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UPPER LONG LAKE CANAL DREDGING

ENGINEERING EVALUATION AND ASSESSMENT

Long Lake Shores Association Canal

**Section 7, Bloomfield Township &
Section 12 West Bloomfield Township
Oakland County, Michigan**

**Prepared For The:
Charter Township of Bloomfield
Lake Board for Upper Long Lake
Long Lake Shores Association
Long Lake Shores Canal Owners Committee**

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Table of Contents

Chapter 1	Introduction.....	1-1
Chapter 2	Project Location.....	2-1
Chapter 3	Short Term Corrective Action Plan	3-1
Chapter 4	Feasibility.....	4-1
	Current Conditions	4-1
	Project Warrants	4-4
	Minimum Requirements	4-5
	Necessity	4-6
	Dredging Ability	4-6
	General Restrictions	4-7
	Environmental Impacts	4-10
	Residential Impacts	4-12
	Viability	4-14
	Schedule	4-14
	Feasibility Summary	4-15
Chapter 5	Upper Long Lake Impacts	5-1
Chapter 6	Implementation Recommendations	6-1
Chapter 7	Estimates of Project Costs	7-1
Chapter 8	Special Assessment Considerations.....	8-1
Chapter 9	Cost Analysis	9-1
Chapter 10	Summary	10-1
	Appendices A thru K	A-1

Chapter 1 - Introduction

The Charter Township of Bloomfield in conjunction with the Lake Board for Upper Long Lake, the Long Lake Shores Association, and the Long Lake Shores Canal Owners Committee authorized Hubbell, Roth, and Clark, Inc. (HRC) to prepare this Engineering Evaluation and Assessment of the proposed dredging of the Long Lake Shores Association Canal located on Upper Long Lake in Bloomfield and West Bloomfield Townships. The specifics of HRC's scope of services were outlined in our proposal dated July 26, 2005, approved by the Lake Board, and signed by the Township Supervisor on October 14, 2005. During the preparation of this report, input was received from the Lake Board Attorney, Township Officials, the Township Engineer, and the Township Assessor.

Part 309 of Public Act (PA) 451 of 1994, as amended, "Inland Lake Improvements of the Natural Resources and Environmental Protection Act", governs lake improvements such as the proposed canal dredging and sets forth the preliminary engineering investigation requirements.

An excerpt of Part 309, Section 30909 states:

- (1) The lake board shall retain a licensed professional engineer to prepare an engineering feasibility report, an economic study report, and an estimate of cost. The report shall include, when applicable, recommendations for normal lake levels and the methods for maintaining those levels.
- (2) The engineering feasibility report shall include the methods proposed to implement the recommended improvements, such as dredging, removal, disposal, and disposal areas for undesirable materials from the lake. The report shall include an investigation of the groundwater conditions and possible effects on lake levels from removal of bottom

materials. A study of existing nutrients and an estimate of possible future conditions shall be included. Estimate of costs of right-of-way shall be included.

(3) The estimate of cost prepared under subsection (1) shall show probable assessments for the project. The economic report shall analyze the existing local tax structure and the effects of the proposed assessments on the local units of government involved. A copy of the report shall be furnished to each member of the lake board.

The following report is issued in accordance with Part 309 of PA 451 and our proposal for Professional Engineering Services dated July 26, 2005.

A short version of Part 309 of PA 451 is included as Appendix A.

A copy of our proposal for Professional Engineering Services is attached as Appendix B.

Chapter 2 - Project Location

The Long Lake Shores Association canal is located in the Long Lake Shores Subdivision(s) lying in Section 7, Bloomfield Township and Section 12, West Bloomfield Township, Oakland County, Michigan. More specifically, the canal is located on the south side of Upper Long Lake, east of Middlebelt Road and north of Long Lake Road. The canal is bordered by homes that front Long Lake Shore Drive, Century Oak Lane, and Bayou Drive.

A location map is attached as Appendix C.

The Subdivision Plats are attached as Appendix D.

Chapter 3 - Project Background

Natural or manmade canal systems are common on the larger lakes around southeast Michigan, specifically in Oakland County where “all sport” lakes are abundant. These canals expand the riparian rights to the associated lake through the adjacent land areas. Thus, these areas become more desirable and profitable for residential development boasting lake frontage or lake access. Most of these canals are now situated within developed and mature subdivisions.

Over time, the canals gradually begin to fill in and lose navigational cross section. The primary causes of this are:

- Erosion from adjacent properties
- Sediment loading from construction sites
- Dirt and dust wash off from roads
- Decomposing leaf litter
- Illegal dumping
- Natural vegetative encroachment
- Stream bank sloughing
- Propeller wash and erosion
- Wind and water erosion

Due to these activities, the use, enjoyment, and benefit (property market value) of the canal diminishes. The impacted property owners often seek canal dredging as a means to restore their riparian rights. However, the Michigan Department of Environmental Quality (MDEQ) no longer permits the dredging of lake bottom lands to create new navigational waterways. Therefore, the dredging of any canal is typically regulated to the restoration of the pre-existing cross section and depth through the limited removal of the sediment that has accumulated in the canal. In addition, vegetative overgrowth may now be determined to be regulated under the

State's wetland definition. Dredging in wetland areas, whether pre-existing or naturally created over recent years, is generally prohibited.

Due to the potential project costs, inability to form a consensus among property owners, complexities of the permit process, and/or inexperience with construction projects, property owners who desire to dredge their canals seek assistance from their local municipality, Lake Board/Association, or Subdivision Association. These governing bodies usually have the mechanism to assist in a project of this nature and more importantly, the authority to spread the associated costs across the benefiting property owners in some equitable fashion. In the case of the Long Lake Shores Association canal, a legally established Lake Board appears to have jurisdiction in this matter.

In this circumstance, the Long Lake Shores Canal Owners Committee has spent a considerable amount of time investigating the potential to dredge the Long Lake Shores Association canal before they brought this matter to the Lake Board and the respective Townships. From our involvement with this project in the past, as Bloomfield Township's engineering consultant, and from a review of the project documentation provided by the Committee, it appears as though the Committee has gone so far as to obtain quotes from contractors to complete a canal dredging project (Appendix E). In addition, a Michigan Department of Environmental Quality (MDEQ) permit for dredging 14,778 cubic yards of material was obtained in the name of the Association (Appendix F). This permit has since been transferred into the Township's name and the expiration date extended. Finally, the Committee has had some discussions with the owner of the island property in the center of the canal regarding its potential use as the location for the

disposal of the dredge spoils. While the specifics of any agreement with this property owner appear to lack definition and specifics, approval to use the island as a disposal site has been granted by the MDEQ.

For the Lake Board to move this project forward and eventually levy assessments to fund the project, an Engineering Evaluation and Assessment is required as provided herein.

