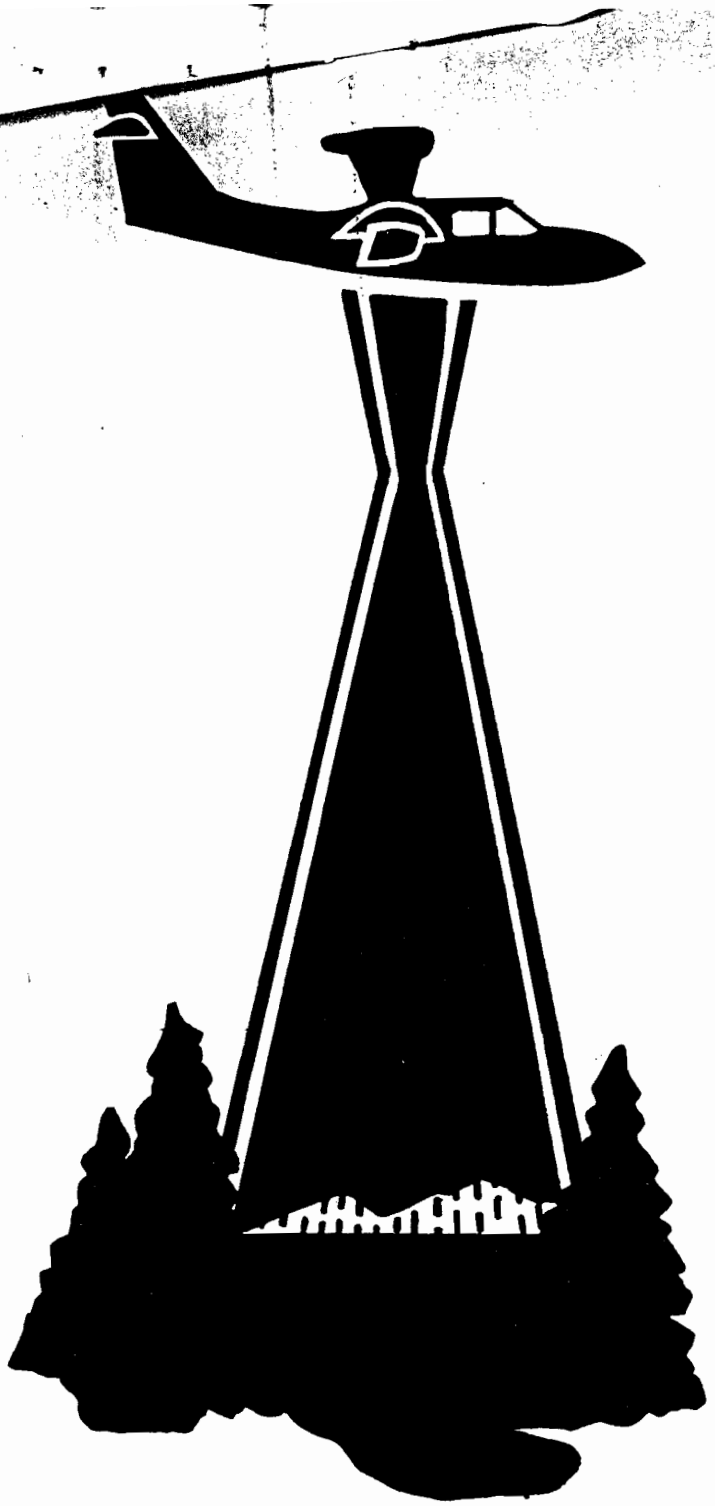
LPL-089
(6011-01)



AERIAL LAKESHORE ANALYSIS

OF

APPLE RIVER FLOWAGE

A.W. RESEARCH LABORATORIES

• WATER ANALYSIS • LAKE ANALYSIS •

• ENVIRONMENTAL AERIAL PHOTOGRAPHY •

Recvd. 12/7/92
DJR

Date: October 1, 1992

To: Apple River Protection and Rehabilitation District
P.O. Box 74
Amery, WI 54001

Subject: Aerial Lakeshore Analysis of Apple River Flowage

From: Carol Ann Sersland
Pat Shelito
Alan W. Cibuzar
A.W. Research Laboratories
711 Laurel Street
Brainerd, Mn. 56401
218-829-7974

PREFACE and USAGE INSTRUCTIONS

This report is designed as a base document for the monitoring and improvement of the Apple River Flowage.

The various sections of this report are designed to guide and prioritize the confirmation of the documented situations by the Apple River Protection and Rehabilitation District, local units of government, and above all, the residents of the lake.

This report is a reference document. The basic definitions of each section are as follows:

SECTION	DEFINITION
Introduction	States the need and purpose for the study.
Lake Data Summary	Includes the estimated number of residences (dwellings) that existed during the overflight, miles of shoreline, dwellings per mile of shoreline, average feet of shoreline per dwelling.
Color Code - Color Coded Map	Describes the environmental conditions which have been observed in the imagery, at each map position.
Imagery	Contains the image data (slides and prints) numerically correlated to the Color Coded Map.
Analysis/Conclusion	Describes the physical and chemical observations which are used to confirm (groundtruth) the aerial analysis. This section also points out specific areas for further investigation and gives recommendations.
Groundtruthing Forms	Explanation of the parameters to be sampled and the forms used for the groundtruthing.

INTRODUCTION

The Apple River Protection and Rehabilitation District was formed in 1975 to conduct a study in conjunction with the Wisconsin DNR. The purpose of the study was to determine various lake management options. The outcome of this study was to initiate a weed harvesting program. This program has continued through 1992.

In 1991 representatives of the District contacted A.W. Research Laboratories regarding completion of an Aerial Lakeshore Analysis for the Flowage. The Analysis would be done if matching funds were obtained through a DNR grant program. After obtaining the go-ahead from the DNR, the flight was scheduled for the spring of 1992.

Extensive increases aquatic vegetation in this small reservoir system induced by nutrient loading that has made the lake less than desirable for various recreational activities - especially at certain times of the year. The objective of this flyover would be to determine and prioritize those nutrient sources causing the most impact and establishing a base of information with which to investigate those sources and to ultimately develop an action plan to mitigate those sources.

The following is the ALA report for Apple River Flowage. The data was acquired during an overflight on May 28, 1992. Our overflight was scheduled to take advantage of the water clarity that exists in early summer, with early plant growth.

The report provides a base document for conducting the following:

a. documenting the state of eutrophication at a point in time.
b. defining the conditions which led to the eutrophication of the lake.
c. defining the next steps necessary to correct the polluting conditions.
d. planning, implementing and assessing lake restoration procedures.

Apple River Flowage provides a scenic environment for its residents and visitors along with areas of ideal habitat for a diversity of wildlife and fish. The homes along the lake's shoreline provide valued seasonal and year-round lake living. The beauty and recreational environment that Apple River Flowage provides is the basic reason that families and individuals have invested in their lakeshore property.

As is the situation throughout all of life's forms, the environment dictates the quality of life in a given geographical area. Apple River Flowage and its watershed provides the environment for its inhabitants. The goal of this project is to restore and preserve that environment.

Restoration and preservation will be accomplished by providing the lake residents with an understandable data base which defines the effects of past and current land use practices on the water quality of Apple River Flowage. The data will generate a decision making tool for future land use planning and lake maintenance.

METHODOLOGY

Aerial imaging has long been utilized to rapidly survey broad land areas. The technique allows the user to cover a considerable amount of area in a short time frame. The aerial perspective also allows the user to see things that would be obscured from the ground perspective. The visual image record can be reviewed under various protocols to detect evidence of conditions the user is interested in. Since that review can take place in a controlled laboratory situation, it can be more consistent than field review.

This methodology begins with Aerial Lakeshore Analysis (ALA) to locate pollution inputs and their effects where manifested near the water/upland interface, and to provide visual data for future uses. This methodology is described below.

AERIAL LAKESHORE ANALYSIS (ALA)

The ALA provides a low altitude oblique view of shorelines; presented in visible and infrared range, 35mm slides of every 300 to 500 feet of lakeshore. Oblique imaging allows an image analyst to see beneath trees and shrubs, and to view both vertical embankments and horizontal land surfaces at the same time. For nonpoint source pollution detection, ALA is a successful methodology because a comprehensive view is provided of the lake, streams, wetlands and adjacent upland area. In this areas, local and upper watershed influences are often manifested as noticeably unusual vegetative patterns, land use, or bank conditions.

1992 LAKE DATA SUMMARY OF APPLE RIVER FLOWAGE

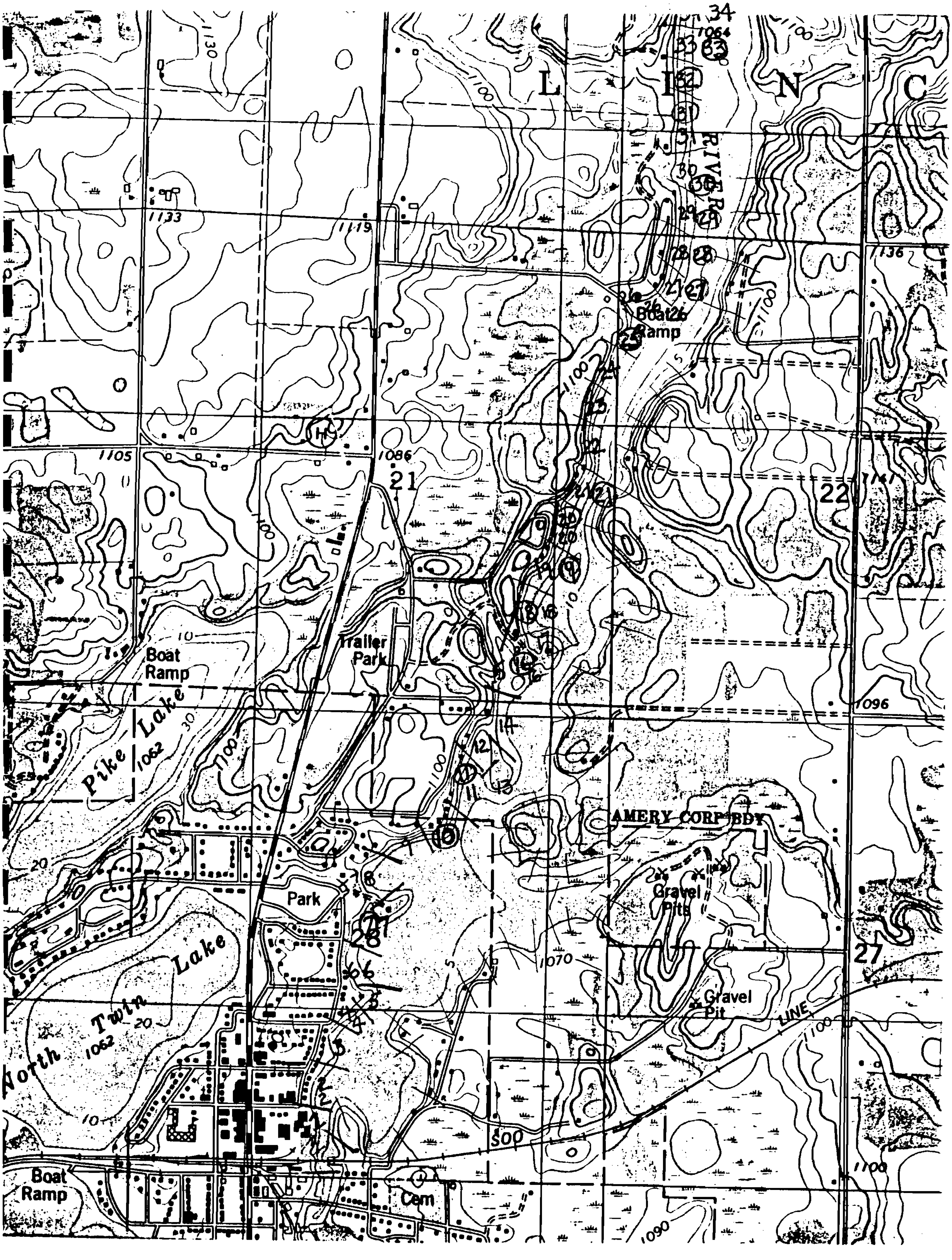
Number of shoreline dwellings observed:	
Homes/Cabins on the Lake	224
Resorts/Campgrounds on the Lake	2
Total miles of shoreline(as planimetered by AWRL)	14.1
Total miles of shoreline analyzed	13.0
Dwellings per mile of total shoreline	16
Average feet of shoreline per dwelling	330

