HYDROMETHODS
water resources engineering

Feasibility Study to Address PAH Contamination in Thompson Lake

Submitted to the Lower Mississippi River WMO

February 25, 2014

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1. Executive Summary

Overview

The main goal of this project is to identify feasible approaches to addressing Polycyclic Aromatic Hydrocarbon (PAH) contamination in Thompson Lake, and to provide a recommendation on which option to pursue. Available data from previous studies, relevant stakeholder input, and general information about PAH-contaminated sediment and related subjects were reviewed in order to achieve the project goal. Several management options for addressing the contamination are described below, along with associated benefits and concerns. The recommended option is the installation of a stormwater treatment pond at the inlet of Thompson Lake, with the majority of the sediment plume not being dredged at this time, because the costs and risks of dredging outweigh the potential benefits.

New Findings

While it does build upon previous efforts, the present study is not intended to repeat past work, but rather to bring all relevant information to bear on the development of a practical solution for Thompson Lake. Some of the impactful findings of this study that had not been previously identified are:

- Although PAHs are generally considered a contaminant of concern, the presence of PAH-contaminated sediment at the bottom of Thompson Lake does not necessarily pose a significant risk to human health or the environment if it is left in place; the risks associated with removing the sediment from main part of the Lake may be greater than the risk of leaving it where it is.
- However, if significant dredging is pursued as an option, the Minnesota Pollution Control Agency (MPCA) has agreed to allow disposal of "Management Level 3" sediments in a nearby (non-landfill) location, which could substantially reduce disposal costs for a large dredging project. ("Management Level 3" is a classification indicating that according to MPCA regulations, the sediment would typically need to be disposed of in a Municipal Solid Waste (MSW) landfill with an industrial solid waste management plan.) This would be considered a disposal "pilot project" approved by the MPCA as part of their effort to find cost-feasible ways of managing contaminated sediment.

  However, it must be noted that this approach is unlikely to be pursued for at least two reasons. First, this approach would only be beneficial for a project where a large amount of contaminated sediment is to be dredged and disposed. In this case, we are not recommending dredging of the whole contaminant plume, but rather a smaller amount of sediment (most of it not requiring landfill placement) near the inlet in order to create a pond. Therefore, there is much less incentive to implement a disposal pilot project, because we do not anticipate excessive costs for normal disposal.

  Furthermore, utilizing an alternative site for disposal of Management Level 3 contaminants would require approval by Dakota County, with the disposal site considered a landfill. Based on multiple discussions with County representatives, it is highly unlikely that a pilot project would be approved, even if it were a desirable option.

- A potential approach to in situ remediation of PAH-contaminated sediment has been identified for the site. Specifically, it is suggested that phytoremediation (remediation by plant activity) combined with the addition of selected microbes could be a way to reduce PAH concentrations in the sediment. Although such an approach would be experimental in nature, it does have at least a reasonable chance of success.
- Given that Thompson Lake is a Public Water, it is under the jurisdiction The Minnesota Department of Natural Resources (MDNR). This has significant implications for the potential scope of any sediment removal project (even if such a project were desirable), as MDNR typically would not permit extensive dredging under these circumstances.

  Even for a smaller project, such as a stormwater treatment pond at the inlet, MDNR approval will be necessary and will require some additional effort. Utilizing as much upland as possible, minimizing the distance between the pond inlet and the project extents, and finding ways to address contamination in the watershed will be likely MDNR priorities for a final project.

Section Summaries

Section 2, “Purpose of Study” identifies the project background and goals. Section 3, “Existing Conditions and Studies” defines the problem and describes previous work. Section 4, “Stakeholders and Concerns” identifies key project stakeholders and summarizes the input obtained as part of this study. Section 5, “PAH Literature Review and Research” summarizes the investigation performed to ensure that the latest information is utilized in identifying a solution for Thompson Lake. Section 6, “Governmental Regulations and Resources” identifies applicable regulatory issues as well as potential funding and technical resources. Section 7, “Options and Recommendation” provides a description of potential management strategies along with our recommendation of which approach is likely to work best for this site.

2. Purpose of Study

Overview

As the centerpiece of Thompson County Park, Thompson Lake is an important water body, providing ecological, aesthetic, and recreational benefits to the community. The park is an important local and regional facility, and Thompson Lake provides a connection between residents and area natural resources. The Lake is also the receiving water for a storm sewer network that drains a significant amount of developed area.

As with many other water bodies throughout the Metro Area, previous investigations of Thompson Lake have revealed a significant amount of Polycyclic Aromatic Hydrocarbon (PAH) contamination within the sediment. PAHs are a group of over 100 commonly occurring chemicals that are recognized as being harmful to human health and the environment; many are known or likely carcinogens. In urban environments, some significant sources of PAHs are coal tar based sealants, automobile exhaust, industrial emissions, and petroleum products.

PAH-contaminated sediments have recently gained attention in Minnesota as the MPCA and other agencies determine how best to address them, particularly because it has often been discovered in the course of conducting maintenance for stormwater ponds. Therefore, when PAHs were discovered during a 2008 road improvement project adjacent to Thompson Lake, additional work was put on hold until further investigation could be conducted.

Since that time, additional sampling of sediment and water in Thompson Lake has been done, with results indicating that PAH-contaminated sediment is present not only near the inlet, but across the entire bottom of the Lake. PAH concentrations in various locations around the lake were significantly higher than Management Level 3, meaning the dredged sediments would normally need to be disposed of in a Municipal Solid Waste landfill. This substantially increases the cost relative to the disposal of non-contaminated sediment, which can normally be reused as fill or placed in another suitable location.

The discovery of such extensive contamination throughout Thompson Lake was the driving force behind the present feasibility study. While substantial site data had been gathered throughout the course of previous work, and the extents and severity of PAH contamination had been adequately defined, it was still not clear what approach should be taken to deal with the problem, and how the solution should be crafted in order to address the concerns of the various stakeholders. This feasibility study is meant to resolve those questions.

Key Outcomes

The original Scope of Services for the project outlined an effective path for achieving the goals of the feasibility study, and this report is meant to fulfill that Scope. Key outcomes include:

- Summarize previous work and improve problem definition
- Convene a stakeholder team and identify goals and concerns
- Conduct a literature review and gather latest information on PAH management
- Identify governmental activities, regulations, and resources that affect the issue at hand
- Provide a list of possible solutions along with a recommended option

3. Existing Conditions and Studies

Overview of Site

Thompson Lake is located in West St. Paul, in Thompson County Park, near the intersection of Butler Avenue and Stassen Lane (Figure 1). It is Minnesota Department of Natural Resources (MDNR) Public Water 48W, and is a shallow lake with a maximum depth of approximately 8 feet. The drainage area to the Lake is approximately 175 acres (Figure 2; drainage area outline from 2009 WSB report referenced below). Approximately 105 acres of the drainage area is fully developed residential and commercial land, connected to the lake via a storm sewer that discharges into the inlet area on the north end of the lake. Another approximately 40 acres of drainage area, also connected by pipe to the north inlet area, is the land occupied by St. Croix Lutheran School and surrounding grounds and facilities, along with some developed residential area. The remaining drainage area (approximately 30 acres) includes some of the park facilities, open space, and some contribution from St. Croix Lutheran School facilities, and is connected to the Lake either by direct drainage or by small local drain pipe.

Thompson Lake and Stormwater

Thompson Lake serves as a receiving water and functions as a stormwater treatment pond for the drainage area. However, when considering dredging, it should be noted that Thompson Lake is a natural water body, not a designed stormwater pond. This is significant because much of the impetus for dredging stormwater ponds is the fact that stormwater treatment requires a certain amount of available storage volume, and that many ponds are in need of maintenance dredging. While sediment is accumulating in Thompson Lake, there is not the same need to replace designed storage volume as there would be in a stormwater pond.

The issue of PAH-contaminated sediment has come to the forefront mainly due to maintenance dredging and the resulting exposure of the sediment. The risks posed by PAHs have been identified primarily in the context of dredged materials rather than in-situ sediments. In other words, when agency guidelines state that contaminated sediment must be placed in a landfill, the guidelines are referring to excavated sediment rather than sediment at the bottom of a pond. If there is no driving force to remove the sediment (i.e., no clear need to replace storage volume), then the risks associated with dredged/exposed sediment can also be avoided.

Related Projects and Studies

A number of projects and studies have been conducted in and around Thompson Lake over the past 5 years. In addition to general studies and surveys addressing overall lake/habitat health, specific studies related to PAH contamination have been conducted.

HISTORICAL AND ENVIRONMENTAL REVIEW (MULTIPLE YEARS)

Numerous environmental assessments have been performed at Thompson Lake, for a variety of purposes. While they are important as background information, they address issues that do not directly impact the decision of how best to manage PAH-contaminated sediment. A good summary of these studies is provided in the *Thompson Park Site Contamination Assessment and Water Quality Monitoring Plan* (2009), by EOR, referenced below.

STASSEN LANE RECONSTRUCTION PROJECT (2007-08)

The Stassen Lane Reconstruction Project involved the realignment of Stassen Lane as well as related improvements to local infrastructure. The plan to construct a stormwater treatment pond at the inlet of Thompson Lake was initially part of the Stassen Lane Reconstruction Project. However, PAH contaminated sediment was discovered during site investigations, changing the trajectory of the overall project and requiring further analysis.

