CARTER LAKE
IOWA AND NEBRASKA

STREAMBANK EROSION CONTROL TECHNICAL ASSISTANCE
SECTION 55 AUTHORITY

U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

CARTER LAKE, IOWA AND OMAHA, NEBRASKA

May 1985

CARTER LAKE, IOWA AND OMAHA, NEBRASKA
SECTION 55, TECHNICAL ASSISTANCE

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PLATES

I. INTRODUCTION

Technical assistance provided in this report consists of advice on shoreline wave erosion control and cost estimates of various methods of achieving this erosion control. The erosion is located along sections of shoreline in Carter Lake, Iowa and Nebraska. This report was prepared in response to letter requests for technical assistance from the Mayors of both Carter Lake, Iowa and Omaha, Nebraska as authorized by Section 55, Public Law 93-251.

II. LOCATION

The shoreline erosion is located primarily along the east shore of the west loop of Carter Lake in Iowa and along nearly the entire outer shore of Carter Lake in Nebraska. These locations are shown on Plate 1.

III. INSPECTION

a. General. On 4 April 1985, personnel of the Geotechnical Branch, Omaha District, Corps of Engineers, inspected the shoreline erosion along Carter Lake. The Mayor of Carter Lake, Mr. John D. Lesley, and Mr. Charles A. Geisler, Senior Environmental Engineer who represented Omaha, Nebraska, were present during the inspection. The lake was near elevation 970.3. This is the level at which the lake is preferred to be held in the future. In general the inspection showed a persistent although mostly slow rate of erosion taking place. Even though some shoreline was being eroded, it was not threatening any structures. It was, however, causing or threatening relatively large trees to fall into the lake and getting close to a significant length of access frontage road along the Nebraska side. The following is a description of the erosion along each area inspected.

b. Iowa Shoreline. The shoreline is about 4,200 feet long. There is erosion along nearly the entire length but for the most part it has been relatively slow. There are, however, some areas of active erosion where a bare scarp is near vertical and extends up to 6 feet above the water surface. There are also extensive lengths of heavy brush and tree growth against the shoreline that will make access to the shoreline difficult. See Photos 1 through 4 on Plates 3 and 4 for typical conditions along this shoreline.

The water adjcent the shoreline is at most 2 feet deep. There is also a flat berm that extends from the shore edge out into the lake. The shoreline material is primarily fine sand below a thin sandy topsoil layer. In general the erosion that is occurring is acting slowly and is not considered an emergency condition. The overwater fetch distance is relatively short and the resulting waves are not considered excessively erosive. However, the prevailing southwest summer winds cause drifting of the berm material and prevent formation of a stable berm. Without this drifting action the ultimate erosion under a steady 970 lake elevation may only advance another 30 to 40 feet landward. However, many trees would be lost by that time and to save the trees the erosion should be stopped at its present location.

c. Nebraska Shoreline. The area of erosion extends nearly around the entire outer shoreline. This distance is about 12,700 feet. The bare erosion scarp or the grassed shoreline slope adjacent the water is steep to nearly

vertical for nearly the entire distance and extends generally 4 to 5 feet above the water surface. There is also a line of mature trees along nearly the entire shoreline. Although this erosion is not threatening any structures it will in time cause most of these trees to fall into the lake. There is also a distance of about 6,200 feet where the erosion is active and is threatening a gravelled public access frontage road. This road is referred to as Carter Lake Shoreline Drive and Carter Lake Drive East on the Aerial Plan Plate 2. See Photos 5 through 14 on Plates 5 through 9 for typical conditions along the shoreline.

The water adjacent the shoreline varies from 1 to 2 feet deep. There is also a relatively flat berm of sandy material that extends from the shore out into the lake. The shoreline material is primarily fine sand below a sandy topsoil layer. In general, the erosion is acting slowly and is not considered an emergency condition. Using the longest overwater fetch distance and an assumed 1-hour duration 50 m.p.h. wind resulted in a maximum wave height of 2.1 feet. This size wave would be high enough to cause significant erosion of this sandy shoreline. Actual conditions along the shoreline indicate that this size wave has not occurred often in the past and of course would occur only along the longest fetch distance.