POSSIBLE ENVIRONMENTAL CONDITIONS

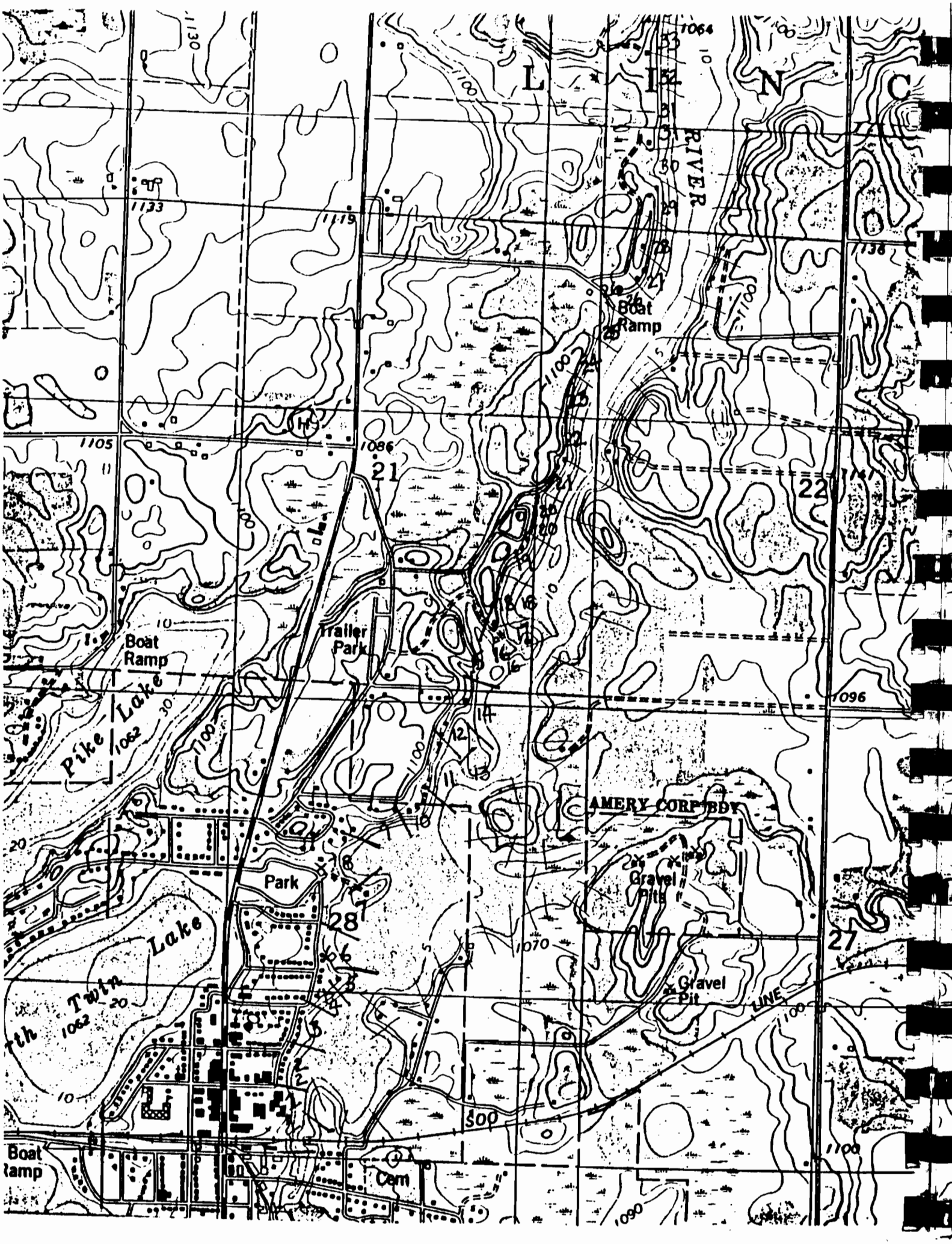
Possible Source	Color Code
1. Nonpoint Septic Source	O
2. Point Septic Source	BRN
3. Nonpoint Runoff Source	
4. Point Runoff Source	
5. Nonpoint Toxic Source	
6. Point Toxic Source	
7. No Excessive Nutrient or Toxic Sources	BLK

8. CONCENTRATED ALGAE BLOOM & AQUATIC VEG.

The color codes are associated with the chemical and physical numbers listed at the top of each Map Position in the analysis section. The physical code indicates which pollution source has been observed at that particular location. If the Apple River Protection and Rehabilitation District decides to do water testing, the chemical code indicates which parameters should be tested at that location. A list of the parameters associated with each number is included in the groundtruthing section of the report.



L
I
N
C
RIVER
Boat Ramp
Boat Ramp
Trailer Park
Pike Lake
North Twin Lake
Park
AMERY CORP BDY
Gravel Pits
Gravel Pit
LINE
Boat Ramp
Cem
21
22
27
1133
1119
1105
1086
1062
1062
1070
1096
1090

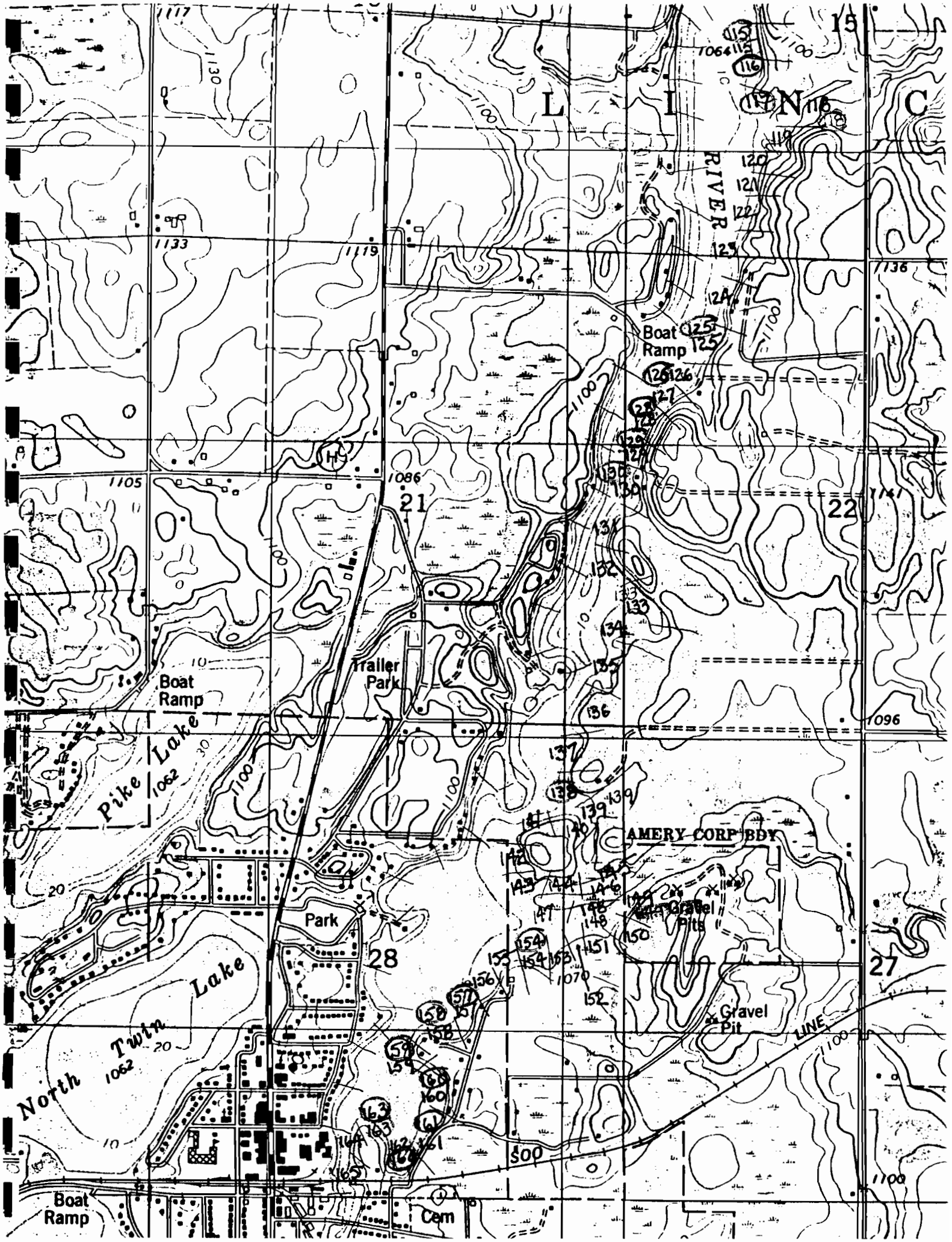

L
I
N
C
RIVER
Boat Ramp
Trailer Park
Boat Ramp
Pike Lake
Park
Lake
Twin
Gravel Pits
Gravel Pit
LINE
Boat Ramp
Cem
21
22
27
28