THOMPSON LK. STORMWATER IMPROVEMENT & HABITAT RESTOR. PROJ. - FEASIBILITY (2009)

This project feasibility study and draft proposal was developed in 2009 by WSB on behalf of the City of West St. Paul. It is a comprehensive project plan that anticipated construction of a stormwater pond at the inlet, as well as sediment removal and disposal, planting of a native wetland buffer and other native vegetation, and related items. Given that this plan was developed before some of the current information was gathered, there may be some elements that are no longer applicable; however, the proposal contains a substantial amount of valuable information, and to some degree can serve as a conceptual starting point.

THOMPSON PK. SITE CONTAMINATION ASSESS. & WATER QUAL. MONITORING PLAN (2009)

This report by EOR summarized previous studies and included additional sampling and laboratory testing of sediment, as well as water quality testing. The key conclusion of this report was that contamination extends beyond the main sediment delta out into the rest of the Lake, and that stakeholders should be brought together to determine the right management strategy.

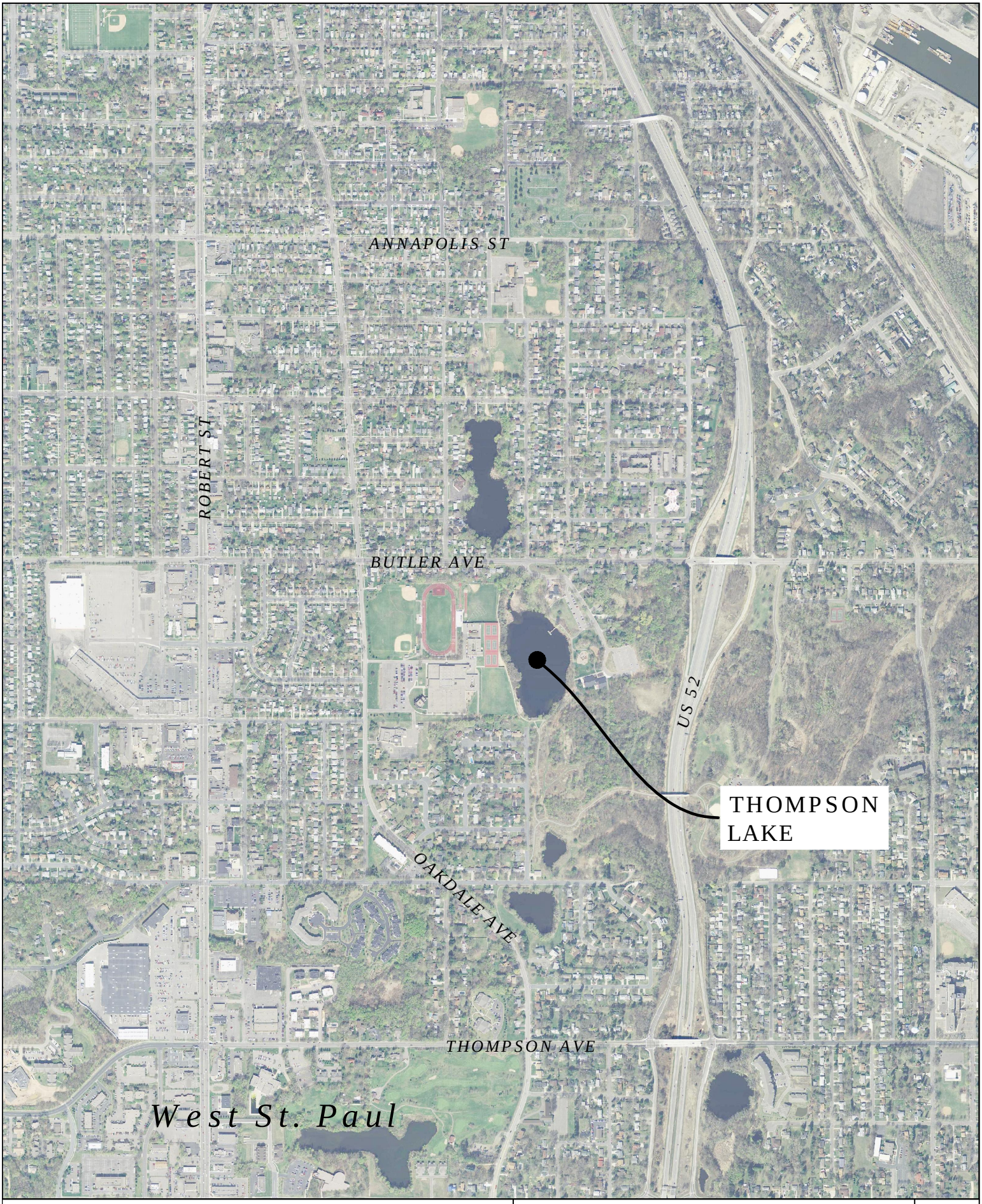
WATERSHED RESTORATION AND PROTECTION STUDY (WRAP) (CURRENT)

Thompson Lake is one of the lakes addressed in the WRAP Study being conducted by the WMO. While the WRAP Study is not focused on PAH contamination, it does share with this study the goal of addressing water quality concerns in Thompson Lake. Notably, both the WRAP Study and this study recommend construction of a storm water treatment pond at the Lake inlet.

Contamination Extents

Requirements for managing contaminated sediments are determined by MPCA standards. There are three Management Levels (1, 2, and 3) corresponding to the Soil Reference Values used to describe the level of PAH contamination. From a cost perspective, the most significant concern is whether the contaminated sediment is at Management Level 3, indicating that it must be disposed of at a Municipal Solid Waste landfill.

The points shown on Figure 3 are the locations where Management Level 3 PAH-contaminated sediments have been found. Sediment samples were collected in 2008-2009, with subsequent monitoring efforts focused on water quality rather than sediment contamination. Due to the strong tendency of PAHs to adsorb to particles, PAH concentrations in the water itself were low, indicating that the contamination is essentially captured within the Lake sediments.



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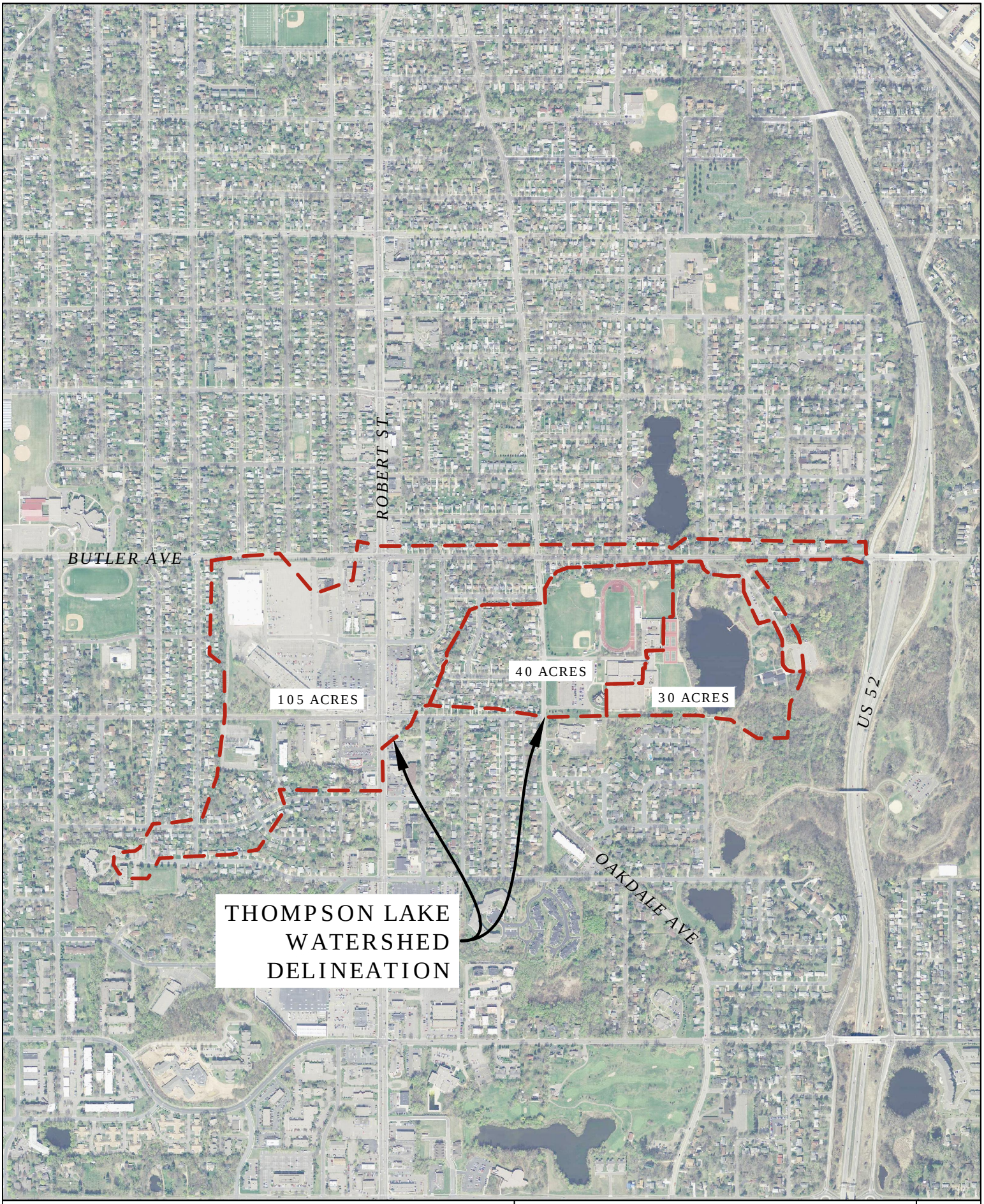
THOMPSON LAKE PAH REMEDIATION STUDY