IV. POSSIBLE REMEDIAL MEASURES

a. General. There are several measures that can be taken to control the wave erosion and the littoral drift along the shore. To control wave erosion would require placing an erosion-resistant barrier between the Lake water and the shoreline. This barrier can vary from a relatively expensive stone-filled wire-basket gabion design to a dumped windrow of broken concrete rubble. The gabions have been ruled out due to their relatively high costs. A windrow of dumped quarried rock or broken concrete rubble offers adequate protection for the least cost. A typical section through this windrow is shown on Plate 10. Photo 5 on Plate 5 shows the appearance of a typical windrow of quarried rock that is slighty smaller than that proposed on Plate 10. The future use and value of the area landward of the shoreline should dictate whether protection is desired now or whether it can wait for future years.

b. Erosion Control With Dumped Quarried Rock or Concrete Rubble Windrows. The proposed windrow should be placed along the shoreline in a section approximately as shown on Plate 10. It should extend a minimum of 2 feet above the proposed permanent lake elevation of 970.3. Based on the water depth of either 1 or 2 feet this windrow section would require from 0.6 to 0.9 cubic yards of material per lineal foot of shoreline. This translates from 1.0 to 1.5 tons per lineal foot. For quantity estimating purposes 1.25 tons per lineal foot was used. The rock is sized to be stable against the 2.1 foot maximum wave and for practical reasons the rock should not be smaller even in short fetch areas. The minimum rock gradation should be as follows:

Weight Maximum = 104 pounds
Weight Average = 26 pounds
Weight Minimum = 3 pounds

The rock should be a well-graded mass from the maximum (approximately 1 cubic foot) to the minimum size (approximately 3-inch diameter piece). This will result in a well-knit mass that will withstand all expected wave action. A larger gradation would, of course, also be stable but this would not make a

neat appearing surface and tend to allow shoreline material to migrate through the windrow. These windrows can be simply constructed by end-dumping the rock or rubble directly in place with a minimum of rock redistribution to achieve the proposed section. More or less manipulation of the rock may be necessary depending upon ease of access to the shoreline due to trees or other obstacles. Broken asphalt or other material such as exposed wire reinforcement should not be placed in these windrows.

c. Littoral Drift Control Measures. These would also be windrows placed on a more or less right angle from the shoreline nd extend in a straight line out into the lake. These have also been ruled out due to their interference with boat traffic and the difficulty of constructing them out into the water.

V. COST ESTIMATE.

a. General. The following estimate reflects April 1985 prices for quarried rock. The cost of broken concrete rubble is not included and will depend upon arrangements each city can make with local contractors for disposal of rubble. The cost of using city forces in placing the windrow, if so desired, is also not included in this estimate.

Item	Unit	Unit Cost
Quarried Rock		
Delivered at Location Only	Ton	$10.00
Delivered and Placed in Windrow	Ton	20.00

Based on this estimate the following is the cost for protecting the entire shoreline using quarried rock:

b. Iowa Side.

Total Shoreline Distance (ft.)	T/lf (avg.)	Total (tons)	Unit Cost	Total Cost
4,200	1.25	5,250	$20.00	$105,000
			10.00	52,500*

c. Nebraska Side.

Total Shoreline Distance (ft.)	T/lf (avg.)	Total (tons)	Unit Cost	Total Cost
12,700	1.25	15,875	$20.00	$317,500
			10.00	158,750*

*Cost of delivering quarried rock only, placement is by city forces.

VI. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that an erosion-resistant barrier between the lake water and the shoreline will be required to stop the wave erosion where it occurs along the shoreline. It is also concluded that a windrow of broken concrete rubble will be an adequate yet relatively inexpensive barrier. It is recommended that where active erosion is now occurring and where trees are

