A Summary of Findings from a LakeScan™
Guided Survey and analysis of:

Upper Straits Lake

Oakland County, MI

PART 1: GOALS, MANAGEMENT OBJECTIVES, AND METHODS

Submitted by:

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Aquest Corporation

LakeScan™

PREFACE

Lakes are complicated systems. There is no simple way to consider all of the interacting systems within a lake and the impact of watersheds and invasive species invasions on these valuable resources. LakeScan™ is a comprehensive system of analysis that is necessary to properly consider conditions in a lake and make reasonable, scientific and empirically based recommendations for management and improvement of aquatic ecosystems. Persons who are already familiar with the LakeScan™ method may wish to skip to Part 2 since Part 1, the methods and approach sections, are primarily "boilerplate" and do not change from year to year. It is also important to remember that this report is only the "tip of the iceberg". All recommendations are based on the comprehensive record of data that are included in the LakeScan™ annual review document, Part 3. That report contains several hundred histograms and tables and will help the reader to understand the conditions and metrics found in different areas of the lake, at different times, and also provide a comprehensive year to year analysis of all metrics at different lake areas. The LakeScan™ Annual Review is available under separate cover.

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PART 1

BACKGROUND

(Understanding the Project)

Goals, Objectives, Methods, Definitions, and Rationale

INTRODUCTION

How to Read This Report: Lakes are complex, and a wide range of data and analysis are necessary to create an effective lake management plan. Responsible lake management requires in-depth analysis of critical ecosystem functions and proper consideration of appropriate lake systems. Good data supports the selection and application of effective and relevant lake management efforts. Furthermore, LakeScan™ findings are absolutely required to prove that program administrators are acting responsibly and assure the public, stakeholders, and regulatory personnel understand that the program is providing benefits to the lake ecosystem and recreationists. Every LakeScan™ lake is considered from many data sets and perspectives; however, many people are satisfied to read just a review some of these data rather than taking the time to examine the voluminous data that are generated by LakeScan™ studies to support prescriptive lake management plans. Consequently, LakeScan™ reports are now divided into three separate documents – a two-part executive summary and a comprehensive data document. Most people will benefit from reading one or both parts of the executive summary and may wish to go no further.

LakeScan™ project goals and objectives do not change dramatically from year to year. The first part, PART 1. of this executive summary provides an outline of these goals and the rationale for the following data review. Yes, it is mostly boiler plate. Persons who are familiar with this lake and have already studied LakeScan™ reports and are already familiar with the maps, goals, objectives and administration of the program may wish to skip to PART 2. PART 2 provides a summary of the conditions observed during the most recent year and make relevant reference to historical data that is cataloged for each lake. It also provides trend analysis for most measures of lake heath that help to understand the impacts that management has had on the lake system. PART 3. Includes category reviews and a comprehensive and detailed data set. These data are all available separately in an effort to provide reports that are meaningful for the broadest range of readers.

Part 1: Geopolitical, GIS, Goals and Objectives of the Program and Administrative Information.

Part 2: An executive summary of conditions from the most current year of LakeScan™ Analysis and selected references to year to year data.

Part 3: Compiled LakeScan™ observations, metrics, and data analysis.

Most lakes are publicly held resources where improvements may cost thousands to tens of thousands of dollars each year on each lake. Riparian property values also hinge on lake quality and other economic benefits also can be attributed to lakes and the areas that surround them. Program administrators must ensure that lake management programs are rational, effective and that the data generated to support decisions is relevant and directly address obvious impairments. Failure to be transparent and provide adequate information to stakeholders and government regulators increases the level of legal and political liability that is assumed by program administrators and can cause a program to fail. LakeScan™ is currently the only monitoring and management guidance system available that can provide relevant monitoring and reasonable assessments of lake conditions with appropriate area and historical references. LakeScan™ lake management programs are goal-driven, always targeted to appropriate parts of the ecosystem, and generate statistically relevant, and transparent data sets that can be used to compare conditions from moment-to-moment (evaluations), season-to-season, year-to-year, and lake-to-lake. Nothing less can satisfy property owners, stakeholders and regulators and provide the relevant guidance needed to improve aquatic resources.

UPPER STRAITS LAKE MANAGEMENT GOALS AND OBJECTIVES

The Project Goal: This Upper Straits Lake Management Plan is goal driven. The primary goal of this plan is to preserve, protect, and if possible – improve the Upper Straits Lake aquatic ecosystem. This can only be accomplished when critical habitat is protected and when biological diversity and ecosystem stability are enhanced. Lakes that are managed with this goal are best suited for all forms of recreation, fishery production and exhibit superior aesthetic qualities. This goal is the basis for a sustainable management approach that can provide long-term benefits and cost savings for lake communities. Failure to attain this goal can lead to a cascade of conditions and events that make the lake less desirable and infinitely more difficult to manage. Some may believe that the only "good aquatic plant is a dead aquatic plant". However, current technology demands that "bad" aquatic plant growth be controlled and managed, but that "good" aquatic plant growth be supported to avert the development of much more undesirable lake conditions.