LOWER MISSISSIPPI RIVER WMO, WEST ST. PAUL, MN

LOCATION MAP

FIGURE 1



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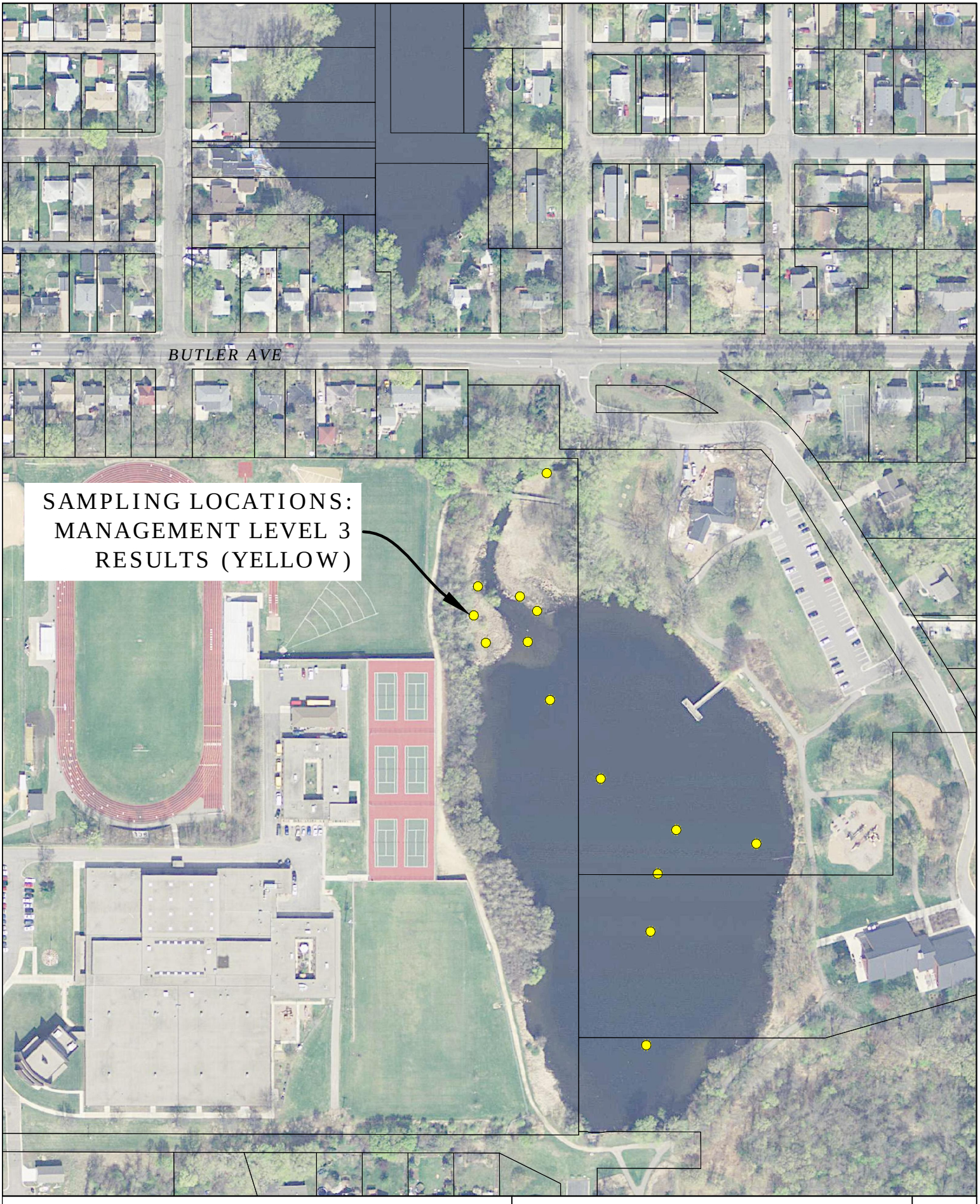
THOMPSON LAKE PAH REMEDIATION STUDY
LOWER MISSISSIPPI RIVER WMO, WEST ST. PAUL, MN

LAKE WATERSHED AREA

FIGURE
2



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THOMPSON LAKE PAH REMEDIATION STUDY

LOWER MISSISSIPPI RIVER WMO, WEST ST. PAUL, MN

SAMPLING LOCATIONS: MANAGEMENT LEVEL 3

FIGURE
3

4. Stakeholders and Concerns

List of Stakeholders

The following table provides a list of the key stakeholder organizations working with the LMRWMO in developing solutions for Thompson Lake, as well as current contact information for correspondence regarding potential projects. As further steps are taken toward a management solution for the Lake, these stakeholders should be kept aware of progress and given the opportunity to provide input where appropriate.

Table 4.1. Stakeholders and Contact Information

Organization	Contact	Title	Email Address
City of West St. Paul	Matt Saam	City Engineer	msaam@cityofwsp.org
Dakota County	Cathy Undem	P.G./Hydrogeologist	cathy.undem@co.dakota.mn.us
St. Croix Lutheran School	Gene Pfiefer	President	gpfeifer@stcroixlutheran.org
MPCA	Donald Berger	Program Administrator	donald.berger@state.mn.us
MDNR	Jennie Skancke	Area Hydrologist	Jennie.Skancke@state.mn.us

Ownership Information

Ownership of Thompson Lake and the surrounding land area is divided between two entities: Dakota County, and the Twin City Lutheran High School Association (site is St. Croix Lutheran School). The City of West St. Paul has drainage infrastructure and local roads that connect to the Thompson Lake area. Figure 3 shows the locations of parcel lines in the vicinity.

Stakeholder Meetings and Input

As part of the present study, two stakeholder meetings were held in order to solicit input, identify concerns, and generally guide project development.

The first stakeholder meeting was held on site on 10/2/2013, and was attended by representatives from the City of West St. Paul, Dakota County, the MPCA, and Hydromethods (as consultant for the LMRWMO). The goals of this initial stakeholder meeting were (1) to provide an opportunity for the parties who will be most heavily invested in the final project – City of West St. Paul, Dakota County – to discuss potential approaches, and (2) to obtain input from MPCA on the possibility of conducting a pilot project at this site, allowing PAH-contaminated sediment to be deposited nearby and covered with unregulated fill, rather than transported to a landfill.

The second stakeholder meeting was held at West St. Paul City Hall on 10/30/2013, and was attended by representatives from the LMRWMO, City of West St. Paul, Dakota County, MPCA, and MDNR. The goal of this broader stakeholder meeting was to provide information about potentially feasible options, and obtain input on organizational goals, specific concerns about any identified options, and clarification of regulatory requirements where applicable. Presentation materials and notes from this meeting are provided in Appendix A.

Additional stakeholder input was gathered throughout the course of the study, with the goal of identifying any potential opportunities or concerns that will need to be addressed as a solution for Thompson Lake is identified. The following table provides a general summary of the key issues identified in the course of the stakeholder input process. This information was used to guide development of other study components, particularly the "Options and Recommendation" section.

Table 4.2 Summary of Stakeholder Input

Issue	Summary of Input/Discussion
PAH contamination extents and risks	• Stakeholders are concerned about the level and extents of contamination. • They would like a better understanding of associated risks to human health and the environment. • They are interested in knowing the sources of contamination and what the options are for reducing concentrations in the future. • They want to know how and to what extent PAHs are transported through the environment and whether or not they break down naturally. • It was noted that Thompson Lake is the key feature of Thompson County Park, and plays a major role in future development of the Park.
Environmental risks associated with dredging	• Stakeholders are concerned about the potential environmental risks associated with dredging sediment. • Some stakeholders expressed concerns about the potential for resuspension of contaminants during dredging operations. • The concern of potentially draining or reducing water levels in the Lake by puncturing a low-permeability bottom layer was mentioned. • Stakeholders raised the concern about PAH contamination leaching out of dredged materials. • Any potential dredging project would need to undergo significant review by the County, MDNR, and other stakeholders.
Potential alternative disposal pilot project	• The MPCA provided input on potential approaches to an alternative disposal pilot project • Following stakeholder meetings and discussion, MPCA approved a pilot project for Thompson Lake if that option is desired. • It was noted that an alternative disposal site would be regulated as a landfill by the County. • It was also noted that it would be difficult if not impossible to obtain County approval for disposal of sediments within Thompson County Park. • This option would be applicable primarily to a larger dredging project where landfill disposal costs are expected to be high.