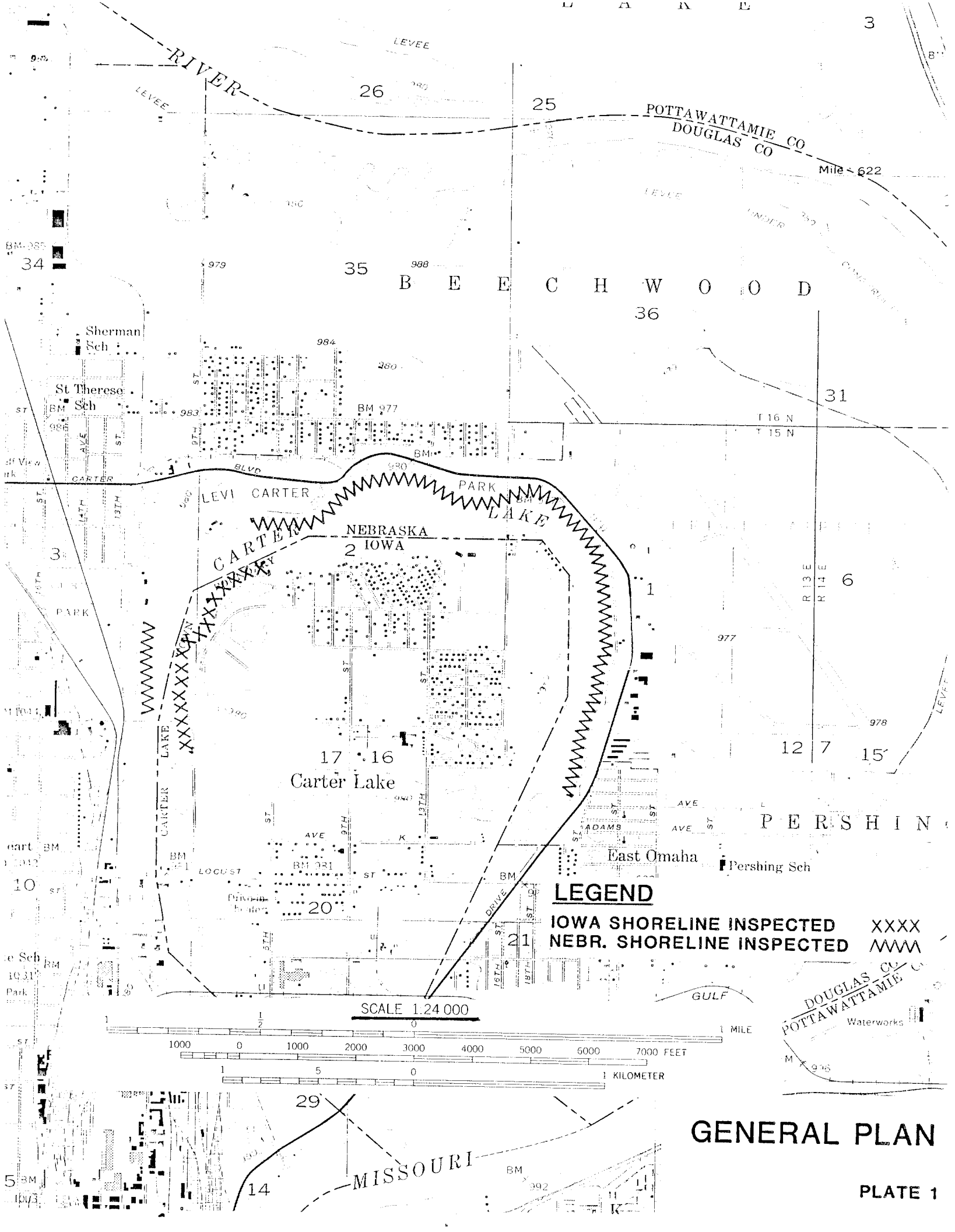
immediate costs considerably, especially along the Nebraska shoreline, where considerable lengths are not actively eroding.

VII. REQUIRED PERMITS

Placing rock or concrete material into Carter Lake will require a permit from the Corps of Engineers. Information on this procedure can be obtained from the Corps by contacting the Regulatory Functions Branch of the Operations Division. The mailing address is:

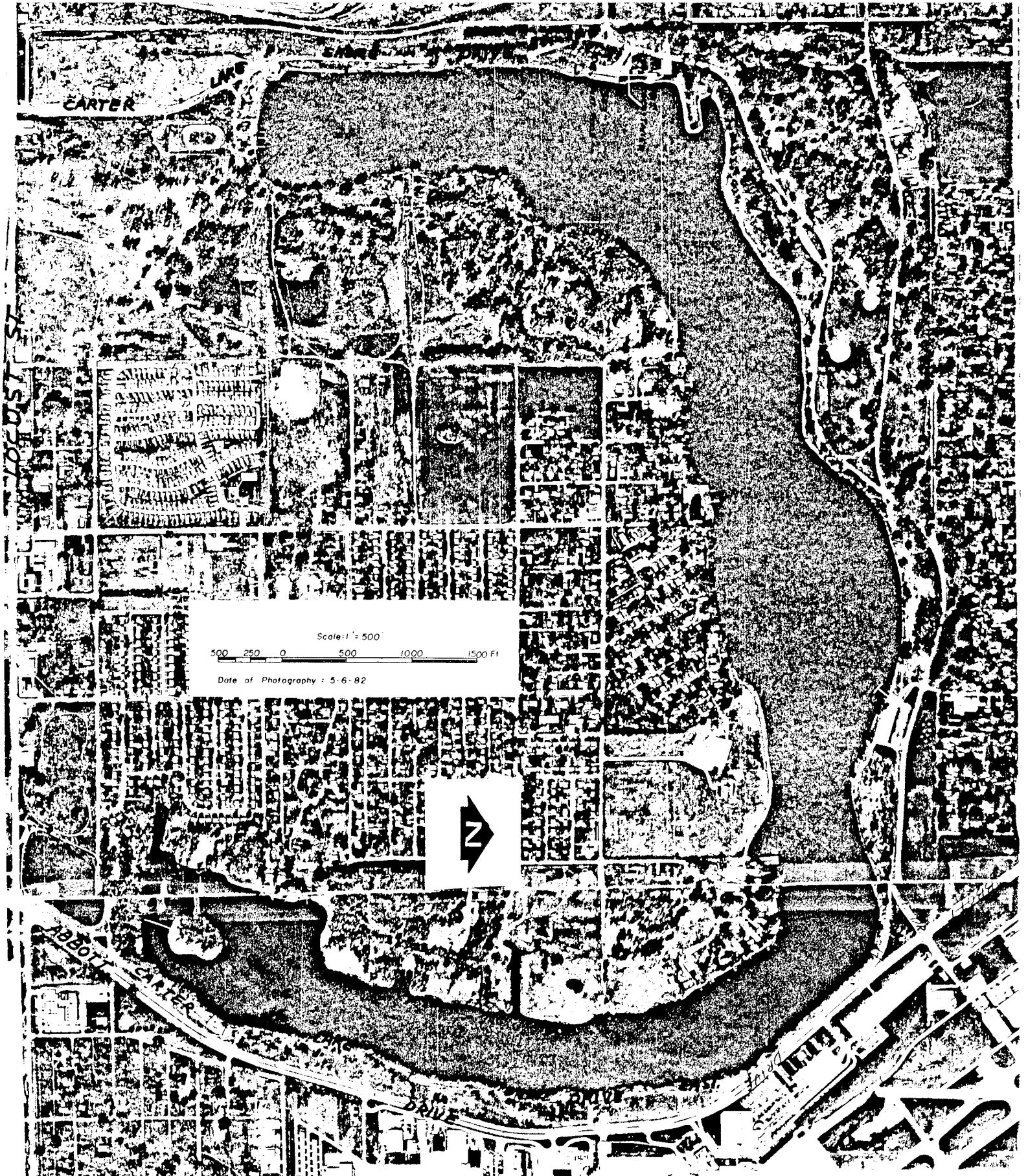
Commander
U.S. Army Engineer District, Omaha
ATTN: MROOP-N
P.O. Box 5
Omaha, NE 68101-0005

Telephone contact can be made by calling (402) 221-4133.



GENERAL PLAN

PLATE 1



CARTER LAKE

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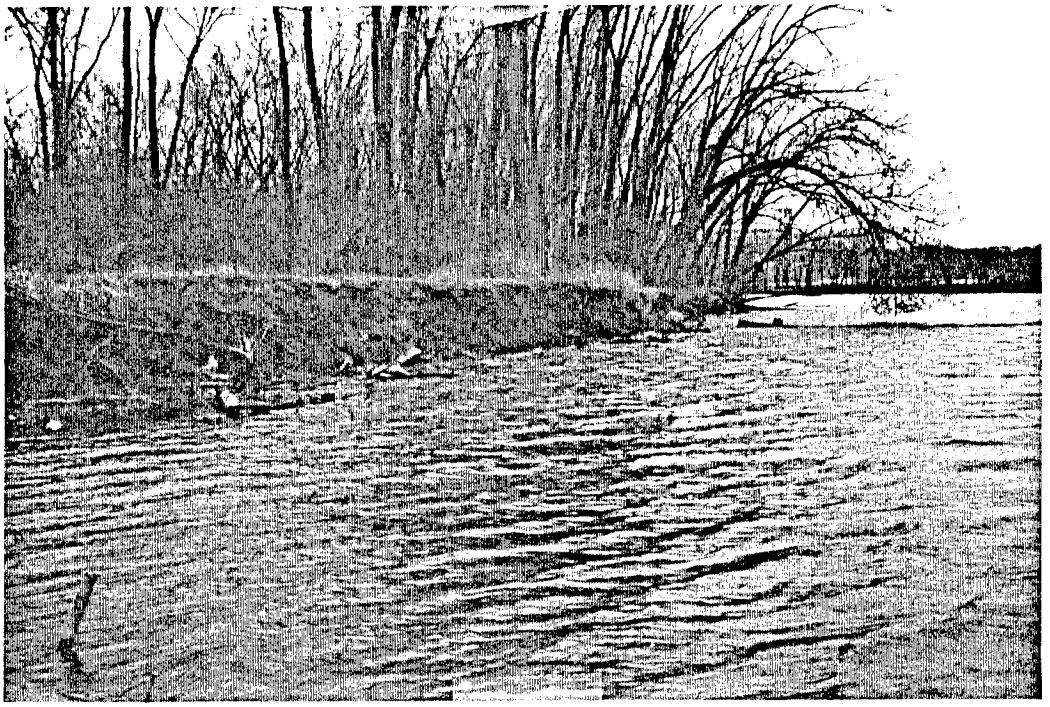
SEC. 55 JUNE 1985