Chapter 4 - Feasibility

Current Conditions

Representatives from our office have visited the canal site on several occasions to evaluate the current conditions of the canal, island, and shoreline. In general, the canal appears to be in good condition from an aesthetic perspective. The shoreline of the canal adjacent to the existing homes has been improved for almost all of the length of the canal. Some residents have installed plastic, timber, or steel sheet piling walls, others have poured concrete seawalls, and a few have built break walls out of modular retaining wall blocks, broken concrete, or larger rocks. Some of the seawalls appear to be in disrepair or are falling into the canal. This could be due to the poor stability of the underlying soils or in the case of the steel sheet piling walls, from corrosion due to increased oxidation as a result of fluctuating lake levels compounded by the salt-like corrosion effects of copper sulfate weed treatments performed in the lake. The rear yards of the homes on the canal consist of predominately manicured lawn areas to the edge of the canal or to the seawalls.

It appears many of the residents leave their docks, boat hoists, personal watercraft floats, and boats in the canal over the winter months. Others have already removed these items and are storing them in their backyards. Most of the residents have installed a pump system to draw canal water for lawn irrigation purposes. Of the pumps we noticed, all had been winterized and the intake lines removed from the canal. It is likely there are other systems that are not in the open or have intakes that are not visible. At the end of the canal, the residents have installed a small aerator in the center of the canal in an attempt to reduce the problems associated with stagnant water.

There is one road crossing over the canal for Long Lake Shores Drive. The bridge has a center support pier which splits the canal width in half. The northwestern side appears to be the dominant channel and the main route for ingress and egress between the canal and the lake. The horizontal clearance on this side of the bridge is approximately 23 feet. The total canal width is about 40 feet at the bridge. The distance from the lowest cross beam on the bridge to the current water level is only 6.5 feet (an additional support beam makes this even less for a portion of this crossing). The water depth, at the bridge, ranges from about two to three feet. In the bridge area, public water main and sanitary sewers cross the canal. Additional private utilities such as aerial or buried electric, gas, cable, telephone, etc. may also be present. Based on the record drawings and some preliminary survey work, it appears that the sanitary sewer casing pipe is less than two feet below the current canal bottom. It should be assumed that the water main is at a similar depth.

During our site visit, samples of the canal bottom sediment were visually inspected. The material throughout the canal was found to be dark brown to black in color, very sticky, and organic in nature. This is consistent with the sediment found in most canals. The color and texture suggest that the material is formed primarily by the natural decay of vegetative material such as leaves, branches, and fallen trees which supplement the fine silty sediment that washes into the canal. Some of the canal bottom materials were sandy in nature but these soils were found along the shoreline and suggest either homeowners had placed this soil for a beachfront effect, or it had washed into the canal from adjacent homes during construction, improvements, or landscaping operations.

The canal width varies but averages 35-40 feet wide and is approximately 3,700 feet long from the lake to the dead end portion which extends into West Bloomfield Township including the canal branch around the island. The canal centerline channel averages over four feet in depth before noticeable sediment accumulation and consolidation is present, except from the bridge to lake where the water is shallower. Also, at the upper end of the canal in West Bloomfield Township, the water becomes shallower, likely due to low flows, lack of circulation, and the normal migration of soils to the end of the canal. The canal appears to have a normal curved cross section with the water depth averaging two to three feet on the property sides of the canal and transitioning into the island on that side of the canal as shown in Appendix G.

Based on the water marks on the existing seawalls and docks and from insight provided by a few residents on the lake, the water level is currently lower than normal by eight to ten inches (8"-10"). We will use the normal water elevation watermarks as a reference elevation when discussing all proposed dredging depths and clearances. We found the depth of sediment in the canal from the normal water surface to the bottom of the sediment varied between five feet and ten feet. Please note that our survey rod could not penetrate the sediment much deeper than ten feet and in most circumstances the sediment consistency prohibited us from probing further, although additional dredge depth would likely be possible.

There are three improved boat launch sites on the lake, one of which is located within the project limits. The launch site within the project limits is one of the platted lots of the subdivision, is relatively small, and could be of some use as a staging/dewatering area. The dredge will have to be launched from this site to dredge the canal inside of the bridge.

To dredge from the bridge to the lake, the dredge equipment will likely have to be launched from elsewhere on the lake as access under the bridge is limited and crane assisted launching from the bridge itself may be difficult due to overhead electric lines.

The large island/outlot shoreline has dense vegetation up to the canal edge. However, there is not much growth into the canal or new wetlands forming around the island perimeter. The undergrowth on the island is very dense and restricts access even on foot. Our limited visual inspection revealed that much of the island is only one to two feet above the normal water elevation. Wet zones, consistent with emergent, forested, or scrub-shrub wetlands, are located throughout the island. The largest trees on the island appear stressed and most are dead or dying.

Project Warrants

Typically, dredging is proposed to restore a canal cross section to its historic dimensions when the sediment accumulation reaches a point where it obstructs the normal use of watercraft on the canal. This typically means dredging becomes an issue when the water depths through the center channel are three feet or less and the canal edge depths, where boats are docked, are less than two to three feet. As mentioned previously, most of the canal center channel is deeper than three feet. However, there are areas, specifically from the bridge to the lake and near the upper end of the canal, that meet these criteria. In addition, there are isolated areas where the canal edges are quite shallow restricting the use of these areas for normal pass through boating or for docking watercraft. It would appear from probing the canal bottom, that dredging is warranted to restore the navigational dimensions of the canal.

In addition to the dimensional warrants as discussed above, canal dredging is warranted when the perceived market value of the homes on the canal or of those homes who use the canal for lake access, declines or remains stagnant due to the conditions of the canal. Residents will propose to dredge the canal when they consider the diminished cross section or access to be such that their property's market value or ability to sell their lake front or lake access property is impacted. This consideration has more to do with the current housing market conditions and people's perceptions of the canal than engineering criteria. Based on the interest shown thus far and the amount of work previously done for this project, it appears that some residents on this canal feel that the current canal situation warrants dredging.

Minimum Requirements

Based on our experience and dredging equipment limitations, we would recommend a dredged cross section as shown in Appendix H. The center channel should be dredged to provide a minimum water depth of eight feet from the normal water elevation. Please note that in some areas, the historic canal bottom (hard pan) is shallower than this. In these instances, we would recommend only dredging down to this soil stratum regardless of the shallower depth. Going below this elevation will be very difficult from a dredging standpoint and will become cost prohibitive. Similarly, where utility conflicts exist, a shallower dredge depth may be required. Due to the nature of hydraulic dredge operations and equipment, the proposed cross section is stepped from the center channel up to the shore lines. We would propose a five foot depth to within five feet of any seawalls or shoreline structures. Once the dredging stops and normal use

of the canal resumes, natural slumping will occur and the stepped cross section will gradually transform back into the typically curved section (Appendix I).

Necessity

While the normal use and enjoyment of the canal is not obstructed at the present time, it appears that it is somewhat hindered. Based on the above discussion, it is our opinion that there is a need to dredge the entire canal within the next five (5) years. At minimum, we would recommend that the canal be dredged from the bridge out to the lake in the very near future (within two years). Dredging the remaining areas of the canal at the same time is the most cost effective and reasonable approach given annual increases in construction costs and potential economy of scale savings, and will provide many years of unhindered canal use.

