

2017 LCCMR Proposals Additional Material

The following packet includes information staff requested related to 2017 proposals. Staff requested information from Minnesota Aquatic Invasive Species Resource Center (MAISRC) and Minnesota Invasive Terrestrial Plant and Pest Center (MITPPC) to help review the proposals related to invasive aquatic and terrestrial species. Staff requested information from St. Anthony Falls Laboratory (SAFL) because of the number of proposals that include SAFL personnel. Staff requested additional clarification regarding proposal 52B in regards to funding a Minnesota Center for Water Treatment Technology Innovation and relationship to several individual proposals from the University of Minnesota. Further information and clarification was sought and received regarding parks and trails proposals, a DNR internship proposal, and a Washington County decontamination proposal. Staff requested information regarding the Renewable Development Fund priorities to help review energy related proposals. The following is a list of the topics, proposals, and people that staff requested information, which can be found within this packet. This information is not intended to be all inclusive. It is a subject of inquiries we have sent for.

Follow up information:

1. Aquatic Invasive Species (AIS) Proposals – 11 proposals, Response from Dr. Sue Galatowitsch, AIS Center Director (page 3)
2. Terrestrial Invasive Species (TIS) Proposals – 8 proposals, Response from Dr. Robert Venette, TIS Center Director (page 11)
3. U of MN, St. Anthony Falls Laboratory (SAFL) - 20 proposals with affiliation, Response from Dr. Chris Paola, Interim Director (page 19)
4. Proposal 52B - The Minnesota Center for Water Treatment Technology Innovation, Response from, Dr. Raymond Hozalski, U of M (page 45)
5. Parks and Trail related – 4 proposals – Response from Kent Skaar, DNR Parks and Trails Division (page 59)
6. Proposal 82C - Increasing Diversity in Environmental Careers: Fellowships, Internships, Mentorships, Response from, Vikki Getchell, DNR (page 65)
7. Proposal 124D Preventing the Spread of AIS with Decontamination Units, Washington County, Response From, Colin Kelly, Washington County (page 67)
8. Renewable Development Fund (RDF) information related to energy proposals, Response from Mark Ritter, RDF Grant Administrator, Xcel Energy (page 71)

1. Aquatic Invasive Species (AIS) Proposals – 11 proposals, Response from Dr. Sue Galatowitsch, AIS Center Director
 - a. LCCMR email request
 - b. Table of 2017 proposals with aquatic invasive species
 - c. Sue Galatowitsch email response
 - d. Additional material

LEGISLATIVE CITIZEN COMMISSION ON MINNESOTA RESOURCES

100 REV. DR. MARTIN LUTHER KING JR. BLVD.
ROOM 65 STATE OFFICE BUILDING
ST. PAUL, MINNESOTA 55155-1201

Phone: (651) 296-2406
Email: lccmr@lccmr.leg.mn
Web: www.lccmr.leg.mn
TTY: (651) 296-9896 or 1-800-657-3550

Susan Thornton, Director

DATE: April 29, 2016
TO: Dr. Susan Galatowitsch, Director
FROM: Susan Thornton, Director
SUBJECT: Regarding 2017 Proposals Received Related to AIS

Dear Dr. Galatowitsch,

The Legislative Citizen-Commission on Minnesota Resources (LCCMR) staff are currently reviewing 2017 project proposals received in response to the Environment and Natural Resources Trust Fund RFP. We received 12 proposals related to aquatic invasive species. In addition to the MAISRC proposal there are 5 carp related proposals and 6 other species. They are listed below. By providing you the suite of projects related to AIS, we are seeking your expertise and sharing with you the range of AIS projects LCCMR will be reviewing. As part of the review process it is helpful to understand how these projects relate to Minnesota Aquatic Invasive Species Research Center mission, goals, and priorities.

We are requesting on behalf of the LCCMR, additional information, insight and expertise, to better understand the research context of these proposals. Questions we have include:

- Were these projects proposed to MAISRC?
- Based on MAISRC mission, goals, and priorities, do these proposals fit into identified priorities?
- Can you provide any insight regards to the status of research related to the topics of these proposals?
- Can you comment on why these projects were proposed to LCCMR and not to MAISRC?

We would greatly appreciate MAISRC's feedback regarding the following proposals. Your insight will help the LCCMR better understand the context of these projects. We would like your feedback by Wednesday May 11th.

Feel free to contact LCCMR with any questions,

Proposals Related to Aquatic Invasive Species**MAISRC (not for review)**

Galatowitsch, Susan (U of M):

Using Science to Solve Minnesota's AIS problems - Phase II-\$6,100,000

For Review**Carp**

Bajer, Przemyslaw (U of MN):

Adapting Stream Barriers to Remove Invasive Fish-\$381,150

Restoring Agricultural Lakes and Watersheds by Managing Carp-\$967,100

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

Mensing, Allen (UMD):

Bioacoustics to Deter and Eliminate Invasive Bigheaded Carp-\$399,934

Parsons, Bradford (DNR):

Continuation of Invasive Carp and Native Fish Evaluation-\$739,064

Smanski, Michael (U of MN):

New Technology to Control Invasive Carp-\$389,000

Sorensen, Peter (U of MN):

Acquiring Key Information for a Carp Deterrent System at Lock and Dam #5-\$284,000

Other Species

Ahlers, Adam (Kansas State University):

A Native Biocontrol for Invasive Hybrid Cattails-\$306,728

Furey, Paula (U of MN):

Will the Invasive Alga *Didymosphenia* Degrade Minnesota Waters?- \$207,213

Hall, Kristin (Audubon Minnesota):

Maximize Value of Water Impoundments to Wildlife [*Cattails*]-\$195,000

Kiesling, Richard (USGS):

Quantifying Spiny Waterflea Threats to Minnesota Walleye Lakes-\$1,690,320

McGaugh, Suzanne (U of M):

Northward Expansion of Ecologically Damaging Species [*Red-Ear Sliders and Bullfrogs*]-
\$213,000

Ozersky, Tedy (UMD):

Impact of Zebra Mussels on Mercury in Fish-\$211,437

2017 Proposals with AIS Aspect

Species	Last	First	Project Title	Affiliation	Amount Requested	Summary
MASIRC	Galatowitsch	Susan	Using Science to Solve Minnesota's AIS problems - Phase II	U of MN	\$6,100,000	10-14 competitive research projects or rapid assessments will be launched to find solutions to Minnesota's top AIS problems through control, prevention, and early detection of existing and emerging AIS threats.
Carp	Bajer	Przemyslaw	Adapting Stream Barriers to Remove Invasive Fish	U of MN	\$381,150	Field tests at existing barrier sites and laboratory experiments to adapt a recently developed technology to remove invasive carp from streams during their spawning migrations in Minnesota
Carp	Bajer	Przemyslaw	Restoring Agricultural Lakes and Watersheds by Managing Carp	U of MN	\$967,100	Whole-lake experiments, surveys, and modeling to show when and where carp management is the most effective and economical approach for improving water quality in lakes and streams across south-central Minnesota
Carp	Mensingher	Allen	Bioacoustics to Deter and Eliminate Invasive Bigheaded Carp	U of MN - Duluth	\$399,934	The next generation of sound based deterrent barriers and herding/capture technology will be developed, tested and deployed to deter, control and/or eliminate invasive silver and bighead carp
Carp	Parsons	Bradford	Continuation of Invasive Carp and Native Fish Evaluation	MN DNR	\$739,064	Minnesota DNR will continue Invasive Carp monitoring in the Mississippi River and tributaries, employ advanced acoustic telemetry, and assess food chains to determine how native species prevent Invasive Carp establishment.
Carp	Smanski	Michael	New Technology to Control Invasive Carp	U of MN	\$389,000	We developed a new technology that can significantly reduce or eradicate an invasive species with no harm to native species. We will apply this to control invasive carp.
Carp	Sorensen	Peter	Acquiring Key Information for a Carp Deterrent System at Lock and Dam #5	U of MN	\$284,000	We complete an approach to stop invasive carp by perfecting a sound deterrent system while helping the DNR with feasibility studies and the US Army Corps with improving gate operations
Cattails	Ahlers	Adam	A Native Biocontrol for Invasive Hybrid Cattails	Kansas State University	\$306,728	Our project will quantify the impact of invasive hybrid cattails on MN wetlands and investigate the effectiveness of reintroduced muskrat populations as a potential native biocontrol.
Alga	Furey	Paula	Will the Invasive Alga Didymosphenia Degrade Minnesota Waters?	St. Catherine University	\$207,213	This project assesses the extent of the invasive alga Didymosphenia in Minnesota waters, examines bloom triggers and foodweb implications to lead to prevention and control measures, and includes outreach components.
Cattails	Hall	Kristin	Maximize Value of Water Impoundments to Wildlife	Audubon Minnesota	\$195,000	Water impoundments function as important artificial wetlands for many migrating and breeding birds. We propose to control invasive hybrid cattail which reduces the habitat quality and functionality of these impoundments.
Spiny Waterflea	Kiesling	Richard	Quantifying Spiny Waterflea Threats to Minnesota Walleye Lakes	U. S. Geological Survey	\$1,690,320	The proposed project will quantify the threats posed by established populations of spiny waterflea (Bythotrephes longimanus) to the sustainability of aquatic ecosystems in vulnerable Minnesota walleye lakes
Turtles and Frogs	McGaugh	Suzanne	Northward Expansion of Ecologically Damaging Species	U of MN	\$213,000	This work will predict the future Northern expansion of two species (American bullfrogs and Red-eared slider turtles) that have great potential to negatively alter the fish communities of Minnesota's lakes and streams.
Zebra Mussels	Ozersky	Tedy	Impact of Zebra Mussels on Mercury in Fish	U of MN - Duluth	\$211,437	Invasive zebra mussels have the potential to impact concentrations on toxic mercury in Minnesota's fish. We will study these effects of zebra mussels, helping understand their impact on Minnesota's resources

From: Susan Galatowitsch [mailto:galat001@umn.edu]
Sent: Tuesday, May 10, 2016 2:32 PM
To: Diana Griffith <diana.griffith@lccmr.leg.mn>
Cc: nash0029@umn.edu; Susan Thornton <susan.thornton@lccmr.leg.mn>; Michael Varien <Michael.Varien@lccmr.leg.mn>; Michael McDonough <michael.mcdonough@lccmr.leg.mn>
Subject: Re: ENRTF 2017 Proposals Received Related to AIS

Hi Susan--Here is my input on these AIS proposals for LCCMR 2017--Let me know if you have any further questions. I hope this is helpful.
Sue Galatowitsch

Minnesota Aquatic Invasive Species Resource Center Response				
ID #	TITLE	SUMMARY	COMMENTS RE: MAISRC COORDINATION	COMMENTS RE: RESEARCH NEED & PRIORITIES
119-D	Adapting stream barriers to remove invasive fish (Bajer-PI)	Field tests at existing barrier sites and laboratory experiments to adapt a recently developed technology to remove invasive carp from streams during their spawning migrations in Minnesota	MAISRC did not discuss the specifics of this project with the PI; but the PI was aware that MAISRC would not be able to fund, in part because of major investments already committed to carp research by MAISRC.	MAISRC considers common carp to be a priority species. This project is not considered a high priority research need for the center, primarily because it already has other major research projects on carp migration and barriers. This work, however, is not redundant with those other projects.
042-B	Restoring agricultural lakes and watersheds by managing carp (Bajer PI)	Whole-lake experiments, surveys and modeling to show when and where carp management is the most effective and economical approach for improving water quality in lakes and streams across south-central Minnesota.	The PI and research team met with the MAISRC Director to discuss the project. Because the primary aim of the project is to quantify water quality benefits from carp management, it was not submitted as a MAISRC project (ie. More about nutrient dynamics than AIS). Also, MAISRC could not consider funding because we do not have available \$ to support the proposal.	There is a high need for this research and there is no other known ongoing work in the state or the region on this topic. MAISRC considers common carp to be a priority species. This particular topic is not on the current research needs assessment, partly because MAISRC had already committed a high level of funding to other carp projects.
113-D	Bioacoustics to deter and eliminate invasive bigheaded carp (Mensinger PI)	The next generation of sound based deterrent barriers and herding/capture technology will be developed, tested and deployed to deter, control and/or eliminate invasive silver and bighead carp	MAISRC did not discuss this project with the PI prior to submission. It is not clear that the various researchers working on Asian carp deterrents collaborate or communicate. MAISRC could not consider funding because we do not have available \$ to support the proposal and Peter Sorensen has already received funding to work on related problems.	MAISRC considers Asian carps to be priority species. This particular topic is not on the current research needs assessment, partly because MAISRC had already committed a high level of funding to other carp projects. There are several groups in the midwest researching deterrents for Asian carps--how these projects and proposal relate to one another is not clear--investigators should address this in proposals.
114-D	Continuation of invasive carp and native fish evaluation. (Parsons-PI DNR)	Minnesota DNR will continue Invasive Carp monitoring in the Mississippi River and tributaries, employ advanced acoustic telemetry, collect baseline "pre-invasion" food chain data, and determine how native species can prevent Invasive Carp establishment.	MAISRC did not discuss this project with the PI prior to submission. It is not primarily research so MAISRC would not consider funding--the work focuses on monitoring for occurrences.	MAISRC considers Asian carps to be priority species. However, this project is primarily observational monitoring--ie does not have specific research aims.
111-D	New technology to control invasive carp. Smanski (PI-UM)	We developed a new technology that can significantly reduce or eradicate an invasive species with no harm to native species. We will apply this to control invasive carp.	The PI discussed this project with MAISRC Director in early stages to find MAISRC faculty collaborators and discuss funding. MAISRC could not consider funding because we did not have available \$ to support the project.	This is early-stage research using innovative technology. Applying this technology to develop a carp biocontrol appears to be novel; we do not know of other researchers working on this topic. This is a priority species for the center, and supporting development of innovative technologies for AIS is also a strategic center priority.
117-D	Acquiring key information for a carp deterrent system at Lock and Dam #5 -(Sorensen PI)	We complete an approach to stop invasive carp by perfecting a sound deterrent system while helping the DNR with feasibility studies and the USACOE with improving gate operations	The PI discussed this project with MAISRC Director when this work was proposed as part of a larger project, including construction of a barrier. MAISRC could not consider funding because we do not have additional available \$ to support the project.	MAISRC considers Asian carps to be priority species. This particular topic is not on the current research needs assessment, partly because MAISRC had already committed a high level of funding to other carp research projects. There are several groups in the midwest researching deterrents for Asian carps--how these projects and proposal relate to one another is not clear--investigators should address this in proposals.
125-D	A native biocontrol for invasive hybrid cattails. (Ahlers-KSU)	Our project will quantify the impact of invasive hybrid cattails on MN wetlands and investigate the effectiveness of reintroduced muskrat populations as a potential native biocontrol	MAISRC did not discuss this project with the PI prior to submission. We would not consider funding because this seems to be a general aquatic ecology research project framed as AIS control research, vs a project that is primarily about AIS control.	MAISRC considers hybrid cattail control to be a priority research need. However the proposed research is unlikely to yield an actionable solution. Muskrat populations have dynamics that make them poor biocontrol agents. Moreover, the research doesn't seem to be mostly about AIS solutions but more basic ecology. Finally, recent research indicates that cattail control will require sediment manipulations--grazing won't be adequate.
116-D	Will the invasive alga Didymosphenia degrade MN waters? Furey -PI (St. Catherines)	This project assesses the extent of the invasive alga Didymosphenia in Minnesota waters, examines bloom triggers and foodweb implications to lead prevention and control measures and includes outreach components	MAISRC did not discuss this project with the PI prior to submission. MAISRC does not currently have funds to support this project.	MAISRC considers Didymo to be a priority species and we have not yet supported research on this species. There has been attention to the species in other parts of the world, but not MN. How this work relates to other research needs to be explored with investigators.