Issue	Summary of Input/Discussion
Need for stormwater treatment	• Stakeholders universally agreed that treatment of stormwater entering the Lake is necessary. • Several stakeholders indicated that the need for stormwater treatment should be addressed prior to any work on PAH contaminated sediment. • It was noted that the current WRAP study recommends stormwater treatment at the Lake inlet.
Dredging and disposal costs	• It was generally recognized that dredging and disposal of the entire sediment plume would be cost-prohibitive. • There was interest in looking for a less expensive disposal option. • There was discussion about potential grant funding and whether MPCA anticipated having additional funds available for PAH cleanup projects.
Potential in-situ remediation study	• Stakeholders generally recognize the desirability of an in-situ treatment option. • MPCA indicated that no viable in-situ remediation techniques have been found for PAH contamination. • An experimental in-situ remediation project may receive support, depending on project cost and likelihood of success.
Restrictions on work within Public Water	• Thompson Lake is a DNR Public Water and therefore there are restrictions potential projects within the Lake. • MDNR has generally discouraged construction of basins within public waters and considered them to be “creation of upland in public waters”, which is prohibited. • MDNR expressed the importance of doing as much work as possible above the Ordinary High Water (OHW) and upstream in the watershed.
Reducing impacts upstream/in watershed	• Stakeholders generally agreed that it is important to look for ways to reduce contaminant loading from the watershed. • It was pointed out that coal tar based sealants are banned, eliminating a significant source of PAHs. • The Signal Hills shopping center was identified as a potential area where stormwater treatment could be provided. • It was noted that the drainage area is fully developed, reducing the feasibility of adding treatment upstream. • It was noted that St. Croix Lutheran School has taken some steps toward reducing the impacts of stormwater from their site.

5. PAH Literature Review and Research

Goals and Approach

An important goal of this feasibility study was to ensure that the most up-to-date information regarding Polycyclic Aromatic Hydrocarbon (PAH) contaminated sediment is utilized in developing a solution for Thompson Lake. Given that several years have passed since the contamination problem was initially identified and assessed, it was important to take a fresh look at the available literature and research regarding the impacts of PAHs on human and environmental health, as well as the latest information regarding management of PAH-contaminated sediment.

PAHs are extremely common both in nature and as a byproduct of industrial processes, and as a result, there is a great deal of information available about this large group of chemicals. However, in light of the goals of the present study, the focus of the literature review was narrower, specifically addressing PAH-contaminated sediment, and particularly (where possible) the issues associated with PAH contamination in stormwater ponds. An effort was made to find information pertaining to or originating from Minnesota, as well as national studies and projects.

Resources / Bibliography

Appendix B is a bibliography with the key resources that were reviewed and consulted for technical information as part of this study. Numerous other resources are available and can be found through an internet search; many documents contain similar information, particularly with regard to the basic properties of PAHs. Many of the documents listed in the Appendix also have extensive bibliographies of their own, identifying additional sources of relevant information.

Summary and Implications for Thompson Lake

The applicable information gathered through the literature review is reflected throughout this report. Given the wide range of subject matter, an overall summary of the available literature cannot be easily provided; however, the following basic information and key conclusions affecting the Thompson Lake project can be noted:

- Polycyclic Aromatic Hydrocarbons are a specific group of over 100 chemicals, natural and man-made; most are bound to sediment; they are products of incomplete combustion (fossil fuels, forest fires, coal tar, etc.) and are very common in nature and in urban environments.
- Coal tar based sealants are repeatedly identified as a major contributor of PAHs to urban lakes.
- With regard to PAH-contaminated sediment, there is not a significant risk to human health, given the limited exposure pathway and the fact that the PAHs are bound to the sediment.

- According to some resources, PAHs are not known to readily bioaccumulate through the food chain. Organisms dwelling on the lake bottom are the most exposed. No data was found for Minnesota showing detrimental effects on fish.
- There are currently no known cost effective methods for in-situ remediation of PAH-contaminated sediments.

6. Governmental Regulations and Resources

Summary of Agency Requirements

A key element of the stakeholder input gathered during this study was discussion of the regulatory requirements for this specific project. Continued discussion with the agency representatives will be critical as a final management strategy is selected for the Lake, to ensure that any remaining issues are addressed and necessary approvals are obtained.

MPCA

Based on stakeholder discussion, the MPCA is generally supportive of a management project for this location. In addition to its general jurisdiction, the key connection of the MPCA to this project is through the MS4 Permit for the City of West St. Paul. Any project related to Thompson Lake would be reflected in the City's SWPPP which is to be compliant with the MS4 Permit. Also, a Construction Stormwater Permit would be required for any construction project implemented in this location.

MPCA is also in charge of regulating the disposal of dredged materials. As mentioned above, for the Thompson Lake site they have approved a disposal pilot project, where Management Level 3 sediments could be disposed of nearby and covered with unregulated fill. If this option is pursued, further discussion with MPCA would be necessary in order to define project details and reporting requirements.

MDNR

Thompson Lake is a Public Water subject to regulation by the DNR. Generally speaking, the any project taking place in a Public Water requires the Public Waters Work Permit. In some cases, a waiver can be given for work specifically involving the removal of stormwater derived sediment, but there are specific limitations and requirements associated with such a waiver.

In short, MDNR approval is very project-specific, and requires ongoing discussion with the area hydrologist assigned to this location (contact information provided above). As an initial consideration, MDNR typically discourages pond construction within public waters, as this is classified as creation of upland in Public Waters. They normally require consideration of options for construction outside the Public Water boundary, as well as upstream/watershed-based pollutant reduction.

Discussions with MDNR regarding a project in this location should emphasize not only the PAH contamination, but also the other constituents entering Thompson Lake at the inlet that should be controlled. Results from the ongoing WRAP study and other information also points to the importance of this site for water quality protection. Highlighting the importance of a stormwater pond at this location for multiple water quality purposes would presumably help in addressing this regulatory obstacle.

U.S. ARMY CORPS OF ENGINEERS (USACE)

A USACE Permit (apply using the MN Joint Application Form) will likely be required for the project. Information and forms for this permit are located on the USACE St. Paul District website (http://www.mvp.usace.army.mil/Missions/Regulatory.aspx). The application contains specific information and instructions for forwarding to other agencies. If the project requires a

USACE permit, it would likely be eligible for a Letter of Permission permit, which can take up to 120 days for processing. It is recommended that the application be submitted in advance to avoid project delays. If a wetland delineation is completed, the USACE may be able to review that separately, in advance of the remainder of the application.

DAKOTA COUNTY

Dakota County is both the owner of much of the affected property as well as a regulatory authority for this location. County review and approval will be required for any construction project and a risk assessment would need to be provided for any proposed dredging. With regard to an alternative disposal pilot project, Dakota County is unlikely to approve any plan to place contaminated sediments outside of an existing landfill. In any case, based on the results and recommendation of this feasibility study, the option will probably not be pursued.

OTHER AGENCY REQUIREMENTS

As a final project is designed, in addition to the LMRWMO's own requirements, there may be additional specific requirements from the City of West St. Paul, Dakota County, Dakota SWCD, or BWSR. Representatives from all relevant agencies with jurisdiction should be kept aware of progress.

Summary of Grant Funding Options

Depending on the specific project to be pursued, there are several possible sources of grant funding. Each grant program has specific limitations and requirements and should be evaluated for applicability after a conceptual design has been developed. Also, additional funding sources may be available through other project stakeholders and participants; it will be important to maintain communication with them as a strategy is developed. The following programs are the most likely candidates for funding options for Thompson Lake.

- Section 319: The MPCA administers the EPA Section 319 program for Minnesota. The projects may involve implementation of recommendations in a TMDL, or can be geared toward applied research/education. Both aspects may be applicable in the case of Thompson Lake.
- Clean Water Partnership: CWP grants and loans are also administered by the MPCA and focus on restoration activities. Thompson Lake has been identified as an important resource and an important location for restoration activities, and would likely be eligible for CWP funding.
- Clean Water Assistance: BWSR administers this program aimed at protection, enhancement, and restoration of water quality in lakes, rivers and streams.

Technical Assistance

A number of technical resources have been developed in order to aid in the management of sediment in general, and PAH contamination is an important consideration in that guidance. As indicated above, in Minnesota the key governmental agency dealing with these issues is the

MPCA. In addition to the basic research they have conducted on the origins, impacts, and mitigation of PAH contaminated sediment, they also provide applicable design guidance and calculation tools.

The key resource for many aspects of sediment management projects is MPCA's *Managing Stormwater Sediment Best Management Practice Guidance for Municipalities* (June 2012). It contains a great deal of information specific to Minnesota regarding sediment removal practices, costs, disposal guidelines. It also includes specific information on testing and evaluation of PAH contamination in stormwater sediments. This guidance document, along with other relevant information, is available at the MPCA stormwater program website (http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/index.html).

For a more in-depth view of requirements for dredging projects, the MPCA has also developed the manual *Managing Dredge Materials in the State of Minnesota* (September 2012). This manual is not specific to stormwater dredging projects, but it does provide useful technical information as well as a good description of the regulatory context. For a brief overview of regulations and technical guidance, the summary document *Best Management Practices for the Management of Dredged Material* (December 2011) is also available from MPCA.

7. Options and Recommendation

Overview

There are a variety of reasonable approaches to managing the sediment and addressing the issue of PAH contamination in Thompson Lake. The selection of a management strategy will depend on several factors, including available funding, final decisions on what is allowed or required by the affected agencies, and organizational priorities of those involved with managing the Lake, including the LMRWMO, the City of West St. Paul, and Dakota County.

