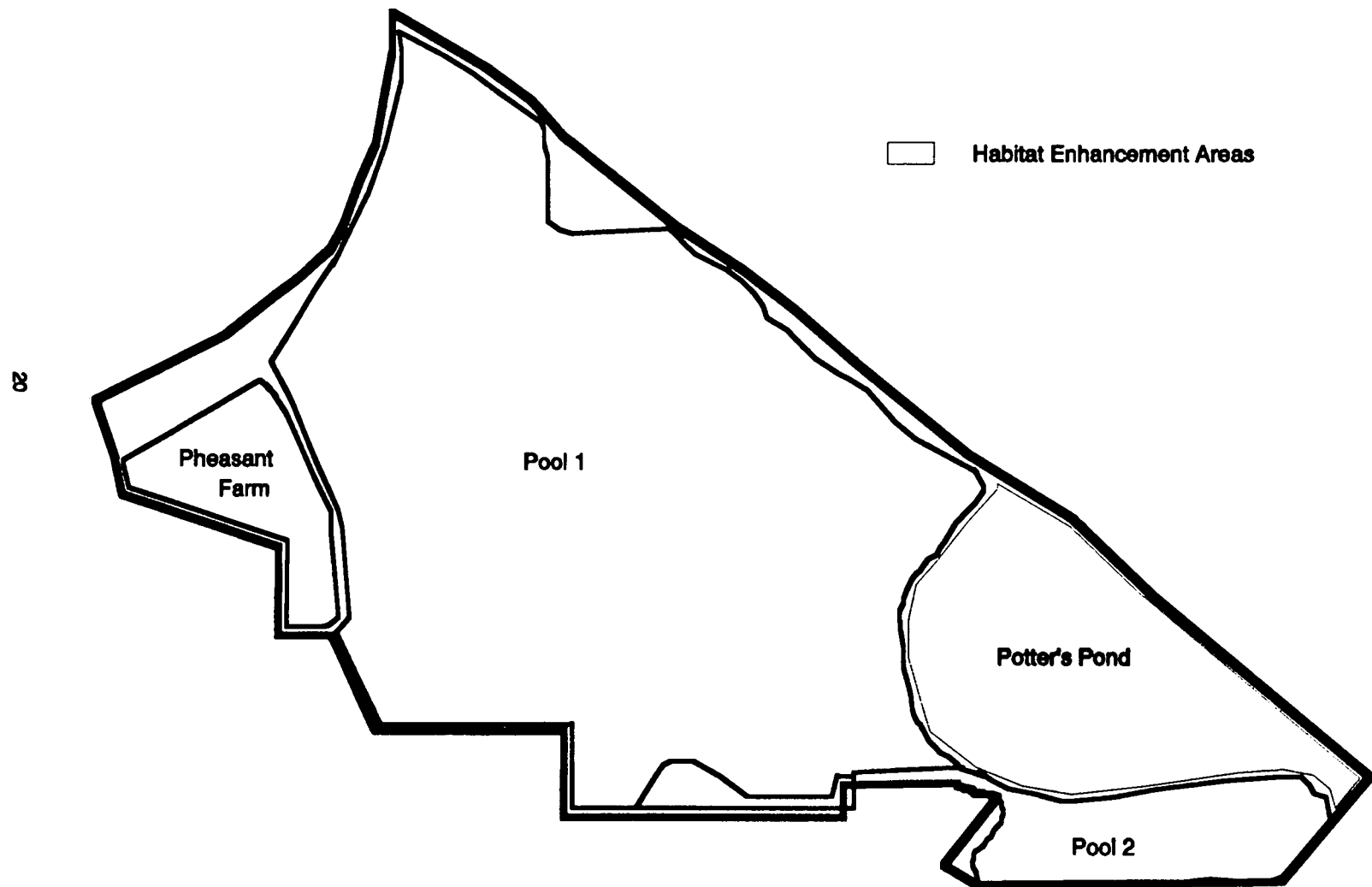


Figure 4. Habitat Enhancement Areas - Cedar Point NWR



VI. WATER MANAGEMENT UNITS

A. Ottawa National Wildlife Refuge

Ottawa National wildlife Refuge was established in 1961 and is a pivotal migration point for migratory birds. Ottawa NWR is comprised of three division: Ottawa, Darby, and Navarre.

The Ottawa Division consists of 4,683 acre mixture of marsh, moist soil, cropland, hardwoods, and grasslands. The marshes consist of diked impoundments managed in different regimes to provide optimal habitat to a diverse wildlife group. Wetlands are managed as moist soil units, permanent and semi-permanent marshes, and green tree reservoirs with riverine open water habitats occurring naturally. These wetland types are generally managed to provide habitat year-round for the greatest diversity of native fauna. Marshes are cycled through periodic drawdowns to foster hemi-marsh conditions that promote the greatest diversity of native wetland-dependent flora and fauna.

Ottawa has extensive pumping capabilities to ensure that water is available to manage impoundments when needed. The main moist soil pump station directly effects MSUs 3, 4, and 5. This pumping station is equipped with a 10,000 gpm axial flow pump powered by a 40 hp vertical hollow shaft electric motor. Pumping capacity is over 14 million gallons (44 acre-feet) in a 24 hour period. In 1989, five pumping stations were installed using flood damage monies. These water control structures contain 8" axial flow pump, belt propelled by a 5 hp motor, moving around 1,000 gpm. Pumping capacity is about 1.4 million gallons (4.5 acre-feet) in a 24 hour period.

Figure 5 shows location of pumping structures and water control structures mostly associated with water movement into and out of the impoundments.

The following pages contains objectives, history, wildlife use, and facilities of individual units. Some information, like acre-feet of water at full pool, was not readily available for every unit. Also, percent of area covered by water and the water depths need to be correlated to water level gauges. This will give refuge personnel a better idea of resources being provided.

Legend:

- Moist Soil Pump
- 8" pump Structures
- 8" Farm Unit Pumps
- Dual 36" screw/flap gates
- 36" Screw gates
- 24" Screw gates
- 18" Screw gates
- 18" Flap gates
- 12" Screw gates
- 12" Flap gates
- 8" PVC flap gate

Diagram Labels:

- Pool 9
- Pool 3
- MSU 3
- MSU 4
- MSU 5
- MSU 6
- MSU 7A
- MSU 7B
- GTR 7
- Mini-Marsh
- MSU 8A
- 2A
- 2B
- 2C
- MSU 8B
- MSU-LL
- Pool 1
- Show Pool
- Goose Pen
- Pool 6
- Entrance Pool

Ottawa Pool 1

Pool Elevation	Surface Acres	Acre-Feet
Full Pool 573.00	275	760
Drawdown 570.00	150	190

Control Structures

- 1 - 36" screw gate into ditch through Magee Marsh
- 1 - 18" screw gate into pump structure on Radar Ditch

History

This unit was managed as a semi-permanent marsh due to lack of adequate water control facilities and deteriorated dikes. The unit was drawn down in the summer of 1988 to facilitate dike construction and repair. The impoundment has retained a hemi-marsh condition and is an interspersed of cattail, bulrush, water smartweed, pickerelweed, arrowheads, submergents and an occasional stand of millet. An 16" pump was added to the already existing water control structure in 1993.

Wildlife

Wildlife use is predominately from waterfowl, especially scaup, during the migration periods. Waterfowl numbers have averaged around 100,000 and 50,000 use days for ducks and geese respectively. The large size of the unit also provides use to egrets, herons, rails, grebes, cormorants, swans etc. Muskrat population has sustained harvest of around 1,000 animals yearly (1990-1994).

Facility Improvements

The majority of the unit is in good condition, however, not the entire inside slope was originally rip-rapped during rehabilitation and these areas are showing small signs of erosion. The 16" pump installed in 1993 is having some mechanical problems and this pump should be repaired or replaced.

Objectives

This unit is managed as a semi-permanent marsh area. The area provides habitat for waterfowl, marsh and water birds, raptors, etc. Management is directed to providing a well balanced hemi-marsh. Drawdown should be done on a rotational basis every 4-5 years or as vegetation needs to be reestablished. Waterfowl use is loafing/roosting for dabblers and roosting/feeding for divers. This unit should annually provide 200,000 waterfowl use days.

Ottawa Pool 2A

Pool Elevation	Surface Acres	Acre-feet
Full Pool 572.00	70	207
Drawdown 568.00		

Control Structures

- 1 - 12" screw gate into MSU 8A
- 1 - 18" Screw gate with concrete structure into pool 2B

History

This unit has been managed as a semi-permanent wetland. This unit was once a large complex with 2B and 2C before it was subdivided in the mid-1980's. This unit has been essentially devoid of vegetation since the division, as much as 90% of the area was considered open water through 1992. In 1993, the unit was drawdown and revegetated with mostly moist soil annuals (44%) and undesirables (31% velvetleaf and cocklebur).

Wildlife

Between 1985 and 1992, the unit was used mostly by waterfowl as a loafing and resting area, mainly during the late-fall and winter. Water areas remained open because the deeper water did not freeze until temperatures were below freezing for extended periods. Also, the woody vegetation provided a wind break. During the 1993, the pool was used by large numbers of shorebirds, egrets, herons, and waterfowl.

Facility Improvements

The facilities are in good condition. There's minor erosion along the southern and eastern dikes. Rip-rap has been placed along the eastern dike, but was not finished. The concrete water control structure is workable but probably should be replaced.