123-D	Maximize value of water impoundments to wildlife -(Hall-Audubon)	Water impoundments function as important artificial wetlands for many migrating and breeding birds. We propose to control hybrid cattails which reduces habitat quality and functionality of these impoundments.	MAISRC did not discuss project with the PI prior to submission. This is not AIS research and so MAISRC would not fund.	MAISRC considers hybrid cattail control to be a priority research need. However, this proposal does not aim to improve control methods and relies on current practices which have very low rates of long-term success. There have been other similar projects recently funded by LCCMR (to David Andersen) and by USGS (Adaptive Management initiative). It is not clear how this research differs from those.
109-D	Quantifying spiny waterflea threats to Minnesota walleye lakes. (Kiesling-PI)	The proposed project will quantify the threats posed by established populations of spiny waterfleas to the sustainability of aquatic ecosystems in vulnerable MN walleye lakes	MAISRC discussed this project with one of the researchers prior to submission. MAISRC could not consider funding because we do not have available \$ for this work. If we did have resources, we would likely fund this in stages to ensure there was sufficient information to drive a dynamic food web model for one lake that produces actionable results.	MAISRC considers SWF to be a priority species. Understanding food web impacts of SWF is also a MAISRC research need. We recently funded a project to explore some key aspects of SWF invasions--the data from our study will be useful for this proposed modeling effort but will not likely be available for two years. Field research on SWF impacts in MN and WI have recently been published, which should help this modeling effort. We do not know of other modeling research on SWF.
121-D	Northward expansion of ecologically damaging species. (McGaugh-PI.)	This work will predict the future Northern expansion of two species (American bullfrogs and Red-eared slider turtles) that have great potential to negatively alter fish communities of MN's lakes and streams.	MAISRC did not discuss the project with the PI prior to submission. For MAISRC to fund, we would first need to assess whether these species warrant priority consideration (ie assessment by MAISRC technical committee).	These species are not currently considered high priorities for MAISRC; however we may have a "gap" in our priorities, since there has been no systematic consideration of amphibians and reptiles by the MAISRC technical committee. There is some work on bullfrogs happening in Iowa; but AIS herps has not received much attention, relative to other aquatic vertebrates (especially fish).
115-D	Impact of zebra mussels on mercury in fish - (Ozersky-PI)	Invasive zebra mussels have the potential to impact concentrations on toxic mercury in Minnesota's fish. We will study these effects on ZM, helping understand their impact on MN resources	This research project was proposed to MAISRC in response to the Fall 2015 RFP. We did not fund because the work was not considered a high priority; i.e., it was not likely to generate information that would lead to an AIS solution --either in the short-term or long-term.	Zebra mussels are a MAISRC priority species, but this topic is not a high priority research need for the Center. The focus is on description of threats rather than having the potential to yield new solutions.

2. Terrestrial Invasive Species (TIS) Proposals – 8 proposals, Response from Dr. Robert Venette, TIS Center Director
 - a. LCCMR email request
 - b. Table of 2017 proposals with TIS
 - c. Robert Venette email response
 - d. Additional material

LEGISLATIVE CITIZEN COMMISSION ON MINNESOTA RESOURCES

100 REV. DR. MARTIN LUTHER KING JR. BLVD.
ROOM 65 STATE OFFICE BUILDING
ST. PAUL, MINNESOTA 55155-1201

Phone: (651) 296-2406
Email: lccmr@lccmr.leg.mn
Web: www.lccmr.leg.mn

TTY: (651) 296-9896 or 1-800-657-3550

Susan Thornton, Director

DATE: April 29, 2016
TO: Dr. Rob Venette, Director
FROM: Susan Thornton, Director
SUBJECT: Regarding 2017 Proposals Received Related to TIS

Dear Dr. Venette,

The Legislative Citizen-Commission on Minnesota Resources (LCCMR) staff are currently reviewing 2017 project proposals received in response to the Environment and Natural Resources Trust Fund RFP. We received 7 proposals related to terrestrial invasive species. They are listed below. By providing you the suite of projects related to TIS, we are seeking your expertise and sharing with you the range of TIS projects LCCMR will be reviewing. As part of the review process it is helpful to understand how these projects relate to Minnesota Invasive Terrestrial Plants and Past Center mission, goals, and priorities.

We are requesting on behalf of the LCCMR, that you as director provide us, additional information to understand the research context of these proposals. Questions we have include:

- Were these projects proposed to MITPPC?
- Based on MITPPC mission, goals, and priorities, do these proposals fit into identified priorities?
- Can you provide any insight regards to the status of research related to the topics of these proposals?

Can you comment on why the Mountain Pine Beetle research project was proposed to LCCMR and not to MITPPC?

We would greatly appreciate MITPPC's feedback regarding the following proposals. Your insight will help the LCCMR better understand the context of these projects. We would like your feedback by Wednesday May 11th.

Feel free to contact LCCMR with any questions,

Proposals Related to Aquatic Invasive Species

Emerald Ash Borer

Abrahamson, Mark (MDA):

Conserving Trees and Biodiversity with Strategic EAB Management- \$708,500

Bushley, Kathryn (U of M):

Microbial Associates of the Emerald Ash Borer - \$400,000

Osthus, Jonathan (MDA):

Jeff Broberg, Sen. Gary Dahms, Sen. Kari Dziedzic, William Faber, Nancy Gibson, Rep. Tom Hackbarth, Bonnie Harper-Lore, John Hoffman, Gary Lamppa, Rep. Denny McNamara, Norman Moody, Rep. John Persell, Sen. David Tomassoni, Rep. Paul Torkelson, Rep. Dan Wagenius, Sen. Torrey Westrom, Dana Young

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

EAB Biocontrol Phase III: Assessment and Citizen Engagement- \$729,540

Other

Aukema, Brian (U of M):

Mountain Pine Beetle Phase II: Protecting Minnesota, \$384,838

Becker, Roger (U of M):

Implementing Biological Control of Garlic Mustard, \$421,987

Chandler, Monika (MDA):

Tactical Invasive Plant Management Plan Development, \$296,832

Wackett, Lawrence (U of M):

Natural Products for Protecting Minnesota Natural Resources- \$247,000

2017 Proposals with TIS Aspect

Last	First	Project Title	Affiliation	Amount Requested	Summary
Abrahamson	Mark	Conserving Trees and Biodiversity with Strategic EAB Management	Minnesota Department of Agriculture	\$708,500	EAB is spreading but most of Minnesota is not yet affected. We will measure impacts of tree removal and treatments on EAB populations and non-target organisms to improve management strategies.
Bushley	Kathryn	Microbial Associates of the Emerald Ash Borer	U of MN	\$400,000	This project will investigate microbes associated with the invasive Emerald Ash Borer with the goal of identifying strain or chemical compounds that can be used for biological control.
Osthus	Jonathan	EAB Biocontrol Phase III: Assessment and Citizen Engagement	Minnesota Department of Agriculture	\$729,540	Biocontrol is the best landscape level management option for EAB. We will implement biocontrol using a newly approved parasitic wasp, assess impact of the statewide program and engage citizen volunteers.
Aukema	Brian	Mountain Pine Beetle Phase II: Protecting Minnesota	U of MN	\$384,838	Phase I found that mountain pine beetle can kill every species of pine in Minnesota. This insect attacks in numbers. Now we extend surveys and determine minimum number for survival.
Becker	Roger	Implementing Biological Control of Garlic Mustard	U of MN	\$421,987	Gain approval and implement release of a crown-mining weevil for biological control of garlic mustard in Minnesota; complete testing of a seed-feeding weevil for additional control of garlic mustard.
Chandler	Monika	Tactical Invasive Plant Management Plan Development	Minnesota Department of Agriculture	\$296,832	Develop regional priorities and an action plan for invasive plant management to protect and promote habitat and native species.
Wackett	Lawrence	Natural Products for Protecting Minnesota Natural Resources	U of MN	\$247,000	We will develop, demonstrate, and disseminate methods to replace the use broad-spectrum pesticides that kill many insects by using natural products that eradicate only undesirable, invasive species insects.

From: Robert Venette [mailto:venet001@umn.edu]

Sent: Friday, May 13, 2016 6:14 PM

To: Diana Griffith <diana.griffith@lccmr.leg.mn>

Cc: Heather Koop <hkoop@umn.edu>; Susan Thornton <susan.thornton@lccmr.leg.mn>; Michael Varien <Michael.Varien@lccmr.leg.mn>; Michael McDonough <michael.mcdonough@lccmr.leg.mn>

Subject: Re: ENRTF 2017 Proposals Received Related to TIS

Dear Susan-

Here are my comments on the TIS proposals for 2017. Please let me know if my comments require any clarification.

Most kindly,
Rob

May 13, 2016

Susan Thornton, Director
Legislative-Citizen Commission on Minnesota Resources
100 Rev. Martin Luther King Jr. Blvd
St Paul, MN 55155

Dear Director Thornton (Susan):

As Director of the Minnesota Invasive Terrestrial Plants and Pests Center, I am pleased to provide feedback on the seven proposals to LCCMR that relate to terrestrial invasive species (TIS). As a matter of full disclosure, I do have a conflict of interest. Specifically, I am a cooperator on three of the proposals and, if funded, would receive financial support for up to two graduate students and a post doc. I will highlight those projects in my proposal-specific comments below.

General comments

None of the proposals in its current form has been submitted to MITPPC. A modified version of the proposal from Prof. Roger Becker (Implementing Biological Control of Garlic Mustard) had been submitted to us in 2015. That proposal had considerable merit, but ranked below four other projects that were competing for funds. Those four projects utilized the complete \$1.2 million that we intended to allocate in the initial round of funding.

The mission of MITPPC is focused on applied research. Planning, outreach, or management (i.e., operational) activities are not eligible for funding through the Center. MITPPC's initial call for proposals reflected research priorities of the four state agencies with primary responsibilities for TIS management in the state. Our second call for proposals will address a broader suite of research needs. MITPPC has completed its initial ranking of the 120 top TIS threats to Minnesota. Those rankings are currently being reviewed by our 12-member prioritization panel and will then be subject to a 30-day public comment period. While I suspect that several of the TIS proposals that LCCMR has received could fit within the upcoming taxonomic and thematic priorities for research, none of those priorities can be considered final until all feedback has been considered (anticipated completion: July 1, 2016).

Project-specific comments (in alphabetical order of the project director)

Abrahamson (Conserving Trees and Biodiversity with Strategic EAB Management) – I am a cooperator on this proposal and would receive funding to co-advise a graduate student. Approximately one third of the project (Activity 2-Assess approaches and develop guidelines) is operational or outreach related and is not eligible for funding through the MITPPC. In my opinion, the proposal complements previous research. Due to my conflict of interest, it is not appropriate for me to comment on the scientific merits of the proposal

Aukema (Mountain Pine Beetle Phase II: Protecting Minnesota) – I am a cooperator on this proposal. I would receive funding to co-advise a postdoctoral research associate to work on Activities 2 and 3. Activity 1 (expanded survey for bark beetles) is operational and not eligible for funding through MITPPC. Due to my conflict of interest, it is not appropriate for me to comment on the scientific merits of the proposal.

Becker (Implementing Biological Control of Garlic Mustard) – I am not a cooperator on this proposal. Activity 1 (Release the crown boring weevil for control of garlic mustard) is purely operational and not eligible for funding through MITPPC. Dr. Becker and his team are leading the effort nationally to implement biological control for garlic mustard. There are no other competing research programs. Dr. Becker and his team have conducted critical feeding trials to determine which plants the weevil, *Ceutorhynchus scrobicollis*, will feed upon. He has also identified a series of studies to determine the range of plants a related weevil, *C. constrictus*, will consume. These studies are well designed and necessary to get regulatory approval of any future field releases. Bringing the previous research into the field has been impeded by forces beyond Dr. Becker's control. He has encountered regulatory reluctance to move forward with field releases of *C. scrobicollis*, largely due to questions about the long-term impact of garlic mustard and concerns about the potential to feed on mustard plants related to garlic mustard that grow in unique environments (e.g., serpentine soils of California or Aleutian islands of Alaska). Activities 3 (Determine factors that enhance effective biocontrol in Minnesota) and 4 (Ensuring biological control is having the desired outcome) are contingent upon getting regulatory approval from the US Department of Agriculture, Animal and Plant Health Inspection Service and the US Fish and Wildlife Service for field release of either weevil species. If those releases are approved, the research would be unique.

Bushley (Microbial Associates of the Emerald Ash Borer) – I am not a cooperator on this proposal. This proposal is 100% research. The project has two goals: (1) identify microbes that might be biological control agents of emerald ash borer; and (2) identify signaling compounds symbionts from emerald ash borer or microbial symbionts that could provide control. Substantial research by the Forest Service has considered the role microbes might play in the control of emerald ash borer. Previous work has focused on the fungi *Beauveria bassiana*, *Lecanicillium lecanii*, *Metarhizium anisopliae*, *Paecilomyces farinosus*, and *P. fumosoroseus*. This research initially was considered promising, but has largely been discontinued. Difficulties with the application of the fungi to trees and the short viability of the fungi after application were severe logistical constraints. Microbial control is generally considered too costly to suppress EAB to desired levels. With respect to goal 2, while there is a growing appreciation for the role symbionts play in the nutritional and reproductive ecology of many insects, research on the manipulation of these symbionts to control plant pests is limited. To my knowledge, there are no cases where symbionts have been manipulated in the field to control plant-feeding insects. Forest Service has also sponsored considerable research into chemical signaling by EAB.

Chandler (Tactical Invasive Plant Management Plant Development) - I am not a cooperator on the proposal but was consulted during its development. I have agreed to provide technical assistance to the project if needed and to review the final plan. I will not receive funds or other support if the proposal is approved. Activity 1 (Facilitate data sharing), Activity 3 (Write a management plan), and Activity 4 (Develop education materials and communicate the plan) are operational or outreach and would not be eligible for funding by MITPPC. Activity 2 (Species distribution and economic analysis) is the most closely related to research. The proposal does not describe the methods that will be used to complete Activity 2. Currently, MITPPC is funding another project to determine the potential distribution of several non-native weeds in Minnesota and how those potential distributions might change in the future. It is not clear how similar the proposed project is to the funded work. The economic analysis is not especially novel, but the

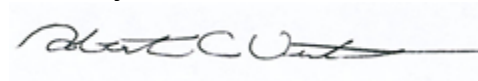
application to Minnesota is unique. Other states have conducted economic analyses of the impact of invasive weeds. Those results are influenced by local conditions, so it is not possible to assume impacts measured in other states will apply to Minnesota. To my knowledge, no other research in Minnesota is examining the economic impacts of invasive plants, especially those plants that may affect natural systems.

