



MINNESOTA

ENVIRONMENTAL QUALITY BOARD

520 Lafayette Road North, Saint Paul, MN 55155 | www.eqb.state.mn.us
Phone: 651-757-2873 | Fax: 651-757-2343

November 18, 2020

Meeting Location: Virtual via WebEx

<https://minnesota.webex.com/minnesota/onstage/g.php?MTID=e16417da4d5c880fda857813bd043c85e>

1:00 pm – 4:00 pm

AGENDA

Meeting Time and Location

In light of the COVID-19 pandemic, the Environmental Quality Board (EQB or Board) will convene its November Board meeting virtually through the WebEx platform. To access the meeting, use the link under the “Meeting Location” above.

Accessibility: This material can be provided in different forms, like large print, braille, or on a recording. Please contact EQB staff at least one week prior to the event at info.EQB@state.mn.us to arrange an accommodation.

Public Engagement Opportunities at EQB Meetings

EQB encourages public input and appreciates the opportunity to build shared understanding with members of the public. During the November Board meeting, public comment will be taken during each agenda topic. Members of the public may submit a written comment or make oral comments. Commenters are asked to keep their statements to fewer than two minutes of speaking (approximately 260 words). In advanced of the Board meeting, please review our “Guide to WebEx Participation” that starts on page 5 of this packet to learn how to use the WebEx platform for engaging in the EQB meeting.

Meeting Objectives

- Review and approve the final report: *Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature*
- Review and approve the final 2020 Minnesota State Agency Pollinator Report
- Discuss the draft Civic Engagement Framework for Pollinator Protection

Agenda:

I. ***Adoption of Consent Agenda & Minutes**

Proposed Agenda for November 18, 2020, Board Meeting
September 9, 2020 Meeting Minutes

II. **EQB Welcome & Introductions**

Laura Bishop
EQB Chair; Commissioner
Minnesota Pollution Control Agency

EQB Members

Margaret Anderson Kelliher; Commissioner – Department of Transportation
Grace Arnold; Commissioner – Department of Commerce
Kristen Eide-Tollefson; Public Member – Congressional District 2
Alan Forsberg; Public Member – Congressional District 1
Julie Goehring; Public Member – Congressional District 7
Steve Grove; Commissioner – Department of Employment and Economic Development
Jan Malcolm; Commissioner – Department of Health
Nicholas Martin; Public Member – Congressional District 4
Bryan Murdock; Commissioner – Congressional District 8
Thom Petersen; Commissioner – Department of Agriculture
Alice Roberts-Davis; Commissioner – Department of Administration
Sarah Strommen; Commissioner – Department of Natural Resources
Gerald Van Amburg; Chair – Board of Water and Soil Resources
Benjamin Yawakie; Public Member – Congressional District 3

III. **Executive Director's Report**

Katie Pratt
Executive Director
Environmental Quality Board

IV. ****Feasibility of Solar Development on State-Managed Closed Landfills Report: Review and Approval**

In 2019, the Minnesota Legislature appropriated funding to the EQB to conduct a study of the potential to deploy solar photovoltaic devices on sites in Minnesota's Closed Landfill Program. This study includes an assessment of solar potential at the sites, identification of barriers to solar development, and policy recommendations that would facilitate solar development in a manner that would contribute to the state's sustainability goals.

Staff and agency experts come before the Board in November for final approval of the report, *Feasibility of Solar Development on State-Managed Closed Landfills: Report to the Legislature*. The report is due to the Legislature on December 1, 2020.

* Items requiring discussion may be removed from the Consent Agenda

** Denotes action may be taken



MINNESOTA

ENVIRONMENTAL QUALITY BOARD

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 Shawn Ruotsinoja, Minnesota Pollution Control Agency: Shawn.Ruotsinoja@state.mn.us
 Technical Assessment: Andy Polzin, Barr Engineering

Materials enclosed:

- Resolution to approve the report, *Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature*
- Final report: *Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature*

V. Public Comment on Agenda Item IV

The Board welcomes public comment on agenda items. Commenters are asked to keep their statements to fewer than 260 words or two minutes of speaking. Please see the “Guide to WebEx Participation” on page 5 of this packet to learn how to use the platform for engaging.

VI. ** Final Review and Approval of the 2020 Minnesota State Agency Pollinator Report and Discussion of Civic Engagement Framework for Pollinator Protection

Executive Order 19-28 directs the Environmental Quality Board to convene the Interagency Pollinator Protection Team (IPPT) to “provide operational support, ensure interagency coordination, develop cross-agency policies and programs, and report on progress toward statewide goals in a report to the EQB by December 1 of each year.”

In September, staff sought input from the Board and the public on draft materials of the 2020 Minnesota State Agency Pollinator Report and the Civic Engagement Framework for Pollinator Protection. Staff provided an overview on the scorecards, progress, challenges and recommendations for each section. They also presented draft materials for a civic engagement

framework to increase public engagement to advance pollinator protection in the state.

Staff and agency experts return before the Board in November for final approval of the 2020 Minnesota State Agency Pollinator Report and continued discussion on the Civic Engagement Framework for Pollinator Protection. The report is due December 1, 2020.

Presenters:

Rebeca Gutiérrez-Moreno
State Pollinator Coordinator
Environmental Quality Board
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Participating Interagency Pollinator Protection Team members:

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Laura Marti, Minnesota Pollution Control Agency: laura.marti@state.mn.us

Materials enclosed:

- Resolution to approve 2020 Minnesota State Agency Pollinator Report
- Final draft report: 2020 Minnesota State Agency Pollinator Report
- Draft: Civic Engagement Framework for Pollinator Protection

VII. Public Comment on Agenda Item VI

The Board welcomes public comment on agenda items. Commenters are asked to keep their statements to fewer than 260 words or two minutes of speaking. Please see the "Guide to WebEx Participation" on page 5 of this packet to learn how to use the platform for engaging.

VIII. Closing Remarks

IX. Adjourn

EQB Guide to Participating in WebEx Meetings

If you have any questions or technical difficulties regarding the Board meeting or WebEx, please contact EQB staff at (651) 757-2873.

Contents

- [Connecting to WebEx](#)
- [Submitting Oral Comment](#)
- [Submitting Written Comment](#) (Written Comments will be included in the subsequent Board Packet)
- [Troubleshooting your connection](#)

Connecting to WebEx

Step 1: Join WebEx through the provided link found on our website or public meeting notification through GovDelivery.

Step 2: Input your name and email address, then select join.

Join Event Now

To join this event, provide the following information.

First name:

Last name:

Email address:

Event password:

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Join Now

[Join by browser](#) **NEW!**

Step 3: This will prompt you to register for the meeting by confirming your email address, after confirming, select "Submit"

Register for Environmental Quality Board Meeting

Please complete this form to register for the event. An asterisk (*) indicates required information.

Please answer the following questions.

* First name:	Environmental Quality
* Email address:	eqb.info@state.mn.us
* Confirm email address:	eqb.info@state.mn.us
Company:	
Address 1:	
Address 2:	
City:	
ZIP/postal code:	
Country/region:	United States of America
Number of employees:	1-99

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☐ Yes ☐ No

First Name:

MN County:

Select all types of licenses or certifications your programs' have:
☐ Children's residential facility
☐ Substance use disorder treatment

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Step 4: If you have not already used WebEx before, follow the prompts to download the plug-in for your web browser. This typically does not take long, but be sure to budget time in advanced to connect to the meeting.

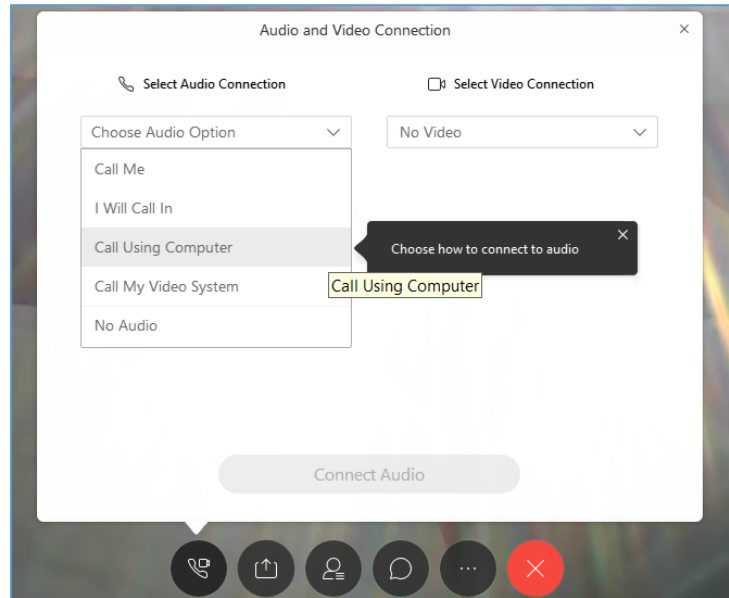
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You will need to download this application once to join a meeting with Microsoft Edge.

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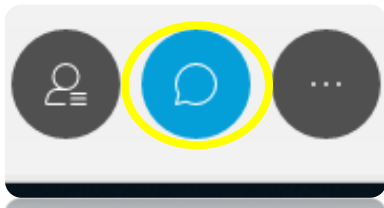
Step 5: Configure your Audio and Video Connection, if you wish to use your computer's microphone and camera, select "Call Using Computer." If you prefer to connect by phone you can either call in or have the WebEx system call a number that you provide.

Note: you will be muted upon entry to the conference call. If you are joining audio by phone, you will only be able to unmute through your computer.

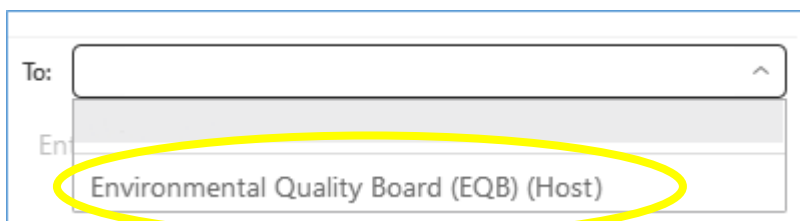


If you wish to provide oral public comment:

Step 5: Open the chat by clicking the chat bubble icon.



Step 6: Then select "Environmental Quality Board (Host)" and notify staff which agenda topic you wish to make comment on.



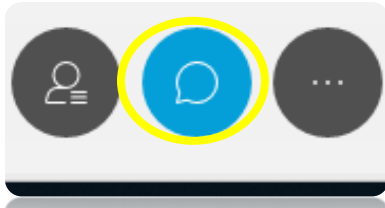
Step 7: Your will be unmuted and your name will be called when it is time for you to comment.

Note: Commenters are asked to keep their statements to fewer than 2 minutes of speaking (approximately 260 words).

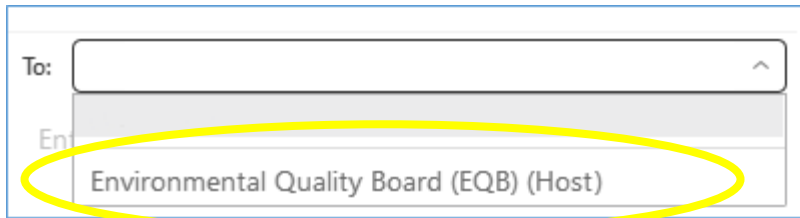
If you wish to submit written public comment

Note: Written comments will not be visible to the Board in real time. They will be included in the subsequent Board packet.

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Step 6: Then in the chat box, select “Environmental Quality Board (Host)” to submit your written public comment.

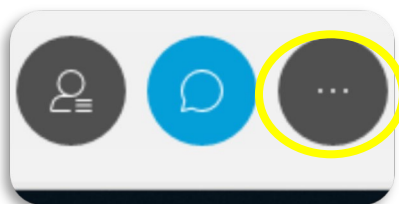


Troubleshooting your Connection

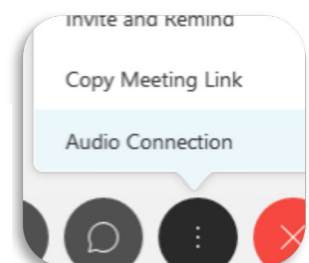
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Having trouble with hearing or speaking? Try joining by phone.

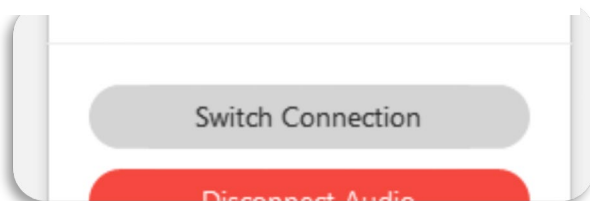
Step 1: Open the options by selecting the three dots icon.



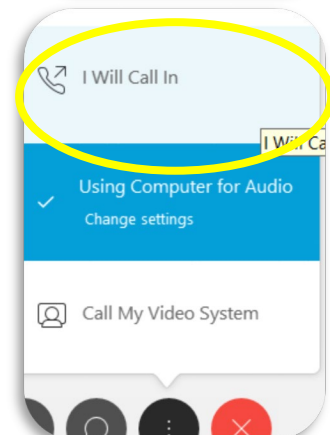
Step 2: Select “Audio Connection” in the menu.



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Step 4: Press “I will call in” to get unique call in information for your phone’s connection.



**MINNESOTA ENVIRONMENTAL QUALITY BOARD
MEETING MINUTES**

September 9, 2020; 1:00 p.m. – 4:00 p.m.

Meeting Location: Virtual via WebEx

Members Present: Margaret Anderson Kelliher, Laura Bishop, Kristen Eide-Tollefson, Alan Forsberg, Julie Goehring, Steve Grove (proxy Kevin McKinnon), Steve Kelley, Jan Malcolm (proxy Dan Huff), Bryan Murdock, Thom Petersen, Alice Roberts-Davis, Sarah Strommen, Gerald Van Amburg, Sue Vento, Benjamin Yawakie

Activity	Audio*
I. Adoption of Consent Agenda & Minutes	--:--:--**
II. EQB Welcome & Introductions	--:--:--**
III. Executive Director's Report Executive Director Katie Pratt announced that the Environmental Review Projects Interactive Map is publicly available on the EQB webpage. The map provides a way to find information on projects undergoing environmental review. Context for subsequent agenda items was shared.	--:--:--**
IV. 2020 State Water Plan: Final Review and Approval EQB staff Erik Dahl gave a presentation on the final steps ahead and changes to the 2020 State Water Plan between the September and August Board meetings. After public comment, the resolution to approve the plan was passed, the voting record can be found on the next page.	00:00:00
V. Public Comment on Agenda Item IV	00:04:25
VI. Minnesota Sands, LLC Project Update EQB staff Denise Wilson and Erik Dahl provided history, current status, and updates on the Minnesota Sands, LLC Project.	00:56:40
VII. Public Comment on Agenda Item VI	01:39:35
VIII. 2020 State Agency Pollinator Report: Purpose and Context EQB staff Rebeca Gutierrez-Moreno shared background and details on the development for the upcoming Interagency Pollinator Report and civic engagement approach.	02:05:20
IX. Public Comment on Agenda Item VIII	02:27:04
VIII. Closing Remarks	02:35:50

* Audio recording and presentations of September 9th meeting resides on the EQB website:
<https://www.eqb.state.mn.us/content/august-122020-board-meeting>

**Note: Due to technical difficulties, the recording begins after the staff presentation provided for the "2020 State Water Plan: Final Review and Approval." You can review presentation slides for that topic through the link above via "September 9, 2020 Board Meeting Presentations and Handouts."

EQB MEETING VOTING RECORD

DATE: September 9, 2020AGENDA ITEM: 2020 State Water Plan: Final Review and ApprovalMOVED BY: Thom PetersenSECONDED BY: Alan Forsberg

BOARD MEMBER	VOTING AYE	VOTING NAY	NOT PRESENT
ANDERSON KELLIHER, M.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BISHOP, Laura	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EIDE-TOLLEFSON, Kristen	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FORSBERG, Alan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GOEHRING, Julie	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GROVE, Steve	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
KELLEY, Steve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MALCOLM, Jan	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MURDOCK, Bryan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PETERSEN, Thom	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ROBERTS-DAVIS, Alice	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
STROMMEN, Sarah	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
VAN AMBURG, Gerald	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
YAWAKIE, Ben	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Notes:



RESOLUTION OF THE

MINNESOTA ENVIRONMENTAL QUALITY BOARD

The Minnesota Legislature appropriated funds to the Environmental Quality Board (EQB) for the completion of a study of the potential to deploy solar photovoltaic devices on closed landfill program sites, as provided by Minnesota Laws 2019, First Special Session chapter 4, article 12, section 2, subdivision 9b. To complete this study, the EQB convened an interagency team with members from the Departments of Administration, Commerce, and Management and Budget; the Metropolitan Council; and the Minnesota Pollution Control Agency. Additionally, the EQB contracted with Barr Engineering Co. to complete a technical assessment of the landfill sites. The report includes:

1. Identification and assessment of properties in the Minnesota Pollution Control Agency's Closed Landfill Program with the highest potential for solar energy production;
2. Identification of potential barriers to solar energy production and potential ways to address those barriers; and
3. Policy recommendations that would facilitate solar energy production on Closed Landfill Program sites in a manner that would contribute to state and local government sustainability goals.

The 2020-2021 EQB work plan directs work on this study, with the desired long-term outcome of implementation of policies that facilitate solar development across Minnesota's Closed Landfill Program sites while maximizing energy generation, ecological benefits, and greenhouse gas mitigation.

The Board resolves to:

- Approve the report, *Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature*, to be released by December 1, 2020.

The Board approves and adopts the report, *Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature*, on this 18th day of November, 2020.

Laura Bishop, Chair
Minnesota Environmental Quality Board

Feasibility of Solar Development on State-Managed Closed Landfills: A Report to the Legislature

Exploring the potential to deploy solar photovoltaic devices on sites in the Minnesota Pollution Control Agency's Closed Landfill Program



Legislative charge

The Minnesota Legislature appropriated funds to the Environmental Quality Board for the completion of this study, as provided by Laws 2019, First Special Session chapter 4, article 1, section 2:

Subd. 9. Environmental Quality Board. (b) \$300,000 the first year is from the remediation fund to conduct a study of the potential to deploy solar photovoltaic devices on closed landfill program sites. This is a onetime appropriation. By December 1, 2020, the board, in consultation with the Pollution Control Agency and the commissioners of administration, commerce, and management and budget, must provide to the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over environment and natural resources policy and finance and energy policy and finance a report on the use of properties in the state's closed landfill program for solar energy production. The report must include:

- (1) Identification and assessment of properties in the closed landfill program with the highest potential for solar energy production;
- (2) Identification of potential barriers to solar energy production and potential ways to address those barriers; and
- (3) Policy recommendations that would facilitate solar energy production on closed landfill program sites in a manner that would contribute to state and local government sustainability goals.

Author

Faith Krogstad

Contributors/acknowledgements

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 John Hunter (Pollution Control Agency)
 Jack Kluempke (Department of Commerce)
 Kirk Koudelka (Pollution Control Agency)
 Hans Neve (Pollution Control Agency)
 Eric Pederson (Pollution Control Agency)
 Katie Pratt (Environmental Quality Board)
 Shawn Ruotsinoja (Pollution Control Agency)

Technical assessment: Andy Polzin (Barr Engineering Co.)

Cover photo: A 2.4 megawatt solar farm built on a landfill in Rehoboth, Massachusetts. (United States Department of Energy, Lucas Faria)

Minnesota Environmental Quality Board

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This report is available in alternative formats upon request, and online at www.eqb.state.mn.us.

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List of Attachments

Attachment I Technical Assessment: *Solar Panels on Closed Landfills Study*

Executive summary

The state of Minnesota has an opportunity to lead by example and promote solar development on brownfields (contaminated sites) like landfills, reducing development pressure on agricultural and natural lands while generating jobs in clean energy. Minnesota's climate is rapidly changing, and climate change impacts are likely to worsen in coming decades unless we can dramatically reduce greenhouse gas (GHG) emissions. The state of Minnesota has ambitious goals to reduce emissions, and while we have made progress on these goals, meeting them will require much more aggressive state and federal policies.

Clean energy, such as solar power, is increasingly displacing the use of fossil fuels in Minnesota, helping to reduce emissions. The cost of solar has fallen in recent years, driving up solar installations and demand for land on which to site solar arrays. Siting solar development on brownfields including closed landfills, may be a way to meet some of the demand for land.

The 1994 Landfill Cleanup Act created Minnesota's Closed Landfill Program (CLP) acknowledging that long term care of waste is a shared responsibility of a waste generating society. The scope of the program however is limited to a subset of 110 closed, state-permitted, mixed municipal solid waste landfills, other closed landfills and dumps in the state are not included in the program.

This legislative report examines: 1) the potential for solar photovoltaic development on sites in the State of Minnesota's Closed Landfill Program (CLP), 2) barriers to development, and 3) recommendations that would facilitate solar development on these sites in line with state and local sustainability goals. To complete this study, the Environmental Quality Board (EQB) assembled an interagency team with members from the Departments of Administration, Commerce, and Management and Budget (MMB); the Metropolitan Council; and the Minnesota Pollution Control Agency (MPCA). Additionally, the EQB contracted with Barr Engineering Co. (Barr) to complete a technical assessment of the CLP sites.