Objectives

This unit has relatively low ground elevations and no direct pumping facilities. This area is best suited as a semi-permanent marsh and occasionally cycled into a drawdown to retain/enhance vegetation and provide some moist soil production. This impoundment is part of the Refuge's public use area and management practices will attract a variety of waterfowl, shorebirds, water birds, and wetland mammals to provide opportunities for wildlife viewing. However, activities during the peak migration or peak use of these units will be curtailed and trails diverted to reduce disturbance, and also increase public awareness and appreciation for the wildlife resource through interpretive materials explaining the need for areas free from human disturbance. A complete drawdown should be conducted every 4-5 years or as vegetation dictates. Annual waterfowl use days should average around 100,000. Shorebird, rails, and other marsh and water birds use will fluctuate depending on drawdown regime.

Ottawa Pool 2B

Pool Elevation	Surface Acres	Acre-feet
Full Pool 572.00	95	228
Drawdown 569.00	15	8

Control Structure

- 1 - 18" screw gate in Radar Ditch/8" pump structure in pool 1
- 1 - 18" screw gate into pool 2A
- 1 - 18" screw gate into pool 2C

History

This unit has been managed as a semi-permanent wetland. This unit was once a large complex with 2A and 2C before it was subdivided in the mid-1980's. This unit has been essentially devoid of vegetation since the division, as much as 50% of the area was considered open water through 1992. Only the small stands of woodlots, submerged aquatics, and water smartweed were present. The drawdown in 1993 produced moist soil annuals and undesirables (velvetleaf and cocklebur) over 45% and 33% of the unit, respectively.

Wildlife

Wildlife use has been limited to waterfowl usage as mainly a roosting/loafing area. Large concentrations of wigeon and gadwall have been observed during the fall migrations feeding on the submergents. During the 1993 drawdown large flocks of shorebirds (400-500 birds), herons and egrets were observed.

Facility Improvements

Most of the facilities are in good condition. Slight erosion has occurred on the south and north dikes due to the number of years of high water levels. Concrete structures into pools 2A and 2B are adequate, but should be replaced in the future.

Objectives

This unit has relatively low ground elevations. This area is best suited as a semi-permanent marsh and occasionally cycled into a drawdown to retain/enhance vegetation and provide some moist soil production. Partial drawdowns should be conducted yearly with a complete drawdown scheduled every 4-5 years depending on vegetation. This impoundment is part of the Refuge's public use area and management practices will attract a variety of waterfowl, shorebirds, water birds, and wetland mammals to provide opportunities for wildlife viewing. However, activities during the peak migration or peak use of these units will be curtailed and trails diverted to reduce disturbance, and also increase public awareness and appreciation for the wildlife resource through interpretive materials explaining the need for areas free from human disturbance. Annual waterfowl use days should average around 120,000. Shorebird, rails, and other marsh and water birds use will fluctuate depending on drawdown regime.

Ottawa Pool 2C

Pool Elevation	Surface Acres	Acre-feet
Full Pool 571.00	80	216
Drawdown 569.00	15	8

Control Structures

- 1 - 18" screw gate into pool 2B
- 1 - dual 36" screw/flap gate into Radar Ditch.

History

This unit has been managed as a semi-permanent wetland. This unit was once a large complex with pools 2A and 2B before it was subdivided in the mid-1980's. This unit has gone through several drawdowns (1985, 1986, and 1987) since being divided to maintain its emergent vegetation of cattail, sedges and rushes, along with producing moist soil annuals. A considerable amount of interspersions is present with water smartweed, cattail, open water, and spike rush. A drawdown was conducted in 1993 and moist soil annuals were produced on over 54% of the unit.

Wildlife

The gradual topographic relief in this unit allows for use by shorebirds, egrets, herons, waterfowl, muskrats etc. with little management required. Egrets, herons, gulls, and terns have gathered in large numbers during the summer for feeding and resting on the mudflats. During the drawdown in 1993, shorebird flocks of 500 birds were common. Waterfowl numbers have averaged 150,000 ducks and 50,000 goose use days annually.

Facility Improvements

Facilities are in good condition. Slight erosion is present along the north dike.

Objectives

This unit has relatively low ground elevations and no direct pumping facilities. This area is best suited as a semi-permanent marsh and occasionally cycled into a drawdown to retain/enhance vegetation and provide some moist soil production. A partial drawdown should be conducted every year with a complete drawdown every 4-5 years depending on vegetation. This impoundment is part of the Refuge's public use area and management practices will attract a variety of waterfowl, shorebirds, water birds, and wetland mammals to provide opportunities for wildlife viewing. However, activities during the peak migration or peak use of these units will be curtailed and trails diverted to reduce disturbance, and also increase public awareness and appreciation for the wildlife resource through interpretive materials explaining the need for areas free from human disturbance. Annual waterfowl use days should average around 150,000. Shorebird, rail, egrets, etc. use will vary depending on management regime.

Ottawa Pool 3

Pool Elevation	Surface Acres	Acre-feet
Full Pool 574.00	260	
Drawdown 570.00		

Control Structures

1 - dual 36" screw/flap gates into Tank Ditch

History

This unit fluctuated with the seiche event of Lake Erie because of deteriorated dikes. In 1988, dike holes were plugged, the unit dewatered, and the dikes repaired. Moist soil annuals produced well during the year of construction. Since then the area has been 50% open water, 30% cattail, and 20% other species.

Wildlife

The unit is mostly utilized by waterfowl, with as many as 210,000 duck and 113,000 goose use days occurring in one year. This is a preferred unit by waterfowl during the fall as a loafing/resting area. The open bay surrounded by cattail allows the birds to be protected against the wind. At times the majority of swans migrating through are present here. The shallower areas support egrets, herons, muskrats etc. A portion of the unit contains a flooded woodlot and provides habitat for nesting wood ducks and brood rearing. A bald eagle nest is located within the woodlot, however, since its development in 1992 the breeding pair has not been able to produce young.

Facility Improvements

The facilities are in good condition.

Objectives

This unit has been managed as a semi-permanent marsh and the bulk of waterfowl use is loafing/roosting. Partial drawdowns should be conducted yearly with complete drawdowns scheduled every 4-5 years, to mimic the natural marsh process. Retaining fishing opportunities for the breeding bald eagle is of great importance. The area provides year round habitat for waterfowl, marsh and water birds, raptors, etc. Waterfowl use is expected to average around 200,000 use days annually.

Ottawa Pool 6

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	160	
Drawdown 569.00		

Control Structures
1 - 36" screw gate

History

This unit has been managed as a semi-permanent marsh when capable of management. The east and south dikes are no longer capable of retaining water. Both dikes are severely eroded in areas and are riddled with muskrat/woodchuck holes and have been this way since the early 1980's. The north half of the east dike is overgrown with sumac and dogwood. The water levels fluctuate with climate conditions. Vegetation composition has not changed much over the past 6-7 years. Vegetation consists of cattail 40%, woody vegetation 10%, aquatic smartweed 5%, smartweed and millets 5%, and open water/submergents 40%.

Wildlife

Waterfowl use has fluctuated between 5,000 to 25,000 annual use days for ducks and 4,000 to 13,000 annual use days for geese. Use has gradually declined since 1992.

Facility Improvements

Almost all existing dikes are in dire need of repair to make this unit functional. Water control structures will also need to be installed.

Objectives

This unit is managed as a semi-permanent marsh area. The area provides habitat for waterfowl, marsh and water birds, raptors, etc. Management is directed to providing a well balanced hemi-marsh. Drawdown should be done on a rotational basis every 4-5 years or as vegetation needs to be reestablished. This unit should annually provide 50,000 waterfowl use days.

Ottawa Pool 9

Pool Elevation	Surface Acres	Acre-feet
Full Pool	158	
Drawdown		

Control Structure

1 - dual 36" screw/flap gates into Tank Ditch.

History

This unit has essentially been overlooked as an intensively managed unit. Management during the late 1980's was to allow the unit to fluctuate with climatic condition. This scheme has allowed cattail to persist over 80% of the unit. An attempt in 1991 was made to thin out the cattail by laying it flat with a disk and over topping the cattail with water. Water was maintained in 1992, but not 1993. Cattail areas still persist with other emergents like sedges, spikerush etc. Part of this unit is scheduled for borrow as a borrow area for the Metzger's Marsh project.

Wildlife

Wildlife use has been limited. Waterfowl use days have fluctuated along with the water levels. Duck and goose use days increased in 1992 when water remained in the unit during the summer. The shallow water provides wading for herons, egrets, rails, bitterns etc.

Facility Improvements

A portion of the unit is designated borrow area for the Metzger's Marsh Restoration Project. Improvements needed will be determined after this project is completed. The north dike is mostly composed of sand washed in from Lake Erie seiche events and may need to be reconstructed.

Objectives

After Metzger's Marsh Project this unit will be managed as a semi-permanent marsh and provide habitat for waterfowl, marsh and waterbirds, raptors, etc., thereby increasing wildlife benefits.

Ottawa Entrance Pool

Pool Elevation	Surface Acres	Acre-feet
Full Pool 572.50	30	
Drawdown 569.00		

Control Structure

1 - 18" screw gate into Radar Ditch

History

This unit was drawn down in 1990 and the north dike was rehabilitated. This unit has been managed as a semi-permanent marsh and is a composite of open water, cattail, and wet meadow. A drawdown was conducted in 1993 for the first time since 1990, however the drawdown was late in the growing season hindering new plant germination over most of the unit. Vegetation composition did not change much except production from moist soil annuals cover 15% of the unit. Cattail and open water still compose the majority of coverage.