The Goal

Because "Without a Defined Target – Lake management will certainly miss the point!"

Job 1: Establish Meaningful, Attainable, Reasonable, and Sustainable Goals, That Can Satisfy Most People Who Enjoy and Use Lakes

The LakeScan™ Standard Goal:

To Preserve, Protect, and if Possible – Improve Aquatic Ecosystem Biological Diversity and System Stability.

"Just killing a nuisance" will certainly backfire – there will always be yet another nuisance. Poorly directed lake management plans worsen conditions. The consequences of killing nuisance organisms without the proper focus on ecosystem health can lead to degraded aquatic ecosystems and undesirable lake conditions and attributes.

LakeScan™ Goals and Measurement

Simply stated, no one knows if you've attained or made progress toward meeting lake management goals unless there are some meaningful measurements of intervention outcomes and long-term monitoring of critical metrics. Meaningful observations take time. The evaluations, comments and recommendations included in this report are not based on a "quick spin around the lake". Observations are compiled in the field with well-defined methods and tools. Subsequent analysis and recommendations are based on specific measures that have been selected to address specific problems and measure success in meeting lake management goals. They are not based on the application of important, but irrelevant analysis of the wrong part of a complex ecosystem. For example, water quality data are not used to inform decisions about weed management and plant community data is not used as the sole source to recommend improvements of lake water quality. Essentially, the LakeScan™ method provides the most appropriate empirical data that is needed to make reasonable management decisions and to evaluate the effectiveness of the overall program. Lake associations, special

assessment districts, and any of the various governmental units that provide the administrative support to any lake management program must have these kinds of data to ensure that their management program is being administered in a responsible and transparent way. The management of publicly held resources that is funded by special tax assessments must be based on relevant data and professional guidance or it will fail responsibly satisfy the public trust and to meet the expectations of stakeholders. Failure to provide these data represent a significant political and fiduciary liability.

Monitoring for Effective Aquatic Resource Management

LakeScan™ management plans are based on "real and relevant numbers". These are critical for effective lake management planning, assessment, and goal setting.

LakeScan™ studies are system based and focus on the individual problems and challenges in each lake. For example, water quality data does not qualify as a basis for weed control. LakeScan™ is the only available system that can provide kind of comprehensive and meaningful data that can serve as a basis for targeted, effective and efficient lake management.

LakeScan™ helps to focus attention on management outcomes (biodiversity, ecosystem stability, low weediness, etc.) and can help to establish realistic user group expectations.

LakeScan™ can help to protect program administrators from legal liabilities associated with management plan development and fiduciary responsibilities. It provides the proof that lake management monies are being managed wisely and demonstrate that administrative bodies are acting responsibly. Everyone wants to be assured that the best technology is being used for each individual lake and that programs are guided by professionals.

LakeScan™ saves money. LakeScan™, goal focused management programs provide a coherent and inclusive approach to resource management. This reduces wasted or misguided efforts that can unnecessarily increase costs.

Critical Elements of the Upper Straits Lake Protection and Improvement Project.

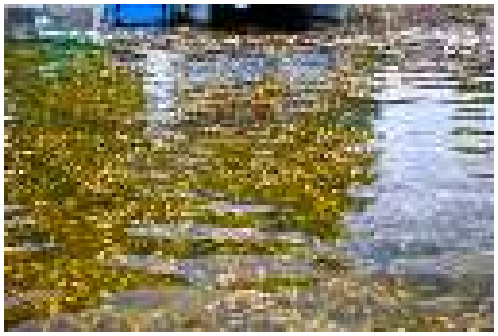
The Selection of Appropriate Metrics for the Upper Straits Lake Monitoring and Management Guidance Project. All lakes are complex and are the sum of several independent but interactive systems. External factors influence these different systems in very different ways. There are a wide range of LakeScan™ monitoring and management guidance methods that can be used to address nearly every one of the subsystems in lake ecosystems. It is helpful if the reader recognizes that lake ecosystems are very much like the human or animal body and the parallels between human and veterinary medicine and lake ecosystem management are can be very helpful. Imagine a person with a brain disorder who is seeking a brain scan but receives a colonoscopy instead. Brain scans and colonoscopies are both extremely important, but it is critical that testing is done in a relevant and responsible manner to preserve the health of the patient and address problems with the "impaired system". This is also true of lakes where it is critical to consider appropriate data to formulate sustainable and

effective management and protection projects. Too often valid, but inappropriate testing is applied to a lake as a means or basis for the development of management project plans. This is a waste of resources and can misinform lake residents and other stakeholders involved in the lake management process. The Upper Straits Lake monitoring and management guidance project is focused on large plant and weed community. No obvious water quality impairments were observed, and this might be expected from a lake of this size and location in the State. The terms “eutrophic, mesotrophic, or oligotrophic” were developed to describe the conditions of the open water systems in lakes and are not applicable as a reasonable assessment of the condition or impairments to the plant community. Fortunately, LakeScan™ Category 700 metrics and methods can be used to evaluate the condition of the plant community system and make reasonable and numbers-based evaluations of the impacts of the management interventions that are applied to the lake.

