

TMDL Scoping - PFOS in Pool 2 of the Mississippi River

June 30, 2011

Prepared For:
Minnesota Pollution Control Agency

Prepared By:
LimnoTech



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SUMMARY

The Minnesota Pollution Control Agency (MPCA) has placed Pool 2 of the Mississippi River on the State's 303(d) list of impaired waters due to elevated levels of perfluorooctane sulfonate (PFOS) in fish tissue. MPCA is required to develop Total Maximum Daily Loads (TMDLs) for waters on the 303(d) list. TMDLs can be developed at different levels of technical rigor, depending on management objectives, site-specific characteristics and available resources (e.g. time, data, and/or budget). This will be the first TMDL developed for PFOS. Its specific characteristics, including poorly defined sources and unique chemical fate, provide no direct template for developing a TMDL work plan.

The objective of this project is to independently review available data and develop preliminary work plans (including budgets and schedules) associated with TMDL development for PFOS in Pool 2 of the Mississippi River at different levels of technical rigor. The data review conducted for this project indicated that the most significant limitation of the available data relative to TMDL development corresponds to source assessment, i.e. how much PFOS is being contributed from various sources. In addition, the available ambient water quality and sediment data are insufficient to support the application of a more complex water quality model capable of simulating the response time of the system to pollutant load reductions, should MPCA choose such a modeling approach. Given the available data, three alternate levels of PFOS TMDL development are recommended for consideration:

1. **Steady state water column model using existing data:** Sufficient data are available to apply a simple water column model to define the maximum PFOS loading that will comply with water quality standards. The information available to define the magnitude of existing sources is very limited, such that the required level of reduction for some sources (such as stormwater) would be unknown.
2. **Steady state water column model with expanded data collection to support source characterization:** This level of TMDL development would apply a simple water column model, but also entail the collection of additional data to better define the magnitude of existing PFOS sources. This option would allow MPCA to make more informed decisions regarding which sources to control, and the required level of reduction for each source.
3. **Time-variable water column and sediment model, with expanded data collection to support source characterization and detailed modeling:** This level of TMDL development would entail the collection of additional data better detailing the magnitude of existing PFOS sources, as well as ambient water column and sediment data, to allow development of a detailed water column and sediment model. This option provides the ability to consider the length of time required to attain standards in response to load reductions.

Sample work plans are provided corresponding to each of the above TMDL development options. The simplest level of TMDL complexity can be completed within 10 months for an estimated budget of \$68,000. The intermediate level of complexity can be completed within 30 months for an estimated budget of \$165,000. The most complex level of complexity can be completed within approximately 50 months for an estimated budget of \$640,000.

BACKGROUND

The MPCA has placed Pool 2 of the Mississippi River on the State's 303(d) list of impaired waters due to elevated levels of PFOS in fish tissue. MPCA is required to develop TMDLs for waters on the 303(d) list. TMDLs can be developed at different levels of technical rigor, depending on management objectives, site-specific characteristics and available resources (e.g. time, data, and/or budget). This will be the first TMDL developed for PFOS, and its specific characteristics (poorly defined sources, unique chemical fate) provide no direct template for developing a TMDL work plan.

The objective of this project is to independently review available data and provide budgets and schedules associated with TMDL development for PFOS in Pool 2 of the Mississippi River at different levels of technical rigor. This report describes the process used to define alternate levels of TMDL development, and provides sample work plans for three different levels of rigor. It is divided into sections describing:

- Water Quality Modeling Options for PFOS TMDL Development
- Data Gap Assessment
- TMDL Work Plans

WATER QUALITY MODELING OPTIONS FOR PFOS TMDL DEVELOPMENT

The development of TMDLs typically requires the use of a water quality model that relates pollutant loading to concentrations in the receiving water. The type of water quality model that is most appropriate for a given situation depends on the characteristics of the chemical of concern, as these characteristics will dictate which fate processes require simulation in the model. Relevant physical/chemical properties for PFOS were summarized by Giesy et al. (2010). PFOS is moderately water soluble, with a reported mean solubility of 680 mg/L in pure water. PFOS is resistant to the environmental fate processes of photolysis, hydrolysis, biodegradation, and volatilization. PFOS has the potential to adsorb to particulate matter. Higgins and Luthy (2006) report a sediment organic carbon-normalized distribution coefficient ($\log K_{OC}$) of 2.83 L/kg_{oc}. This distribution coefficient corresponds to a chemical that is expected to overwhelmingly (>99%) be in the dissolved phase in the water column, but primarily bound to particulate matter in the bed sediments.

The absence of any significant loss processes in the water column, coupled with an affinity for PFOS in bed sediments to remain in the sediments, results in two candidate modeling options:

- **Simple steady state dilution model considering water column concentrations:** PFOS can be treated as a conservative substance and simulated using a simple water column dilution model, as long as the assumption is made that steady state conditions (i.e. conditions where concentrations are in long-term equilibrium with loading rates) exist.
- **Time-variable model considering the partitioning of pollutant between dissolved and sediment-sorbed phases, in both the water column and bottom sediments:** The ability of PFOS to bind to bed sediments indicates that the response time of PFOS concentrations in Pool 2 to load reductions may take many years, as sediment

concentration slowly reaches equilibrium with reduced loading rates. Simulation of this response time will require application of a time-variable model capable of describing the rate at which sediment PFOS concentrations respond to reduced loading rates.

Each modeling approach is discussed below.

Simple Steady State, Water Column Approaches

Several organic toxicant TMDLs have been developed using simple steady state approaches that consider concentrations in the water column but not in the sediments. The term “steady state” indicates that changes in concentration over time are not considered; the model predicts the concentrations that will occur after the system fully responds to the new pollutant load. These steady state approaches are typically based on a simple dilution model:

$$C_x = \Sigma W_x / Q_x \quad (1)$$

where

- C_x = Pollutant concentration at location x
- ΣW_x = Cumulative pollutant load upstream of location x
- Q_x = Flow available for dilution

The subscript x indicates that the model can be applied one-dimensionally and is capable of predicting pollutant concentrations (and load capacity) at multiple locations along the length of the pool. TMDL loading capacity is calculated by algebraically rearranging Equation 1 to solve for the pollutant load that will attain water quality standards for a given flow condition, i.e.

$$W_{LCx} = C_{WQS} \times Q_{Designx} \quad (2)$$

where

- C_{WQS} = Water quality standard concentration
- W_{LC} = Load capacity at location x
- Q_{Design} = Design dilution flow (e.g. harmonic mean flow) at location x

The use of simple steady state models in TMDL development has the following advantages/disadvantages:

- Capable of defining the magnitude of loads that ultimately will meet water quality standards;
- TMDL load capacity can be readily calculated with existing data;
- Cannot predict time response of system to changes in loading; and
- Cannot predict PFOS concentrations in the bed sediments. These models are consequently not capable of considering potential sediment-based BAFs/water quality criteria, should they be adopted in the future.

Time-variable, Water Column and Sediment Approaches

These approaches differ from the simple steady state approaches in two key areas: 1) they consider the partitioning of pollutant between dissolved and sediment-sorbed phases, in both the

water column and surface sediments, and 2) they predict the change in concentration over time. Modeling approaches for sediment-sorbed chemicals generally consist of three sub-models considering water balance, sorbent balance, and pollutant balance. This increase in capabilities brings with it the requirement for much more supporting data.

The use of complex time-variable approaches in TMDL development has the following advantages/disadvantages:

- Potential to consider time-history of response to load reductions;
- Potential to more accurately predict the impact of remediation actions such as dredging on response time; and
- Requires an extensive amount of supporting data.

SELECTION OF ALTERNATE LEVELS OF TMDL DEVELOPMENT

The objective of this project is to define a range of candidate approaches for developing a PFOS TMDL, and determine the resources (i.e. time, additional data) required for each approach. The additional data needed to support various approaches depend on the amount of data currently available. This section describes LimnoTech's review of the suitability of existing data to support TMDL development, and defines potential alternate levels of TMDL development

Data Reviewed

The definition of alternate levels of TMDL assessment was based on the review of the following Pool 2 data sources provided by MPCA:

- PFCs in Minnesota's Ambient Environment: 2008 Progress Report (MPCA, undated);
- Mississippi River Pool 2 Intensive Study of Perfluorochemicals in Fish and Water: 2009 (MPCA, 2010);
- Remedial Investigation Report (Weston, 2007) for fluorochemicals at the Cottage Grove site. A database containing the sample results from this study was also provided in Access format;
- An Excel spreadsheet containing Pool 2 PFOS fish concentrations for:
 - 84 samples collected between 2004 and 2008 (count includes duplicates and 2007 3M results); and
 - 297 samples collected in 2009.
- An Excel spreadsheet containing Pool 2 PFOS water column concentrations for:
 - 31 samples collected from Pool 2 in 2008 (count includes duplicates); and
 - 36 samples collected from Pool 2 in 2009.
- A list with locations of NPDES-permitted point sources identified by MPCA as discharging within the Pool 2 watershed;

- An excel spreadsheet containing 2007-2009 PFOS concentrations in wastewater treatment plant (WWTP) effluent from two active Metropolitan Council Environmental Services (MCES) WWTPs that discharge directly to Pool 2; and
- Pool 2 watershed delineation provided by MPCA.

