

2005 PROJECTS

Subd. 05 Fish and Wildlife Habitat

Integrated and Pheromonal Control of Common Carp

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Subd. 05g \$550,000

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RESEARCH

Overall Project Outcome and Results:

The common carp (*Cyprinus carpio*) is an invasive fish that has dominated our shallow lake ecosystems for the past century and caused enormous damage to their water quality, plants, waterfowl and fisheries. The overarching goal of this project was to develop guidelines for an integrated control scheme for the common carp based on its life history and reliance on pheromones (species-specific chemical signals). The possible use and identity of a female pheromonal attractant was studied in the laboratory while the reproductive habits of carp in the field were documented to determine how these traits might be targeted for control. Basic elements of carp biology were also examined to produce a statistical model that explored carp population dynamics and control strategies. Several key discoveries were made. First, behavior tests combined with chemical analysis confirmed the presence of a highly attractive, male-derived sex pheromone. This cue has polar and non-polar components with androstendione serving as a key component. While the presence of androsetendione causes the pheromone to attract sexually-active carp, the other components also serve as a strong species-specific signal that attracts all life stages and thus have potential for application. Detailed studies of carp spawning for two years demonstrated that while females prefer to spawn in fine-leaved, shallow vegetation in the spring and aggregate in the winter, removal schemes are possible. Lastly, a study of carp population dynamics discovered that while carp are mobile (they migrate into spawn each year), long-lived (over 50 years), fecund (females have up to 3 million eggs), but their young rarely survive. Further, larval survival only occurs in shallow, interconnected wetlands in years following severe winter-kills after which predatory native fish are not present: it appears that game-fish can control carp. This discovery was confirmed by modeling and demonstrates that carp control likely is feasible using an integrated scheme.

Project Results Use and Dissemination

The results of this project are being used by two large watershed districts (Riley Purgatory Creek, Ramsey Metro Washington) to study and start experimental projects to control carp. Both districts are contributing to the costs and are using techniques from this project. In addition, we are speaking with and advising at least half a dozen other groups on this topic across the state. The DNR is consulting with us. Late summer we disseminate our findings at the National Meeting of the American Fisheries Society where we have organized an entire day-long symposium on carp control. Since the inception of the study, we have been giving 4-8 public talks a year on carp to various groups including watersheds. Our results have been covered by both the Star Tribune and Pioneer Press, The Chanhassen Villager, and Outdoor News; Kare11 TV and the syndicated TV show "Minnesota Bound" have done shows on us; and we were covered twice by NPR. Two peer reviewed publications are in press with four others in preparation.

FINAL REPORT

Project completed: 06/30/2008

Subd. 06 Recreation

Metropolitan Regional Parks Acquisition, Rehabilitation and Development

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Subd. 06e \$2,000,000

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Overall Project Outcome and Results:

This appropriation leveraged \$1,333,000 of Metropolitan Council bonds and \$701,000 of 2005 State bonds in grants from the Metropolitan Council to regional park agencies to accomplish the following:

- Acquire 567 acres in 4 parks (0.8 acre for Long Lake Regional Park in Ramsey County , 543 acres for Rice Creek Chain of Lakes Park Reserve in Anoka County , 18.6 acres for Lake Waconia Regional Park in Carver County , and 5 acres for Big Marine Park Reserve in Washington County).
- Acquire a permanent trail easement from Burlington Northern Railroad for a 0.8 mile of right-of-way for the Bruce Vento Regional Trail in Ramsey County.
- Partially finance trail and shoreline rehabilitation at Lake of the Isles in Minneapolis.
- Replace 4 pit toilets with sewer-served restrooms for picnic areas at Keller Regional Park in Ramsey County.
- Rehabilitate 0.7 miles of separated bike/pedestrian trails, lighting and landscaping along East Lakeshore Drive at Como Regional Park in St. Paul.
- Build 2 classrooms, storage and reception areas for a visitor center at Gale Woods Special Recreation Feature in Three Rivers Park District.
- Design/engineering for 1.5 miles of North Urban Regional Trail in Dakota County.
- Build a picnic shelter at the Sucker Lake portion of Grass-Vadnais Regional Park in Ramsey County.