Aquest recognizes that every lake is different and develops individual management prescriptives each year, for each lake. The monitoring data and management guidance provided in this report are based on real numbers and relevant measurements. Each lake is different, and these data are needed to properly create the management plan, establish annual yearly management objectives and to evaluate the short and long-term impacts of the applied elements of the lake management project for each individual lake. Management guidance and recommendations are not only based on the quality and character of the lake ecosystem, but are also framed in the context of regulatory, lake use, and budget considerations. Upper Straits Lake is a multi-use lake, and this is an important consideration. A goal focused lake management project where diversity and stability are targeted can provide benefits to lake users from anglers to jet skiers, protect the public health and support property values.

LakeScan™ Category 700 Analysis - the Plant Community (System)

LakeScan™ is comprised of various component parts or "Categories" that can be used to analyze everything in a lake from microbes to wildlife. The LakeScan™ method uses 8 different measures of the plant community to determine the condition of this critical part of the lake ecosystem. These measures or metrics are used to characterize the plant community in the entire lake, and they are also used to calculate values for distinct or individual areas in the lake. For example, each metric is calculated for the distinct biological tiers or the distinct plant communities that are present and depend on the distance from the shore. LakeScan™ also identifies different management zones or areas in the lake where different management objectives are applied. And finally, the metrics are calculated for treatment zones and these data area critical to evaluate the impact and consequences of applied management objectives. Each metric can also be applied to different groupings of plant species when they differ in quality or impact on the lake ecosystem. For example; plant community biodiversity is calculated "with weed species" or "without weed species". Research has also revealed that different plant species are found in different lake ecosystems. Ranking scales have been used to describe these different plant qualities and a thorough analysis of these quality differences is also a part of the LakeScan™ system.



LakeScan™ data can be used to compare observations of conditions that are surveyed at different times of the year. They are also used to compare conditions found in the same lake in different years. For example, early and late season plant communities can be very different, and the amount of difference may be significant. Everyone knows that each individual lake can be very different from other lakes, but LakeScan™ data can also be used to compare one lake to another and place these comparisons in reasonable context. The result is that nearly 100 different metric values are calculated for each lake. All of these are considered and reviewed and used to formulate the most appropriate plant community management plan for individual lakes. LakeScan™ is unique because it provides the data necessary to make certain that any management interventions result in no further degradation of the lake ecosystem. A typical LakeScan™ report is over 100 pages, but is presented in an easy to understand, graphical format. Histograms (bar graphs) are used to provide a quick understanding of lake conditions. Readers are encouraged to read the entire annual LakeScan™ report for this and other lakes.

Category 700 LakeScan™ Metrics

Species Richness
(total species present)
Species Percent Occurrence
Predominant Leaf Type
Morphotype Richness
(total morphotypes present)
Biodiversity
Biodiversity of Preferred Species
Morphological Diversity
BioVolume
Weediness of Lake
Perceived Nuisance Levels

Category 700 LakeScan™ Qualifiers

Species Density
Species Distribution
Species Coefficient of Conservatism
Species Assigned Control Target Level

Category 700 LakeScan™ Time and Event

Seasonal Events
Survey Events VS1 to VS6
Treatment Events
Sum Season Surveys and Treatments
Year to Year

Category 700 LakeScan™ Areas

Biological Tier Areas
Usually vary with depth and distance from shore
Management Zones
Where different management objectives are established
Treatment Zones
Areas where different herbicides, herbicide combinations, mechanical controls, physical controls or biological controls are applied

Lake Management Actions and Objectives

"Whatever is done to a lake must be based on clear understanding of the goals and solid and empirical data that is relevant to the problems that have been identified through good monitoring."

Management Planning Benefits

~ Harvesting, Herbicides, Algaecides, Biological Manipulations, Physical and Mechanical Interventions – These are a few of the current lake management tools available to managed lakes. LakeScan™ can help and inform in the selection of the best tool for a given problem.

~ Only LakeScan™ provides the kind of seasonal and yearly data that can truly evaluate the outcome and consequences of Lake Management Program Actions.

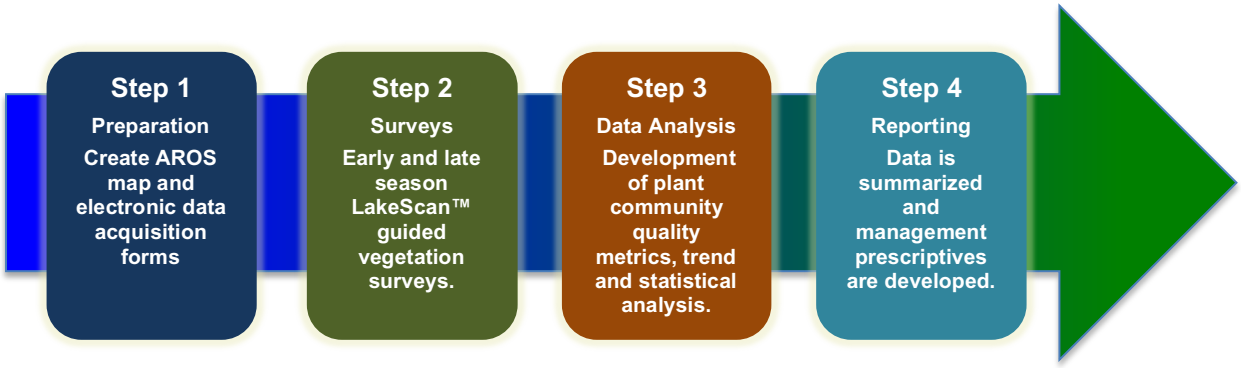
~ Respected LakeScan™ scientists insure access to the latest and best technologies. This approach is critical in the fight against invasive species impacts, toxic bluegreen algae blooms, and issues related to herbicide and harvesting resistance.