Suitability of Available Data to Support TMDL Development

The available data were assessed regarding their ability to support the component steps of TMDL development. Component steps can be defined differently for different TMDLs. The following categories were selected to be consistent with MPCA and EPA checklist categories for TMDL review:

- Problem Definition
- Source Assessment
- Specification of a TMDL Target
- Linkage Analysis
- Allocation
- Implementation Planning

The following sections first describe what each component step represents (including how it corresponds to the MPCA and EPA TMDL checklist categories), followed by an assessment of the ability of the available data to support development of a PFOS TMDL for that step.

Problem Definition

The Problem Definition step provides the general setting for the TMDL. Items that are typically addressed during this step include:

- Definition of the pollutant(s) of concern and the impaired beneficial use(s)
- Priority ranking of the waterbody
- Delineation of the study area to be addressed by the TMDL
- Temporal and spatial extent of the impairment

The available data are fully suitable to define the pollutant(s) of concern, the impaired beneficial use(s), and the priority ranking of the waterbody.

Delineation of the study area to be addressed by the TMDL is driven as much by management objectives as it is by data availability. It is our understanding that the study area for this TMDL will be the watershed directly draining to Pool 2 of the Mississippi River. Loads entering from Lock and Dam #1 will be treated as boundary conditions, as will loads from major tributaries such as the Minnesota River. MPCA has provided a GIS coverage corresponding to the watershed area draining to Pool 2. The available data are sufficient to support delineation of the study area.

Some data are available to describe the temporal and spatial extent of the impairment. The intensive Pool 2 monitoring conducted in 2009 indicated that water column concentrations are in compliance with water quality standards in the upstream section of the Pool, exceed standards in

the middle section of the Pool, and are further elevated downstream of Cottage Grove. Fish tissue concentrations are consistent with these spatial trends. Long-term temporal information is available for fish tissue concentrations, with samples collected over the period 2004 to 2009. Limited information is available describing temporal variation in water column concentrations. In summary, these data are sufficient to confirm that impairment exists, to identify the portions of Pool 2 in which impairment occurs, and determine that fish tissue concentrations have not decreased significantly over the last several years.

Source Assessment

Source assessment is an important precursor step to TMDL development, because an understanding of the pollutant loading contributed by each source helps identify which sources require reduction. Source assessment also provides information on the magnitude of reduction from existing loads that is required to meet the target load, which will inform implementation planning.

Source categories for the PFOS TMDL can be defined based on a review of the literature and site-specific data as, and include:

- Municipal wastewater treatment plants
- Industrial point sources
- Stormwater runoff
- Atmospheric sources
- Contaminated groundwater
- Boundary sources

Available data are sufficient to confirm the presence of a continuing large source in the vicinity of the 3M Cottage Grove facility, and to identify the MCES Metro and Eagles Point facilities as other potentially important sources. Boundary sources do not appear to be contributing significantly to the impairment, although available data are sparse. Little to no data exist for stormwater sources, as well as for other wastewater treatment plants.

Municipal Wastewater Treatment Plants: Municipal wastewater treatment plant discharges have been established in the scientific literature as a potential source of PFOS. There are two active municipal wastewater treatment plants in the watershed. These are the MCES Metro and Eagles Point WWTPs. The following information is available for the 2009-2010 period, characterizing wastewater effluent concentrations:

- 4 samples from the Metro WWTP (mean concentration = 100.4 ng/l, s.d. = 20.2)
- 3 samples from the Eagles Point WWTP (mean = 166.6 ng/l, s.d. = 279). The observed concentrations from this facility exhibited wide variability, with concentrations ranging from less than detection (5.14 ng/l) to 489 ng/l.

These data indicate that both the Metro and the Eagles Point facilities have the potential to cause or contribute to violations of the water quality standard, because the average effluent concentration is 14 to 24 times larger than the water quality standard. The potential significance of these sources is consistent with the 2009 intensive monitoring survey data, which show an

increase in water column PFOS concentrations between stations upstream and downstream of the each facility.

Other Industrial Point Sources: Several industries have NPDES permits allowing them to discharge to surface waters in the Pool 2 watershed. Data are available for four of these facilities for the 2007-2009 period:

- 3M Cottage Grove Center (single sample less than detection limit of 97 ng/l.)
- Saint Paul Park Refining Co LLC - Marathon Petroleum (mean concentration = 61.8 ng/l, s.d. = 42.8, with one sample less than detection)
- Xcel Energy - Combined Cycle Plant - High Bridge (single sample, below detection)
- MAC - Minneapolis/St Paul Intl Airport (mean concentration = 129.5 ng/l, s.d. = 176.3) - The observed concentrations from this facility exhibited wide variability, with concentrations ranging from 23.8 ng/l to 393 ng/l.

Stormwater Runoff: PFOS can also be present in stormwater runoff, especially in urban areas. There are numerous NPDES-permitted stormwater discharges in the Pool 2 watershed, as well as combined sewer overflows. No information has been provided describing PFOS concentrations in stormwater in the Pool 2 watershed.

Atmospheric Sources: The presence of PFOS in water bodies around the world that are far distant and hydraulically disconnected from any PFOS sources indicate that the atmosphere likely serves as a source of PFOS or PFOS-precursors. No information has been provided describing atmospheric loading of PFOS specific to the Pool 2 watershed. Given the relatively small surface area of the water body, it is unlikely that direct atmospheric deposition is a significant source of impairment in Pool 2.

Contaminated groundwater: Elevated groundwater PFOS concentrations near the 3M Cottage Grove facility reported in Weston (2007), and corresponding elevated pore water and sediment PFOS concentrations at nearby locations in Pool 2, indicate that groundwater at the Cottage Grove site may be an important source contributing to the impairment.

PFOS concentrations above the surface water quality standards have been identified in shallow groundwater at other monitoring wells in the watershed, but not at levels high enough where they would be considered a significant source to the Pool 2 impairment.

Boundary Sources: PFOS concentrations have been measured at sites that should reflect the primary boundary sources. PFOS has been sampled directly below Lock and Dam #1 at River Mile 847 three times in June, 2009. Four samples (two unique 2008 sampling events, each with a duplicate sample) are available from the Minnesota River at Fort Snelling. All samples have been below detection limits, although the limited temporal coverage of this sampling precludes making a definitive statement that these sources are unimportant to the impairment.

Specification of a TMDL Target

The Specification of a TMDL Target step defines the “endpoint” of the TMDL. For pollutants such as PFOS where impairment is caused by human health concerns due to consumption of fish, the target can be specified either as a fish tissue concentration and/or water column

concentration. MPCA has already established both a water quality standard and a fish tissue target for PFOS. In that regard, no additional data is required to specify TMDL targets.

It is noted, however, that the observed bioaccumulation factor (BAF) that was used to define the water quality standard for Pool 2 may be influenced by elevated sediment concentrations. Fish tissue data show higher PFOS concentrations in bottom-feeding fish, supporting the hypothesis that sediments are a primary source of PFOS. To the extent that future remediation efforts reduce sediment PFOS levels, bioaccumulation factors for PFOS could change in the future.

Linkage Analysis

The Linkage Analysis step defines the relationship between pollutant load and concentration in the environment, and ultimately defines the maximum load that will result in attainment of the TMDL target. This step in TMDL development corresponds to the shared MPCA and EPA checklist category of Loading Capacity. As discussed above, modeling options can be divided into categories of:

- Simple steady state approaches that consider total water column pollutant concentration
- Complex time-variable approaches that consider the partitioning of pollutant between dissolved and sediment-sorbed phases, in both the water column and bottom sediments

The data needs for the steady state approaches are very small, consisting only of information to describe dilution. The specific nature of the dilution information requirements depends upon whether compliance with water quality standards will be evaluated on a laterally-averaged basis near major sources, or whether incomplete mixing between effluent and receiving water will be considered. For the completely mixed assumption, the only data requirement is an historical hydrograph of flows through Pool 2. For consideration of lateral variation in concentrations, a two-dimensional hydrodynamic model would be required. Sufficient data exists to support either case, as the hydrodynamic model developed for the Lake Pepin TMDL can be used for PFOS if consideration of incomplete lateral mixing will be required.

The data required to support a time-variable model considering dissolved and sediment-sorbed PFOS in both the water column and bottom sediments are extensive, as model coefficients would need to be calibrated to site-specific data. The required data would include measurements of all significant PFOS sources, as well as ambient water column and sediment data. Measurements would be required at multiple locations over an extended period of time (a year to several years). The available data fall well short of satisfying this requirement.

