



Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2019 ENRTF Work Plan (Main Document)

Today's Date: August 27, 2018

Date of Next Status Update Report: March 1, 2020

Date of Work Plan Approval: June 5, 2019

Project Completion Date: June 30, 2022

Does this submission include an amendment request?

PROJECT TITLE: Neonicotinoid Insecticides: Occurrence And Influence on Algal Blooms

Project Manager: William Arnold

Organization: University of Minnesota

College/Department/Division: Civil, Environmental, and Geo- Engineering

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Location: Statewide

Total Project Budget: \$350,000

Amount Spent: \$0

Balance: \$350,000

Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04a

Appropriation Language: \$350,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to quantify the occurrence of neonicotinoid insecticides in Minnesota's surface waters and groundwaters and assess if the insecticides are contributing to the formation of algal blooms.

I. PROJECT STATEMENT:

New studies that document the baseline occurrence of neonicotinoid insecticides in natural and engineered waters (such as drinking water, wastewater, and storm water) are urgently needed to determine any potential effects in Minnesota waters and to develop guidelines for safe use of neonicotinoids. Neonicotinoid insecticides, are synthetic chemicals that are widely used in urban and agricultural areas. They are highly toxic to many aquatic and terrestrial organisms. They were introduced in the 1990s and now represent a large portion of insecticides not only used in row-crop agriculture, but also in nurseries, in lawns and gardens, and for flea treatment of pets. In the few studies that have been conducted, neonicotinoid compounds have been detected in urban and agricultural streams, groundwater, and even wastewater treatment plant effluent. They have also been detected in soil and rain. Our previous ENTRF research has shown that neonicotinoid insecticides are relatively persistent and likely highly mobile in the environment. These characteristics would suggest they could move away from their point of application and into the broader aquatic environment. The neonicotinoid insecticides have been shown to produce a number of breakdown products, but little is known about the environmental behavior or environmental occurrence of these chemicals. This study would provide a baseline survey of where and at what level these chemicals occur in Minnesota and provide insight into the pathways by which they reach surface and ground waters.

The goals of the project are to:

- Quantify the occurrence of neonicotinoids and their breakdown products in Minnesota's natural and engineered waters,
- Assess any relationship between neonicotinoid levels and formation of algal blooms, and
- Disseminate the findings to stakeholders, regulators, and the public.

Data on neonicotinoid use and environmental detections in Minnesota's waters are limited. Six neonicotinoid insecticides are registered for use in Minnesota for non-agricultural (i.e., urban) and agricultural uses. The Minnesota Department of Agriculture has found four of the six in streams and three of the six in groundwater samples. *The results of this work will have direct impacts on management of neonicotinoid use and the environmental health of Minnesota's urban and out-state surface waters and ground waters.* This work will provide information to the public on the occurrence of these high profile chemicals and aid in management and regulatory decisions related to these compounds.

II. OVERALL PROJECT STATUS UPDATES:

First Update March 1, 2020

Second Update September 1, 2020

Third Update March 1, 2021

Fourth Update September 1, 2021

Fifth Update March 1, 2022

Final Report between project end (June 30) and August 15, 2022

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title: *Frequencies and concentrations of neonicotinoids and breakdown product occurrence in natural and engineered waters*

Description: Streams (50 samples), storm water (20 samples), drinking water (10 samples), and treated wastewater effluents (20 samples) in urban and agricultural areas throughout Minnesota will be sampled to provide a baseline survey of the frequency of occurrence and concentrations of the neonicotinoid insecticides and reaction products. Locations of the sampling sites will inform and complement the work of the MN Departments of Agriculture and Public Health as well as water and wastewater treatment facilities. Water samples will be analyzed for six neonicotinoid insecticides, fipronil (a related veterinarian insecticide), and selected breakdown products.