METHODS

The LakeScan™ / Aquest Approach

Category 700 Submersed Aquatic Plant Community Monitoring and Analysis

Aquest will employ a four-step approach to understand Upper Straits Lake and provide management guidance.



Step 1: Preparation

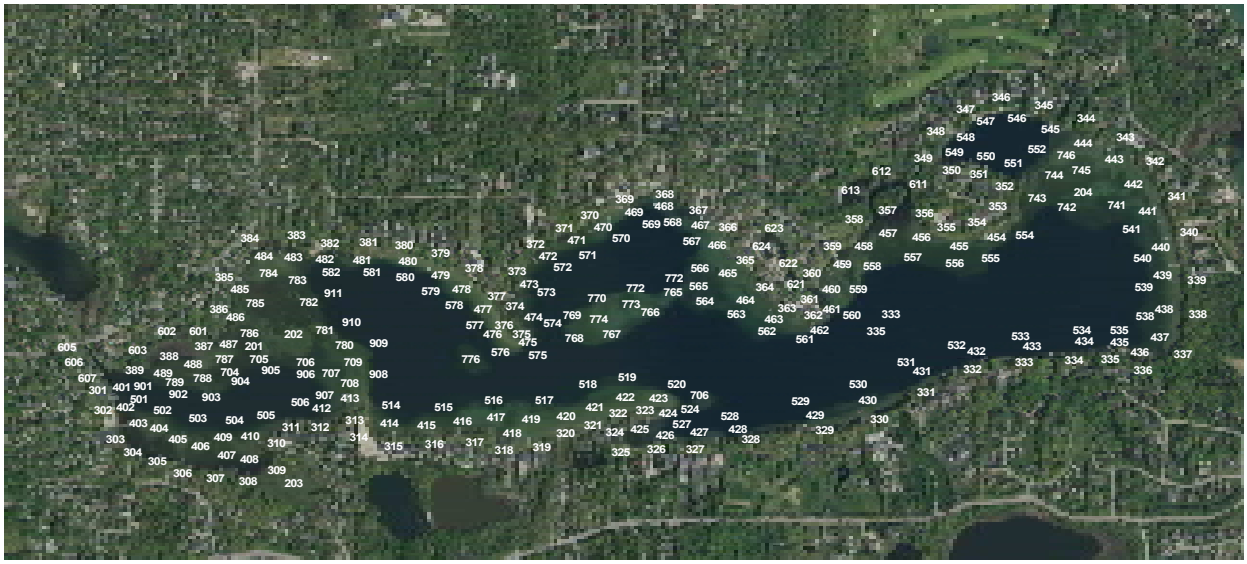
LakeScan™ guided vegetation surveys are based on a system where the lake is divided into observation sites. Each of the Upper Straits Lake aquatic resource observation sites is georeferenced and placed on a map that serves to guide field personnel as they record critical information at each one of these places in the lake. AROS are not randomly scattered, but are purposefully placed to identify distinct biological zones and habitats in the lake. The information collected at each site can be weighted to reflect the size, volume, or relative importance of different areas in a lake. The LakeScan™ guided submersed aquatic vegetation survey is comprehensive.

Step 2: The LakeScan™ Cat 700 Aquatic Vegetation Survey

Field personnel record the density, distribution, and relative position of each aquatic plant species in the water column at each AROS. The perceived nuisance level of each AROS is also recorded and offending plant species are identified. Certain plant species are only present in either the early or late summer. Consequently, two surveys are usually conducted each season to obtain a more complete analysis of the vegetation in the lake. Assessments are made from a boat by visual observations, rake (frodis) toss and plant retrieval, advanced hydroacoustics (sonar), and using an under-water video camera. Each one of these devices and methods seems to reveal a different "picture" and consequently, they are combined to provide proper assessment of the plant community. Data are recorded on a tablet computer and are sent to the "cloud" immediately at the end of the survey.

AROS

An AROS (Aquatic Resource Observation Site) is merely a point location in a lake, pond, reservoir, or running water resource. These points are assigned a number and are often georeferenced. Various observations can be made at each point site. Areas are often assigned to each AROS, but these might vary with how data is considered at each of the AROS.