Allocation

The Allocation step partitions the total allowable load into individual source categories. Allocations to point sources are called wasteload allocations, while allocations to nonpoint sources are called load allocations. In addition, a portion of the loading capacity must be allocated to a margin of safety, to account for the uncertainty concerning the relationship between load and wasteload allocations and water quality. This step in TMDL development corresponds to the shared MPCA and EPA checklist categories of Wasteload Allocation, Load Allocation, and Margin of Safety.

The amount of data required to support the allocation process varies widely on a case-by-case basis, as there are many ways that the total allowable load can be allocated to existing sources. The available data are sufficient to identify a major PFOS source near Cottage Grove, as well as effluent concentrations an order of magnitude above the water quality standard from the MCES Metro WWTP. The allocation process could proceed using the available data, by defining the maximum allowable load from these sources that would result in compliance with water quality standards. The available data would require that the allocation process include many poorly informed assumptions, because insufficient information is available describing existing loads to allow for a more detailed assessment. An example for difficulties in conducting allocation with the available data can be seen in selection of an allowable stormwater loading. It is possible to define a maximum allowable loading for stormwater that would result in compliance with water quality standards, but it is not currently possible to determine whether this allocation would require any load reductions and/or whether the required reductions would be equitable compared to reductions being required from other sources.

Implementation Planning

The Implementation step describes the specific actions to be conducted to reduce contributing sources to the level required by the TMDL. This step in TMDL development corresponds to the MPCA checklist category called Implementation. The existing data are sufficient to provide insight into the level of reduction required from municipal point sources to attain a given allocation, and potentially provide limited insight regarding the level of reduction of groundwater contamination near Cottage Grove. The data are not sufficient to support implementation planning for load reductions from any other source category. Using the stormwater source again as an example, it is not currently possible to determine the implementation steps necessary to meet whatever loading target is selected during the allocation process (or whether the target is already being met).

Potential Alternate Levels of TMDL Development

The data gap assessment identifies two primary areas where future data collection can be used to support additional level of TMDL complexity: 1) additional data for source assessment, 2) additional data to support development of a time-variable water column and sediment model. The data required to support model development include the data necessary to support source assessment, resulting in three levels of options for TMDL development.

1. Steady state water column model with existing source characterization
2. Steady state water column model with expanded source characterization
3. Time-variable water column and sediment model, with expanded source characterization

Steady State Water Column Model with Existing Source Characterization

TMDL development could proceed immediately with the existing data at a very simple level. Sufficient data are available to apply a dilution model to define the maximum allowable PFOS loading that will comply with water quality standards. This total allowable loading could then be allocated to the contributing sources. The specification of allocations to contributing sources

could only be done on a cursory basis, however, due to the lack of information on existing loading rates from sources such as stormwater.

The primary advantage to this approach is that it can be conducted quickly, without additional data collection. In addition, this type of approach is consistent with the approach taken in many other approved TMDLs. The primary disadvantage is the lack of information available to inform the allocation and implementation planning steps.

Steady State Water Column Model with Expanded Source Characterization

This level of TMDL development would entail the collection of additional data better detailing the magnitude of existing PFOS sources. This approach would maintain application of the simple water quality model described previously. More informed decisions could be made regarding the relative importance of the major contributing sources and the required level of reduction for each source.

The advantage to this approach is that it provides the fastest, least-cost method for developing a TMDL with a rigorous allocation process. The disadvantages are that this approach is more costly and time consuming than the simplest approach, and it cannot consider the time history of system response as can the more detailed approach.

Time-variable Water Column and Sediment Model, with Expanded Source Characterization

This level of TMDL development would entail the collection of additional data better detailing the magnitude of existing PFOS sources, as well as the collection of ambient water column and sediment data at multiple locations and time periods. These data would be used to support a time-variable model that would consider the pollutant partitioning between dissolved and sediment-sorbed phases, in both the water column and bottom sediments.

The advantage to this approach is that it provides the ability to consider the time-history of response to load reductions. The ability to consider time scales may be advantageous should groundwater contamination be determined to be a primary source of impairment, as the time required to attain standards could vary drastically between alternative implementation actions such as source control (e.g. expanded groundwater capture) and source control plus dredging. This approach also has the potential to more accurately reflect future fish concentrations, to the extent that fish tissue contamination is driven by PFOS concentrations in the sediment. The disadvantage to this approach is that it is the most costly and time consuming to conduct.

PRELIMINARY WORK PLANS

Preliminary work plans were developed for each of the three alternate levels of TMDL development. These work plans are provided as Appendices 1 through 3 of this report. This section describes the costs and schedules estimated for each level, and lists the key assumptions associated with those estimates.

Level 1: Steady state water column model using existing data

The preliminary work plan for Level 1 is provided in Appendix 1. TMDL development at this level can be completed within ten months for a budget of \$68,000.

The primary key assumption in this work plan is that compliance with the TMDL endpoint can be addressed via the use of a simple dilution model, rather than through a more detailed mixing zone assessment.

Level 2: Steady state water column model with expanded data collection to support source characterization

The preliminary work plan for Level 2 is provided in Appendix 2. TMDL development at this level can be completed within 30 months for a budget of \$165,000. The following key assumptions were made in preparing this estimate:

- Monitoring to support source characterization will be conducted over the period of one field season;
- Municipal stormwater sources will be characterized into three categories (e.g. commercial, high-density residential, medium density residential);
- Two municipal stormwater outfalls will be sampled for each category;
- Three industrial stormwater outfalls will be monitored;
- Three storms will be monitored for all stormwater outfalls;
- Three samples will be collected over the duration of each storm;
- Four continuous point sources will be monitored;
- Five samples will be collected for each continuous point source; and
- Five samples will be collected at each of the proposed system boundaries, the Mississippi River at the upstream end of Pool 2, and the Minnesota River.

Level 3: Time-variable water column and sediment model with expanded data collection to support source characterization and detailed modeling

The preliminary work plan for Level 3 is provided in Appendix 3. TMDL development at this level can be completed within approximately 50 months for a budget of \$640,000. The following key assumptions were made in preparing this estimate:

- Source characterization will include all of the monitoring described above in Level 2, using the same assumptions.
- Monitoring to support water column and sediment model development will be conducted over the period of two field seasons.
- Three monitoring surveys will be conducted each season to support model development.
- Each monitoring survey will collect 30 water column samples and 20 sediment samples.

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Appendix 1 – Preliminary Level 1 Work Plan

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Development of a Total Maximum Daily Load for Perfluorooctane Sulfonate in Pool 2 of the Mississippi River Level 1 Work Plan

Project Contact Information

Financial Agent: Minnesota Pollution Control Agency

Project Manager:

Address/Phone:

Project Partners:

Contractor Information

Company name:

Project manager:

Address:

Phone:

Email:

Project Information

Project Title: Development of a Total Maximum Daily Load for PFOS in Pool 2 of the Mississippi River

Project Dates: September, 2011 – July, 2012

Requested Amount: \$68,000

Abbreviations/Glossary of Terms:

BMPs	Best Management Practices
EPA	United States Environmental Protection Agency
MCES	Metropolitan Council Environmental Services
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer Systems
QAPP	Quality Assurance Project Plan
TMDL	Total Maximum Daily Load, maximum amount of a pollutant that a waterbody can receive and still meet water quality standards

Project Summary

Pool 2 of the Mississippi River is included on the Minnesota's 303(d) list of impaired waters. PFOS concentrations in fish tissue are above safe levels for human consumption, and observed PFOS concentrations in the water column exceed the state's water quality standard. MPCA is required to develop Total Maximum Daily Loads (TMDLs) for waters on the 303(d) list. A TMDL will define the maximum amount of pollutant loading that will result in attainment of the water quality standard, as well as providing an implementation plan designed to ensure that the necessary load reductions are achieved. The goal of this project is to develop a TMDL for perfluorooctane sulfonate (PFOS) in Pool 2 of the Mississippi River. The PFOS data collected by MPCA as part of an intensive monitoring program for Pool 2 in 2009, along with Pool 2 data collected by MPCA as part of statewide PFOS monitoring prior to 2009, will serve as the basis of TMDL development. No additional field monitoring will be required.

Project Tasks and Schedule

Work will be accomplished via the following nine tasks:

1. Development of a Quality Assurance Project Plan (QAPP)
2. Problem Definition
3. Specification of a TMDL Target
4. Source Assessment
5. Linkage Analysis
6. Allocation
7. Implementation Plan
8. Public Participation
9. Reporting

Task 1: Development of a Quality Assurance Project Plan (QAPP)

Fall 2011

The objective of a QAPP is to define procedures for obtaining the type and quality of environmental data and information necessary to support decision making. The consultant will develop a draft QAPP that defines and establishes data quality objectives and procedures for assessing data and information for use in developing the PFOS TMDL. The focus of the QAPP will be on secondary data (i.e. data that has already been collected elsewhere), as no new data collection will be required for this TMDL. The draft QAPP will discuss data acquisition, assessment and oversight, and data validation and usability of data from the various databases to be used in this project. A final QAPP will be developed upon receipt of comments from MPCA.