Key takeaways

Solar potential

There is significant potential for solar development on Minnesota's CLP sites. The technical assessment estimated that there is potential to generate 950 megawatts (MW) using solar on 4,500 acres in the CLP, or enough to power over 100,000 homes.

Barriers

Several barriers limit solar development on CLP sites.

- The current statutory mission of the CLP is limited to taking environmental response actions and protecting human health and the environment. **Establishing beneficial property reuse was not included and funded in the original CLP program mission.**
- Half of the CLP's 110 sites have use restrictions because of **past general obligation bond financing** of cleanup actions. The prospects for beneficial reuse, including solar development, are limited for property where bond financing was used until the bonds are retired.
- **Solar development could be more costly and complex on closed landfills** than on greenfield (uncontaminated) sites. Solar developers face uncertainty about site-specific suitability for solar, increased costs associated with construction on the landfill cap as well, as real and perceived risks associated with CLP responsibilities.

- **State regulations impose limitations on solar projects** under some solar ownership and operation models. For example, Community Solar Garden projects are limited to 1 MW, which is well below the estimated solar energy generation capacity of many CLP sites. Legislative action would be required to raise this limit at brownfield locations such as CLP sites.

Recommendations

1. **Expand statutory authority of the CLP to authorize and fund proactive work on property reuse, including solar development, and provide funding to establish a Closed Landfill Beneficial Reuse Program.**
 - The CLP is able to enter into leases when there is an expressed interest in leasing state property provided the proposed land use is appropriate. However, CLP is not authorized or funded to proactively facilitate beneficial property reuse. With increased authority and resources, the CLP could facilitate beneficial reuse, including solar development on state-owned sites, and develop guidance for local government- and privately-owned CLP sites.
 - Development of a Closed Landfill Beneficial Reuse Program would require further investigation into several topics, including solar ownership models, incentives, lease revenue uses, Solar Renewable Energy Certificate ownership, and interconnection costs. Continued interagency collaboration would be necessary to develop a Closed Landfill Beneficial Reuse Program aligned to the state's economic, equity, environmental justice, and environmental goals.
2. **Appropriate funds to retire bond debt early and legislatively authorize the release of state bonding restrictions for select CLP sites.** Freeing property from bond restrictions would open up lands for solar development and could generate significant revenues into the future

Introduction

Solar development is rapidly increasing in Minnesota but is constrained by access to suitable land. As climate change threatens our way of life, businesses, communities, and families, the state of Minnesota is seeking creative ways to increase renewable energy generation and reduce greenhouse gas emissions. Locating large-scale solar development on sites in the State's Closed Landfill Program would make land available for clean energy projects, protect agricultural and natural lands from development, advance the State's climate goals, and transform blighted property into community assets. Minnesota has a unique challenge, however – half of these closed landfill sites have use restrictions that limit solar development due to past utilization of general obligation bond financing to remediate the sites. This challenge is unique to Minnesota as compared to other states, which typically do not have restrictions due to bond financing on closed landfill sites.

In 2019, the Minnesota Legislature appropriated funds to the EQB to gain a better understanding of the solar opportunity at sites in the State's Closed Landfill Program and ways to address barriers to solar, including bond restrictions. The EQB contracted with Barr Engineering Co. to conduct a technical assessment of the sites, as well as stakeholder engagement to uncover barriers and opportunities and inform policy recommendations. This assessment, completed in October 2020, is in Attachment I.

The EQB also convened a Solar on Closed Landfills interagency team, which collaborated closely with Barr throughout 2020. Following the completion of Barr's assessment, the interagency team prepared reflections on the conclusions, followed up on additional lines of inquiry beyond the scope of Barr's assessment, and summarized information and recommendations in this legislative report.

Background

Facilitating solar development on closed landfill sites in Minnesota has the potential to forward the State's climate, environmental justice, and equity goals while minimizing land development impacts and generating clean energy jobs.

While the threat of climate change can feel like a far-off possibility, the scientific consensus is clear: Minnesota's climate has already rapidly changed over the last several decades and additional, significant changes are expected through the end of this century. Dramatic reductions in GHG emissions are needed to avoid the worst impacts of climate change.

Minnesota has ambitious goals to reduce GHGs outlined in the 2007 Next Generation Energy Act, which calls for reducing annual emissions by 80% between 2005 and 2050. While we have made progress, achieving our goal will require much more aggressive action. Minnesota is taking important steps, including establishing a Climate Change Subcabinet and Advisory Council¹ and setting GHG reduction goals for state government operations.² Transitioning from fossil fuels to renewable sources of energy, including solar, is important for meeting the state's climate goals.

Solar energy generation specifically and directly supports the State's equity and environmental justice goals through pollution reduction. As outlined in the 2015 MPCA Environmental Justice Framework,³ the agency will proactively target resources to address environmental justice concerns and commit to the goal that "pollution does not have a disproportionate negative impact on any group of people." In its

¹ [Executive Order 19-37](#), December 2019.

² [Executive Order 19-27](#), April 2019.

³ Minnesota Pollution Control Agency. [Environmental Justice Framework](#), December 17, 2015.

2017 report,⁴ the Interagency Climate Adaptation Team recommended that the State identify ways to strengthen the health and resilience of vulnerable populations through cooperation with local governments. Climate-vulnerable populations include the very old and very young, people of color, and people with health issues, disabilities, economic vulnerability, outdoor occupations, disproportionate exposure to environmental pollution, and cultural/language barriers.

Solar in Minnesota

Interest in solar power is surging in Minnesota. Driven in part by advances in technology, the cost of installed solar has fallen by over 70% in the last decade,⁵ making it competitive with other sources of energy. Solar development began accelerating in 2013 after Minnesota passed legislation⁶ promoting the growth of solar energy. This included a goal of achieving 10% of Minnesota's electricity from solar by 2030. Additionally, the Department of Commerce and the Solar Pathways Project estimate that the state can meet 70% of electricity demand from solar and wind by 2050 at costs comparable to other sources.⁷

Solar now accounts for about 3% of Minnesota's energy portfolio⁸ and is expected to continue growing and displacing generation from other sources of energy, particularly fossil fuels. Solar power offers many benefits, including a reliable "homegrown" energy source, reduced greenhouse emissions, and job growth. These are especially important as the state faces economic damage and job losses from the COVID-19 pandemic as well as the urgent need to address climate change.

Large-scale solar development requires sizable areas of land and applies development pressure on agricultural and natural lands. The Department of Commerce's Solar Energy Production and Prime Farmland report⁹ notes that areas with the best solar resources overlap with the state's prime farmland, and "solar production removes the entire area...from agricultural production" for the life of the project. State policy is to "preserve agricultural land and conserve its long-term use for the production of food and other agricultural products" by means including:

Guiding the orderly construction and development of energy generation and transmission systems and enhancing the development of alternative energy to meet the needs of rural and urban communities and preserve agricultural land to the greatest possible extent by reducing energy costs and minimizing the use of agricultural land for energy production facilities [...].¹⁰

As the State seeks to protect prime farmland and natural lands while promoting solar energy, it is looking to reduce pressure on these lands through reuse of closed landfills as potential sites for solar development.

⁴ Minnesota Pollution Control Agency. [Adapting to Climate Change in Minnesota: 2017 Report of the Interagency Climate Adaptation Team](#), May 2017.

⁵ Solar Energy Industries Association (SEIA)/Wood Mackenzie. Power & Renewables U.S. [Solar Market Insight](#), 2020 Q3.

⁶ [Minn. Stat. § 216B.1691](#).

⁷ Minnesota Solar Pathways. [Solar Potential Analysis Report](#), November 2018.

⁸ United States Energy Information Administration. [Minnesota State Profile and Energy Estimates](#), May 21, 2020.

⁹ Minnesota Department of Commerce. [Solar Energy Production and Prime Farmland](#). May 19, 2020.

¹⁰ [Minn. Stat. § 17.80](#).

Beneficial reuse of brownfields

A brownfield is any property that is abandoned or underused due to the known or likely presence of contamination. Reuse and revitalization of brownfields can include green space, residential, commercial, industrial, or mixed-use development. Brownfield reuse can benefit communities by growing the local tax base and jobs, reducing development pressure on higher value lands, using existing infrastructure, and increasing recreational space and habitat.¹¹ A closed landfill is a unique type of brownfield that may not be suitable for construction of buildings, but offers a great opportunity to expand our reliance on renewable energy sources.

Solar development on brownfield sites is a win-win for Minnesota because we can put low-value, contaminated land to use generating clean energy and revenue while maintaining the integrity of the sites to protect human health, safety, and the environment. Brownfields reused for solar energy are called “brightfields.” Minnesota has one example of brightfield development on the waste footprint of a landfill in Hutchinson, where solar energy powers a wastewater treatment plant. Some other states, most notably Massachusetts, have successfully implemented solar on closed landfills. To date, Massachusetts has approved over 100 projects rated to generate over 220 MW.¹² These projects can offer specific benefits to communities, such as electricity cost savings, and be implemented with diverse native plant communities to benefit pollinators.

Initiatives at the state and federal levels are promoting and supporting renewable energy development on brownfields:

- **U.S. Environmental Protection Agency’s RE-Powering America’s Lands** encourages renewable energy development on current and formerly contaminated lands, landfills, and mine sites when such development is aligned with the community’s vision for the site. The program tracks projects and their community benefits.¹³ Goals of the program are to:
 - Provide technical and programmatic assistance
 - Promote policies and best practices that encourage renewable energy on brownfields
 - Partner with stakeholders and leverage agency efforts
- **Minnesota Brightfields Initiative** focuses on creating an environmentally, fiscally, and socially responsible development pathway for solar on Minnesota’s closed landfills. The statewide partnership was formed in late 2017 to offer cost-free professional, technical, financial, and regulatory expertise and analysis to support local governments across Minnesota. The desired outcomes of the initiative are to:
 - Bring redevelopment potential to land that is otherwise undevelopable
 - Bring value-adding economic redevelopment to the local governments (townships, cities, counties) and their communities, which stand to benefit from such developments
 - Make Minnesota a national leader in solar on landfills, showcasing how projects can save money, create jobs, and decrease negative environmental impacts from landfills
 - Bring these savings and benefits to all of Minnesota
 - Guide national and state policies and incentives to support renewable energy redevelopment projects on landfills, brownfields, Superfund sites, other contaminated lands

¹¹ U.S. Environmental Protection Agency. [Overview of the EPA’s Brownfields Program](#). Accessed October 28, 2020.

¹² State of Massachusetts. [Siting Clean Energy on Closed Landfills](#). Accessed October 28, 2020.

¹³ U.S. Environmental Protection Agency. [RE-Powering America’s Lands Benefits Matrix](#). December 2019.

As the Minnesota Brightfields Initiative worked with local governments to explore solar development, they encountered a barrier unique to Minnesota: solar development could not proceed on some sites due to use restrictions imposed on the property by past use of bond financing. While these sites were owned by local governments, they are managed by the state through the Minnesota Pollution Control Agency's Closed Landfill Program. The Closed Landfill Program has frequently used general obligation bonds to finance closure and remediation activities at landfill sites. Revenue generation of a solar project would threaten the tax-exempt status of the State's general obligation bonds.

Closed Landfill Program

The 1994 Landfill Cleanup Act created Minnesota's Closed Landfill Program (CLP) to properly close, monitor, and maintain Minnesota's closed municipal sanitary landfills. The creation of the program acknowledged that the adverse environmental effects at mixed municipal solid waste landfills resulted not just from industrial waste, but also from household garbage. Therefore, cleanup of these landfills, which served a public need, is a public responsibility. The CLP is unique in that it is the first such program in the nation that provides an alternative to the U.S. Environmental Protection Agency's Superfund program (Comprehensive Environmental Response, Compensation and Liability Act of 1980) for cleaning up and maintaining closed landfills.

The CLP gives the Minnesota Pollution Control Agency (MPCA) the responsibility to care for up to 114 closed, state-permitted, mixed municipal solid waste landfills to mitigate risks to the public and the environment. The CLP manages these sites by:

- Monitoring environmental impacts and site conditions associated with each landfill
- Determining the risk each landfill poses to public health, safety and the environment
- Implementing environmental response actions to help reduce site risks
- Maintaining the landfill properties and the landfill covers and operating any engineered remedial systems that are necessary
- Managing land issues on the property the CLP is responsible for, including working with local governments to incorporate land-use controls at and near the landfills.

Closed landfills in the CLP are a subset of closed landfills in Minnesota. Currently, 110 landfills are the responsibility of the CLP, with four more eligible for the program. Of the 110, 45 are state-owned, 53 are owned by municipalities, and 12 are in private ownership.

Funding for the CLP comes from the Remediation Fund, the Closed Landfill Investment Fund, and state general obligation bonds (GOB). GOBs are used to fund capital improvements, including the construction of new landfill covers and engineered remediation systems to address groundwater contamination and landfill gas generation, and sometimes to acquire "buffer" land to separate the waste footprint from the surrounding privately owned lands. GOBs have been spent at about half of the program landfills.

The CLP is required to develop Land Use Plans for each program landfill. These plans determine appropriate land uses where cleanup activities are occurring and provide information about properties that are affected by groundwater contamination and methane gas migration. The CLP partners with local governments to adopt zoning amendments or other land-use controls to incorporate land uses compatible with the risks at each landfill.

The CLP can enter into leases for appropriate property reuse, like solar, at the landfills that are state owned. At landfills that are owned by municipalities or are privately owned, the CLP can review proposed plans for reuse, taking into account prior use of general obligation bonds, where appropriate. However, proactively developing a beneficial reuse program is not authorized or funded in the existing CLP mission.

Use of bond financing

A frequent theme in this study has been the barrier to solar development imposed by the prior use of state general obligation bonds for remediating closed landfills. When the Legislature first appropriated bonds to the CLP program in 1994, no one could foresee the potential these sites might provide for future solar energy generation. Nonetheless, federal tax law, the state constitution, and state statute impose various restrictions on the use of these sites for nongovernmental purposes; these restrictions must be resolved before large-scale solar developments can advance on bond restricted sites.

The state constitution and state statutes require bond funded projects to be publicly owned and used for the governmental program identified by the Legislature. In the case of prior use of bonds for the CLP, this means MPCA must have a qualifying ownership interest (fee ownership or a qualifying long-term lease or easement) in the CLP sites and the sites must be operated in compliance with the CLP statutory program. These restrictions apply for a time period equal to 125% of the useful life of the improved project, which for CLP sites has been deemed to be 37.5 years. The restrictions attach to parcels when bonds are first spent on the property and remain in place for 37.5 years from the last date when GOB funds were used.

While MPCA does have authority to enter into leases when a proposal for a property reuse is made it does not have explicit statutory authority to proactively engage in property reuse as part of authorized CLP activities. Even if state law authority amended the CLP statutes to include beneficial reuse of the sites, including solar development, federal tax law prevents the use of bond restricted sites for private use. Private use can include site leases that grant a private solar developer rights to access and use the CLP site for their own purposes. Private use can also include the generation of electricity that is excess to the needs of the power-producing site and that flows into the grid thus benefitting the utility service provider. This second scenario can include arrangements like net metering, interconnection agreements, and power purchase agreements. The consequence of approving private use on bond financed property is that the bonds issued for the closed landfill program may lose their tax-exempt status thus subjecting the state to financial penalties.

On bond restricted CLP sites, one avenue to pursue is the installation of publicly owned smaller scale solar installations on CLP sites. Additionally, there are alternative financing mechanisms to consider for CLP sites that are not yet bond restricted.

Solar ownership models on CLP sites

There are many possible models for solar ownership, operations, and financing. Below are a few examples that may apply to CLP sites. More study is needed to enumerate possible models and fully explore the benefits and risks of each model.

Land lease

In this scenario, the agency or site owner would negotiate a land lease with the developer who would own the solar asset. The value of the lease is dependent on several factors, including distance to interconnection points, ease of access, and cost for site prep. In many, if not most, of this type of agreement a power purchase agreement (PPA) is also included. This PPA may be separate from the lease payment or the lease payment may be factored into the PPA price.

A land lease scenario reduces much of the risk and responsibility for the agency and places it with the developer or owner of the solar project. The design, finance, construction, and maintenance become the responsibility of the developer. In return, the developer maintains much of the project revenue and tax advantages. Land lease develop model could be an option for sites that are free from general obligation bond restrictions.

Power purchase agreement (PPA)

A PPA is a contract between the landfill owner and the developer or project owner where the agency purchases all the electricity produced by the array at a predetermined price. This price may have periodic steps or escalators throughout the term of the contract which is typically 25-30 years. This model provides a predictable price for the electricity for the agency.

This model allows for an owner with limited capital resources to reap the benefits of solar without a capital investment, and it also allows for a third party to take advantage of the tax benefits of solar development further reducing the PPA price.

It is important to note that the availability of utility incentives such as Solar Rewards in Xcel Energy territory would also help to lower the PPA price, though many CLP sites are served by utilities lacking such incentives. Incorporating a utility incentive reduces the cost of the solar but forfeits the Solar Renewable Energy Credits to the utility for a period of ten years, thus impacting which entity gets credit for GHG reductions during this time period. Taking advantage of the incentives allows for an agency with a limited budget to participate in solar and lower their energy bills but pushes out the timetable for meeting their GHG reduction goals for that 10-year period.

Public ownership

In this model, the State or local government landfill owner would pay the full market-value cost of purchasing, installing, maintaining, and operating a solar photovoltaic system without the benefit of utilizing tax incentives. The owner may then do one of two things:

1. Sell the power generated tax-free to the local electric utility.
2. Sell the power generated tax-free via a public-to-public transaction with another publicly-owned entity.

Community Solar Gardens

Community Solar Gardens are subscription-based, centrally located solar installations. Community solar subscribers participate in a solar energy system along with other subscribers. Each subscriber's share of the electricity generated by the project is credited on their utility bill. Most community solar projects in Minnesota are owned and operated by electric cooperative utilities, which offer subscriptions to their customers. The largest community solar program (Solar*Rewards Community) is administered by Xcel Energy and regulated by the state, but private solar developers—not the utility—own the projects and sell the subscriptions. The State or local governments could lease land for Community Solar Garden projects.

Reflections on the technical assessment

The technical assessment prepared by Barr (Attachment I) offered valuable insights into the solar capacity represented at CLP sites, the key barriers, and recommended steps to facilitate solar development at CLP sites. The following are the interagency team's reflections on Barr's findings:

- **Solar potential**
 - CLP sites represent a **significant opportunity for solar development**, both on landfill waste footprints (caps) and in buffer areas.
 - **Half of the CLP sites do not have bond restrictions**, and even on some landfill sites where bonds were used, there are non-bond encumbered parcels. Facilitating solar development on non-GOB restricted property may be a way to move forward with solar development quickly. Because the technical assessment considered each landfill site as a whole, more information is needed to understand the opportunity for solar development on non-bond encumbered acres at sites where bonds were used.
- **Barriers**
 - The study helped clarify that there are relatively **few technological barriers to siting solar on closed landfills**. Solar development can be done safely and in a way that protects the integrity of the landfill.
 - The **study helped clarify ways the state can and cannot remove existing GOB restrictions**, and illuminated steps to take in future projects to limit use restrictions on CLP sites.
 - Many of the **highest-ranking sites have GOB-restricted property** and are located near electricity demand.
 - **Many barriers to solar identified in the technical assessment are not unique to solar on closed landfills** and relate to solar in general. These include upgrades to the grid, funding of small projects, and in some cases, a higher cost of energy relative to other energy sources.
- **Recommended steps**
 - Many of the recommended steps would **require expanded statutory authority and funding for the CLP** to focus on property reuse.
 - While **solar development may proceed on non-bond restricted CLP sites**, the process may be constrained by the CLP's existing staff capacity.
 - The **MPCA can develop publicly owned and operated small-scale solar to serve electricity needs** on-site, even on bond restricted sites. It may be possible that the MPCA could size a solar project to offset electricity use from multiple MPCA CLP sites within a utility service area, however more study is needed to determine what the exact barriers might be.
 - **More study is needed to explore incentives and policies** that would facilitate solar development. Understanding the specific revenues and costs of solar development at closed landfills, as well as market conditions, would help the state determine whether incentives are necessary, and how they would be best applied in Minnesota's context.
 - **More study is needed to explore various solar ownership models**, the costs and benefits of each, and which would be appropriate for Minnesota.

- **Minnesota has access to technical assistance and resources** from the federal level (e.g., U.S. Environmental Protection Agency, National Renewable Energy Laboratory) as well as from other states that have implemented solar on closed landfills. These programs can offer valuable information and reassurances to funders, developers, landowners, and others about this type of development.

DRAFT

Recommendations

The interagency team followed up on the recommended steps suggested in the technical assessment to assess resource needs and present additional information to guide action. We also identified areas that need further study to ensure that solar development is aligned with state and local government sustainability and equity goals. The team incorporated the recommended steps from Barr into the following three recommendations to facilitate solar development on closed landfills.

1. Expand CLP statutory authority and fund Beneficial Reuse Program

Expand statutory authority of the CLP to authorize and fund proactive work on property reuse, including solar development, and provide funding to establish a Closed Landfill Beneficial Reuse Program. The current scope of the CLP as outlined in the 1994 Landfill Cleanup Act includes environmental response actions at qualified facilities. While the CLP is able to enter into leases when there is an expressed interest in leasing state property, provided the proposed land use is appropriate, the CLP is not authorized or funded to proactively facilitate property reuse. Lack of direct authority and resources have constrained landfill property reuse. Expanding the scope of the CLP outlined in the Landfill Cleanup Act to specifically authorize and fund work focused on beneficial property reuse would facilitate beneficial reuse, including solar development.