AERIAL PLAN

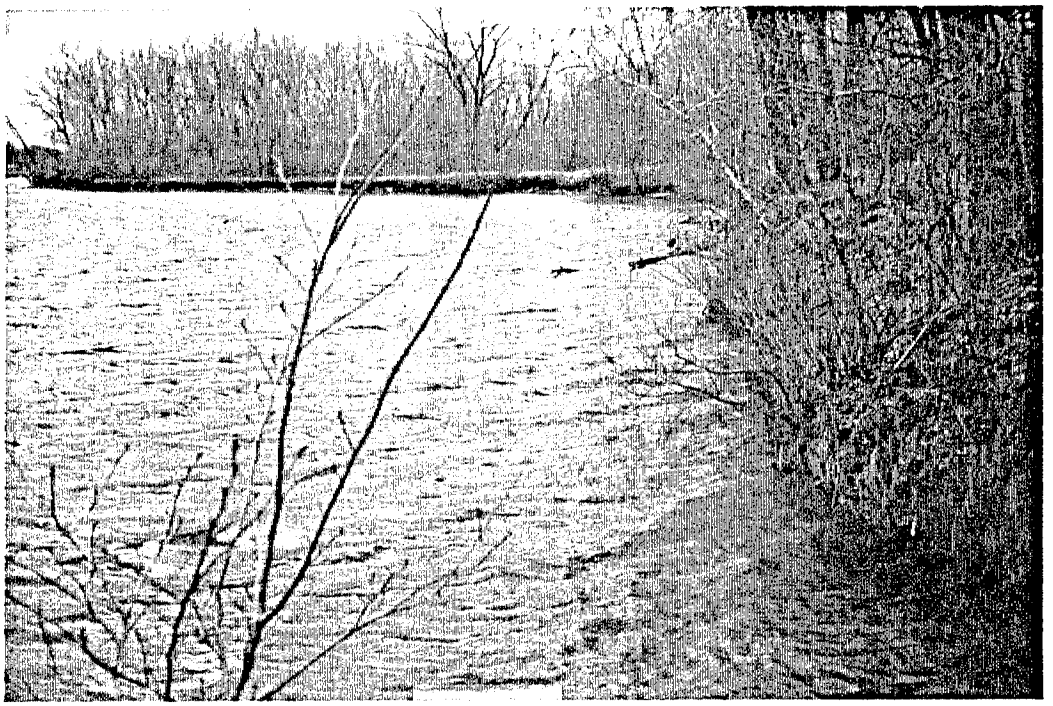
PLATE 2

1. Looking north from near south end of east shore area. Erosion not active as evidenced by grass and tree growth up to water's edge, but persistent enough that in time trees fall into lake. Lake elevation 970.3.



2. Looking SW at active erosion near northern end of area of concern.

Carter Lake, Iowa
Sec. 55
Plate 3



3. Looking NE at area of active erosion in background. Heavy tree growth along shore is typical for Iowa side.

4. Looking SW at areas of slight erosion adjacent to area of active erosion. Nowhere along Iowa shoreline are there structures or other facilities threatened by erosion.