Dredging Ability

There are two primary methods to dredge a canal, mechanical and hydraulic. Mechanical dredging uses normal excavation equipment located on the shoreline or on barges in the canal to dig the sediment out of the canal. The wet spoils are then placed on the barge or deposited on the adjacent upland shore areas. Due to the clearance under the bridge, limited launch facilities, and restricted site access behind the homes, mechanical dredging would have numerous logistical problems and is not considered cost effective.

Hydraulic dredging equipment utilizes a cutter head that breaks through the sediment and suspends the soils into the water column where they are vacuumed through a large pumping system. The sediment laden water is then pumped through a network of pipes floating in the

canal to the disposal area. Filter bags at the outlet pipe are the most common way to collect the sediment and release the water back into the canal. Earthen embankment or impoundment areas are another way to dewater the dredged slurry.

Based on our canal survey, the sediment composition, and the canal layout, this project is ideal for hydraulic dredging which is the most practical method to use.

General Restrictions

All dredging projects rely heavily on the availability of staging, dewatering, and disposal sites. The launch area would be the obvious staging area available to the contractor. There has also been much talk in the past about using the island as the dewatering and disposal site.

From the equipment storage and staging perspective the launch area would be suitable for use during this project. For staging purposes, the contractor would likely place an equipment or tool storage trailer on-site and stockpile pipes, pipe fittings, filter bags, etc. The contractor may want to temporarily fence this area to secure their construction items.

As mentioned above, there have been previous discussions with the property owner of the island outlot. In fact, the MDEQ approved permit is for the use of the island for the dewatering and disposal of the dredge spoils. Our office exchanged brief voicemails and e-mails with the property owner discussing this project and the use of the island for this purpose. The property owner's comments/requirements from previous correspondence and our recent limited discussions may be summarized as follows:

- The island must be restored to its original condition, specifically replacing any removed trees.
- Geo bags or geo tarps must be used to build a containment area.
- The Association must assume liability for the project
- The island owner's property(ies) will not be included in any Special Assessment.

Our office has independently evaluated the possibility of the island as a disposal site and we do not recommend its use, even if the property owner's terms are agreeable. The island vegetation is very dense, making access for dewatering and disposal very difficult. The contractor would have to somehow bring clearing and grading equipment over to the island, which would have to be smaller than normally utilized due to the wet ground conditions on the island. To provide a dewatering/disposal area, all of the trees and brush would need to be removed in a relatively large area (over one acre) and then replaced as mentioned in the island owner's requirements. Just clearing a landing/access point on the island would involve hand clearing and grading that would be very expensive. Also, due to the island hydrology, if the dredged soils were to become saturated soon after dewatering and grading, they could give off a noxious odor.

It is our opinion that the dewatering and disposal of the dredged sediment would substantially disrupt the island and permanently alter the island's natural ecosystem including the regulated floodplain that overlays the entire island. From a project logistics, cost, and environmental standpoint, the island is not the best option for sediment dewatering and disposal.

Further, to dispose of dredged materials in upland areas such as the island, the MDEQ typically requires this material to be tested for contaminants. While the permit does not specifically reference this, we feel it will still be required. It is assumed, from past experience, that most lake or canal bottom dredged materials are somewhat contaminated. Therefore, in accordance with MDEQ's policies, the dredge material will have to be tested and if contaminants are identified, deed restrictions will have to be put in place over the disposal area to restrict future development over the spoils and use of the island. This is a burdensome requirement for the property owner.

It is our opinion the island is not a viable dewatering and disposal location. Therefore, the launch site becomes the only practical property for dewatering the spoils for eventual disposal off-site, likely at a Type II landfill. The square footage of area available at this site is very restrictive. An area of less than 100 feet by 100 feet exists without the removal of site trees and bushes. To utilize this area, multiple project stages will be required. The dredging operation will consist of multiple cycles of dredging, dewatering, transportation off site, and preparation for the next cycle. This will be very time consuming for the remobilization efforts of the contractor. However, this remobilization expense would be less than the estimated costs associated with permanent disposal on the island.

This project is also restricted by the potential limitations to hydraulic dredging under and near the existing bridge. First, the existing bridge may be difficult to dredge under and still protect the structural integrity of the bridge foundations. Detailed analysis of the existing structure will be part of the future engineering tasks for this project. However, it is our preliminary opinion

that any significant spoil removal could affect the integrity of the bridge foundations and supports. Second, the stream channel through the bridge appears to have been armored with broken concrete or large rocks making dredging more difficult. Third, the existing sewer and water main crossings appear to be in very close proximity to the existing canal bottom. No dredging operations may occur in close proximity to these facilities and relocating the utilities is not practical. Fourth, standard hydraulic dredging equipment may not fit under the existing bridge. Therefore, dredging under the bridge may not be feasible without bringing in additional equipment at an added cost and the dredge will have to be launched from elsewhere on the lake to dredge the section between the bridge and the lake. These conditions may likely result in a reduced dredged cross section or special construction techniques to improve the canal cross section near the bridge. This area may remain the restriction for access and use of the canal. We would also recommend that only the northwestern portion of the bridge crossing be improved and the other side be posted "No Access" due to the rock material in the canal, canal alignment through this section of the crossing, and the geometry of the nearby concrete seawalls.

In addition, a sanitary sewer runs behind the homes on the north side of the canal and an SBC cable runs under the canal near the canal terminus in West Bloomfield Township. The sewer may be in close proximity to the edge of the canal. The SBC cable may be near the current bottom of the canal. Proper clearances and considerations for the stability of these facilities must also be made part of the project specifications

Environmental Impacts

This project could have several significant environmental impacts, including;

- The existing project documentation does not include any soil testing results. Should contaminants be found in the sediment to be dredged, the requirements, provisions, and restrictions for the disposal of this material increase dramatically. Stirring this sediment up during the dredging process should not create any long term environmental issues. In the short term, the sediment suspended in the water column may impact water quality by possibly releasing nutrients or decreasing the water's dissolved oxygen and the turbidity will affect the canal appearance for several weeks. Any contaminants in the soil left on the island or other nearby disposal site must be dealt with appropriately.
- Based on the known utility locations around the canal, utility conflicts should be minimal except at the bridge crossing in relation to the sanitary sewers or water main and possibly near the SBC utility crossing. Occasionally, unmapped or undisclosed utilities are found in close proximity to the dredging operations. These utilities must be protected and may result in a less than desirable cross section being created at these locations. These areas should be identified and warning signs installed accordingly.
- Dredged spoils are typically high in organic material. Therefore, during the dredging and dewatering process, this soil material may give off a noxious odor. However, we would propose to use geotextile filter bags to dewater the spoils in lieu of an open air containment area. Filter bags significantly reduce any odors that exist during dewatering.
- The shoreline of the outlot/island is densely vegetated and the root structure serves to naturally stabilize the existing banks. The dredging operations would not directly impact

any of the shore line vegetation. However, small sections of the shoreline may slump off as the sediment left in the canal settles into the channel after the dredging is completed.