ACTIVITY 1 ENRTF BUDGET: \$128,000

Outcome	Completion Date
1. <i>Analytical method developed for low-level analysis neonicotinoids and degradates</i>	06/30/20
2. <i>Water samples collected and analyzed for low-level neonicotinoid and degradates</i>	11/01/21
3. <i>Dissemination of Activity 1 findings via open access journal publication(s)</i>	06/01/22

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ACTIVITY 2 Title: *Quantify the occurrence of neonicotinoids and breakdown products in shallow groundwater*

Description: Neonicotinoid insecticides are persistent and mobile in the environment. They have a high potential for moving into and through shallow groundwater. Groundwater is an important source of drinking water to a large portion of the State's population, and groundwater discharge (base flow) is also an important source of water to most lakes and streams. Thus, when groundwater becomes contaminated with the neonicotinoid insecticides, the groundwater can be a vector for delivering these chemicals to both humans and aquatic biota. This portion of the study collaborates with the MN DNR County Geologic Atlas Program to investigate the occurrence of the neonicotinoid insecticides and breakdown products in 72 wells in 12 counties across the state in a mixture of urban, agricultural, and natural lands.

ACTIVITY 2 ENRTF BUDGET: \$122,000

Outcome	Completion Date
1. <i>Groundwater samples collected and analyzed for neonicotinoid and degradates</i>	11/01/21
2. <i>Statistical summary and interpretation of the data</i>	02/01/22
3. <i>Dissemination of Activity 2 findings via open access journal publication(s)</i>	06/01/22

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Fifth Update March 1, 2022

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ACTIVITY 3 Title: *Assess any relationship between neonicotinoid levels and formation of algal blooms*

Description: Neonicotinoid insecticides present in surface waters are toxic to many aquatic fauna including aquatic insects and zooplankton, which eat algae, are important in controlling the algal populations in surface waters. If the neonicotinoid insecticides are present at concentrations that affect the *fauna*, then their control on the algal population may be comprised, and the insecticides may indirectly facilitate in the development of an algal bloom. This Activity examines this possible relationship by quantifying neonicotinoid insecticides concentrations and relative abundance of *Daphnia* populations during periods with and without algal blooms in selected lakes (4 lakes, sampled weekly during one spring to fall season).

ACTIVITY 3 ENRTF BUDGET: \$100,000

Outcome	Completion Date
1. <i>Sampling and analysis of neonicotinoids and Daphnia during and without algal blooms</i>	09/01/21
2. <i>Data analyzed and statistical relationships established</i>	02/01/22
3. <i>Dissemination of Activity 3 findings via open access journal publication(s)</i>	06/01/22

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Fourth Update September 1, 2021

Fifth Update March 1, 2022

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IV. DISSEMINATION:

Description: Results will be disseminated by publication in peer-reviewed journals, presentations and conferences, and via a final report. Funds are requested to make journal articles open access. Data sets will be archived in the Data Repository for the University of Minnesota (<https://conservancy.umn.edu/handle/11299/166578>), a publically available collection of research data. ENTRF support will be acknowledged on all disseminated materials.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the [ENRTF Acknowledgement Guidelines](#).

First Update March 1, 2020

Second Update September 1, 2020

Third Update March 1, 2021

Fourth Update September 1, 2021

Fifth Update March 1, 2022

Final Report between project end (June 30) and August 15, 2022

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Explanation of Use of Classified Staff: N/A

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours for entire duration of project: 4770	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 2.3
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Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Contract Personnel Hours for entire duration of project: N/A	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: N/A
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VI. PROJECT PARTNERS:

Name	Title	Affiliation	Role
Paul Capel	Adjunct Assoc. Prof.	U of MN	Co-investigator

A. Partners outside of project manager’s organization receiving ENRTF funding: N/A

B. Partners outside of project manager’s organization NOT receiving ENRTF funding

Name	Title	Affiliation	Role
John Barry	Hydrogeologist	MN DNR	Collect groundwater samples
Shawn Schottler	Environmental scientist	Science Museum of Minnesota	Algal bloom sampling