A partial extension to the appropriation timeline is allowing Anoka County to use \$524,000 remaining from a land acquisition grant to match \$1,050,000 of Federal Transportation Enhancement grant funds to construct two linked sections of the Rice Creek North Regional Trail within Rice Creek Chain of Lakes Park Reserve that totals 4 miles.

Project Results Use and Dissemination:

The parks and trails where these projects are located had 9,233,000 visits in 2007, which was 28% of all visits to the Metropolitan Regional Park System in 2007.

Each regional park agency that received a grant or grants from this appropriation informs the public about the land acquisition, or new or rehabilitated park facilities with its own website and news releases. The Metropolitan Council also publishes a "Regional Parks Directory and Map" that informs the public about the recreation activities available at each regional park and trail and includes website addresses and phone numbers for each park agency for more information. Finally, the Metropolitan Council's website includes an interactive parks map that contains the same information as the paper version of the "Regional Parks Directory and Map" at <http://www.metrocouncil.org/parks/r-pk-map.htm>

Project completed: 12/31/2010

Gitchi-Gami State Trail

Subd. 06f \$500,000

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To design and construct approximately two miles of Gitchi-Gami state trail segments.

Project due to be completed: Open through timeframe of federal match funding

The Casey Jones State Trail

Subd. 06g \$1,200,000

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Overall Project Outcome and Results

This project expanded and further developed the Casey Jones State Trail in southwestern Minnesota. Development included bituminous paving of five miles of existing state owned trail corridor in Pipestone county, along with construction of two trail bridges. Acquisition from willing sellers added one and a half miles of state owned trail corridor and also preserved 180 acres of remnant native prairie/oak savanna on the banks of Plum Creek in Murray County. The parcels acquired include:

- Eunice Anderson Living Trust: 19.58 acres (1 mile of trail corridor)
- Ralph Manwarren Estate: 180 acres (1/2 mile of trail corridor & remnant prairie)

The Anderson acquisition was significant because it extended one mile west the Lake Wilson segment of state owned trail corridor, reducing the gap to 3 miles between the Lake Wilson and Pipestone county trail corridor. The Manwarren acquisition on Plum Creek will serve as a significant trail foundation as we acquire trail corridor southwest to Lake Shetek State Park, and northeast to Plum Creek County Park near Walnut Grove.

Project Results Use and Dissemination

DNR Trails & Waterways in conjunction with Friends of the Casey Jones Trail Association and the City of Pipestone held a Grand Opening Trail Dedication on July 10th, 2008, celebrating the development of the first five miles of trail. Updated information on acquired parcels and trail development is published on DNR trail maps & the DNR website.

FINAL REPORT

Project completed: 06/30/2009

Paul Bunyan State Trail Connection

Subd. 06h \$400,000

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Overall Project Outcome and Results

The City of Bemidji acquired approximately 7.42 acres of land in the Wye area from Burlington Northern Santa Fe Railway. The DNR acquired approximately 4 acres of the Wye area from the City for \$845,000. \$400,000 from the Environment and Natural Resources Trust Fund was used to acquire the portion of the Wye area needed for the Paul Bunyan State Trail corridor from the City. The DNR used 2006 bonding funding to supplement the acquisition of this property.

The Wye area will be used to accommodate the trail corridor and future trail bridge over TH 197, along with trail amenities such as a parking lot and rest area. The City of Bemidji and DNR will continue to work together to cooperatively develop this area. Additional property rights will need to be acquired from the City, as it continues to work with CP Railway and Burlington Northern Santa Fe Railway and other residential property owners along the trail route. The Wye area corridor will connect the south lake Bemidji area trail corridor to the Clausen Avenue trail corridor.

This land acquisition and future trail construction will help to provide a major connection for the trail through the City and an amenity to the City's south shore economic development project. Future funding will be required to construct a bridge over TH 197. Once these projects are completed, a continuous paved trail will be provided from Lake Bemidji State Park to Crow Wing State Park.

Project Results Use and Dissemination

Information about the project has primarily been disseminated through the local media in relation the City's south shore development project. The Bemidji City Manager and City Council used this information as part of their overall development project, since the City was relying on the DNR acquisition funds to help with their south shore development project.