Wildlife

This unit has quite a variety of diverse use from dabbling and diving ducks, geese, egrets, herons, black-crowned night herons, and pied-billed grebes. Usually during August hundreds of herons and egrets congregate for feeding in the early morning. Waterfowl use days have averaged around 50,000 ducks and 40,000 geese. Flocks of 50-100 shorebirds were present during the drawdown and flooding in 1993.

Facility Improvements

The north dike has some minor erosion and the western dike (along entrance road) has cave ins from muskrat damage. These areas need to be filled, reshaped, and rip-rapped.

Objectives

The location of this unit along the entrance road is highly visible to refuge visitors and is the first area of the refuge they see while entering the refuge. Thus, the unit is managed to provide a diversity of marsh type habitats, ranging from cattail stands to open water. Partial drawdown should be done early and complete drawdown every 4-5 years as needed. The unit receives large amounts of waterfowl, marsh and water birds use year long and shorebird use during drawdowns. Entrance pool should be able to provide 80-100,000 waterfowl use days annually. Marsh and other water bird use will be dependent on management regime.

Ottawa Show Pool

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.50	30	
Drawdown 569.00		

Control Structures

1 - 24" screw gate into Tank Ditch

History

This unit has maintained a mosaic of open water, cattail, submergents, wet meadow, smartweeds, and upland. The center is an island/remnant dike which most of the time is a wet meadow. The pool in front of the office was borrow to mound up the area for the office. Management has been "hands off" by allowing the water level to fluctuate with climatic conditions. However, if water needs to be removed or added, a portable pump is required.

Wildlife

Wildlife use has been minimal, but consistent. Waterfowl use days have averaged around 3,000 for ducks and 5,000 for geese. Shorebird are present during summer when water is evaporating off the higher ground. Egrets and herons are present year long and diving ducks - mainly hooded mergansers - feed in the borrow area during fall.

Facility Improvements

Due to high water levels for long periods, the bank in front of the office is eroding and needs to be shaped and rip-rapped. Also, the bank around the water control structure needs the same attention.

Objectives

Because of the location of this pool to the office, it has been designated as a "show" pool with the intent that it can provide viewing of waterfowl and be a model wetland. Partial drawdown should be done early and complete drawdown every 4-5 years as needed. Waterfowl, shorebirds, etc. would be attracted to the area during flooding in the fall, providing great viewing opportunities.

Ottawa Mini-Marsh

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	16	
Drawdown 571.00		

Control Structures

8" pump and water control structure

History

This impoundment has been managed as a semi-permanent marsh to provide viewing opportunities for visitors staying at the Butternut Lodge. A drawdown was conducted in 1988 and excellent response from moist soil annuals was observed. The current pumping facility was installed in 1989 with a diversion box added in 1992 so that drainage ditch water could be pumped directly to the lake. Dikes were rehabilitated in 1990 and filter fabric and rip-rap added in 1991. The unit is dominated with cattail and open water, but with no interspersions -- the cattail covers the western half and open water the eastern half. A drawdown was conducted in 1993 with excellent response from moist soil annuals especially smartweeds.

Wildlife

Wildlife use has been limited but consistent. Waterfowl was the majority of use prior to the drawdown in 1993. Duck numbers averaged around 1,000 use days annually and then escalated to 9,000 in 1993. Goose use days stayed steady at 3,000 per year. Shorebird, egrets, herons and other marsh birds were steady users of the unit during drawdown in 1993.

Facility Improvements

Majority of the facilities are in good condition. The western dike along the unit's ditch has minor erosion and will need to be reshaped and rip-rapped in the future.

Objectives

Due to its small size, location, and pumping facility, this unit is best served as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow water areas for foraging wildlife. Annual waterfowl use should be around 6-7,000 use days. Shorebird, egrets, herons etc. use will vary depending on the management strategy. Overall management will be to keep this unit in an early successional stage and retain high seed productivity from moist soil plants.

Ottawa Moist Soil Unit 3

Pool Elevation	Surface Acres	Acre-feet
Full Pool 574.50	213	
Drawdown 567.00		

Control Structures

- 2 - 24" screw gates into the moist soil ditch
- 1 - dual 36" screw/flap gates into Tank Ditch
- 1 - 36" screw gate into the moist soil ditch

History

This unit was converted to a moist soil unit in 1976, however little management was conducted prior to 1981 due to lack of pumping facility. Drawdowns were conducted in 1984 and 1985 and produced moist soil plants over 50% of the unit. During the late 1980's the unit gradually changed from emergent vegetation to a thicket of woody vegetation and reed-canarygrass. By the early 1990's, reed-canarygrass and woody vegetation composed 90% of the cover. This vegetation was probably encouraged when unit was dewatered in 1989 to rehabilitate dikes and add water control structures. During 1992, the reed-canarygrass and woody vegetation was mowed, portions were disked, and unit was gradually flooded. A 36" screw gate was added in 1993 to increase the flow rate of water from the moist soil pump.

Wildlife

Waterfowl use days peaked in 1984 with 800,000 and 200,000 use days for ducks and geese, respectively. Since then waterfowl use has drastically decreased to 16,000 duck and 3,000 goose use days by 1991. Waterfowl use rebounded slightly in 1992 due to the mowing and flooding. In 1992, duck use days rose to over 120,000 and goose use days increased to 31,000. Egrets, herons, etc. have also shown a decline since the mid-80's

Facility Improvements

Drainage tile that went through the south dike into the moist soil ditch were removed in 1993. The spoil area still need to be leveled and the dike seeded and rip-rapped. The northeast corner has shown some erosion and needs attention.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 75-100,000 during spring migration and another 300-400,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 4

Pool Elevation	Surface Acres	Acre-feet
Full Pool 574.00	106	
Drawdown 567.00		

Control Structures

- 2 - 24" screw gates into the moist soil ditch
- 1 - dual 36" screw/flap gates into Tank Ditch

History

This unit was converted into a moist soil unit in the late-70's, however, little management was conducted prior to 1981 due to lack of pumping facility. During 1981-85 this unit went under extensive disking for control of woody vegetation and reed-canarygrass. Moist soil plants responded well to disking, however, control of vegetation was not achieved. In 1986, the unit was plowed, disked, and planted to buckwheat. This unit was also cropped in 1987(75%), 1988(30%), 1989(5%), and 1990(75%). The year following the planting moist soil plants were produced, however, reed-canarygrass always came back. In 1991, 60% of the unit was covered by millets, bidens, and smartweeds. By 1992, the unit contained 90% reed-canarygrass. The unit was deep disked in 1993, and problem areas planted to corn and milo in 1994.

Wildlife

Waterfowl use was fair during the 1980's with an average of 10,000 duck and 35,000 goose use days, respectively. Duck use days rose to 30,000 in 1990 and then escalated to over 200,000 in 1991 and 1992. The early spring drawdowns did not discourage the reed-canarygrass, but still provided invertebrate substrate and shallow foraging areas for waterfowl, shorebirds, egrets, herons etc. Wildlife use dropped again in 1993 due to control efforts.

Facility Improvements

Facilities are in good condition. The drainage tile going through the south dike into the moist soil ditch were removed in 1993. This area needs to be shaped and seeded.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 30-40,000 during spring migration and another 200-300,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 5

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	250	
Drawdown 567.00		

Control Structures

- 1 - dual 36" screw/flap gate into Tank Ditch
- 2 - 30" flap gates into the moist soil ditch

History

This unit was converted to a moist soil unit in the late 1970's with little management conducted prior to 1981 due to lack of pumping facility. Water was held high during 1982-83 to stress woody vegetation and cattail areas expanded. During 1984-85 drawdowns were conducted and management via mowing, disking, and flooding were conducted. Good stands of moist soil plants were produced from 1985-88. Portions of the unit were cropped in 1986(30%) and 1987(80%). Filter fabric, rip-rap, and water control structures were added in 1989. The dewatering facilitated woody encroachment. High water levels were held through 1991 in hopes to stress the willow. In 1991, the entire unit was mowed and small areas disked. Drawdowns were conducted in 1992 and 1993 with excellent stands of moist soil annual produced, however, Woody vegetation is once again reclaiming the unit.

Wildlife

Waterfowl use during the 1980's peaked in 1985 with 450,000 duck and 240,000 goose use days, respectively. The average annual use days during the 1980's were 200,000 for ducks and 170,000 for geese. During the early 1990's waterfowl use days have averaged 240,000 for ducks and 115,000 for geese. Shorebirds, herons, egrets, etc. have used the unit during drawdowns for foraging. The deeper water areas are used by waterfowl for roosting/resting during fall.

Facility Improvements

Facilities are in good condition.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 80-90,000 during spring migration and another 400-500,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 6

Pool Elevation	Surface Acres	Acre-feet
Full Pool	70	
Drawdown		

Control Structures
None at this time

History

This area was converted to a moist soil unit in the late 1970's. Due to deteriorated dikes this unit fluctuated with Lake Erie seiches until 1992. During 1990 and 1991, both the south and west dikes were rebuilt making the unit self-contained. Vegetation composition, which is relatively unchanged since converting to a moist soil unit, consisted mainly of cattail 50% and willow/cottonwood 40%. In 1993, almost the entire unit was deep disked and remained dry to stress the undesirable vegetation.

