

**Environment and Natural Resources Trust Fund  
2018 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 033-A**

Tracking and Communicating Ice Safety

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**Category:** A. Foundational Natural Resource Data and Information

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**Total Project Budget: \$** 282,000

**Proposed Project Time Period for the Funding Requested:** 3 years, July 2018 to June 2021

**Summary:**

Minnesota DNR has reported that 193 people have lost their lives in the last three decades. Mid-winter warmth, road salt lead to uncertainty and higher risk to human safety.

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**Sponsoring Organization:** U of MN

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:** Statewide

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**Alternate Text for Visual:**

The proposal will look at lakes across Minneota

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



**Environment and Natural Resources Trust Fund (ENRTF)**

**2018 Main Proposal**

**Project Title:** *Don't Fall Through the Cracks: Tracking and Communicating Ice Safety*

**PROJECT TITLE:** Don't Fall Through the Cracks: Tracking and Communicating Ice Safety

**I. PROJECT STATEMENT**

Many Minnesotans enjoy outdoor ice activities on lakes during winter. However, thin ice-related accidents occur too often — the Minnesota DNR has reported that 193 people have lost their lives in the state in the last three decades. Mid-winter warm spells and increased salt in Metro lakes has led to uncertainty and higher risk to human safety.

This project will develop inexpensive devices to measure ice thickness and quality in real-time and make the information publically available online. A team of engineers and scientists will determine how many, and which lakes should be monitored for greatest efficacy, followed by the installation of a remote sensing arrays to communicate ice depth and quality data to the public. The data from this installation would also prove useful in the future for predicting seasonal ice parameters from year to year.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Design of ice depth and quality sensing platform**

**Budget: \$99,000**

*Design of GPS-enabled impedance-measurement based ice depth and quality sensors capable of inexpensive bulk deployment and remote data acquisition. (Lead by Kouttron)*

<b>Outcome</b>	<b>Completion Date</b>
<i>1. Evaluate design requirements and establish sensor package and communication system design</i>	<i>April 2019</i>
<i>2. Prototype sensor package and communication design</i>	<i>December 2018</i>
<i>3. Basic bench testing (including calibration) and design iteration</i>	<i>June 2019</i>
<i>4. Establishment of final design</i>	<i>September 2019</i>

**Activity 2: Field Testing phase**

**Budget: \$101,000**

*Testing of both physical sensor package and communication infrastructure in varying field settings along with evaluation of failure modes, followed by design adjustment using data gathered during testing. (Lead by Magner)*

<b>Outcome</b>	<b>Completion Date</b>
<i>1. Testing of sensor package in local water bodies</i>	<i>April 2020</i>
<i>2. Evaluate robustness and failure modes of both physical sensor package and communication/data management infrastructure</i>	<i>April 2020</i>
<i>3. Evaluate quality and consistency of data collected</i>	<i>April 2020</i>
<i>4. Modify prototype designs if necessary</i>	<i>September 2020</i>

**Activity 3: Determination of spatial and geographical deployment parameters**

**Budget: \$27,000**

*Decisions regarding sensor placement will be made using statistical and limnological analysis of potential targets at both state and local levels. (Lead by Wilson)*

<b>Outcome</b>	<b>Completion Date</b>
<i>1. Classify and rank lakes for ice safety and recreational importance</i>	<i>November 2019</i>
<i>2. Determine how many sensors should be placed within lakes of highest importance</i>	<i>November 2019</i>
<i>3. Decide sensor distribution within individual lakes</i>	<i>November 2019</i>
<i>4. Determine strategy for statistical representation of lakes across Minnesota</i>	<i>November 2019</i>



**Environment and Natural Resources Trust Fund (ENRTF)**

**2018 Main Proposal**

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**Activity 4: Deployment**

**Budget: \$55,000**

*Deployment of sensor packages and website system before the lakes begin freezing over. (Lead by Magner)*

<b>Outcome</b>	<b>Completion Date</b>
1. Deploy sensors (number/location determined in Activity 3) in each of 5 lakes.	November 2020
2. Publicly accessible website for ice depth/quality data launched simultaneously.	November 2020
3. Active monitoring of sensors throughout the winter with monthly side-by-side comparisons.	November 2020
4. Sensor recovery after lakes thaw completely; post-project data analyses	May 2021

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

Dr. Joe Magner is a research professor in the Bioproducts and Biosystems Engineering (BBE) department of the University of Minnesota will be supervising the project; he has 40 years of experience with field deployment of water test equipment including winter measurements. He has a depth of knowledgeable concerning the geography and limnology of Minnesota.