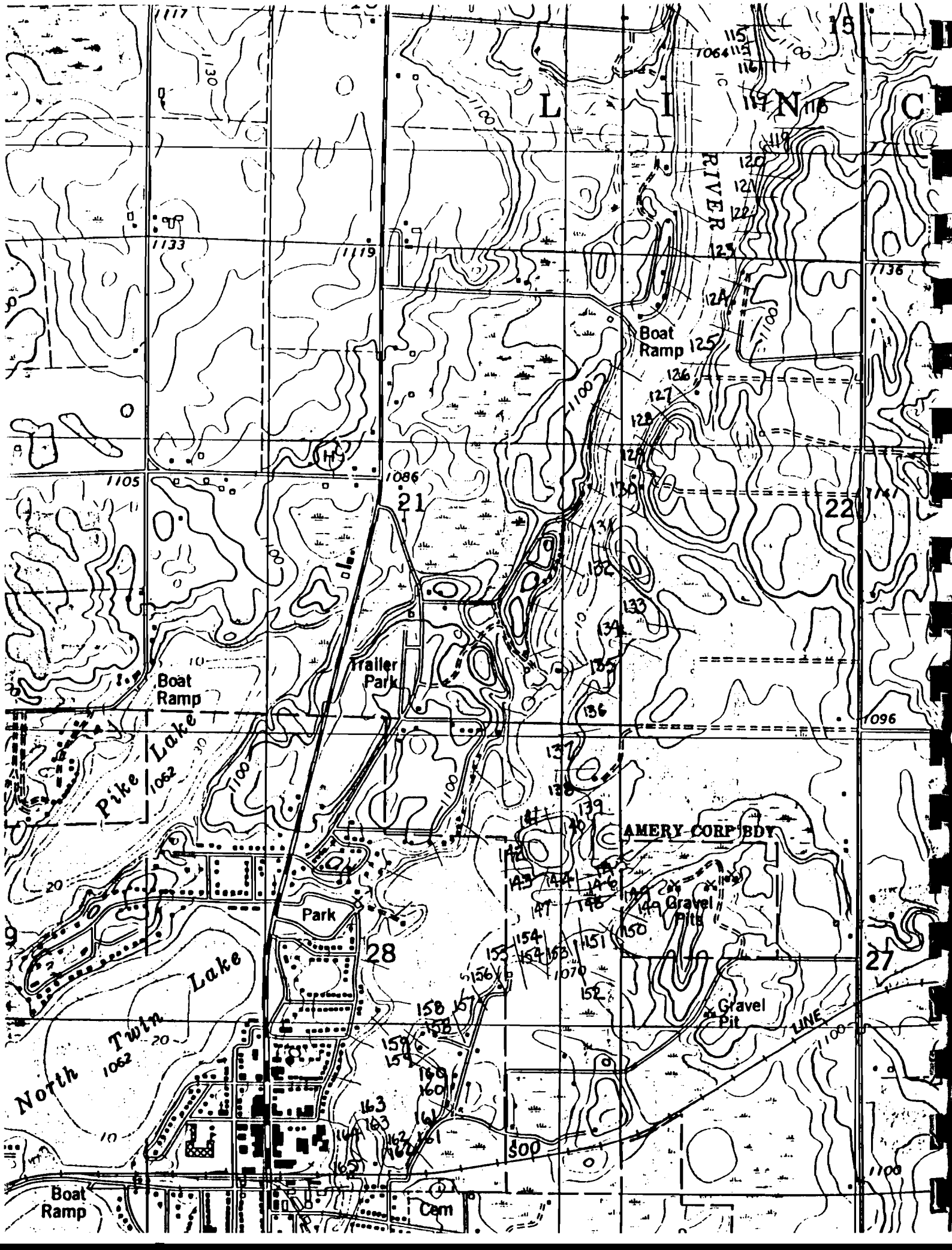

Gibson Lake
1114
1111
1121
1114
1122
1162
1125
1114
1150
L I N C O
4
4
3
1100
Wayside Park
1079
1108
1075
1098
9
10
Burns
Gravel Pit
APPLE
Boat Ramp
1112
1131
1087
1116
1120
1117
16


Gibson Lake
1114
LINCOLN
Wayside Park
Boat Ramp
APPLE
Gravel Pit
Burma
16


Gibson
Lake
1114
1111
1121
1114
1122
1162
1125
1114
150
L I N C O
4
4
3
1100
Wayside
Park
1108
1079
075
1098
1100
9
10
Burns
Gravel
Pit
1112
Boat
Ramp
APPLE
1100
1131
1087
1116
1120
1100
1117
16


Gibson Lake
Wayside Park
Boat Ramp
APPLE
Burns
Gravel Pit
L I N C O
4
3
9
10
16


15
L I N C
RIVER
Boat Ramp
Trailer Park
Boat Ramp
Pike Lake
Park
28
21
22
27
AMERY CORP BDY
Gravel Pits
Gravel Pit
North Twin Lake
LINE
Boat Ramp
Cem


Boat Ramp
Trailer Park
Pike Lake
Boat Ramp
Park
Twin Lake
North
Boat Ramp
Cem
AMERY CORP BDY
Gravel Pits
Gravel Pit
LINE
RIVER
21
22
28
27
15

Note to the Reader: Printing in capitals indicates a high priority area.

An asterisk(*) indicates no specific visible biological evidence of a failing septic system - however other conditions indicate the need to specifically groundtruth the sewage treatment system at that location.

MAP POSITION	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
1				X				X

THE DEBRIS SURROUNDING THE CHEMICAL PLANT MUST BE CLEANED UP IMMEDIATELY. THE RUNOFF DURING RAIN EVENTS IS GOING DIRECTLY FROM THE ROOF OF THE PLANT ONTO THE PILED UP DEBRIS AND HAS A MERE 25 TO 50 FOOT UNOBSTRUCTED PATH TO THE LAKE. IT IS HIGHLY RECOMMENDED THAT A WATER MONITORING PROGRAM BE IMPLEMENTED TO DETERMINE THE IMPACTS ON THIS AREA OF THE LAKE. Planting of vegetation is also highly recommended to divert and absorb as much of the runoff as possible. Berming the shoreline to trap runoff is also highly recommended. The vegetation along the railroad tracks is good. The same recommendations are made for the industrial building north of the tracks. Investigation into the use of the RV-like vehicle to the south of the white building should be made.

MAP POSITION	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
2			X	X			X	X

Work with the City of Amery to remedy the runoff from the road from entering the lake so easily - storm sewer drains that divert water away from the lake to a holding area, for example. Review lawn fertilization practices with all residents within a 300 foot distance of the flowage and encourage no additional fertilization or a low phosphorus mixture.
In particular, investigate the very red areas (appearing on the IR slide) near the shore in front of the white house with the attached garage. All residences should be encouraged to implement procedures to reroute the runoff from their roofs away from the lake.

MAP POSITION	CHEMICAL				PHYSICAL			
3	1	2	3	4	1	2	3	4
		X				X		

Discuss rerouting runoff from resident's roofs away from the lake. Discuss proper burning practices with residents where the burning barrels are found. Encourage reestablishment of vegetative screening between the homes and the flowage. Discuss proper fertilization procedures with home owners. Riprap may be necessary to stabilize the shoreline and prevent further soil loss. Investigate storm sewer drainage through culverts into the flowage in this urban area.

MAP POSITION	CHEMICAL				PHYSICAL			
4	1	2	3	4	1	2	3	4
		X	X			X	X	

CONDUCT SAMPLING ANALYSIS TO DETERMINE CONTENTS OF RUNOFF ENTERING THE FLOWAGE FROM THE CULVERT IMMEDIATELY NORTH OF THE RED FENCE. The dark organic matter on the shore indicates that the culvert is depositing nutrients in the flowage and should be diverted.
Discuss rerouting runoff from resident's roofs away from the lake. Discuss proper burning practices with residents where the burning barrels are found. Encourage reestablishment of vegetative screening between the homes and the flowage. Discuss proper fertilization procedures with home owners. Replace the biodegradable shoreline riprap with rock at the white house with the garage. Determine if there is a specific source for the macrophytes growing immediately next to shore to the northeast of the tan house. Check on the significance of the break in the rock riprap under the conifer located east of the road curve.

MAP POSITION	CHEMICAL				PHYSICAL			
5	1	2	3	4	1	2	3	4
		X				X		

Discuss rerouting runoff from resident's roofs away from the lake. Discuss proper burning practices with residents where the burning barrels are found. Encourage reestablishment of vegetative screening between the homes and the flowage. Discuss proper fertilization procedures with home owners. Replace biodegradable riprap with rock at the home with the red roof.
Check on possible reasons for the notable difference in bottom composition in the area next to the point.

MAP POSITION	CHEMICAL				PHYSICAL			
6	1	2	3	4	1	2	3	4
		X	X			X	X	

MONITOR FLOW AMOUNT AND CONTENTS OF FLOW FROM THE DITCH ON THE SOUTH SIDE OF THE PARK THAT APPEARS TO CONTINUE UNDER THE ROAD AND OUT TOWARDS THE LAKE.
Stabilize the shoreline in the areas where the erosion is most severe: directly to the south of the ditch outlet.
Discuss rerouting runoff from resident's roofs away from the lake. Discuss proper burning practices with residents where the burning barrels are found. Encourage reestablishment of vegetative screening between the homes and the flowage. Discuss proper fertilization procedures with home owners.

MAP POSITION	CHEMICAL				PHYSICAL			
7	1	2	3	4	1	2	3	4
	X	X	X		X	X	X	

See comments in Map Position 6 regarding the ditch outlet.
Explore the possibility of leaving a larger vegetation buffer strip along the shore of the park - including trees (preferably conifers). Investigate sewage treatment facilities and capacity for the park and the house on the point.

MAP POSITION 8

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
			X		X		X

INVESTIGATE THE IMPACT OF THE DISTURBED AREA ON THE HILLSIDE TO THE NORTH AND WEST OF THE ONLY DOCK IN THE BAY - DETERMINE THE PURPOSE FOR THE DISTURBANCE (appears black in the IR slide).
Encourage maintenance of the established vegetation along the shoreline.

MAP POSITION 9

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

Work on stabilization of the shoreline for control of erosion. *Investigate past and present septic system use - although the three residences appear to have adequate setback. Investigate a possible runoff source in the form of a ditch located approximately halfway between the residence with the white roof and the blue-gray house. Determine the purpose of the small white structure near the shore of the lot of the blue-gray house.
Note the agricultural land use in close proximity to the lake and determine runoff patterns.

MAP POSITION 10

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X			

Encourage maintenance of vegetation on the hillside and along the shoreline.
*Investigate past and present septic system use at the residences in this image.

MAP POSITION 11

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

Investigate runoff patterns at the red roofed residence with the tire along the shoreline and determine if there are nutrients contributing directly to the macrophyte bloom. Reroute runoff away from the lake at those houses (including boathouses) that have a close setback to the flowage.
*Investigate the past and present septic system use at these residences.

MAP POSITION	CHEMICAL				PHYSICAL			
12	1	2	3	4	1	2	3	4
		X				X		

Lake sampling in this area to determine the effects, if any, of the agricultural land across the road from the shore residents and what influence it may have on the heavy plant growth.
Reroute runoff from the white residence with red chimney away from the lake and determine past and present sewage system.
Determine contents and intentions of the toxic area found to the south of the fuel tank in back of the light blue two story residence.

MAP POSITION	CHEMICAL				PHYSICAL			
13	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 14.

MAP POSITION	CHEMICAL				PHYSICAL			
14	1	2	3	4	1	2	3	4
		X				X		

Investigate runoff patterns and impact on the hillside to the north of the residences in Map Position 13 (and they can be partially seen in this Map Position) and flowing into the v-shaped mini-bay with the heavy macrophyte growth.

MAP POSITION	CHEMICAL				PHYSICAL			
15	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 14.

MAP POSITION	CHEMICAL				PHYSICAL			
16	1	2	3	4	1	2	3	4
					X	X		

*Investigate past and present septic system use for all buildings that have a history of human habitation. Determine past agricultural uses on this point especially from an animal standpoint. Stabilize shorelines near the two residences (and other disturbed areas) with rock riprap. Determine use of outbuildings and check for fuel tanks, buried and/or above ground.

MAP POSITION	CHEMICAL				PHYSICAL			
17	1	2	3	4	1	2	3	4
		X				X		

Determine past and present use of the structure located on the north shore of the peninsula and any possible impacts. Investigate use of the white structure as seen through the trees to the north of the road before coming on to the peninsula. Note the heavy macrophyte growth on the south side of the peninsula and look for causes on a local basis.