The potential components of a management strategy can be generally divided into non-dredging and dredging related activities. The approach ultimately selected may include a combination of activities from each of these categories.

Non-Dredging Options

NO ACTION

The No-Action alternative in this case refers to implementing no on-the-ground management solution, though it may include continued studies/monitoring. Throughout the course of the study, essentially all stakeholders agreed that something does need to be done to address water quality issues in Thompson Lake; however, it is still important to consider the No-Action alternative as a baseline.

The obvious advantage of No-Action is that there are no immediate costs for construction or excavation. In some regards, it is also a low-risk option, because the status quo will continue and it is unlikely that the situation will soon become drastically worse. In addition, it does leave open the option of taking advantage of future technical or regulatory developments, and it gives stakeholders an opportunity to see if any long-term improvements result from, for example, the ban on coal tar based sealants.

On the other hand, the obvious disadvantage of this option is that it does nothing to address ongoing pollution of the Lake, simply pushing the problem into the future and in some regards wasting the effort and funding that has been invested up to this point. Stakeholders may find it hard to justify doing nothing to protect the quality of Thompson Lake when issues and solutions have been identified.

SEDIMENT CAPPING / ARMORING

One of the potential approaches called out for analysis in the original Scope of Services was the idea of capping or armoring the contaminated sediment, to isolate the PAH contamination from the surrounding environment. This could mean either covering the PAH-contaminated sediment with a protective layer without removing it from the Lake, or first dredging the sediment and then placing it somewhere where it can then be covered with clean fill. The latter approach is covered to some degree in the next section, under "MPCA 'PILOT PROJECT' ALTERNATIVE."

The idea of capping or armoring the contaminated sediment while it is still in place may be feasible in some settings, and for some contaminants. However, with regard to PAH contamination in Thompson Lake, this approach presents several concerns. First and foremost, given that this is a Public Water subject to related MDNR restrictions, the placement of

additional fill within the water body would not be allowed, particularly since there is no clear need or hazard presented by the contaminated sediment. Even if placement of fill were allowed, it would not be recommended because it would reduce the storage capacity of the Lake, making it even shallower than it currently is and potentially further disrupting the habitat. Finally, performing any such work in an area of PAH-contaminated sediment does present the risk of resuspension and downstream transport.

IN SITU REMEDIATION

In situ remediation refers to the idea of treating the PAH-contaminated sediment without removing it from the lake, by introducing some kind of mechanism that breaks down the PAHs into harmless components. Clearly, if such an approach could be effectively implemented, there would be a number of benefits. First, the PAHs would actually be eliminated, rather than just placed in a different location, thereby removing the associated environmental risk. Additionally, even if the sediment does need to be dredged from the water body in order to restore storage volume, substantial cost savings could be achieved by treating the PAH contamination in place, because the need to dispose of the sediment in a landfill is removed.

This is a subject of significant interest to numerous agencies involved in the management of contaminated sediment, including the MPCA which has devoted substantial resources toward investigating the viability of alternative PAH management methods. Unfortunately, although the approach is worth exploring due to the significant potential benefits, at present there is no known cost effective method for in situ remediation of PAH contaminated sediment.

Having said that, there are entities actively engaged in promising research on in situ remediation, and there are certain avenues of investigation that may ultimately lead to a feasible treatment method. Given the right combination of stakeholder interest and available funding, the Thompson Lake site may be a good candidate for an experimental in situ remediation project. In order to fulfill the goals of this feasibility study, some additional investigation into this potential approach was conducted, to obtain a better sense of what such an experimental project may entail.

One of the key articles along these lines, identified through the PAH literature review and research described above, was *In Situ Phytoremediation of PAH- and PCB-Contaminated Marine Sediments*, by Huesemann, et al. Based on the information presented in this article, the associated research laboratory (Pacific Northwest National Laboratory, or PNNL) was contacted for further discussion of the research and potential applicability to the Thompson Lake site.

In general, the response from PNNL was that there is a reasonable chance that in situ remediation could work, although the level, rate, and degree of remediation are unknown. The suggested mechanism for remediation was a combination of phytoremediation (remediation resulting from plant activity) and bioaugmentation (introduction of a known PAH-degrading microbial community). Two key factors that would need to be considered with such an approach are: (1) plants need adequate light to offset respiratory demands especially if they are planted in highly reduced (hypoxic) sediments; and (2) if the sediments are too contaminated they could kill the plants along with the microbes, thus negating any remediation effect.

As a broad outline of how such an experiment may be conducted, PNNL suggested demonstrating the feasibility of the in situ approach using small demonstration plots. Patches of macrophytes (aquatic plants) known to grow in lakes in the area could be sown in the sediment, and then bioaugmentation (addition of microbes) could be performed on one plot, while another plot just has plants and indigenous microbes. The plots could be left in place for an extended period of time, after which PAH concentrations of the treated and untreated plots.

SOURCE CONTROL

In this context, source control refers to identifying areas or activities within the watershed that contribute to PAH contamination within the Lake, and taking action to reduce or eliminate those contributions. In general the strategy of addressing contamination at the source, upstream in the watershed, is preferred over end-of-pipe solutions. There may be opportunities to work with landowners or developers in implementing stormwater treatment at other locations within the Thompson Lake drainage area. However, it will not likely be feasible to achieve substantial pollution reduction through source control alone.

ADDITIONAL SAMPLING

In the development of the *Thompson Lake Stormwater Improvement and Habitat Restoration Project* referenced above, a number of sediment samples were taken from the Lake and the inlet area in order to determine the extent and severity of contamination. Those tests indicated a substantial volume of sediment classified as Management Level 3, both in the inlet area as well as within the main body of the Lake. This would suggest that any amount of dredging (whether for an inlet treatment pond or for excavation of the overall sediment plume) would involve removal of at least some Management Level 3 material.

However, it should also be noted that varying calculation procedures for determining contamination levels can have a significant impact on the results, and in 2011 the MPCA changed the recommended calculation procedures. The currently recommended calculation methodology would tend to produce lower concentration values and would potentially reduce the amount of sediment classified as Management Level 3. Therefore, it is recommended that prior to any sediment excavation, additional sampling, testing, and calculations be conducted to more clearly define the extents of contamination. As a starting point, the original sampling data (if available) could be used to recalculate the Management Levels of the sediment.

Dredging / Construction Options - Components

OVERVIEW

If the decision is made to proceed with a management option that involves excavation, dredging, and other construction, the specific extents and details of the project will need to be determined in final design. Broadly speaking, such a project would involve some combination of excavation and dredging at the Lake inlet, dredging and disposal of sediment from the main body of the Lake, installation of any necessary infrastructure connections and control structures, and site erosion control and restoration. Some of the key factors to consider with regard to each of the components of a dredging/construction approach are identified here.

MPCA "PILOT PROJECT" ALTERNATIVE

One of the primary concerns about any dredging project, particularly when contaminated sediments are involved, is the cost of disposal. As indicated above, when PAH concentrations are high enough to place contaminated sediment at Management Level 3, MPCA regulations require that the sediment be disposed of at a solid waste facility (landfill). For the large volumes of material typically associated with pond dredging projects, the cost can quickly become unmanageable. Understanding this concern, within the past few years the MPCA has started to consider alternative disposal scenarios for contaminated sediment from stormwater ponds (or water bodies acting as stormwater ponds).

Currently, there is one such pilot/demonstration project in place in the City of White Bear Lake. For that project, approximately 10,000 cubic yards of sediment was removed from a constructed stormwater pond and placed on-site, to be managed as a regulated fill upland and immediately adjacent to the pond, on approximately 2 acres of City property. The sediment is covered with approximately 2 feet of non-contaminated fill, forming a landscape feature that been restored with prairie grasses for stabilization. Because the risks associated with this management technique have not been fully evaluated, the site is being monitored through 2016 to determine if it is a safe alternative with regard to environmental and human health concerns.

The MPCA played an active role in the discussions for the present study, and provided substantial input and technical advice with regard to the feasibility of such a pilot project for the Thompson Lake site. While there would be other agencies and concerns to address as well, from the MPCA perspective, an alternative disposal pilot project is a viable option for this site. The executive managers of the MPCA met in November 2013 to review and approve doing additional pilot projects (alternatives to landfill disposal), and the Thompson Lake demonstration project was among the approved projects. If the City and County decide to pursue the option of managing dredged sediment on site, the MPCA will support that approach.

INLET TREATMENT POND

Ever since investigation of the site began in earnest with the implementation of the Stassen Lane Realignment project, construction of a stormwater pond at the inlet of Thompson Lake has been recognized as an important step to take for protection of water quality and habitat. Indeed, the PAH contamination of the site was initially identified during site investigations performed in support of treatment pond design, which was to be implemented for the purpose of removing nutrients and other common pollutants.

The discovery of PAH-contaminated sediment in that location triggered additional investigations and put the construction of a treatment pond on hold, but the pond continues to be an important component of any solution for this site. In addition to the initially identified benefits (e.g., nutrient removal), a stormwater pond would also help to address the issue of PAH contamination in the lake. Because PAHs are very often attached to sediment particles, the stormwater pond would provide a place for most contaminants to settle out prior to entering the Lake, and would be relatively easy to access for future sediment removal requirements.