The creation of a Closed Landfill Beneficial Reuse Program would actively enable and facilitate all appropriate beneficial closed landfill reuses. A closed landfill is a unique type of brownfield that has fewer options for beneficial reuse than many other types of brownfields, in part because constructing buildings on or near landfills is problematic. Renewable energy development, such as solar, can be a compatible reuse for closed landfills because public access is often restricted, solar panels can be installed without penetrating the cap, and landfill maintenance activities can be accommodated. Additionally, there may be compatibility of different reuses, for example, pollinator habitat can be paired with solar development.

This recommendation would incorporate three of the recommended steps included in the technical assessment, including:

- **Develop a technical guide to solar development on CLP sites.** A technical guide could provide general information about the unique design aspects of closed landfills and more detailed information about the CLP program responsibilities associated with the landfills and process for developing solar on a closed landfill site.
- **Provide detailed technical and regulatory information for CLP sites.** Detailed technical and regulatory information may include specific design elements of the sites, permit conditions, information on cap construction and maintenance status, surrounding land use and natural features and other site-specific information deemed useful. The MPCA or Department of Commerce could also consider completing techno-economic analysis for each of the top sites using the free System Advisor Model¹⁴ from the National Renewable Energy Laboratory.
- **Reach out to stakeholders.** One common barrier to development of solar energy on CLP sites is lack of awareness of these sites and the solar development potential they represent among non-developers. The Department of Commerce and MPCA could prepare informational materials for the top 10 sites and invite key stakeholders to open discussions about the sites and solar

¹⁴ National Renewable Energy Laboratory. [System Advisor Model](#), accessed November 6, 2020.

development potential. These meetings would provide an opportunity to gauge interest, collect site specific feedback and identify local barriers/concerns and opportunities.

Developing a Closed Landfill Beneficial Reuse Program

Continued interagency collaboration would be necessary to develop a Closed Landfill Beneficial Reuse Program aligned to the state's economic, equity, environmental justice, and environmental goals. Development of a Closed Landfill Beneficial Reuse Program would require further investigation into several topics, including solar ownership models, incentives, lease revenue uses, Solar Renewable Energy Certificate ownership, and interconnection costs. In the process of answering some questions in this study, the team encountered many more. The interagency team began documenting topics requiring further study. The following is not an exhaustive list of these topics:

Continued research relating to bonds

- **Use of lease revenue.** If CLP land is leased to a developer according to Minnesota Statute 115B.17, all CLP lease revenue must be deposited in the Remediation Fund. Adjustments to that statute could allow for lease revenue to be used in other ways. For example, the interagency team could explore whether it would be feasible to use lease revenue to finance other renewable projects or pay off GOB obligations at other sites.
- **Publicly owned and operated solar on bond-restricted property.** One possible path forward where the bonded status of a CLP site would not present a barrier is for the MPCA to acquire, install, own and operate solar equipment sized to meet the energy needs of the landfill it is situated on and directly connected to the energy-using elements on the landfill. It may also be possible for MPCA to install solar equipment on a CLP site that produces energy in excess of that site's needs if MPCA remains a net purchaser of energy from the utility company within its territory. This scenario needs further vetting under state statutes and consultation with the State's bond counsel. If allowable, the maximum amount of solar energy produced by MPCA-owned equipment would be limited to the amount of energy consumed by MPCA within a utility service territory.
- **Non-bond restricted property at sites where bonds were used.** On many CLP sites where bond financing was used there are property parcels that did not have bond financed construction activities and have no bond restrictions. Understanding more about these lands and their suitability for solar development could help the MPCA and other landfill owners understand the solar potential.
- **Future financing of capital projects at CLP sites.** There are many CLP sites that are not bond restricted. To the extent any of these sites will require future remediation work under the closed landfill program *and* appear to be ideal locations for solar development, there are several options that should be considered before undertaking cleanup work. First, if the land area most suitable for solar development is not located on the area of the landfill to be improved, MPCA could still seek general obligation bonds to pay for the work but first subdivide the real estate in advance of using any bonds. If the exact boundary of the landfill improvements cannot be determined until the work is completed, thus making an initial parcel split infeasible, MPCA and MMB can develop a means for documenting an intent to subdivide once construction is complete. This would leave the areas suitable for solar separate and distinct from the bond restricted parcels. Second, MPCA could seek alternative sources of financing for future improvements that would not result in bond restrictions. These options can include cash or taxable state appropriation bonds, which are a slightly more expensive form of debt for the state.

Determining best practices in program design

- **Solar ownership models.** More research is needed to enumerate the possible models for solar development, considering land ownership, solar system ownership, Renewable Energy Credit (REC) ownership, and financing arrangements. Research is needed to understand the risks and benefits of each, and how these can be structured to align with Minnesota’s economic, environmental, and equity goals.
- **Environmental and social considerations.** The MPCA could consider incorporating aspects that contribute to the environment and communities, particularly environmental justice communities and climate-vulnerable populations. For example:
 - **Equity and environmental justice considerations.** Program design must take into account who benefits from solar development at CLP sites and who bears the costs and risks. Use of an equity policy review tool could help the MPCA and partner agencies develop a program that considers equity and environmental justice in its processes and results and incorporates ways to address environmental, social, and public health needs.
 - **Pollinator habitat and solar development.** Executive Order 19-28 aimed at restoring pollinator health in Minnesota directs the MPCA to “manage closed landfills under its supervision to create, protect, and enhance pollinator habitat.” Pollinator habitat is commonly implemented in conjunction with solar projects in Minnesota. The Board of Soil and Water Resources (BWSR) has a Habitat Friendly Solar program that offers guidance and encourages those implementing solar to meet program standards. Pollinator habitat has been implemented in brightfield projects in other states, including Massachusetts. The MPCA could seek guidance from BWSR and other states on specifications and implementation. More study is needed to understand how pollinator habitat could lower or increase costs associated with a solar project.

Understanding economics of solar development on landfills

- **Preliminary interconnection study for top sites.** The interconnection to a local transmission/distribution system is a large cost component to solar development and uncertainty around what would be required on a site-by-site basis makes it difficult to determine the viability of solar development.
- **Hard-to-develop sites and policies and incentives that would make these developable.** State policy and incentive programs have proven very valuable in Minnesota, in other states, and at the federal level in encouraging renewable energy development. Some landfill sites may require additional incentives and policies to facilitate development. Many ideas were raised during the study, however, these need to be vetted. For example:
 - **Virtual net metering.** Virtual net metering or a similar policy for grid-tied projects could assist in overcoming financial barriers related to developing solar on landfills. Virtual net metering is a mechanism allowing energy customers to credit kilowatt-hours from one meter to another. Many CLP sites are large enough to support solar systems that can produce many megawatts of electricity. Most of those sites, however, do not have need for the power onsite. These sites will be connected to the grid and can provide power to nearby communities or to other grid connected users.
 - **Brownfield adder.** In Minnesota, there is one policy that most closely approximates net metering, the Community Solar Gardens program (CSG). These projects, however, are limited to one MW, and at this threshold are not cost effective for a developer. Projects with one MW cap would not make use of many potential acres of available land. A solution could be to include a “brownfield adder” to the CSG rules allowing for development of projects greater than one MW.

- **Public Use Community Solar Gardens.** Add language to the Community Solar Garden statute ([MN Stat. § 216b.1641](#)) to create a new subsection for Public Use CSGs with parameter exceptions for size, number of subscribers, colocation, and ownership structure amenable to public entities exclusively hosting and subscribing to CSG's closed landfill sites. Public entities would include school districts, municipalities, libraries, park agencies, state agencies, sports arenas, water treatment facilities, etc.
- **CLP solar development incentives.** The state could earmark incentives for solar development on CLP sites. If Minnesota determines that brownfield projects are a public good and worth encouraging, the Legislature could set up incentives to offset the additional costs associated with solar development on CLP sites and other brownfield sites. A rule of thumb for developing solar on brownfields to cover the cost of ballasted systems and permitting is approximately 15 percent more than a greenfield site. A state incentive that bridged that additional cost could assist in making solar development at brownfield sites feasible for solar developers.

2. Retire bond debt and release state bond restrictions

Appropriate funds to retire bond debt early and legislatively authorize the release of state bonding restrictions for select CLP sites. Freeing property from bond restrictions would open up lands for solar development and could generate significant revenues into the future.

Under existing law, the only ways to release the bonding restrictions are either the running of time (37.5 years) or sale at fair market value. However, it may be possible for the Legislature to release bonding restrictions by appropriating funds to MMB for the purpose of retiring outstanding bonds and legislatively releasing the property from the bonding restrictions.

If the Legislature appropriated funds, retiring outstanding debt for a CLP site would require MMB to first calculate the amount of outstanding bonds for that site. This is complicated by the following factors: 1) when MMB sells bonds it is not for specifically identified projects, but rather for the group of projects included in any bonding bill as a whole; 2) adequate accounting records going back 20 or more years may not always exist; and 3) many bond appropriations for CLP sites were made to the program as a whole, and not specific projects, which might complicate the tracing of particular bonds to specific projects.

For the top five bond restricted sites identified in the Barr report, MMB attempted to calculate the amount of debt still outstanding. MPCA originally expended a total of \$19.7 million of bond proceeds for those sites. Expenditures covered the years 1999 through 2016 and involved approximately 18 separate bond sales. MMB estimates that \$7.5 million of principal debt remains outstanding. If the Legislature desired to appropriate funds to retire the outstanding debt in order to remove any bonding restrictions, MMB would need an amount sufficient to pay principal for the portion of debt that can be retired early, to pay principal and interest on the portion of debt that cannot be retired early but could be legally defeased (terminated when funds sufficient to service the debt are set aside), and to pay costs associated with the debt retirement. A precise figure is not available for purposes of this report, but MMB would provide the Legislature with an accurate figure in the event a legislative proposal is introduced.

Any legislation would also need to create a mechanism for expressly releasing the CLP sites from the state's bonding restrictions. As mentioned above, those restrictions extend for a time period equal to 125% of the useful life of the project and are not tied to the status of any bonds. The appropriate mechanism should be investigated in consultation with the state's bond counsel and is an area requiring further inquiry.

Conclusion

Prior to this study, we knew little about the opportunity for solar development on Minnesota's Closed Landfill Program sites. The technical assessment of the sites provides a conservative estimate of land suitable for solar that could support nearly one gigawatt of power (950 MW).

Bond restrictions at half of these sites represent a significant barrier to development, which would need to be resolved to achieve the high aims outlined in this report. Nonetheless, these sites represent a significant economic opportunity distributed across the state that could increase access to clean energy, bring underutilized land back onto the tax rolls, and spur job growth.

Facilitating large-scale solar developments across closed landfills will require expanded statutory authority and funding for the CLP to specifically allow and fund proactive property reuse. Creation of a Closed Landfill Beneficial Reuse Program will require continued interagency collaboration and research to ensure that solar development is aligned with the State's environmental, equity, and economic goals. Minnesota has been a leader in both renewable energy development and responsible management of brownfields. With statutory changes and investment in staffing and bond retirement, Minnesota could accelerate brownfield development – simultaneously improving brownfields and growing clean energy.

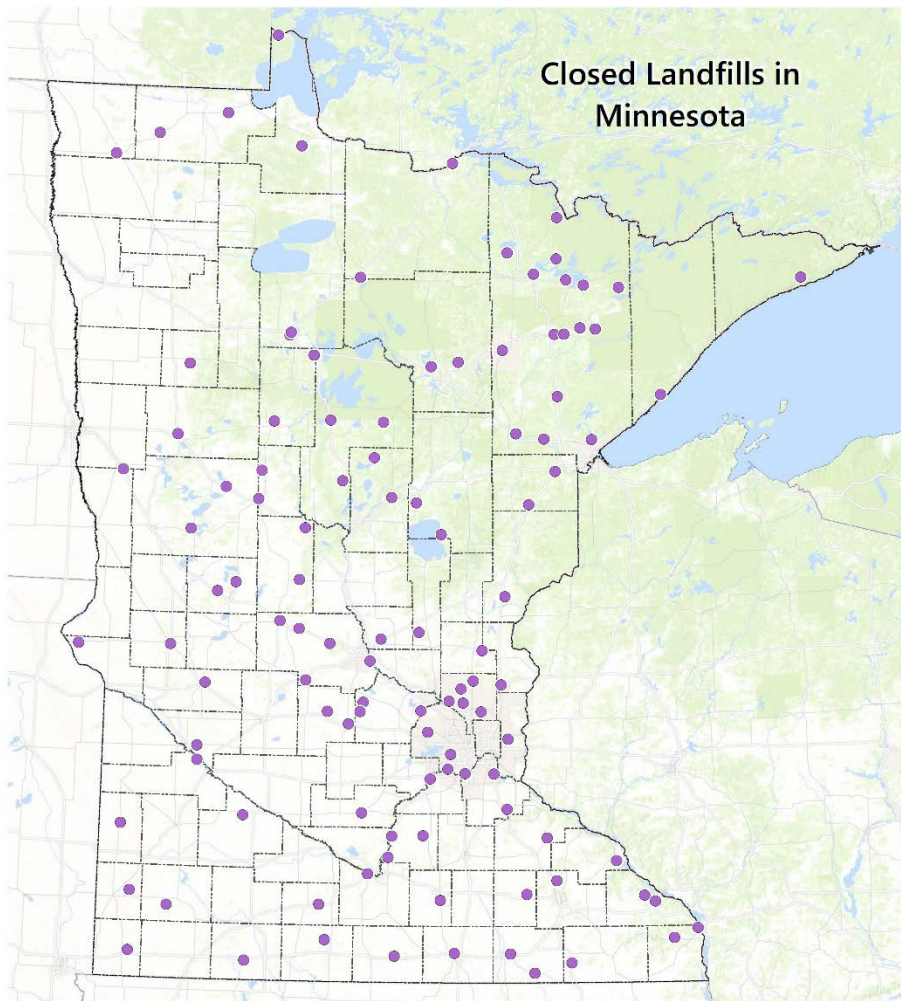
Attachment I. Technical assessment ***Solar Panels on Closed Landfills Study***

Solar Panels on Closed Landfills Study

Prepared for
Minnesota Environmental Quality Board

Prepared by
Barr Engineering Co

October 2020



Solar Panels on Closed Landfills Study
October 2020

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Abbreviations

Atlas	Minnesota Groundwater Contamination Atlas
Barr	Barr Engineering Co.
CLP	Closed Landfill Program
co-ops	cooperatives
CSG	community solar garden
EQB	Minnesota Environmental Quality Board
GIS	geographical information system
GOB	general obligation bond
LMA	land management areas
MMB	Minnesota Department of Management and Budget
MPCA	Minnesota Pollution Control Agency
MW	megawatt(s)
PV	photovoltaic
REC(s)	Renewable Energy Credits or Renewable Energy Certificate(s)

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- Academia
- Contractor/construction companies
- Energy development companies
- Legal
- Midcontinent Independent System Operator (MISO)
- Minnesota Solar Energy Industries Association (MnSEIA)
- Municipalities
- Nonprofit organizations
- Utilities

Executive Summary

The Environmental Quality Board (EQB) received Minnesota Legislature funding in 2019 to conduct a study on the potential to deploy solar photovoltaic (PV) systems on the Minnesota Pollution Control Agency's (MPCA) Closed Landfill Program (CLP) sites. There are currently 110 sites in the CLP; however, there is insufficient information about the sites and their viability for PV development. In this study, Barr Engineering Co. (Barr) and a team of Minnesota state agency representatives (agency team) examine the important criteria relative to PV development on CLP sites, rank the sites for PV development based on key criteria, identify barriers to PV development and make recommendations to address those barriers.

Criteria

Barr and the agency team assembled stakeholders in a wide-ranging engagement/outreach effort to identify a comprehensive list of criteria and determine their relative importance.

The comprehensive list of criteria includes the following:

- General obligation bond (GOB) status
- Interested power purchaser
- Cost associated with connection to transmission and distribution grid
- Finance / investor interest and availability
- Site generation capacity
- Transmission / distribution / substation grid capacity
- Increased construction costs / constructability
- Local acceptance and interest
- Geotechnical characteristics of the cap
- CLP program authorized actions
- Availability of incentives
- Ownership
- Equity considerations
- Local land use and zoning

In discussions with stakeholders, the comprehensive list of criteria was refined to the following list of key criteria which are central to solar development on CLP sites:

- GOB status
- Cost associated with connection to the transmission and distribution infrastructure
- Site generation capacity
- Increased construction costs/constructability
- Availability of incentives

These key criteria were carried forward in our analysis of the sites and identification of barriers and recommended actions.

Geospatial Analysis and Ranking

The geospatial analysis was limited by the availability of geospatial data relative to the key criteria. In light of these limitations, we used the following criteria in our scoring and ranking model:

- Landfill cap generation potential in megawatts (MW)
- Buffer generation potential in MW
- Total site solar generation potential in MW
- Distance to the nearest substation (miles)

We ranked all 110 CLP sites and identified the top five sites where GOBs were used and the top five sites where GOBs were not used. They are:

- Flying Cloud Landfill – GOB restricted
- Western Lake Superior Sanitary District Landfill – GOB restricted
- Anoka-Ramsey Landfill – GOB restricted
- Redwood County Landfill – GOB restricted
- Winona County Landfill – GOB restricted
- Olmsted County Landfill
- Freeway Landfill
- Hibbing Landfill
- Kummer Landfill
- Maple Landfill

Geospatial analysis and scoring/ranking results are provided in the study for all 110 CLP sites.

Barriers and Recommendations

Stakeholders identified many potential barriers. The following three key barriers are common to all sites and were the focus of discussion with the agency team and external stakeholders:

- Uncertainty about costs to connect to nearby transmission or distribution systems
- Uncertainty related to site suitability and CLP program responsibilities
- Increased construction costs associated with the unique features of closed landfill caps

The use of GOBs to improve 55 of the CLP sites represents a unique barrier to solar development on those sites. According to the Minnesota Department of Management and Budget (MMB), federal tax law imposes certain restrictions on the parcels where funds from a GOB were spent, and restrict private benefits deriving from use of the parcels.

Barr worked with the agency team to develop the following recommendations to address the three key barriers and the GOB restrictions:

- Develop a technical guide to solar development on CLP sites
- Provide detailed technical and regulatory information for each of the top 10 sites
- Initiate a preliminary interconnection study for each of the top 10 sites
- Reach out to stakeholders with information about CLP solar development potential
- Pursue state-wide policy and incentive programs to encourage solar development on CLP sites
- Retire GOB obligations early (prior to their natural expiration)

Conclusions

Based on the results of this study Barr has developed the following conclusions:

- There is significant capacity for solar development on Minnesota's CLP sites. Generating capacity, on a site-by-site basis, is approximate; however, we have estimated 950 MW of solar potential on approximately 4,500 acres of CLP land.
- The top ten sites, five bond-restricted and five non bond-restricted sites, do not represent the only favorable CLP sites for solar development. The scope of this study required us to rank the sites in the CLP and identify the top five bond-restricted and top five non bond-restricted sites. In fact, there is no significant difference between the tenth and eleventh sites (and so on) in the ranking. Many sites have favorable characteristics and will be attractive to solar development.
- Solar power and energy storage are a valuable combination. The scope of the study required our focus on solar development. More than one stakeholder suggested we consider other distributed energy resources such as energy storage.
- There are barriers but they are not insurmountable. The most significant barrier is GOB restrictions; however, this only impacts half of the sites and it is possible solar development could proceed on non-GOB restricted land at sites where there is some GOB restricted land. There is some uncertainty with respect to site suitability and state CLP responsibilities, construction costs associated with some unique features of CLP sites, and capacity of transmission/distribution infrastructure. There are many examples of solar energy successfully installed on landfill sites in Minnesota and in other states. Acting on the recommendations in this study report will help to address these barriers and enable development of solar energy on Minnesota CLP sites.

1 Introduction

Closed landfills are promising sites for solar PV systems. Solar on closed landfills could make use of already disturbed land, avoid greenfield development of prime farmland or other undisturbed or undeveloped land, provide a revenue stream from land that would otherwise have no use, and assist the state in meeting carbon reduction goals. The EQB received Minnesota Legislature funding in 2019 to conduct a study on the potential to deploy solar PV systems on the MPCA CLP sites. The MPCA-administered CLP is a program established by the Legislature in 1994 to properly construct, monitor, and maintain closed municipal sanitary landfills.

There are currently 110 sites in the CLP (Figure 1). However, there has been insufficient information regarding whether CLP sites are viable for solar development. The EQB issued a competitive request for proposal and selected Barr to facilitate a study to evaluate the viability of CLP sites for solar development, examine barriers to solar development, and recommend actions to address those barriers.