No articles appeared in the paper specific to the DNR acquisition of the City property, except for when the project was referenced in relation to the City's overall development project and reliance on the acquisition funds as part of that project. Once the trail is constructed, a news release will be submitted indicating the funding sources for the acquisition and construction.

An article did appear in the Bemidji Pioneer on August 13, 2008, pertaining to an LCCMR visit to Bemidji to get an update on the project, along with others in the area. See attached article for details.

FINAL REPORT

Project completed: 06/30/2010

Local and Regional Trail Grant Initiative Program

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Subd. 06l \$700,000

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To provide matching grants to local units of government for the cost of acquisition, development, engineering services, and enhancement of existing and new trail facilities.

Project due to be completed: 06/30/2011 (Extended due to availability of Federal grant)

Mesabi Trail

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Subd. 06m \$1,000,000

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To acquire and develop segments of the Mesabi Trail.

Project due to be completed: Open through timeframe of federal match funding

Land Acquisition, Minnesota Landscape Arboretum

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Subd. 06p \$650,000*

*An equal match of non-state dollars was required for this project.

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Overall Project Outcome and Results:

A 90-acre parcel within the boundaries of the Minnesota Landscape Arboretum was acquired on September 22, 2009 by

combining these Environment and Natural Resources Trust Fund (ENRTF) funds with funds from a ML 2003 ENRTF appropriation. This particular land acquisition concluded a 25 year long process to acquire this parcel. The acquisition provides an internal connection to the Horticultural Research Center and adds to the Arboretum additional big woods, high quality wetlands, prairie remnants, oak savanna, and valuable tillable land for future research and education programs.

A master planning effort by the Minnesota Landscape Arboretum determined that, to a great extent, the Arboretum's watershed follows the surrounding roadways. By purchasing lands within the roadways, the Arboretum aims to secure approximately 90 - 95% of its watershed, control adjacent development, preserve a major part of the ecosystem in the Chanhassen/Victoria/Chaska area, and make the area accessible to the general public.

The Arboretum's planning efforts identified 278 acres of lands to acquire. With the 90 acres added through this project, to date, 241 of the identified acres have been acquired and 37 acres of in-holdings remain left to purchase. This progress has been made possible by \$2.38 million from the Environment and Natural Resources Trust Fund along with \$2.38 million in privately-raised matching funds.

Project Results Use and Dissemination:

Information about this purchase and the ENRTF funding support will be disseminated through Arboretum publications and through information resources at the University Of Minnesota.

FINAL REPORT

Project completed: 06/30/2009

Subd. 07 Water Resources

Improving Water Quality on the Central Sands

Subd. 07i \$587,000

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RESEARCH

Overall Project Outcome and Results

Nitrate leaching to groundwater and phosphorus runoff to surface water are major concerns in sandy ecoregions in Minnesota. Some of these concerns can be attributed to agricultural crop management. This project was comprised of research, demonstration, and outreach to address strategies that can be used to minimize or reduce nitrate leaching and phosphorus runoff in agricultural settings.

Research evaluating slowed nitrogen transformation products, nitrogen application timing, and nitrogen rates was conducted on potatoes, kidney beans, and corn under irrigation on sandy soils. For potatoes, variety response to nitrogen rate, source, and timing was also evaluated. Results showed several nitrogen management approaches reduced nitrate leaching while maintaining economic yields. Based on these results, promising treatments were demonstrated at a field scale using cost share monies. In some cases, producers tested or adopted new practices without the cost share incentive.

- For potatoes, results show that at equivalent nitrogen rates, use of slow release nitrogen reduced nitrate leaching on average by 20 lb nitrogen per acre. Economically optimum nitrogen rates could be reduced by an average of 15 lb nitrogen per acre with slow release nitrogen. In addition, a primary advantage of using slow release nitrogen was that only one application was required instead of multiple applications, which resulted in lower application costs. As a result of this research, slow release nitrogen is being used on ~15,000 acres in the state or about 1/3 of the potato acreage. The reduction in leaching to groundwater based on these results is 300,000 lbs of nitrogen in the state for potatoes alone.
- For corn the slow nitrogen release product applied at planting resulted in a 29 bu/acre increase over the one time application of untreated urea at planting and also allowed eliminating a split nitrogen application. Nitrate leaching was also significantly reduced.
- Similar results were found for kidney beans. It was also shown that the kidney bean nitrogen rate could be reduced by one third when the coated urea was used at planting. A number of best management practices for using polymer coated urea in irrigated potato, kidney bean, and corn production systems have been developed as result of this research.