Upper Straits Lake LakeScan™ AROS (Aquatic Resource Observation Site) map. Observation data is collected from each AROS. The colored areas represent distinct biological tiers where distinct biological communities are found.

Step 3: LakeScan™ Data Collection and Compilation

AROS Tiers

Aquatic resources support a variety of distinct habitats that vary according to depth distance from the shore. AROS are grouped in distinct tiers labeled from 1 to 8.

Tier 3	**Near shore**
Tier 4	**Just off shore but distinct from Tier 3**
Tier 5	**The "drop off" zone where depth descends quickly to the bottom of the lake.**
Tier 6	**Narrow channels where there is little flow and the area is similar from shore to shore.**
Tier 7	**Submerged "off shore islands".**
Tier 8	**Flowing water where plants lay over because of consistent flow.**

Aquest will utilize LakeScan™ metrics and analysis tools to develop a complete and comprehensive – numbers-based analysis of lake conditions. These values and metrics will be used to characterize the special characteristics of the different vegetation tiers (i.e. near-shore, off-shore, drop offs, submerged islands) and in areas of the lake where different management objectives might be applied according to perceived need, shoreline development, and regulations. The AROS in treatment zones can be aggregated to provide appropriate analysis of the impacts of management interventions applied to each area. The perceived nuisance level of each AROS is also recorded and these can be used to understand variations in nuisance conditions from early to late season and from year to year. Responsible lake management demands much more than a mere summary of the percent occurrence of plants scattered around a lake and maps that depict the location of those plants at a single date or point in time. Management projects that are based on these scant data are conducted more like an aimless game of "Whack a Mole". Established goals, realistic and relevant data collection, numerical analysis, and the expert interpretation of those data are necessary to develop proper lake management plans. Lake associations, special assessment districts, townships, towns, and counties must have these kind of data to demonstrate due diligence and the appropriate stewardship of assessed dollars.

Why is Monitoring So Important?

Accountability, Liability, Compliance, and Cost

Most lakes are public resources being shared by multiple individuals and stakeholder groups. Unlike a individually owned, private pond, commonly held aquatic resources require competent, relevant, and independent management guidance. An independent lake management consultant is necessary for numerous reasons. 1. Monitoring by a professional and independent lake management consultant provides access to the broadest range of lake management technologies. The aquatic resource will be managed better where there is no conflict of interest. 2. Monitoring is necessary to reduce the public perception issues and the legal and fiduciary liabilities that are assumed by those who are paid and who volunteer to oversee lake management programs. 3. Regulators are too often perceived as "the enemy". However, regulators are frequently required to prove that the management programs that they permit do no harm to the environment. When these data do not exist, there is little any regulator can do to justify what some may perceive to be controversial management actions. Changes in permitting requirements on a Federal level will certainly demand compliance with more rigorous monitoring programs as a conditions of permit issuance. 4. An independent lake management consultant brings a perspective that is not encumbered by conflicts of interest. Proper monitoring, by a lake management consultant that is not tied to an application company or management contractor can reduce cost by being free to detect failed management outcomes and ensuring that only the most necessary management objectives are applied each year.

Performance

LakeScan™ licensed independent lake management consultants are not directly affiliated with any company or corporation that manufactures or applies any of the herbicides, mechanical devices, or systems that are used to management aquatic nuisance conditions. An independent consultant can provide unbiased guidance to design the best lake improvement projects that provide the greatest benefits to the lake ecosystem and for those that use and appreciate these valuable aquatic resources.

Administration Responsibility and Liabilities

Many states provide statutory authority to establish various governmental mechanisms for the governance and administration of programs intended to protect and potentially improve lakes and other water resources. Surprisingly, these programs were often conducted without any formal measurement of success or ancillary consequences. Large sums of public monies can be spent with no reasonable measure of the "health of the ecosystem". Most everyone in America is very aware of how people on both sides of the political spectrum are unified in their desire and demand for greater accountability from the public official who oversee and administer a broad range of programs. Project outcomes are as important in aquatic ecosystem management as are health outcomes in human and veterinary science. Imagine how ridiculous it would be to visit your physician with a persistent abdominal problem and he or she responds with only a prescription and does not perform a thorough examination or even ask pertinent questions. Sadly, this has been the state of water resource management for decades. When sampling is done, it is often focused on improper or irrelevant measures. All too often traditional water quality measures are provided as "substantiating data" to support weed control programs even if these data are as relevant as a brain scan may be to gastrointestinal illness. Occasionally the percent occurrence of plant species is presented with some relative measure of density. But, these data cannot provide a meaningful measure of lake health. People have the right to neglect their personal health - as unwise as that might be. But those who administer publically funded programs have a responsibility to those who are assessed and that everything is being done to ensure that project outcomes are being adequately and reasonably assessed. Failure to provide professional guidance for the management of a publically held resource significantly increases the legal and fiscal liability of the public and private officials that administer lake improvement programs.