Osthus (EAB Biocontrol Phase 3: Assessment and Citizen Engagement) – I am a cooperator on this project proposal. I would receive funding to advise a graduate student and complete Activity 3. Activity 1 (Expand biological control implementation) is operational, and Activity 4 (Citizen engagement and biosurveillance) is outreach. Neither would be eligible for funding from the Center. Due to my conflict of interest, it is not appropriate for me to comment on the scientific merits of the proposal.

Wackett (Natural Products for Protecting Minnesota Natural Resources) – I am not a cooperator on the proposal. The proposal is purely research. This proposal does not provide enough detail to support meaningful comment on the status of research that may be related to the project. The project team has identified a praiseworthy goal, to produce bio-rational insecticides. Industry has made significant investments in the development of many of these products. Biorational products include plant extracts, fermentation products, minerals, and others. Fermentation is mentioned generally in the proposal, but fermentation to produce insecticides is not new. A fermentation reaction is used to culture and extract the Bt-toxin from the bacterium *Bacillus thuringiensis* for insecticidal sprays, for example. Typically, a proposal of this type might identify a candidate organism or compound with insecticidal properties and specify one or more target pests. Without this detail, the novelty of the work cannot be determined.

Please let me know if any of these comments require further clarification. I hope these perspectives will be helpful to you and members of the Commission.

Sincerely,



Robert Venette, PhD
Director, MITPPC

3. U of MN, St. Anthony Falls Laboratory (SAFL) - 20 proposals with affiliation, Response from Dr. Chris Paola, Interim Director
 - a. LCCMR email request
 - b. Table of 2017 proposals with SAFL personnel
 - c. Chris Paola email response
 - d. Additional material
 - e. Personnel response email from Gene-Hua Crystal NG and Rusen Yang
 - i. Gene-Hua Crystal Ng email regarding SAFL and 057-B Predicting Hidden Groundwater Connections Between Land and Lakes
 - ii. Rusen Yang email regarding SAFL and 062-B Environment-Friendly Nanosensors to Detect Nutrients in Water and 146-E Cheap and Clean Energy from Friction-Induced Static Charges

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

100 REV. DR. MARTIN LUTHER KING JR. BLVD.
ROOM 65 STATE OFFICE BUILDING
ST. PAUL, MINNESOTA 55155-1201

Phone: (651) 296-2406
Email: lccmr@lccmr.leg.mn
Web: www.lccmr.leg.mn

TTY: (651) 296-9896 or 1-800-657-3550

Susan Thornton, Director

DATE: April 29, 2016

TO: Dr. Chris Paola, Interim Director

FROM: Susan Thornton, Director

SUBJECT: Regarding 2017 Proposals Received Related to SAFL

Dear Dr. Paola,

The Legislative Citizen-Commission on Minnesota Resources (LCCMR) staff are currently reviewing 2017 project proposals received in response to the Environment and Natural Resources Trust Fund RFP. We received 17 proposals with University of Minnesota St. Anthony Falls Laboratory faculty and staff listed as project managers and an additional 3 proposals have SAFL faculty/staff included as project team/partners. They are listed below. As part of the review process it is helpful to understand SAFL goals and priorities related to these proposals.

We are requesting on behalf of the LCCMR, that you as director provide us, additional information to understand the research context of these proposals. Questions we have include:

- What is SAFL's role in these projects?
- How would SAFL prioritize these projects based on SAFL mission and goals?
- What is the status of research related to these proposals?
- Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?
- If funded, will project be able to implement to achieve beneficial natural resource outcomes?
- Who are the users or beneficiaries of this research?

We would greatly appreciate SAFL's feedback regarding the following proposals. Your insight will help the LCCMR better understand the context of these projects. We would like your feedback by Wednesday May 11th.

Feel free to contact LCCMR with any questions,

Proposals with SAFL Faculty or Staff as Lead PI

Coletti, Filippo:

Enabling Extraction of Solar Thermal Energy in Minnesota -\$351,040

Removing Plastic Particle Pollution from Minnesota Water Bodies-\$359,540

Furey, Paula:

Will the Invasive Alga Didymosphenia Degrade Minnesota Waters?-\$207,213

Guala, Michele:

Developing Sensors for River-Flow Turbidity and Sediment-Transport-\$311,367

Developing Bank-Protection Energy-Converter Systems for Minnesota Rivers-\$622,000

Jeff Broberg, Sen. Gary Dahms, Sen. Kari Dziedzic, William Faber, Nancy Gibson, Rep. Tom Hackbarth, Bonnie Harper-Lore, John Hoffman, Gary Lamma, Rep. Denny McNamara, Norman Moody, Rep. John Persell, Sen. David Tomassoni, Rep. Paul Torkelson, Rep. Dan Wagenius, Sen. Torrey Westrom, Del. Yoon

LEGISLATIVE-CITIZEN COMMISSION ON MINNESOTA RESOURCES

Gulliver, John:

Preventing Phosphorus Pollution from Stormwater Ponds-\$497,460

Hansen, Amy:

Continuous Data to Guide Nitrate Reduction Strategy-\$385,241

Herb, William:

Prioritizing Shoreline Habitat Restoration in Minnesota Lakes-\$294,913

Hong, Jiarong:

Underwater Robots for Hazard Monitoring in Minnesota Lakes-\$442,877

Ng, Gene-Hua Crystal:

Predicting Hidden Groundwater Connections Between Land and Lakes-\$408,455

Shen, Lian:

Modeling/Measurement of Wetland Processes for Habitat Protection-\$298,504

Shen, Lian:

Wind-loading Study for Environmental Management and Engineering Innovation-\$397,270

Wickert Andrew:

Continuous Nitrate Pollution Monitoring at the Kitchen Sink-\$276,590

Snowpack-Driven Groundwater Recharge across Minnesota-\$453,386

Yang, Rusen:

Cheap and Clean Energy from Friction-Induced Static Charges-\$422,874

Environment-Friendly Nanosensors to Detect Nutrients in Water-\$455,026

Proposals that include SAFL as a partner or consultant

Bajer, Przemyslaw (U of MN):

Restoring Agricultural Lakes and Watersheds by Managing Carp-\$967,100

Bly, John (Metro Blooms):

Pollinator and Clean Water Stewardship through Community Engagement-\$252,864

Lenhart, Christian (U of MN):

Mississippi River Gorge Restoration Planning and Assessment-\$130,000

Proposals with SAFL Faculty or Staff as Lead PI

Last	First	Project Title	Summary	Requested Amount
Coletti	Filippo	Removing Plastic Particle Pollution from Minnesota Water Bodies	We tackle the problem of plastic particles polluting water bodies in Minnesota. Our goals are to monitor the particle motion, forecast their pathway, and remove them effectively and inexpensively.	\$359,540
Coletti	Filippo	Enabling Extraction of Solar Thermal Energy in Minnesota	This project will develop new Solar Particle Receivers, a low-cost, high-efficiency and clean technology to absorb, store, and utilize solar thermal energy, and show its viability at Minnesotas latitudes.	\$351,040
Furey	Paula	Will the Invasive Alga Didymosphenia Degrade Minnesota Waters?	This project assesses the extent of the invasive alga Didymosphenia in Minnesota waters, examines bloom triggers and foodweb implications to lead to prevention and control measures, and includes outreach components.	\$207,213
Guala	Michele	Developing Sensors for River-Flow Turbidity and Sediment-Transport	The development of a low-cost automated sensor measuring bedload and suspended sediment load in Minnesota rivers is proposed, aiming to extend monitoring and reduce turbidity in the river network.	\$311,367
Guala	Michele	Developing Bank-Protection Energy-Converter Systems for Minnesota Rivers	A new device able to prevent side-bank erosion while extracting energy will be designed, tested and deployed in Minnesota rivers. The material included is being evaluated for a provisional patent.	\$622,000
Gulliver	John	Preventing Phosphorus Pollution from Stormwater Ponds	Stormwater ponds can lose their benefits over time and lead to unintended pollution of downstream environments by phosphorus. This project will develop tools to predict phosphorus release from stormwater ponds.	\$497,460
Hansen	Amy	Continuous Data to Guide Nitrate Reduction Strategy	Inform Minnesota's strategy to reduce nitrate with analysis of continuously captured data in the Minnesota River Basin so that the strategy can utilize most cost-effective management options.	\$385,241

Herb	William	Prioritizing Shoreline Habitat Restoration in Minnesota Lakes	This project will enhance efforts to increase natural reproduction of fish in Minnesota lakes by assembling easily accessible information on wave energy and near-shore spawning habitat.	\$294,913
Hong	Jiarong	Underwater Robots for Hazard Monitoring in Minnesota Lakes	Based on existing underwater robotic technology, the project aims at developing an autonomous system specialized in monitoring Minnesota lake waters for early identification of potential chemical and biological hazards.	\$442,877
Ng	Gene-Hua Crystal	Predicting Hidden Groundwater Connections Between Land and Lakes	Assess baseline groundwater influence on four representative lakes; Develop groundwater models that predict land-use impacts on lake levels and contamination; Assess scenarios of crop-conversions, irrigation, and fertilization	\$408,455
Shen	Lian	Wind-loading Study for Environmental Management and Engineering Innovation	We will utilize a unique facility of wind research station to study wind loading for environmental management and engineering innovation, with a focus on wind turbines, solar arrays, and infrastructures.	\$397,270
Shen	Lian	Modeling/Measurement of Wetland Processes for Habitat Protection	We will measure/model water and sediment/nutrients motions in wetlands for accurate description of habitat environment, and will develop predictive tools for vegetation landscape evolution for wetland restoration and habitat protection.	\$298,504
Wickert	Andrew	Continuous Nitrate Pollution Monitoring at the Kitchen Sink	Provide citizens with an inexpensive, automated, in-home method to instantly test their water for dangerous nitrate levels, and help them to provide these data to state agencies and decision-makers.	\$276,590
Wickert	Andrew	Snowpack-Driven Groundwater Recharge across Minnesota	Snowmelt provides up to 80% of Minnesotas groundwater recharge. We will measure this statewide, build spring recharge forecasts, and find solutions where climate and land-use change impact snowmelt water resources.	\$453,386

Yang	Rusen	Environment-Friendly Nanosensors to Detect Nutrients in Water	Excessive nutrients in water can trigger harmful algal blooms and cause serious environmental problems. We propose to develop environment-friendly nanosensor arrays for simultaneous detection of multiple nutrients in lakes/rivers.	\$455,026
Yang	Rusen	Cheap and Clean Energy from Friction-Induced Static Charges	We will develop nanogenerators to harness energy from road vibration, wind, and waves. The device will power a state-wide sensor network and improve the air, water, and safety in Minnesota	\$422,874

Proposals that include SAFL as a partner or contract

Bajer (U of M)	Przemyslaw	Restoring Agricultural Lakes and Watersheds by Managing Carp	Whole-lake experiments, surveys, and modeling to show when and where carp management is the most effective and economical approach for improving water quality in lakes and streams across south-central Minnesota	\$967,100
Bly (Metro Blooms)	John	Pollinator and Clean Water Stewardship through Community Engagement	This project will promote native plantings, increase the capacity of businesses to supply relevant material and expertise, and create a map of pollinator-friendly stormwater best management practices to support research.	\$252,864
Lenhart (U of M)	Christian	Mississippi River Gorge Restoration Planning and Assessment	Restoration of the Mississippi River Gorge would have great ecological and recreational benefits. With increasing opportunity for restoration, a feasibility assessment is needed to guide future restoration and management actions.	\$130,000

From: Chris Paola [mailto:cpaola@umn.edu]

Sent: Tuesday, May 24, 2016 3:19 PM

To: Susan Thornton <susan.thornton@lccmr.leg.mn>; Diana Griffith <diana.griffith@lccmr.leg.mn>; Michael McDonough <michael.mcdonough@lccmr.leg.mn>; Michael Varien <Michael.Varien@lccmr.leg.mn>

Cc: Jeffrey Marr <marrx003@umn.edu>; Lian Shen <shen@umn.edu>; Jennifer Snyder <jsnyder@umn.edu>

Subject: summary of LCCMR proposals from St Anthony Falls Laboratory

Here is the information you requested in the email that was forwarded to me on May 19. Thanks for giving us a chance to provide further information on our LCCMR proposals, and please do not hesitate to contact me if you require anything further. It would be best to copy Lian Shen, Jeff Marr, and Jenni Snyder on any requests as well.

with best wishes,
Chris Paola

--

Chris Paola
Department of Earth Sciences
Interim Director, St Anthony Falls Laboratory
University of Minnesota
Minneapolis MN 55414 USA
1 612 624 8025
<http://www.safl.umn.edu>

*Twin Cities Campus**Saint Anthony Falls Laboratory
College of Science and Engineering**#2 - 3rd Avenue S. E.
Minneapolis, MN 55414**Dept. Main Office: 612-624-4363
Fax: 612-624-4398*

2016 May 24

Susan Thornton
Director
Legislative-Citizen Commission on Minnesota Resources

Chris Paola
Interim Director
St. Anthony Falls Laboratory, University of Minnesota
2 Third Ave SE
Minneapolis, MN 55414

RE: Supplemental detail on 2016 ENRTF Proposals associated with the St. Anthony Falls Laboratory, University of Minnesota.

Dear Ms. Thornton –

This is in response to the email request I received May 19 requesting further information on proposals submitted to the 2016 Environmental and Natural Resources Trust Fund RFP involving the St. Anthony Falls Laboratory, University of Minnesota (SAFL). Your letter identifies 19 proposals associated with SAFL. This summary is based on input from the SAFL investigators listed on the proposals and SAFL general administrative policy.

SAFL is a unique research center and it is worth providing further details on our structure and research role at the University of MN. The focus of SAFL research and outreach, at the highest level, is fluid dynamics at the intersection of major societal needs in energy, environment and health. We are an interdisciplinary research center within the College of Science and Engineering that provides unique laboratory, field, and computational facilities and specialized permanent research staff. In general we operate as a collective of faculty from several academic departments across the university.

As with all academic departments, research proposals are developed by the researchers themselves based on their interests and knowledge of research needs. This is certainly the case at SAFL. The leadership of SAFL serves to provide administrative oversight of the facility and an operational framework for the research activities to flourish. In general, SAFL does not establish large-scale research priorities by which I could rank the proposals; our research program is driven by the PIs themselves, rather than by the Director. The subject areas in which we submitted are all high-priority areas for us.

The remainder of this response addresses the individual projects. We include an updated table that categorizes the 19 projects as either (a) led by SAFL, (b) involving SAFL as collaborators, or (c) not involving SAFL. Of these, 12 are led by SAFL PIs. For all project involving SAFL (a) and (b) we have asked the PIs to address the questions contained in the email that was forwarded to me on May 19. Because proposals listed in (c) do not incorporate SAFL, we have not provided any further information on these proposals.

We appreciate the opportunity to provide you more information on these research proposals. LCCMR has been an important research sponsor at SAFL and we hope that our close collaboration will continue long into the future.

Sincerely,

A handwritten signature in black ink, appearing to read "Chris Paola", with a large, stylized initial "C" on the left.

Chris Paola,
Interim Director

Cc: Lian Shen, Jeff Marr, Jenni Snyder

Table 1. Summary of proposals submitted to 2016 Environmental and Natural Resources Trust Fund associated with SAFL-UMN.