MAP POSITION	CHEMICAL				PHYSICAL			
18	1	2	3	4	1	2	3	4
	X	X			X	X		

Determine past and present septic system use at the tan residence with the red and white garages, at the two story residence with the brown pole barn and the red cabin with the boat house. Determine cause for bare ground to the south of the dock with the pontoon near the shore and possible runoff impacts - reseed to native grasses. Investigate use of the white structure near shore to the south of the bare ground.

Determine purpose of the two small structures near shore and to the north of the dock with the pontoons and why there is soil exposed in this area. Encourage maintenance of grasses and brush along the shoreline.

Slow runoff at the hill in front of the two story residence with with trees and additional vegetation. Determine purpose of the pipe on the hill and potential impacts.

Reroute runoff from red cabin away from the lake and reroute runoff from the boathouse away from the lake. Revegetate disturbed hillsides. Stabilize shoreline where erosion is occurring.

(Note to groundtruther: the IR image of the red cabin can be found on slide 19.)

MAP POSITION	CHEMICAL				PHYSICAL			
19	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the white residence with the red dock, at the residence with the propane tank to the southwest, at the residence with the dark gray roof and the blue residence. Reroute runoff away from the lake at the boathouse. Stabilize the shoreline through out with rock. Revegetate the hillside with native trees and grasses at the residence with the propane tank. Encourage the maintenance of the vegetative screening.
Investigate the bare soil to the west of the white fence and east of the driveway.
Note the difference in macrophyte growth from Map Position 18 to 19 and investigate for possible causes.

MAP POSITION	CHEMICAL				PHYSICAL			
20	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic system use at the brown trailer, the white residence with the gray roof, the gray cabin and the white residence with the white roof.
Stabilize any disturbed shoreline.
Revegetate the shore next to the water on the lot of the trailer. Revegetate and/or install a berm at the shore to catch road runoff across the lawn to the northeast of the white residence with the white roof.
Investigate cause of the bare areas on the lawn of the above mentioned residence and located to the southeast.

Regarding the three residences located on backlots - it is recommended, because of their crucial location between a major wetland/drainage and the lake, that their sewage treatment facilities be checked.
Revegetating the disturbed soil at the tan residence is necessary also.

MAP POSITION	CHEMICAL				PHYSICAL			
21	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use for the tan residence with the brown roof and the white residence.
Install riprap along the shore to stabilize and filter runoff. Leave a buffer strip of vegetation also to absorb nutrients. Note dark organic matter next to shore at the dock with the two boats: revegetate in front of this residence for screening and nutrient uptake. Check on use of the structure to the north of the white residence to verify that adequate sewage treatment is provided, if necessary. Check on small area of bare ground lakeward of the
white residence and its cause.

MAP POSITION	CHEMICAL				PHYSICAL			
22	1	2	3	4	1	2	3	4

No excessive nutrient inputs.

MAP POSITION	CHEMICAL				PHYSICAL			
23	1	2	3	4	1	2	3	4

No excessive nutrient inputs.

MAP POSITION	CHEMICAL				PHYSICAL			
24	1	2	3	4	1	2	3	4

No excessive nutrient inputs.

MAP POSITION	CHEMICAL				PHYSICAL			
25	1	2	3	4	1	2	3	4
					X			

*Investigate past and present septic system use. Encourage maintenance of tree cover!

MAP POSITION 26

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X	X		X	X	X	

WORK WITH THE PUBLIC ACCESS AUTHORITIES TO IMPLEMENT METHODS TO CONTROL AND DIVERT THE RUNOFF FROM THE PUBLIC ACCESS. SAMPLING THIS AREA WILL DEMONSTRATE THE AMOUNTS OF NUTRIENTS THAT ARE ENTERING THE LAKE AT THIS POINT.

*Determine past and present use of the septic system at the residence with the covered boat. Maintain shoreline vegetation and install riprap to prevent further wasting of the shoreline as has happened to the north of the access. Reroute runoff from the residence away from the lake.

Determine the difference in lake macrophytes south of the access vs. the north.

MAP POSITION 27

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

*Determine the past and present septic system history at the residence with the tan roof,the residence with the dark brown roof, and the white residence. Revegetate the bare ground areas on the lawn of the residence with the l-dock. Encourage not mowing down to the water's edge for increased stabilization of the shore and to collect nutrient runoff. Investigate the rectangular light object and circular dark object on the shore in front of the docked pontoon. If burn sites are located discuss proper burning practices. Encourage maintenance of trees and shoreline vegetation at the white residence.

MAP POSITION 28

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

*Determine the past and present septic system use at the residence with the pool and the residence adjacent to the north.

Review proper pool draining methods.

Investigate the white pipe-like structure to the north of the pool on the hillside.

Determine use of the tan structure to the south east of the residence with the shorestation. Encourage vegetation maintenance.

MAP POSITION	CHEMICAL				PHYSICAL			
29	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic system use at the residence with the green deck and the tan residence with the light brown roof. Maintain the vegetation along the shoreline as it appears both residences have been doing. Determine runoff potential from the white structure and bare area to the south of the residence with the green deck.

MAP POSITION	CHEMICAL				PHYSICAL			
30	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the residence with the red roof and the white roofed residence.
Maintain the vegetation cover. Determine use of the outbuildings at the white roofed residence. Check on the runoff or the possibility of an inlet at the indentation along the shore. If there is runoff from the wetlands behind, this will be a site recommended for water sampling to determine nutrient content in the runoff.

MAP POSITION	CHEMICAL				PHYSICAL			
31	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the brown residence. Determine the source for the excessive macrophyte growth to the north of the dock.

MAP POSITION	CHEMICAL				PHYSICAL			
32	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic system use at the brown residence. Leave as much vegetation along the shore as possible to curb runoff.

MAP POSITION 33

	CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

*Determine sewage disposal system type at the residence that is not seen due to the wonderful vegetative screening. Determine the nutrient source for some of the pockets of macrophyte growth along the shoreline. Investigate possibility of a creek or ditch just south of the green macrophyte growth in water. Notice the break in the vegetation along the shoreline at this point (visible slide). MOST IMPORTANTLY INVESTIGATE THE DIRECTION OF RUNOFF FROM THE FIELD IN THE BACKGROUND AND DETERMINE METHODS FOR RETENTION TO REDUCE LOADING TO THE LAKE.

MAP POSITION 34

	CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

Continuing with the discussion regarding the farm field: note the dark green patch in the meadow to the east of the dirt field, investigate this area as a potential drainage area for the field.
Note the dock on the shoreline, investigate the possibility of an accompanying structure and sewage treatment system.

MAP POSITION 35

	CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X	X		X	X	X	

*Determine past and present septic system use at the yellow residence with the white roof, the two story residence and the yellow garage with the addition.
Investigate runoff patterns from the road and the possibility that agricultural runoff is reaching the lake via the road.
Check on gardening practices at both residences and the use of fertilizers.
Investigate the erosion potential of this stretch of shoreline and encourage maintaining and adequate buffer strip of vegetation along the shore to catch runoff.
Determine source of nutrients causing the excessive macrophyte and algae growth in this area and if the characteristics of the shore and river flow could be contributing factors.
Determine the purpose of the white structure to the west of the covered boat.

MAP POSITION	CHEMICAL				PHYSICAL			
36	1	2	3	4	1	2	3	4
	X	X			X	X		

Determine past and present septic system at the residence with the light brown roof and the red cabin. Discuss setback compliance with both these residents and rerouting runoff away from the lake. Note fertile vegetation patterns (e.g. along the shore westerly of the residence with the light brown roof and around the red cabin), investigate possible fertilization methods. Determine the purpose of the outbuildings, including the red structure to the southwest of the cabin and the white structures adjacent to the shore.
Note the dark organic area along the shore on both sides of the dock with the red boat on shore, also the algae growth in this area, review eroded areas to determine the amount of sediments they may be contributing along with other sources of nutrients.
Investigate sewage treatment systems for the yellow cabin with the white roof (hidden by trees in this slide but easily seen in slide 37) and at the brown and tan residence and the red residence to the northwest of the brown and tan residence.

MAP POSITION	CHEMICAL				PHYSICAL			
37	1	2	3	4	1	2	3	4
					X	X		

*Investigate past and present septic system use at the residences belonging to the red dock, the square platform dock and the t-dock with the red chair. Investigate the number of campsites at the area to the south of the bridge, determine if proper sewage treatment systems are in use and that proper setbacks are being maintained. Reroute runoff from impermeable areas away from the lake, into basins or berm. Note nonvegetated area seen close to shore through the tree cover, check on revegetating with native grasses.

MAP POSITION	CHEMICAL				PHYSICAL			
38	1	2	3	4	1	2	3	4
			X			X	X	

Discuss options with the highway department for developing alternatives to sending road runoff down asphalt chutes to the lake.
*Investigate past and present septic system at the blue residence on the west side of the road and at the white residence on the north side of the road.

MAP POSITION	CHEMICAL				PHYSICAL			
39	1	2	3	4	1	2	3	4
					X	X		

*Investigate past and present septic system use at the gray residence. Discuss potential impacts from the close lake setback. Note healthy vegetation surrounding the tree to the east of the structures and determine source of nutrients and/or runoff patterns.

MAP POSITION	CHEMICAL				PHYSICAL			
40	1	2	3	4	1	2	3	4
		X			X	X		

Investigate past and present septic system use at the white mobile home and the white two story residence. Investigate the contents of the trash pile to the southwest of the mobile home. DETERMINE THE PURPOSE OF THE BARE GROUND NEAR SHORE AND SOUTHWEST OF THE MOBILE HOME - POSSIBLE FERTILIZER APPLICATIONS AND EROSION POTENTIAL.
Discuss close lake setback and measures to route runoff away from the lake and/or into catch basins. Check into the small square bare area on the point and reasons for the healthy vegetation surrounding it.
At the white house work on stabilizing the eroded areas near shore and check on the purpose of the small white structure to the west of the pontoon. Discuss the use of lawn fertilizer (note the healthy lawn in the IR slide).

MAP POSITION	CHEMICAL				PHYSICAL			
41	1	2	3	4	1	2	3	4
						X		

See comments regarding the white residence in Map Position 40. In addition, review gardening practices and possible runoff patterns from the garden that may be entering the lake. (Note algae in their little mini-bay.)

MAP POSITION	CHEMICAL				PHYSICAL			
42	1	2	3	4	1	2	3	4
					X	X		

*Investigate past and present septic systems at the two houses on the point. Due to the lack of lake setback of these residences, work to route runoff from all impermeable surfaces away from the lake.
Note the large trash pile of leaves and debris on the west side of the point. Find an alternative site for dumping as this will be a major contributor of nutrients to the lake.
Investigate possible road runoff as a contributor to the algae bloom in the bay on the west side of the point.
*Investigate past and present septic system use at the residence with the upside-down canoe and half submerged dock.

MAP POSITION	CHEMICAL				PHYSICAL			
43	1	2	3	4	1	2	3	4
					X	X		

*Investigate past and present septic system use at the white residence with the swingset. Review proper yard fertilization methods. Determine nutrient source for algae bloom along shoreline north of this residence.

MAP POSITION	CHEMICAL				PHYSICAL			
44	1	2	3	4	1	2	3	4
	X	X			X	X		

Investigate past and present septic system use at the brown cabin and its possible relationship to the algae bloom along the shore. Review setbacks for the new construction and getting the disturbed areas reseeded and stabilized as quickly as possible. Investigate the septic system, including that it was upgraded to match the size of the residence.