Hanna Lin, a graduate student also in the BBE department at UMN, has experience in mechanical design, fabrication, and environmental hardening. She will be involved in the design, deployment, and analysis phases of the project.

Dane Kouttron, Special Projects Engineer at MIT, has experience designing, testing, and deploying a wide range of sensing systems spanning several scientific disciplines. He has an extensive background in electrical engineering, radio communications, and power electronics.

Dr. Bruce Wilson is a professor (BBE). His extensive knowledge of hydrological modeling, parameter estimation, and statistical design will guide Activity 3 and the post-project data analyses portion of Activity 4.

**B. Project Impact and Long-Term Strategy**

The long term impact of this work is to establish a dependable, state-funded platform where Minnesotans can get statewide reliable and timely ice safety information before engaging in lake-related recreational activities.

**C. Timeline Requirements**

The timeline for this proposal is three years (July 2018 to June 2021), Product development in 2018-19 and deployment in 2020-21; including both deployment before ice-in and recovery and analysis after ice-out).

## 2018 Detailed Project Budget

**Project Title:** *Don't Fall Through the Cracks: Tracking and Communicating Ice Safety*

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM (See "Guidance on Allowable Expenses", p. 13)	AMOUNT
<b>Personnel:</b>	\$ -
Joseph Magner, PI, (self-supporting faculty) will provide direction for the project. 75% salary/25% benefits	\$ 50,000
Bruce Wilson, Co-PI - No funds requested	\$ -
Civil services and other technical staff (3 individuals); approximately 0.3 FTE. 78.5% salary/22% fringe	\$ 63,000
Undergraduate support staff, part-time academic year and full-time summer. 100% salary	\$ 44,000
Graduate research assistant, .25 FTE time, 58% salary/42% fringe	\$ 70,000
<b>Professional/Technical/Service Contracts:</b>	\$ -
Professional services for MIT engineer	\$ 25,000
<b>Equipment/Tools/Supplies:</b>	\$ -
Lab supplies and construction materials	\$ 30,000
<b>Acquisition (Fee Title or Permanent Easements):</b> <i>In this column, indicate proposed number of acres and name of organization or entity who will hold title.</i>	\$ -
<b>Travel:</b> <i>Be specific. Generally, only in-state travel essential to completing project activities can be included.</i>	\$ -
<b>Additional Budget Items:</b> <i>In this column, list any additional budget items that do not fit above categories. List by item(s) or item type(s) and explain how number was determined One row per type/category.</i>	\$ -
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 282,000</b>

### V. OTHER FUNDS (This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)

SOURCE OF FUNDS	AMOUNT	Status
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	<i>Indicate: Secured or Pending</i>
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	<i>Indicate: Secured or Pending</i>
<b>In-kind Services To Be Applied To Project During Project Period:</b> <i>Unrecovered Indirect Costs</i>	\$ 140,000	<i>Secured</i>
<b>Past and Current ENRTF Appropriation:</b>	\$ -	<i>Indicate: Unspent? Legally Obligated? Other?</i>
<b>Other Funding History:</b>	\$ -	

# Magner Water Lab placing prototype sensor in Fleming Lake



## Project Manager Qualifications & Organization Description

Joe Magner is a licensed professional hydrologist (WI), a licensed professional soil scientist (MN) and an American Institute of Hydrology registered professional hydrogeologist. He received degrees from the University of Wisconsin-River Falls and the University of Minnesota and has served as an environmental scientist and educator in varying roles for over 38 years; primarily with the MN Pollution Control Agency but also advising federal and local governments, including officials in China, India, Azerbaijan and South Africa. Additionally, Dr. Magner has also advised David Letterman, private sector consultants, NGOs.

He uses varying tools to assess, communicate protect and restore ecosystem services, ecohydrologic and hydrogeologic function. Dr. Magner is a research professor in the Department of Bioproducts & Biosystems Engineering at the University of Minnesota. He teaches classes and advises students in water sensors, agroforestry, water quality, hydrology, ecological engineering and watershed management. Joe has over 80 publications and is a co-author of the 4<sup>th</sup> edition of *Hydrology and the Management of Watersheds* published by Wiley-Blackwell (2012).

Dr. Magner leads a water lab in the Department of Bioproducts & Biosystems Engineering at the University of Minnesota. He has managed over 25 project varying in size and scope and has technicians and professionals who assist in his lab. Work objectives and tasks will be assigned to key staff for completion, but Dr. Magner will be responsible for completing the project on time and within budget.