Proposals with SAFL Faculty or Staff as Lead PI (Alphabetical Order)			
Last Name	First Name	Project Title	\$
Coletti	Filippo	Enabling Extraction of Solar Thermal Energy in Minnesota	\$351,040
Coletti	Filippo	Removing Plastic Particle Pollution from Minnesota Water Bodies	\$359,540
Guala	Michele	Developing Sensors for River-Flow Turbidity and Sediment-Transport	\$311,367
Guala	Michele	Developing Bank-Protection Energy-Converter Systems of Minnesota Rivers	\$622,000
Gulliver	John	Preventing Phosphorous Pollution from Stormwater Ponds	\$497,460
Hansen	Amy	Continuous Data to Guide Nitrate Reduction Strategy	\$385,241
Herb	William	Prioritizing Shoreline Habitat Restoration in Minnesota Lakes	\$294,913
Hong	Jiarong	Underwater Robots for Hazard Monitoring in Minnesota Lakes	\$442,877
Shen	Lian	Modeling/Measure,ment of Wetland Processes for Habitat Protection	\$298,504
Shen	Lian	Wind-loading Study for Environmental Management and Engineering Innovation	\$397,270
Wickert	Andrew	Continuous Nitrate Pollution Monitoring at the Kitchen Sink	\$276,590
Wickert	Andrew	Snowpack-Driven Groundwater Recharge across Minnesota	\$453,386
Proposals with other organizations as Lead institution/PI & including SAFL as collaborator			
Last Name	First Name	Project Title	\$
Furey	Paula (St. Catherine U)	Will the Invasive Alga Didymosphenia Degrade Minnesota Waters?	\$207,213
Yang	Rusen (ME, UMN)	Environment-Friendly Nanosensors to Detect Nutrients in Water	\$455,026
Proposals incorrectly associated with SAFL (and should be reviewed independently)			
Last Name	First Name	Project Title	\$
Bajer	Przemyslaw (FWCB, UMN)	Restoring Agricultural Lakes and Watersheds by Managing Carp	\$967,100
Bly	John (Metro Blooms)	Pollinator and Clean Water Stewardship through Community Engagement	\$252,864
Lenhart	Christian (BBE, UMN)	Mississippi River Gorge Restoration Planning and Assessment	\$130,000
Ng	Gene-Hua Crystal (ES, UMN)	Predicting Hidden Groundwater Connections Between Land and Lakes	\$408,455
Yang	Rusen (ME, UMN)	Cheap and Clean Energy from Friction-Induced Static Charges	\$422,874

Project Title: Enabling Extraction of Solar Thermal Energy in Minnesota

PI: Filippo Coletti (UMN-Aerospace Engineering, SAFL)

Co-PI/Investigators: Jane Davidson (UMN-Mechanical Engineering) and Lian Shen (UMN-Mechanical Engineering, SAFL)

Amount: \$351,040

What is SAFL's role in these projects?

SAFL will provide the technical resources to build the proposed prototype device (specifically manufacturing capabilities and measurement apparatuses), as well as the computer capabilities to carry out the device optimization.

How would SAFL prioritize these projects based on SAFL mission and goals?

The goal of the project, which is to develop a technology to enable usage of a clean and affordable renewable energy source in Minnesota, is well aligned with SAFL priorities (energy).

What is the status of research related to these proposals?

There has been very little research by other researchers on the proposed technology (solar particle receivers), and only towards designs that cannot function at Minnesota latitudes.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

The project is novel, and is not part of an existing funded effort. However, the tools needed to perform the proposed research are already in place, and the project will leverage relevant techniques used by the PI and co-PI in ongoing projects, which have laid the groundwork for the present proposal.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, because it will enable a clean and efficient renewable energy harvesting technology, with great potential to limit the environmental impact of fossil fuels.

Who are the users or beneficiaries of this research?

The project will benefit the general population, in that it will help to reduce the negative impact of carbon emissions, and will improve energy affordability. In particular, it will facilitate local power generation which is critical in rural areas. Additionally, by making solar thermal energy possible in Minnesota, the proposed technology will generate numerous green job opportunities.

Project Title: Removing Plastic Particle Pollution from Minnesota Water Bodies

PI: Filippo Coletti (UMN-Aerospace Engineering, SAFL)

Co-PI/Investigators: Lian Shen (UMN-Mechanical Engineering, SAFL)

Amount: \$ 359,540

What is SAFL's role in these projects?

SAFL will have an essential role, in that it will provide the means and technical support to carry out the field measurements of plastic particle concentration in Minnesota bodies of water, as well as the experimental facilities to perform the laboratory experiments.

How would SAFL prioritize these projects based on SAFL mission and goals?

The goal of the project, which is to preserve Minnesota's water streams and lakes from an increasingly abundant and poorly understood source of pollution, is well aligned with SAFL priorities (environment).

What is the status of research related to these proposals?

The problem of micro-plastic particle water pollution has emerged recently. No previous study in the literature has focused on the dispersion of this contaminant. This will also be the first study to put in place remediation strategies based on knowledge of the dispersion of this contaminant.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

The project is novel, and is not part of an existing funded effort. However, the tools needed to perform the proposed research are already in place, and the project will leverage relevant techniques used by the PI and co-PI in ongoing projects, which have laid the groundwork for the present proposal.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, because the project is structured to preserve Minnesota rivers and lakes, and so the population, against an emerging type of contaminant.

Who are the users or beneficiaries of this research?

This project will help to preserve the Minnesota aquatic ecosystem, and therefore is expected to benefit the entire population. The results will benefit state agencies, including Minnesota DNR, MPCA, and BWSR.

Project Title: Developing Sensors for River-Flow Turbidity and Sediment-Transport**PI: Michele Guala****Co-PI/Investigators: Arvind Singh (U of Central FL); Efi Foufoula Georgiou (UMN)****Amount: \$ 311,367****What is SAFL's role in these projects?**

The SAFL facility and personnel will have a major role in this project. Research facilities such as the Main Channel and tilting bed flumes both have the sediment recirculation capabilities and scanning technologies necessary to prototype this technology. Facilities with these capabilities are extremely rare. Also SAFL research personnel will be involved in advising the engineering and analytics of the project.

How would SAFL prioritize these projects based on SAFL mission and goals?

This project, which focuses on estimating bedload and fine sediment transport from an integrated system for bed elevation and turbidity measurements, is well aligned with SAFL priorities (environment) and supports current research themes.

What is the status of research related to these proposals?

The theoretical framework has been published in 2014 in the *Journal of Geophysical Research*. It was the PI's work, with the help of a master student (2013-2014). Now the project is carried on by an undergrad student supported by an internal UMN research undergrad program (UROP) which is running until August 2016. The project requires a dedicated PhD student and the PI is preparing a submission to NSF. The PI is committed to try all possible resources to fund this work, because questions, procedure research objectives have been identified and facilities are ready to be used.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

The theoretical framework has been validated using a relatively small laboratory flume. The extension of the theory and of the experimentation to real rivers is a major part of this project. In broad terms, we have solid preliminary results. However, the engineering and societal impact of this project will be realized only after 3 years of additional work, because that is the time needed to have a reliable validated sensor that can be deployed in natural fluvial ecosystems.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, the project will allow construction and deployment of sensors in the river network and will allow detection of sink and sources of fine sediments. That may direct work and intervention for bank stability in specific river reaches that are keen to provide suspended sediments.

Who are the users or beneficiaries of this research?

Principally river management authorities that could benefit of an affordable water quality monitoring system. Indirectly, all the communities concerned with mitigation of erosion effects and improving water clarity in rivers, and subsequently in lakes.

Project Title: Developing Bank-Protection Energy-Converter Systems of Minnesota Rivers**PI: Michele Guala****Co-PI/Investigators: Jeffrey Marr****Amount: \$ 622,000****What is SAFL's role in these projects?**

SAFL has a central role in this project. The machine shop and research facilities will be used to develop and test prototype technologies and stage for field deployment. SAFL staff expertise will be used in the engineering design of the technology.

How would SAFL prioritize these projects based on SAFL mission and goals?

This project, which focuses on developing a clean-energy technology for Minnesota rivers and stream, is well aligned with SAFL priorities (energy) and supports current research themes.

What is the status of research related to these proposals?

The team has experience in this type of energy technology and has the facilities to support the research. This is a new project.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This is a new project design that was envisioned by the PI after 4 years of research on marine and hydrokinetic (MHK) river turbines. This is a new device that will be tested in the laboratory and in the field. The work is new and innovative, but it builds on past experimentation.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, the idea of promoting renewable energy installation while protecting river banks from erosion is dual purpose; contributing to both preserving/protecting our natural river and stream systems and limiting the carbon footprint through clean energy generation.

Who are the users or beneficiaries of this research?

The results from this research will benefit stakeholders interested in distributed energy such as small rural communities, watershed district, landowners. Organization interested in restoring or protecting streams and rivers will benefit from a new option for protecting from erosion and reducing sediment inputs into channels.

Project Title: Preventing Phosphorous Pollution from Stormwater Ponds**PI: John Gulliver (UMN-Civil Engineering, SAFL)****Co-PI/Investigators: Jacques Finlay (UMN – Ecology, Evolution and Behavior, SAFL), Ben Janke (UMN-SAFL), Poornima Natarajan (UMN-SAFL), Peter Weiss (Valparaiso Univ.)****Amount: \$ 497,460****What is SAFL's role in these projects?**

SAFL will provide the facilities to perform the research, including laboratory space, desk space, and a staging area for field work.

How would SAFL prioritize these projects based on SAFL mission and goals?

This project is well aligned with SAFL's priorities (environment).

What is the status of research related to these proposals?

The project "Preventing Phosphorus Pollution from Stormwater Ponds," is an expansion of a project funded by the Clean Water Action fund, because the initial project was limited in scope.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project is in the early stages of research.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes. By determining when stormwater ponds need to be maintained, the release of excess phosphorus and associated algae blooms in lakes can be avoided.

Who are the users or beneficiaries of this research?

Preventing Phosphorus Pollution from Stormwater Ponds: Cities, counties, watershed districts, MnDOT, etc. will benefit from a knowledge of how to determine the time that their ponds need to be maintained to prevent phosphorus release.

Project Title: Continuous Data to Guide Nitrate Reduction Strategy**PI: Dr. Amy Hansen****Co-PI/Investigators: Dr. Arvind Singh (U of Central FL); Chris Ellison/Joel Groten (USGS); Dr. Jacques Finlay (UMN-EEB); Kent Johnson (Metropolitan Council); Lee Ganske (MPCA)****Amount: \$ 385,241****What is SAFL's role in these projects?**

SAFL personnel (Hansen) would coordinate the project and analyze the data.

How would SAFL prioritize these projects based on SAFL mission and goals?

This project aligns well with SAFL mission and goals (Environment, Energy, Health) and focuses on using our expertise in hydrology to solve a significant problem within the environment in Minnesota. This project does not depend on shared resources so would not be subject to internal prioritization issues. The only SAFL personnel involved is Hansen who will coordinate the effort with the project partners and complete much of the data analysis. If funded she would give this project top priority.

What is the status of research related to these proposals?

This project is complementary to ongoing research of Dr. Hansen on nitrogen uptake and transport in southern Minnesota but involves installing sensors and collecting data at a significantly higher frequency which will require different analysis techniques than are currently being used. Both Dr. Hansen and Dr. Singh have explored this data type using data collected in Iowa but no formal analysis of this has been completed.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project supports on-going research objectives (understanding nitrate source, transport and uptake) but would be a new approach. For this reason, it is considered in the early stages of research.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

If funded, the outcome of this project would be an improved understanding of nitrate sources and uptake rates that natural resource managers could use to implement an effective nitrate reduction strategy. Implementing a successful long term solution to the nitrate problem requires better understanding of long term stores that what we currently possess.

Who are the users or beneficiaries of this research?

Natural resource managers would be the direct users of this research to guide the implementation of an effective nutrient reduction strategy.

Project Title: Prioritizing Shoreline Habitat Restoration in Minnesota Lakes**PI: William Herb (UMN-SAFL)****Co-PI/Investigators: Dr. Heinz Stefan (UMN-Civil Engineering, SAFL)****Amount: \$ 294,913****What is SAFL's role in these projects?**

SAFL is leading the project and performing most of the technical work, in collaboration with the Minnesota DNR. Personnel at the Natural Resources Research Institute will assist in generating the deliverable wave energy maps.

How would SAFL prioritize these projects based on SAFL mission and goals?

SAFL has a long history of providing support to state agencies in managing the state's water resources, including work on stormwater and on natural lakes and streams. This project is well aligned with SAFL priorities (environment) and uses SAFL's strengths in computer modeling, laboratory experiments, and field monitoring.

What is the status of research related to these proposals?

In general, there is a lack of information for estimating wave energy on lakes in Minnesota, particularly for the many small and medium sized lakes. This project will tie in with ongoing projects in the Minnesota DNR to improve fish habitat in lakes and manage shoreline vegetation and erosion.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

SAFL has begun addressing this specific problem with a small project funded by the Minnesota DNR, which builds on previous lake modeling efforts at SAFL.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

The deliverables of this project (lake wave energy maps) will assist the MN DNR and lake management organizations in effectively managing lake shorelines, for purposes of improving fish habitat and managing shoreline erosion.

Who are the users or beneficiaries of this research?

The Minnesota DNR will be the primary user, along with lake management associations. Beneficiaries will include lakeshore property owners and fisherman.

Project Title: Underwater Robots for Hazard Monitoring in Minnesota Lakes**PI: Jiarong Hong (UMN-Mechanical Engineering, SAFL)****Co-PI/Investigators: Miki Hondzo (UMN-Civil Engineering, SAFL)****Amount: \$ 442,877****What is SAFL's role in these projects?**

The main objective of the proposed project is to develop underwater robotic systems for scientific research and the monitoring of lake ecology including a number of main water-related hazards in Minnesota. The robot is equipped with different types of environmental sensors including holographic imaging sensors. SAFL facilities and engineering team will contribute to the design, prototype and testing of the robot.

How would SAFL prioritize these projects based on SAFL mission and goals?

This project is well aligned with SAFL priorities (environment) through the development of new capability for field research on water resources and environmental flow mechanics.

What is the status of research related to these proposals?

My team has constructed one underwater holographic robotic system based on OpenROV robotic technique, which has been tested in the SAFL Main Channel and in Minnesota lakes. Currently, the development is primarily supported by my startup funding. A potential LCCMR grant will significantly accelerate our progress on implementing advanced imaging and robotic technique for SAFL's interest.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

The project is in early stages of development. A beta-version prototype has been developed but further research and development is required for this technology to serve as useful tools for scientific research and environmental monitoring related to Minnesota lakes and rivers.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, the technologies developed from this project will create new capabilities for environmental monitoring and sampling. These capabilities will significantly enhance our understanding on the ecological conditions of Minnesota lakes by providing detailed information with unprecedented spatial and seasonal coverage. This enhanced understanding will help researchers construct better forecast models as well as preventive and mitigation strategies to cope with hazards in Minnesota lakes.

Who are the users or beneficiaries of this research?

The project will benefit state agencies including Minnesota Pollution Control Agency (MPCA) and Department of Natural Resources (DNR). As stated in the proposal, two complete robotic systems will be delivered to these agencies. The project will also benefit a large community of water resource researchers by providing them new measurement capabilities.