Carter Lake, Iowa
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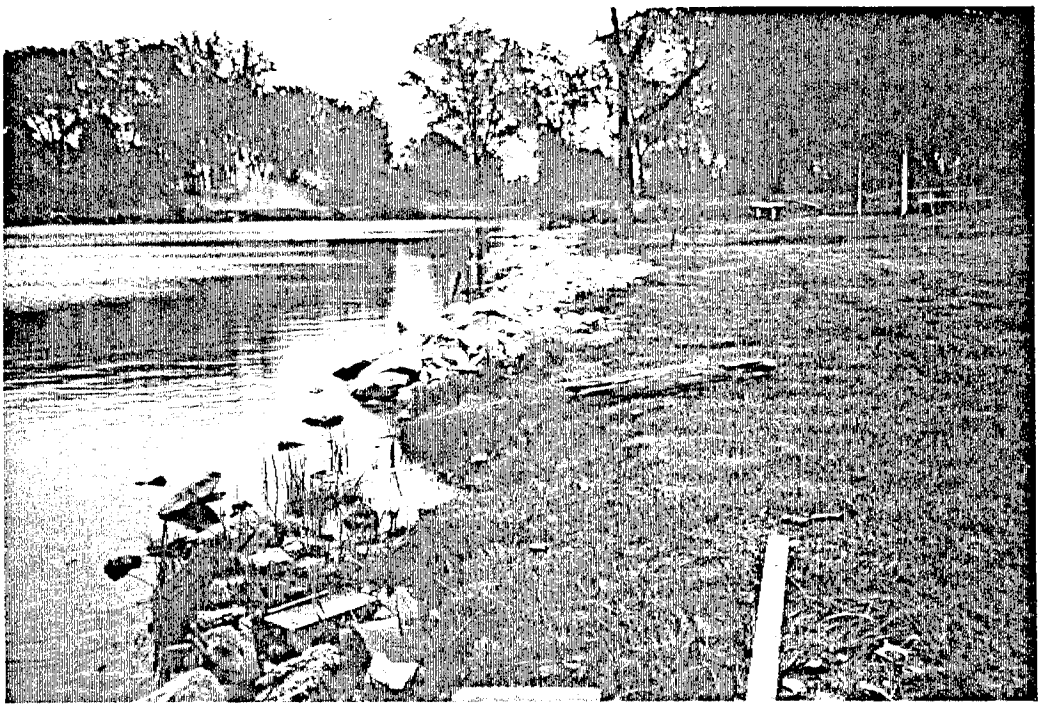
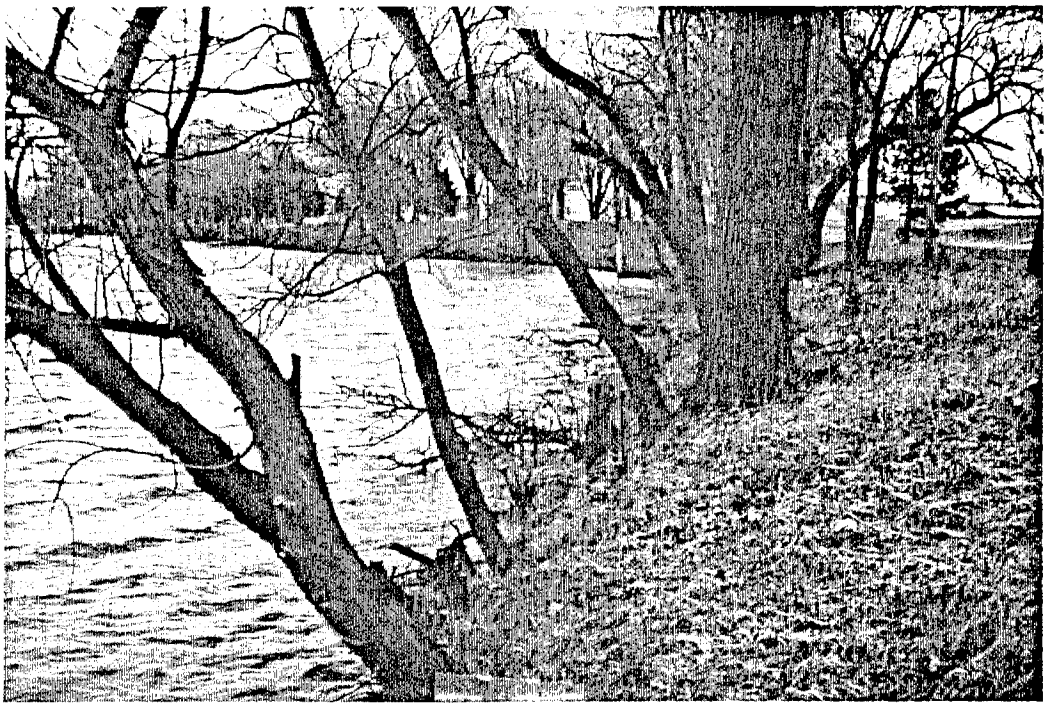
Plate 4



5. Typical quarried rock windrow looking east along south shore of west leg of lake. This is a smaller section than proposed in this report.

6. Typical active erosion looking north along west shore of west leg of lake. Public access road immediately to left of erosion and mature trees.