- The outer canal edge is generally residential lawn area, dock, seawall, rock lined or typical lake shore. The dredging operations would not directly impact any of the shoreline features. However, small sections of the shoreline may slump off as the sediment left in the canal settles into the channel affecting these features.
- Dredging operations will temporarily disrupt the aquatic vegetation, fisheries, and wildlife living in the canal. However, they typically rebound very quickly once dredging is completed or the dredging operation moves to another portion of the canal.

Residential Impacts

If this project is to proceed, the residents along the canal and those residents with launch and use rights on the canal will be impacted in several ways. These include:

- During construction, residents will be subjected to the noise, inconvenience, dust, etc. that is normally associated with a construction project. These nuisances will be the most noticeable during the removal of the dewatered sediment if an on-site disposal area is not available (as believed to be the case).
- Whether this project is hydraulically or mechanically dredged, the contractor's equipment, piping, sediment control measures, etc. will be in the canal. Therefore, during the dredging operations, the residents will experience the loss of their boating access on a temporary basis.
- To adequately dredge the canal and provide the recommended cross section, the contractor must be given the proper working space. Thus, we would recommend that all

removable docks, watercraft, boat hoists, irrigation pumps, aerators, etc. be removed for the duration of the construction project.

- To dredge the canal to the recommended cross section, the dredging operation may be in close proximity to existing seawalls or permanent docks. The soil against the seawall or near the dock foundations may be removed or slough off into the new deeper center channel. This could affect the stability of these structures. The contractor, Lake Board, Townships, or the engineer will not be held responsible should this occur and will not pay for any repairs.
- The riparian rights of the canal front owners or those with deeded access and use rights should not be impacted by the proposed project. The dredging project will not create any new canal frontage or provide access for any property that does not already have this right through deed restrictions or private agreements with the Subdivision Association. Further, any minor sloughing or bank failures should not extend into the adjacent properties and should not result in a loss of usable property.
- It appears from the Plat that the properties that front on the canal and the outlot island actually own to the center of the canal. However, access rights to the canal are present in the subdivision(s) Declaration(s) of Restrictions. The Subdivision Association By-Laws also indicate that the canal frontage properties can act to improve, maintain, and protect the canal. Generally, the dredging operations will stay within the current canal limits. Based on this information, our knowledge of riparian laws, and Part 309 of PA 451, the Lake Board appears to have the authority to enter on to the canal front properties to perform the proposed activities. However, a legal opinion may be required regarding this matter and permission may be requested from the affected property

owners prior to the start of construction to enter upon their property. The remaining easement and property rights will not be affected by the proposed dredging property.

Viability

Based on the above comments, the proposed canal dredging project is viable. However, consideration must be given to the restrictions and impacts the construction will cause.

Schedule

Special Assessment projects through Lake Boards typically involve a lengthy process. In this circumstance, the process is further complicated by the MDEQ permitting process and restrictions. The following is a list of the process steps in accordance with Part 309 of PA 451 and Township requirements, milestone tasks, and anticipated project timing:

<u>Step, Task, or Milestone (Part 309 reference)*</u>	<u>Anticipated Timing</u>
Engineering Evaluation and Assessment Complete (324.30909).....	February 2006
Public Information Meeting on Engineering Study	March 2006
Schedule and Notice the Public Hearing of Practicability (324.30910)	March 2006
Public Hearing of Practicability (324.30910)	April 2006
<i>Lake Board Decision to Move Forward</i>	April 2006
Engineering and Permitting	April - August 2006
Bidding.....	August 2006
Schedule and Notice the Public Hearing on Assessment Roll (324.30913)	August 2006
Public Hearing on Assessment Roll (324.30913).....	September 2006

Lake Board Decision to Move Forward September 2006
Construction ** Fall 2006 – Summer 2007

* Please note that this schedule is heavily dependant on the Lake Board Approval Process and Public Hearings occurring in a prompt and timely manner.

** Also, during construction boating access will be restricted and all boats, hoists, floats, irrigation lines, etc. must be removed from the canal for the project duration.

There has been some interest expressed by residents on Upper Long Lake to dredge the other three canals, specifically Mallard Court, Upper Long Lake Estates (ULLE or C-Beach), and the interconnection to Lower Long Lake up to the Upper Long Lake – Lake Board limits. These projects, if they are to occur, are substantially behind the Long Lake Shores Association project in terms of permitting and other necessary approvals. It is doubtful that they will be able to catch up to this project and the Long Lake Shores Association Canal should continue to proceed on its own.

However, in the unlikely event that these projects proceed faster than expected, it may be in the best interest of all parties to merge the projects into one construction project to take advantage of the potential project cost savings realized due to economies of scale. Should this occur, the Lake Board should inform the residents in the Long Lake Shores Association canal project of the changes to the above mentioned process and anticipated schedule.

Feasibility Summary

As with all dredging projects, this project is very complicated and requires consideration of the numerous impacts to the environment and local residents. A properly designed, specified, and administered project will limit most of these impacts. In our opinion, with the proper requirements put in place, this project appears necessary, viable, and feasible.

Chapter 5 - Upper Long Lake Impacts

Part 309 of PA 451 requires the evaluation of possible effects on lake levels from the removal of bottom materials. Further, a study of existing nutrients and an estimate of possible future conditions shall be included in the analysis presented to the Lake Board.

Upper Long Lake has an approximate water surface area of 121 acres at an average depth of ten (10') feet. Ignoring, for a moment, any water inputs to Upper Long Lake, the canal systems, the interconnection to Lower Long Lake, and the fact that many of the area lakes are lower than historical levels, dredging 15,000 cubic yards of solid material would theoretically result in a water level drop of less than one inch. However, given the added volume of water in the various canal systems, the inputs from area drainage facilities or other lakes, the interconnection with Lower Long Lake, and the fact that the dredged material is usually more than 40% water by volume, dredging the Long Lake Shores Association canal will not result in any noticeable drop in water surface elevation in Upper or Lower Long Lake. Any water loss due to the dredging process and water needed to fill the dredged material void would be quickly supplemented by any precipitation, runoff, or by the local groundwater table.

Canal dredging projects may impact adjacent water courses, water bodies, or wetlands if proper soil erosion and sedimentation control measures are not installed or utilized correctly. As with any construction project, the migration of sediment from the construction site can negatively impact downstream properties. First, the dredging operation will stir up the sediment proposed to be dredged. The canal water will temporarily look very murky until the suspended sediment settles out of the water column. Second, as the dredged spoils dewater for transportation off site

or for eventual grading in place, runoff can re-suspend the dredged sediment or may cause erosion and sedimentation of native soil material and transport that sediment back to the canal or downstream lake. Proper soil erosion control measures such as turbidity curtains at the mouth of the canal, silt fence and check dams around the spoil containment areas, and filter bags or geotextile tubes/bags, etc. must be included in any project specifications, installed correctly by the contractor, and adequately maintained throughout the project duration to reduce the downstream sedimentation potential. Furthermore, project performance guarantees must be in place to ensure the contractor fulfills their obligations in this regard.