Project Title: Modeling/Measurement of Wetland Processes for Habitat Protection**PI: Lian Shen (UMN-Mechanical Engineering, SAFL)****Amount: \$298,504****What is SAFL's role in this project?**

Professor Lian Shen is a faculty member and Associate Director for Research of SAFL. The proposed project will be performed at SAFL, and SAFL will provide full support to ensure the success of this project.

How would SAFL prioritize this project based on SAFL mission and goals?

This project is well aligned with SAFL priorities (environment) and its goal "to benefit society by implementing this knowledge to develop physics-based, cost-effective, and sustainable engineering solutions to major environmental, water, ecosystem, health, and energy-related problems."

What is the status of research related to these proposals?

The research in this proposal is at the cutting edge of study in this area. Prof. Shen is a world-renowned expert in the study of environmental fluid flows. He has developed advanced research tools, in a way far superior to conventional methods, to address two important questions in the conservation of wetlands and habitat: what is the habitat environment inside wetlands, and how the vegetation patch landscape evolves during wetland restoration and protection.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project is part of on-going research in Prof. Shen's group. During the course of this project, the results of the study are expected to have direct and immediate impact on the wetland restoration and habitat protection practices in Minnesota.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

The Wetlands Conservation Act states that there should be no loss in the quantity, quality, and biological diversity of the existing wetlands in Minnesota. If funded, this project will assist conservation programs of wetland restoration and habitat protection.

Who are the users or beneficiaries of this research?

This research will benefit state agencies, including Minnesota DNR, MPCA, and BWSR, water quality and lake/wetland managers. The data acquired and the models developed in this project will be useful for wetland restoration and habitat protection programs. The results will also be shared with citizen scientists, students and teachers, and the public.

Project Title: Wind-loading Study for Environmental Management and Engineering Innovation**PI: Lian Shen (UMN-Mechanical Engineering, SAFL)****Co-PI/Investigators: Jeffrey Marr (UMN-SAFL)****Amount: \$397,270****What is SAFL's role in these projects?**

This proposed project will be led by a SAFL research faculty and staff associated with the UMN's wind energy research project called Eolos Wind Energy Consortium. The Eolos team conducts research (basic and applied) in various areas of wind energy utilizing SAFL's computational facilities, laboratory facilities (wind tunnel) and field facilities (Eolos Wind Research Field Station, Rosemount, MN). Eolos is a major research effort of SAFL and the College of Science and Engineering and includes faculty from various CSE departments (Aerospace, Mechanical, and Civil) and therefore SAFL's role in providing research staff, faculty, and facilities to support the effort.

How would SAFL prioritize these projects based on SAFL mission and goals?

This proposed project is to carry forward research in wind energy and expand the effort to allow other areas of wind research such as solar energy, structural engineering, and environmental engineering. Energy and environmental fluid mechanics are topics that are well aligned with SAFL priorities (energy).

What is the status of research related to these proposals? Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

The Eolos field station is an active research site established largely with \$8M in U.S. Department of Energy funds. The site is fully functional and in use by sponsored and non-sponsored research. Current research topics include advanced turbine control techniques and wind turbine acoustic noise analysis. The projects proposed here are new projects that are relevant to this field but will leverage the existing field station facility. While these topics are new, this research team has the expertise and experience to quickly move forward on the research and complete it within the proposed schedule.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes, this project will result in benefits to Minnesota natural resources. Virtually all research conducted by the Eolos team provides knowledge and innovation to wind-related topics. This project will provide benefit through developing accurate models of boundary layer wind for wind energy generation technologies. It will provide much needed structural loading data for wind turbine blades design and utility scale solar arrays. The project will also allow expansion of research and education access to the highly unique Eolos Field Station research site for the general public and other agencies and researchers.

Who are the users or beneficiaries of this research?

- Structural engineers will have better insight into the loading on the blades, towers, and foundations of wind turbines. The wind loads and lift and drag forces on solar arrays can also be better predicted.
- Manufacturers and designers of these renewable energy systems will have better information that they can use to optimize their designs for actual loads. Reducing the need to overdesign solar framing or turbine foundation reduces installation costs and thus will lead to lowering the cost of energy.
- Better information on loading provided to state agencies and regulators will lead to better confidence in the safety of deployed systems. This also reduces costs of design, project financing, and overall costs of energy.

Project Title: Continuous Nitrate Pollution Monitoring at the Kitchen Sink**PI: Andy Wickert (UMN-Earth Science, SAFL)****Co-PI/Investigators: Chad Sandell (UMN-Earth Science)****Amount: \$276,590****What is SAFL's role in these projects?**

SAFL provides a research home at the University of Minnesota for this project to help citizens monitor nitrate concentrations in their water supplies. The longstanding expertise of SAFL-affiliated faculty with water resources issues will aid the project team.

How would SAFL prioritize these projects based on SAFL mission and goals?

SAFL's mission is to advance water- and fluid-related science in both fundamental knowledge and its applications to real-world problems, and has a strong history of applied research performed in Minnesota and across the world. This project is well aligned with SAFL priorities (environment).

What is the status of research related to these proposals?

The path forward is clear, as outlined in the proposal, and the necessary prerequisite research is complete. No research has yet taken place on the proposed project.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project is in the proposal stage: research on how to pursue the project is complete, but any future progress depends on funding.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes: the goal of this project is to create a method for citizens to monitor their own groundwater wells and to report data to the MPCA. If it succeeds, it will reduce nitrate pollution hazards and improve core data on nitrate concentrations

Who are the users or beneficiaries of this research?

Citizens who drink groundwater and Minnesota agencies tasked with groundwater monitoring and quality.

Project Title: Snowpack-Driven Groundwater Recharge across Minnesota

PI: Andy Wickert (UMN-Earth Science, SAFL)

Co-PI/Investigators: Crystal Ng (UMN-Earth Science); Nathan Anderson (MnCORS); Kristine Larson (U.Colorado)

Amount: \$ 453,386

What is SAFL's role in these projects?

SAFL provides a research home at the University of Minnesota, and the expertise assembled at SAFL in water supply issues, infiltration, and hydrology, will aid in its success.

How would SAFL prioritize these projects based on SAFL mission and goals?

SAFL's mission is to advance water- and fluid-related science in both fundamental knowledge and its applications to real-world problems, and has a strong history of applied research performed in Minnesota and across the world. This project is well aligned with SAFL priorities (environment).

What is the status of research related to these proposals?

MnDOT's set of GPS monuments is in place, and data from them is being recorded. This archive of historical data can be processed into a long-term record of snowpack and soil moisture, if the project is funded.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project is in the proposal stage: research on how to pursue the project is complete, but any future progress is pending funding.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes: the state of Minnesota will gain a new network of snowpack and soil moisture measurements over the past decade and into the future from an existing network of monitoring stations. We will be able to better estimate water resource availability in Minnesota without focusing on building new infrastructure.

Who are the users or beneficiaries of this research?

Citizens of Minnesota, such as farmers, who are affected by water availability and changes in groundwater and lake levels; natural resource managers working to understand a changing snowpack; users of streamflow and flooding forecasts; and weather forecasters.

Project Title: Will the Invasive Alga Didymosphenia Degrade Minnesota Waters?**PI: Paula Furey (St. Catherine Univ.)****Co-PI/Investigators: Amy Hansen (UMN-SAFL), Bob Sterner (UMD)****Amount: \$ 207,213****What is SAFL's role in these projects?**

Amy Hansen is a staff research associate at SAFL and is a team member on a LCCMR proposal with Dr. Paula Furey. Paula is an Assistant Professor at St. Catherine University. Furey and Hansen propose to complete a risk assessment of the likelihood for Didymo blooms in Minnesota streams. Hansen will complete a spatial analysis of the existing water chemistry data to map anticipated vulnerable areas, and participate extensively in the field sampling component. Additional SAFL roles in this project are to coordinate undergraduates for field sampling, supply equipment such as an acoustic Doppler velocimeter (ADV), light or temperature or dissolved oxygen sensors and to provide technical expertise including building a structure to support ADV sampling in the break zone of Lake Superior (where Didymo blooms are currently occurring).

How would SAFL prioritize these projects based on SAFL mission and goals?

In terms of SAFL missions and goals, this project is well aligned with one of SAFL's three missions; Environment. It would employ SAFL personnel expertise with fluid mechanics and mass transfer to characterize environmental triggers of Didymo blooms.

What is the status of research related to these proposals?

This project has not been initiated although the research team has worked with Didymo in the past, and Pillsbury (the third collaborator) is currently part of a funded research project assessing Didymo blooms in Michigan. Hansen has measured velocity profiles within other mat forming species (Cladophora, hydrozoa) and has a lot of experience working with both the water quality monitoring data and performing water chemistry analysis. The proposed work builds on our experience but is not research any of us are currently actively pursuing.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

This project is at the early stage of research.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Yes.

Who are the users or beneficiaries of this research?

Natural resource managers will directly use the results of this research. Other beneficiaries include cold water recreationists such as people who use our cold water streams to: fish, canoe, kayak, photograph and enjoy.

Project Title: Environment-Friendly Nanosensors to Detect Nutrients in Water**PI: Rusen Yang (UMN-Mechanical Engineering)****Co-PI/Investigators: Lian Shen (UMN-Mechanical Engineering, SAFL)****Amount: \$ 455,026**

Professor Rusen Yang is a faculty member of the department of Mechanical Engineering at the University of Minnesota. All his proposals are submitted by the Mechanical Engineering Department, not the St. Anthony Falls Laboratory. His proposals should not be counted in the pool of SAFL proposals, and need to be considered separately. This proposal has one SAFL faculty member as project partner. Additional information is provided below about this proposal.

What is SAFL's role in these projects?

SAFL provides facilities for field tests of the proposed sensors, so that the sensors can be quickly developed and optimized for their application in water bodies in Minnesota.

How would SAFL prioritize these projects based on SAFL mission and goals?

The proposal's goal is aligned well with SAFL's priorities (environment).

What is the status of research related to these proposals?

Sensors to monitor water quality is an active research topic. The proposed sensing technology has a clear advantage over conventional technologies in terms of safety, speed, cost, and accuracy.

Can you provide comments in regards to whether projects are in early stages of research, if projects are part of on-going research, or if projects are near completion?

Rusen Yang is a leading scientist in the field of nanotechnology. His research on nanomaterials and sensing applications has been featured in the Star Tribune and reported by CNN, Discovery News, etc. The proposed nanosensor development is part of his ongoing research effort.

If funded, will project be able to implement to achieve beneficial natural resource outcomes?

Significant preliminary research, the world-class scientist, and the state-of-the-art facilities in SAFL promise the success of the project. The nanosensor from this project provides a convenient way to assess the nutrients in water in real time and with unprecedented accuracy. This project will increase understanding of effects of nutrients on water quality and enable the development of strategies to protect and conserve water resources in Minnesota.

Who are the users or beneficiaries of this research?

Minnesota Pollution Control Agency will benefit from the low-cost and autonomous sensor to assess the condition of all water bodies in the state, as required by the Clean Water Act. The residents of Minnesota will benefit from a better understanding of water quality as the sensor can be widely implemented at very low cost.

From: Gene-Hua Crystal Ng [<mailto:gcng@umn.edu>]
Sent: Friday, May 20, 2016 9:42 AM
To: Michael McDonough <michael.mcdonough@lccmr.leg.mn>
Subject: 2017 Proposal - SAFL affiliation

Hello Michael,

I was included on an email from Jenni Snyder, an administrative staff member at SAFL (St Anthony Falls Laboratory), asking for information about SAFL's role in LCCMR 2017 proposed projects. The email indicated that I was on LCCMR's list of lead PI's from SAFL. I would like to clarify that I routed my proposal "Predicting Hidden Groundwater Connections Between Land and Lakes" through the Dept of Earth Sciences, not SAFL. While I am a member of SAFL, the proposal includes a co-PI from Earth Sciences (Scott Alexander), and I do not anticipate utilizing SAFL resources for the proposed work. I've replied to Jenni about this. I also wanted to inform you directly.

The proposal led by Andy Wickert on which I am a co-PI ("Snowpack-Driven Groundwater Recharge across Minnesota") WAS indeed routed through SAFL.

Please let me know if you need anymore information from me. This is something I would normally call about, but given that you're probably all very busy handling 2016 proposals at the moment, I thought an email would be preferable.

Best,
Crystal

G.-H. Crystal Ng
Department of Earth Sciences
University of Minnesota - Twin Cities
310 Pillsbury Dr SE
Minneapolis, MN 55455-0231
Ph. 612-624-9243
gcng@umn.edu

From: Rusen [mailto:yangr@umn.edu]
Sent: Sunday, May 22, 2016 8:52 PM
To: Michael McDonough <michael.mcdonough@lccmr.leg.mn>
Cc: Diana Griffith <diana.griffith@lccmr.leg.mn>
Subject: Re: ENRTF 2017 Proposals Received Related to SAFL

Dear Mr. McDonough,

Thank you for working on our submitted proposals in response to ENRTF. Last Friday (5/20/2016), I heard from St. Anthony Falls Laboratory (SAFL) at the University of Minnesota that my proposals were mistakenly considered as proposals from SAFL. Please allow me to clarify this confusion. I am a faculty member of the Department of Mechanical Engineering at the U of MN, and I am not affiliated with SAFL. Both of my proposals were submitted by the Mechanical Engineering Department, not SAFL.

I submitted two proposals to LCCMR. The first proposal of "Cheap and Clean Energy from Friction-Induced Static Charges" will be conducted solely by my laboratory group in Mechanical Engineering Department. The second proposal of "Environment-Friendly Nanosensors to Detect Nutrients in Water" will also have its major work done in Mechanical Engineering Department, and SAFL will only play a minor role in facilitating the test of my sensors in their Outdoor StreamLab. Therefore, neither proposals should be considered as SAFL proposals. They should be evaluated independently from each other (as they are on very different topics) and both separately from SAFL proposals.

Thank you again for considering my proposals.

Regards,

Rusen

--

Rusen Yang
Assistant Professor
Department of Mechanical Engineering
University of Minnesota
111 Church Street SE,
Minneapolis, MN 55455
Phone: (612) 626-4318
<http://www.me.umn.edu/labs/nstl/index.shtml>

4. Proposal 52B - The Minnesota Center for Water Treatment Technology Innovation, Response from, Dr. Raymond Hozalski, U of M
 - a. LCCMR request email
 - b. Ray Hozalski's response email
 - c. Additional material
 - d. Letters from Dean and Department Head

On Tue, Apr 19, 2016 at 2:08 PM, Michael McDonough <michael.mcdonough@lccmr.leg.mn> wrote:

Hi Ray,

Regarding the 2017 proposal to the LCCMR “The Minnesota Center for Water Treatment Technology Innovation” we are looking for answers to the following questions to help explain to members how the proposal fits with related completed and current projects and with other related 2017 LCCMR proposals

There are seven projects listed with the statement - The 2017 LCCMR Water Center proposal says approximately 5-8 major research projects will be run simultaneously for 2-3 years duration each. Each project will align with the Center’s research priorities. At the outset, the Center will focus on the following specific projects:

Projects listed in 2017 proposal:

- (1) Effects and Removal of Antimicrobials and Antimicrobial Resistance in Wastewater
- (2) Carbon Filtration for Treating Nitrate-Contaminated Groundwater & Stormwater
- (3) Biosorption and Bioaccumulation of Precious Metals in Wastewater
- (4) Seasonal Dynamics of Comammox During Wastewater Treatment
- (5) Occurrence and Control of Bacteria on Water Mains
- (6) Innovative Membrane-Based Low-Energy Biological Nitrogen Removal
- (7) Producing Renewable Energy and Clean Water from Waste-Phase II.