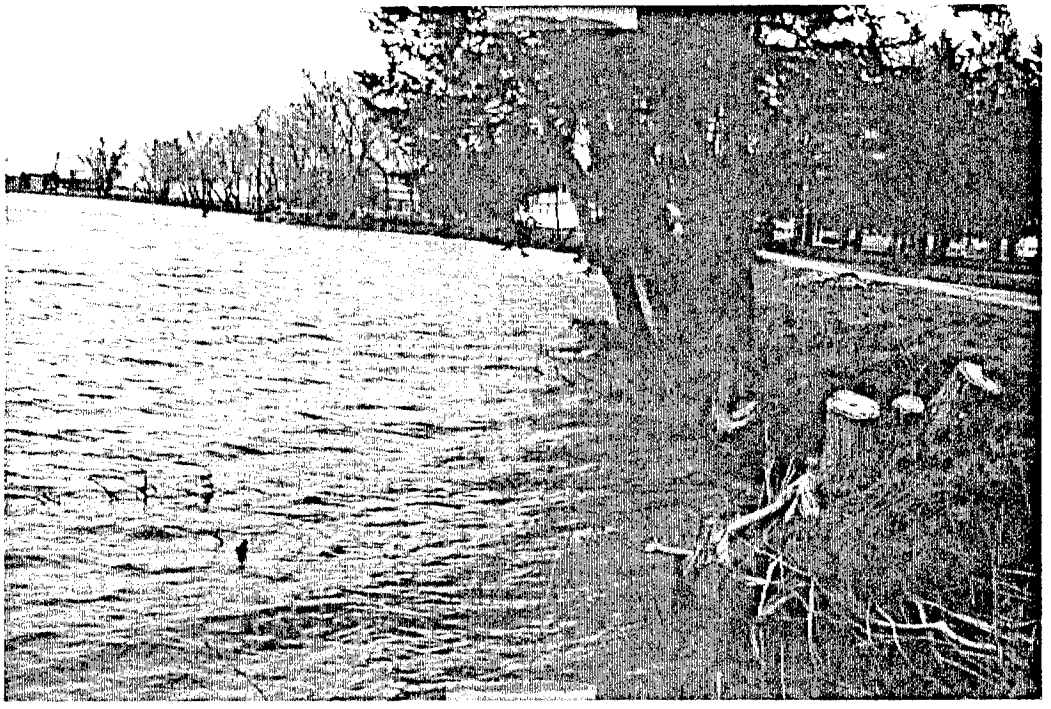
7. Looking SW at very slight but persistent erosion near southern end of east leg of Carter Lake. Future erosion considered to be slow.



8. Looking NW from same location as Photo 7. Erosion slow and not considered to be area of concern at present.

Carter Lake, NE
Sec. 55
Plate 6

9. Looking north along east shore of east leg of lake. Slope is steep and erosion is close to trees. Would need some protection now to save the trees nearest the water.



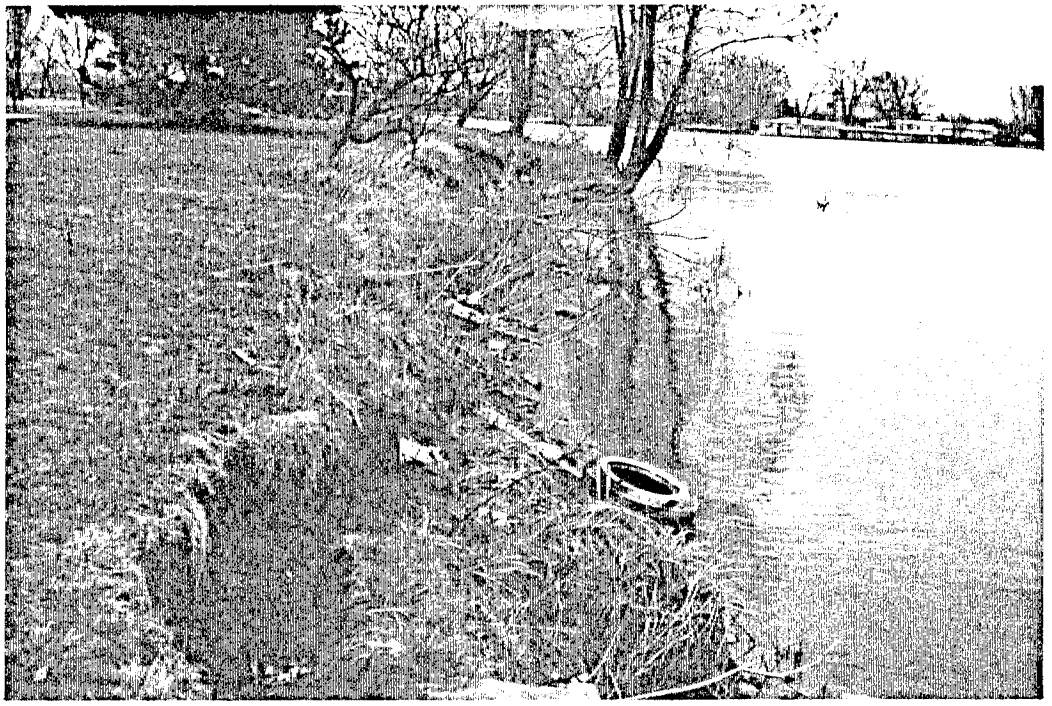
10. Looking north along east shore of east leg of lake. Active erosion in foreground and Civil Air Patrol building near center picture. Would need protection now to save some of the trees.