The research and demonstration results were the basis for a number of educational programs for farmers and those that advise farmers to encourage implementation over a wide area with high risk soils and aquifers. In cooperation with the Minnesota Department of Agriculture, two surveys were also conducted in 12 counties with sandy soils and surficial aquifers to determine nitrate levels in private and municipal well water and the economics of treating water from them. The survey was targeted to sandy regions by combining a zip code map with a soil association map or with nitrate probability maps from the Minnesota Department of Health. In the private well water survey about 6% of the wells were found to be above the USEPA drinking water standard of 10 ppm nitrate-nitrogen. The survey highlighted the economics of nitrate leaching and some of the options that municipalities and private well owners have taken to deal with high nitrate in their drinking water. The Minnesota Phosphorus Source Assessment Tool (PSAT) was developed to allow evaluation of phosphorus sources in small watersheds for educational and planning purposes. The PSAT is currently being used by water planners such as Soil and Water Conservation Districts, Watershed Districts, and Lake Associations. Six peer reviewed publications and three fact sheets have been produced based on the research conducted in this project.

Project Results Use and Dissemination

Presentations were made to various organizations and at various conferences throughout the project period. This included presentations to the Northern Plains Potato Growers Association, Soil Science Society of America, American Society for Horticultural Science, Minnesota Ground Water Association, and others. Additionally, hundreds of growers and grower consultants were contacted about the project and its findings. Hands-on demonstrations of the Phosphorus Source Assessment Tool (PSAT) were conducted across the state, and it is now being used by soil and water conservation districts, watershed districts, lake associations, and others. The tool, back ground information, and user manual are available at <http://www.mnpi.umn.edu/psat.htm>. Finally, the project findings were presented in numerous peer-reviewed articles and through numerous fact sheets available on the web.

FINAL REPORT (Project Publications Attached)

Project completed: 06/30/2010

Improving Impaired Watersheds: Conservation Drainage Research

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Subd. 07j \$300,000

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RESEARCH

Overall Project Outcome and Result

Rural drainage systems are being repaired and replaced in Minnesota at an increasing rate. This provides a unique opportunity to simultaneously install conservation designs and practices with drainage repairs and improvements. This project measures the efficacy of three conservation practices with in-field methods and computer simulation of their performance in southern Minnesota. These innovative conservation practices may play a vital role in improving water quality in Minnesota and the hypoxic zone in the Gulf of Mexico.

Measuring the Efficacy of Three Conservation Practices:

1. **Managed Drainage:** Water control structures in drainage pipe designed to retain soil moisture by seasonally elevating the water table in the crop field within 2 feet from the soil surface.
2. **Shallow Drainage:** Drainage pipe installed at 2.5-3ft depth, rather than the traditional 4-5 ft depth.
3. **Woodchip Bioreactor:** Connecting drainage outlet pipe to an excavated area filled with woodchips, then area is capped with 12-18" of topsoil.

Results for Managed and Shallow Drainage: Field-based Studies

The field-based studies occurred in Nicollet and Mower County with fully instrumented flow measurement devices and weekly nitrate-nitrogen grab samples. There were two research plots, each approximately 10 acres for each site. Findings showed a 20% reduction in the flow discharge from managed drainage compared to conventional drainage. Nitrate concentrations between plots were very similar, and nitrate load reduction in managed drainage plots compared to conventional subsurface drainage practices were associated with the total amount of flow discharged, not the nitrate concentration.

Computer Simulation for Managed and Shallow Drainage

Computer modeling can help understand the range of impacts where field based studies may be cost prohibitive. Important site specific parameters for modeling subsurface drainage include soil and climate factors such as rainfall, temperature, and evapotranspiration. Together these dictate the range of potential effects a drainage system and the associated designs have upon the receiving water body. Also, simulations can associate the size and timing of the associated benefits with these two conservation management practices: managed and shallow drainage.