- Have the center’s priorities been determined already?
- How were these projects selected/determined?
- Are they in prioritized order of importance?
- Please provide a short description on what these projects would do.

- Some look like continuations of existing or previous ENRTF projects – please provide the name of projects that would be continued and the name of the project manager and what was learned in the previous phase(s) and what is expected to be learned in the continuation.
- Four people listed on the Center’s proposal (listed below) also have separate 2017 LCCMR proposals – how do these relate to the center’s proposal? Which are higher priorities?
- Do other staff at the U of M, not listed on the proposal, have related 2017 LCCMR proposals?
- Do the seven listed projects have a lead faculty person already determined?

Faculty listed on Water Center Proposal with separate 2017 proposals

Arnold, William - Household chemicals as water pollutants and toxic precursors

Behrens, Sebastian - New self-sustaining nitrate and pesticides removal biotechnology

Gulliver, John - Preventing Phosphorus Pollution from Stormwater Ponds

Novak, Paige - Innovative Nitrogen Removal Technology to Protect Water Quality

Faculty listed on Water Center Proposal without separate 2017 proposal

Hondzo, Miki

Hozalski, Raymond M.

Lapara, Timothy

Romero-Vargas Castrillon, Santiago

The proposal also include the following staffing. How will these personnel resources be allocated to the seven projects?

Center Director

Associate Director

5 Post-doctoral researchers

10 graduate researchers

10 Undergraduate researchers

Two Technicians

The LCCMR proposal asks for the current status of staff so any future staffing for the center director and associate director would have to be appointed through a U of M hiring process in the Civil, Environmental, and Geo-Engineering Department of the College of Science and Engineering.

We would appreciate an email response to these questions by the end of next week-- Friday April 29, 2016

Thanks, The LCCMR Staff

Michael C. McDonough

Manager Research and Planning

Legislative-Citizen Commission on Minnesota Resources

[651 296-2443](tel:651-296-2443)

From: Raymond H [<mailto:hozal001@umn.edu>]
Sent: Wednesday, May 11, 2016 9:25 PM
To: Michael McDonough <michael.mcdonough@lccmr.leg.mn>
Cc: Paige Novak <novak010@umn.edu>; Timothy LaPara <lapar001@umn.edu>; Bill Arnold <arnol032@umn.edu>; John Gulliver <gulli003@umn.edu>; Sebastian Behrens <sbehrens@umn.edu>; Santiago Romero Vargas Castrillon <sromerov@umn.edu>
Subject: Water Center Supplementary Info

Hi Michael:

Attached are 3 files: 1) a Supplementary Information file that addresses your questions and concerns, 2) a letter of support from the CSE Dean's office (Assoc. Dean Mos Kaveh), and 3) a letter of support from my department head, Joe Labuz.

Thanks again for letting us provide more information on our plans for the Minnesota Center for Water Treatment Technology Innovation. Please let me know if you need more information or have further questions.

Regards,
Ray

--

Raymond M. Hozalski, Ph.D., P.E.
Professor of Environmental Engineering
Member of the BioTechnology Institute
<http://www.cege.umn.edu/directory/faculty-directory/hozalski.html>
<http://www.bti.umn.edu/faculty/biohozalski.html>

University of Minnesota
Dept. of Civil, Environmental, and Geo- Engineering
500 Pillsbury Dr. SE
Minneapolis, MN 55455
Ph: 612-626-9650
Fax: 612-626-7750



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

SUPPLEMENTARY INFORMATION

Core Center Faculty (All in Civil, Environmental, and Geo-Engineering at U of MN)

William Arnold
 Sebastian Behrens
 John Gulliver
 Miki Hondzo
 Raymond Hozalski
 Timothy LaPara
 Paige Novak
 Santiago Romero Vargas Castrillon

Research Priorities

The initial priorities were developed and provided in the proposal as follows:

- Removal of current and emerging contaminants in drinking water, wastewater, and in surface waters through innovative and efficient treatment approaches
- Low-energy, low-cost, reliable nutrient removal and resource recovery from wastewater & stormwater
- Development of water/wastewater treatment technologies for small communities & rural households
- Technologies to facilitate reuse of stormwater and wastewater

These priorities were determined based on: 1) discussions of the MN Wastewater Think Tank that included representation from government (including Met Council Environmental Services), engineering consulting firms, the University of Minnesota and wastewater facilities around the state; 2) Input from LCCMR members provided by LCCMR staff; and 3) input from contacts in the drinking water field including engineers and scientists from the Minnesota Department of Health (MDH), water utilities, and consulting. The priorities are expected to be modified and change over time as the initial priorities are addressed and we receive input from the Center Board and stakeholders on new or emerging problems and concerns. The Center Board will consist of 8 to 10 members including the Center Director and professionals from private industry (e.g., consulting firms, water technology companies), public utilities, watershed districts, and government agencies (e.g., MDH, MPCA) and a member of the LCCMR staff (non-voting).

The initial research projects to be performed by the Center are listed in Table 1 below. The project ideas were developed by Center faculty (usually in teams of 2 or 3) to fit within the listed priorities and to address pressing needs in the fields of water, wastewater, and stormwater management. Each of these projects is intended to last up to 3 years. In year two, we will work with the Board and stakeholders to develop and solicit ideas for a second round of projects. The order of the priorities and the order of the projects do not represent any ranking or order of importance. Brief project descriptions for each project are included after Table 1.



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

Table 1
Initial research projects listed in Center proposal

Project	Title	Investigators	New or Continuation	Comments
1	Effects and Removal of Antimicrobials and Antimicrobial Resistance in Wastewater	Arnold, LaPara	New	Builds on the 2014 project Antibiotics and antibiotic resistance genes in Minnesota lakes; PI: Arnold
2	Carbon Filtration for Treating Nitrate-Contaminated Groundwater & Stormwater	Gulliver, Arnold, LaPara, Hozalski, Behrens	New	Project concerns a renewable technology for removing this important nutrient and toxic compound from water
3	Biosorption and Bioaccumulation of Precious Metals in Wastewater	Behrens, Novak, Gralnick (Microbiology)	New	Project will use microorganisms in a new technology to recover precious metals from wastewater
4	Seasonal Dynamics of Comammox During Wastewater Treatment	Behrens, LaPara, Novak	New	The goal of this project is to improve wastewater treatment plant performance in terms of ammonia and total nitrogen removal by studying the newly discovered "comammox" bacteria in full-scale plants. Comammox bacteria convert ammonia to nitrate.
5	Occurrence and Control of Bacteria on Water Mains	Hozalski, LaPara	New	Project will study the impact of water distribution system operating and maintenance decisions on the bacteria living in biofilms on the water main walls to determine the potential risks to water users.
6	Innovative Membrane-Based Low-Energy Biological Nitrogen Removal	Novak, Castrillon, M. Hillmyer (Chemistry)	New	This project will focus on the development of a new wastewater treatment technology to facilitate inexpensive, low-energy, and robust total nitrogen removal for enhanced surface water quality.
7	Producing Renewable Energy and Clean Water from Waste-Phase II	Novak, A. Aksan (Mech. Eng.), Arnold	Continuation	Project will focus on optimization and scale up of a successful membrane-based technology for recovering energy (in the form of hydrogen) from wastewater



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

Brief Project Descriptions

(1) Effects and Removal of Antimicrobials and Antimicrobial Resistance in Wastewater

This work seeks to understand how full-scale wastewater treatment operations behave in terms of release of antimicrobial compounds and antibiotic resistance genes to surface waters, including the potential impacts on drinking water treatment. This information is critical in evaluating potential technologies for minimizing the environmental release and effects of antibiotics/resistance genes in Minnesota.

Project Impact and Long-Term Strategy

Knowing the fate of antimicrobial chemicals/resistance genes in wastewater treatment systems and in the environment will aid in assessment of environmental and human health impacts, which include alteration of the wastewater treatment process, disruption of plant or algal function in surface waters, development/harboring of antibiotic resistance, and production of carcinogens in disinfected waters. This work will provide guidance for improved operation of wastewater treatment infrastructure and potential regulations.

(2) Carbon Filtration for Treating Nitrate-Contaminated Groundwater & Stormwater

This project seeks to develop a self-regenerative granular activated carbon filter than can capture nitrate from urban and agricultural stormwater runoff for the protection of surface water quality and from contaminated groundwater to protect drinking water supplies in agricultural areas.

Project Impact and Long-Term Strategy

Previous research by the PIs reveals that a stormwater filter containing activated carbon removes a substantial fraction of dissolved metals and nitrate from contaminated water as it passes through the filter, requiring minimal contact time. Incorporating biodegradation of the nitrate (i.e., denitrification) between storm events could self-regenerate the media for future events. Such filters that capture nitrate with a short contact time and self-regenerate represent a significant advancement to the industry with potentially lasting and widespread impact.

(3) Biosorption and Bioaccumulation of Precious Metals in Wastewater

In this project we will develop new bioprocesses for the efficient separation and recovery of economically important metals from wastewater. The research is important for the state of Minnesota to prevent supply shortages of critical materials and sustain future economic growth.

Project Impact and Long-Term Strategy

The long-term goal of this project is to make Minnesota independent of future supply insecurities of critical materials by developing new bioprocesses for the efficient recovery and recycling of precious metals and rare earth elements from wastewater. Recovery of these substances from sewage sludge has been estimated to be valued at US\$ 13 million per year for a treatment plant size of 1 million person-equivalents. The project will make use of advanced microbiological and molecular techniques developed in our laboratories to identify and quantify microbes and their interactions with specific metals in wastewater.

(4) Seasonal Dynamics of Comammox During Wastewater Treatment

In an extension of the 2016 LCCMR project 040-B "Wastewater treatment process control improvements" we will develop detection tools and identify process parameters to quantify and control 'complete ammonia oxidizing' (comammox) microorganisms in wastewater to help Minnesota's municipal wastewater treatment facilities meet future nitrogen discharge regulations.

Project Impact and Long-Term Strategy

In the near future, new regulations are expected for Minnesota's municipal wastewater discharges for total nitrogen (ammonia, nitrite, and nitrate) to protect inland water bodies (e.g., Lake Pepin) and coastal zones (e.g., Mississippi River delta) from the harmful effects of eutrophication. The goal of this proposed



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

project is to understand the quantities of comammox and their contributions to nitrification in Minnesota wastewater treatment plants and to identify factors affecting their abundance. The removal of nitrogen involves two processes, nitrification (i.e., the conversion of ammonia to nitrate) and then denitrification where the nitrate is converted to non-bioavailable N₂ gas and released from the wastewater. The benefit of this research will be a new set of tools and useful set of process parameters that govern nitrification in wastewater which can be used to better control wastewater treatment for removal of total nitrogen.

(5) Occurrence and Control of Bacteria on Water Mains

This research will quantify and characterize the bacteria growing on water mains used to distribute drinking water from its source (groundwater and/or water treatment utility) to the end users (residential, commercial, or industrial). This research is critically needed to determine whether water utilities should maintain a low concentration of disinfectant in their water to protect public health.

Project Impact and Long-Term Strategy

The long-term goal of our research is to identify the best, most cost-effective ways to supply drinking water to Minnesotans. The proposed research will utilize novel, state-of-the-art techniques pioneered in our laboratories to investigate the microbes living on water mains throughout Minnesota, for which we currently have minimal knowledge. This work will provide guidance to public water utilities regarding the use of a residual concentration of disinfectant in their distribution system.

(6) Innovative Membrane-Based Low-Energy Biological Nitrogen Removal

In this project, we will develop a new materials and membrane-based wastewater treatment technology to facilitate inexpensive, low-energy, and robust total nitrogen removal for enhanced surface water quality. A new membrane material will be developed to encourage the growth and accumulation of so-called "Anammox" bacteria that anaerobically (i.e., without oxygen) oxidize ammonia to N₂ gas by coupling the oxidation of ammonia to the reduction of nitrite. Thus, this project explores nitrogen removal using a "short-cut" strategy that is different than that proposed in Project 4 where ammonia is first completely oxidized to nitrate in the presence of oxygen then reduced to N₂ gas in the absence of oxygen.

Project Impact and Long-Term Strategy

The proposed research complements current and prior research in the area of new treatment technologies for water and wastewater. There are likely to be additional nitrogen removal requirements for wastewater treatment plants in the future. Current technology for the removal of nitrogen is energy and resource intensive. In this effort, we will develop novel membrane materials that will enable anaerobic ammonia oxidation for nitrogen removal from wastewater. This work will result in inexpensive, low-energy nitrogen removal in the absence of complex process control.

(7) Producing Renewable Energy and Clean Water from Waste-Phase II

In a continuation of an existing ENRTF project, we will expand on technology we have successfully developed to produce energy from high strength waste, modifying the process for better water treatment and energy production and making it easier and cheaper to scale-up and manufacture.

Project Impact and Long-Term Strategy

The proposed work fits into a larger research agenda centered at UMN focused on the development of new treatment technologies for water and wastewater. The first phase of the research has led to a patentable technology; additional research will facilitate licensing and application of the technology.



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

Table 2
Research proposals submitted by Center Faculty outside of the Center proposal

Project	Title	Project Lead	Included in Center Budget if Center is Funded?
1	Household chemicals as water pollutants and toxic precursors	Bill Arnold	Yes (Project 1)
2	New self-sustaining nitrate and pesticides removal biotechnology	Sebastian Behrens	Yes (Project 2 and continue as a new round two project)
3	Preventing Phosphorus Pollution from Stormwater Ponds	John Gulliver	No (Concerns maintenance, not technology development)
4	Innovative Nitrogen Removal Technology to Protect Water Quality	Paige Novak	Yes (Project 6)

Center Staffing Requirements

Center Director

Associate Director

5 Post-doctoral researchers

10 graduate researchers

10 Undergraduate researchers

Two Technicians

The *post-docs*, *graduate students*, and *undergraduate students* will be allocated as shown in the table below. The Center Director, Associate Director, and Technicians will not have specific allocations to individual research projects.

Table 3. Project Staffing Requirements

Project Title	# PDs	# RAs	# UGs
(1) Effects and Removal of Antimicrobials and Antimicrobial Resistance in Wastewater	1	2	2
(2) Occurrence and Control of Bacteria on Water Mains	1	2	2
(3) Carbon Filtration for Treating Nitrate-Contaminated Groundwater & Stormwater	1	1	2
(4) Seasonal Dynamics of Comammox During Wastewater Treatment	0	1	2
(5) Biosorption and Bioaccumulation of precious metals in Wastewater	1	1	0
(6) Innovative Membrane-Based Low Energy Biological Nitrogen Removal	1	2	2
(7) Producing Renewable Energy and Clean Water from Waste-Phase II	0	1	0
Totals	5	10	10

Notes: PD = post-doc, RA = graduate student research assistant, UG = undergraduate student

The *Director* and *Associate Director* initially will work to establish the center in terms of staffing, equipment purchasing and installation, lab setups, establish the Board and initiate an outreach program.