Our office is not aware of any detailed scientific study on the impacts of canal dredging projects to the long term plant and animal ecosystem in a canal. However, due to the spawning season of the fisheries typically found in Oakland County, dredging operations are not permitted during the spring months. This type of restriction is usually found in the MDEQ permit. The permit already received for the Association's project does not indicate any time frame that dredging is restricted. However, based on previous projects, spring dredging will not be allowed regardless of the permit specifics. In our experience, dredging operations will temporarily disrupt the aquatic vegetation, fisheries, and wildlife living in the canal. However, they typically rebound very quickly once dredging is completed or the operation moves to another portion of the canal. Submergent plant life growing in the canal bottom material to be dredged will be removed with the dredged spoils. Due to the seed stock that is present in the underlying soils and in the water, these plant species should return quickly.

Water flowing into the canal from point and non-point sources, storm runoff, on adjacent properties is typically nutrient rich. Dredging the canal will not correct this situation. However, nutrients such as phosphorus and nitrogen typically bind to soil particles found in the canal bottom. These nutrients promote weed and plant growth in the lake which may then require weed harvesting or chemical treatment. Removing the existing sediment in the canal will remove much of the accumulated canal bottom nutrients. In addition, dredging this material will create capacity within the canal for sediment to precipitate out of the water column before flowing into the lake. Finally, by protecting any existing wetland areas during dredging, which act as nutrient uptake areas, the project will improve the current nutrient loading in Upper Long Lake.

It may be in the Lake Board's or Subdivision Association's best interest to inventory and monitor the point source inputs to the canal to determine a base line assessment of the nutrient loading into the canal, and thus the lake. The Lake Board or Subdivision Association should also consider fertilizer regulations for adjacent lawn areas to reduce the nutrient load in the canal and lake.

Chapter 6 - Recommendations

Throughout the previous project discussion, we have identified most of our recommendations should this project proceed forward. These recommendations as well as some additional thoughts are presented in summary form as follows:

- Hydraulic dredging is recommended based on the canal survey performed by this office, the sediment composition, and the canal layout. Geotextile filter bags should be used at the hydraulic dredge discharge point for a variety of reasons.
- We would recommend a dredged cross section as shown in Appendix H. The center channel should be dredged to provide a minimum water depth of eight feet.
- In some areas, the historic canal bottom (hard pan) is less than eight feet. In these instances, we would recommend only dredging down to this soil stratum regardless of the more shallow depth.
- We would propose a five foot dredge depth to within five feet of any seawalls or shoreline structures.
- A reduced dredged cross section or special construction techniques are recommended to improve the canal cross section near the bridge. Dredging under the bridge may not be feasible due to the bridge foundations and existing public utilities.
- We also recommend that only the northwestern side of the bridge crossing be improved and the other side be posted “No Access”.
- It is our opinion that the dewatering and disposal of the dredged sediment would substantially disrupt the island and permanently alter the island’s natural ecosystem.

From a project logistics, cost, and environmental standpoint, the island is not the best option for sediment dewatering and disposal.

- The launch site should be utilized as a staging area for the contractor's operations and a dewatering area for the eventual hauling and disposal of the dredged materials off-site.
- The dredging and dewatering process will have to be completed in cycles because space is severely limited at the launch site.
- We recommend looking for an MDEQ suitable off-site disposal area. However, for cost estimating purposes, we have assumed disposal at a Type II landfill.
- Considering the proposed cross section, it appears that the dredge volume indicated in the MDEQ permit, 14,778 cubic yards, was a close estimate. For cost estimating purposes, we have assumed a total dredge volume to be 18,000 cubic yards to: (1) be conservative, (2) include the added material found at the mouth of the canal, and (3) cover any inconsistencies in the existing canal bottom profile not found in our preliminary field investigation.
- We recommend that all removable docks, watercraft, boat hoists, irrigation pumps, aerators, etc. be removed from the canal for the duration of the construction project.
- The contractor, Lake Board, Townships, or the engineer will not be held responsible for any damage to or settlement in any of the existing seawalls and will not pay for any repairs.

Chapter 7 - Estimates of Project Costs

UPPER LONG LAKE CANAL DREDGING

Engineering Evaluation and Assessment
 Long Lake Shores Association Canal
 Preliminary Estimate of Project Costs

<u>No.</u>	<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Unit Cost</u>	<u>Total Cost</u>
1	Mobilization	6	ea @	\$ 5,000.00 =	\$ 30,000.00
2	Preconstruction Video Survey	1	lsum @	\$ 2,000.00 =	\$ 2,000.00
3	Dewatering Location Preparation	1	lsum @	\$ 7,000.00 =	\$ 7,000.00
4	Soil Erosion & Sedimentation Control	1	lsum @	\$ 6,000.00 =	\$ 6,000.00
5	Filter Bags	1	lsum @	\$ 50,000.00 =	\$ 50,000.00
6	Turbidity Curtain	200	lft @	\$ 10.00 =	\$ 2,000.00
7	Hydraulic Dredging	18,000	cyd @	\$ 14.00 =	\$ 252,000.00
8	Trucking to Type II Landfill	9,000	cyd @	\$ 7.50 =	\$ 67,500.00
9	Type II Landfill Disposal Fees	9,000	cyd @	\$ 7.50 =	\$ 67,500.00
10	Warning Signs	5	ea @	\$ 200.00 =	\$ 1,000.00
11	Restoration of Dewatering Areas	1	lsum @	\$ 15,000.00 =	\$ 15,000.00
	Sub Total - Estimated Construction Costs				\$ 500,000.00
	Engineering Evaluation and Assessment				\$ 3,600.00
	Engineering, Survey, Layout, Administration (~20%)				\$ 100,000.00
	Soil Sampling				\$ 6,400.00
	SAD, Legal, Bonding Expenses (~5%)				\$ 25,000.00
	Contingencies (~10%)				\$ 50,000.00
	TOTAL ESTIMATED PROJECT COSTS				\$ 685,000.00

Chapter 8 - Special Assessment Considerations

Background

It is our understanding that the scope/authority of the current Lake Board is to be amended to include this project and possibly others like it. No new special assessment districts are to be created.

In accordance with Part 309 of PA 451, the Lake Board must make a determination as to the appropriate Special Assessments to be levied on the properties within its current jurisdiction. All properties in the current Lake Board District are included in the Special Assessment District. However, the Lake Board must decide which of these parcels of land and local units will be benefited by this specific improvement of the lake (section 324.30908).

By Part 309, PA 451 definition, “benefit” or “benefits” means advantages resulting from a project to public corporations, the inhabitants of public corporations, the inhabitants of this state, and property within public corporations. Benefit includes benefits that result from elimination of pollution and elimination of flood damage, elimination of water conditions that jeopardize the public health or safety; increase of the value or use of lands and property arising from improving a lake or lakes as a result of the lake project and the improvement or development of a lake for conservation of fish and wildlife and the use, improvement, or development of a lake for fishing, wildlife, boating, swimming, or any other recreational, agricultural, or conservation uses (section 324.30901).

Numerous Michigan Tax Tribunal cases and recent case law provides that for an improvement to have conferred a special benefit upon the properties subject to a special assessment, it must have caused an increase in the market value of the land specially assessed. This assessment must not create a substantial or unreasonable “disproportionality” between the amount assessed and the value that accrues to the land as a result of the improvements.