Wildlife

Wildlife use has consisted of a few hundred use days of waterfowl, egrets, herons, etc. because water availability was unpredictable. Since 1991, use days have jumped to 30,000 for waterfowl and 1,000 for marsh and water birds. Wildlife habitat will slowly be increased as the unit becomes more manageable.

Facility Improvements

The recently finished dikes need rip-rap placed to prevent erosion. Water control structures need to be installed to connect this unit with the main moist soil pump. Currently, water movement is conducted by portable pumps.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 20-30,000 during spring migration and another 100-120,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 7A

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.50	49	
Drawdown 570.50		

Control Structures

- 8" pump and control structure
- 1 - 18" screw gate into MSU 7B
- 1 - 24" screw gate into Crane Creek

History

This unit was converted to a moist soil unit in the late 1970's. During the 1980's, drawdowns conducted produced excellent stands of moist soil annuals. Continuous early season drawdown strategies in the late 1980's and early 1990's has produced more xeric conditions and resulted in upland plant species dominating the unit. The drawdowns were conducted for dike rehabilitation.

Wildlife

Waterfowl use days have averaged around 16,000 for ducks and 19,000 for geese (1984-1993). Waterfowl use days have fluctuated greatly depending on the management regime. From 1991-1993 waterfowl use days averaged 30,000 annually. The southern portion of the unit, when at full pool, is only 2-4" deep and receives excellent use by waterfowl and shorebirds during the spring.

Facility Improvements

Facilities are in good condition. North dike was rebuilt in 1990 and reshaped in 1991. Rip-rap is scheduled for summer 1994.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 20-30,000 during spring migration and another 20-30,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 7B

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	44	
Drawdown 570.00		

Control Structures

1 - 18" screw gate into MSU 7A

History

This unit was converted to a moist soil unit in the late 1970's. During the 1980's, drawdowns produced excellent stands of moist soil annuals. Portions of the unit were cropped in 1985(27%), 1988(35%), and 1990(70%). Continuous early season drawdown strategies in the late 1980's and early 1990's has produced more xeric conditions and resulted in upland plant species dominating the unit. The drawdowns were conducted for dike rehabilitation.

Wildlife

Wildlife response is similar to MSU 7A because of almost identical management practices. Waterfowl use days dropped from 1989 to 1991 due to the upland vegetation community. Since 1991, moist soil habitat conditions have increased and so has the wildlife use days. Waterfowl use increased to 64,000 use days in 1992. The southern portion of the unit is only a few inches deep at full pool and is used by waterfowl and shorebirds extensively during the early spring.

Facility Improvements

Facilities are in good condition. The north dike was rebuilt in 1990 and reshaped in 1991. Rip-rap was laid on the interior slope in 1993. Management could possibly be improved with a water control structure placed on the eastern side of the unit and running into a ditch drained by the Mini-Marsh pump. This would make MSU 7B independent from MSU 7A.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 20-30,000 during spring migration and another 20-30,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 8A

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	44	
Drawdown 570.00		

Control Structures

8" pump and water control facility into Lindsey-Limestone ditch
1 - 12" screw gate into pool 2A

History

This unit was converted to a moist soil unit in the late 1970's. Drawdowns were conducted in the 1980's with excellent moist soil annual production. In 1986, this unit was planted to corn, milo, and buckwheat, which covered 65% of the unit. For most of the 1980's and early 1990's vegetation composition averaged 30% moist soil annuals, 30% upland plants, 30% open water, and 10% other plants. The unit was drawdown in 1991 for dike rehabilitation. The west, north, and east dike were all resloped and a new ditch system dug during 1991 and 1992. Willow and cottonwood seedlings encroached as a factor to the drawdowns and no control efforts.

Wildlife

Waterfowl numbers have fluctuated according to management regime. During early 1980's, waterfowl use was excellent with yearly averages of 100,000 duck and 30,000 goose use days. Waterfowl use decreased in the late 1980's to approximately 50,000 duck and 15,000 goose use days, respectively. The drawdown of 1991 produced excellent stands of moist soil annuals which in turn increased waterfowl use days to about 150,000. Construction of dikes in 1992 and 1993 again decreased waterfowl use. Shorebirds, herons, egrets, etc. increase use during drawdown years.

Facility Improvements

Majority of improvements have already been made, however, the dike to the south is in poor condition and will need attention in the future. Dikes that were resloped in 1991 need to be seeded.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 30-40,000 during spring migration and another 60-70,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit 8B

Pool Elevation	Surface Acres	Acre-feet
Full Pool 572.50	85	
Drawdown 571.50		

Control Structures

- 1 - 30" flap gate into drainage ditch (dewater unit)
- 1 - 12" flap gate into drainage ditch (high ground - to flood unit)
- 8" pumping facility and control structure

History

This unit was converted to a moist soil unit in 1981. This unit was last farmed in 1986. Drawdowns were conducted from 1984-1993 and have produced excellent stands of moist soil plants. On average, over 50% of the unit was composed of moist soil plants during 1984-1993. During the late 1980's this unit has slowly started to be covered with spikerush. However, moist soil plants are still being produced over the majority of the unit. The spikerush appears to retain soil moisture and help the millets and bidens.

Wildlife

This unit is always exploited by waterfowl, shorebirds, egrets, herons etc. Waterfowl use days have averaged around 100,000 for ducks and 60,000 for geese (1984-1993). Herons, egrets, and other waders have averaged around 4,000 use days. Shorebirds are present in flocks of 300-400 birds during spring drawdowns.

Facility Improvements

The north, south, and west dikes are all showing signs of erosion and will have to be repaired in the near future. The south dike has had muskrats burrow through the dike not allowing the dike to retain water. Minor repairs have already been done.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 30-40,000 during spring migration and another 110-120,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Moist Soil Unit Lindsey-Limestone

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.50	20	
Drawdown 570.00		

Control Structures

1 - 18" screw gate into the 8" pump structure in MSU 8A

History

This area was converted into a moist soil unit in 1992. The majority of vegetation cover consists of uplands plants and woody vegetation such as willow and cottonwood. The completion of the dike along the Lindsey-Limestone and installation of the screw gate allows for water manipulation to take place. The topographic relief is minor making it ideal for moist soil management.

Wildlife

Not very much wildlife use has been recorded due to this unit being new. Shorebirds, egrets, herons, etc. have been observed foraging. Waterfowl responded very quickly to the new unit when first flooded in spring 1993. Duck use days in spring were about 10,000 with an additional 15,000 in the fall of 1993.

Facility Improvements

The western dike along Lindsey-Limestone was completed in 1992. The north dike (dividing MSU 8A and this unit) is in poor shape but is functional. At full pool, water seeps into the adjacent woodlot. A low level dike should be constructed with a water control structure to provide for dewatering of trees prior to one-third leaf to reduce tree damage. A water level gauge needs to be installed.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 30-40,000 during spring migration and another 30-40,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Ottawa Goose Pen

Pool Elevation	Surface Acres	Acre-feet
Full pool	35	
Drawdown		

Control Structures
None

History

This unit has not been intensively managed. A "hands off" approach has been taken and the unit water levels have fluctuated with climatic condition. The impoundment usually fills during the spring and fall from precipitation and losses water during the hot summers. The unit consists of emergents such as spikerush and cattail, but mostly open water. Mudflats are usually exposed by late summer.

Wildlife

Recorded wildlife use is lacking. Waterfowl use is usually associated with resting/loafing during fall.

Facility Improvements

The objective is to manage this unit as a moist soil unit. Some dike rehabilitation will need to be done on the east side, and a water control structure added. If water manipulation is conducted a portable pump is required.

Objectives

The primary objective of this unit is to provide wildlife food resources as a moist soil unit. Under optimum conditions, this unit should be able to provide up to 1,200 lbs/acre of high energy foods, substrate for invertebrates, and shallow foraging areas for wildlife during drawdown and flooding. Waterfowl use days should range from 30-40,000 during spring migration and another 30-40,000 during the fall. Other marsh and water birds will benefit depending on management scheme. Rails, egrets, herons, and bitterns will benefit when unit is flooded during the summer. Where as, shorebirds, waterfowl, and other migrant will benefit during drawdowns. Overall, management will be to keep this unit in an early successional stage to retain highly productive food resources.

Green Tree Reservoir 7

Pool Elevation	Surface Acres	Acre-feet
Full pool	13	
Drawdown		

Control Structures

1 - 8" PVC flap gate into adjacent drainage ditch

History

This unit was flooded as a green tree reservoir in the fall of 1993. The impoundment is located directly east of MSU 7B. Flooding did not take place until October, thereby missing the primary use species -- wood ducks. The woodlot is a composite of pin, red, and swamp white oaks, shadbark and shagbark hickory, basswood, and ash. The impoundment will be flooded earlier in the year to determine wildlife benefits.

Wildlife

The primary wildlife species observed using the GTR has been wood ducks and mallards. Use days for 1993 totalled 50. In spring of 1994, mallard and wood duck flocks of 5-10 birds were observed on occasion. A bald eagle nest is located in the southwest corner of this impoundment. The pair built the nest during winter of 1994, but was unsuccessful in producing young.