The draft QAPP will be prepared within one month of project initiation, and finalized within two weeks of the receipt of comments.

Deliverables for Task 1:

- Draft QAPP
- Final QAPP

Responsible Parties: Consultant (Development of QAPP), MPCA (Review of draft QAPP)

Task 2: Problem Definition

Fall 2011

The Problem Definition step provides the general setting for the TMDL. For this task, the consultant will:

- Collect all data relevant to development of the PFOS TMDL and consolidate into a Microsoft Excel spreadsheet or database software program determined by MPCA, in a format specified by MPCA;
- Characterize key watershed features relevant to development of the TMDL;
- Characterize the temporal and spatial extent of the impairment; and
- Delineate the study area to be addressed by the TMDL.

The above tasks will be documented in a draft technical report which will fully characterize the watershed and water bodies. A draft report will be submitted to MPCA for review and finalized in response to comments received.

Task 2 will be completed within two months of approval of the QAPP.

Deliverables for Task 2:

- Computer database of all relevant PFOS data for Pool 2
- Draft watershed characterization report
- Final watershed characterization report

Responsible Parties: MPCA (Provision of in-house data, specification of database software requirements, review of draft characterization report), Consultant (Retrieval of non-MPCA data, creation of database, development of characterization report)

Task 3: Specification of a TMDL Target

Fall 2011

The purpose of this task is to identify the numeric target(s) to serve as the endpoint for the TMDL. The consultant will:

- Document all relevant water quality targets (e.g. water quality standards, fish tissue targets);
- Select a specific target value for use as the TMDL endpoint
- Work with MPCA to define the spatial extent (if any) to which in-stream concentrations may exceed the target;
- Specify the duration (i.e. temporal averaging period) and frequency (allowable frequency of excursions) associated with the target; and
- Demonstrate that the target selected is protective of all designated uses.

A draft technical memorandum documenting the above activities will be submitted to MPCA for review and finalized in response to comments received.

Task 3 will be completed within two months of approval of the QAPP.

Deliverables for Task 3:

- Draft memorandum defining selection of a TMDL target
- Final memorandum defining selection of a TMDL target

Responsible Parties: MPCA (Input on spatial extent to which in-stream concentrations may exceed the target, review of draft memorandum), Consultant (development of memorandum)

Task 4: Source Assessment

Fall 2011 - Winter 2012

The objective of this task is to quantify the PFOS load contributed by each source category of concern. The consultant will:

- Work with MPCA to define appropriate source categories for consideration in the TMDL; and
- Estimate the PFOS loading rate for each source category, based upon either site-specific data and/or literature values.

A draft technical memorandum documenting source assessment will be submitted to MPCA for review and finalized in response to comments received.

Task 4 will be completed within three months of approval of the QAPP.

Deliverables for Task 4:

- Draft memorandum documenting source assessment
- Final memorandum documenting source assessment

Responsible Parties: MPCA (Input on appropriate source categories, review of draft memorandum), Consultant (development of memorandum)

Task 5: Linkage Analysis

Winter 2012

The objective of this task is to develop a model capable of relating PFOS loads to resulting PFOS concentration along the entire length of Pool 2. The consultant will develop and apply a steady state dilution model capable of calculating the loading capacity (i.e. maximum pollutant load that will result in attainment of the TMDL target defined in Task 3). The model will be applied to define the loading capacity using temporally averaged inputs for upstream flow representative of the frequency and duration components of the TMDL target.

The consultant will prepare a draft technical memorandum documenting development of the model, as well as its application to calculate maximum allowable loads. The draft memorandum will be submitted to MPCA for review and finalized in response to comments received.

Task 5 will be completed within one month of completion of the source assessment.

Deliverables for Task 5:

- Draft memorandum documenting model development and application

- Final memorandum documenting model development and application

Responsible Parties: MPCA (Review of draft memorandum), Consultant (development of memorandum)

Task 6: Allocation

Winter 2012

The objective of this task is to apply the model developed in Task 5 to define the necessary load allocations (LA) and wasteload allocation (WLA) that will result in meeting the loading capacity. This task will begin with selection of specific allocation strategies to be considered. The consultant will define a range of allocation strategies in consultation with MPCA. These strategies will be converted into scenarios that will be simulated with the water quality model to define the maximum allowable load from each source category. The TMDL allocations will also contain a margin of safety and (as appropriate) a reserve capacity incorporating any foreseeable reasonable growth in the watershed and the corresponding increase in point source discharges.

The seasonality of loadings, rainfall and other factors will be evaluated to ensure relevant seasonal factors are considered in the development of the TMDL. Methods for incorporating any seasonal factors will be identified and justification provided if seasonality is not deemed significant.

The consultant will prepare a draft technical memorandum documenting development of the allocations. The draft memorandum will be submitted to MPCA for review and finalized in response to comments received.

Task 6 will be completed within one month of completion of the linkage analysis.

Deliverables for Task 6:

- Draft memorandum documenting allocation strategy and resulting allocations.
- Final memorandum documenting allocation strategy and resulting allocations

Responsible Parties: MPCA (Input on allocation strategy, review of draft memorandum), Consultant (development of memorandum)

Task 7: Implementation Plan

Spring 2012 - Summer 2012

The objective of this task is to define the actions to be taken to achieve the load reductions required by the TMDL. The consultant will develop an implementation plan that will include:

1. Identification of causes and sources
2. Load reductions
3. Nonpoint source controls and identification of critical areas
4. An estimate of assistance needed, costs and sources and authorities to be relied upon for implementation
5. Public involvement
6. Implementation schedule
7. Description of interim measurable milestones

8. Criteria for measuring success
9. Monitoring to evaluate effectiveness

The consultant will prepare a draft implementation plan, which will be submitted to MPCA for review and finalized in response to comments received.

Task 7 will be completed within two months of completion of the allocation task.

Deliverables for Task 7:

- Draft Implementation Plan
- Final Implementation Plan

Responsible Parties: Consultant (development of implementation plan), MPCA (review/approval of implementation plan)

Task 8: Public Participation

Spring 2012 - Summer 2012

The objective of this task is to solicit public input on both the development of the TMDL and the implementation plan. Two public meetings will be conducted. The first will be held to present the draft TMDL and the second to present the draft implementation plan. The consultant will lead each of these public meetings at a location selected by MPCA. The consultant will provide the Agency with presentation materials prior to the meeting, for review and approval.

The first public meeting will be completed within one month of the development of the draft TMDL. The second public meeting will be completed within one month of the development of the draft implementation plan.

Deliverables for Task 9:

- Two public meetings and associated presentation material

Responsible Parties: Consultant (development of presentation materials), MPCA (review of presentation materials, meeting logistics)

Task 9: Reporting

Summer 2012

The objective of this task is to document all project activities in a manner that will allow the TMDL to be approved by EPA. Deliverables from previous tasks will be used to develop a draft TMDL report. The report will contain all elements necessary to meet the requirements contained in the checklists used by MPCA and EPA for reviewing TMDLs.

The consultant will prepare a draft TMDL, which will be submitted to MPCA for review and finalized in response to comments received. Task 9 will be completed within two months of completion of the Implementation Plan.

Deliverables for Task 9:

- Draft TMDL
- Final TMDL

Responsible Parties: Consultant (development of TMDL), MPCA (review of TMDL)

Measures and Outcome

This work plan lays out the process which the MPCA and the hired consultant will take to develop a PFOS TMDL for Pool 2 of the Mississippi River. The overall outcome will be submittal of a final PFOS TMDL to EPA for approval. In doing so, this will address the PFOS impairment on the Federal 303(d) impaired waters list. A final Implementation Plan will also be developed that will be utilized by local partners to implement practices that will restore and protect surface waters.