Therefore, the Lake Board must answer the following questions and be able to defend their answers in the event of a challenge to the Special Assessment:

1. Which properties would be specially benefited by the proposed improvements?
2. To what extent are these properties benefited by the proposed improvements?
3. Is the proposed assessment per unit of benefit reasonably proportionate to the anticipated increase in market value of the property?

HRC’s opinion of the appropriate answers and supporting rationale are hereby presented for the Lake Board’s consideration.

Which properties would be specially benefited by the proposed improvements?

There are no public access points on Upper Long Lake. It is our understanding that the various private boat launch facilities are tightly controlled by Subdivision restrictions and covenants in which the launch/access sites are located. Therefore, the current Lake Board District represents the limits of all properties that may receive a special benefit by a proposed canal dredging project, i.e. there is no at large public benefit to this project.

Therefore, dredging the canal would be advantageous to the following categories of property owners within the established Lake Board District:

1. Canal Front Property Owners (35 lots plus the 2 outlots)
2. All Property Owners that have deeded or purchased launch rights onto this canal including:
 - a. The Long Lake Shores Lake Front Property Owners (21 lots)
 - b. The Long Lake Shores Off Canal/Lake Property Owners (23 lots)
3. The Long Lake Shores Subdivision Association (1 lot)
4. Riparian Right/Privilege Property Owners in general (the entire Lake Board District minus the above properties)

The Declaration of Restrictions recorded against all properties in Long Lake Shores, Long Lake Shores No. 1, and Long Lake Shores No. 2, and the Subdivision Association Bylaws, are clear in that access to the Lake through the canal is restricted to only those property owners residing in the named subdivisions, see Appendix J. Further, under the deed restrictions, the canal or lake front property owners are permitted to launch their watercraft from the dedicated easement shown on the plat but must keep their boats or personal watercraft at their individual properties. The properties not on the canal or lake can apparently launch and use the easement area on a temporary (daily) basis. Thus the property owners consisting of Categories 1, 2a, and 2b (above) have deeded canal access rights and through the Subdivision Association Bylaws have some obligations to maintain the canal. Obviously, these parties should be included in the Special Assessment.

The Subdivision Association owns one of the canal front lots. This lot is the launch facility discussed previously. This lot has been included in previous Lake Board assessed projects, such as the weed harvesting project. Further, we understand that through private agreements, other area subdivisions such as Wabeek or Turtle Lake Farms, have obtained launch rights from the respective Associations with the boat launch ramps. These users must pay annual fees to the respective Subdivision Associations for this right. Therefore, there maybe some logic to include the Subdivision Association lot in the canal dredging special assessment. In the past, we have seen Associations individually assessed a small unit of benefit or more prevalent, the Association contributes a lump sum payment to the project.

Since the residents in the other categories listed above also pay into the Subdivision Association and we are relatively confident that the sale of launch rights is not sufficient to cover the annual costs of an assessment levied onto this property, **we recommend that the Subdivision Association property be excluded from the special assessment roll for this project.** The Subdivision Association can elect to contribute in a lump sum manner at a later date, prior to the roll being set by the Lake Board. The Subdivision Association should consider their fee structure in the context of any contribution to the project.

Typically, Lake Boards which reside over the entire lake or canal contribute to a canal dredging project. Therefore, the riparian owners on the remaining portions of the lake, in effect, contribute to the project. As mentioned previously, there is interest on the other three canals, which evidently provide launch and access points to the lake, to undertake a similar dredging project to the one proposed for Long Lake Shores. Since residents with launch or access rights

on these canals would be similarly assessed in the future, it stands to reason that everyone on the lake would eventually contribute their equitable share to improving their riparian rights. **Therefore, this Special Assessment and any Special Assessment in the future for any of the canal dredging projects on Upper Long Lake should be limited to just those properties that are associated with each of the respective launch/access areas on the canal.**

To what extent are these properties benefited by the proposed improvements?

Canal front property owners - lots 37-61 and 70-80 inclusive (including the Association property) and Outlots A and B

The Long Lake Shores Association Bylaws (Appendix J) places the responsibility of protecting the canal on this group of property owners, identified as Group “B” members. This group may levy assessments upon itself to improve the canal. The other groups, discussed in this section, do not share a similar responsibility via the Bylaws. These properties would receive the most benefit of the various stakeholders as the proposed improvements would be made directly to their properties. *We would recommend these property owners receive a full unit of benefit (1.00) in the assessment calculations.*

As mentioned above, we would recommend excluding the Subdivision Association property from being assessed.

An additional comment is appropriate regarding the island/outlot assessment. Currently this land is considered one property and due to access limitations, the floodplain, and existing

wetlands, likely considered unbuildable. As such, the island (Outlot A) should not be assessed. Outlot B should be assessed and has been included in the previous Lake Board special assessment projects. If the island is found to be buildable and developed during the term of the Special Assessment, then it should be added to the special assessment roll at 1.00 unit of benefit per canal front lot. Similarly, should any other property in the district develop/split into more than one property while the assessment district is still in place, we would recommend that each of the newly created home sites be added to the assessment roll at the same cost as other properties with one (1.00) unit of benefit less any previously paid assessments.

There are a total of 38 properties in this category; 35 properties, 2 outlots, and the Subdivision Association property. As mentioned above, the Subdivision Association property and the island, Outlot A, should not be assigned an assessment for this project leaving 36 assessed properties.

Lake front property owners - lots 12-32 inclusive

These property owners are referred to in the Subdivision Association Bylaws as Group "A". These properties utilize the canal primarily for launching and removing their watercraft seasonally for use on the lake directly from their properties. Group "A" residents are held responsible for the regulation, maintenance, and improvement of the shoreline in front of the lots identified and other such matters as directly and specifically affect their members. Providing for an unobstructed route from the improved boat launch site to their lake front properties would undoubtedly affect/benefit this membership. However, their respective unit of benefit should be less than those property owners on the canal as the actual lake frontage

contributes more to their property value than the canal launch/access. *We would recommend these property owners be assessed 40% of the canal frontage properties or 0.40 units of benefit.*

Please note that there are 21 lots on Upper Long Lake in the Long Lake Shores subdivision(s). However, two of the lots are currently under one ownership and occupied by one residence. Therefore, only 20 properties are assessed in this category. Should this property split back into two properties, while the assessment roll is still in place, we would recommend that each of the newly created home sites be added to the assessment roll at the same cost as other properties with 0.40 unit of benefit, less any previous assessment paid.

Off canal/lake property owners

These properties, Group “C” in the Subdivision Bylaws, are within the subdivision(s) but not physically located on the canal or lake. The canal is their only way into and out of the Lake. It appears that they are only permitted to use the canal on a temporary basis, i.e. launch a watercraft for use that day and remove it that evening. Therefore, canal access is the foundation for their riparian rights and privileges. The Subdivision Bylaws make these property owners responsible for the boat launch lot including the beach and water adjoining the lot. They may levy assessments against themselves to improve the utility of the lot.