As an overview, the CLP program includes the following key features:

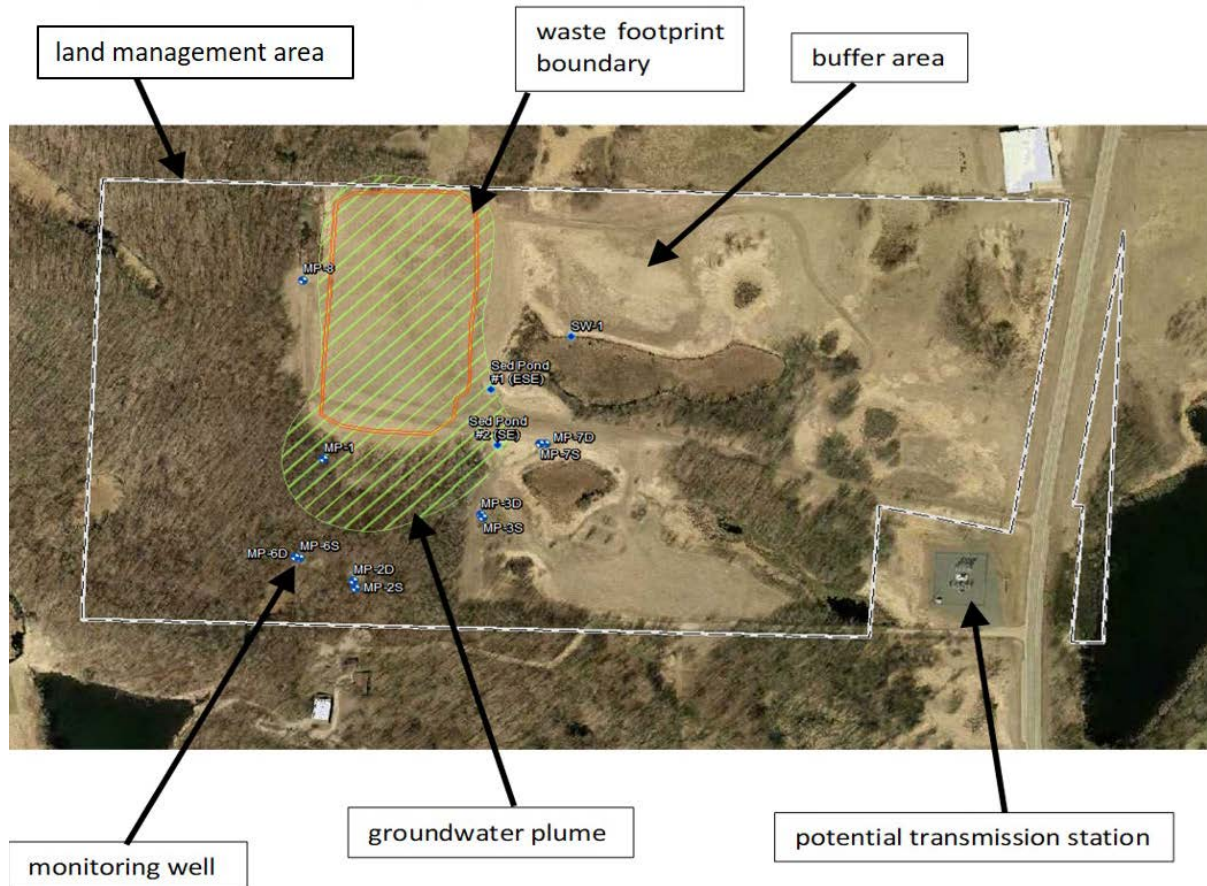
- The CLP currently manages over 8,500 acres of closed landfill property—about 75 percent of this acreage does not contain solid waste. Each site is defined by a land management area (LMA) which is land under control of the MPCA and includes permitted areas and adjacent waste management areas plus any lands acquired by the MPCA. At each CLP site, the capped waste footprint (“cap”) is surrounded by buffer areas, which vary in size from minimal to dozens of acres.
- The underlying ownership of the CLP sites is as follows: 45 state-owned sites, 54 local government-owned sites, and 11 privately-owned sites. Appendix A provides a list of sites and current ownership.
- Some of the landfills use electricity to manage environmental impacts of the closed landfill, for example 20 landfills have active gas extraction and 6 landfills have groundwater treatment systems.
- The CLP develops land-use plans for each landfill with which local government plans must be consistent. According to the MPCA, The CLP includes solar energy generation as a use in nearly all its land-use plans.
- In Minnesota, GOB funds were used to improve some of the sites. The use of these bond funds creates restrictions for certain uses including site leases to private solar developers, energy output contracts governing the sale of solar energy generated onsite, or other revenue generating activities. Fifty-five of the sites include these restrictions on some portion of the site.

Solar PV systems on closed landfills must be designed to consider the following unique characteristics of a closed landfill site:

- Solar PV systems on landfills outside of Minnesota are typically installed on the landfill caps; however, Minnesota landfills often include ample buffer land available for solar development around the cap.

- Topography is important. Large, flat areas are optimal. While it may be technically feasible in certain cases to develop mounting structures for steeply sloped areas (greater than 15%) usually the cost of engineering and custom mounting structures is too high to be economically feasible. CLP sites have significant area where topography on the cap and in the buffer is conducive to solar development.
- Construction activities and solar generating equipment used on the cap area must not impact the integrity of the landfill cap and the gas management systems if present. The load limit of the cap dictates the weight of the construction equipment that can be used to install solar generating systems. Typically, the cap cannot be penetrated, so solar panels attach to the surface using weighted ("ballasted") racking systems, and above-ground cabling systems to avoid burying wires.
- Heavy concrete pads and inverters (electrical equipment) are typically placed in the buffer area to avoid settlement issues on the cap.
- Solar development in a buffer area is conducted as a typical solar development without the unique conditions of the cap area.
- Like any solar energy development, a solar PV system on a closed landfill needs to be connected to an electrical "load" or user. A load can be a local user through a distribution system or the electrical grid through the regional transmission system. A load could also be an energy storage system.

The aerial photo below illustrates a typical closed landfill site and the basic features mentioned throughout this report.



At least one other state – Massachusetts – has successfully developed solar PV systems on hundreds of privately owned closed landfill properties (albeit without bond restrictions) over the last ten years. Massachusetts is a good example (reference (1)). Minnesota can learn from these successes.

There are many criteria to consider when determining if solar development is appropriate for a specific CLP site. To learn more about these criteria and their relative importance, Barr led a process of stakeholder engagement, gathering input from state agencies, utilities, solar developers, local government units, and non-profit organizations. We carefully considered the input and criteria and, using geospatial analysis techniques, created a ranking system to identify the top five GOB-restricted sites and the top five non-GOB restricted sites for solar development. With input from the state agencies participating in this study, barriers were identified and recommendations to address those barriers developed. The balance of this report organized as follows:

Section 2. Presents the criteria this study identified that affect the potential for solar development on closed landfill properties.

Section 3. Describes the geospatial analysis used to rank closed landfills for potential solar development.

Section 4. Describes barriers to solar development on closed landfills and actions to address those barriers.

Section 5. Presents recommendations for initiating solar development on the top ranked closed landfill properties.

Section 6. Provides conclusions.

Section 7. Contains a list of references cited.

2 Criteria That Affect the Potential for Solar Development on Closed Landfills

We identified criteria that affect the potential for solar development on closed landfills by reviewing literature and consulting with a wide range of stakeholders. Details of the criteria identification process are in Appendix B. The full list of criteria developed through the literature review and stakeholder consultation process is presented in Table 2-1. Stakeholder input was used to assess the relative importance of the criteria in regard to feasibility and they are listed from most to least important in Table 2-1.

In our discussions with stakeholders we identified key criteria which are central to development of solar on closed landfill sites. These criteria were carried forward in our geospatial analysis and ranking and are discussed further with respect to barriers and actions to address those barriers. They are:

- GOB status
- Cost associated with connection to the transmission and distribution infrastructure as represented by distance to transmission and distribution infrastructure
- Site generation capacity
- Increased construction costs/constructability
- Availability of incentives

Table 2-1 Criteria that Affect the Potential for Solar Development on Closed Landfills

Criteria	Description/Comments	Data Source
General obligation bond (GOB) status	The environmental controls at 55 CLP sites were improved by the MPCA using state-issued GOBs funds. Using GOBs places significant restrictions on the use of land where bond money was spent. All 55 of the sites where GOBs were originally used still include land subject to the State's bonding restrictions. The Minnesota Department of Management and Budget manages this debt. The GOBs can be retired by any one of two methods: 1) allowing the term (37.5 years) to expire, and 2) selling the property at fair market value. A third possibility requiring new legislation was also discussed: retiring the GOB debt early through legislative appropriation and action releasing the GOB restrictions. There are outstanding questions surrounding this criterion which are addressed more fully in Section 4.2.	MPCA
Interested power purchaser	Renewable energy projects, including solar, require an interested party who will agree to purchase or use the power generated. Power purchasers can include property owners/operators, governmental organizations, investor owned utilities, and municipal or other independent power cooperatives. Often price of energy is the primary driver for power purchasers. Price can be dependent on solar technology, financial incentives, time of use, price of alternative generation sources and other factors. The federal investment tax credit has been an effective driver for solar development in that it allows power to be sold and purchased at very competitive rates. Interest in carbon reduction and other societal goals can also motivate purchases of solar power.	none identified
Cost associated with connection to transmission and distribution (T/D) grid	In general terms, the transmission grid carries electricity from a generating station (power plant) to a substation. The distribution grid carries electricity from a substation to the user such as a home or commercial/industrial site. Interconnection of a PV generating system to T/D grid infrastructure can be costly. Costs include easements, engineering, studies (depending on size of the PV system) and construction. In some cases, substations must be upgraded or new ones constructed.	Minnesota Electric Transmission Mapping Project
Finance / investor interest / availability	An interested financial partner with experience weighing the various opportunities and risks associated with solar projects is important. Opportunities include stable return on investment, equipment depreciation, renewable energy credits (RECs) and federal investment tax credits. Risks specific to solar on closed landfills include insurance risk such as long-term stability of the site (cap) and loss due to premature removal of PV equipment. Premature removal of PV equipment could be caused by presence or discovery of some public health issue arising from the landfill and requiring removal of the cap or other excavation where PV equipment is installed. Additional information about solar project finance can be found in the following National Renewable Energy Laboratory publication https://www.nrel.gov/docs/fy16osti/66991.pdf	none identified
Site generation capacity	Generally, a solar development project benefits from scale. The larger the site the more generating capacity. The sites in the CLP range in size from over 400 acres to as little as five acres. In this study we looked at the cap and buffer areas in some detail to identify buildable area within each. Features that limit solar panel installation on the cap include steep slopes, stormwater management features, and gas and leachate collection systems. Features that limit solar panel installation in the buffer areas include open water, wetlands, floodplains, slopes, forest land, and human development (buildings and roads).	<ul style="list-style-type: none"> – National Land Cover Database – National Wetland Inventory – Land contour data provided in MnGEO LiDAR – MPCA
Transmission / distribution / substation grid capacity	The size in megawatts (MW) of a solar development may be limited by the capacity of the nearby T/D grid or substation. Grid systems and substations at or near capacity may not be able to accommodate a solar development at the scale at which the solar project is feasible. It is difficult to determine the capacity of the T/D grid or substation without specific input from the owner of that system.	Utilities, transmission/distribution system owners/operators.
Increased Construction Costs / Constructability	Construction techniques, construction equipment and solar generating equipment are all important factors when building a solar project on a landfill site. Construction techniques and equipment in the buffer area are typical relative to other ground mounted solar installations, however construction on the cap requires special equipment and construction techniques. To prevent damaging the cap, low ground pressure construction equipment is used and ballasted racking systems and above ground wiring systems are required, which increase construction costs.	none identified
Local Acceptance / interest	Nearby landowners, local government units, and local advocates or detractors can promote development or prevent development of solar on CLP sites. The budget and schedule for this study did not allow for an analysis of local acceptance or interest.	unknown
Geotechnical characteristics of cap	A landfill cap is an engineered cover constructed of soil and sometimes includes a plastic layer. The cap is designed to minimize or eliminate infiltration of rainwater and manage stormwater runoff rate and minimize erosion. When a cap is new, there is typically a period when some settling of the cap occurs. It is important to know if settling is complete and if these geotechnical characteristics have stabilized before constructing a solar project on the cap. There is no clear consensus as to the age when a cap is done settling and it can be site specific; however, it is an important consideration when choosing to construct solar on a landfill cap.	MPCA
CLP Program Authorized Actions	The MPCA's Closed Landfill Program is responsible for the long-term care of the program landfills in-perpetuity. These responsibilities include monitoring, addressing groundwater and vapor impacts, operating engineered gas and groundwater remediation systems, and site care and repairs. Solar development cannot interfere with the program's ability to take these environmental response actions nor jeopardize the integrity each site's response action equipment, including the landfill cover system. Facilitating reuse of closed landfill properties was not part of the scope of the CLP program outlined in statute.	MPCA
Ecological co-benefits	Depending on how the solar project is engineered and constructed, there can be water quality improvements and the creation and protection of habitat. There can also be carbon reduction benefits resulting from solar power generation if the solar power replaces or reduces the use of fossil-fuel generation sources.	<ul style="list-style-type: none"> – National Land Cover Database – National Wetland Inventory
Availability of incentives	Incentives can be a strong driver of solar development. Accelerated equipment depreciation, renewable energy credits, federal investment tax credits and net metering laws are some of the existing incentives which have facilitated a great deal of solar development in the United States. At this time there are no incentives focused on the development of solar on MN CLP sites.	Minnesota Public Utilities Commission has more information on net metering https://mn.gov/puc/energy/distributed-energy/net-metering/ .

Criteria	Description/Comments	Data Source
Ownership	Depending on the situation the ownership (state, local government, or private) of a site could impact the process for procuring a site or leasing a site for solar development.	MPCA
Equity considerations	The way solar energy is implemented can have potential to harm or benefit low income or underserved populations. Low income or underserved populations must be proactively engaged in the conversation for solar development on CLP sites to help address equity and social justice issues.	none identified
Local land use / zoning	Local counties, townships and cities may have land use/zoning requirements that are incompatible with solar development at the CLP site.	City/county land use authorities.

3 Geospatial Analysis and Scoring of Sites

Barr performed a geospatial analysis of the landfill sites in the CLP and ranked their potential for solar development. The following subsections describe the data sources and the ranking methodology and present the results.

3.1 Data Sources

To identify potential data sources, we reviewed the comprehensive list of criteria developed during our outreach to stakeholders in Task 1. With these criteria in mind we assembled publicly available sources of geographical information system (GIS) data sets and using ESRI's ArcGIS created a GIS tool to analyze the sites. The list of GIS data sets are as follows:

- LMA – MPCA. Received via email on February 6, 2020.
- Waste Footprints – MPCA. Received via email on February 6, 2020.
- Bond Restricted Parcels – MPCA. Received via email on March 20, 2020.
- National Wetland Inventory within the LMAs – Minnesota Department of Natural Resources (reference (2)).
- Elevation contours – derived from MnGEO LiDAR data (reference (3))
- Electric substations – Minnesota Electric Transmission Mapping Project (reference (4))
- Electric transmission lines – Minnesota Electric Transmission Mapping Project (reference (4))
- Land Cover – National Land Cover Database (reference (5))

3.2 Criteria

To facilitate ranking our focus centered on four important criteria where we could identify GIS data for each criterion or could complete straightforward calculations to create a data set that could be scored for each CLP site. Each criterion is described in detail below:

- Landfill cap generation potential in MW
- Buffer generation potential in MW
- Total site solar generation potential in MW
- Distance to the nearest substation (miles)

Landfill cap generation potential represents the solar capacity of the portion of the site where waste is managed and covered with an engineered cap. This is an important criterion because solar construction on landfill caps presents some unique challenges when compared to greenfield solar development. The landfill cap is designed to prevent water from percolating through waste material and creating contamination issues in local ground water. For this reason, penetrations are not allowed, and solar developers will use ballasted racking systems and equipment with lower ground pressure ratings when constructing solar on landfill caps. To refine the available construction acreage on each cap we used our GIS system to identify slopes greater than 15% and we subtracted these steeply sloped areas from total cap acreages reported by our GIS system. Thus, we created a “buildable area” in acres for each landfill cap. To calculate the generating potential for each landfill cap we divided each buildable area in acres by a

capacity factor (4.81 acres per MW) to calculate the generating potential in MW. Our capacity factor is calculated based on typical equipment specifications and a ground coverage ratio of 30%. Capacity factor will vary depending on equipment, arrangement of panels and barriers/obstructions to equipment. The resulting number represents the nameplate capacity which is the maximum or rated capacity for typical installed equipment.

Buffer generation potential represents the solar capacity of the non-cap areas within the LMA. While the "buffer," as it is commonly called, does not present the same unique construction challenges as the cap area, we found a wide variety of natural and human-made features which can reduce the buildable area within the buffer. Using our GIS tool, we identified data sets for wetlands, open water, scientific and natural areas, forest (conifer, deciduous and mixed), and developed areas (low, medium, and high density). We identified the acreage for each of these natural and human-made features for each site, subtracted those acres from the total buffer acreage and calculated the buildable acres for each buffer. To calculate the generating potential for each buffer we divided each buildable area in acres by a standard capacity factor to calculate the generating potential in MW. The standard capacity factor for solar development is 4.81 acres per MW. The resulting number represents the nameplate capacity for the landfill buffer.

Site solar generation potential represents the combined solar capacity of the buffer and the cap to calculate the total nameplate capacity of the landfill site. This is an important criterion because it gives a more complete picture of the generating potential of a site. It is important to identify both the cap and buffer capacity because each has solar potential, and each may be preferred for solar development for different reasons. We received feedback from developers suggesting the cap area has been more likely to be developed in other states where solar had been developed on landfill sites. This may be related to a lack of buffer land or the way in which solar development incentives were crafted. Advantages of solar development on the cap include large, relatively flat surfaces with little or no large vegetation to remove or wetlands/open water to work around or requiring a permit. Disadvantages include operational features which need to be avoided: gas extraction wells, passive gas vents, stormwater management features and leachate cleanout access. Another disadvantage is increased construction costs associated with the use of ballasted racking systems in order to avoid penetrating the cap. The advantages to the buffer include good quantity of available land and the ability to use lower cost conventional construction equipment and techniques. Disadvantages associated with the buffer include natural landscape that will have to be affected (wetlands, forests, and other vegetation), the existing grade may not be conducive to solar development and human development within the LMA (buildings, roads, and residents). In any case, calculating the site solar generation potential provides a sense of the scale of the development opportunity of these sites. Specific challenges with cap and/or buffer development at any site may be overcome with greater scale.

Distance to the nearest electrical substation is an important criterion because of the significant cost of connecting solar generation to the existing transmission or distribution grid. We chose distance to a substation because a substation represents a logical place to connect to an existing transmission or distribution network. We identified existing, publicly available data regarding the location of existing electrical substations and used our GIS system to measure the distance in miles from the closed landfill sites to the nearest substation.

3.3 Limitations and Exceptions

It is important to acknowledge the limitations of our data and subsequently our analysis of the characteristics of these sites relative to the criteria described above:

- Our scope and budget did not include the design/layout work necessary to provide more accurate generation capacities. For example, we did not plot or estimate small reductions in acreages related to leachate or gas collection systems. Our generation capacities are estimates based on the GIS data available at the time of this study.
- The buildable acreages calculated for the buffer may underestimate the buildable area. The various data sets may double count some acres for exclusion that appear similar depending on the method of data acquisition and sensing/analysis technique. We attempted to eliminate double counting (e.g., wetlands and open water) where we could. Generally, we believe our buffer generation capacity values to be conservative.
- Data on substation type was not considered for this study, only distance to a substation. Because a substation is close doesn't necessarily mean it is available for connection. Transformer capacity is a key variable as is the capacity of the lines attached to the substation. The accuracy and availability of public information about substation capacity is questionable. This type of information would need to be obtained from the owner and was beyond the scope of this study.

In our review of available GIS data sets we discovered there is much readily available GIS data describing land use and features for Minnesota. However, we discovered some issues which limited their usefulness in ranking all CLP sites.

- For many of the criteria there were no readily available GIS data to support ranking for each landfill site. The following are examples of criteria excluded for this reason:
 - Local land use/zoning
 - Transmission/distribution/substation grid capacity
- Some of the criteria were associated with multiple variables and there was no viable way to accurately score the criteria for all the sites in the CLP based on the GIS data. The following is a list of criteria that was excluded for this reason:
 - Interested power purchaser
 - Local acceptance
 - Investor interest and availability
 - Ecological co-benefits
 - Equity considerations
- For some criteria we were unable to identify a workable scoring model that made sense and accurately compared the sites across the state. The following is a list of criteria that was excluded for this reason:
 - Interested power purchaser

- Investor interest
- Equity considerations
- Ecological co-benefits

Two criteria received significant discussion among the agency team participants: GOBs and landfill cap age. A brief description of the issues and approach during scoring and ranking follows:

- GOBs are an important criterion. However, in our geospatial analysis GOBs were considered a binary factor for CLP sites and not a physical characteristic. Whole landfill sites were considered bonded or not bonded, even when some “bonded” landfills had parcels not restricted by bond appropriations. The study, as described in the scope of work, is intended to identify the top five sites with GOB restrictions and the top five sites without GOBs. Our ranking identified the top sites irrespective of GOB status and then applied the GOB criteria as a means to narrow down the top five sites with and without GOB restrictions. The GOB issue is complex and adds significant restrictions to the use of parcels at sites where GOB funds were used to improve or close the site. There are ways to address or remove these restrictions; however, they are complex and not well tested in the context of solar development on CLP sites.
- Cap age was also considered as a criterion for our geospatial analysis. As mentioned previously; the CLP caps are soil material meeting certain design specifications and there may or may not be a barrier layer of man-made material (plastic) incorporated below the earthen material. The cap is designed to minimize or eliminate infiltration of rainwater and manage stormwater runoff rate and minimize erosion. The MPCA has records of cap construction and provided data regarding the age of the soil cap. Settlement is often an issue with soil caps during the first few years after construction and is dependent on the relative consolidation of the waste material, the characteristics of the soil used to construct the cap and the construction techniques used to install the cap. A specific age, after which settlement is considered minimal, is difficult to determine and there is no clear consensus. Ten years was discussed as a conceptual age; however, there are only five sites with caps less than ten years old, (Flying Cloud, Hopkins, Washington County, WLSSD and East Mesaba). Regardless of the age of the cap, it is likely that the cap construction documentation will be reviewed, and a geotechnical survey completed to verify the status of the cap prior to solar development.