Schedule:

Task	2011												2012						2013					
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
1. Development of QAPP																								
2. Problem Definition																								
3. Specification of a TMDL Target																								
4. Source Assessment																								
5. Linkage Analysis																								
6. Allocation																								
7. Implementation Plan																								
8. Public Participation																								
9. Reporting																								

Budget Estimate:

TASK	Estimated Hours					Time Total (hours)	Task Total (\$)	Subcontractors (\$)	Non Personnel Costs (\$)	Vehicle Mileage	Total all (\$)
	Level 4 Modeler/ TMDL	Level 3 Manager/ Water Quality	Level 2 Scientist/ Water Quality	Level 1 Scientist/ GIS	Level 3 Manager/ Water Quality						
1 Development of a Quality Assurance Project Plan (QAPP)	8	60	-	-	-	68	\$ 9,140	-	-	-	\$ 9,140
Total Task 1	1,520	7,620	-	-	-	64	\$ 7,640	-	-	-	\$ 7,640
2 Problem Definition	4	19	10	-	-	33	\$ 4,073	-	-	-	\$ 4,073
Total Task 2	760	2,413	900	-	-	64	\$ 7,640	-	-	-	\$ 7,640
3 Specification of a TMDL Target	4	40	20	-	-	64	\$ 8,380	-	-	-	\$ 8,380
Total Task 3	760	5,080	1,800	-	-	84	\$ 10,124	-	-	-	\$ 10,124
4 Source Assessment	4	60	-	-	-	64	\$ 8,948	-	-	-	\$ 8,948
Total Task 4	760	7,620	-	-	-	64	\$ 8,948	-	-	-	\$ 8,948
5 Linkage Analysis	8	52	8	16	-	84	\$ 10,124	-	-	-	\$ 10,124
Total Task 5	1,520	6,604	720	1,280	-	84	\$ 10,124	-	-	-	\$ 10,124
6 Allocation	4	24	-	-	-	28	\$ 3,808	-	-	-	\$ 3,808
Total Task 6	760	3,048	-	-	-	48	\$ 6,500	-	-	-	\$ 6,500
7 Implementation Plan	8	40	-	-	-	48	\$ 6,500	-	-	-	\$ 6,500
Total Task 7	1,520	5,080	-	-	-	64	\$ 8,948	-	-	-	\$ 8,948
8 Public Participation	-	64	8	720	-	72	\$ 8,948	-	-	-	\$ 8,948
Total Task 8	-	8,128	8	720	-	69	\$ 9,330	-	-	-	\$ 9,330
9 Reporting	9	60	-	-	-	69	\$ 9,330	-	-	-	\$ 9,330
Total Task 9	1,710	7,620	-	-	-	69	\$ 9,330	-	-	-	\$ 9,330
Total Cost Proposal	9,310	53,213	4,140	1,280	-	530	\$ 67,943	-	-	-	\$ 67,943

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Appendix 2 – Preliminary Level 2 Work Plan

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Development of a Total Maximum Daily Load for Perfluorooctane Sulfonate in Pool 2 of the Mississippi River Level 2 Work Plan

Project Contact Information

Financial Agent: Minnesota Pollution Control Agency

Project Manager:

Address/Phone:

Project Partners:

Contractor Information

Company name:

Project manager:

Address:

Phone:

Email:

Project Information

Project Title: Development of a Total Maximum Daily Load for PFOS in Pool 2 of the Mississippi River

Project Dates: September, 2011 – March, 2014

Requested Amount: \$165,000

Abbreviations/Glossary of Terms:

BMPs	Best Management Practices
EPA	United States Environmental Protection Agency
MCES	Metropolitan Council Environmental Services
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer Systems
QAPP	Quality Assurance Project Plan
TMDL	Total Maximum Daily Load, maximum amount of a pollutant that a waterbody can receive and still meet water quality standards

Project Summary

Pool 2 of the Mississippi River is included on the Minnesota's 303(d) list of impaired waters. PFOS concentrations in fish tissue are above safe levels for human consumption, and observed PFOS concentrations in the water column exceed the state's water quality standard. MPCA is required to develop Total Maximum Daily Loads (TMDLs) for waters on the 303(d) list. A TMDL will define the maximum amount of pollutant loading that will result in attainment of the water quality standard, as well as providing an implementation plan designed to ensure that the necessary load reductions are achieved. The goal of this project to develop a TMDL for perfluorooctane sulfonate (PFOS) in Pool 2 of the Mississippi River. MPCA has collected PFOS data as part of an intensive monitoring program for Pool 2 in 2009, and has also collected data in Pool 2 prior to 2009 as part of statewide PFOS monitoring. These data will be supplemented with field monitoring conducted during this project to better characterize existing PFOS loading sources.

Project Tasks and Schedule

Work will be accomplished via the following ten tasks:

1. Development of a Quality Assurance Project Plan (QAPP) and Monitoring Plan
2. Problem Definition
3. Specification of a TMDL Target
4. Field Monitoring
5. Source Assessment
6. Linkage Analysis
7. Allocation
8. Implementation Plan
9. Public Participation
10. Reporting

Task 1: Development of a Quality Assurance Project Plan (QAPP) and Monitoring Plan

Fall 2011- Winter 2012

Under this task, the consultant will:

- Meet with MPCA to finalize monitoring objectives; and
- Prepare a draft monitoring plan and QAPP.

The monitoring plan will provide detailed information regarding monitoring locations, parameters, and frequency/schedule. The sampling methods and related equipment will be described, as well as sample handling, storage and shipment procedures. The documentation and reporting requirements for the monitoring program will be provided. The monitoring plan will also include the specific analytical methods to be used and the blanks and duplicate samples to be collected to meet QA/QC requirements.

The objective of a QAPP is to define procedures for obtaining the type and quality of environmental data and information necessary to support decision making. The consultant will develop a draft QAPP that defines and establishes data quality objectives and procedures for

assessing data and information for use in developing the PFOS TMDL. The QAPP will cover new data that will be collected during this project as well as secondary data (i.e. data that has already been collected elsewhere). The QAPP will discuss all aspects of measurement system design and implementation, ensuring that appropriate methods for sampling, analysis, data handling, and quality control are employed and will be thoroughly documented. The QAPP will also address data validation and usability, to ensure that the individual data elements conform to the specified criteria.

A draft QAPP and monitoring plan will be prepared within two months of project initiation, and finalized within two weeks of the receipt of comments from MPCA.

Deliverables for Task 1:

- Draft QAPP and monitoring plan
- Final QAPP and monitoring plan

Responsible Parties: MPCA (Input on monitoring objectives, review of draft QAPP and monitoring plan), Consultant (Development of QAPP and monitoring plan)

Task 2: Problem Definition

Winter 2012

The Problem Definition step provides the general setting for the TMDL. For this task, the consultant will:

- Collect all data relevant to development of the PFOS TMDL and consolidate into a Microsoft Excel spreadsheet or database software program determined by MPCA, in a format specified by MPCA;
- Characterize key watershed features relevant to development of the TMDL;
- Characterize the temporal and spatial extent of the impairment; and
- Delineate the study area to be addressed by the TMDL.

The above tasks will be documented in a draft technical report which will fully characterize the watershed and water bodies. A draft report will be submitted to MPCA for review and finalized in response to comments received.

Task 2 will be completed within two months of approval of the QAPP.

Deliverables for Task 2:

- Computer database of all relevant PFOS data for Pool 2.
- Draft watershed characterization report
- Final watershed characterization report

Responsible Parties: MPCA (Provision of in-house data, specification of database software requirements, review of draft characterization report), Consultant (Retrieval of non-MPCA data, creation of database, development of characterization report)

Task 3: Specification of a TMDL Target

Winter 2012

The purpose of this task is to identify the numeric target(s) to serve as the endpoint for the TMDL. The consultant will:

- Document all relevant water quality targets (e.g. water quality standards, fish tissue targets);
- Select a specific target value for use as the TMDL endpoint;
- Work with MPCA to define the spatial extent (if any) to which in-stream concentrations may exceed the target;
- Specify the duration (i.e. temporal averaging period) and frequency (allowable frequency of excursions) associated with the target; and
- Demonstrate that the target selected is protective of all designated uses.

A draft technical memorandum documenting the above activities will be submitted to MPCA for review and finalized in response to comments received.

Task 3 will be completed within two months of approval of the QAPP.

Deliverables for Task 3:

- Draft memorandum defining selection of a TMDL target
- Final memorandum defining selection of a TMDL target

Responsible Parties: MPCA (Input on spatial extent to which in-stream concentrations may exceed the target, review of draft memorandum), Consultant (development of memorandum)

Task 4: Field Monitoring

Winter 2012 – Winter 2013

The purpose of this task is to collect the additional data necessary to better characterize existing PFOS loads to Pool 2 of the Mississippi River. Under this task, the consultant will:

- Conduct field sampling. The consultant will perform the necessary data collection activities, consistent with the requirements specified for sampling in the field monitoring plan and the QAPP.
- Process collected data: The consultant will review all data collected during this project, to verify that it complies with all data quality objectives outlined in the QAPP. All data found to be in non-compliance with the data quality objectives will be flagged. The overall ability of the dataset to satisfy project objectives will also be assessed, and any data gaps will be identified.
- Prepare a data report: The results of the data review will be documented in a draft data report and provided to MPCA for review. A final version of this report will be produced that incorporates all comments received.
- Enter the data into the project database. Information that will be included in this spreadsheet will be used to identify the sampling location, the segment ID, sampling results by parameter and any data qualifiers.

Task 4 will be completed within 13 months of approval of the QAPP.