Three sites were chosen for simulation, as they provided needed baseline information for climate, soils and associated drainage management practices (managed and shallow drainage). The sites included were located in Redwood, Waseca and Mower counties, which provided a range of climate and soil parameters.

Results from Computer Simulation

- Redwood County site exhibited the greatest drainage volume reduction for shallow and managed drainage compared with conventional drainage: 18% and 38% respectively. The Mower County site exhibited the least volume reduction for shallow and managed drainage: 7% and 26% respectively.
- Managed drainage provided a 15% volume reduction beyond shallow drainage at each of the three site locations.

Woodchip Bioreactor: Rice and Dodge County Sites

The primary focus at these two sites was to measure the efficacy of a woodchip bioreactor, which is an excavated area intercepting subsurface drainage and retaining drainage water long enough to significantly reduce nutrient and bacteria concentrations. The two sites and infrastructure will be used for ongoing analysis of herbicide remediation in 2010-2011.

Results for Woodchip Bioreactor

- 50% of nitrate-nitrogen load was reduced within the woodchip trench in less than 32 hours, 30% of the load was reduced in 22 hours, and nearly 100% in 50 hours.
- Phosphorus concentrations were reduced by about 50%.

Project Results Use and Dissemination

The results from this study were disseminated through USDA and USEPA task force and coalition meetings that included industry in public-private partnerships with the research and field-based studies. Leadership and program development was provided primarily with the USDA - Natural Resources and Conservation Service (NRCS) and the USDA - Agricultural Research Service (ARS), beginning in 2003. Related activities included presentations to more than 32 groups, and delivering 2,200 publications to interested stakeholders and agency staff. These activities occurred in concert with Dr. Gary Sands's University of Minnesota "Drainage Outlet" website that has been redesigned to increase information delivery and overall ease-of-access. Full reports are located at www.mda.state.mn.us

FINAL REPORT

Project completed: 06/30/2009

Subd. 09 Agriculture and Natural Resource Industries

Completing Third-Party Certification of DNR Forest Lands

Subd. 09a \$250,000

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Due to the complexity and general lack of awareness of Forest Certification among the general public, numerous "Fact Sheets", briefing documents, newsletter articles, and general informational publications have also been produced and distributed to internal staff and/or external stakeholders. In some cases, these are also available on DNR's website.

Since initially pursuing dual certification in 2005, Minnesota DNR's Forest Certification Coordinator and other members of the Forest Certification Implementation Team (FCIT) have attended and presented a great number of conferences, stakeholder meetings, workshops, field tours, training sessions, etc. Over the course of the last five years, it is likely that several thousands, if not more, people have been reached via the methods described above.

More recently, Minnesota DNR has been closely engaged in the FSC and SFI Standard revision process. Minnesota DNR, along with other partners, has submitted extensive comments on the SFI and FSC Standard revisions and has also participated in several conference calls, face-to-face meetings, and in a field test of the newly proposed FSC National Standard. Through these efforts, Minnesota DNR has reached many more people and stakeholder groups, either directly or indirectly.

Supplementary Materials (available on DNR's website or upon request):

- FSC and SFI Forest Management Certificates for 2005-2010 (website)
- FSC and SFI Assessment and Annual Audit Reports (website)
- Map of Certified Forestlands in Minnesota (website)
- DNR's Internal Audit Team Reports (upon request)
- Minnesota DNR CAR Response (upon request)
- Issue "Fact Sheets" (upon request)
- Presentations (upon request)
- General Publications, Newsletter Articles, etc. (various sources - upon request)

FINAL REPORT

Project completed: 06/30/2010

SUBD. 10 ENERGY

Clean Energy Resource Teams and Community Wind Energy Rebate and Financial Assistance Programs

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Subd. 10a \$700,000

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The project has been divided into two parts. Part 1 - Clean Energy Resources Teams for \$300,000 was completed in 2007. Part 2 - Community Wind Energy Rebate and Financial Assistance Program for \$400,000 which will be completed in 2010.

PART 1: Clean Energy Resource Teams

Appropriation Amount: \$300,000

Overall Project Outcome and Results:

The Clean Energy Resource Teams (CERTs) provide technical assistance to implement cost-effective conservation, energy efficiency, and renewable energy projects throughout Minnesota. This is accomplished through a network of six regional teams working with the statewide CERTs coordinators to implement community-based energy projects that addressed their respective regional priorities.