The size and configuration of the stormwater pond would need to be determined in a final design process that would also involve additional input from MDNR and other agencies. Generally speaking, the larger the stormwater pond, the greater the pollutant removal capacity, but substantial benefit can be gained from a smaller stormwater pond as well. This is important to note, because installation of a stormwater pond in this location would require excavation and construction within a Public Water, which is significantly restricted by MDNR.

DREDGING OF SEDIMENT PLUME

Removal of the sediment deposited in the main body of the Lake has been a key consideration ever since a project has been contemplated for this location. In the context of this study, dredging of the sediment plume refers to additional dredging outside any area that would need to be excavated for the purposes of constructing a treatment pond at the inlet. Initially, it was thought that the PAH contamination was located primarily in the north part of the Lake, where a larger volume of sediment deposition can be identified. However, now that further investigation has revealed significant PAH contamination in all parts of the Lake bottom, the proper boundaries of a sediment removal project are no longer clear.

In any case, considering all the applicable circumstances, it is difficult to envision a feasible scenario in the near future that includes dredging of the sediment in the main body of the Lake.

Summary of Options/Costs

As mentioned above, there are a variety of possible management strategies for Thompson Lake. Based on the information gathered as part of this feasibility study, including the stakeholder input, there are a few approaches that stand out as being the most realistic or suitable for this setting. These options and the associated approximate costs are briefly outlined below, along with our recommendation for a path forward.

Table 7.1 Summary of Options/Costs

#	Description	Advantages	Disadvantages	Cost Range
1	**No-Action**	• No immediate construction costs • Low risk of making things worse • Leaves options open for future	• Does not address Lake pollution • Pushes problem into future • Wastes effort and funding invested so far	**$0 - $50,000 (studies/monitoring)**
2	**Construct Settling Basin and Dredge Sediment Plume – Disposal in Landfill**	• Removes unwanted sediment from Lake • Landfilling sediment removes exposure risk • Provides stormwater treatment	• Unlikely to be permitted • Very high cost • Uncertain level of benefit • Risk of contaminant resuspension	**$1M - $1.5M**

#	Description	Advantages	Disadvantages	Cost Range
3	**Construction of Settling Basin Only – Disposal in Landfill**	• Provides stormwater treatment • Reduced dredging volume/cost • Fewer approval hurdles	• Does not remove contaminated sediment from main body of Lake • Requires land to be used for pond construction	**$300K - $500K**
4	**Construction of Settling Basin Only – Disposal on Site (Pilot Project)**	• Provides stormwater treatment • Dredging costs further reduced by eliminating landfill costs • Adds to knowledge base regarding sediment disposal • Pilot project approved by MPCA	• Additional permitting required for disposal site • Requires park land to be used for sediment disposal • Though isolated, contaminants do remain on site • May require future monitoring and reporting	**$200K - $400K**
5	**In-Situ Remediation (add-on to other options)**	• Could result in reduction of PAH concentrations in sediment • Adds to knowledge base regarding PAH remediation	• Pilot project is experimental; may not achieve desired results • Substantial time commitment to prepare and monitor remediation experiment • Project costs difficult to estimate	**~$50K - ~$150K (in addition to other construction costs)**

Recommendation

Based on all the information presented above, it is our recommendation that a stormwater treatment pond be constructed at the inlet of Thompson Lake. If the necessary approvals can be obtained (e.g., from Dakota County), it would be beneficial from a cost perspective to pursue the MPCA pilot project of on-site (non-landfill) disposal of any Management Level 3 contaminated sediments encountered. If this is not feasible or desirable, the stormwater treatment pond should still be constructed, and appropriate sediment disposal guidelines should be followed.

The specific details of the stormwater treatment pond would need to be worked out in final design. This process will benefit greatly from the input and participation of all stakeholders. In order to provide a concrete starting point for that discussion, we are providing a conceptual design and preliminary cost estimate for a stormwater pond that would achieve the intent of our recommendation. Figure 4 illustrates this conceptual design, which has also been guided by knowledge gained through this study, including stakeholder preferences and agency requirements.

A preliminary cost estimate for the recommendation shown in Figure 4 is provided in Appendix C. This cost estimate was developed assuming that no contaminated sediment will need to be

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SCALE: FEET

THOMPSON LAKE PAH REMEDIATION STUDY

LOWER MISSISSIPPI RIVER WMO, WEST ST. PAUL, MN

RECOMMENDED TREATMENT POND

FIGURE 4

hauled to a landfill. This is an appropriate assumption, not only because it may be possible to conduct an on-site disposal pilot project, but also because in our conceptual design, much of the area being excavated is currently upland, and the extent of Management Level 3 materials in the vicinity of the proposed pond is expected to be quite limited. A partial retaining wall has been included for estimating purposes. It may be feasible to grade the basin without a retaining wall, depending on setback requirements or other local concerns. The total estimated construction cost for the pond as shown, with the stated assumptions, is approximately **$265,000**. Again, it must be emphasized that this is a preliminary estimate, and that the cost will depend entirely on the final design, disposal requirements, and other factors.

An experimental in-situ remediation project may also be beneficial, but given the high level of uncertainty, it is not specifically recommended at this point. However, if LMRWMO or another agency would like to pursue such a project as part of their overall mission of protecting water resources, the approach described earlier in this report would be a reasonable starting point.

8. Conclusion

Scope Completed

This report represents the fulfillment of the Scope originally identified for this feasibility study, with several potential management solutions and a recommended option based the best available information. This report summarizes, and our recommendation incorporates, previous work as well as applicable literature, governmental regulations and resources, and most importantly, input gathered from key stakeholders during the course of the study. However, there remain some issues to be resolved as management options are considered and the project moves toward a final design stage.

Next Steps

The next step toward management of Thompson Lake, with regard to PAH contamination and water quality in general, is to resolve any remaining differences that may exist between stakeholders and agencies with jurisdiction, and to decide on a management strategy. If a stormwater treatment pond at the inlet of Thompson Lake is selected as part of the management approach, the next step will be to develop the final design for the pond and acquire all necessary permits and approvals. This will require, among other things, substantial consultation with MDNR to arrive at a design that is acceptable to the agency while providing adequate pollutant removal capacity.

As mentioned above, concurrent with this report there is a separate WRAP study being conducted that has implications for Thompson Lake. While it has not yet been finalized, it is expected that the WRAP study (like the present study) will recommend construction of a stormwater treatment pond at the inlet to Thompson Lake. In deciding how to best manage PAH contamination, it will obviously be important to consider the relevant recommendations from the WRAP study and properly coordinate any future implementation projects.

Finally, again assuming that construction of a stormwater treatment pond will be pursued, it will be important to more clearly define the extent and severity of contamination within the anticipated excavation area. The primary goal will be to determine how much sediment volume will be classified as Management Level 3, using the most up-to-date calculation protocols from MPCA. As a first step, 2 or 3 sediment samples should be taken from the area previously identified as containing Management Level 3 materials, to determine whether the sediment remains in that category. Depending on how the new samples compare to the previous results, additional sampling may be conducted to establish the limits of various degrees of contamination.