Deliverables for Task 4:

- Electronic database containing all monitoring results
- Draft data report
- Final data report

Responsible Parties: MPCA (Review of draft data report), Consultant (field data collection, development of database, development data report)

Task 5: Source Assessment

Winter 2013 - Summer 2013

The objective of this task is to quantify the PFOS load contributed by each source category of concern. The consultant will:

- Work with MPCA to define appropriate source categories for consideration in the TMDL; and
- Estimate the PFOS loading rate for each source category, based upon field monitoring data collected in Task 4. An analysis of stormwater catchments areas will also be conducted to support load calculations.

A draft technical memorandum documenting source assessment will be submitted to MPCA for review and finalized in response to comments received.

Task 5 will be completed within four months of completion of the field monitoring.

Deliverables for Task 5:

- Draft memorandum documenting source assessment
- Final memorandum documenting source assessment

Responsible Parties: MPCA (Input on appropriate source categories, review of draft memorandum), Consultant (development of memorandum)

Task 6: Linkage Analysis

Summer 2013

The objective of this task is to develop a model capable of relating PFOS loads to resulting PFOS concentration along the entire length of Pool 2. The consultant will develop and apply a steady state dilution model capable of calculating the loading capacity (i.e. maximum pollutant load that will result in attainment of the TMDL target defined in Task 3). The model will be applied to define the loading capacity using temporally averaged inputs for upstream flow representative of the frequency and duration components of the TMDL target.

The consultant will prepare a draft technical memorandum documenting development of the model, as well as its application to calculate maximum allowable loads. The draft memorandum will be submitted to MPCA for review and finalized in response to comments received.

Task 6 will be completed within one month of completion of the source assessment.

Deliverables for Task 6:

- Draft memorandum documenting model development and application
- Final memorandum documenting model development and application

Responsible Parties: MPCA (Review of draft memorandum), Consultant (development of memorandum)

Task 7: Allocation

Summer 2013- Fall 2013

The objective of this task is to apply the model developed in Task 6 to define the necessary load allocations (LA) and wasteload allocation (WLA) that will result in meeting the loading capacity. This task will begin with selection of specific allocation strategies to be considered. The consultant will define a range of allocation strategies in consultation with MPCA. These strategies will be converted into scenarios that will be simulated with the water quality model to define the maximum allowable load from each source category. The TMDL allocations will also contain a margin of safety (MOS) and (as appropriate) a reserve capacity incorporating any foreseeable reasonable growth in the watershed and the corresponding increase in point source discharges.

The seasonality of loadings, rainfall and other factors will be evaluated to ensure relevant seasonal factors are considered in the development of the TMDL. Methods for incorporating any seasonal factors will be identified and justification provided if seasonality is not deemed significant.

The consultant will prepare a draft technical memorandum documenting development of the allocations. The draft memorandum will be submitted to MPCA for review and finalized in response to comments received.

Task 7 will be completed within two months of completion of the linkage analysis.

Deliverables for Task 7:

- Draft memorandum documenting allocation strategy and resulting allocations
- Final memorandum documenting allocation strategy and resulting allocations

Responsible Parties: MPCA (Input on allocation strategy, review of draft memorandum), Consultant (development of memorandum)

Task 8: Implementation Plan

Fall 2013 – Winter 2014

The objective of this task is to define the actions to be taken to achieve the load reductions required by the TMDL. The consultant will develop an implementation plan that will include:

1. Identification of causes and sources
2. Load reductions
3. Nonpoint source controls and identification of critical areas
4. An estimate of assistance needed, costs and sources and authorities to be relied upon for implementation

5. Public involvement
6. Implementation schedule
7. Description of interim measurable milestones
8. Criteria for measuring success
9. Monitoring to evaluate effectiveness

The consultant will prepare a draft implementation plan, which will be submitted to MPCA for review and finalized in response to comments received.

Task 8 will be completed within four months of completion of the allocation task.

Deliverables for Task 8:

- Draft Implementation Plan
- Final Implementation Plan

Responsible Parties: Consultant (development of implementation plan), MPCA (review/approval of implementation plan)

Task 9: Public Participation

Fall 2013 – Winter 2014

The objective of this task is to solicit public input on both the development of the TMDL and the implementation plan. Two public meetings will be conducted. The first will be held to present the draft TMDL and the second to present the draft implementation plan. The consultant will lead each of these public meetings at a location selected by MPCA. The consultant will provide the Agency with presentation materials prior to the meeting, for review and approval.

The first public meeting will be completed within one month of the development of the draft TMDL. The second public meeting will be completed within one month of the development of the draft implementation plan.

Deliverables for Task 9:

- Two public meetings and associated presentation material

Responsible Parties: Consultant (development of presentation materials), MPCA (review of presentation materials, meeting logistics)

Task 10: Reporting

Fall 2013 Winter 2014

The objective of this task is to document all project activities in a manner that will allow the TMDL to be approved by EPA. Deliverables from previous tasks will be used to develop a draft TMDL report. The report will contain all elements necessary to meet the requirements contained in the checklists used by MPCA and EPA for reviewing TMDLs.

The consultant will prepare a draft TMDL, which will be submitted to MPCA for review and finalized in response to comments received. Task 10 will be completed within two months of completion of the Implementation Plan.

Deliverables for Task 10:

- Draft TMDL
- Final TMDL

Responsible Parties: Consultant (development of TMDL), MPCA (review of TMDL)

Measures and Outcome

This work plan lays out the process which the MPCA and the hired consultant will take to develop a PFOS TMDL for Pool 2 of the Mississippi River. The overall outcome will be submittal of a final PFOS TMDL to EPA for approval. In doing so, this will address the PFOS impairment on the Federal 303(d) impaired waters list. A final Implementation Plan will also be developed that will be utilized by local partners to implement practices that will restore and protect surface waters.

PFOS TMDL Scoping for Pool 2 of the Mississippi River
 Appendix 2 – Preliminary Level 2 Work Plan

June 30, 2011

Schedule:

Task	2011												2012												2013			2014							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar			
1. Development of QAPP and Monitoring Plan																																			
2. Problem Definition																																			
3. Specification of a TMDL Target																																			
4. Field Monitoring																																			
5. Source Assessment																																			
6. Linkage Analysis																																			
7. Allocation																																			
8. Implementation Plan																																			
9. Public Participation																																			
10. Reporting																																			

Budget Estimate:

TASK	Estimated Hours					Time Total (hours)	Task Total (\$)	Subcontractors (\$)	Non Personnel Costs (\$)	Vehicle Mileage	Total all (\$)
	Level 4 Modeler/ TMDL \$790.00	Level 3 Manager/ Water Quality \$727.00	Level 2 Scientist/ Water Quality \$90.00	Level 1 Scientist/ GIS \$80.00	Level 1 Scientist/ GIS \$80.00						
1 Development of a OAPP and Monitoring Plan	16	100	4	4	4	124	\$ 16,420	-	-	0.51	\$ 16,420
Total Task 1	\$ 3,040	\$ 12,700	\$ 360	\$ 320	\$ 320						
2 Problem Definition	4	19	10	-	-	33	\$ 4,073	-	-	-	\$ 4,073
Total Task 2	\$ 760	\$ 2,413	\$ 900	\$ -	\$ -						
3 Specification of a TMDL Target	4	40	20	-	-	64	\$ 7,640	-	-	-	\$ 7,640
Total Task 3	\$ 760	\$ 5,080	\$ 1,800	\$ -	\$ -						
4 Field Monitoring	-	172	140	-	-	312	\$ 34,480	\$ 50,820	\$ 1,430	-	\$ 86,730
Total Task 4	\$ -	\$ 21,844	\$ 12,636	\$ -	\$ -						
5 Source Assessment	4	60	-	40	104	104	\$ 11,580	-	-	-	\$ 11,580
Total Task 5	\$ 760	\$ 7,620	\$ -	\$ 3,200	\$ 3,200						
6 Linkage Analysis	8	52	8	16	84	84	\$ 10,124	-	-	-	\$ 10,124
Total Task 6	\$ 1,520	\$ 6,604	\$ 720	\$ 1,280	\$ 1,280						
7 Allocation	4	24	-	-	28	28	\$ 3,808	-	-	-	\$ 3,808
Total Task 7	\$ 760	\$ 3,048	\$ -	\$ -	\$ -						
8 Implementation Plan	8	40	-	-	48	48	\$ 6,600	-	-	-	\$ 6,600
Total Task 8	\$ 1,520	\$ 5,090	\$ -	\$ -	\$ -						
9 Public Participation	-	64	8	-	72	72	\$ 8,848	-	-	-	\$ 8,848
Total Task 9	\$ -	\$ 8,128	\$ 720	\$ -	\$ -						
10 Reporting	9	60	-	-	69	69	\$ 9,330	-	-	-	\$ 9,330
Total Task 10	\$ 1,710	\$ 7,620	\$ -	\$ -	\$ -						
Total Cost Proposal	\$ 10,830	\$ 58,293	\$ 4,500	\$ 4,800	\$ 626		\$ 78,423	\$ -	\$ -	\$ -	\$ 165,153