11. Looking north along east shore of east leg of lake. Active erosion along most of this reach will need protection to some trees. Public access road immediately to right of shoreline. Best Western Motel in background.

12. Looking north along public access road from same location as Photo 11. Indicates close proximity of shoreline. Trees and access road typical for this east shore of lake.

Carter Lake, NE
Sec. 55
Plate 8

13. Looking southerly along east leg of lake. Some erosion along trees and access road.

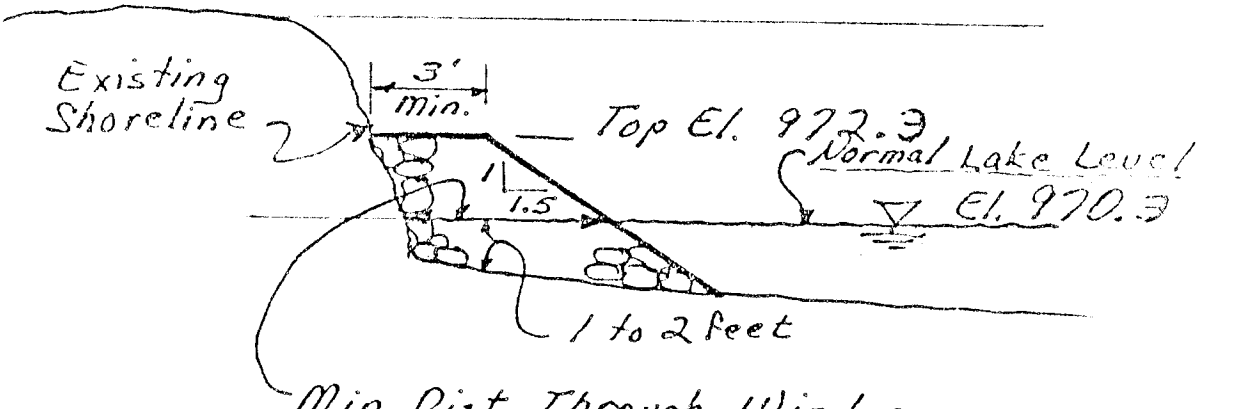


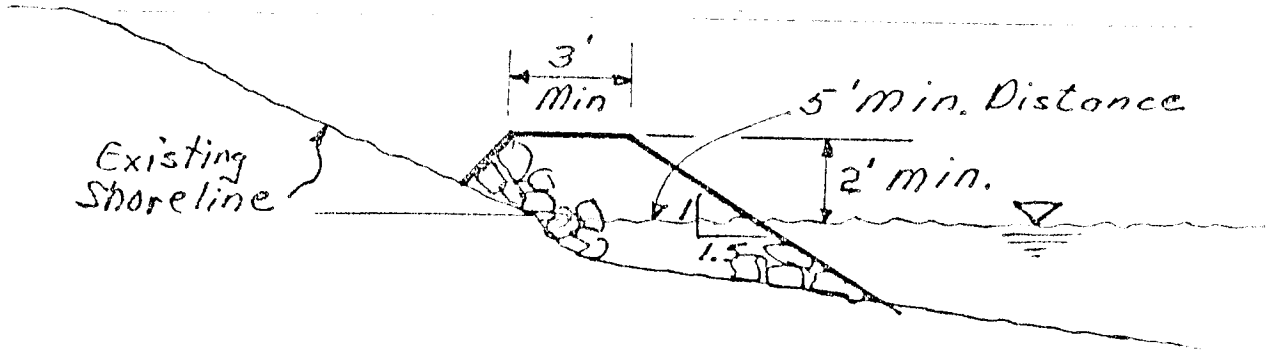
14. Looking east along north shore of lake. Active erosion. Not critical but loss of land base is occurring.

Carter Lake, NE
Sec. 55
Plate 9

COMPUTATION SHEET

CORPS OF ENGRS.		SHEET NO.	OF
	PROJECT	COMPUTED BY	DATE
	SUBJECT	CHECKED BY	DATE
	REMARKS	RETURN TO	





TYPICAL SECTIONS

Proposed Windrow

5 0 5

Scale: 1" = 5'

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