Regulatory Requirements

Recent changes in aquatic herbicide application permitting systems acknowledge the critical need for professional, third party assessment of aquatic ecosystems and management outcomes. Regulators are exposed to the same labilities as lake improvement program administrators (even volunteers) when they appropriate funds for programs where there is no oversight or reasonable measure of success. There are new federal mandates (NPDES) that are now being applied to lake management programs throughout the U.S. that require that monitoring be a part of any management program. It will no longer be possible to base most lake management programs program on simplistic anecdotal comments about lake condition. Most lakes will be required to provide some cursory measures of success and responsible program management. It has been said that the LakeScan™ program should be applied to every lake; but the program is still in development and not ready to roll out to all but a select group of lakes. Fortunately, Upper Straits Lake is one of those lake and administrators, stakeholders, volunteers, lake association members, and even regulators can all be assured that everything is being done to satisfy the most stringent regulatory legal requirements associated with an effective lake management program.

Fiscal Responsibility

Not only does monitoring measure responsible program management, but it can also be used to ensure that a lake is managed in an ecologically responsible manner. This can save money. Often, monitoring "pays for itself" with the cost savings that occur because of judicious monitoring and data analysis. A properly managed lake becomes more stable and stability helps to reduce the cost of management. It's certainly a lot more than "go out and kill the weeds". Residents of Upper Straits Lake should be proud that they have also been distinguish as one of the first LakeScan Lakes in America and already can meet the requirements of the regulatory community. Furthermore, the data provided in these reports are a testament to the generally effective management program that has been founded on empirical and reliable data.

Step 4: Records and Reporting

Empirical data is critical to create effective lake management plans. Imagine an office visit where the physician simply looked at your throat, eyes, and in your ears and proclaimed that you needed surgery. No blood sample, no blood pressure monitoring, no data from x-ray images, no comparisons to prior health data – that simply doesn't make any sense. Too often lake management programs are similarly based on simplistic observations, scant data, and simplistic maps that cannot be reviewed in historical or regional perspectives. A quick observational tour of a lake can help to resolve some specific and immediate problems and questions, but cannot be used to evaluate the impacts of long-term, year-after-year, management plans. Maps can be used to illustrate a "point", but cannot generate the kind of numerical rigor that is necessary for administrative bodies and government units to demonstrate that they are doing their "due diligence". Sometimes a listing of species present and relative proportions of species at a few randomly selected sites along randomly placed transects in a lake are used to evaluate lakes in a similar manner to the way that some studies are done in terrestrial ecology. However, these methods do not apply to aquatic ecosystems because they fail to recognize how aquatic plants grow in aquatic ecosystems where critical habitats can change quickly on a relatively small spatial scale. LakeScan™ metrics can be used to effectively meet these challenges because they can be applied to unique areas of the lake, such as critical nearshore areas or areas of the lake where the depth drops off steeply. The diversity of plant communities is believed to a key determinant of ecosystem stability. But, realistic planning and evaluation cannot be reasonably accomplished without empirical data that is based on rigorous sampling and analysis and that is tailored to the specific characteristics of aquatic ecosystems. These data are presented in LakeScan™ reports and can be used to determine if lake management goals are being approached and if the objectives of the program are helping to meet those goals.

AROS MZL

Different areas of a lake require different management objectives. A "varied approach is required to protect ecosystem stability and to satisfy State and Federal regulations.

MZL 1	**Highly targeted and selective plant management. Only the most invasive species will be managed in these areas.**
MZL 2	**Highly targeted management but some non-target impacts are acceptable if the impact is short-lived and there is rapid recovery of non-target plants.**
MZL 3	**Limited broad spectrum plant control. Some species may not drop from the water column, even though they show signs of injury.**
MZL 4	**No "holds barred" management of swimming areas and around boat moorings.**


Weedy American Pondweed

The reader is referred to Part 2 of the LakeScan Executive Summary to view an over view of the critical metrics that have been used to establish yearly management objectives.

Category 100

Location and Geo Information

100/100.120 Location

State:	Michigan
County:	Oakland
Township:	West Bloomfield
Township/Range:	T2N, R9E
Section:	11,12,13,14
Geo Location:	N 42.5913, W -83.3384
Elevation (feet above mean sea level):	930

100/120.210 Basic Morphometry

Total Area (Acres):	323
Maximum Depth (Feet):	95
Mean Depth Feet):	18
Total Lake Volume (Acre Feet):	16,670
Shoreline Length (Feet):	23,510
Littoral Zone Depth (Feet):	15
Littoral Zone Area (Acres):	89
Littoral Zone Mean Depth (Feet):	4
Littoral Zone Volume (Acre Feet):	367
Hydraylic Residence Time:	

100/110.110 Watershed Factors

Tributaries:	Influent stream on noth end from lake from canal area.
	Several Storm Drains
Outlet Type:	Covered Weir to Orchard Lake
Diffuse Connections:	Mixed wetland/residential
Undeveloped and Diffuse Shore Length (Feet):	1,329
Commercial and Communal Shore Length (Feet):	4,216
Developed Shoreline Length (Feet):	17,966
Undeveloped and Diffuse Shoreline (%):	6%
Percent Commercial or Communal Shoreline (%):	18%
Percent Developed Shoreline (%):	76%