The *Associate Director* will be in charge of coordinating all outreach and education activities including overseeing development and updating of a Center website and social media presence. We expect that approximately one half of the Associate Director's time will be spent on outreach and dissemination activities. The Associate Director will also be responsible for budgeting, staff review [e.g., technicians, postdocs, etc.], interfacing with the Board of Directors, progress report preparation, and interfacing with LCCMR staff.



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: *The Minnesota Center for Water Treatment Technology Innovation*

The *Director* will provide overall leadership and direction for the center by working in collaboration with the Board and core Center faculty. The Director will coordinate quarterly meetings with Center faculty to review progress on research, outreach, and educational programs to ensure adequate progress is made on all planned Center activities. The Director will also network with Minnesota-based water industry companies to establish collaborative relationships concerning water treatment technology development and implementation. The Director will also work with state agency representatives (e.g., from MPCA, MDH) to discuss policy issues and possible changes that can promote innovation in water, wastewater, and stormwater treatment. The Director will be responsible for working with the Board to review project progress and make decisions regarding possible re-allocation of research funds if it is deemed that adequate progress is not being made (and after warnings and adequate time to rectify the situation). For any planned reallocation of research funds LCCMR staff will be informed and consulted with. Finally, the Director will supervise the technicians and ensure that the laboratory facilities function well and meet the needs of the Center faculty and research teams.

Technicians will initially work on setting up new equipment and then provide ongoing help to all projects by maintaining and calibrating instrumentation (quality assurance/quality control), developing new analytical methods, training students and post-docs, and helping prepare for fieldwork campaigns.

Support and Involvement of the Department of Civil, Environmental, and Geo-Engineering (CEGE) and the College of Science and Engineering (CSE)

Ray Hozalski has discussed the Center in detail with the Department Head of Civil, Environmental, and Geo-Engineering (Prof. Joe Labuz) and the College of Science and Engineering (CSE) Dean's office (Associate Dean Mos Kaveh). Both the CEGE department and the CSE Dean's office are fully supportive of the Center and letters of support and commitment are attached. The inaugural Center director will be appointed by the Dean of CSE after a recommendation is submitted by the Department Head of CEGE. The Director position will be subject to a formal review and re-appointment every 4 years. The review will be coordinated by the Head of CEGE who will solicit input from Center faculty, Center Board members, and stakeholders. Following the review, the Head can recommend to the Dean that the acting Director be reappointed for another term or assign a new Director from the existing core center faculty. We do not anticipate hiring any new faculty for the Center or searching among external candidates [i.e., external to the U of MN] for the Center Director position. The Associate Director will be hired by the Center Director after a formal position announcement and interview process done with the involvement and input of the core Center faculty and approval of the CEGE Department Head. This would be a new position at the university.

Contracts, Capital Equipment, Supplies, and Travel

The contracts are for analytical services to support the various research projects. For example, we expect that several of the projects will utilize the U of MN Genomics Center for DNA sequencing and related services. Other funds are budgeted for using the ICP-MS in the Geology department for analyzing metals, including toxic or "heavy" metals in water and soil samples.

The capital equipment will be located in the Civil Engineering building. Initially, the plan is to build our existing research capacity by purchasing cutting-edge equipment to analyze trace contaminants in water (LC MS/MS), count microorganisms (i.e., genes) with high precision (nanodrop digital PCR), investigate interactions of particles and chemicals with surfaces (quartz crystal microbalance), and perform field work around the state (mobile laboratory). The second round of equipment purchases is intended to maintain our analytical capabilities by replacing aging equipment. The plan is to house the equipment in a central 'Center' laboratory. All Center participants will have access to use of equipment purchased for Center activities. Schedules for use will be maintained by Center staff/scientists. The equipment requested will be used in multiple first round projects, and we anticipate it will be used in projects developed/chosen in

**Environment and Natural Resources Trust Fund (ENRTF)****2017 Main Proposal****Project Title:** *The Minnesota Center for Water Treatment Technology Innovation*

subsequent cycles. The equipment will continue to be used for projects benefiting Minnesota until the end of useful operation/manufacture support.

The supplies will be used to perform the various research projects. Examples of supplies to be purchased include DNA extraction kits, reagents for PCR, glassware, chemicals (including standards), disposable filters, cylinders of compressed gases for the instrumentation, solvents and solid phase extraction cartridges for trace contaminant analyses. The supplies will be purchased as needed and used for the intended LCCMR projects.

Travel funds will be used for in-state travel only for the purposes of fieldwork, sample collection, pilot testing, meetings, outreach, and educational activities. A portion of the travel funds will be used to cover expenses for Board members to attend meetings for reviewing and planning Center activities.

UNIVERSITY OF MINNESOTA*Twin Cities Campus**College of Science and Engineering
Office of the Dean**105 Walter Library
117 Pleasant Street S.E.
Minneapolis, MN 55455**Office: 612-624-2006
Fax: 612-624-2841
cse.umn.edu*

May 11, 2016

To: Raymond Hozalski, Professor
Department of Civil, Environmental, and Geo-Engineering

From: M. Kaveh 
Associate Dean for Research and Planning,

Subject: College of Science and Engineering support for
the Minnesota Center for Water Treatment Technology Innovation

The College of Science and Engineering (CSE) enthusiastically supports the proposal to the LCCMR for the establishment of the Minnesota Center for Water Treatment Technology Innovation.

The college views research and workforce development in water related science and technologies as a strategic area of importance. Accordingly, should the proposed center be funded, the college will cover the cost pool charges associated with the center's personnel, research expenditures, space and utilities. This cost pool amount is estimated to be approximately \$200,000 per year during the life of the center.

Please accept my very best wishes for a successful proposal.

C: Steven L. Crouch, Dean
Joseph Labuz, Head, CECE Department
David Pappone, Director of Finance
Nicole Pilman, Administrator, CECE Department

May 11, 2016

To: Raymond Hozalski, Professor

From: Joseph Labuz, MSES/Kersten Professor & Head

Re: Minnesota Center for Water Treatment Technology Innovation

As head of the Department of Civil, Environmental, and Geo- Engineering, I strongly support the proposal to the LCCMR titled the “Minnesota Center for Water Treatment Technology Innovation.” The proposed center fits well with the faculty expertise in the department.

Water-related engineering and sciences are priority areas identified in our strategic plan, and I am willing to devote resources to the center for its development and growth. Thus, the department will provide laboratory space (approximately 600 ft²) for center research projects, and this space will be made ready for equipment installation and operation, in an amount not to exceed \$10,000. In addition, we will assign the associate director a first floor office (approximately 120 ft²), premium space in an underground building.

Assuming you will serve as the director of the proposed center, I am prepared to offer you a reduced teaching load of one course per semester for the six years of the center. The reduced teaching load amounts to approximately \$15,000 per year. Together with the equipment setup, the total support from the department is potentially \$100,000.

I look forward to working with you and our colleagues on this exciting project.

c: Nicole Pilman, Administrator

5. Parks and Trail related – 4 proposals – Response from Kent Skaar, DNR Parks and Trails Division
 - a. LCCMR email request
 - b. Kent Skaar email response

From: Michael McDonough [<mailto:michael.mcdonough@lccmr.leg.mn>]

Sent: Friday, April 15, 2016 3:34 PM

To: Skaar, Kent (DNR)

Cc: Tidemann, Jason (DNR); Susan Thornton; Diana Griffith; Michael Varien; Rivers, Erika (DNR)

Subject: LCCMR questions on Parks and Trails related development proposals

Hi Kent,

Thanks for the phone conversation this afternoon. Following is more detail on the proposals we talked briefly about and our related questions. I am copying Erika on the email too keep her in the loop.

City of Tower - Tower Trailhead Boat Landing and Habitat Improvement - \$983,448

The City of Tower is requesting funding for the construction of a trailhead/parking lot, access road, boat landing and for the construction of a vegetative habitat area.

- The proposal includes the following statement "As part of the Federal Environmental Assessment review of the highway project, the US Department of Interior requested the City of Tower and Minnesota Department of Natural Resources (MN DNR) work cooperatively to re-establish a boat launch and river access in this location. In fall of 2009, the City and MN DNR agreed in principal to working together to replace the East Two River access and boat launch in this area. "
- What has the DNR's conversation been with them about the access?
- Are there Water Rec funds available?
- Is this on a priority list for water access development and if it is, how does it rank?

City of Redwing - Mississippi Blufflands State Trail Red Wing River Walk - \$1,840,000

Design and construction of a three-quarter mile segment of the Mississippi Blufflands State Trail from Barn Bluff Park to Colvill Park in Red Wing.

- How does what they are proposing fit with the State trail master plan?
- Is this section designated as state trail or not?

Chisago County - Swedish Immigrant Regional Trail, Interstate State Park Connection - \$1,785,000

A paved trail and bridge within Interstate State Park providing connections to internal trails, a trail head and providing accessibility and a logical terminus for a developing regional trail.

- The proposal includes the statement "The MN DNR will complete this trail project in 24 to 36 months (July 2017 – November 2019)" -- Is DNR agreeable this?
- Their proposal includes this statement "While this segment of the trail will be in the State Park, it should not be considered a state trail but rather the eastern end of an eight-segment regional trail." Does this make sense to DNR?
- The proposal includes the statement "This segment of the County regional trail, the subject of this grant request, is within Interstate State Park. Due to its location, the responsible partner for this project will be MN DNR Parks and Trails." - FYI

St. Louis and Lake Counties Regional Rail Authority - Mesabi Trail, Wetland Crossing and Bridge Rehab. - \$1,231,500

This project is needed to complete the TH 135 to Embarrass segment of the Mesabi Trail. Work needed is specific to constructing a 4,000 LF floating dock over a wetland and rehabilitating a bridge (circa 1928) over the Embarrass River.

- The proposal says “The bridge is located within the Darwin Meyers WMA managed by the MN DNR. MN DNR currently uses the bridge for light-duty maintenance equipment and foot travel. The bridge is a through-truss, steel girder with a concrete deck. The bridge deck is deteriorated and needs to be replaced along with wing walls and railings. An engineering analysis has been conducted along with a report recommending repairs.” – Is DNR agreeable to a trail in this WMA?
- The proposal says “Construct an 8 foot wide, 4,000 feet long floating dock across the Embarrass River wetland/floodplain. The choice of a floating dock is to minimize the impact to this wetland by avoiding fill material and dissection of the wetland.” It says the trail is 10 feet wide. Would the 8 foot width of the floating dock part meet current design standards.

We would appreciate the department’s input from you or the appropriate person. We realize the WMA question may need input from Fish and Wildlife.

Please call if you would like clarification.

Thanks, Michael

Michael C. McDonough
Manager Research and Planning
Legislative-Citizen Commission on Minnesota Resources
651 296-2443

From: Skaar, Kent (DNR) [mailto:Kent.Skaar@state.mn.us]

Sent: Monday, May 02, 2016 4:56 PM

To: Michael McDonough <michael.mcdonough@lccmr.leg.mn>

Cc: Susan Thornton <susan.thornton@lccmr.leg.mn>; Diana Griffith <diana.griffith@lccmr.leg.mn>; Rivers, Erika (DNR) <erika.rivers@state.mn.us>; Leversedge, Phil G (DNR)

<phil.leversedge@state.mn.us>; Tidemann, Jason (DNR) <Jason.Tidemann@state.mn.us>

Subject: FW: LCCMR questions on Parks and Trails related development proposals

Michael,

Always good to talk to you. Here's what I can provide for insight to the referenced project proposals:

1) City of Tower - Tower Trailhead Boat Landing and Habitat Improvement:

- a. The Parks and Trails Division has provided our technical advice and expertise regarding the development of a new Public Water Access at East Two Rivers for a number of years and up to the present – an opportunity provided by MnDOT's reconstruction of TH169. In 2009 the Division provided written support for the proposal to the Mayor of Tower indicating that the cooperative creation of Public Water Access facilities with local units of government is a priority for the MN DNR Water Access Program and we agreed that a new Public Water Access to Lake Vermilion in the City of Tower would represent an invaluable contribution to the success of the redevelopment project but that the extent of our potential participation will be defined by many factors including fiscal ability. Currently our commitment to the Community is to provide direct assistance with the design and installation of the launch ramp/ramps.
- b. The planks and technical assistance have and or will be provided thru Water Recreation Account Funding. Existing commitments statewide, including our commitment to the redevelopment of the Lake Vermilion- Moccasin Point Water Access acquired by the Dept in 2008 make it difficult to allocate additional funding toward this project in the foreseeable future.
- c. This project has not been considered or ranked within the Division of Parks and Trails Water Recreation Development Program in recent years. Although remaining supportive of the City's proposal – we have a long standing relationship with the City of Tower for the existing Hoodoo Point Public Water Access to Lake Vermilion – located approximately a mile north of the proposed East Two River Access facility.

2) City of Redwing - Mississippi Blufflands State Trail Red Wing River Walk

- a. The State Trail Master Plan for the Mississippi Blufflands State Trail, which is presently in-progress, includes a search corridor consistent with the Legislative authorization extending between the terminus of the Cannon Valley Trail on the western limits of Red Wing to the Community of Lake City. As a result the City of Red Wing's proposal as referenced is within the legislatively authorized State Trail corridor.
- b. Although the trail segment as referenced, is within the State Trails authorized corridor, it is our understanding that this segment will be an extension of the City's existing trail system that will provide the link between the northern terminus of the Cannon Valley Trail and the proposed Mississippi River Blufflands Trail. The City of Red Wing will be solely responsible for the development, administration, operations and maintenance of the proposed segment.

3) Chisago County - Swedish Immigrant Regional Trail, Interstate State Park Connection

- a. The proposal was written in consultation with the Division of Parks and Trails – Central Region Management – and is consistent with our commitment to implement the Regional Trail corridor within the boundaries of State ownership. The time for completion anticipates the requirements for the completion of the Natural and Cultural resources assessments, final alignment selection, the completion of Engineering plans and specifications and a projected construction schedule.
 - b. Yes – the extension of the Swedish Immigrant Regional Trail thru the State Park is consistent with other circumstances throughout the State where LGU's have constructed recreational trails connections to State Park facilities. The most recent example is a Lyon County trail connection into Camden State Park from the community of Marshall.
 - c. The Parks and Trails Division has agreed to accept responsibility for successful implementation within the boundaries of State ownership. With adequate funding provided by the County, the Parks and Trails Division has agreed to complete the final design and engineering and to administer construction of the trail within Interstate State Park.
- 4) **St. Louis and Lake Counties Regional Rail Authority - Mesabi Trail, Wetland Crossing and Bridge Rehab**
- a. The Division of Wildlife has indicated that they are in active discussions with the Mesabi Trail /Regional Rail Authority regarding the accommodation of the Mesabi Trail within the boundaries of the Darwin Meyers WMA (it should be noted that the WMA is a wetland mitigation site with an active mitigation plan). However the placement of the Trail within the boundaries of the WMA has not yet been approved to proceed.
 - b. Our guidance as well as that of MnDOT and ASHTO indicate the following:
 - i. Boardwalk would be considered a “bridge” if water depth exceeds 36 inches.
 - ii. If assumed to be a “Bridge” – bridge width is recommended to be the width of the approaching trail (+) 2ft.
 - iii. In some instances where traffic (ped and bike) are expected to be low even during peak hours a “substandard” width of 8ft for a bridge may be acceptable.
 - iv. Structural insufficient for “typical” trail maintenance vehicles and equipment.
 - v. Railings: trail bridges require railings of a minimum of 54 inches in height if height over ground (in this case the river bed) of 36 inches or more. Railings reduce the “travel lane/s” – given the “obstacle” represented by the railings for bicycle users.