Facility Improvements

The woodlot is surrounded by dikes on all sides and they are all in fairly good condition. The south dike may need to be rehabilitated in the future, but for now its not necessary. A water gauge should be installed to monitor water manipulations. A diversion box to the outlet pipe on the Mini-Marsh pump should be added so water can be pumped into the unit without setting up a portable pump.

Objectives

The primary objective is to provide waterfowl food from mast production without harming the growth of the trees.

B. Darby Marsh Unit

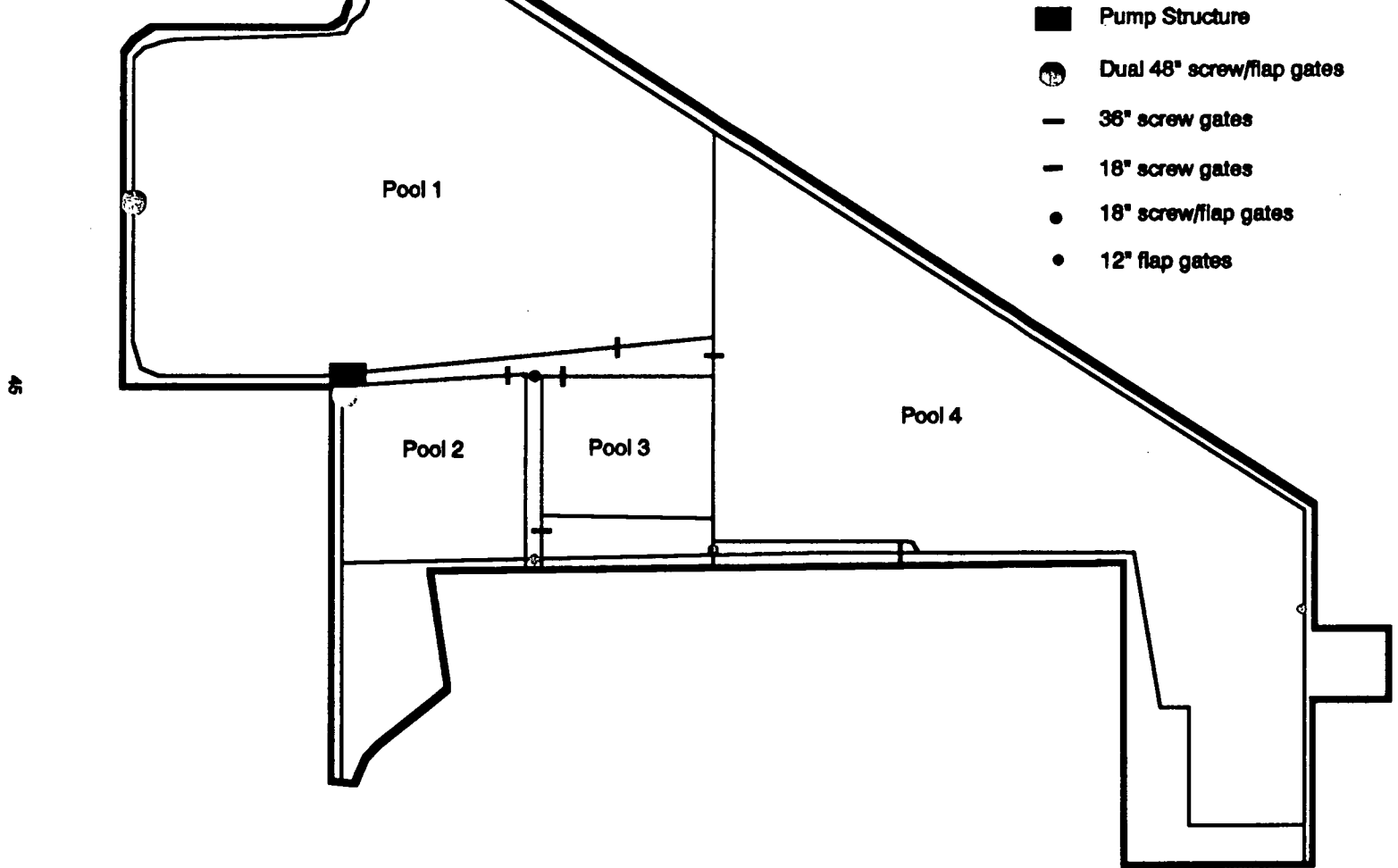
Darby Marsh Unit is a 520 acre diked marsh complex acquired through land exchange with Toledo-Edison for the Navarre Marsh Unit. This transaction started in 1968 and ended in 1972. This unit was managed as permanent to semi-permanent marshes through the mid-1980's due to the reliance on Lake Erie water levels and gravity flow for water movement. Water was only pumped out using a Crissifulli pump when high waters in Lake Erie and dike breaches were eminent. This high labor and energy consumption process was only done to save the dikes and lower the water level below existing plant structure.

Since 1989, dike repairs, ditch clean out, and the installation of a pumping facility and water control structures to be able to manage each unit separately has greatly improved the management. The pump station is equipped with two 16" axial flow pumps powered by a 20-horsepower electric motor. Each pump is capable of moving 4,000 gpm. The station can move over 11.5 million gallons (35 acre-feet) in a 24-hour period. All units at Darby can be serviced separately by the pump structure through the main ditch.

Muskrat damage to the interior dikes and drainage of private lands into the units themselves has limited the ability to manage the marshes as desired. This problem has been remedied with the construction work performed during the summers of 1992 and 1993. The shaping of dikes and the construction of a low level dike in the south part of pool 4 has diverted all private lands runoff into the ditch system to provide better water control over individual units.

The marsh unit will be managed with more permanent water on pools 1 and with drawdowns as needed to create hemi-marsh conditions and moist soil management on pools 2 and 3. The impoundments and physical facilities are shown in Figure 6.

Figure 6. Darby Division Water Control Structures and Pump Facility



DARBY POOL 1

Pool Elevation	Surface Acres	Acre-Feet
Full Pool 573.00	200	586
Drawdown 566.00		

Control Structures

- 2 - 48" screw/flap gates into LaCarpe Creek
- 1 - 36" screw gate into the main pump ditch

History

This unit has been managed mainly as an emergent marsh due to the lack of adequate water control structures or breaks in the dikes. Lately the water has been lowered in the spring and summer months to retain its natural marsh. This unit is at a good hemi-marsh stage with a composition of open water, floating emergents, cattail, bulrush, and some millets and smartweeds.

Wildlife

Wildlife use has been tremendous in this unit with waterfowl use as a loafing area and feeding on submergent vegetation as seen from large concentrations of wigeon and gadwall. A bald eagle nest is located on a remnant dike within the pool. The pair built the nest during the breeding season of 1992. Another nest was built during the winter of 1994. Muskrat populations have also been steady, by producing 400-500 animals a year. The shallower areas are used by great blue herons, egrets, shorebirds, and gulls.

Facility Improvements

Facilities are in good condition.

Objectives

The unit should continually be managed as a hemi-marsh and management should maintain the current vegetation composition. Partial drawdowns will be completed yearly to maintain wetland vegetation. Complete drawdown is only necessary to reestablish lost vegetation - every 4-5 years. Maintaining protection of the bald eagle nest is a priority. This pool should provide 150,000 duck and 40,000 goose use days. Muskrat populations should be maintained. The shallow waters during the summer will provide feeding opportunities for breeding great blue herons, great egrets from West Sister Island, and other wading and waterbirds.

DARBY POOL 2

Pool elevation	Surface Acres	Acre-Feet
Full Pool 573.00	25	60
Drawdown 569.00		

Control Structure

1 - 18" screw gate into the main ditch

History

The pool has been managed as a permanent to semi-permanent marsh due to lack of good water control and deteriorated dikes. Vegetation is composed of a good interspersions of cattails, pickerelweed, submergents, with millets and smartweeds on the higher elevations. Drawdowns were conducted in the spring of 1992 and 1993 for construction. Vegetation response was excellent with over 75% composition of Walter's millet and nodding smartweed in 1992 and the majority was rice-cutgrass, smartweeds, and some millets in 1993.

Wildlife

Use by wildlife is sporadic depending on the time of year. The majority of use has been by waterfowl due to the permanent marsh conditions. Over the past five years, waterfowl use has averaged 10,000 ducks and 1,000 goose use days. Great blue herons and egrets have also been associated with the impoundment.

Facility Improvements

The facilities have been enhanced during 1992 and 1993 construction years. Dikes were resloped, holes repaired, and adjoining ditches cleaned out. This unit can now be managed as individual unit. Inside dikes slopes still need to be seeded and outside dike slope along drainage ditches needs rip-rap placed.

Objectives

With refurbished dikes, good water control, the small size, and close proximity of this unit to larger hemi-marshes, this unit would best support the objectives by being placed in a moist soil management regime. The annual production of seeds from moist soil annuals would complement the already available roosting and loafing areas in pools 1 and 4. This unit should be able to contribute 20,000 and 1,000 duck and goose use days, respectively. Additionally, during drawdown stages habitat will be provided for shorebirds, marsh and water birds, rails, bitterns, etc.