MAP POSITION 45

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present sewage treatment systems the the white trailer, the residence with the 1-dock, the cabin that belongs to the dock and stairs, the residence that belongs to the pontoon and the cabin with the white roof and covered boat.

MAP POSITION 46

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

Starting at the cabin to the north of the fence: *Investigate past and present septic system history at the cabin with the red dock, at the cabin with the retaining wall and pontoon, at the brown residence with the covered boat and pontoon, the possible residence up the hill from the gray structure along the shore.
Investigate use and impact of the blue-gray building on the shore and reasons for the very healthy grass surrounding it. All biodegradable riprap should be removed from the entire shoreline and replaced with rock. Determine the cause for the algae growth on the shore surrounding the pontoon.

MAP POSITION 47

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

*Investigate past and present septic system at the cabin with the white roof and at the white cabin 15 feet from shore and at the structure behind it. Work on routing runoff away from the lake at the two story cabin. Stabilize shoreline using proper techniques. Determine the source for nutrients that is making the grass in front of this cabin so healthy.

MAP POSITION 48

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present septic system use at the yellow cabin. Develop measures to reduce the amount of runoff from the asphalt driveway heading straight to the lake. Any additional measures to reroute runoff from the residence away from the lake would be helpful in reducing the nutrient load.

MAP POSITION 49

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present septic system use at the brown cabin, the cabin with the red dock and the cabin with the 1-dock. Reroute runoff away from the lake on all of these residences. Discuss proper burning practices with the residents on the point.

MAP POSITION 50

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X			X	X		

Determine if there is any runoff source from the road entering this bay. Investigate the possible ditch located to the north of the canoe.
Investigate past and present septic system use at the residence with the dark gray roof (mostly hidden in the trees) with the red dock and at the residence with the concrete parking pad and the white residence near shore. Investigate the possibility of another residence to the north of the white residence belonging to the single dock with no boats. Discuss rerouting of runoff away from the lake at the white residence.
On the IR slide note the gray area on the lawn located a short distance up the hill and between the two canoes, investigate the reason for this and possible impacts to the lake. Note the garden area to the north of the white garage, discuss proper fertilization methods.

MAP POSITION 51

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X			X	X	X	X	

CHECK FOR INCOMING NUTRIENT AND SEDIMENTS AT THE INDENTATION IN THE SHORELINE - NOTE MACROPHYTE GROWTH OFFSHORE IN THE LAKE AND THE SEDIMENTS ON THE BOTTOM INDICATING HEAVY RUNOFF.

Investigate past and present septic system use at the residence close to shore with the light gray roof, at the brown residence close to shore, the residence at the top of the hill with the light colored roof and the residence with the reddish roof (this residence is more clearly defined in Map Position 52). Investigate the two residences -the mobile home and the home with the gray roof - for septic system conformity.

Investigate the use and necessity of a sewage treatment system at the structure next to the red dock with the bench. Discuss impacts of impermeable surfaces close to the lake with the two residents near the lakeshore and how to reroute runoff away from the lake.

Determine the necessity of stabilizing the shoreline along this stretch of shore.

NOTE THE CULVERT NEXT TO THE HIGHWAY (AS SEEN IN THE IR SLIDE). DETERMINE THE AREA THIS CULVERT DRAINS AND WHERE THE WATER RUNS OFF WHEN IT DRAINS FROM THE CATCH BASIN LOCATED TO THE EAST OF THE HIGHWAY.

MAP POSITION 52

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
				X	X		

Investigate past and present septic system use at the white cabin. Discuss methods for rerouting runoff away from the lake at this cabin. Investigate the bare areas located to the north of the cabin, determine cause and impact to the lake. Determine contents of debris pile in this same area. Review the need for shoreline stabilization in this area. Note the white cabin/structure to the west of this cabin and up the hill. Investigate use and the need for a sewage treatment system.

MAP POSITION	CHEMICAL				PHYSICAL			
53	1	2	3	4	1	2	3	4
	X			X	X	X	X	

INVESTIGATE SOURCE OF NUTRIENTS CAUSING THE MACROPHYTE GROWTH ALONG THE SHORE - MOST LIKELY A COMBINATION OF RUNOFF FROM THE ACCESS AND THE LAWN. SAMPLE THIS AREA TO DETERMINE THE LEVELS OF PHOSPHORUS, ETC. THAT MAY BE ENTERING THIS AREA. NOTE THE CLOSE PROXIMITY TO THE AGRICULTURAL LANDS ACROSS THE ROAD AND CHECK FOR DRAINAGE PATTERNS FROM THIS AREA TOWARDS THE LAKE.
Note build-up of dark organic matter along the shore - particularly near the boats and near the covered pontoon and along the shore by the overturned canoe.
Encourage stabilization of the shoreline in this area with rock riprap and the installlation of a berm to reduce runoff in to the lake. Discuss proper burning practices at the resort.
Discuss setback compliance for placement of travel trailers at the resort. (Note the two RV's parked on the shore.) Determine sewage treatment facilities for all of the RV's.
Investigate past and present septic system use at the blue residence and the tannish cabin. Note patterns of healthy vegetation on the lawn - discuss proper fertilization methods.
For both residences stress the importance of controlling runoff from their structures before it can reach the lake. Investigate use and impact of the outbuildings surroundings the tannish cabin.

MAP POSITION	CHEMICAL				PHYSICAL			
54	1	2	3	4	1	2	3	4
	X			X	X	X	X	

INVESTIGATE THE SOURCE OF NUTRIENTS CAUSING THE BUILD UP OF ORGANIC MATTER, MACROPHYTES AND ALGAE ALONG THE SHORE AND OUT INTO THE WATER NORTH OF THE COVERED PONTOON. CONDUCT SAMPLING TO DETERMINE THE CONTENTS OF THE WATER IN THIS AREA. DETERMINE DRAINAGE PATTERNS FOR THE AG RUNOFF FROM THE FIELD LOCATED TO THE WEST OF THE LAKE.
Discuss with the highway department methods for reducing the runoff to the lake caused by the road.
Investigate past and present septic system use at the green residence on the west side of the road.

MAP POSITION	CHEMICAL				PHYSICAL			
55	1	2	3	4	1	2	3	4
	X	X			X	X		

Investigate past and present septic system use at the white residence (obscured by trees), the quonset hut-like residence and the square tan residence. Reroute runoff from all of these structures away from the lake. Determine the use and impact of the black, pink and green configuration to the south of the quonset. Determine the extent of the deck/patio in front of the quonset and discuss possible alternative structures and locations. Investigate reasons for the difference in lawn quality between the hillside just north of the quonset and the lawn extending down from the tan residence. Determine the purpose of the brown object west of the water's edge. Check on the object going into the water - a pipe - north of the brown object regarding whether it is draining into the lake or pumping water from the lake.

MAP POSITION 56

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present septic system use at the residence with the red dock, the residence with the l-dock and bench, the white roofed cabin next to shore, the small cabin with the gray roof.
Reseed the hillside to the north of the red dock with native grasses.
Reroute runoff away from the lake at all the residences that are close to shore.
Encourage maintenance of the shoreline vegetation.

MAP POSITION 57

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present septic systems at the red-brown residence and the blue residence.
Investigate the contents of the large debris pile to the north of the blue residence and possible impacts it may have for the lake.

MAP POSITION 58

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X				X	X		

Investigate past and present septic system use at the farmstead across the road.
Determine past and current land use practices on the farm and most importantly and drainage patterns that may carry the loading from this area to the lake.

MAP POSITION 59

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X		X		X		X	

Investigate the past and present septic system, if necessary, for the building with the gray roof west of the highway. Also investigate its original and current use to determine potential impacts on the lake.
NOTE THE ALGAE BLOOM ALONG THE LAKESHORE.
WORK WITH THE HIGHWAY DEPARTMENT TO DEVELOP METHODS OF ROUTING RUNOFF AWAY FROM THE LAKE AND TO STABILIZE THE SHORELINE WITH PLANTINGS AND RIPRAP.

MAP POSITION 60

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X			X	X			X

WORK WITH THE HIGHWAY DEPARTMENT TO REROUTE HIGHWAY RUNOFF AWAY FROM DIRECTLY ENTERING THE LAKE FROM THE DITCHES ON THE BRIDGE. (NOTE THE VERY HEALTHY VEGETATION AROUND THE BRIDGE BASES.)
Check on the septic system of the residence on the south end of the bay.

MAP POSITION 61

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X				X		

DETERMINE THE SOURCE OF NUTRIENTS FOR THIS AREA OF SHORELINE. THE AREA IS HEAVILY WOODED AND INCLUDES A GOOD PROPORTION OF PINES, HOWEVER DESPITE THESE SHORELAND CONDITIONS THERE IS A HEAVY ALGAE BLOOM.
Note the farmstead located in the background.

MAP POSITION 62

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X				X		

Conduct sampling in this area to determine loading impacts of land use in this area. Investigate past and present land use activities on this field. Note at the corresponding location on the USGS map the contour lines indicate a mini-watershed that would direct all water flow in this area into the lake. Determine the use and impact of the gray colored chute entering the lake in the open portion of the shore.
Work at determining the runoff pattern for the agricultural lands in the background. Investigate the need for stabilizing the shoreline in this area.

MAP POSITION 63

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

*Investigate past and present septic systems at the two residences on the point.

MAP POSITION	CHEMICAL				PHYSICAL			
64	1	2	3	4	1	2	3	4
		X				X		

CONDUCT SAMPLING IN THIS BAY AREA TO DETERMINE WHAT RUNOFF CONSISTS OF AND HOW IT MAY BE STIMULATING THE AQUATIC VEGETATION GROWTH. Use the results of the sampling to determine if a modification to the existing runoff pattern is needed and/or if a larger buffer strip of vegetation along the shoreline would be helpful.

MAP POSITION	CHEMICAL				PHYSICAL			
65	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 64.

MAP POSITION	CHEMICAL				PHYSICAL			
66	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 64.

MAP POSITION	CHEMICAL				PHYSICAL			
67	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 64.

MAP POSITION	CHEMICAL				PHYSICAL			
68	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 64.

MAP POSITION	CHEMICAL				PHYSICAL			
69	1	2	3	4	1	2	3	4
		X				X		

Investigate past and present land use activities at the farmstead. Determine runoff patterns, especially north of the tree line and approximately 200 feet back from shore. There is a section that appears to have heavily eroded in the past.

MAP POSITION	CHEMICAL				PHYSICAL			
70	1	2	3	4	1	2	3	4
		X				X		

Conduct sampling to determine what the runoff consists of in this area. Investigate bare areas for toxic possibilities.

MAP POSITION	CHEMICAL				PHYSICAL			
71	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 70.

MAP POSITION	CHEMICAL				PHYSICAL			
72	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 70.

MAP POSITION	CHEMICAL				PHYSICAL			
73	1	2	3	4	1	2	3	4
	X	X			X	X		

Discuss past and present land use at the white residence with the windowed porch, (visible slide 73a) particularly the areas of shoreland. Investigate past and present septic system use at the white residence and the structure in the trees to the southwest of the white residence. Investigate past and present methods of disposing of animal wastes from barn northwest of residence with windowed porch.