3.4 Ranking Method

Our GIS analysis provided data for each landfill site which we scored to rank the sites and identify the top five GOB-restricted and top five non-GOB-restricted sites. For each of the criteria described above we used a simple scoring system. The range of values for a criterion was divided into equal parts and a score (five being high and one being low) was assigned for each landfill. The criteria were weighted based on our assessment of importance: cap generation capacity 20%, buffer generation capacity 20%, site generation capacity 40% and distance to nearest substation 20%. The weighted scores for each criterion were added together to create a composite score for each site. The limited number of criteria and

simplicity of the scoring system created some duplicate scores. To address duplicate scores, a secondary sort was performed based on site generation capacity (highest capacity to lowest capacity).

3.5 Results

Results of our analysis are presented as a table in Appendix C. CLP sites are listed from the most likely suitable for development to the least. The top five bond-restricted sites are highlighted in blue and the top five non-bond restricted sites are highlighted in green in Appendix C. Table 3-1 summarizes the results for the top five bond-restricted and top five non-bond-restricted sites, and indicates the figure showing each site.

Table 3-1 Top 5 Ranked Bond Restricted and Non-Bond Restricted CLP Sites

CLP Site	City	County	Overall Ranking ^[1]	Bond Restricted ^[2]	Figure
Flying Cloud Landfill ^[4]	Eden Prairie	Hennepin	1	Yes	Figure 2
Western Lake Superior Sanitary District Landfill ^[4]	Duluth	St. Louis	2	Yes	Figure 3
Anoka-Ramsey Landfill	Ramsey	Anoka	4	Yes	Figure 4
Redwood County Landfill	Redwood Falls	Redwood	5	Yes	Figure 5
Winona County Landfill	Winona	Winona	6	Yes	Figure 6
Olmsted County Landfill	Oronoco	Olmsted	3	No	Figure 7
Freeway Landfill ^[3]	Burnsville	Dakota	8	No	Figure 8
Hibbing Landfill	Hibbing	St. Louis	15	No	Figure 9
Kummer Landfill	Bemidji	Beltrami	21	No	Figure 10
Maple Landfill	Pequot Lakes	Cass	22	No	Figure 11

- [1] The scope of this study required identification of the top five GOB restricted and top five non-GOB restricted sites in the CLP. The majority of the top twenty ranked sites were GOB restricted which necessitated using sites farther down the ranking to find five non-GOB restricted sites. This ranking does not suggest that sites further down the ranking are in some way unsuitable for solar development.
- [2] In this analysis bond restriction is treated as a binary criterion (yes or no). The reality is more complex. GOB restrictions are specific to a defined area of land or parcel. Some of these landfill sites are divided into multiple parcels of land and in some cases only part of the site carries a GOB restriction. GOB restrictions are described in more detail in Section 4.2.
- [3] Freeway Landfill does not currently include GOB-restricted parcels. In recent years there have been discussions about using bond money to make improvements to the site.
- [4] The cap for this landfill is identified as less than 10 years old. Cap construction documentation and geotechnical information should be reviewed to understand potential subsidence risks.

4 Barriers and Actions to Address Barriers

Stakeholders identified numerous potential barriers and opportunities associated with developing solar on CLP sites. These barriers and opportunities are summarized (in no particular order) in Table 4-1 and Table 4-2. The literature review and stakeholder engagement process to identify these barriers is described in Appendix B.

Table 4-1 Barriers Associated with Developing Solar on CLP Sites

Barriers
Use of state general obligation bonds to pay for site improvements restricts use for solar power generation.
Need approximately 5 “buildable” acres per megawatt (MW). Not all acres at a site can support solar development. Awareness of the size of these sites is not well known.
Connection to transmission/distribution and an off-taker (user of electricity) can be expensive and some of these sites may be too far from this infrastructure to be economically feasible. This is unique to CLP sites because the sites were originally located where they are because of the need to manage waste, not generate energy for a near-by user.
Upgrades to transmission/distribution system may be required to accommodate solar on landfills. This is not unique to solar development on CLP sites.
MPCA CLP responsibilities for closed landfills (maintenance, erosion control, gas collection system management/maintenance) may make development of solar more complex.
Funding may be hard to get for small sites. This is not unique to solar development on CLP sites.
Local and state support for solar development on closed landfills is not assured for every site.
Current contracts with power producers may prohibit or limit development of distributed energy sources (small-scale power generation connected to the grid at the distribution level). This is specifically an issue with Municipal and other cooperative power producers and is not unique to solar development on CLP sites.
Competition with other energy generation sources on price of power, or levelized cost of energy (LCOE). Solar on closed landfills might not be the cheapest source of electricity.
Construction limitations on the landfill cap (smaller equipment, prohibition of penetrations, ballasted racking systems, prohibition of buried/trenched lines) leading to higher construction costs.
Perception of risk affecting lenders (increased risk premium over greenfield site). Landfill sites carry some risk that future maintenance or contamination issues will require part or all of a solar installation to be moved.
The age and stability of the landfill cap can be a barrier to installing solar equipment.
Local zoning/land use requirements may not be amenable to solar development. This is not unique to solar development on CLP sites.
Interconnect queue. For larger sites, the queue for connecting to the existing transmission infrastructure is long and difficult to predict. This is not unique to solar development on CLP sites.

Table 4-2 Opportunities Associated with Developing Solar on CLP Sites

Opportunities
CLP sites represent large amounts of available land that currently do not have a higher value use. These sites could replace agricultural land as solar development options.
Production of renewable energy and corresponding reduction of greenhouse gas emissions from the power generation sector.
Support for short-term construction and long-term maintenance jobs.
Electricity to serve on-site load.
Opportunity for local developers to continue solar development in Minnesota.
Good use for otherwise marginal/impaired land, beneficial reuse.
Solar energy could help local government meet their renewable energy/greenhouse gas reduction goals.
Energy production is a potential source of stable revenue.
Solar energy could be a community asset/amenity.
Solar energy can provide various grid services including peak shaving. Peak shaving reduces the load on the local transmission and distribution grid during times of peak electricity use.
Development of solar on CLP sites could be an opportunity to create streamlined/standardized program for leasing and selling power.
Minnesota could show leadership in brownfield solar development.
Solar energy could be a source of tax revenue.
Solar development has the potential to support pollinator-friendly and other natural habitat development.

4.1 Common Key Barriers to All Sites and Potential Actions to Address Those Barriers

Based on the July 13, 2020 focus group discussion and participant feedback, the key barriers common to solar development at all CLP sites are uncertainty about costs to connect to nearby transmission or distribution systems, uncertainty related to site suitability and CLP program responsibilities, and increased construction costs related to the unique features of closed landfill caps. These, of course, do not represent all the barriers; however, these barriers were repeatedly mentioned by stakeholders as key barriers that were common to all CLP sites and would need to be addressed in order to enable solar development on MN CLP sites. In the balance of Section 4.1 we will describe each of these barriers in more detail and recommend some actions to address these barriers.

Uncertainty About Costs to Connect to Nearby Transmission or Distribution Systems. We learned from our stakeholders the cost to connect to existing infrastructure is a significant part of the total cost to construct solar generating systems. These costs are directly related to several important variables: distance from the solar generating equipment to the existing electrical infrastructure, availability of a substation, existing equipment in a substation, electrical capacity of the substation and associated transmission/distribution system and permitting and interconnect costs. Publicly available GIS data, showing locations of transmission and distribution infrastructure (wires and substations), gave us a means of calculating the distance to local electrical infrastructure from our CLP sites. Generally, as a rule of

thumb, closer is better and results in lower connection costs. However, the other variables associated with the connection to local transmission/distribution systems can have a significant impact on costs and information regarding these variables is not easy to acquire for all sites and therefore they were not investigated as part of this study. In this case the barrier is the uncertainty about the costs to connect to nearby electrical infrastructure. To illustrate the uncertainty, we provide some feedback from developers and utilities.

Several utilities and developers discussed the importance of distance to grid infrastructure. Qualitatively speaking, if a project is very large then it can be further from grid infrastructure to make it cost-effective. That said, predicting the weight of the distance criteria is difficult. One developer said: *"In rural areas, sometimes the distance can be farther than you'd expect. I have connected a 5MW [solar on landfill] project to a substation located 2 miles away, for very reasonable cost. I have also connected a 30MW project with the substation located on the same parcel at a very high cost. Utilities are hard to predict!"*

Another developer seemed to say it was difficult to predict the weight of the distance criteria. She said, *"Most of the smaller projects (from less than 1 to over 10 megawatts) can be tied into the nearest 3-phase distribution line, even if the line has to be extended to the site for some distance at a cost to the project... Most of these sites have little on-site load and may only have a single-phase pole at the site. Therefore, extending the line could be a significant cost. But interconnection is always costly, and the additional cost will not likely be overly burdensome relative to typical ['greenfield' or undeveloped sites] interconnection costs."*

The solar project developer typically bears all costs associated with interconnection. Therefore, it is critical to understand what is required and the costs for interconnection. The voltage rating for a distribution line may dictate the largest size project that can be installed in a given location. Some rules of thumb from developers include that a 5 kV transmission line can support only a few hundred kW of intermittent renewable generation capacity. A 13 kV line can typically only support up to 3 MW of renewable generation capacity. A 23 kV line may support up to 6 MW of renewable generation capacity. There are many factors that influence what a given transmission or distribution line can support. Finally, a large-scale solar array will require three-phase power.

To address this uncertainty, we recommend performing an interconnection survey for the top ten sites (five bonded and five non-bonded). We are not advocating for a complete interconnect study as required under state siting requirements; however, contacting utilities and collecting information to identify information about the critical characteristics of local electrical infrastructure would provide some level of certainty about the costs required to connect.

Uncertainty Related to Site Suitability and CLP Program Responsibilities. Generally, landfill caps provide a clear, engineered surface on which to install solar equipment; however, they also present unique technical and engineering challenges which result in increased costs (when compared to greenfield solar installations). Specific issues include age of cap, use of lighter weight installation/construction equipment, presence of steep slopes, presence of leachate and gas collection systems, potential for cap maintenance activities and a general restriction from penetrations of the cap. Steep slopes and the presence of leachate

and gas collection systems can reduce the buildable area available for solar installations. Using the GIS tool developed for this project, we eliminated slopes on each cap greater than 15% when calculating buildable cap area; however, we did not plot or estimate reductions associated with leachate or gas collection systems. These features can also reduce the buildable area which reduces the site generating capacity.

With respect to the age and maintenance activities associated with the cap, there is not good agreement about the rate of settlement and corresponding appropriate age for installing solar on a cap. Based on data provided by the MPCA, there are five caps in the CLP that are less than ten years old (Flying Cloud, Hopkins, Washington County, WLSSD and East Mesaba). This does not mean they are unsuitable. It means a geotechnical evaluation may be necessary to verify suitability. Future cap maintenance activities could also impact a solar installation; however, a good method of predicting maintenance activities with any precision is not available. Stormwater management is an especially important issue on a landfill cap. A solar site design will be required to manage stormwater to prevent cap erosion. Developers indicated that solar installations on landfill caps are inspected at a greater frequency than landfill caps without solar installations. This tends to ensure erosion and other issues with the integrity of the cap are identified earlier. In general, the cap issues described here represent a potential financial risk for the solar installation during the economic life (approximately 25 years) of the site. This risk may be addressed with additional insurance coverage at additional cost to the project.

Increased Construction Costs Associated with the Unique Features of Closed Landfill Caps. Based on experience in other parts of the country, where solar installations on landfill caps is more common, construction techniques and solar racking and cabling required for landfill cap installations is where the significant increases in construction costs are associated. The cap must not be damaged by construction activities/equipment and because the cap cannot be penetrated, ballasted racking systems are usually employed. Smaller, lighter equipment results in longer construction schedules and ballasted racking systems and above ground cabling are more expensive to purchase and install.

Investor owned and cooperative (co-op) utility stakeholders pointed out power pricing is a key issue for them. Their goal is to provide customers the lowest priced electricity. There is a perception solar is not the least expensive option and given the increased capital and construction costs (over greenfield sites), utilities are skeptical these sites can be developed, and power purchased economically.

These barriers, and the resulting additional costs, cannot necessarily be changed but it might be possible to reduce the real and perceived risk associated with them by collecting and providing some detailed technical information about the sites. We recommend developing a guide for solar development on CLP sites to help interested parties understand the opportunities and challenges associated with building solar on MN CLP sites. We suggest this guide include technical details about the sites and more general information about installing solar on the sites.

It is unlikely the state of Minnesota can directly impact the increased capital and construction costs associated with solar installations on closed landfills; however, we recommend the state consider

promoting the development of solar energy on MN CLP sites and also consider the adoption of a variety of policy and financial incentives. Policy and financial incentives are described in more detail in Section 5.

The US Department of Energy's National Renewable Energy Laboratory recently completed a technical and economic analysis of a potential solar energy development for the Becker landfill. At the time this report was completed this analysis had not yet been vetted; however, the process and information provided in the analysis could be very helpful in explaining the potential for development on CLP sites in Minnesota. We recommend the state consider doing this analysis on the top ten sites identified in this study.

4.2 Specific Barriers to the Top Five Bond Restricted Sites and Specific Actions to Address those Barriers

The top five bond restricted and top five non-bond restricted sites share the common barriers described in Section 4.1. In Section 4.2 we will focus on the barrier exclusive to the bond restricted sites: prior use of state tax-exempt GOBs to finance improvements.

There are 55 CLP sites where MPCA used state GOBs to clean up the sites. It should be noted these CLP sites often contain more than one parcel of land and, in some cases, some of the parcels carry the bond restrictions and some do not. According to the MMB, federal tax law imposes certain restrictions on the parcels where funds from a GOB were spent, and restrict private benefits deriving from use of the parcels. The restrictions attach to parcels identified in a real property declaration recorded with the associated county by the MPCA and remain in place for 37.5 years from the last date when GOB funds were used. MMB reports private use under federal tax law may include site leases to private solar developers, energy output contracts governing the sale of solar energy generated onsite, or other revenue generating activities.

MMB has indicated if solar energy systems are to be developed on GOB-restricted parcels, and if those developments benefit private parties such as developers or lessees, the GOB restrictions will first have to be removed. There are two methods MMB described under existing law for removing the restrictions: 1) allow the declaration as restricted property to expire at the end of the 37.5-year period, or 2) sell the GOB-restricted land at fair market value. A third possibility requiring new legislation was also discussed: retiring the GOB debt early through legislative appropriation and action releasing State bonding restrictions. Appendix D shows GOB expenditures by site, the estimated GOB expiration date, the acres of restricted parcels and the acres of unrestricted parcels. The next paragraphs describe the bond challenges in more detail and identify questions to be answered if solar is to be developed on GOB-restricted land.

Expiration of 37.5-year time period. Waiting for GOB debt to expire at the end of the 37.5-year period may be challenging. Based on the table of GOB expenditures (Appendix D), the soonest some of the restricted parcels would be available is 2034 and the last restrictions would expire in 2056. GOB funds were expended over multiple years and some sites have multiple restricted parcels, all improved at different times. This suggests some individual sites may have GOB's retiring over a series of years, further complicating a solar development plan.

Sale at fair market value. It is not unreasonable to expect a site with GOB-restricted land to be of interest to a solar developer, utility, or local unit of government. Interest may be high enough to make purchase of a GOB restricted site or portion of a GOB restricted site an option to consider. However, MPCA has statutory responsibilities for these sites which may limit sale is a feasible option.

Retiring GOB debt. The remaining debt and time left on the obligation are important datapoints if attempting to retire the debt early. Appendix D includes MPCA's records regarding expenditures and timeframes by landfill but does not indicate the amount of the remaining debt for each site. MMB reports it is challenging to identify remaining debt for a specific landfill site because when the State sells bonds it is not for specifically identified projects but rather for particular enacted bonding bills. Any assessment of outstanding debt will require a careful analysis of past accounting records. It is unlikely that remaining debt could be determined at the individual parcel level. Because parcel-by-parcel debt accounting is so complex MMB has indicated all GOB debt for a site would need to be retired at a site for solar development to occur.

MMB has indicated retiring a bond obligation early would require legislative action. At this time, it is difficult to gauge the legislature's interest in or ability to pay off this debt to promote or enable solar development on closed landfills.

The following are questions summarized from the discussion above that may serve as future lines of inquiry:

- How much is the outstanding bond obligation for a given CLP site?
- What is the legislative process for retiring the obligation early?

The existence of GOB restrictions presents a significant challenge to development of solar on bond-restricted parcels at 55 sites. Given the potential for solar development at non-GOB restricted sites it might be prudent to first focus on the sites where there are no such restrictions, and non-bond restricted parcels on landfill sites where bond-restricted parcels exist. However, the state is interested in understanding the barrier imposed by GOBs and identifying options to addressing it.

To address this barrier, we might suggest using the top five sites with bond obligations (identified in Section 3) to develop a process and report identifying options for addressing the existing general bond obligation and allow solar development on these five sites. This would supply options and valuable information regarding the legal actions and associated time-frames necessary to proceed with potential development. Furthermore, a successful process could perhaps be replicated for other sites as interest in those sites is identified.

5 Recommended Steps for Initiating Solar Development on the Top Ranked Sites

To respond to this element of the scope of work we make the distinction between those sites with GOBs (bond-restricted) and all top ten sites regardless of bond status. We will begin with the bond-restricted sites.

Top Five Bond-Restricted Sites

As previously stated in Section 4, half of the sites in the CLP have at least one bond-restricted parcel. The top five bond-restricted CLP sites as ranked are:

- Flying Cloud
- Western Lake Superior Sanitary District
- Anoka-Ramsey
- Redwood County
- Winona County

The first step to consider solar development on these five sites (and all bond-restricted sites) is to continue the dialog between the MMB and MPCA to resolve questions around this barrier. Specific considerations are: what the remaining debt is on each of the top five bond-restricted sites, and what the legislative process is for retiring the debt early.

Top Ten Sites Regardless of Bond Status

The top ten ranked sites are:

- Flying Cloud
- Western Lake Superior Sanitary District
- Olmsted County
- Anoka-Ramsey
- Redwood County
- Winona County
- Freeway
- Hibbing
- Kummer
- Maple

We identified the following action items to address the barriers identified. We acknowledge state agencies may need additional authority to act on some of these recommendations.

Retire GOB obligations early. The Minnesota Legislature could take action to retire GOB obligations early to remove the associated restrictions. This would seem to be a strong incentive for solar develop and

other beneficial reuse of closed landfills and would indicate the legislature's intent to promote development on the sites in the CLP.

Develop a technical guide to solar development on CLP sites. A technical guide could provide general information about the unique design aspects of closed landfills and more detailed information about the CLP program responsibilities associated with the landfills and process for developing solar on a closed landfill site. The audience would be utilities, developers, local government, and finance stakeholders who are unfamiliar with closed landfills and their potential for solar development. Subject matter experts at the MPCA and Department of Commerce could develop this guide and be a clearinghouse for questions or comments from users of the guide. We reference an example technical guide from the state of Massachusetts for use as a starting point, which includes guidance in terms of working with local governments, financiers, utilities, and developers and a process to address many of the same barriers discussed in this document.

Provide detailed technical and regulatory information for each of the top 10 sites. The MPCA is developing the Minnesota Groundwater Contamination Atlas (Atlas) which is a GIS tool. The Atlas is intended to develop into being the primary communication platform for information about environmentally impacted properties in Minnesota. The MPCA is currently in the process of adding information about the CLP sites and is awaiting additional Environment and Natural Resource Trust Fund money to further expand the Atlas. We recommend MPCA identify detailed technical and regulatory information that would be important to solar development on the CLP sites and ensure the information is integrated into the Atlas platform. Detailed technical and regulatory information may include specific design elements of the sites, permit conditions, information on cap construction and maintenance status, surrounding land use and natural features and other site-specific information deemed useful. The MPCA or Department of Commerce could also consider completing techno-economic analysis for each of the top sites using the free System Advisor Model. The audience for this information would be developers, local land-use planning/zoning officials, utilities, and finance stakeholders who are interested in developing plans and specifications for solar development on these sites.

Initiate a preliminary interconnection study for each of the top 10 sites. The interconnection to local a transmission/distribution system is a large cost component to solar development and uncertainty around what would be required on a site-by-site basis makes it difficult to determine the viability of solar development. We do not assume a full-scale interconnection study as required by certain size solar developments; however, collecting more detailed information about nearby transmission/distribution and substation equipment, capacity, and ownership/control status. We believe this study could be conducted by Minnesota Department of Commerce and the audience for this information is developers, utilities, and transmission/distribution planners.