DARBY POOL 3

Pool Elevation	Surface Acres	Acre-Feet
Full Pool 573.00	25	30
Drawdown 569.00		

Control Structures

1 - 18" screw gate into main ditch

History

With no water control capabilities, the unit was essentially managed as a permanent marsh. By 1985, the unit was almost 100% open water and remained in that condition until 1988 when the unit was pumped down. From 1989 through 1992 the pool had continued to be in a permanent marsh with good interspersions of open water, aquatic smartweed, pickerelweed, cattail, and annual moist soil plants. Drawdowns occurred in spring of 1992 and 1993 for refurbishing dikes and to create a ditch system that completely isolated private lands runoff from the unit. The drawdowns produced excellent stands of millets and smartweeds.

Wildlife

Wildlife use picked up after 1988 when the unit was revegetated. Waterfowl use peaked at 25,000 duck and 1,500 goose use days in 1989 and has since declined. Muskrat populations fluctuate according to the management scheme.

Facility Improvements

The facilities have been enhanced during 1992 and 1993 construction years. Dikes were resloped, holes repaired, and adjoining ditches cleaned out. This unit can now be managed as individual unit. Inside dikes slopes still need to be seeded and outside dike slope along drainage ditches needs rip-rap placed.

Objectives

With refurbished dikes, good water control, the small size, and close proximity of this unit to larger hemi-marshes, this unit would best support the objectives by being placed in moist soil management. The annual production of moist soil plants will provide good fall waterfowl use of 20,000 use days. In addition, drawdowns will benefit other species as well like shorebirds, great blue herons, egrets, and other wading and waterbirds.

DARBY POOL 4

Pool Elevation	Surface Acres	Acre-Feet
Full pool 573.50	170	687
Drawdown 566.60		

Control Structures:

- 1 - 36" screw gate into the main ditch
- 1 - 24" flap gate from private land

History

Again, due to lack of pumping facilities this unit was managed mostly as a permanent marsh, which by 1989 continued to have 60-70% open water. Partial drawdown in 1989 brought the open water down to 50% with vegetation consisting of cattail and cottonwood/willow growth. By 1992 open water was once again up to 70% with vegetation occurring only along the edges. Drawdowns were conducted in the spring of 1992 and 1993 for the construction of a low-level dike and ditch system in the southwest corner to divert private land runoff through a ditch system instead of going through the unit. The 1992 results were fair with millet and smartweed and bulrush produced along the edges. The unusually wet summer and runoff from private lands kept water levels too deep for plant germination. Adequate drying in 1993 produced excellent stands of 6-foot-tall millet and smartweeds along with cattail germination and nutsedge stands.

Wildlife

Wildlife use has fluctuated according to management strategies. With mostly open water in the late 1980's diver duck use was extensive. At times during spring migration 4,000-5,000 scaup were seen on the pool in addition to dabblers loafing along the edges. As the pool became more vegetated and food resources were produced, use switched towards dabblers. Up to 1,000 shorebirds were observed feeding on the shallow mudflats during the spring drawdowns.

Facility Improvements

In 1993, a ditch/dike system was constructed to divert private land drainage away from pool 4. A portion of this dike could use rip-rap to protect it from wave action.

Objectives

This unit should be managed as a semi-permanent marsh as much as possible, however, being put through a cycle of moist soil will allow open areas to revegetate. As the vegetation moves from annuals to later successional stages and more emergent plants, then management to a more permanent regime should occur. As more open water and less vegetation persist, a drawdown can be scheduled. This cycle may take 4-8 years to complete. Wildlife use should be consistent, however, changing according to time in the cycle. Waterfowl use days should be approximately 100,000 for ducks and 50,000 for geese. Shorebirds will be able to exploit mudflats during drawdown years and wading/marsh birds should utilize the pool year round.

C. Navarre Marsh Unit

The Navarre Marsh Unit is a 591 acre diked marsh system that is under a 25- and 50-year lease agreement with Toledo-Edison. The Davis-Besse Nuclear Power Station was located here after an exchange of properties took place in the late 1960's. The trade gave the Service fee title to the Darby Marsh Unit, which Toledo-Edison owned, in exchange for the Navarre area with an agreement to manage the area as part of the wildlife refuge.

The area has been managed as a permanent marsh and has critical remnant beach ridges along the Lake Erie shoreline. The refuge staff act as consultants to the Environmental Division of the power station for management needed on the area. All pumping costs, etc. are covered by the power station.

The procedure for marsh management is to provide the environmental division with management objectives. They in return contact their engineering department to turn pumps on and off, open and close screw/flap gates as needed. This type of process is too in depth for intensive, attentive marsh management. Hence, these pools are best suited to be managed as semi-permanent marshes and provide optimum emergent, and submergent vegetation, interspersed with open water. These deep marsh characteristics provide especially important nesting habitat for bitterns, rails, grebes, neotropical migrants, etc. where tall vegetation structure occurs.

Since all water manipulation and facility improvements are conducted by power station personnel, a map of the facilities and listing of water control structures were not listed.

NAVARRE DIVISION POOL 1

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	130	366
Drawdown 569.50	66	36

History

This unit has been managed as a semi-permanent to permanent marsh due to the in depth process need to manipulate water levels. Water is lowered in the spring and summer months to retain the wetlands natural vegetation. Drawdowns are conducted to reestablish lost vegetation. This unit has maintained a good hemi-marsh composition of 30% emergents (cattail, bulrush), 40% submerged aquatics/open water, 20% willow/cottonwood, and a 10% mixture of millets, smartweeds, burreed, etc.

Wildlife

Waterfowl use days have averaged around 50,000 for ducks and 40,000 for geese during the 1980's. The early 1990's have shown a slight decrease in the yearly average of use days to 40,000 for ducks and 30,000 for geese. The majority of use occurs during the fall and winter, because power plant operations maintain some open water during the colder time of year.

Facility Improvements

Maintained by Davis-Besse Power Station.

Objectives

The unit should continually be managed as a hemi-marsh and maintain the current vegetation composition. Partial drawdowns will be completed yearly to maintain wetland vegetation. Complete drawdown is only necessary to reestablish lost vegetation - every 4-5 years. The area provides habitat for waterfowl, marsh and water birds, raptors, rail, bitterns, neotropical migrants etc. Annual waterfowl use days should average around 50,000 for ducks and 50,000 for geese. Shorebirds, rails, and other marsh and water birds use will fluctuate depending on management regime.

NAVARRE DIVISION POOL 2

Pool Elevation	Surface Acres	Acre-feet
Full Pool 573.00	340	846
Drawdown 569.50	0	0

History

This unit has been managed as a semi-permanent to permanent marsh due to the in depth process need to manipulate water levels. Water is lowered in the spring and summer months to retain the wetlands natural vegetation. Drawdowns were conducted to reestablish lost vegetation. This unit has maintained a good hemi-marsh composition of 30%-40% emergents (cattail, bulrush), 30%-40% submerged aquatics/open water, 10%-20% willow/cottonwood, and a 10%-15% mixture of millets, smartweeds, burreed, etc.

Wildlife

Waterfowl use days have averaged around 120,000 for ducks and 90,000 for geese during the 1980's and early 1990's. The majority of use occurs during the fall and winter, because power plant operations maintain some open water during the colder time of year. This pool also contains remnant beach ridges that are important to neotropical migrant.

Objectives

The unit should continually be managed as a hemi-marsh and maintain the current vegetation composition. Partial drawdowns will be completed yearly to maintain wetland vegetation. Complete drawdown is only necessary to reestablish lost vegetation - every 4-5 years. The area provides habitat for waterfowl, marsh and water birds, raptors, rail, bitterns, neotropical migrants etc. Maintain and protect the beach ridges used by neotropical migrants. Annual waterfowl use days should average around 50,000 for ducks and 50,000 for geese. Shorebirds, rails, and other marsh and water birds use will fluctuate depending on management regime.

NAVARRE DIVISION POOL 3

Pool Elevation	Surface Acres	Acre-feet
Full Pool	188	
Drawdown		

History

This pool became a manageable unit in 1988 and since has been managed as a semi-permanent to permanent marsh due to the in depth process need to manipulate water levels. At times, manipulation of water levels has been difficult due to deteriorated dikes and faulty pumps. The facilities have greatly been improved and between 1989-1993 the unit has been a mosaic of open water, cattail, bulrush, smartweed, and submergents. Water levels were maintained high in 1993 and emergent vegetation was once again set back.

Wildlife

Waterfowl use has fluctuated from 3,000 to 30,000 use days for ducks and 1,000 to 10,000 goose use days during the late-1980's and early 1990's.

Objectives

The unit should continually be managed as a hemi-marsh and maintain the current vegetation composition. Partial drawdowns will be completed yearly to maintain wetland vegetation. Complete drawdown is only necessary to reestablish lost vegetation - every 4-5 years. The area provides habitat for waterfowl, marsh and water birds, raptors, rail, bitterns, neotropical migrants etc. Annual waterfowl use days should average around 20,000 for ducks and 10,000 for geese. Shorebirds, rails, and other marsh and water birds use will fluctuate depending on management regime.