Category 100

Aquatic Resource Observation Site (AROS) Data

100/100.200 Monitoring and Data Analysis

Aquatic Resource Observation Sites (AROS) **Tier and MZL Assignments:**

AROS TIER ASSIGNMENTS	AROS Numbers		AROS Acres	
Total Tier AROS:	**292**		**105**	
	#	**%**	**acre**	**%**
Total Tier 1 AROS				
Total Tier 2 AROS				
Total Tier 3 AROS	79	27%	57	54%
Total Tier 4 AROS	63	22%	5	5%
Total Tier 5 AROS	13	4%	1	1%
Total Tier 6 AROS	33	11%	2	2%
Total Tier 7 AROS				
Total Tier 8 AROS	11	4%	1	1%

Total AROS Acres: 0.36 Acre/AROS
Percent Total AROS Area and Whole Lake Area: 33% Total Lake Acres

AROS MANAGEMENT ZONE LEVEL (MZL) ASSIGNMENTS	AROS Numbers		AROS Acres	
Total MZL AROS (including MZL 0):	**292**		**105**	
Total Managed MZL AROS (MZL 1 to 4):	**259**		**87**	
	#	**%**	**acre**	**%**
Total MLZ 0 AROS:	33	11%	18	17%
Total MLZ 1 AROS:	101	35%	19	18%
Total MLZ 2 AROS:				
Total MLZ 3 AROS:	158	54%	68	65%
Total MLZ 4 AROS:				

% Total Managed MZL AROS: 83% Of Total AROS Acres
% Total Managed MZL AROS Acres in Whole Lake: 27% Of Total Lake Acres