CERTs awarded grants for technical assistance for at least two projects in each region, funding fifteen in all. An estimated thirty energy efficiency and renewable energy projects received assistance from CERTs while countless individuals consulted with CERTs coordinators for project advice.

The CERTs model has proven to be an effective way for citizens to participate in energy efficiency and renewable energy development. In 2006, the Minnesota Environmental Initiative recognized the Clean Energy Resource Teams with the Partnership of the Year award. As further affirmation of the CERTs model, both the governor and the legislature budgeted for a second phase of CERTs through fiscal year 2009. (Minnesota State Laws 2007, 216C.385.) This legislation also appropriated funds to create a seventh CERT to serve the Twin Cities area. A survey titled, Report on the Clean Energy Resource Teams (CERTs) Project is part of the final report and measures volunteer satisfaction with the CERTs program statewide at 95%. (See Attachment D.)

Project Results Use and Dissemination:

Each CERT hosts a quarterly meeting that draws between 20 and 100 people. Additionally, there are frequent workshops and trainings. This year, the CERTs statewide conference drew 400 people from the public, private, and not-for-profit sectors.

Designing a Clean Energy Future: A Resource Manual was published in 2003 to highlight opportunities for communities to work together on energy issues. It offers basic information on energy efficiency, biofuels, solar, and wind as well as other renewable technologies with tips on how to implement projects. The manual is available in hard copy and at <http://www.cleanenergyresourceteams.org>.

The CERTs website had nearly 16,000 new visitors this year. Additionally, there are 1,100 e-mail subscribers to CERTs monthly updates which cover upcoming events, funding opportunities and regional project highlights.

The CERT model is receiving recognition nationwide. This fall, CERTs is presenting to the Will Steger Foundation Summer Institute, the Rural Youth Summit in Ames, Iowa and the Western Mountains Alliance in Maine. The presentations will focus on how partnerships between land grant universities, not-for-profit organizations, and state energy offices can be an effective way for citizens to get involved in implementing successful community-based energy projects.

FINAL REPORT

Project completed: 06/30/2007

PART 2: Community Wind Energy Rebate and Financial Assistance Program

Appropriation Amount: \$400,000

Overall Project Outcome and Results

The Community Wind Energy Rebate and Financial Assistance Program was designed to competitively select proposed community-owned wind energy projects to receive financial assistance and rebates of \$200,000 for the successful completion of megawatt-scale, grid-connected wind turbines. The goal behind the program was to demonstrate how a local government could use local resources to utilize renewable energy development as a means to direct funding to the public and to help contribute to local renewable energy goals. Two local government projects were competitively selected to participate in this program including Winona County Economic Development Authority (EDA) and a collaborative effort by the Rural Minnesota Energy Board (RMEB) and the Metropolitan Energy Policy Coalition (MEPC), formerly known as the Metro County Energy Task Force (MCETF). Both entities found that publicly owned megawatt-scale wind projects are difficult to develop without private partnerships that allow for federal financial support.

In the case of Winona County EDA, there were a number of hurdles and barriers encountered. During the 2007 legislative session, the county first had to pursue legislation (Minn Laws 2007 Ch. 57, art. 2, Sec. 39) to allow the county to sell power. Following that a number of financing options were considered before one was settled upon. Based on the selected option, Winona County EDA submitted their proposal for approval to receive the rebate in January 2010. However, at this time Winona County EDA's effort was determined to be ineligible for a rebate due to the project ownership structure necessary to allow eligibility for federal grants. Under the proposal, the Winona County EDA would have entered into a partnership with private investors to create a limited liability corporation. Winona County EDA proposed receiving the Environment and Natural Resources Trust Fund dollars and in turn, lending the funds to the project partners. However, this structure was deemed not to fit the requirements of the grant that the project be owned by a public entity. In a letter dated April 28, 2010, the Department of Commerce officially requested that the \$200,000 in funds reserved for Winona County EDA be returned to the Trust Fund.