Conclusion

9. Appendices

Appendix A: Stakeholder Meeting Presentation and Notes

Appendix B: Bibliography of Key Resources

Appendix C: Preliminary Cost Estimate

Appendices

Appendix A: Stakeholder Meeting Presentation & Notes

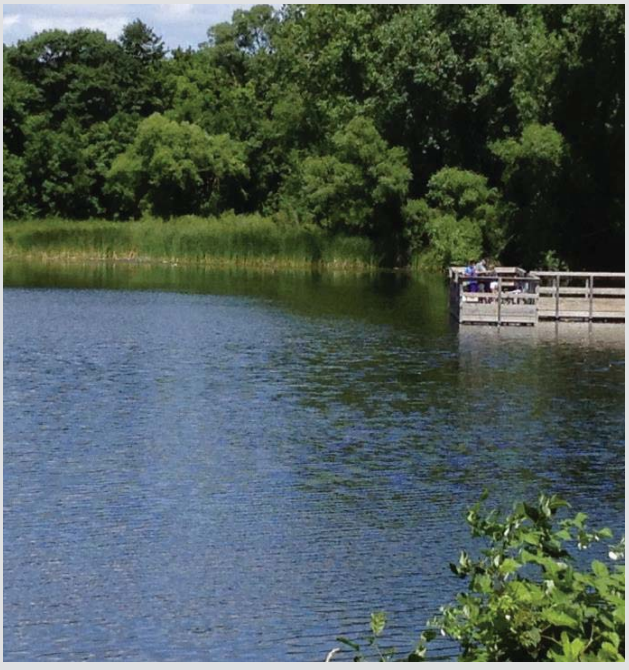
THOMPSON LAKE PAH CONTAMINATION FEASIBILITY STUDY

Stakeholder Meeting

Wednesday, October 30, 1:00 pm

PRESENTATION OVERVIEW

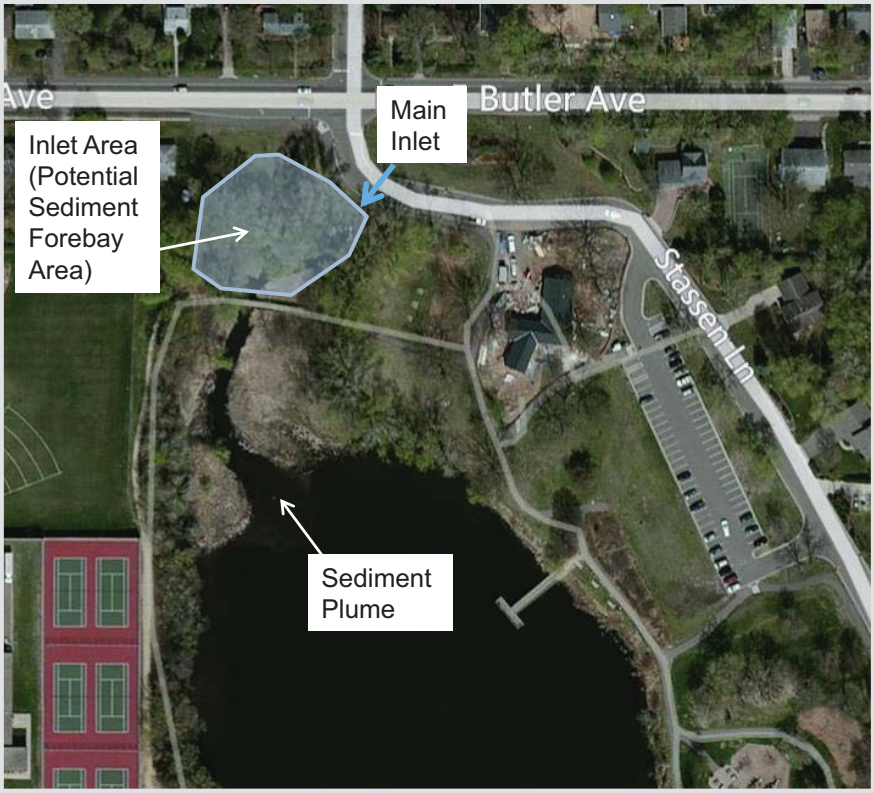
1. Project Overview/Project History
2. PAH Contamination
3. Current Project Goals
4. Initial List of Alternatives / Pros & Cons – STAKEHOLDER INPUT NEEDED
5. Regulatory Issues – STAKEHOLDER INPUT NEEDED
6. Other Questions / Suggestions / Concerns / Next Steps



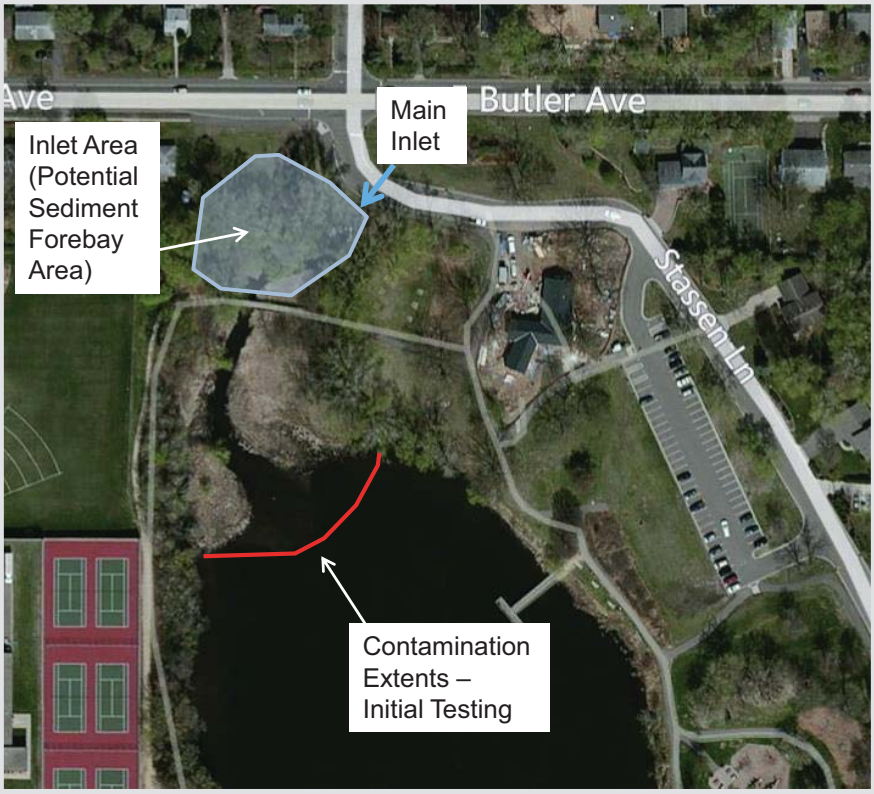
Location Map and Drainage Area

Lake Inlet and Area of Concern

Lake Inlet and Area of Concern

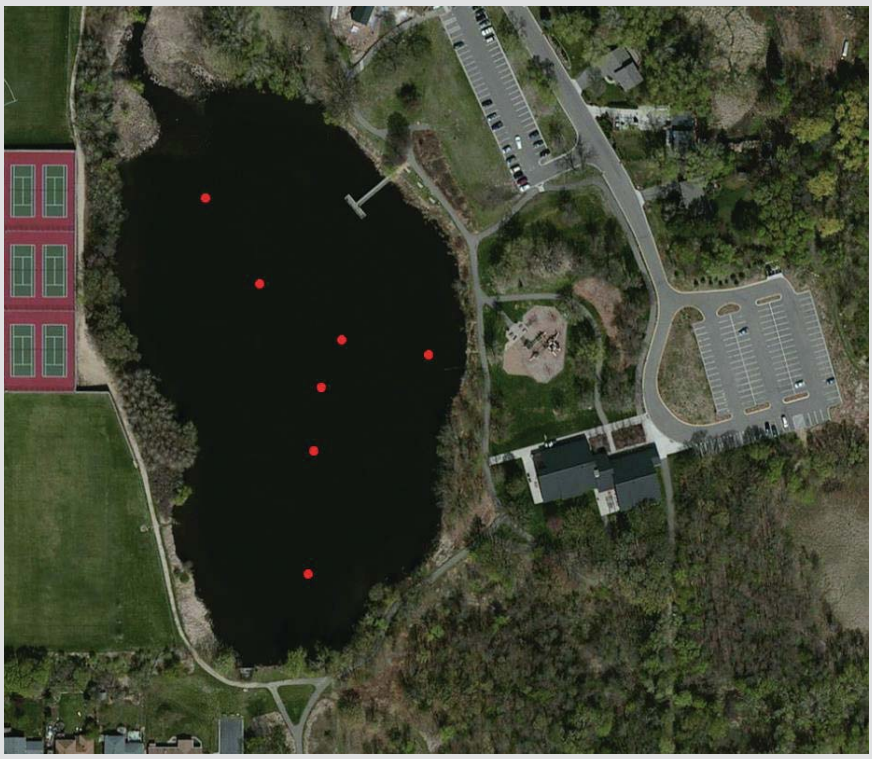


Lake Inlet and Area of Concern



Additional Sampling

Further testing indicated that PAH contamination is present throughout the lake



PAHs – Description

- What are PAHs?
  - Polycyclic Aromatic Hydrocarbons – specific group of over 100 chemicals, natural and man-made
  - Most bound to sediment
  - Products of incomplete combustion (fossil fuels, forest fires, coal tar, etc.) – very common in nature and in urban environments
  - Coal tar based sealant identified as a major contributor (already banned in West St. Paul; banned statewide as of Jan. 1, 2014)

PAHs – Concerns

- Primary Concerns
  - Ecological health risks – bottom-dwelling organisms, others
  - Human health risks - many are known or probable carcinogens
  - PAHs accumulate in water bodies (sediment)
  - Dredged PAH-contaminated sediment considered a health risk
- Two categories of PAH concern:
  1. PAHs in sediment dredged out of water body (more exposure)
  2. PAHs in sediment that stays in water body (less exposure)

PAHs: Stormwater Pond Vs. Lake

- Stormwater Treatment Ponds
  - Stormwater treatment requires a certain amount of storage volume
  - Many ponds have reached their design life and require maintenance dredging
  - PAH contamination showing up at high concentrations - in many ponds at levels requiring landfilling of dredged material (high cost)

PAHs: Stormwater Pond Vs. Lake

- Lakes and Wetlands
  - Natural water bodies – not designed “stormwater ponds”
  - Not the same impetus (storage volume) for maintenance
  - Many act as a “treatment” areas for stormwater runoff
  - Retrofitting a treatment “forebay” provides a defined area for sediment accumulation

Current Project Goals

- Improve Problem Definition
- Review Latest PAH Research
- Evaluate All Management Options
- Address Stakeholder Goals / Concerns

Initial List of Alternatives / Pros & Cons

→ STAKEHOLDER INPUT NEEDED

1) No-Action Alternative
2) Construct Settling Basin and Dredge Sediment Plume – Disposal in Landfill
3) Construct Settling Basin and Dredge Limited Area – Disposal in Landfill
4) Construction of Settling Basin Only
5) Alternative: Nearby Disposal Site – MPCA Pilot Project
6) Alternative: In-Situ Treatment Pilot Project – Methods Under Consideration

1. No-Action Alternative

- Leave as-is; no excavation or construction
- May include continued studies/monitoring
- Pros
  - No immediate costs for construction or excavation
  - Maintains status quo – low risk of making things drastically worse
  - May be able to take advantage of future technical or regulatory developments
- Cons
  - Does nothing to address ongoing pollution of the Lake
  - Pushes the problem into the future
  - Largely wastes the effort and funding invested up to this point
- Cost Range: $0 - $50,000 (studies/monitoring)