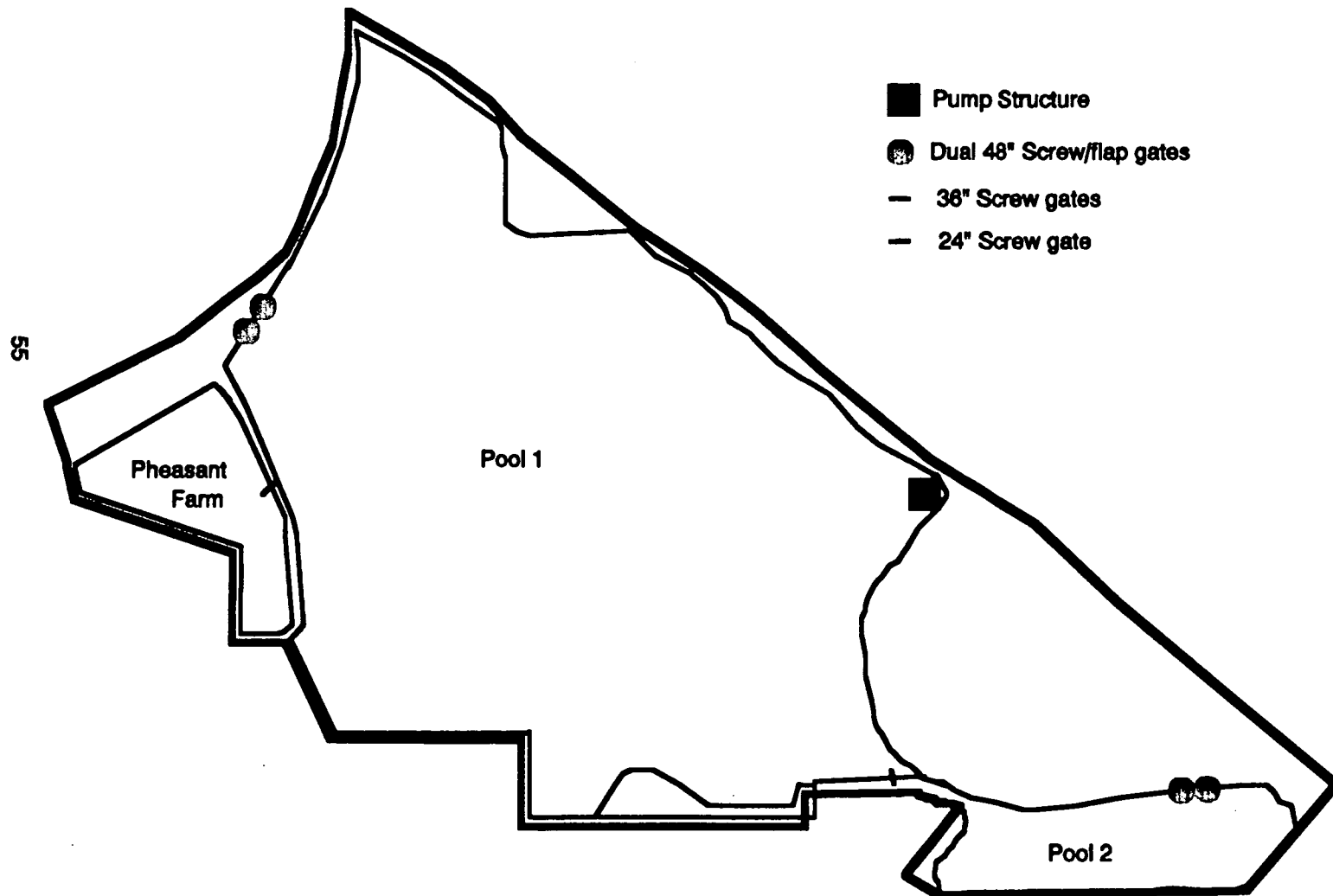
D. Cedar Point National Wildlife Refuge

Cedar Point NWR was donated to the Service in 1965. The area was an established hunting club and managed as a waterfowl marsh since 1882. Upon receipt of the 2,445 acre property, the Service quickly started to repair dilapidated dikes that were being severely eroded by Lake Erie. The dike system was then breached during the high water levels in 1972 and 1973. Construction funds were available in 1976 and rehabilitation was completed in 1977 including placement of rip-rap on exterior and interior dikes. Once again control over water levels was achieved and the vegetation-devoided pool was back to an emergent marsh by fall of 1977.

Since then, Cedar Point has been managed as an emergent marsh and serves primarily as a resting and feeding area for migrating waterfowl. Water control has mostly been due to the influence of the lake and dewatering in the spring and summer and flooding in the fall for migration. The ability to move water was greatly enhanced in 1989 when a pumping facility was built. The pump station is equipped with two 24" axial flow pumps, each powered by a 60-horsepower electrical motor. The station is able to move 20,000 gpm (10,000 gpm each pump). Pumping capacity is almost 29 million gallons (88 acre-feet) in a 24-hour period. The pump directly serves pool 1 (1,460 acre) and can indirectly serve pool 2 (135 acres) through pool 1. Pheasant farm pool has gravity drainage to the lake via a drainage ditch.

Pool 1 should continually be managed as a permanent marsh and a good composition of plant to open water ratio should be maintained. Lowered water levels during the growing season will maintain emergent vegetation and encourage submergents. Pools 2 and pheasant farm should be considered for moist soil management. These two pools could provide highly productive growth from annuals to complement the permanent, emergent marsh of pool 1. This management will sustain waterfowl use at around 1.2 million duck use days and 150,000 goose use days per year. In addition, furbearer populations should be consistent and trapping should provide harvest of 10,000 muskrats annually.

Figure 7. Cedar Point NWR Water Control Structures and Pump Facility



CEDAR POINT POOL 1

Pool Elevation	Surface Acres	Acre-feet
Full pool 574.00	1,460	4,120
Drawdown 570.00	230	120

Control Structures

- Main pumping station (see previous page)
- 2 - 48" dual screw/flap gates into Lake Erie
- 1 - 36" screw gate into pool 2

History

The pool has gone through several cycles of emergent marsh to an open pool, with little or no vegetation, and then back to an emergent marsh. The poor conditions of dikes prohibited water control over this unit. Water manipulation was essentially from climate conditions and holes in the dike. In 1989, Management capabilities were enhanced with rehabilitation of dikes and installation of pumping facility. Since then, the pool has supported a continued hemi-marsh condition with emergents like cattail, arrowheads, pickerelweed etc. in the shallow water areas, and smartweed, millets, and nutsedge on the exposed mudflats. Purple loosestrife is present in few acre blocks.

Wildlife

The 1,400-acre pool has provided many waterfowl use days over the years and has lately been around 1 million duck and 110,000 goose use days. At times 6,000-7,000 scaup have been observed resting on the pool during the spring and fall migrations. The gradual change in topography allows use by shorebirds, marsh and water birds, waterfowl, raptors, etc. A bald eagle nest is located in the woodlot just north of the pool and the adults usually fledge two young.

Facility Improvements

Facilities were greatly improved in 1989, however, some stretches of inside dikes were not rip-raped and small erosion has occurred. Also, the dike surrounding the fishing area also has minor erosion.

Objectives

This unit is managed as a semi-permanent marsh area. By virtue of its size, pool 1 provides year round habitat for waterfowl, marsh and water birds, raptors, (especially important for feeding area for nesting bald eagles) etc. Management is directed to providing a well balanced hemi-marsh, with an partial drawdowns to retain emergent and submergent vegetation. Complete drawdown should be conducted every 3-5 years or has vegetation requirements dictate. Waterfowl use days should average around 1 million annually and muskrat populations should sustain 10,000 animals harvested yearly.

CEDAR POINT POOL 2

Pool Elevation	Surface Acres	Acre-feet
Full Pool 574.00	135	360
Drawdown 569.40	35	15

Control Structures

- 2 - 48" dual screw/flap gates in Lake Erie
- 1 - 36" screw gate into pool 1

History

This unit has also gone through the change in vegetation and facility improvements like pool 1. Minimal water control over the unit was available due to dilapidated dikes and lack of water control structures. After improvements in 1989, the unit has slowly been revegetated with plants such as cattail, bulrush, willow, cottonwoods, phragmites, and annuals like millet and smartweed. Purple loosestrife is also present, but only as single plants scattered through out the unit.

Wildlife

The majority of use has occurred and recorded is from waterfowl with an average of 15,000 duck and 2,300 goose use days annually. Egrets, herons, bitterns, rails, grebes, and coots use the pool.

Facility Improvements

The southwest dike has some holes and high water puts water into woodlot owned by the City of Oregon. Currently this does not cause a problem if water is removed in the spring. A water control structure on the east side has been silted in for numerous years and the last estimate for clean out was \$10,000. Portions of the dike/roads could use gravel. Purple loosestrife control measures will need to be continued.

Objectives

With facility improvements and good water management this unit could be managed as a moist soil unit and would complement the semi-permanent wetland of pool 1. Moist soil management will provide habitat requirements for migratory during spring migration and moist soil seed production will provide food sources for migratory birds during the fall. The drawdowns to facilitate plant seed production would also provide mudflats and shallow areas for shorebirds, marsh and waterbirds, rails, bitterns, etc.

CEDAR POINT PHEASANT FARM

Full Pool	Surface Acres	Acre-feet
Full Pool 574.00	155	
Drawdown 571.00		

Control Structures

1 - 24" screw gate into drainage ditch.

History

Limited water control is exercised over this unit because the refuge relies on the seiche events of Lake Erie for water movement. Hence, this pool has been managed as a semi-permanent wetland. The unit is composed of cattail, bulrush, arrowhead, and other emergents. Purple loosestrife and phragmites are also present.