Reach out to stakeholders. One common barrier to development of solar energy on CLP sites is lack of awareness of these sites and the solar development potential they represent among non-developers. The Department of Commerce and MPCA could prepare informational materials for the top 10 sites and invite key stakeholders to open discussions about the sites and solar development potential. Key stakeholders include owners, utilities, transmission operators, developers, local government, and other regulators.

These meetings would provide an opportunity to gauge interest, collect site specific feedback and identify local barriers/concerns and opportunities. Providing stakeholders information on specific sites helps to “make it real” and could create opportunities.

Pursue state-wide policy and incentive programs to encourage solar development on CLP sites.

State policy and incentive programs have proven very valuable in Minnesota, other states and at the federal level in encouraging renewable energy development. In Minnesota, our practice of upgrading the environmental controls at closed landfills with GOBs has resulted in proactive management of these legacy waste management sites. It has also created a barrier to solar development for about half of the sites. Increased capital and construction costs associated with solar installations on closed landfills is also a significant barrier. Based on previous experience in Minnesota with the community-based solar program and elsewhere in other states there are many policy and incentive programs to consider. Here are a few ideas:

- **Virtual net metering.** Virtual net metering or a similar policy for grid-tied projects could assist in overcoming financial barriers related to developing solar on landfills. Virtual net metering is a mechanism allowing energy customers to credit kilowatt-hours from one meter to another. Many CLP sites are large enough to support solar systems that can produce many MW of electricity. Most of those sites, however, do not have need for the power onsite. These sites will be connected to the grid and can provide power to nearby communities or to other grid connected users. With a virtual net metering policy, the landfill owners could be compensated for the power they produce. In Massachusetts, a similar net metering policy allowed those who owned the solar systems to receive 100 percent net metering credits for their solar generation up to six MW. For example, credits could be transferred to a customer of the same distribution utility as long as they are within the same service territory and MISO (Midwest Independent System Operator - the regional electricity grid operator) load zone. The value of each kilowatt-hour could be valued more as a net-metered credit under this policy than if the kWh was sold to the utility grid at the clearing price.

In Minnesota, there is one policy that most closely approximates net metering, the community solar garden (CSG) program. These projects, however, are limited to one MW, and at this threshold are not cost effective for a developer. Projects with one MW cap would not make use of many potential acres of available land. A solution could be to include a “brownfield adder” to the CSG rules allowing for development of projects greater than one MW.

- **CLP solar development incentives.** The state could earmark incentives for solar development on CLP sites. If Minnesota determines that brownfield projects are a public good and worth encouraging, the Legislature could set up incentives to offset the additional costs associated with solar development on CLP sites and other brownfield sites. A rule of thumb for developing solar on brownfields to cover the cost of ballasted systems and permitting is approximately 15 percent more than a greenfield site. A state incentive that bridged that additional cost could assist in making solar development at brownfield sites feasible for solar developers.

- **Renewable Energy Credit or Renewable Energy Certificate (REC) ownership by MPCA.** One developer said they had heard the MPCA would like to retain the RECs earned by solar development at CLP sites, as a way of meeting its greenhouse gas reduction obligations. This may be possible. Understanding in more detail what MPCA REC ownership means in terms of policy and how it works practically is key to determining whether it hinders or encourages solar development at CLP sites.

6 Conclusions

There is significant capacity for solar development on Minnesota's CLP sites

In developing and analyzing data regarding the sites in the MN CLP we estimate solar energy capacity statewide to be on the order of 950 MW. Landfill caps have the potential for 280 MW on approximately 1300 acres and buffer areas could produce 670 MW on approximately 3200 acres. The generating capacity varies from site to site. Table 6-1 shows groupings by capacity.

Table 6-1 Solar Generating Capacity at CLP Sites

Range of generating capacity (megawatts)	Number of sites
20 – 45	8
10 – 19	22
5 – 9	42
1 – 4	35
Less than 1	4

These numbers are approximate; exact capacities are typically determined by developers during the solar equipment design phase. For context: according to the Minnesota Department of Commerce report (reference (6)), there were 596 MW of solar PV capacity operating in Minnesota in 2017.

The solar potential at CLP sites could be well aligned with solar development plans being pursued by power utilities with operations in Minnesota. Here are a few examples:

- By 2030 **Xcel Energy** plans to reduce carbon dioxide emissions 80 percent below 2005 levels company wide. They intend to invest in wind and solar under their "Steel for Fuel" strategy and offer customers more renewable energy options. From their most recent carbon report: *"We anticipate adding thousands of megawatts of wind and solar power to our system and incorporating both natural gas and storage resources to help balance high levels of renewables"* For more information about Xcel's plans see their most recent carbon report: <https://www.xcelenergy.com/staticfiles/xcel/PDF/Xcel%20Energy%20Carbon%20Report%20-%20Feb%202019.pdf>
- **Minnesota Power** is implementing their "Energy Forward" strategy and intend to be at 50% renewable energy by 2021. They intend to install about 23 MW of new solar in Minnesota to be operational in 2021. For more information about their Energy Forward strategy see their website: <https://www.mnpower.com/Environment/EnergyForward>

- In 2018 **Great River Energy** (GRE) adopted its corporate goal to achieve 50% renewable energy for its member co-ops by 2030. GRE has been adding solar in various co-op service territories. For more information see their "Renewable Energy Position Statement": <https://greatriverenergy.com/the-cooperative-difference/legislative-activity/renewable-energy-position-statement/>

The top ten sites, five bond-restricted and five non bond-restricted sites, do not represent the only favorable CLP sites for solar development. The scope of this study required us to rank the sites in the CLP and identify the top five bond-restricted and top five non bond-restricted sites. In fact, there is no significant difference between the tenth and eleventh sites in the ranking. We believe many of the sites have favorable characteristics (e.g., capacity and distance to transmission/distribution infrastructure) and will be attractive to power users (off-takers), utilities and solar developers. With proper application of incentives and with improved awareness among non-developer stakeholders many of these sites will attract interest and eventually solar power development.

Solar power and energy storage are a valuable combination. During focus group discussions the concept of co-located solar and energy storage was mentioned by more than one stakeholder. Solar paired with energy storage systems can provide stacked electrical grid support services (e.g., voltage regulation, peak shaving, and peak shifting) which can improve the economics of distributed energy resource development on CLP sites. Although not specifically included in the scope of this study, CLP sites, especially the buffer area, is well suited to co-located energy storage systems.

There are barriers. While MN CLP sites hold great potential for solar development there are barriers which can make development challenging for some of the sites. Some of these barriers are more challenging than others but all can be overcome. Based on discussions with stakeholders and MN agency representatives we developed the following list of barriers.

GOBs. Over \$100 million in GOB funds were used to make improvements, including closure, at 55 of the CLP sites. Restrictions associated with use of GOB funds affect approximately 4100 acres across these 55 sites, while there are approximately 1,100 acres at these 55 sites where GOB funds were not spent. The non-bond restricted acres at these 55 sites may have fewer barriers to solar development, however the presence of GOB restrictions elsewhere at the landfill site may complicate solar development at these sites. It is highly likely many of these 55 sites will be attractive to power users, utilities, and developers. Eliminating a majority of acreage from half of the CLP sites from consideration for solar power development solely on the basis of bond status would severely limit the opportunity to meet renewable energy goals and reduce carbon emissions in Minnesota.

In the course of this study there have been several conversations about this topic with members of MPCA and MMB. Section 4.2 describes the issues as we understand them now and identifies outstanding questions requiring further investigation to move forward. We recommend MPCA and MMB work together to find answers to the outstanding questions so this barrier can be

addressed balancing the benefits of renewable energy development and our obvious need to comply with the conditions of our GOB requirements.

Uncertainty related to site suitability and CLP program responsibilities. There are perceived and real risks associated with building solar on CLP sites. Some of these risks are associated with the structures (cap) and systems (leachate and gas collection and management) and some are related to future events that are difficult to predict. Future events include CLP program required cap maintenance and potential discovery of contaminants requiring removal of solar equipment. Anyone seeking to develop solar systems on these sites will attempt to quantify risks and insure against associated losses. The MPCA has technical information about these sites and their construction that could be provided to interested parties to help explain the risks better and address this barrier.

Increased construction costs related to the unique features of closed landfill caps.

Constructing solar power systems on a landfill cap requires lighter weight construction equipment and construction techniques and racking systems that eliminate penetrations. Stormwater management and erosion control are also especially important considerations when working on a landfill cap. We have heard this increases the costs to construct solar on the landfill cap. We believe state renewable energy policy could be created to help off-set these costs and promote solar energy development on CLP sites.

Investments in transmission and distribution infrastructure may be needed. CLP sites were typically located to be convenient, from a transportation standpoint, to the point of waste generation and on marginal land without competing uses. This does not mean they are convenient to an off-taker (someone who would use the electricity). We have identified the location of existing transmission and distribution infrastructure and assumed distance to infrastructure is an important criterion for siting solar on CLP sites. Distance is important but there are other factors that can also impact the cost to connect solar on CLP sites to the local/regional infrastructure. We recommended a preliminary interconnect study for the top ranked sites to help identify these other important factors and determine their impact on solar development on CLP sites. It is possible that investments in Minnesota's transmission and distribution infrastructure would enable or promote solar development on CLP sites across Minnesota.

7 References

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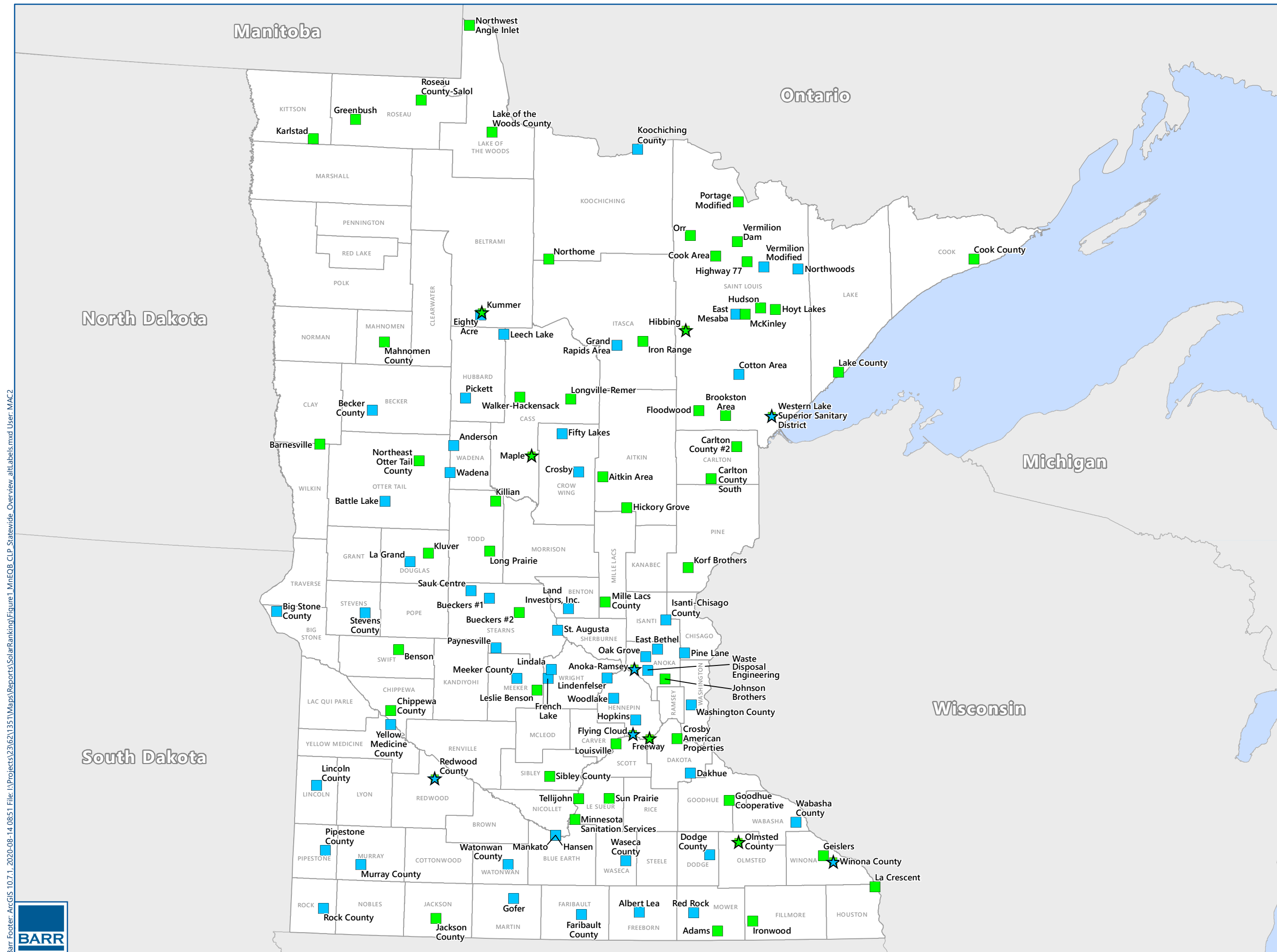
Figures

Important notes to figures:

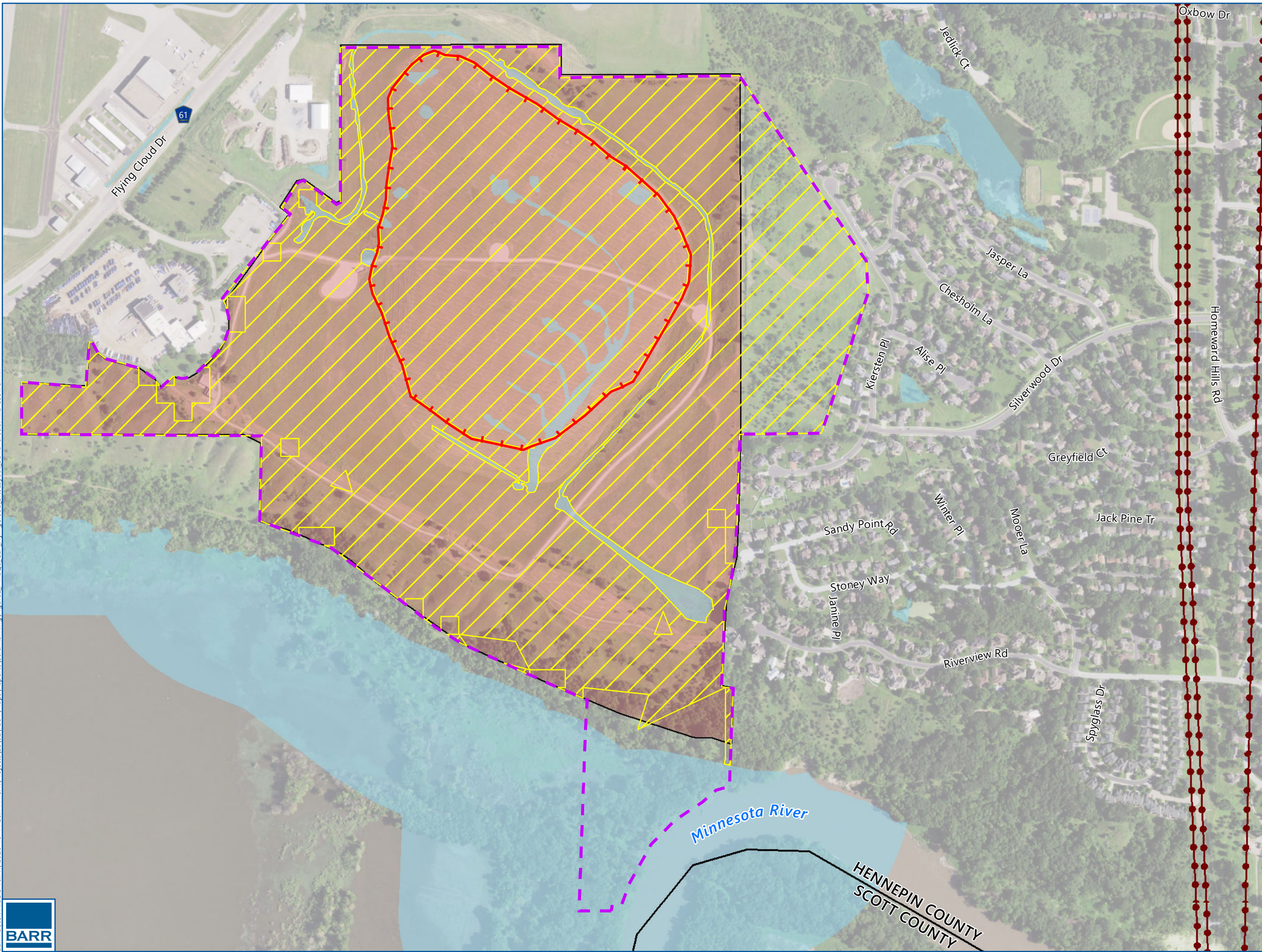
"Buildable Area" and estimated generating potential in MW – The yellow hatch pattern shown on the top ten site figures recognizes the buildable acres and approximate generating potential for the landfill cap and buffer areas. To identify the buildable area on the landfill cap, we used our GIS system to identify slopes greater than 15% and we subtracted these steeply sloped areas from total cap acreages reported by our GIS system. To identify the buildable area in the buffer we identified data sets for wetlands, open water, scientific and natural areas, forest (conifer, deciduous and mixed), and developed areas (low, medium, and high density). We identified the acreage for each of these natural and human-made features for each site, subtracted those acres from the total buffer acreage, and calculated the buildable acres for each buffer. To estimate the generating potential for each site, we divided each buildable area in acres by a capacity factor (4.81 acres per MW) to calculate the approximate generating potential in MW. Our capacity factor is calculated based on typical equipment specifications and a ground coverage ratio of 30%.

The buildable area within the buffer appears fragmented and discontinuous at some of the sites. This is a function of the National Land Cover Database (NLCD) used to identify the specific natural and human made features that were subtracted from the total buffer area. The NLCD may occasionally misinterpret land cover and, due to time and scope constraints, we did not attempt to field verify land cover for each site.

GIS data for GOB restricted parcels was provided by the MPCA. The restrictions attach to parcels identified in a real property declaration recorded with the associated county by the MPCA. The location of parcels with GOB restrictions should be verified by reviewing the declaration prior to contemplating development of non-GOB restricted parcels.



Barr Footer: ArcGIS 10.7.1, 2020-10-14 2011 File: \\Projects\\23\\231351\\Maps\\Reports\\SolarRanking\\Figure2 MneEQB CLP FlyingCloud SiteLayout BondParcels.mxd User: amn



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Hennepin County

- Land Management Area
- Waste Footprint
- Buildable Area (≈43.1 MW)
- County Boundary

Parcel (Bond Status)

- Bonded Parcel
- Wetlands
(National Wetlands Inventory)

Electric Transmission

- 116kV - 500kV

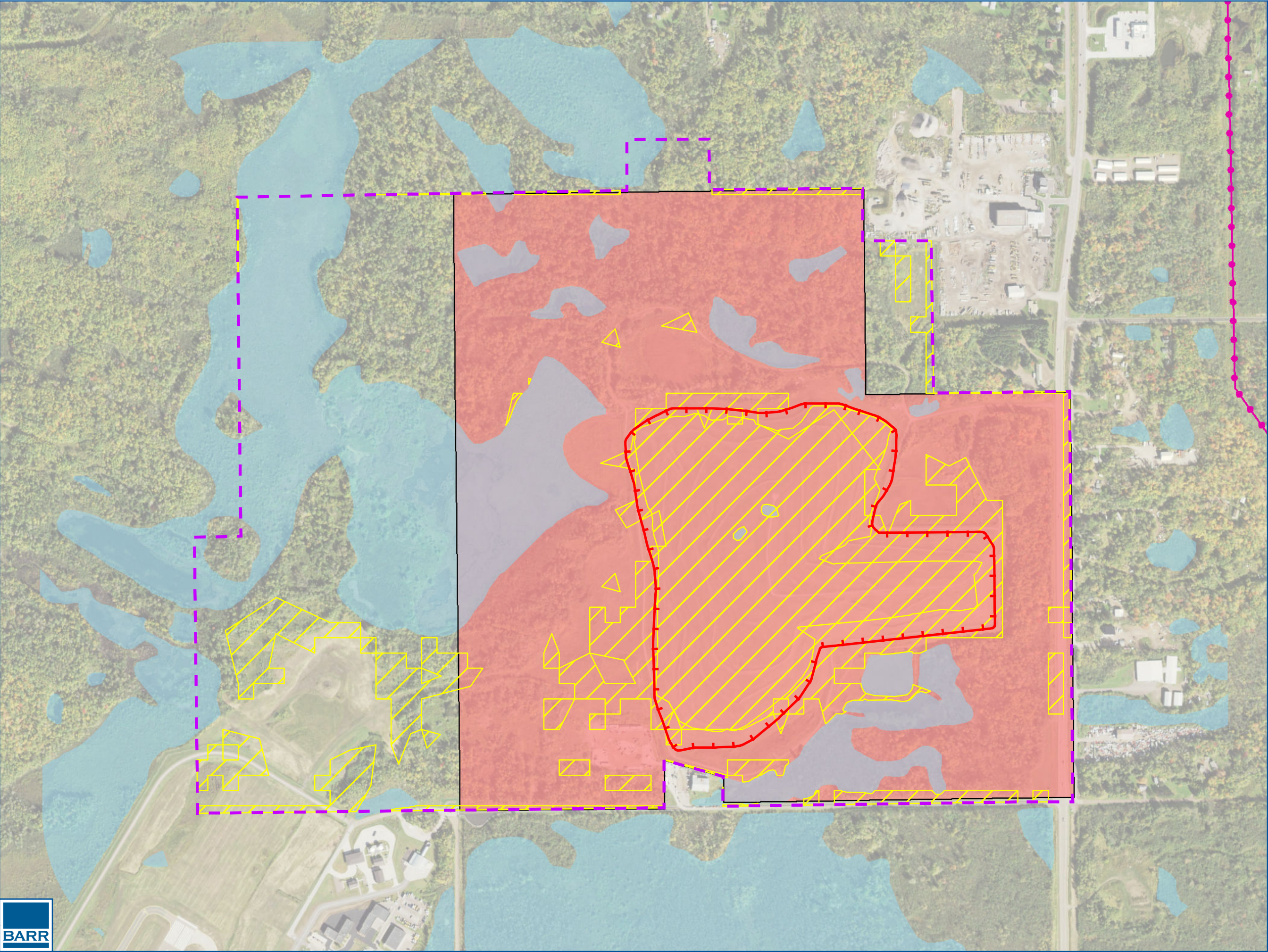
Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

0 500 1,000
Feet

Aerial Image: 2019 FSA NAIP

SITE LAYOUT
FLYING CLOUD LANDFILL
Minnesota Environmental
Quality Board
Hennepin County
Eden Prairie, Minnesota

FIGURE 2



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Saint Louis County

Land Management Area

Waste Footprint

Buildable Area (≈40.3 MW)

County Boundary

Parcel (Bond Status)

Bonded Parcel

Wetlands
(National Wetlands Inventory)

Electric Transmission

34kV - 115kV

Notes

Elevation contours shown based on MnTOPO LiDAR elevation data.