2. Construct Settling Basin and Dredge Sediment Plume – Disposal in Landfill

- Original proposed alternative
- Full cleanout and construction of sediment pond
- Pros
  - Takes contaminated and excess sediment out of Lake
  - Landfilling sediment eliminates any further exposure risk
  - Provides stormwater treatment at Lake inlet
- Cons
  - High cost
  - Uncertain level of benefit
  - Potential risk of contaminant resuspension during excavation
- Cost Range: $1,000,000 - $1,500,000

3. Construct Settling Basin and Dredge Limited Area – Disposal in Landfill

- Reduced dredging footprint – based on level of contamination, budgetary limits, or other considerations
- Construct sediment pond at inlet
- Pros
  - Removes some sediment from Lake based on specific criteria
  - Reduced cost relative to the “full cleanout” option
  - Still provides stormwater treatment at Lake inlet
- Cons
  - Still involves substantial excavation costs
  - Uncertain benefit / contaminant resuspension concerns remain
- Cost Range: $500,000 - $1,000,000 depending on specifics

4. Construct Settling Basin Only

- Construct proposed sediment pond/forebay at Lake inlet (storm sewer outfall)
- Highly contaminated sediments would be landfilled
- Do not excavate or do other work in main body of Lake
- Pros
  - Provides stormwater treatment at Lake inlet
  - Eliminates costs of dredging within main body of Lake
  - Reduces or eliminates concerns about contaminant resuspension
- Cons
  - Does not immediately address concerns in main body of Lake
- Cost Range: $300,000 - $500,000

5. Alternative: Nearby Disposal Site – MPCA Pilot Project

- Place sediment nearby and cap (per MPCA guidance)
- Disposal alternative for any of the listed options
- Pros
  - Eliminates need for landfilling, drastically reducing disposal costs
  - Adds to knowledge base regarding sediment management options
- Cons
  - Land required nearby; PAHs are present (but not exposed)
  - Consumes / modifies landscape area
- Cost Range: Can reduce project cost by 50% or more

6. Alternative: In-Situ Treatment Pilot Project

- In-situ remediation pilot project in main body of Lake (along with forebay construction)
- Pacific Northwest National Laboratory has done similar research in saline environment; interested in participating
- Phytoremediation and bioaugmentation
- Pros
  - Stormwater treatment at Lake inlet would still be provided
  - Could result in reduction of PAH concentrations in sediment
  - Adds to knowledge base regarding PAH remediation
- Cons
  - Pilot project is experimental; may not achieve desired results
- Cost Range: Adds cost of pilot project ($50,000 - $150,000)

Regulatory Issues

→ STAKEHOLDER INPUT NEEDED

- MnDNR – Public Waters Work Permit, Other Requirements
- MPCA – Construction Permit, Endorsement/Assistance for Pilot Project
- Dakota County – Approval for Pilot Project (Alternative Disposal Site)
- Other Stakeholder Requirements / Restrictions

Initial List of Alternatives / Pros & Cons

STAKEHOLDER INPUT NEEDED

1) No-Action Alternative
2) Construct Settling Basin and Dredge Sediment Plume – Disposal in Landfill
3) Construct Settling Basin and Dredge Limited Area – Disposal in Landfill
4) Construction of Settling Basin Only
5) Alternative: Nearby Disposal Site – MPCA Pilot Project
6) Alternative: In-Situ Treatment Pilot Project – Methods Under Consideration

6. Other Questions / Suggestions / Concerns / Next Steps

Lower Mississippi River Watershed Management Organization

Thompson Lake PAH Contamination Feasibility Study
Stakeholder Meeting Notes
Wednesday, October 30, 1:00 pm
West St. Paul City Hall ~ Administrative Conference Room
1616 Humboldt Ave., West St. Paul MN

Attendees: Cathy Undem and Dave Magnuson (Dakota County), Janna Kieffer (Barr Engineering on behalf of LMRWMO), Laura Jester (Keystone Waters on behalf of LMRMWO), Bob Bullard (LRMWMO Chair), Mary Lou Sabin (LMRWMO Vice Chair) Kent Brander (Hydromethods), Matt Saam (City of West St. Paul), Jennie Skancke (MDNR), Don Berger (MPCA)

Brander opened the meeting and introductions were made around the table. Brander presented the following through a PowerPoint presentation (a paper copy of which was also distributed).

Brander reviewed the history of the PAH contamination in Thompson Lake, noting where sediment analysis had been done in the past and showed a map of the watershed area draining to the lake. It was noted that no stormwater treatment is provided for the lake right now. The city had planned to install a pre-treatment pond (a forebay or settling basin) at the north end of the lake. That is when PAH-contaminated soils were discovered (2008). PAH contamination is found throughout the lake in fairly high amounts (although the highest levels are at the stormwater inlet to the lake).

Brander went on to describe PAHs in general, their source, and the human health and ecological concerns. He noted PAHs are a specific group of over 100 chemicals that usually bind to sediment. PAH contamination in Thompson Lake is a result of runoff from asphalt sealants that contain coal tar. West St. Paul banned coal tar based sealants in last year. A state-wide ban goes into effect January 1, 2014.

Brander noted there are two main areas in which to consider the risk of PAHs: 1) when they are present in lake sediments that are not disturbed and 2) when contaminated sediments are dredged and moved elsewhere. He noted PAHs are not known to readily bioaccumulate through the food chain. PAHs accumulate in organs (rather than in fat or tissue). Bottom dwelling organisms are the most affected – there are no data in Minnesota that show detrimental effects on fish. Sabin asked if much is known about the aquatic life present in the lake. Undem reported the lake is stocked with fish. There is likely data from the County's Wetland Health Evaluation Program as well, although it was unknown at the time of the meeting. Although many PAHs are probable carcinogens, the human health impact of PAHs is unknown.

Brander reported there are no known mechanisms to breakdown PAHs, even with strong solvents. Some research was even done by the University of Minnesota.

Brander reviewed the goals of this project and then listed the alternatives to address the contaminated sediments including:

1. No action
2. Construct settling basin and dredge sediment plume with disposal in landfill
3. Construct settling basin and dredge limited area within the lake; sediment disposal in landfill
4. Construct settling basin only with sediment disposal in landfill
5. Use a nearby disposal site as a MPCA pilot project
6. In-situ treatment pilot project – methods are under consideration

There was discussion about the various alternatives. Berger noted that on-site disposal of dredged sediments is a possibility through the State's pilot program if landfill disposal costs are economically unfeasible. Magnuson noted that Dakota County has ordinances regulating the disposal of contaminated sediments. He doubted if the County would allow disposal in Thompson County Park (alternative #5). Additionally, he noted the County would need a good risk assessment of any dredging in the lake.

Skancke noted the DNR might not be able to permit the construction of a settling basin within the lake boundary which would likely extend into the wetland area where the stormsewer outfall is currently located. However, she also mentioned that localized dredging at a stormsewer outfall does not need a permit to "remove sediment to maintain hydrologic conveyance." (Berger noted the same from MPCA.) Ultimately, however, constructing a pond within the ordinary high water level of the lake may not be permittable by the DNR.

There was discussion about the potential location of a stormwater pond (settling basin) at the north end of the lake. It was determined that the size of the pond needed to treat as much of the watershed as possible was a key piece of information when determining an alternative. Kieffer noted the current TMDL (WRAP study) for Thompson Lake identified the need for a stormwater pond in that area.

There was consensus that treating stormwater before it enters the lake is the priority goal for work in the area. It was also noted that Thompson Lake could be used in future research projects related to PAHs and in-situ treatments.

After much discussion, the group agreed that alternatives 2, 3, or 4 seem the most practical. More information is needed regarding the appropriate pond size needed and pond placement alternatives.

Appendix B: Bibliography of Key Resources

Key Resources Used in Study

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Appendix C: Preliminary Cost Estimate

PAH Study - Preliminary Construction Estimate **1/23/2014**

Thompson Lake Pond Forebay, West St. Paul, MN

Lower Mississippi River WMO

Item I.D.	Description	Approx. Quantity	Unit	Unit Cost	Total Amount
1	MOBILIZATION	1	LUMP SUM	$7,500.00	$7,500.00
2	CLEAR & GRUB	1	LUMP SUM	$10,000.00	$10,000.00
3	COMMON / MUCK EXCAVATION & HAUL (CV) (P)	8500	CU YD	$18.00	$153,000.00
4	VEGETATED GEOGRID WALL	1000	SQ FT	$40.00	$40,000.00
5	ARTICULATED CONCRETE W/ FABRIC	30	SQ YD	$120.00	$3,600.00
6	TEMPORARY EROSION & SEDIMENT CONTROL	1	LS	$3,000.00	$3,000.00
7	RIPRAP, CL. IV W/ FABRIC, TYPE 4	12	CU YD	$100.00	$1,200.00
8	SEED & BLANKET	2500	SQ YD	$3.00	$7,500.00
9	BYPASS PUMPING / DEWATERING	50	HR	$50.00	$2,500.00
				SUBTOTAL CONSTRUCTION:	$228,300.00
				CONTINGENCIES (15%):	$34,245.00
				TOTAL ESTIMATED CONSTRUCTION:	**$262,545.00**