Appendix 3 – Preliminary Level 3 Work Plan

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Development of a Total Maximum Daily Load for Perfluorooctane Sulfonate in Pool 2 of the Mississippi River Level 3 Work Plan

Project Contact Information

Financial Agent: Minnesota Pollution Control Agency

Project Manager:

Address/Phone:

Project Partners:

Contractor Information

Company name:

Project manager:

Address:

Phone:

Email:

Project Information

Project Title: Development of a Total Maximum Daily Load for PFOS in Pool 2 of the Mississippi River

Project Dates: September, 2011 – January, 2016

Requested Amount: \$640,000

Abbreviations/Glossary of Terms:

BMPs	Best Management Practices
EPA	United States Environmental Protection Agency
MCES	Metropolitan Council Environmental Services
MPCA	Minnesota Pollution Control Agency
MS4	Municipal Separate Storm Sewer Systems
QAPP	Quality Assurance Project Plan
TMDL	Total Maximum Daily Load, maximum amount of a pollutant that a waterbody can receive and still meet water quality standards

Project Summary

Pool 2 of the Mississippi River is included on the Minnesota's 303(d) list of impaired waters. PFOS concentrations in fish tissue are above safe levels for human consumption, and observed PFOS concentrations in the water column exceed the state's water quality standard. MPCA is required to develop Total Maximum Daily Loads (TMDLs) for waters on the 303(d) list. A TMDL will define the maximum amount of pollutant loading that will result in attainment of the water quality standard, as well as providing an implementation plan designed to ensure that the necessary load reductions are achieved. The goal of this project to develop a TMDL for perfluorooctane sulfonate (PFOS) in Pool 2 of the Mississippi River. MPCA has collected PFOS data as part of an intensive monitoring program for Pool 2 in 2009, and has also collected data in Pool 2 prior to 2009 as part of statewide PFOS monitoring. These data will be supplemented with field monitoring conducted during this project to: 1) better characterize existing PFOS loading sources, and 2) allow calibration of a time-variable water quality model describing the fate and transport of PFOS in the water column and sediments of Pool 2.

Project Tasks and Schedule

Work will be accomplished via the following ten tasks:

1. Development of a Quality Assurance Project Plan (QAPP) and Monitoring Plan
2. Problem Definition
3. Specification of a TMDL Target
4. Field Monitoring
5. Source Assessment
6. Linkage Analysis
7. Allocation
8. Implementation Plan
9. Public Participation and Technical Advisory Committee
10. Reporting

Task 1: Development of a Quality Assurance Project Plan (QAPP) and Monitoring Plan

Fall 2011 – Spring 2012

The objective of this task is to select a modeling framework that best meets MPCA's management objectives, determine monitoring objectives, and subsequently develop a monitoring plan and a QAPP for modeling and monitoring.

Under this task, the consultant will:

- Work with MPCA to select a modeling framework that best meets MPCA's management objectives, and prepare a draft memorandum documenting model selection;
- Work with MPCA to finalize monitoring objectives; and
- Prepare a draft monitoring plan and a QAPP for monitoring and modeling.

The monitoring plan will provide detailed information regarding monitoring locations, parameters, and frequency/schedule. The sampling methods and related equipment will be described, as well as sample handling, storage and shipment procedures. The documentation and reporting requirements for the monitoring program will be provided. The monitoring plan will also include the specific analytical methods to be used and the blanks and duplicate samples to be collected to meet QA/QC requirements.

The objective of a QAPP is to define procedures for obtaining the type and quality of environmental data and information necessary to support decision making. The consultant will develop a draft QAPP that defines and establishes data quality objectives and procedures for assessing data and information for use in developing the PFOS TMDL, including modeling (e.g., quality objectives and criteria for model inputs/outputs and model calibration). The QAPP will cover new data that will be collected during this project, secondary data (i.e. data that has already been collected elsewhere), and the development and application of the water quality model used to develop the TMDL. The QAPP will discuss all aspects of measurement system design and implementation, ensuring that appropriate methods for sampling, analysis, data handling, and quality control are employed and will be thoroughly documented. The QAPP will also address data validation and usability, to ensure that the individual data elements conform to the specified criteria.

A draft QAPP and monitoring plan will be prepared within four months of project initiation, and finalized within two weeks of the receipt of comments from MPCA.

Deliverables for Task 1:

- Draft memorandum documenting model selection
- Final memorandum documenting model selection
- Draft QAPP and monitoring plan
- Final QAPP and monitoring plan

Responsible Parties: MPCA (Input on management objectives related to model selection, Input on monitoring objectives, review of draft model selection memorandum, review of draft QAPP and monitoring plan), Consultant (Development of model selection memorandum, QAPP and monitoring plan)

Task 2: Problem Definition

Spring 2012 – Summer 2012

The Problem Definition step provides the general setting for the TMDL. For this task, the consultant will:

- Collect all data relevant to development of the PFOS TMDL and consolidate into a Microsoft Excel spreadsheet or database software program determined by MPCA, in a format specified by MPCA;
- Characterize key watershed features relevant to development of the TMDL;
- Characterize the temporal and spatial extent of the impairment; and
- Delineate the study area to be addressed by the TMDL.

The above tasks will be documented in a draft technical report which will fully characterize the watershed and water bodies. A draft report will be submitted to MPCA for review and finalized in response to comments received.

Task 2 will be completed within two months of approval of the QAPP.

Deliverables for Task 2:

- Computer database of all relevant PFOS data for Pool 2
- Draft watershed characterization report
- Final watershed characterization report

Responsible Parties: MPCA (Provision of in-house data, specification of database software requirements, review of draft characterization report), Consultant (Retrieval of non-MPCA data, creation of database, development of characterization report)

Task 3: Specification of a TMDL Target

Spring 2012 – Summer 2012

The purpose of this task is to identify the numeric target(s) to serve as the endpoint for the TMDL. The consultant will:

- Document all relevant water quality targets (e.g. water quality standards, fish tissue targets);
- Select a specific target value for use as the TMDL endpoint;
- Work with MPCA to define the spatial extent (if any) to which in-stream concentrations may exceed the target;
- Specify the duration (i.e. temporal averaging period) and frequency (allowable frequency of excursions) associated with the target; and
- Demonstrate that the target selected is protective of all designated uses.

A draft technical memorandum documenting the above activities will be submitted to MPCA for review and finalized in response to comments received.

Task 3 will be completed within two months of approval of the QAPP.

Deliverables for Task 3:

- Draft memorandum defining selection of a TMDL target
- Final memorandum defining selection of a TMDL target

Responsible Parties: MPCA (Input on spatial extent to which in-stream concentrations may exceed the target, review of draft memorandum), Consultant (development of memorandum)

Task 4: Field Monitoring

Spring 2012 – Spring 2014

The purpose of this task is to collect the additional data necessary to better characterize existing PFOS loads to Pool 2 of the Mississippi River, and allow calibration of a time-variable water quality model describing the fate and transport of PFOS in the water column and sediments of Pool 2. Under this task, the consultant will:

- Conduct field sampling: The consultant will perform the necessary data collection activities, consistent with the requirements specified for sampling, in the QAPP.
- Process collected data: The consultant will review all data collected during this project, to verify that it complies with all data quality objectives outlined in the QAPP. All data found to be in non-compliance with the data quality objectives will be flagged. The overall ability of the dataset to satisfy project objectives will also be assessed, and any data gaps will be identified.
- Prepare a data report: The results of the data review will be documented in a draft data report and provided to MPCA for review. A final version of this report will be produced that incorporates all comments received.
- Enter the data into the project database. Information that will be included in this spreadsheet will be used to identify the sampling location, the segment ID, sampling results by parameter and any data qualifiers.

Task 4 will be completed within 24 months of approval of the QAPP.

Deliverables for Task 4:

- Electronic database containing all monitoring results
- Draft data report
- Final data report

Responsible Parties: MPCA (Review of draft data report), Consultant (field data collection, development of database, development data report)

Task 5: Source Assessment

Spring 2013- Summer 2014

The objective of this task is to quantify the PFOS load contributed by each source category of concern. The consultant will:

- Work with MPCA to define appropriate source categories for consideration in the TMDL; and
- Estimate the PFOS loading rate for each source category, based upon field monitoring data collected in Task 4.

A draft technical memorandum documenting source assessment will be submitted to MPCA for review and finalized in response to comments received.

Task 5 will be completed within four months of completion of the field monitoring.