Dredging the canal would improve the utility of the boat launch and would provide better access to the canal and lake. Thus their riparian rights, granted by Declaration of Restrictions and Bylaws, would be maintained and improved. This would then equate to a potential increase in

market value. Specifically, these homes could be marketed as lake access properties. In our opinion, this potential increase would be less than the canal front or lake front owners.

We would recommend that these property owners be assessed 20% of the canal frontage properties or 0.20 units of benefit as access to the canal features constitute a significant portion of the market value of their property.

Riparian Right/Privilege Property Owners in general (the entire Lake Board district minus the above properties)

As mentioned above, we would recommend that the riparian owners on the lake, not otherwise described in the other categories above, not be assessed or included in this Special Assessment.

Is the proposed assessment per unit of benefit reasonably proportionate to the increase in market value of the property?

We have prepared a preliminary assessment roll for this project based on the estimated project costs discussed in Chapter 7 and per the Township's direction. A summary of the preliminary Assessment Roll is shown below. Please note that this information is subject to the Lake Board's approval and should only be considered preliminary for the purpose of estimating project costs for this report. The Assessment Roll will be updated with input from the Lake Board prior to moving forward and the final Special Assessment roll will be discussed at the second public hearing.

Based on the total estimated project costs and total units of benefit, the above referenced property owner categories would have the following estimated assessments:

Property Owner Category	Suggested Unit of Benefit	Estimated Assessment	Percentage of Project Costs by Category
Canal Front Property Owners (35 lots + Outlot B)	1.00	\$14,095	74.1%
Lake Front Property Owners (20 lots)	0.40	\$5,638	16.4%
Off Canal/Lake Property Owners (23 lots)	0.20	\$2,819	9.5%
Riparian Right/Privilege Property Owners, Subdivision Association Property, Outlot A (Island)	0.00	\$0.00	0%

From our engineering perspective and considering the higher market value of homes with lake or canal frontage or lake access, these assessments seem reasonable. Conversely, these assessments are minor when compared to the decrease in market value that may occur should the canal become obstructed with sediment and access is no longer available to the canal and lake.

Annual Assessments

The typical canal dredging Special Assessment is established with a 10 year term. Assessed property owners may pay off their assessment, including the principal balance and any accumulated interest, at any time during the Special Assessment without penalty. Using a 10 year term and 6% interest rate, annual payments on the estimated assessments are as follows:

Canal Front Property Owners – Estimated Assessment \$14,095

<u>Year</u>	<u>Principal</u>	<u>Interest</u>	<u>Total Payment</u>	<u>Balance</u>
1	\$1,410	\$0.00	\$1,410.00	\$12,686.00
2	\$1,410	\$761.13	\$2,170.63	\$11,276.00
3	\$1,410	\$676.56	\$2,086.06	\$9,866.50
4	\$1,410	\$591.99	\$2,001.49	\$8,457.00
5	\$1,410	\$507.42	\$1,916.92	\$7,047.50
6	\$1,410	\$422.85	\$1,832.35	\$5,638.00
7	\$1,410	\$338.28	\$1,747.78	\$4,228.50
8	\$1,410	\$253.71	\$1,663.21	\$2,819.00
9	\$1,410	\$169.14	\$1,578.64	\$1,409.50
10	\$1,410	\$84.57	\$1,494.07	\$0.00
TOTALS	\$14,095	\$3,806	\$17,901	

Average Payment - \$1,790.07

Maximum Payment - \$2,170.63

Lake Front Property Owners – Estimated Assessment \$5,638

<u>Year</u>	<u>Principal</u>	<u>Interest</u>	<u>Total Payment</u>	<u>Balance</u>
1	\$564	\$0.00	\$564.00	\$5,074.00
2	\$564	\$304.45	\$868.25	\$4,510.40
3	\$564	\$270.62	\$834.42	\$3,946.60
4	\$564	\$236.80	\$800.60	\$3,382.80
5	\$564	\$202.97	\$766.77	\$2,819.00
6	\$564	\$169.14	\$732.94	\$2,255.20
7	\$564	\$135.31	\$699.11	\$1,691.40
8	\$564	\$101.48	\$665.28	\$1,127.60
9	\$564	\$67.66	\$631.46	\$563.80
10	\$564	\$33.83	\$597.63	\$0.00
TOTALS	\$5,638	\$1,522	\$7,160	

Average Payment - \$716.03

Maximum Payment - \$868.25

Off Canal/Lake Front – Estimated Assessment \$2,819

<u>Year</u>	<u>Principal</u>	<u>Interest</u>	<u>Total Payment</u>	<u>Balance</u>
1	\$282	\$0.00	\$282.00	\$2,537.00
2	\$282	\$152.23	\$434.13	\$2,255.20
3	\$282	\$135.31	\$417.21	\$1,973.30
4	\$282	\$118.40	\$400.30	\$1,691.40
5	\$282	\$101.48	\$383.38	\$1,409.50
6	\$282	\$84.57	\$366.47	\$1,127.60

7	\$282	\$67.66	\$349.56	\$845.70
8	\$282	\$50.74	\$332.64	\$563.80
9	\$282	\$33.83	\$315.73	\$281.90
10	\$282	\$16.91	\$298.81	\$0.00
<hr/>				
TOTAL	\$2,819	\$761	\$3,580	

Average Payment - \$358.01

Maximum Payment - \$434.13

Next Step

After receiving this Engineering Evaluation and Assessment, the Lake Board may proceed as identified in Section 324-30910 of Part 309 of PA 451, which reads:

Within 60 days after his or her receipt of the reports, the chairperson shall hold a meeting of the lake board to review the reports required under section 30909 and to determine the practicability of the project. The hearing shall be public, and notice of the hearing shall be published twice in a newspaper of general circulation in each local unit of government to be affected. The first publication shall be not less than 20 days prior to the time of the hearing. The board shall determine the practicability of the project within 10 days after the hearing unless it is determined at the hearing that more information is needed before the determination can be made. Immediately upon receipt of the additional information, the board shall make its determination.

Chapter 9 - Cost Analysis

The preceding chapters outline the preliminary estimates of project costs and the recommended means to assess the benefiting property owners. The average estimated assessment in the district is approximately \$8,670 without any contribution to the project from the Long Lake Shores Association or the Lake Board. As described herein, the three categories of properties within the subdivision will pay approximately \$14,095, \$5,638, and \$2,819 for the canal dredging project. Based on our past dredging project experience, this is slightly higher than most canal dredging projects. The higher costs may be attributed to the lack of a large staging and dewatering area for the dredging operations which will create multiple stages and mobilizations for the project.

To offset the total project costs, our office explored currently available grant funding opportunities. We found very little or no grant monies available for canal dredging projects. Of the water quality grant programs available, canal dredging would be a stretch to meet the program requirements. In addition, it is our experience that grant applications are expensive to prepare and the selection process is highly competitive and lengthy. Further, administrating the grant is time consuming and costly, thus diminishing the value of the grant. Grant assistance for this project should not be considered viable.