MAP POSITION	CHEMICAL				PHYSICAL			
74	1	2	3	4	1	2	3	4
	X	X			X	X		

Note the healthy green grass (red circular pattern in the IR) on the field side of the turn in the road indicating the drainage pattern for the field and the culvert that is carrying the drainage under the road and towards the flowage. Discuss alternative drainage patterns for the field runoff. Investigate past and present septic system use at the two white residences. Discuss garden practices, fertilizer applications and rerouting runoff at the residence with the garden with the red shed.
Discuss various alternatives for preventing agricultural runoff from entering the flowage, or at least to slow its impact.
Remove the debris from the shoreline.

MAP POSITION	CHEMICAL				PHYSICAL			
75	1	2	3	4	1	2	3	4
		X				X		

Reseed and stabilize the disturbed areas surrounding the new construction as quickly as possible. Discuss alternatives for preventing agricultural runoff from entering the flowage, or at least to slow its impact. Determine past land use and analyze soil samples. If area was used as pasture, berm shoreline and plant canary grass.

MAP POSITION	CHEMICAL				PHYSICAL			
76	1	2	3	4	1	2	3	4
		X				X		

Take water samples to determine the limiting nutrient for the organic matter in the small bay. Review overall runoff patterns in the watershed for a better understanding of the source of nutrients in the bay.

MAP POSITION	CHEMICAL				PHYSICAL			
77	1	2	3	4	1	2	3	4

See comments in Map Position 76.

MAP POSITION	CHEMICAL				PHYSICAL			
78	1	2	3	4	1	2	3	4

Note the pattern along shore where there appears to be less nutrients where the pine trees are closest to the shore. Determine if there is any significance to this pattern. If a significance is noted, implement pine trees in other strategic areas on the lake.

MAP POSITION	CHEMICAL				PHYSICAL			
79	1	2	3	4	1	2	3	4
					X			

*Determine past and present septic system use at the red residence. Discuss proper yard fertilization methods. Determine use and impact of the white structure along the top of the 'bluff'. Encourage maintenance of the vegetation along the shore.

MAP POSITION	CHEMICAL				PHYSICAL			
80	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the gray roofed residence. Investigate the reason for the bare areas on the lawn to the south of this residence.
*Determine past and present septic system use at the tan roofed residence. Determine the reason for the dirt fill on the hill in front of the residence and how it will be stabilized following the construction.
*Determine past and present septic system use at the dark brown home. Discuss proper yard fertilization methods.
Review land use to the east of the road around the pond, note the plume that shows in the north end of the pond - it is visible in the IR slide.

MAP POSITION	CHEMICAL				PHYSICAL			
81	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the residence with the dark gray roof set back in the trees.
*Determine past and present septic system use at the white residence and if the system was upgraded when the residence was added on to.
Determine if the area to the west of the garage/pole barn is used for animals.
Reroute runoff from this residence away from the lake. Investigate if additional erosion control methods are necessary for the hill to the lake.

MAP POSITION	CHEMICAL				PHYSICAL			
82	1	2	3	4	1	2	3	4
					X			

*Determine past and present septic system use at the blue residence with the corner deck. Investigate the light green area along the shore to the south of the stairs at this residence. Discuss tree replacement on the hillside.
*Determine past and present septic systems at both white residences. Determine the cause for the bushy vegetation at the top of the hill at the residence with the garage to the side of the house.

MAP POSITION	CHEMICAL				PHYSICAL			
83	1	2	3	4	1	2	3	4
					X	X		

*Determine the past and present septic system use at the brown residence. Investigate the bare areas on the lawn - determine reason and impact.
*Determine past and present septic system use at the white residence with the red roof. Determine the purpose of the various small structures on the hillside and if there is a need for soil stabilization at the bare areas located northwest of the residence near the shore.
*Determine past and present septic system use at the residence with the grayish roof located in the trees. Determine the purpose of the white object (structure?) located on the hillside between this residence and the residence to the south.

MAP POSITION	CHEMICAL				PHYSICAL			
84	1	2	3	4	1	2	3	4
		X			X	X		

*Determine past and present septic system use at the residence with the white top and the gray bottom. Check out the white pipes extending from the corner of the house and determine if these are runoff devices that could be rerouted away from the lake. Investigate the need for additional hillside stabilization near shore.
*Determine past and present septic system use at the light blue residence with the light gray roof. Investigate the need for additional shoreline/hillside stabilization. Discuss proper lawn and garden fertilization methods.

MAP POSITION	CHEMICAL				PHYSICAL			
85	1	2	3	4	1	2	3	4
	X			X	X			X

Investigate the possibility of a dump site beneath the power line.

MAP POSITION	CHEMICAL				PHYSICAL			
86	1	2	3	4	1	2	3	4
		X	X			X	X	

NOTE THE SEVERE MACROPHYTE GROWTH IN THESE BAYS ON EITHER SIDE OF THE HIGHWAY. INVESTIGATE RUNOFF PATTERNS FROM THE AGRICULTURAL LAND NORTH OF THE BAY. WATER SAMPLING IS RECOMMENDED IN THIS AREA ALSO.

****

Note: map positions 87 through 95 were not analyzed per the District's instructions.

****

MAP POSITION 96

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

DETERMINE RUNOFF PATTERNS FOR THE AGRICULTURAL LANDS FOUND TO THE EAST OF THE RESIDENCES. INVESTIGATE THE USE OF FERTILIZERS AND/OR CHEMICALS IN THIS AREA.
*Determine the past and present septic system use for the residence with the grayish roof and deck. Discuss rerouting runoff from the home away from the lake due to the close proximity of the house to the lake. Check on methods for draining the swimming pool.
*Determine the past and present septic system use at the residence with the dark gray roof. Review proper lawn fertilization methods at this residence.

MAP POSITION 97

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

Review garden fertilization methods and chemicals applied to the large garden. Determine if any additional design is necessary to prevent runoff from the garden from entering the lake. Determine the purpose of the small structures to the south of the garden. Review necessity of shoreline stabilization construction in this area.
*Determine the past and present septic system use for the white roofed residence. Investigate the use of the lake access immediately south of the white roofed residence and the white object located on shore to the north of the access.
*Determine the past and present septic system use at the flat roofed residence. Review purpose of the small structure on shore near the l-dock and the pipe-like object on the south side. Investigate the need for shore line stabilization and/or additional vegetation for the shore area.
*Determine the sewage disposal system for the travel trailer located on the west edge of the garden. Investigate types of fertilizer and/or chemicals to the garden and the need for mitigation of runoff.
*Determine the past and present septic system use of the white residence. Replace the shore area with rock riprap. Investigate the large bare area of lawn to the north east of this residence.

MAP POSITION	CHEMICAL				PHYSICAL			
98	1	2	3	4	1	2	3	4
					X	X		

*Determine the past and present septic system use at the yellow residence. Review shoreline and hillside stabilization methods to reduce erosion and shoreline wasting. Investigate the purpose of the dark area located to the east of the fishing boat and its possible impact on the lake.
*Determine the past and present septic system use at the tan residence. Determine the purpose of the light colored object located near shore to the north east of the pontoon. Reroute runoff away from the lake due to the close proximity of the residence.
*Determine the past and present septic system use at the residence with the brown roof obscured by trees. Repair hillside erosion by planting with native vegetation.

MAP POSITION	CHEMICAL				PHYSICAL			
99	1	2	3	4	1	2	3	4
	X	X		X	X	X		

*Determine the past and present septic system use at the residence with the light colored roof and the l-dock. Investigate the need for shoreline stabilization to prevent erosion and runoff.
*Determine the past and present septic system use at the residence with the brown roof and the canoe parked on the shore.
CONDUCT WATER SAMPLING AT THE OUTLET OF BURNS CREEK TO DETERMINE THE EXTENT AND CONTENT OF THE NUTRIENT LOADING DUE TO THE AGRICULTURAL AND ANIMAL RUNOFF. (NOTE THE HORSES AND FIELDS LOCATED UPSTREAM.)

MAP POSITION	CHEMICAL				PHYSICAL			
100	1	2	3	4	1	2	3	4
					X	X		

*Determine the past and present septic system use at the residence with the black mottled roof with the elevated deck. Investigate the use of the light brown area located near the shore and what substances may be used on it.
SEE SAMPLING COMMENTS IN MAP POSITION 99.

Map Position	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
101		X	X			X		

Investigate use of path shown as a green leading from the trees in the background (on the right side of the visible slide) to the flowage. Investigate reason for the two unvegetated areas evident in the IR slide (on the left side). Notice very uneven coloring of the vegetation, (most evident in the IR slide) investigate past and present land use.

Map Position	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
102	X	X	X	X		X		

The presence of very healthy submergent vegetation along this entire shoreline together with dense algae blooms indicate extreme nutrient loading however there is no obvious land use cause in this slide. Investigate past land use history. Take sediment samples.

Map Position	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
103	X	X	X	X		X		

See comments for Map Position 102.

Map Position	CHEMICAL				PHYSICAL			
	1	2	3	4	1	2	3	4
104	X	X	X	X		X		

See comments for Map Position 102. Investigate light brown irregular area in water evident in visible slide on the right side.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
105	X	X	X	X		X		

See comments for Map Position 102. Investigate the whitish area in the water on the bottom center of the IR slide (this area corresponds to the brownish area in the visible slide 104). Determine use of trail that ends near the light colored square object near the end of the point (visible slide). Investigate use of the light colored object and impact, if any, on the flowage.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
106	X	X	X	X	X	X		X

See comments for Map Position 102. Notice the break in the trees running from the back of the visible slide towards the flowage, investigate possibility of a point source in this area.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
107	X	X	X	X		X		

Investigate source of creek running into the flowage. Take water samples to determine the type and amount of nutrient loading occurring at this point source. Notice extremely healthy vegetation in the vicinity of the creek, shown as bright red areas in IR slide. Investigate management methods for agricultural field in background including crop, chemical usage, and method of tillage.

Map Position 108

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X	X	X	X	X		

Investigate past and present septic system at brown residence with a black roof. Review 3 foot separation of sewage treatment from ground water.
Investigate possibility of past fill activity. Determine reason for rectangular unvegetated areas near dock and near tree line on the north side of the lot. Determine use of small structures near residence and the one near the dock. Dense macrophyte and algae beds continue.

Map Position 109

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X	X	X	X	X		

Investigate past and present septic systems at residence with a grey roof, brown residence with a white roof and residence on the point with a black roof. Check on 3 foot separation for sewage treatment to groundwater. Determine compliance with setback requirment for residence with grey roof and for residence with a black roof on the point, re-route runoff away from the lake at these two residences. Investigate possibility of fill activity in the past on these three lots. Review proper fertilization methods for the garden at the residence with grey roof. Investigate activities at curve in shoreline (where the grey areas are) south of pontoon. Dense macrophyte and algae beds continue.