Deliverables for Task 5:

- Draft memorandum documenting source assessment
- Final memorandum documenting source assessment

Responsible Parties: MPCA (Input on appropriate source categories, review of draft memorandum), Consultant (development of memorandum)

Task 6: Linkage Analysis

Spring 2012 – Winter 2015

The objective of this task is to develop a model capable of relating PFOS loads to resulting PFOS concentration along the entire length of Pool 2. The consultant will develop and apply the time-variable fate and transport model framework selected in Task 1, capable of calculating PFOS concentrations in the water column and sediments over time in response to reduction in loads (or other remedial activities such as removal of contaminated sediments). The model will be calibrated to the field monitoring data collected in Task 4. After the model is calibrated, it will be applied to define the loading capacity of the system, i.e. the maximum PFOS load that will result in attainment of the TMDL target.

The consultant will prepare a draft technical memoranda documenting: 1) the development and calibration of the model, and 2) its application to calculate maximum allowable loads. The draft memoranda will be submitted to MPCA for review and finalized in response to comments received.

Task 6 will be completed within one month of completion of the source assessment.

Deliverables for Task 6:

- Draft memorandum documenting model development and calibration
- Draft memorandum documenting model application
- Final memorandum documenting model development and calibration application
- Final memorandum documenting model application

Responsible Parties: MPCA (Review of draft memoranda), Consultant (development of memorandum)

Task 7: Allocation

Spring 2015- Summer 2015

The objective of this task is to apply the model developed in Task 6 to define the necessary load allocations (LA) and wasteload allocation (WLA) that will result in meeting the loading capacity. This task will begin with selection of specific allocation strategies to be considered. The consultant will define a range of allocation strategies in consultation with MPCA. These strategies will be converted into scenarios that will be simulated with the water quality model to define the maximum allowable load from each source category. The TMDL allocations will also contain a margin of safety and (as appropriate) a reserve capacity incorporating any foreseeable reasonable growth in the watershed and the corresponding increase in point source discharges.

The seasonality of loadings, rainfall and other factors will be evaluated to ensure relevant seasonal factors are considered in the development of the TMDL. Methods for incorporating any seasonal factors will be identified and justification provided if seasonality is not deemed significant.

The consultant will prepare a draft technical memorandum documenting development of the allocations. The draft memorandum will be submitted to MPCA for review and finalized in response to comments received.

Task 7 will be completed within two months of completion of the linkage analysis.

Deliverables for Task 7:

- Draft memorandum documenting allocation strategy and resulting allocations
- Final memorandum documenting allocation strategy and resulting allocations

Responsible Parties: MPCA (Input on allocation strategy, review of draft memorandum), Consultant (development of memorandum)

Task 8: Implementation Plan

Summer 2015

The objective of this task is to define the actions to be taken to achieve the load reductions required by the TMDL. The consultant will develop an implementation plan that will include:

1. Identification of causes and sources
2. Load reductions
3. Nonpoint source controls and identification of critical areas
4. An estimate of assistance needed, costs and sources and authorities to be relied upon for implementation
5. Public involvement
6. Implementation schedule
7. Description of interim measurable milestones
8. Criteria for measuring success
9. Monitoring to evaluate effectiveness

The consultant will prepare a draft implementation plan, which will be submitted to MPCA for review and finalized in response to comments received.

Task 8 will be completed within four months of completion of the allocation task.

Deliverables for Task 8:

- Draft Implementation Plan
- Final Implementation Plan

Responsible Parties: Consultant (development of implementation plan), MPCA (review/approval of implementation plan)

Task 9: Public Participation and Technical Advisory Committee

Summer 2012 – Fall 2015

The objective of this task is to solicit external input on both the development of the TMDL and the implementation plan. This input will be obtained through two types of meetings:

- Technically-oriented meetings with a Technical Advisory Committee
- General information meetings with the public

Three Technical Advisory Committee meetings will be conducted. The first meeting will cover selection of the water quality model to be used in the TMDL. The second meeting will cover model calibration, and the final meeting will cover model application.

Two public meetings will be conducted. The first will be held to present the draft TMDL and the second to present the draft implementation plan. The consultant will lead each of these public

meetings at a location selected by MPCA. The consultant will provide the Agency with presentation materials prior to the meeting, for review and approval.

The first public meeting will be completed within one month of the development of the draft TMDL. The second public meeting will be completed within one month of the development of the draft implementation plan.

Deliverables for Task 9:

- Three Technical Advisory Committee meetings
- Two public meetings and associated presentation material

Responsible Parties: Consultant (development of presentation materials), MPCA (review of presentation materials, meeting logistics)

Task 10: Reporting

Summer 2015 – Winter 2016

The objective of this task is to document all project activities in a manner that will allow the TMDL to be approved by EPA. Deliverables from previous tasks will be used to develop a draft TMDL report. The report will contain all elements necessary to meet the requirements contained in the checklists used by MPCA and EPA for reviewing TMDLs.

The consultant will prepare a draft TMDL, which will be submitted to MPCA for review and finalized in response to comments received. Task 10 will be completed within two months of completion of the Implementation Plan.

Deliverables for Task 10:

- Draft TMDL
- Final TMDL

Responsible Parties: Consultant (development of TMDL), MPCA (review of TMDL)

Measures and Outcome

This work plan lays out the process which the MPCA and the hired consultant will take to develop a PFOS TMDL for Pool 2 of the Mississippi River. The overall outcome will be submittal of a final PFOS TMDL to EPA for approval. In doing so, this will address the PFOS impairment on the Federal 303(d) impaired waters list. A final Implementation Plan will also be developed that will be utilized by local partners to implement practices that will restore and protect surface waters.

PFOS TMDL Scoping for Pool 2 of the Mississippi River
 Appendix 3 – Preliminary Level 3 Work Plan

June 30, 2011

Schedule:

Task	2011			2012			2013			2014			2015			2016		
	Sep	Nov	Jan	Jan	Mar	May	Jul	Sep	Nov	Jan	Mar	May	Jul	Sep	Nov	Jan	Mar	
1. Development of QAPP and Monitoring Plan																		
2. Problem Definition																		
3. Specification of a TMDL Target																		
4. Field Monitoring																		
5. Source Assessment																		
6. Linkage Analysis																		
7. Allocation																		
8. Implementation Plan																		
9. Public Participation																		
10. Reporting																		

Budget Estimate:

TASK	Estimated Hours					Time Total (hours)	Task Total (\$)	Subcontractors (\$)	Non Personnel Costs (\$)	Vehicle Mileage	Total all (\$)
	Level 4 Modeler/ TMDL	Level 3 Manager/ Water Quality	Level 2 Scientist/ Water Quality	Level 1 Scientist/ GIS							
1 Development of a QAPP and Monitoring Plan	36	160	4	4	320	204					
Total Task 1	\$ 6,840	\$ 20,320	\$ 360	\$ 320	\$ 320	\$ 27,840	\$ -	\$ -	\$ -	\$ 0.51	\$ 27,840
2 Problem Definition	4	19	10			33					
Total Task 2	\$ 760	\$ 2,413	\$ 900	\$ -	\$ -	\$ 4,073	\$ -	\$ -	\$ -	\$ -	\$ 4,073
3 Specification of a TMDL Target	4	40	20			64					
Total Task 3	\$ 760	\$ 5,080	\$ 1,800	\$ -	\$ -	\$ 7,640	\$ -	\$ -	\$ -	\$ -	\$ 7,640
4 Field Monitoring		382	560			942					
Total Task 4	\$ -	\$ 48,463	\$ 50,400	\$ -	\$ -	\$ 98,863	\$ 184,800	\$ 13,130	\$ -	\$ -	\$ 296,793
5 Source Assessment	4	60		40		104					
Total Task 5	\$ 760	\$ 7,620	\$ -	\$ 3,200	\$ -	\$ 11,580	\$ -	\$ -	\$ -	\$ -	\$ 11,580
6 Linkage Analysis	150	500	900	900		2,450					
Total Task 6	\$ 28,500	\$ 63,500	\$ 81,000	\$ 72,000	\$ -	\$ 245,000	\$ -	\$ -	\$ -	\$ -	\$ 245,000
7 Allocation	4	24				28					
Total Task 7	\$ 760	\$ 3,048	\$ -	\$ -	\$ -	\$ 3,808	\$ -	\$ -	\$ -	\$ -	\$ 3,808
8 Implementation Plan	8	40				48					
Total Task 8	\$ 1,520	\$ 5,080	\$ -	\$ -	\$ -	\$ 6,600	\$ -	\$ -	\$ -	\$ -	\$ 6,600
9 Public Participation and Technical Advisory Committee	96	64	12			172					
Total Task 9	\$ 18,240	\$ 8,128	\$ 1,080	\$ -	\$ -	\$ 27,448	\$ -	\$ -	\$ -	\$ -	\$ 27,448
10 Reporting	9	60				69					
Total Task 10	\$ 1,710	\$ 7,620	\$ -	\$ -	\$ -	\$ 9,330	\$ -	\$ -	\$ -	\$ -	\$ 9,330
Total Cost Proposal	\$ 59,850	\$ 122,809	\$ 85,140	\$ 75,520	\$ 3,172	\$ 343,319	\$ -	\$ -	\$ -	\$ -	\$ 640,112