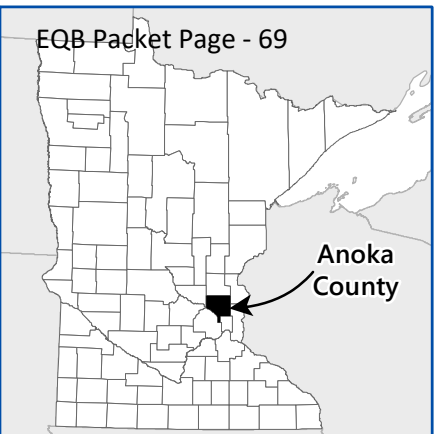
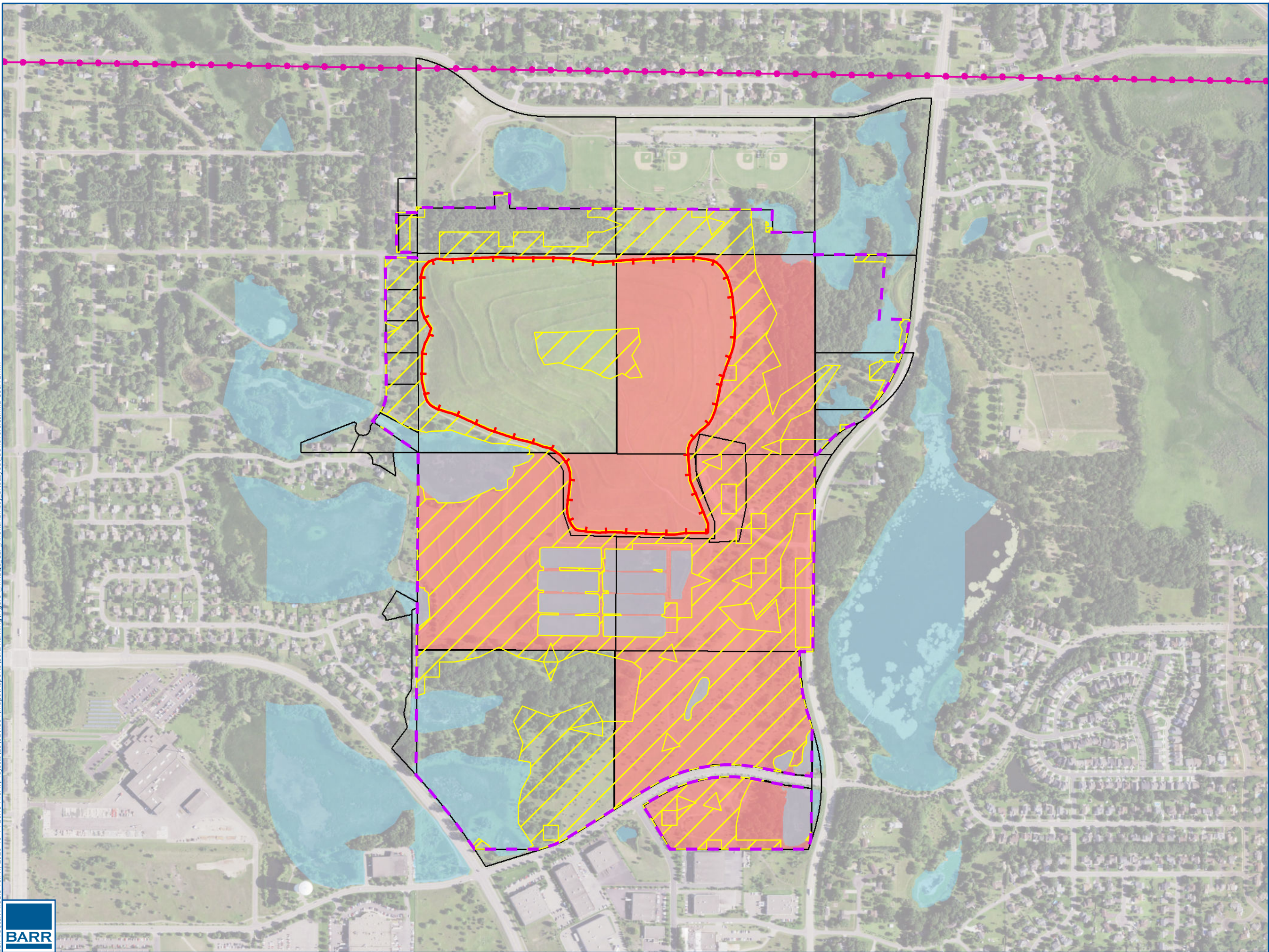
Elevation contours and wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

0 500 1,000
Feet

Aerial Image: 2019 FSA NAIP

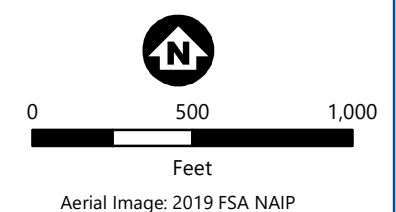
SITE LAYOUT
WESTERN LAKE SUPERIOR
SANITARY DISTRICT LANDFILL
Minnesota Environmental
Quality Board
St. Louis County
Duluth, Minnesota

FIGURE 3



- Land Management Area
- Waste Footprint
- Buildable Area (≈27.5 MW)
- County Boundary
- Parcel (Bond Status)**
 - Bonded Parcel
 - Wetlands
(National Wetlands Inventory)
- Electric Transmission**
 - 34kV - 115kV

Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

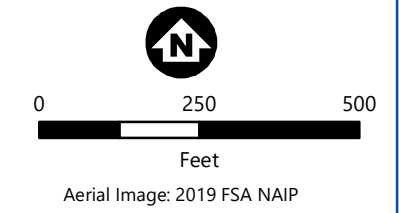


Barr Footer: ArcGIS 10.7.1, 2020-10-14 2032 File: \\Projects\\23\\231351\\Maps\\Reports\\SolarRanking\\Figure5 MnEQB CLP RedwoodCounty Sitelayout BondParcels.mxd User: amn



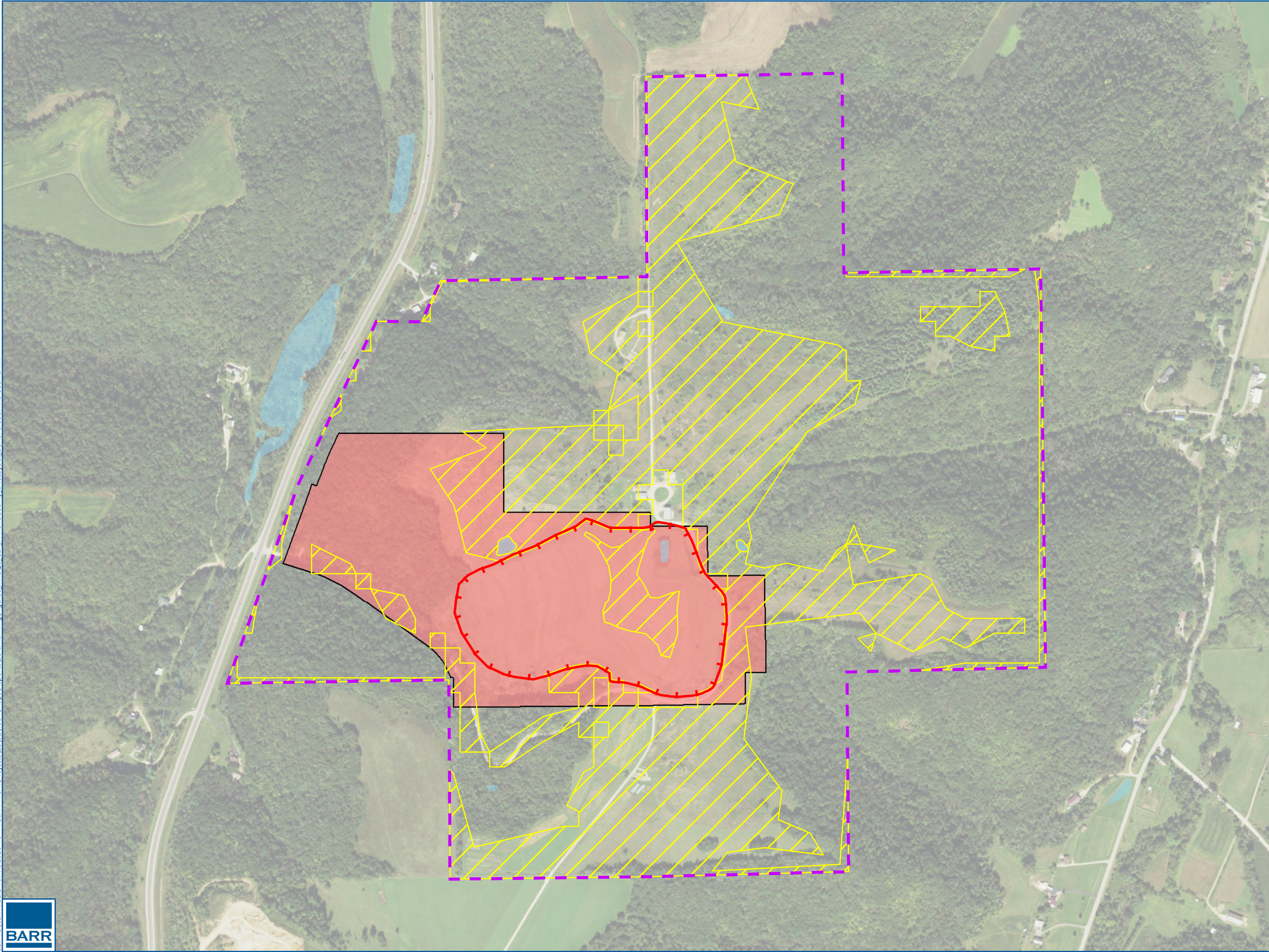
- Land Management Area
- Waste Footprint
- Buildable Area (≈31.7 MW)
- County Boundary
- Parcel (Bond Status)**
 - Bonded Parcel
 - Wetlands
(National Wetlands Inventory)

Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.



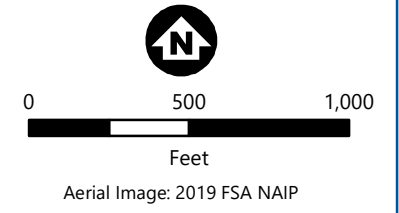
SITE LAYOUT
REDWOOD COUNTY LANDFILL
Minnesota Environmental
Quality Board
Redwood County
Redwood Falls, Minnesota

FIGURE 5



- Land Management Area
- Waste Footprint
- Buildable Area (≈30.9 MW)
- County Boundary
- Parcel (Bond Status)**
- Bonded Parcel
- Wetlands
(National Wetlands Inventory)

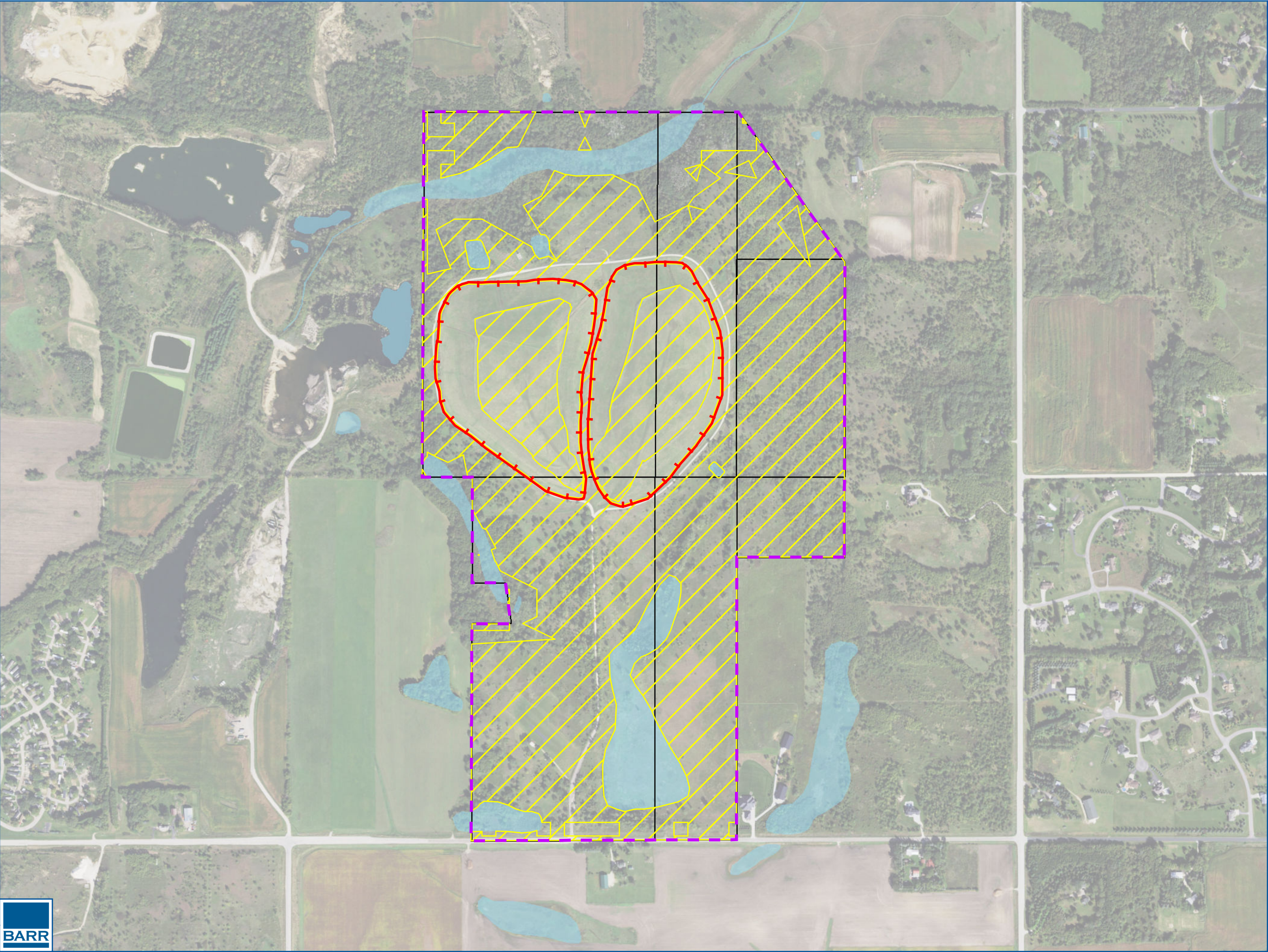
Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.



SITE LAYOUT
WINONA COUNTY LANDFILL
Minnesota Environmental
Quality Board
Winona County
Winona, Minnesota

FIGURE 6

Barr Footer: ArcGIS 10.7.1, 2020-10-15 13:57 File: I:\Projects\23\231351\Maps\Reports\SolarRanking\Figure7 MneQB CLD OlmstedCounty_SiteLayout_BondParcels.mxd User: amn



EQB Packet Page - 72

Olmsted County

Land Management Area

Waste Footprint

Buildable Area (≈44.8 MW)

County Boundary

Parcel (Bond Status)

Bonded Parcel

Wetlands
(National Wetlands Inventory)

Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

0 600 1,200
Feet

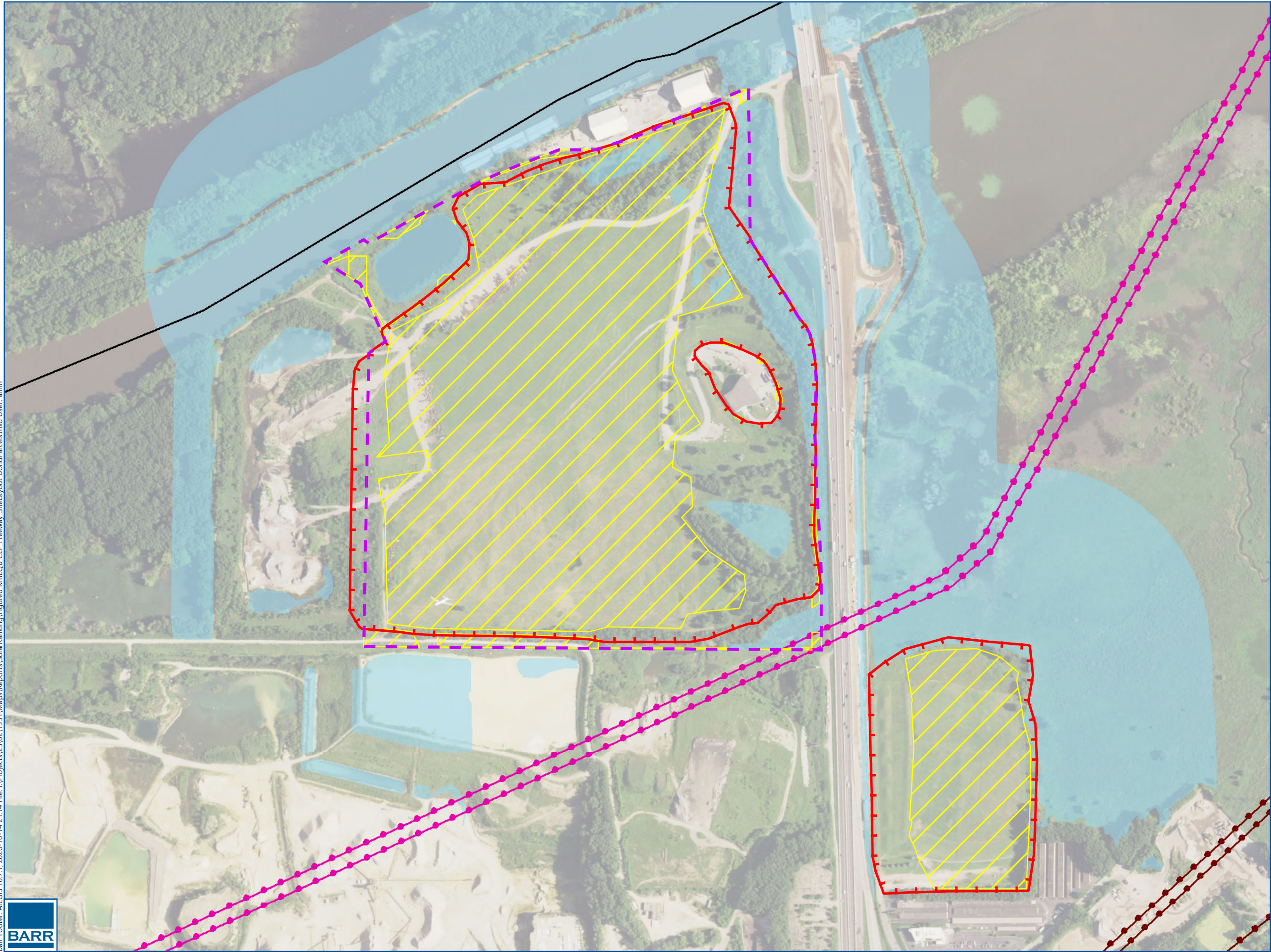
Aerial Image: 2019 FSA NAIP

SITE LAYOUT
OLMSTED COUNTY LANDFILL
Minnesota Environmental
Quality Board
Olmsted County
Oronoco, Minnesota

FIGURE 7



Barr Footer: ArcGIS 10.7.1, 2020-10-14 21:14 File: I:\Projects\23\62\1351\Maps\Reports\SolarRanking\Figure8 MnEQB CLP Freeway SiteLayout BondParcels.mxd User: amn



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Land Management Area

Waste Footprint

Buildable Area (≈23.6 MW)

County Boundary

Parcel (Bond Status)

Bonded Parcel

Wetlands
(National Wetlands Inventory)