Map Position 110

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X	X	X	X			

Investigate past and present septic system at white residence with a brown roof and for structure with a reddish roof. Dense macrophytes and algae beds continue.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
111	X	X	X	X	X	X		

Investigate septic systems for all possible residences and mobile homes in this slide. Investigate if this is a resort or possible trailer court and if so, compliance with appropriate permits for this activity. Review compliance with setback requirement for white mobile homes and for brown structure with a brown roof and for smaller light colored structure with a white roof; re-route runoff away from the lake. Investigate possibility of past fill activity near the bridge. Notice sudden lack of macrophyte and algae growth along this shoreline and determine if chemical control has been used.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
112		X	X	X		X		X

Investigate the runoff pattern on the lake side of the road, east of the residence with a white roof in the trees. Notice the yellowish color of this area in the IR slide, indicating unhealthy vegetation (possible toxíc area). Notice the coloring of the grass on the west side of the road (visible slide) extending to the previously mentioned yellowish area on the lake side of the road. Investigate the eroded area on the west side of the road, determine impact, if any on the lake.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
113		X	X		X	X	X	

Clean up and properly dispose of the possible refuse surrounding the farm buildings on both sides of the road. * Investigate past and present septic system at the residence with the light brown roof and deck.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
114	X	X			X	X		

Investigate past and present septic system at large residence with a red-brown roof. Notice reappearance of algae bloom along the north edge of shoreline and dense macrophyte growth in deeper water. Construct a berm to control yard runoff.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
115	X	X	X	X	X	X		

Investigate past and present septic system at residence in the trees (dock with white covered boat lift). Notice unusual colored area in deeper water (both visible and IR). Investigate what type of vegetation/substance this is and possible source of nutrients or toxics.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
116	X	X	X	X	X	X		

Investigate past and present septic system at residence with a brown roof. Notice unusual colored area in deeper water (both visible and IR). Investigate what type of vegetation/substance this is and possible source of nutrients or toxics.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
117	X	X			X	X		

Investigate past and present septic system at residence with a silver roof on the point. Review setback requirement and re-route runoff away from the lake.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
118	X	X	X	X		X		X

Determine reason for area of dead vegetation, investigate runoff patterns from field in background to assess the affect it may be having on this area.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
119	X	X	X	X		X		

Investigate runoff patterns to determine nutrient source for algae blooms and macrophytes.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
120	X	X	X	X		X		

See comments for Map Position 119.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
121	X	X				X		

Investigate possible nutrient sources for dense submergent macrophyte growth.

	CHEMICAL				PHYSICAL			
Map Position	1	2	3	4	1	2	3	4
122								

No excessive nutrient loading.

	CHEMICAL				PHYSICAL			
Map Position 123	1	2	3	4	1	2	3	4

No excessive nutrient loading.

	CHEMICAL				PHYSICAL			
Map Position 124	1	2	3	4	1	2	3	4

No excessive nutrient loading.

	CHEMICAL				PHYSICAL			
Map Position 125	1	2	3	4	1	2	3	4
	X	X			X	X		

Review setback requirement at white residence with a black roof, re-route runoff away from the lake. Determine nutrient source for algae bloom along shoreline near south edge of the property. *Determine past and present septic system use at this residence.

MAP POSITION	CHEMICAL				PHYSICAL			
126	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic system use at this residence. Due to the close proximity of the house to the shore, reroute runoff from the roof away from the lake. Determine the use of the large white ground structure on the shore to the west of the garage (possible boat access). Check on the need for shoreline stabilization (note the faint dark area on the shore in front of the residence).

MAP POSITION	CHEMICAL				PHYSICAL			
127	1	2	3	4	1	2	3	4

See comments in Map Position 126.

MAP POSITION	CHEMICAL				PHYSICAL			
128	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic use at the residence with the gray roof. Discuss proper lawn fertilization methods (note the very red lawn to the north of the house in the IR slide). Determine the reason for the toxic area (bare ground) to the northwest of the residence. Encourage the maintenance of the vegetation on the shoreline.

MAP POSITION	CHEMICAL				PHYSICAL			
129	1	2	3	4	1	2	3	4
					X			

*Determine past and present septic system use at the residence with the covered boat. Investigate the cause for the area of no vegetation on shore and any possible impact and restoration measures.

MAP POSITION 130

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X			X	X		

*Determine past and present septic system use at the residence with the pontoon. Due to the close proximity of the cabin to the lake, discuss procedures to route runoff away from the lake.
*Determine past and present septic system use at the yellow residence. Discuss measures to reroute runoff from the building away from the lake.
NOTE THE BUILD UP OF ORGANIC MATTER IN THIS BAY, CONDUCT SAMPLING IN THIS AREA TO DETERMINE THE SOURCE OF NUTRIENTS. DETERMINE THE RUNOFF PATTERNS IN THIS AREA.

MAP POSITION 131

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4

See comments in Map Position 132.

MAP POSITION 132

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X			X		X		

CONDUCT SAMPLING IN THIS BAY TO DETERMINE THE TYPE OF NUTRIENTS THAT ARE CAUSING THE SUBSTANCES AS SEEN IN THE IR SLIDE.
NOTE THE DARK AREAS IN TOWARD SHORE AND THE DARK BROWN SUBSTANCES OCCURRING IN THE MIDDLE PORTION OF THE NARROW PART OF THE BAY. CHEMICAL SAMPLING IS RECOMMENDED HERE. DETERMINE SOURCE OF INLET AT THE NARROW PART OF THE BAY. SAMPLE WATER IN INLET TO DETERMINE THE AMOUNT OF NUTRIENTS IT IS CONTRIBUTING TO THE FLOWAGE.

MAP POSITION 133

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X			X		X		

See comments in Map Position 132. DETERMINE SOURCE OF INLET AT THE NARROW PART OF THE BAY. SAMPLE WATER IN INLET TO DETERMINE THE AMOUNT OF NUTRIENTS IT IS CONTRIBUTING TO THE FLOWAGE.

MAP POSITION 134

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4

See comments in Map Position 132.

MAP POSITION	CHEMICAL				PHYSICAL			
135	1	2	3	4	1	2	3	4

No readily evident runoff sources in this area. Evidence of nutrients is readily available. Note the red areas out from shore in the IR slide.

MAP POSITION	CHEMICAL				PHYSICAL			
136	1	2	3	4	1	2	3	4

See comments in Map Position 135.

MAP POSITION	CHEMICAL				PHYSICAL			
137	1	2	3	4	1	2	3	4

No readily evident sources of nutrients at this position. Evidence of nutrients is abundantly available.

MAP POSITION	CHEMICAL				PHYSICAL			
138	1	2	3	4	1	2	3	4
					X			

*Determine past and present septic system use at the cabin on the point.

MAP POSITION	CHEMICAL				PHYSICAL			
139	1	2	3	4	1	2	3	4
	X			X		X		

CONDUCT SAMPLING PROCEDURES TO DETERMINE TYPES AND AMOUNTS OF NUTRIENTS THAT ARE ENTERING THE LAKE AT THIS POINT.

MAP POSITION	CHEMICAL				PHYSICAL			
140	1	2	3	4	1	2	3	4
	X		X			X		

No visual evidence of loading, other than the small wetland that appears to be draining into the lake.

MAP POSITION	CHEMICAL				PHYSICAL			
141	1	2	3	4	1	2	3	4

No visual evidence of loading.

MAP POSITION	CHEMICAL				PHYSICAL			
142	1	2	3	4	1	2	3	4

No visual evidence of loading.

MAP POSITION	CHEMICAL				PHYSICAL			
143	1	2	3	4	1	2	3	4

No visual evidence of loading.

MAP POSITION	CHEMICAL				PHYSICAL			
144	1	2	3	4	1	2	3	4

No visual evidence of loading.

MAP POSITION	CHEMICAL				PHYSICAL			
145	1	2	3	4	1	2	3	4
	X				X			

No visual evidence of loading. However, from further investigation of the topographic map, there appears to be a drainage where sampling should be conducted.

MAP POSITION	CHEMICAL				PHYSICAL			
146	1	2	3	4	1	2	3	4
	X				X			

See comments in Map Position 145.

MAP POSITION	CHEMICAL				PHYSICAL			
147	1	2	3	4	1	2	3	4

No visual evidence of loading.

MAP POSITION	CHEMICAL				PHYSICAL			
148	1	2	3	4	1	2	3	4
	X			X		X	X	X

CONDUCT SAMPLING IN THIS AREA TO DETERMINE TYPES AND AMOUNTS OF LOADING OCCURING FROM THE AGRICULTURE LAND USES DRAINING INTO THIS AREA. NOTE ON SLIDE NUMBER 147-50 THE POSITION OF THE AG LAND IN RELATION TO THIS DRAINAGE. CHECK PAST LAND USE HISTORY.

MAP POSITION	CHEMICAL				PHYSICAL			
149	1	2	3	4	1	2	3	4
		X		X		X		X

See comments in Map Position 148.
NOTE THE LIGHT BROWN AREA LOCATED ALONG THE NARROWER CHANNEL AND INVESTIGATE ANY POSSIBLE CORRELATION WITH DISCHARGE FROM THE GRAVEL PITS. ALSO NOTE HOW HEALTHY THE VEGETATION IS ON THE EAST SIDE OF THIS CHANNEL AND IMMEDIATELY TO THE NORTH OF THE LIGHT BROWN AREA. (The healthy vegetation shows up as bright red in the IR slide.)
INVESTIGATE THE POTENTIAL IMPACT OF THE AREA NEAR THE CHANNEL THAT IS LACKING VEGETATION - this shows up on the 'b' series of Map Position 149 - AND APPEARS TO BE CONTRIBUTING LOADING TO THE RIVER BASED ON THE BROWN RESIDUE ALONG THE SHORELINE.

MAP POSITION	CHEMICAL				PHYSICAL			
150	1	2	3	4	1	2	3	4
		X		X		X		X

See comments in Map Position 149.

MAP POSITION	CHEMICAL				PHYSICAL			
151	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 152.

MAP POSITION	CHEMICAL				PHYSICAL			
152	1	2	3	4	1	2	3	4
		X				X		

CONDUCT SAMPLING IN THIS AREA TO DETERMINE TYPES AND AMOUNTS OF NUTRIENT LOADING.
INVESTIGATE METHODS OF PREVENTING RUNOFF FROM ENTERING THE LAKE DIRECTLY FROM THE ADJACENT AGRICULTURAL LAND USES AND/OR DISCUSS ALTERNATIVE LAND USE PRACTICES AND/OR METHODOLOGIES. INVESTIGATE THE POSSIBILITY OF DRAINAGE TILES FROM THE AG LAND EMPTYING INTO THE FLOWAGE WHERE THE FIELDS MEET THE WATER.

MAP POSITION	CHEMICAL				PHYSICAL			
153	1	2	3	4	1	2	3	4
		X				X		

See comments in Map Position 152.

MAP POSITION 154

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X			X	X		

See comments in Map Position 152.
*Determine past and present septic system use at the residence with the barn. Review use of the red gas pump and regulations regarding underground storage tanks. Review purpose of the yellow tank to the northwest of the barn and the adjacent structure. Discuss the need for shoreline stabilization and/or berms to intercept runoff. Review fertilization use around the farm complex.

MAP POSITION 155

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X			X	X		

See comments in Map Position 154.

MAP POSITION 156

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
	X	X			X	X	

See comments in Map Position 154.
Investigate runoff patterns from the fields towards the road and further investigate possible impacts from the road. Discuss mitigative measures if runoff is impacting the lake.

MAP POSITION	CHEMICAL				PHYSICAL			
157	1	2	3	4	1	2	3	4
					X	X		

*Determine past and present septic system use at the brown residence (with the white roof and the red boat). REROUTE RUNOFF AWAY FROM THE LAKE. Discuss proper burning practices. Investigate reason for the bare areas on the lawn. Determine if a separate sewage treatment system is needed for the structure to the south of this residence.
*Investigate past and present septic system use at the brown residence on the east side of the road.
*Investigate past and present septic system use at the white roofed residence. Reroute runoff away from the lake and plant vegetation to further reduce runoff and take up nutrients. Investigate the need for shoreline stabilization. Investigate the soil disturbances near shore and to the south west of the residence - plant and mulch to prevent erosion.
*Investigate past and present septic system use at the gray roofed residence on the east side of the road.
*Investigate past and present septic system use at the white roofed residence with the white roofed garage (located on the south side of the driveway that goes to the point).