While this program did not contribute financial assistance to a local government to support the development of a megawatt-scale local wind project, the grant opportunity was helpful in obtaining the legal authorization to own interest in a wind generation project and to do so on a timeline that will allow for the contribution of federal funds. The lessons learned through this exercise are included in the final report and may be valuable to other public entities seeking to participate in public-private partnerships.

RMEB is a Joint Powers of sixteen counties in southern Minnesota formed to provide policy guidance on issues surrounding energy development in rural Minnesota. MEPC is a member group of seven metro area counties and the Metropolitan Council with "longterm interest in the use of secure, safe, reliable, sustainable, economical and environmentally responsible energy for constituents." The RMEB-MEPC County Wind Initiative (CWI) was the result of discussions among RMEB and MEPC members with mutual interest to assist in developing local wind projects, especially in rural southwest counties, with the potential to provide rural and metro counties with clean renewable electricity and the opportunity to stabilize energy costs.

These initial discussions explored the technical and governmental framework necessary for constructing 5-20 MW of community-owned wind generation capacity. Due to the complexity of the development process, CWI requested that LCCMR allow funds to be directed to assist with the planning process rather than as a \$200,000 rebate. The request was approved

with the objective of developing a procurement approach by which other public institutions in similar situations could develop and benefit from community-owned wind energy projects. The lessons learned through this exercise may be valuable to other public entities seeking to develop large-scale renewable energy projects by utilizing public-private partnerships and other governance structures.

FINAL REPORT

Project completed: 6/30/2010

Wind to Hydrogen Demonstration

Subd. 10e \$800,000

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Overall Project Outcome and Results

The Wind to Hydrogen Demonstration project was funded by the Environment and Natural Resources Trust Fund in July 2005 with the goal of demonstrating the use of wind energy to store hydrogen for use as base load or peak power.

After a lengthy development process, in March 2010 the University granted final approvals necessary to proceed with construction of the facility. An electrolyzer capable of producing 1.2 lbs of hydrogen per hour was purchased from Proton Energy Systems and a 60 kilowatt engine generator was purchased from the Hydrogen Engine Center. The electrolyzer uses electricity to separate hydrogen and oxygen from water. The engine generator produces electrical energy by combusting hydrogen gas. The systems were installed at the West Central Research and Outreach Center in June 2010. Following installation, Proton Energy Systems and Hydrogen Engine Center commissioned the equipment and trained University staff. All commissioning steps were completed. The electrolyzer produced 3.5 cubic feet or 2.6 lbs of hydrogen. The hydrogen engine generator was brought up to full power generation.

The goal of the project to use wind energy to store hydrogen for use as base load or peak power has been successfully demonstrated. The University will continue to operate the pilot facility to determine the feasibility of using hydrogen to store wind energy and to create value-added products such as nitrogen fertilizer. Successful demonstration of the system can address main barriers for wind energy. Storage processes such as the production of hydrogen may be an opportunity to overcome the 'intermittency' barrier. The second barrier is the lack of transmission capacity. The production of hydrogen can impact this barrier by using excess wind energy to produce hydrogen and other value added components thereby diminishing the need for additional transmission to move power to load centers. Energy intense industries may then be created in rural areas with high wind resources. The benefits are three-fold: the grid is better managed, the environment benefits from increased use of renewable energy, and the state economy is enhanced.

Project Results Use and Dissemination:

The intent is for the results to lead to commercial wind to hydrogen production facilities. Initial funding for the Wind to Hydrogen Demonstration was provided by the Environment and Natural Resources Trust Fund. Additional funding from the State and the University for a second phase will be used to demonstrate using hydrogen to produce nitrogen fertilizer. It is anticipated that the combination of hydrogen storage for electrical energy generation and use for nitrogen fertilizer production could be a viable economic model in the near future. The information has been disseminated to a wide group of stakeholders and students through presentations, print materials, media articles, tours, and the web including seven national presentations, twenty-two regional presentations, and over fifty local presentations. Since its installation in June 2010, over 1,000 people have toured the facility. There have been several news articles primarily in agriculture magazines. The project has also been mentioned in hydrogen-related stories in the New York Times and the Washington Post. As a University of Minnesota Research and Outreach Center - inherent in the name and mission - information regarding the project will continue to be disseminated to a broad audience in multiple formats.

FINAL REPORT

Project completed: 06/30/2010