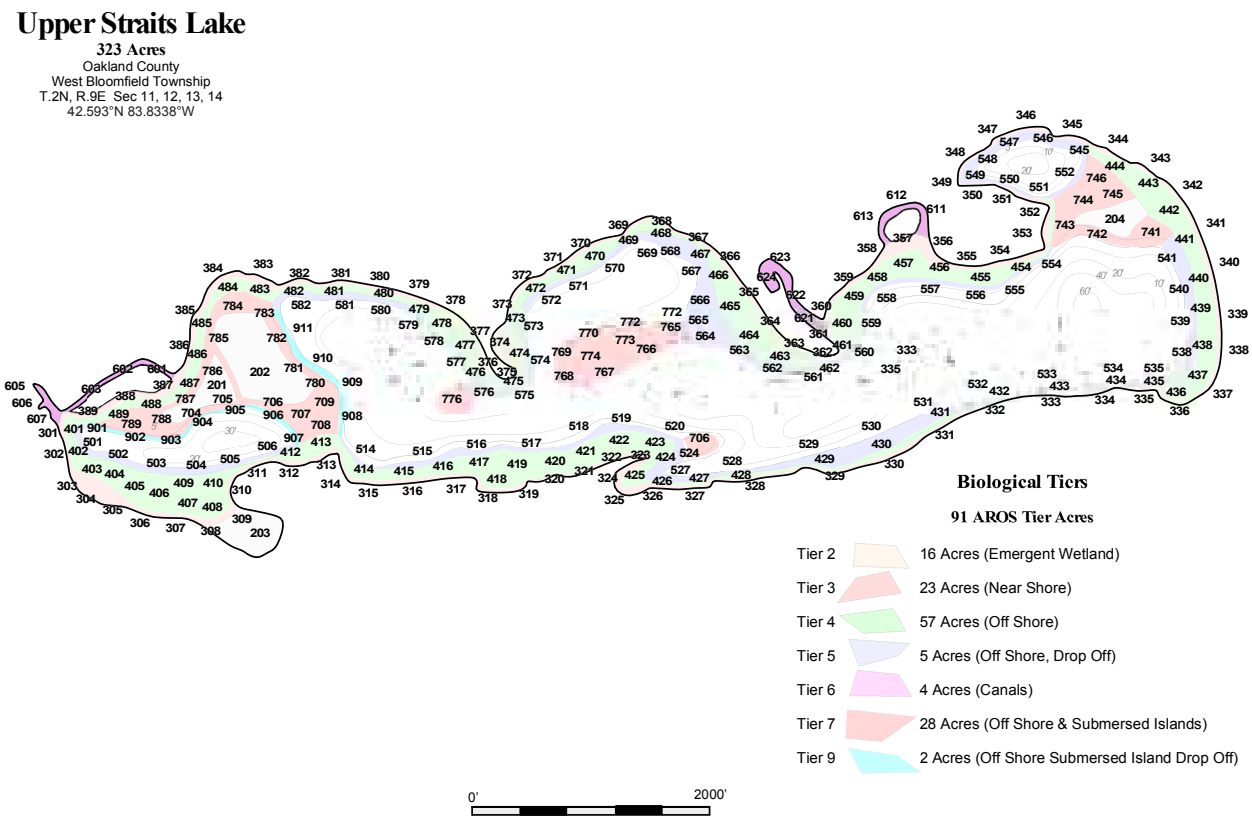
Category 1000

Management History and Authorities

Management Authority:	Lake Association
Contact:	Doug Cooper
Address:	
Telephone:	
Email:	
Web Page:	http://www.upperstraitscleanlake.org
Year SAD Established:	
Total SAD Units:	
Lake Management Guidance Consultant:	Aquest Corporation
Contact:	Dr. G. Douglas Pullman
Address:	12030 Stone Brook Cove Alpharetta, GA 30009
Telephone:	810-516-6830
Email:	aquest@mac.com
Web Page:	
Herbicide Application Contractor:	
Contact:	Aquatic Services, Inc.
Address:	Mr. Jeff Knox P.O Box 647 8249 Ridge Road
Telephone:	Goodrich, MI 48438
Email:	810-636-3303
Web Page:	jlknox50@gmail.com
Mechanical Improvements Contractor:	Huron Lakes Weed Control, LLC
Contact:	Mr. Bill Tupper
Address:	11865 Durston Pickney, MI 48169
Telephone:	734-878-9960
Email:	
Web Page:	huronlakesweedcontrol.com

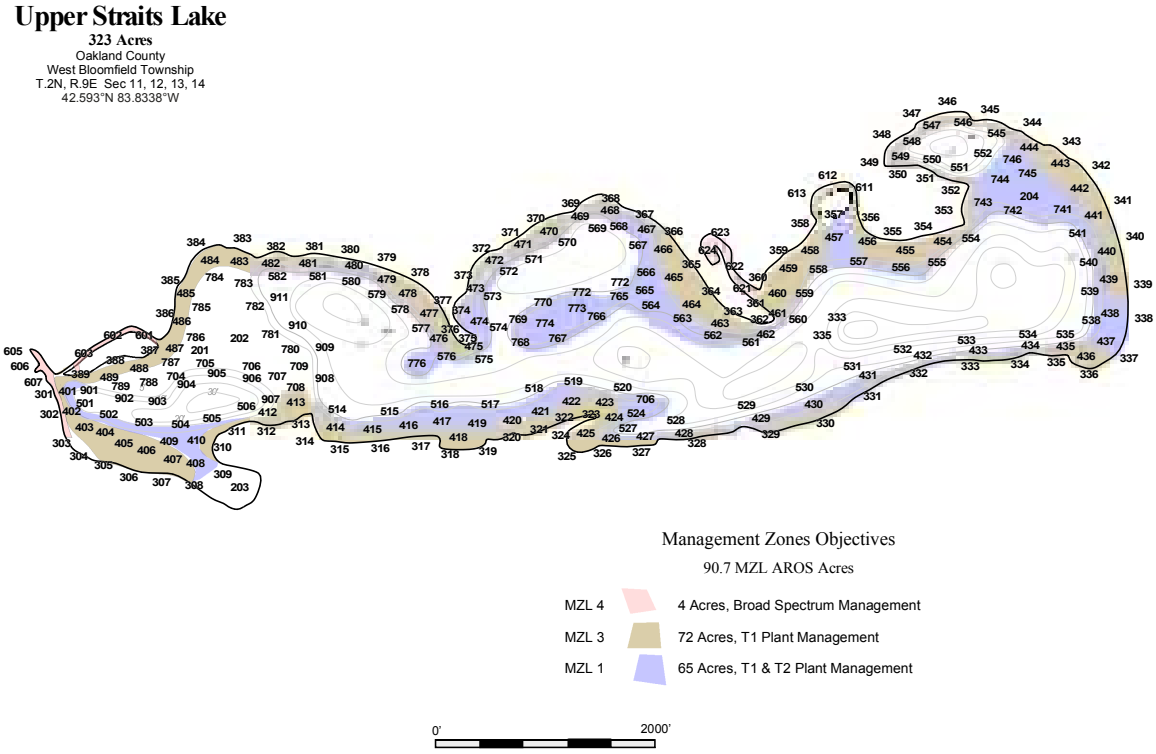
Management History

Years of Professional Management Guidance:	Since 2013
Lake Management Consultant:	Aquest Corporation, (since 2013)
Herbicide Application Contractor:	Aquatic Services, Inc. (since2013)
Years of LakeScan Analysis:	2014 to present
First Year of Monitoring Program:	2013



Upper Straits Lake Biological Tier Map

Upper Straits Lake LakeScan™ AROS (Aquatic Resource Observation Site) map. Observation data is collected from each AROS. The colored areas represent distinct biological tiers where different biological communities and critical habitat are found. The characteristics of each biological zone often correspond with the depth of the area and proximity to shore.



Upper Straits Lake Management Zone Priority Level

Upper Straits Lake LakeScan™ MZL map where the colors designate the differing management objectives that are typically assigned to different areas of the lake. Observation data is collected from each AROS. The colored areas represent distinct biological tiers where different biological communities and critical habitat are found. MZL 3 are areas where more a more aggressive management approach may be taken. Only the most species selective management objectives are assigned to MZL 2.