I hope that the above helps answer your questions. Should you wish to discuss further please contact me at your convenience.

Kent Skaar

6. Proposal 82C - Increasing Diversity in Environmental Careers: Fellowships, Internships, Mentorships, Additional Material from, Vikki Getchell, DNR
 - a. Additional material to clarify graphic submitted with proposal

Clarifications for the DNRs Increasing Diversity in Environmental Careers Project

This project will involve **a total of 80 students** over the duration of the requested funding period. The fellowships, internships and mentorships will be distributed as follows:

***80 Fellowships:

- Each student will be awarded a **fellowship at the beginning of their freshman year**.
- The fellowship will be distributed in annual installments at the beginning of each academic year.
- Although the DNR will be striving to secure additional funding sources (e.g. biennial budget) to continue this program past the ENRTF requested funding period, the **first cohort** of 20 students in this proposal will be the only group to start their senior year and thus receive all four installments that make up the entire fellowship award.
- Each subsequent cohort of 20 students will then receive a reduced number of installments based on the academic year that they enter the program.

Fellowship Distribution: \$280,000 (ENRTF requested funding)

Cohort 1, 2, 3, 4: 80 students total X \$2000 distributed beginning of freshman year = \$160,000

Cohort 1, 2, 3: 60 students total X \$1000 distributed beginning of sophomore year = \$60,000

Cohort 1, 2: 40 students total X \$1000 distributed beginning of junior year = \$40,000

Cohort 1: 20 students total X \$1000 distributed beginning of senior year = \$20,000

***120 Internships:

- Each student will be awarded a paid **internship each summer following the completion of their freshman, sophomore and junior years**.
- The first internship following a student's freshman year will specifically address the awareness barrier surrounding natural resources careers. Students who have completed their freshman year will then spend 4 weeks at MNDNR, 4 weeks at MPCA and 4 weeks at BWSR being exposed to a wide variety of natural resources careers.
- The second and third year internships will be at the agency that can provide the "hands-on" learning experience that best aligns with the student's academic and career pursuits.
- An internship will not be granted to a student after the completion of the student's senior year because the student will graduate and no longer be eligible to receive academic credit or fulfill an academic requirement as mandated by statute for an internship.
- Once again, although the DNR will strive to secure additional funding sources to continue this program, the **first cohort** of 20 students will be the only cohort during the requested funding period that will become eligible for an internship **after completing their junior year**.
- Each subsequent cohort of 20 students will receive a proportionate share of the internships based on the academic year that they enter the program.

Internship Awards: \$372,039 (ENRTF requested funding) \$372,039 (MNDNR, MPCA & BWSR secured funding)

Cohort 1, 2, 3: 60 students total X Freshman internship \$6200.65 = \$372,039 (ENRTF requested funding)

Cohort 1, 2: 40 students total X Sophomore internship \$6200.65 = \$248,026 (MNDNR, MPCA & BWSR)

Cohort 1: 20 students total X Junior internship \$6200.65 = \$124,013 (MNDNR, MPCA & BWSR)

***80 Mentorships:

- Each student will be assigned an agency mentor at the **beginning** of their freshman year resulting in a total of 80 assigned mentors over the duration of the requested funding period.

7. Proposal 124D Preventing the Spread of AIS with Decontamination Units, Washington County, Response From, Colin Kelly, Washington County
 - a. LCCMR email request
 - b. Colin Kelly email response

From: Susan Thornton [<mailto:susan.thornton@lccmr.leg.mn>]
Sent: Wednesday, April 20, 2016 10:27 AM
To: Colin Kelly
Cc: Michael McDonough; Michael Varien; Diana Griffith
Subject: RE: Washington County Board of Commissioners - Resolution to Authorize LCCMR Proposal Submission

Thank you for the follow-up.

I have a few additional inquiries. Regarding the state funding for local government aid for aquatic invasive species, how much does Washington County receive and what is it being spent on? Second, did Washington County apply to the DNR for inspection and awareness grants?

Thank you,

Susan

Susan Thornton
Director, LCCMR
651-296-6264
Rm. 65 State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd
St. Paul, Mn 55155

From: Colin Kelly [<mailto:Colin.Kelly@co.washington.mn.us>]
Sent: Wednesday, April 20, 2016 10:46 AM
To: Susan Thornton <susan.thornton@lccmr.leg.mn>
Cc: Michael McDonough <michael.mcdonough@lccmr.leg.mn>; Michael Varien <Michael.Varien@lccmr.leg.mn>; Diana Griffith <diana.griffith@lccmr.leg.mn>
Subject: RE: Washington County Board of Commissioners - Resolution to Authorize LCCMR Proposal Submission

Thank you for your response, Susan.

Based on the state's funding formula, Washington County will receive \$139,013 in Local Aquatic Invasive Species Prevention Aid in 2016.

In late March, the County Board of Commissioners approved 2016 grant agreements to prevent the spread of aquatic invasive species in local waterways. The projects will deploy several strategies across the county, including coordinated Level One watercraft inspections; control of existing infestations; public awareness, education and outreach; early detection/rapid response planning; and implementing public water access best management practices.

Washington County did not apply for "Watercraft Access Inspections by DNR staff" grants because the type of watercraft inspectors needed to operate decontamination units – Level Two inspectors – are not funded through the DNR.

http://www.dnr.state.mn.us/grants/aquatic_invasive/watercraft_inspections.html Wendy Crowell, Ecological Resources Grants Coordinator, informed me that these grants only fund Level One inspectors.

Further, the "Watercraft Access Inspections Administered by Local Government Units" grant program is not funded in 2016.

http://www.dnr.state.mn.us/grants/aquatic_invasive/watercraft_inspections_lgu.html Ms. Crowell adds, "No decision has been made about the program in subsequent years. We will not be able to decide until we know what our budget will be for next year."

Unfortunately the same is true of the "Aquatic Invasive Species Public Awareness Projects" grant program; it is not funded in 2016.

http://www.dnr.state.mn.us/grants/aquatic_invasive/aq_inv_prevention_public_awareness.html

I hope that helps provide some context for Washington County's proposal, Susan.

Thank you for your time and consideration.

Sincerely,
Colin Kelly

8. Renewable Development Fund (RDF) information related to energy proposals, Response from Mark Ritter, RDF Grant Administrator, Xcel Energy
 - a. LCCMR email request
 - b. Table of 2017 energy proposals related to RDF priorities
 - c. Mark Ritter email response
 - d. Additional material

From: Michael Varien [<mailto:Michael.Varien@lccmr.leg.mn>]
Sent: Tuesday, May 17, 2016 2:55 PM
To: Fredregill, Amy S; Ritter, Mark G
Subject: RDF Evaluation Criteria and Information

Dear Amy and Mark,

We have 15 new proposals for the 2017 Environment and Natural Resources Trust Fund RFP that might fit the Renewable Development Fund and we need assistance to analyze eligibility and evaluate proposals. We are looking for information to help LCCMR members review these proposals.

Could you provide us with information regarding RDF's evaluation criteria, RDF funding priorities, and examples of the kinds of projects RDF funds?

Thanks,

Michael Lind Varien

Project Analyst
Legislative-Citizen Commission on Minnesota Resources (LCCMR)
65 State Office Building
100 Rev. Dr. Martin Luther King Jr. Blvd.
St. Paul, Minnesota 55155
Email: Michael.Varien@lccmr.leg.mn
Web: <http://www.lccmr.leg.mn>

From: Ritter, Mark G [mailto:Mark.G.Ritter@xcelenergy.com]
Sent: Thursday, May 19, 2016 9:52 AM
To: Michael Varien <Michael.Varien@lccmr.leg.mn>
Subject: RE: RDF Evaluation Criteria and Information

Michael,

Attached is a list of the projects that have been funded by the RDF and an excerpt of the criteria and process used to score Cycle 4 awards. Please note that the list of projects includes both energy production projects and research development projects. I have also included a flow chart of the selection process, the eligibility screening worksheet

Each RDF advisory group member received a full set of the proposals. Since we had 79 proposals in Cycle 4, two members were assigned each proposal to review (see attached review worksheet) and were the lead reviewers when describing a proposal pros and cons during the selection meeting. Some members did read through every proposal. Although randomly assigned, changes in the assignment were made if there appeared to be a conflict of interest. Since the environmental group and Xcel Energy each have two members on advisory group, changes were also made in the assignment to assure that both of the assigned members were not an environmental representative or and Xcel Energy representative.

Let me know if you have any questions.

Mark

Eligibility Screening Criteria for RDF Projects

In the screening process, the evaluation team eliminates any proposals that do not provide adequate information to allow a more quantitative review. Responses to the RFP should address the following questions:

- Does the proposal include all of the submittal information listed in Section X Proposal Format?
- Does the proposal describe the focus of the project, the goals and objectives to be achieved, and the products that will result from successful completion?
- Does the proposal contain a budget that identifies (1) the total amount of funding being requested from the Renewable Development Fund for each year of the contract, (2) the overall project cost (including any matching funds), and (3) a narrative describing how the RDF funds will be expended in relation to the stated objectives, milestones, and products to be developed?
- Does the proposal describe how the proposed project will advance the market penetration of renewable electric energy technology?
- Does the proposal identify the institution sponsoring the project, if any, and its capabilities, as well as the people making up the project team, their individual responsibilities in conducting the work, and their skills and experience in the technical areas being addressed?
- Does the proposal describe the communication, project tracking and budget management techniques that will be used to manage project work efforts?
- Is the proposal consistent with Minnesota Statute, Section 116C.779, as amended?

Only one project per Xcel Energy customer location may receive an RDF grant award. Any applicant that received a grant award through prior RDF funding cycles will not be eligible for additional funding to support activities for scope of work yet to be completed for the prior selected projects. However, applicants that received funding through prior RDF funding cycles may submit requests for funding in this solicitation provided that the proposal is for a new and distinctly different project, or to advance a previously developed project which has been completed under a prior RDF grant contract.

Xcel Energy reserves the right to withdraw the RFP or adjust amounts available for grants. There is no maximum grant amount but proposals that include cost-sharing are preferred.

Project Types

The RDF funds two categories of projects – Energy Production (“EP”) and Research & Development (“RD”).

Energy Production (EP)

Energy Production projects are those projects whose main objective is to produce or more efficiently and innovatively deliver renewable electric energy. The objective of the EP category is to facilitate the development of new near commercial and demonstration scale renewable electric projects in Minnesota that produce and/or deliver renewable electric energy, as well as renewable energy projects that will increase the market penetration of electric energy resources within the state.

In supporting Energy Production projects, Xcel Energy hopes to provide sufficient funding to lower the cost to produce energy so that any electric output of the project may be cost competitive when measured against the benchmark of Xcel Energy's avoided costs. It is expected that selected projects will facilitate the movement of renewables into the energy marketplace and eventually result in installations of renewable technologies that are not currently commercially viable. These RDF-sponsored projects are not meant to subsidize commercial renewable installations, but to narrow the competitive gap for emerging technologies. A new renewable project is considered to be either a newly constructed renewable energy facility or a refurbishment of an existing generation facility that results in an increase in the production of renewable energy.

- Eligible renewable electric energy production technologies can be biomass based generation, small wind technology (less than 1,000 kW per site), performance testing of innovative wind technology, solar PV systems (between 100 – 1,000 kW per site), solar electric systems, hydroelectric power, and anaerobic digester systems.
- Deployment of solar PV technology may feature a performance-based incentive offering and Xcel Energy-owned systems.
- Biomass projects must meet the Minnesota statutory definition for a renewable energy fuel in Minn. Stat. 216B.1691, subd. 1.
- Projects developed for self-generation may be located anywhere within Minnesota and Wisconsin. A preference will be given to self-generation projects that are located in Xcel Energy's Minnesota and Wisconsin service territory.
- Projects proposing to sell energy must also be able to deliver that energy to Xcel Energy.
- Self-generation projects should be sized as closely as possible to produce no more electricity than can be consumed on-site. Any excess electrical output may be sold to Xcel Energy under any applicable and available tariff.
- All renewable energy credits generated by a Cycle 4 project will be owned by Xcel Energy.

Research and Development (RD)

Research and Development projects are those projects that research innovative renewable energy technologies, including more efficient renewable electric energy delivery technologies. The objective of the RD category is to assist in moving technologies along the path towards commercial introduction and production. The primary objective of research projects is to test a hypothesis or the marketability and application of an electric energy-related

technology. Electric generation may be a by-product of the research. Emphasis will be given to technologies in the later stages of development and testing.

- Eligible renewable electric energy technologies for which research may be performed include wind, hydro, biomass, biofuel, solar photovoltaics, and innovative energy delivery project research.
- Research and development of technologies intended to efficiently deliver renewable electric energy may include, but is not limited to, advanced energy storage technologies, technologies that facilitate the use of demand response from “intermittent” to “firm,” and the testing of enhanced forecasting technologies
- Income from intellectual property and inventions developed through the RD project will be subject to royalty sharing.
- RD projects can be proposed by organizations located outside of Minnesota but the projects themselves must be located within the state.

Ineligible Proposals

The following types of projects are not eligible for funding:

- Projects that primarily involve public or private education programs to promote benefits or awareness of renewable energy technologies.
- Projects involving hydrogen applications unless such applications use a qualifying renewable biomass fuel stock, or derived from a solar source, or involve research that would enable the more efficient use of renewable fuels in fuel cells.
- Projects that apply to or emphasize energy use or conversion applications other than for electricity production (*e.g.*, biofuels, thermal)
- Projects that receive Renewable Energy Production Incentive payments from any RDF-funded program sponsored by the Minnesota Department of Commerce under Minnesota Statutes Section 216C.41 or have received a rebate through the 1st cycle RDF sponsored Department of Commerce Solar Rebate Program.
- Projects that propose to displace electricity use through energy conservation or demand-side management projects.
- Projects that propose to use existing Xcel Energy facilities or resources unless Xcel Energy has approved such use, in writing, prior to proposal submittal. Written approval should accompany submitted proposal.
- Solar thermal projects, whose primary purpose is producing heat, for example solar thermal water heating.
- Project proposals that have received funds from the Solar Rewards or the Minnesota Bonus Rebate Program.
- Projects sponsored by other electric utilities.

Proposal Selection

Xcel Energy is required to utilize an independent third-party expert to evaluate proposals submitted in response to this RFP. In making final selections, Xcel Energy considers the independent expert's evaluation as well as the recommendations of the RDF advisory group.

All selections must be submitted to the MPUC for final approval. To the extent possible, the final portfolio of selected projects contains a mix of technologies and market penetration time frames, consistent with overall funding availability and requirements for sufficient return on RD investments. There is no obligation on Xcel Energy to fund projects within every targeted area proposed. A number of projects are selected as alternates in the event a bidder decides to withdraw from an approved project or does not sign a grant contract within a allotted time. In such an event, an alternate project may receive funding in order to proceed. Xcel Energy also reserves the right to select no projects bid into this RFP.