VII. LONG-TERM- IMPLEMENTATION AND FUNDING: This project will provide a baseline assessment of the occurrence of the neonicotinoid and selected reaction products in various waters impacted by humans and if they play any role in algal blooms. This work will provide methods to the Minnesota State Agencies for continued studies of these chemicals if needed. Results of the proposed work will provide a strong basis for evaluating the persistence and toxicity of neonicotinoids thus allowing for informed use, management, and, if needed, regulatory actions. The results will be disseminated via open-access scientific literature and reports.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted March 1 and September 1 each year of the project
- A final report and associated products will be submitted between June 30 and August 15, 2022

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

A. Budget Spreadsheet

B. Visual Component or Map

C. Parcel List Spreadsheet: N/A

D. Acquisition, Easements, and Restoration Requirements: N/A

E. Research Addendum

Attachment A:

Environment and Natural Resources Trust Fund

M.L. 2019 Budget Spreadsheet

Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04a

Project Manager: William Arnold

Project Title: Neonicotinoid Insecticides: Occurrence And Influence on Algal Blooms

Organization: University of Minnesota

Project Budget: \$350,000

Project Length and Completion Date: 3 years, June 30, 2022

Today's Date: August 27, 2018



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$ 297,500	\$ -	\$ 297,500
William Arnold, Project Manager (75% salary, 25% fringe benefits). 6% FTE for years 1-3. Project coordination, development of analytical protocols. supervision of graduate and undergraduate researchers. \$51,000			
Paul Capel, co-Project Manager (75% salary, 25% fringe benefits). 6% FTE for years 1-3. Field sampling study design, supervision of graduate and undergraduate researchers. \$51,000			
Graduate student Research assistant, sample collection, processing, measurement of concentrations (57% salary, 43% fringe benefits) 50% FTE for years 1-3. \$149,000			
Undergraduate researcher #1. Assist with field sampling, processing of samples, data analysis. 10 hrs per week during academic year, 40 hours per week in summer. (100% salary) \$23,350			
Undergraduate researcher #2. Assist with field sampling, processing of samples, data analysis. 10 hrs per week during academic year, 40 hours per week in summer. (100% salary) \$23,350			
Equipment/Tools/Supplies			
Laboratory Supplies (chemical and isotopically labelled standards, chemical reagents, necessary glassware, solvents, consumable supplies, laboratory notebooks, software licenses	\$ 16,000	\$ -	\$ 16,000
Analytical time for compound quantification (210 samples including surface waters, groundwaters, and samples during algal blooms	\$ 21,000	\$ -	\$ 21,000
Operating costs for laboratory instruments required for analyses and experiments; costs portioned based on usage by project	\$ 3,000	\$ -	\$ 3,000
Travel expenses in Minnesota			
Charges and university vehicle rental charges for trips to collect water samples. Hotel/meal charges if overnight stay required. Attendance for students at local conferences to disseminate project findings to agriculture and environmental interests. Reimbursement will be according to University of Minnesota guidelines.	\$ 7,500	\$ -	\$ 7,500
Other			
Publication charges to make to make published journal articles (2-3) immediately available via open access to maximize data availability and dissemination	\$ 5,000	\$ -	\$ 5,000
COLUMN TOTAL	\$ 350,000	\$ -	\$ 350,000

OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind: Because the project is overhead free, laboratory space, electricity, and other facilities/adminstrative costs (54% of direct costs excluding permanent equipment and graduate student tuition benefits) are provided in-kind. Additionally, in kind sample collection will be performed by MN DNR and St. Croix Watershed Research Station.	secured	\$ 164,000	\$ -	\$ 164,000

PAST AND CURRENT ENRTF APPROPRIATIONS	Amount legally obligated but not yet spent	Budget	Spent	Balance
Current appropriation:		\$ -	\$ -	\$ -
Past appropriations: M.L.2016,Chp186,Sec.2,Subd.04e,Assessing Neonicotinoid Insecticide Effects on Aquatic and Soil Communities \$400,000	\$ 185,000	\$ 400,000	\$ 215,000	\$ 185,000