MAP POSITION	CHEMICAL				PHYSICAL			
158	1	2	3	4	1	2	3	4
	X	X			X	X		

Determine the reason for the bare soil along the roadway and reseed with native vegetation. Determine runoff patterns from the roadway and any possible runoff occurring from the tilled field immediately south of the road.
Determine past and present septic system use at the white residence with the red roof. Reroute runoff from the roof away from the lake.

MAP POSITION 159

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X			X	X		

Determine past and present septic system use at the white residence with the red roof (and porch facing the lake) and at the gray residence. In particular, check the very healthy area of grass to the north east of this residence (shows up very red on the IR slide). Determine the reason for the brown colored area on the lawn to the south of the white residence.
Investigate the white pipe-like structure on the surface of the lawn to the north and east of the gray residence for its use and potential impact on water quality.
Determine any drainage patterns that carry water directly to the lake.

MAP POSITION 160

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X			X	X		

The heavy growth of submergent vegetation in the northern portion of the bay indicates nutrient loading. Check on runoff patterns from the surrounding agricultural lands and conduct sampling in this area to determine types of nutrients present and in what amounts.
Discuss proper chemical application regarding the bushes growing in the open field. Review proper burning practices.
Determine past and present septic system use at the gray residence, at the white residence and at the brown residence. Discuss proper yard fertilization methods at the white residence. Investigate the need for shoreline stabilization structures along this entire shoreline. Runoff at the brown residence should be routed away from the lake and additional berms installed to absorb runoff from the parking area.

MAP POSITION 161

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X	X		X	X	X	

CONDUCT SAMPLING TO DETERMINE HOW DRAINAGE FROM THE WETLAND IS AFFECTING THIS AREA. SAMPLING WILL HELP TO INDICATE TYPES OF RUNOFF FROM THE ROAD.

Determine past and present septic system use at the white residence on the lake and the white residence on the east side of the road. At the lake residence, reroute runoff from the roof away from the lake, install a nonbiodegradable shore stabilization structure. Determine if fill being placed in the wetland to the north of the cemetary is permitted and mitigated.

MAP POSITION 162

CHEMICAL				PHYSICAL			
1	2	3	4	1	2	3	4
X	X	X		X	X	X	

Investigate the pile of debris located on the south end of the bay near the railroad tracks and determine if clean-up efforts are necessary.

Determine the past and present septic system use at the yellow residence. Determine if a berm to prevent road runoff is necessary. The entire bay is so loaded with organic matter (it's black) that it's difficult to tell where specific loading sites are located. More complicated measures may be necessary to remove the organic material. Determine the purpose of the smaller yellow structure and any impact on the lake. There are garden areas on this peninsula - review types of chemicals being used and drainage patterns for these areas. (This area is more readily seen in Map Position 163.)

MAP POSITION	CHEMICAL				PHYSICAL			
163	1	2	3	4	1	2	3	4
						X		

See comments in Map Position 164. INVESTIGATE POSSIBILITY OF A TOXIC SUBSTANCE I.E., CHLORIDES, ENTERING THE WATER AT THE NARROW END OF THE BAY. NOTICE THE DIFFERENCE IN MACROPHYTE GROWTH AT THAT END OF THE BAY COMPARED TO THE OPENING OF THE BAY (IR SLIDE #163-164).

MAP POSITION	CHEMICAL				PHYSICAL			
164	1	2	3	4	1	2	3	4
						X		

Check on runoff patterns from the garden. Review the use of the small outhouse-like building located behind the yellow garage. Investigate the disturbed area located on the shoreline to the west of the garden.

MAP POSITION	CHEMICAL				PHYSICAL			
165	1	2	3	4	1	2	3	4
	X			X		X		

Discuss the effects of direct runoff from impermeable surfaces and from lawns with these residents - including fertilizers and other lawn chemicals. Review methods for rerouting runoff away from the lake. Work to construct shoreline stabilization structures and berms where there is direct runoff to the lake - such as at the road. Investigate the toxic areas (bare ground) in the yard at the gray roofed residence and at the slope for the railroad tracks.

2. Winter 1993-94
   a. Prepare and present a Watershed Restoration Plan based on this report, groundtruthing information, user perception, water quality assessment, and lake morphometry. The plan will define the specific activities and response mechanisms necessary to manage the lake. The following concerns should be included in the plan:
      1) Keep the lake's environment within the established user perception guidelines.
      2) Stabilize any increased eutrophication of the lake.
      3) Define the procedures and maintenance tasks necessary to accomplish the goals in items one and two immediately above.

4. Summer 1994 - Future
   a. Begin implementation of the management plan.

RECOMMENDATIONS

It is recommended that the Apple River Protection and Rehabilitation District carry out the following activities:

1. Spring/Summer/Fall 1993

   a. Use the ALA report to prioritize the point and non-point sources to be sampled and analyzed. Start a year long baseline water quality assessment of identified point sources. This is accomplished by collecting and analyzing water samples and biological measurements according to a sampling design protocol based on this report. This assessment will provide information concerning the chemical and biological loading characteristics. See map of priority sampling locations. (Use any additional information from past studies that will assist in determining the direction water quality is heading.)

   b. Use the ALA report to prioritize the priority areas to be groundtruthed. Present the slides and analysis to the residents as an educational tool to instruct them on how to use Best Management Practices on their property.

   c. Harvesting aquatic vegetation should continue. No specific mention of harvesting was make in the analysis due to the fact that the District has an existing program. Additional measures should be implemented to monitor for Eurasian Water Milfoil. If found it should be treated immediately and follow-up monitoring should be implemented.

   d. Management efforts should focus on the watershed and sub-watersheds that flow into the lake. Once the drainages have been prioritized, based on the sampling results, it will take a cooperative effort between the District, the DNR and the land owners to develop effective and acceptable projects to reduce sediment and nutrient delivery from the watershed. Possible alternatives include restoring and/or creating wetlands that will trap sediments, with plants that will absorb the nutrients. The image data in this report will be a valuable resource in the planning of these projects.

RECOMMENDATIONS

The Aerial Lake Analysis identifies particular areas of concern which should be investigated. These observed land use practices listed in degree of priority are:

1. Point and nonpoint source runoff of surrounding agricultural lands.

2. Nonpoint runoff of possible toxic substances at Map Postion 1.

3. Nutrient and sediment loading from shoreline erosion.

4. Failing septic systems.

The past and current land use practices by lakeshore owners and land owners within the watershed and near shore area have a direct affect on the eco-systems in the littoral zone.

The practice of maintaining a lawn adjacent to the waters edge should be discouraged. This situation presents an opportunity for lawn fertilizers and chemicals to flow uninterrupted into the lake. Homeowners should work with the DNR/Planning & Zoning to install berms to control runoff from steep hillsides and impervious areas, install riprap to prevent erosion, where appropriate. Ice ridges that may form in the winter should be left intact because they function as a natural berm to prevent yard runoff from directly entering the lake.

Hardwood trees along the perimeter of the lake can result in an accumulation of leaves. As these organic materials decay they release nutrients into the water. Deciduous leaves that fall into the lake can be raked up and disposed of on shore in such a way that they will not affect the lake.

Shoreline stabilization efforts should be approached on an individual basis. Because of the good job many shoreline owners have done in leaving vegetation between their residence and the water's edge the erosion problem appears to be minimal. However at those locations where the vegetation has been removed the shore does exhibit evdence of wasting. Owners should be made aware of this and the effect of additional sediments in the water and encouraged to berm, riprap and most importantly : revegetate. The planting of conifers for controlling aquatic vegetation should be investigated and implemented.

This is not to say that there are not problem areas and we have indicated on the maps and in the analysis where the "hot" spots are regarding septic systems. There is a stretch of shoreline on the northwest portion of the flowage that is first on the priority list for possible sewage system failure. Starting at Map Position 35 and continuing north to Map Position 58 are older cabins, many of which do not have adequate setbacks from the shore.

In the analysis portion of this study note that an asterisk, preceding the septic comment, means that there was no evidence of septic intrusion other than the location of the house and/or the structure's age.

Limiting nutrients from septic systems may have an impact but from the aerial analysis it appears that a larger decrease in nutrients will result from limiting input of sediments and nutrients at the numerous point sources discharging into the lake. There are two locations where the upstream land uses graphically show how the nutrients feed directly into the flowage. (See Map Positions 139 and 149.)

In total there were eleven point sources (including but not limited to ditches and creeks) located on the analyzed shoreline. See Map Positions 4, 6, 26, 30, 38, 60, 99, 106, 139, 145/46, 148/49. Many of these point sources involve a sub-watershed that has agricultural land use. These point sources deserve prompt attention since the image data indicates that they could be contributing high amounts of phosphorus, nitrogen and possibly toxic chemicals. The source in Map Position 139 appears particularly serious and needs immediate attention.

The image data reveals how interralated these upstream areas are to the flowage. It will be important for the District to acquire more data regarding the volume of flow entering the lake, at what times of the year and what types of chemicals and/or sediments are entering the lake year after year from these sources. It appears that the flowage has a very large watershed (land area that drains to the lake) relative to the lake's surface area and volume. It is important that methods of intercepting runoff from the watershed to treat it before it enters the lake be put into place.

Serious non-point sources that warrant prompt attention are the industries located in Amery. The most notable is at the first map position: 1. Agricultural lands can also be a large contributor of toxins.

Other issues that need to be addressed on an individual basis are the residences located within 65 feet of the shoreline, this proximity contributes nitrogen and phosphorus to the lake through runoff from impermeable areas like the roof.

CONCLUSION

Apple River Flowage is located in Lincoln Township of Polk County, Wisconsin. The town of Amery is located on the southern end of the flowage.

Shoreline regulations are administered and enforced by Polk County Planning and Zoning. The flowage is approximately five miles long and covers 634 acres.

The entire flowage would be considered littoral zone, that is, less than 15 feet, except for specific portions of the channel which can be up to 18 feet deep. Shallow water areas will allow for higher light penetration and warmer temperatures. When the nutrients are there to feed plant growth the result is what we have seen along the shoreline of Apple River.

The surrounding topography consists of rolling hills interrupted by level areas and wetlands. There are many inlets which feed the flowage -varying in size from small intermittent drainages to large creeks that, most often, flow year-round. The Apple River empties into the Mississippi River.

Primarily hardwood forest is immediately adjacent to the shoreline (with some conifers mixed in). Agricultural land is in close proximity, with both active farming and retired or converted farmland combined.

The following conclusions are based on the results of the slide analysis, however each slide should be groundtruthed to confirm the findings. The slide analysis will provide a guide to

1. ensure that nothing is overlooked during groundtruthing
2. determine if there are problems which need immediate attention
3. provide an individualized educational tool for each landowner.

It is very clear to even an untrained observer that this water body is highly eutrophic based on the amount of weed growth this early in the season. The presence of organic matter on most of the lakeshore bottom indicates sources of nutrients beyond just septic contamination from the 224 residences on the shore. Even though the shoreline is well developed with homes, many of which looked year-round in nature, the homes have adequate setbacks, there is adequate vegetation between the structures and the shoreline and many of the residences appear to be of newer construction which is an indicator of complying sewage treatment systems. All of those factors are indicators of septic intrusion being a minimal factor in the lake's water quality problems.