Wildlife

This unit provides wildlife benefits in the form of waterfowl maintenance especially mallards and large concentrations scaup during spring migration. Wading and marsh water birds use the shallower areas for feeding. Muskrat populations have remained stable and harvest efforts have removed about 1,000 animals annually.

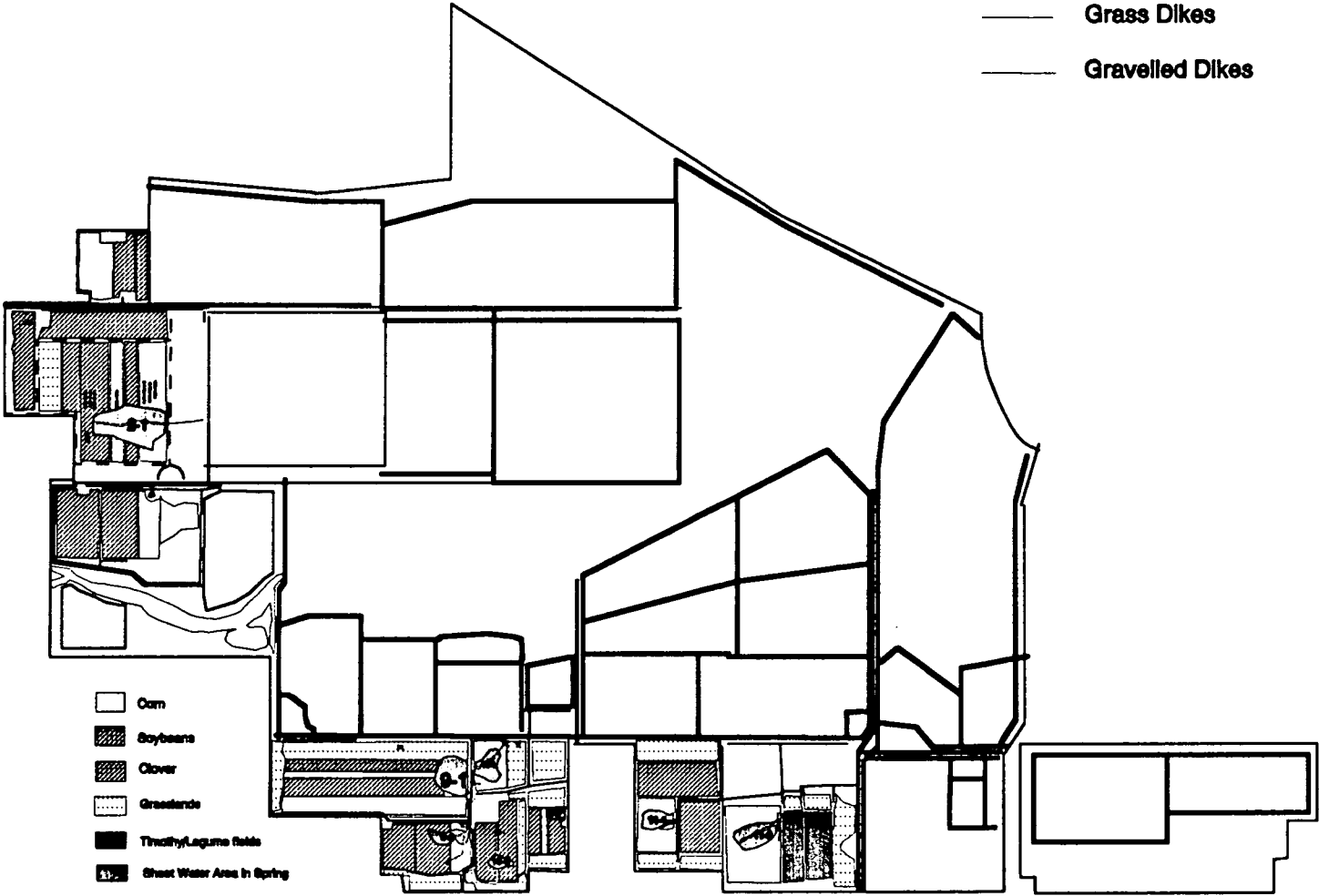
Facility Improvements

The entire dike system around this impoundment is in dire need of rehabilitation. This is scheduled for rehab in 1995. Purple loosestrife is present and control efforts need to be taken to inhibit loosestrife spreading.

Objectives

With facility improvements and good water management this unit could be managed as a moist soil unit and would complement the semi-permanent wetland of pool 1. Moist soil management will provide habitat requirements for migratory during spring migration and moist soil seed production will provide food sources for migratory birds during the fall.

Croplands Showing Spring Sheet Water Areas



AGREEMENT
BETWEEN
STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
AND
THE U.S. FISH AND WILDLIFE SERVICE

RECEIVED

JUN - 8 1994

U.S. FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20541

This agreement is made and entered into this 28th day of April, 1994 by and between the Division of Wildlife, Department of Natural Resources, State of Ohio, hereinafter referred to as the Division and the U. S. Fish and Wildlife Service, hereinafter referred to as the Service under the authorities granted in Section 1 of the Fish and Wildlife Coordination Act (48 Statute 401. as amended; 16 U.S.C. 661 et seq.) and Section 7 of the Fish and Wildlife Act of 1956, 16 U.S.C. 742f(a) (4) and Ohio Revised Code Section 1531.04 and 1531.07.

WITNESSETH:

WHEREAS, the Division and the Service have agreed that it is mutually desirable to construct a 7700 foot common lakefront dike, water exchange/fish passage structures, and pump systems to restore the open coastal marsh values of the 908 acre Metzger Marsh located on both state and federal lands; and

WHEREAS, the Division of Wildlife has funded a project to construct a pump system and water exchange/fish passage structure on Wards' Canal and 3100 lineal feet of dike as their portion of the project;

WHEREAS, the Service proposes to fund and construct a water exchange/fish passage structure, a pump system, and 4600 lineal feet of dike as their portion of the project;

WHEREAS, cooperative management of Metzger Marsh will be necessary and desirable since a common interior dike will not be constructed;

NOW THEREFORE, in consideration of the mutual benefits resulting from such cooperation it is mutually agreed as follows:

THE SERVICE SHALL:

1. Provide, at its expense, all necessary funds for the construction, operation, and maintenance of the water exchange/fish passage structure, the pump system and dike located on Service property.
2. Pump a prorated share or pay to the Division a prorated share for the cost of pumping based on the acre-feet of water covering the Service portion of the marsh when adding or removing water.
3. Provide a site for borrow for the entire dike at no expense to the Division.

THE DIVISION SHALL:

1. Provide, at its expense, all necessary funds for the construction, operation, and maintenance of the water exchange/fish passage structure, the dike and pumping system located on Division property.
2. Pump water on and off the marsh in accordance to mutually agreed upon management direction provided below.


IT IS MUTUALLY AGREED AND UNDERSTOOD:

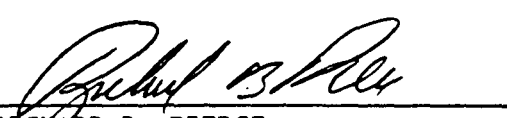
1. That Metzger Marsh will be managed as an integral part of Lake Erie. Management will focus on maintaining a high quality lacustrine emergent open coastal marsh identified as critical habitat in the North American Waterfowl Management Plan. The marsh will provide a diverse community of fish and wildlife.
2. That Metzger Marsh will be dewatered for a minimum of two consecutive growing seasons after construction is completed. That after vegetation is established, the water exchange/fish passage structure will be opened and remain open to allow for fish access and hydrological exchange between Lake Erie and Metzger Marsh. Any subsequent water level control as deemed necessary by the Service and the Division will only be conducted to establish and sustain vegetation necessary for the maintenance of the hydrologic cycle and biological diversity in the open coastal marsh.
3. That research projects will be undertaken to document the response of flora and fauna to marsh reestablishment. These projects will be jointly developed and will identify benchmarks for marsh management evaluation.
4. Reimbursement of expenses previously agreed upon therein by the Service will be contingent upon the availability of funds and shall not obligate the Service in the event of unavailability of funds resulting from failure to appropriate by the U.S. Congress.
5. Obligations of the State are subject to the provisions of Ohio Revised Code Section 126.07 and 125.111.
6. That this agreement shall become effective as of the date of the last signatory and shall continue in effect until the conditions of the permit issued by the U. S. Army Corps of Engineers are met. This agreement will be reviewed by the Division and the Service by December 31, 2004 to assess the need for amendments to the agreement. This agreement will remain in effect until December 31, 2044 or it may be terminated by either party upon thirty (30) days prior written notice.

IN WITNESS WHEREOF, the parties have set their hands to this agreement as of the date written below.

U.S. FISH AND WILDLIFE SERVICE

DIVISION OF WILDLIFE


 Marvin E. Moriarty
 Acting Regional Director

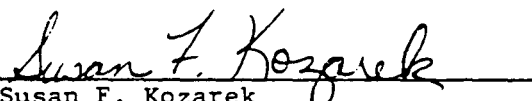

 RICHARD B. PIERCE
 CHIEF
 DIVISION OF WILDLIFE


5-3-94
 DATE

5-23-94
 DATE

Approved:

Reviewed and approved by:


 Susan F. Kozarek
 Contracting Officer
 April 27, 1994


 FRANCES S. BUCHHOLZER
 DIRECTOR
 DEPARTMENT OF NATURAL RESOURCES

5/31/94
 DATE