Property value is primarily based on the current housing market conditions. Therefore, it is difficult to estimate the increase in market value that will occur to the properties within the Special Assessment once this project is complete. However, without this project, the canal will continue to fill in and the use of the canal for access to Upper Long Lake will eventually

become more restrictive for the use and enjoyment of the properties on the canal and the remaining properties with access rights. The inability to navigate the canal or to use the canal to access Upper Long Lake will negatively impact the value of all properties within this Special Assessment.

As stated previously herein, it is recommended that, at very least, the canal from the bridge to the lake be dredged in the next two years. Due to mobilization, permitting, and contract administration expenses, it is cost effective to dredge the entire canal at one time instead of delaying the balance of the canal dredging for a few more years. We anticipate that without dredging within five years, other areas of the canal will require dredging to remain viable.

Based on the estimated project costs, weighing these costs against the potential impact to the property values in the district, and impacts to seasonal use and enjoyment of the canal, we believe that this proposed project has a positive cost to benefit ratio. Further, it would be in the residents' best interest to complete the entire project at one time. Construction costs have been increasing an average of approximately five percent (5%) per year. Also, the construction industry is heavily dependant on gas prices. Therefore, we can state with reasonable assurance, based on recent spikes in fuel costs, that from a cost standpoint, it is advantageous to proceed with this project sooner rather than later. Further, if this project could be combined with the other canals on the lake, additional cost savings could be realized due to potential economies of scale.

The Long Lake Shores subdivisions were platted in the late 1950s. We are not sure if any other canal maintenance dredging has occurred since that time. Therefore, we have assumed that the sediment that has accumulated has done so over the past 40+ years. Since construction in the area appears to be minimal and the surrounding areas are developed, it is reasonable to assume that future sediment loading into the canal will be minimal. The residents must be diligent about prohibiting the amount of leaf, tree, and lawn debris that is dumped into the canal. Further, the residents must limit the amount of nutrients from fertilizers and lawn care chemicals that are ultimately discharged to the canal. If these efforts are successful, this dredging project could give the canal another 30-40 years. However, due to wind, water, and boat erosion, we would estimate that the project life span of the proposed dredging will likely be closer to 20-25 years.

Chapter 10 - Summary

HRC has endeavored to discuss all relevant aspects of dredging the Long Lake Shores Association canal so the Lake Board may determine if it is practical to move the project forward and so the affected residents may be informed of the project benefits, restrictions, costs, and the means to implement the project. In summary we have identified the following:

- The navigational dimensions of the canal have become hindered and based on our observations; the canal from the bridge to the lake will need dredging within the next two years. The balance of the canal will need to be dredged within the next five years.
- Based on the canal survey performed by this office, the sediment composition, and the canal layout, hydraulic dredging is viable and recommended.
- It is our opinion that the dewatering and disposal of the dredged sediment would substantially disrupt the island and permanently alter the island's natural ecosystem. From a project logistics, cost, and environmental standpoint, the island is not the best option for sediment dewatering and disposal.
- The launch site should be utilized as a staging area for the contractor's operations and a dewatering area for the eventual hauling and disposal of the dredged materials off-site.
- Dredging of the Long Lake Shores Association canal will have some restrictions.

Specifically;

- A reduced dredged cross section or special construction techniques are recommended to improve the canal cross section near the bridge. Dredging under the bridge may not be feasible.
- We also recommend that only the northwestern side of the bridge crossing be improved and the other side be posted "No Access".

- The dredging and dewatering process will have to be completed in cycles because space is severely limited at the launch site.
- The canal dredging operations may have environmental and residential impacts, such as:
 - In the short term, the sediment suspended in the water column may impact water quality by releasing nutrients and will affect the canal appearance for several weeks. However, stirring this sediment up during the dredging process should not create any long term environmental issues.
 - Based on the known utility locations around the canal, utility conflicts should be minimal, except as noted above at the bridge crossing in relation to the sanitary sewers and water main. These utilities must be protected and may result in a less than desirable cross section being created at these locations.
 - Geotextile filter bags should be specified to mitigate any noxious odors released from the dredging and dewatering operations.
 - The dredging operations would not directly impact any of the shore line vegetation. However, small sections of the shoreline may slump off as the sediment left in the canal settles into the channel after the dredging is completed.
 - Dredging operations will temporarily disrupt the aquatic vegetation, fisheries, and wildlife living in the canal. However, these typically rebound very quickly once dredging is completed or the operation moves to another portion of the canal.
 - During construction residents will be subjected to the noise, inconvenience, dust, etc. that is normally associated with a construction project. These disturbances

will be the most noticeable during the removal of the dewatered sediment if an on-site disposal area is not available, as believed to be the case.

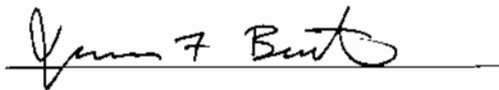
- During the dredging operations, the residents will experience the loss of their boating rights on a temporary basis.
- All removable docks, watercraft, boat hoists, irrigation pumps, aerators, etc. must be removed from the canal for the duration of the construction project.
- The contractor, Lake Board, Townships, or the project engineer will not be held responsible for any seawall or shoreline structures that become unstable due to the removal of the canal sediment near these structures.
- The riparian rights of the canal front owners or those with deeded access and use rights should not be impacted by the proposed project.
- Canal assessments are recommended as follows:
 - The canal front property owners category, made up of the owners of lots 37-61 and 70-80 inclusive and Outlot B, (not including the Subdivision Association property) should receive a full unit of benefit (1.00) in the assessment calculations or an estimated \$14,095.
 - The lake front property owners category, lots 12-32 inclusive, should be assessed 40% of the canal frontage properties or 0.40 units of benefit or an estimated \$5,638.
 - The off canal/lake property owners, those properties that are within the subdivision(s) but not physically located on the canal or lake, should be assessed 20% of the canal frontage properties or 0.20 units of benefit or an estimated \$2,819.

- Outlot A, the island, should not be assessed.
- The Subdivisions Association property should not be included in the Special Assessment. However, the Association should consider contributing to the canal dredging project, if found to be legally appropriate, since the Association collects launch revenue from “third party” subdivision residents.
- We would recommend that the riparian owners on the lake, not otherwise described in the other categories above, not be assessed, included in this Special Assessment, or participate via a contribution from the Lake Board.

HRC does believe that this project is warranted, feasible, viable, and should be given favorable consideration by the Lake Board to move forward. Based on the potential impacts a deficient canal cross section may have on property values for those homes in the district, proper maintenance of the canal, including dredging, should be a priority for the Lake Board, Subdivision Association, and the residents in the Special Assessment.

This report was prepared by:

Hubbell, Roth & Clark, Inc.
James F. Burton, P.E.



Date: 2/27/2006

APPENDIX

<u>Index</u>	<u>Appendix</u>
Part 309 of PA 451.....	A
HRC Proposal for Professional Engineering Services.....	B
Location Map.....	C
Subdivision Plats.....	D
Contractor Quotes.....	E
MDEQ Permit.....	F
Existing Canal Cross Section.....	G
Proposed Canal Cross Section.....	H
Future Canal Cross Section.....	I
Subdivision Deed Restrictions.....	J
Project Photos.....	K