Electric Transmission

34kV - 115kV

116kV - 500kV

Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

0 400 800
Feet

Aerial Image: 2019 FSA NAIP

SITE LAYOUT
FREEWAY LANDFILL
Minnesota Environmental
Quality Board
Dakota County
Burnsville, Minnesota

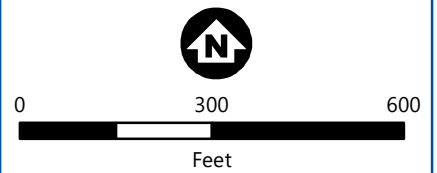
FIGURE 8

Barr Footer: ArcGIS 10.7.1, 2020-10-14 21:21 File: I:\Projects\23\1351\Maps\Reports\SolarRanking\Figure9 MneEQB CLD Hibbing SiteLayout_BondParcels.mxd User: ammm



- Land Management Area
- Waste Footprint
- Buildable Area (≈12.4 MW)
- County Boundary
- Parcel (Bond Status)**
 - Bonded Parcel
 - Wetlands
(National Wetlands Inventory)
- Electric Transmission**
 - 34kV - 115kV

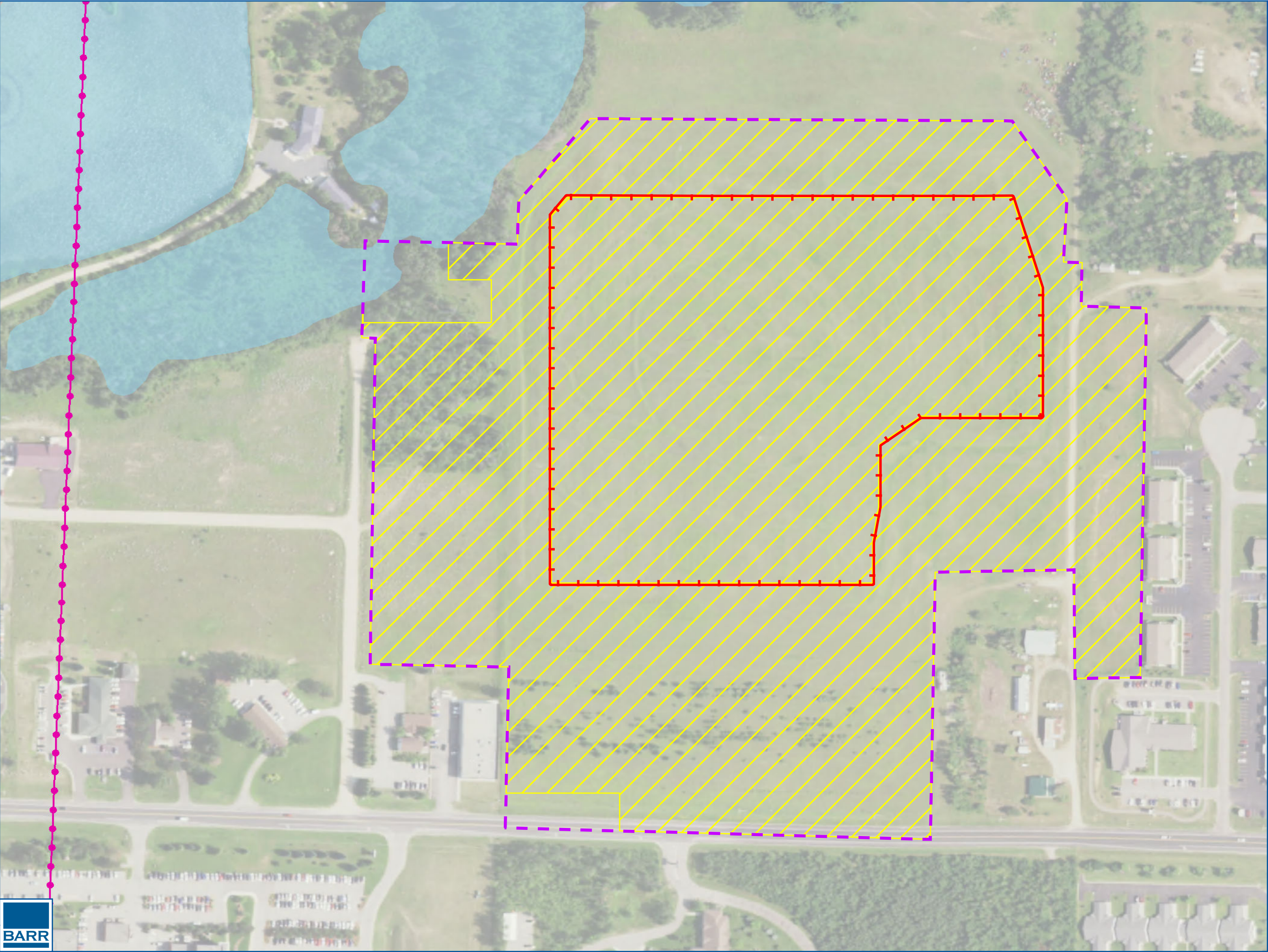
Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.



Aerial Image: 2019 FSA NAIP

SITE LAYOUT
HIBBING LANDFILL
Minnesota Environmental
Quality Board
St. Louis County
Duluth, Minnesota

FIGURE 9



EQB Packet Page - 75

- Land Management Area
- Waste Footprint
- Buildable Area (≈11.1 MW)
- County Boundary

Parcel (Bond Status)

- Bonded Parcel
- Wetlands
(National Wetlands Inventory)

Electric Transmission

- 34kV - 115kV

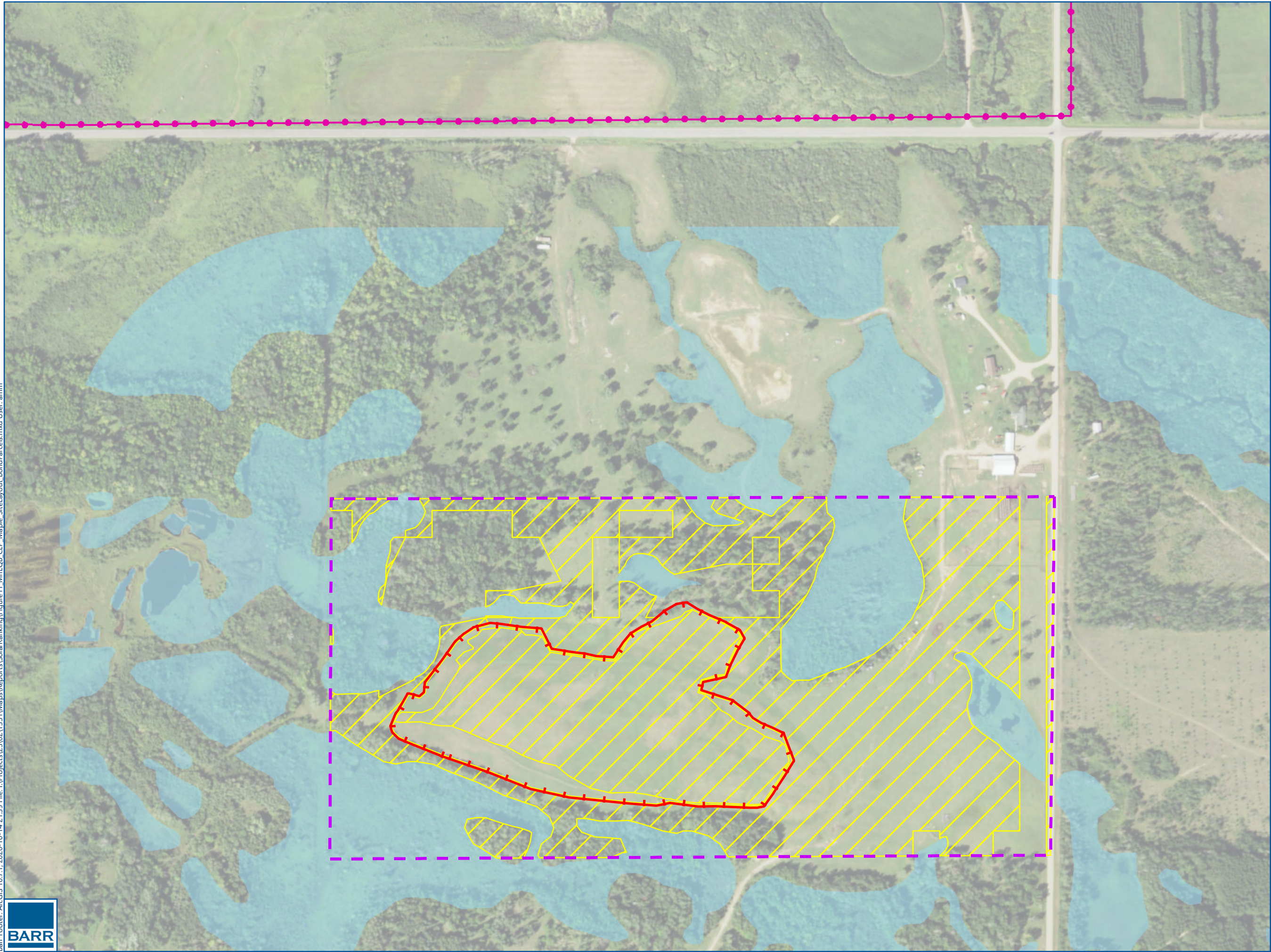
Notes
Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

0 200 400
Feet
Aerial Image: 2019 FSA NAIP

SITE LAYOUT
KUMMER LANDFILL
Minnesota Environmental
Quality Board
Beltrami County
Bemidji, Minnesota

FIGURE 10

Barr Footer: ArcGIS 10.7.1, 2020-10-14 21:39 File: I:\Projects\23\231351\Maps\Reports\SolarRanking\Figure11_MnEOB CLP Maple_Sitelayout_BondParcels.mxd User: amn



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- Land Management Area
- Waste Footprint
- Buildable Area (≈10.6 MW)
- County Boundary

Parcel (Bond Status)

- Bonded Parcel
- Wetlands
(National Wetlands Inventory)

Electric Transmission

- 34kV - 115kV

Notes

Wetlands shown have been clipped down to include the Land Management Area and 1000 feet buffer.

Aerial Image: 2019 FSA NAIP

SITE LAYOUT
MAPLE LANDFILL
Minnesota Environmental
Quality Board
Cass County
Pequot Lakes, Minnesota

FIGURE 11

Appendices

Appendix A

Closed Landfill Program Property Owners

Closed Landfill Program Property Owners

Landfill	Property Owner
Adams Landfill	City of Adams
Aitkin Area Landfill	Aitkin County
Albert Lea Landfill	City of Albert Lea
Anderson Landfill	State of Minnesota
Anoka-Ramsey Landfill	State of Minnesota
Barnesville Landfill	State of Minnesota
Battle Lake Landfill	City of Battle Lake; Clitherall & Everts Townships
Becker County Landfill	Becker County
Benson Landfill	State of Minnesota
Big Stone County Landfill	State of Minnesota
Brookston Area Landfill	St. Louis County
Bueckers #1 Landfill	State of Minnesota
Bueckers #2 Landfill	Ervin J. Bueckers Trust
Carlton County #2 Landfill	Carlton County
Carlton County South Landfill	Carlton County
Chippewa County Landfill	Chippewa County
Cook Area Landfill	St. Louis County
Cook County Landfill	Cook County
Cotton Area Landfill	St. Louis County
Crosby American Properties Landfill	State of Minnesota
Crosby Landfill	City of Crosby; State (Department of Natural Resources)
Crow Wing County Landfill	Crow Wing County
Dakhue Landfill	State of Minnesota
Dodge County Landfill	Dodge County
East Bethel Landfill	State of Minnesota
East Mesaba Landfill	State of Minnesota
Eighty Acre Landfill	City of Bemidji
Faribault County Landfill	Faribault County
Fifty Lakes Landfill	Crow Wing County
Floodwood Landfill	State of Minnesota
Flying Cloud Landfill	State of Minnesota
Freeway Landfill	RB McGowan Co., Inc.
French Lake Landfill	State of Minnesota
Geislars Landfill	John David Fort & Thomas Fort, et al.
Gofer Landfill	Martin County

Landfill	Property Owner
Goodhue Cooperative Landfill	John & Janice Holst Trust
Goodhue County Landfill	Goodhue County
Grand Rapids Area Landfill	Itasca County
Greenbush Landfill	City of Greenbush
Hansen Landfill	Harvey Hanel; Raymond & Evelyn Hanel Trust
Hibbing Landfill	St. Louis County
Hickory Grove Landfill	David & Lydia Simonson
Highway 77 Landfill	St. Louis County
Hopkins Landfill	City of Hopkins
Houston County Landfill	Hop Hollow, LLP
Hoyt Lakes Landfill	St. Louis County*
Hudson Landfill	St. Louis County
Iron Range Landfill	Itasca County
Ironwood Landfill	Wilderness Lake Estates, LLC; Brian Mildenstein
Isanti-Chisago County Landfill	State of Minnesota
Jackson County Landfill	Jackson County
Johnson Brothers Landfill	City of Blaine
Karlstad Landfill	State of Minnesota
Killian Landfill	Harlan & Myrna Killian
Kliver Landfill	State of Minnesota
Koochiching County Landfill	State of Minnesota
Korf Brothers Landfill	State of Minnesota
Kummer Landfill	Kummer Land Holding Co.*
La Crescent Landfill	City of La Crescent
La Grand Landfill	State of Minnesota
Lake County Landfill	Lake County
Lake of the Woods County Landfill	Lake of the Woods County
Land Investors, Inc. Landfill	State of Minnesota
Leech Lake Landfill	State of Minnesota
Leslie Benson Landfill	Joan Benson
Lincoln County Landfill	Lincoln County
Lindala Landfill	State of Minnesota
Lindenfelser Landfill	State of Minnesota
Long Prairie Landfill	State of Minnesota
Longville-Remer Landfill	Cass County
Louisville Landfill	State of Minnesota
Mahnomen County Landfill	State of Minnesota

Landfill	Property Owner
Mankato Landfill	State of Minnesota
Maple Landfill	Oakridge Ranch, LLC
McKinley Landfill	State of Minnesota
Meeker County Landfill	Meeker County
Mille Lacs County Landfill	Mille Lacs County
Minnesota Sanitation Services Landfill	State of Minnesota
Murray County Landfill	Murray County
Northeast Otter Tail County Landfill	Northeast Otter Tail County
Northome Landfill	Koochiching County
Northwest Angle Inlet Landfill	Lake of the Woods County
Northwoods Landfill	St. Louis County
Oak Grove Landfill	State of Minnesota
Olmsted County Landfill	State of Minnesota
Orr Landfill	St. Louis County
Paynesville Landfill	State of Minnesota
Pickett Landfill	State of Minnesota
Pine Lane Landfill	State of Minnesota
Pipestone County Landfill	State of Minnesota
Portage Modified Landfill	St. Louis County
Red Rock Landfill	State of Minnesota
Redwood County Landfill	Redwood County
Rock County Landfill	Rock County
Roseau County-Salol Landfill	State of Minnesota
Sauk Centre Landfill	State of Minnesota
Sibley County Landfill	Sibley County
St. Augusta Landfill	State of Minnesota
Stevens County Landfill	Stevens County
Sun Prairie Landfill	State of Minnesota
Tellijohn Landfill	Tom Kat Trux, Inc.; Tim Tellijohn
Vermillion Dam Landfill	St. Louis County
Vermillion Modified Landfill	State of Minnesota
Wabasha County Landfill	State of Minnesota
Wadena Landfill	City of Wadena
Walker-Hackensack Landfill	Cass County
Waseca County Landfill	Waseca County
Washington County Landfill	City of Lake Elmo*
Waste Disposal Engineering Landfill	State of Minnesota

Landfill	Property Owner
Watonwan County Landfill	Watonwan County
Western Lake Superior Sanitary District Landfill	State of Minnesota
Winona County Landfill	Winona County
Woodlake Landfill	State of Minnesota
Yellow Medicine County Landfill	Yellow Medicine County

Appendix B

Development of Criteria That Affect the Potential for Solar Development on Closed Landfills and Identification of Barriers

Appendix B

Development of Criteria That Affect the Potential for Solar Development on Closed Landfills and Identification of Barriers

Contents

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B1. Introduction

To identify criteria that affect the potential for solar development on closed landfills, as well as barriers and opportunities, Barr staff conducted a literature review (Section B2) and gathered stakeholder input in a variety of settings (Section B3).

B2. Literature Review

B2.1 Approach

Barr reviewed publicly available information retrieved from online resources. The goal of this task was to become familiar with case studies and key issues related to solar development on brownfield sites and benefit from previous studies/efforts that were publicly available.

B2.2 Results

The online materials from the EPA's Re-Powering America's Land website (<https://www.epa.gov/re-powering>) and the Massachusetts Siting Clean Energy at Closed Landfills website (<https://www.mass.gov/siting-clean-energy-at-closed-landfills>) are the best available sources of information for this project that we identified. We include highlights from these materials below. We also spoke to Laura Strine, United States Environmental Protection Agency (EPA), regarding the EPA website and resources. In addition, we reviewed and consulted state specific materials including presentations from the Closed Landfill Program (CLP) program and information from the Minnesota (MN) Office of Management and Budget regarding bonding of CLP sites.

B2.2.1 EPA's Repowering America's Land Website

EPA's Repowering America's Land website provided the following key information applicable to the MN Environmental Quality Board (EQB) CLP Solar project.

- Project Benefits
 - Improve the local tax base, create jobs, and turn blight into an economic opportunity. (RE-powering America's Land Initiative: Benefits Matrix https://www.epa.gov/sites/production/files/2019-12/documents/benefits_matrix_508_121119.pdf)
- Mapping and Screening Tools
 - Mapping tool with locations by state of a range of brownfield sites. Can search for MN only sites <https://www.epa.gov/re-powering/re-powering-mapper>
- Solar Decision Trees
 - The RE-Powering Electronic Decision Tree tool guides interested parties through a process to screen sites for their suitability for solar photovoltaics or wind installations. EPA encourages renewable energy on already developed or degraded land instead of green space <https://www.epa.gov/re-powering/re-powerings-electronic-decision->

[tree#:~:text=Developed%20by%20US%20EPA%27s%20RE-Powering%20America%27s%20Land%20Initiative%2C,developed%20or%20degraded%20land%20instead%20of%20green%20space](#)

- The tool addresses the following types of sites:
 - Potentially Contaminated Sites (Superfund, Brownfield, RCRA, mine site)
 - Landfill (Municipal Solid Waste, Construction and Demolition or similar unit)
 - Underutilized (Abandoned parcels, parking lots, buffer zones)
 - Rooftop (Solar PV only; Commercial / Industrial roofs)
- This informational resource will help ascertain whether potential barriers to a solar or wind project exist at a site of interest. It provides:
 - A step-by-step walk through of key considerations for renewable energy development at the site;
 - Suggested resources to help you answer screening questions to gauge the site's potential; and
 - Reports summarizing your answers to the screening questions, initial findings regarding suitability and other comments about the site.
- Feasibility Studies
 - National Renewable Energy Laboratory (NREL), 2013. Feasibility Study of Economics and Performance of Solar Photovoltaics at the Peru Mill Industrial Park in the City of Deming, New Mexico, **Technical Report** NREL/TP-7A30-58368 April 2013.
 - NREL, 2013. Feasibility Study of Economics and Performance of Solar Photovoltaics at the Former Chicago, Milwaukee, and St. Paul Rail Yard Company Site in Perry, Iowa, **Technical Report** NREL/TP-7A40-56793 March 2013.
- Solar on Landfills
 - Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills (<https://www.epa.gov/re-powering/best-practices-siting-solar-photovoltaics-municipal-solid-waste-landfills>)
- Financing projects https://www.epa.gov/sites/production/files/2015-06/documents/re-powering_financing_fact_sheet.pdf
 - Owner-operator financing, where the system is purchased directly
 - Third-party power purchase agreements, where the system is owned by an energy developer and the site owner purchases electricity for a given term.
 - Sale/lease back models, which enable the energy user, such as a city government, to use the energy through leasing agreements, while the system owner benefits from tax advantages.

- In several states, community solar gardens or virtual net metering policies enable energy developers to partner with consumers who subscribe to purchase power for a given period of time.
- For large, utility-scale projects, financing is typically provided through project banks. Development of these utility-scale projects typically employs complex financing deal structures. The potential project scale, site owner, market conditions, and renewable energy developer typically dictate the financing option.
- Available incentives and policies
 - EPA may have some funding sources; need more details from EPA about these.

B2.2.2 Massachusetts Siting Clean Energy at Closed Landfills

The Massachusetts Siting Clean Energy at Closed Landfills Program website <https://www.mass.gov/siting-clean-energy-at-closed-landfills> is user-friendly and leads the viewer to the requirements for developing solar on landfills in MA. The following information from that site is applicable to the MN EQB CLP Solar project.

- Highlights of the Program
- Factsheet that is brief and provides a concise overview and key procedures to development (<https://www.mass.gov/doc/fact-sheet-developing-renewable-energy-facilities-on-closed-landfills>)
 - Emphasizes key goals of these projects: not to compromise environmental protection from cap and provide income to landfill owners
 - Path to Approval
 - List of Resources
- Detailed Report (<https://www.mass.gov/doc/photovoltaics-on-massachusetts-landfills-0/download>)
 - Overview: outstanding guide to developing solar on landfills in Massachusetts; seems a terrific guide for other states trying to do the same thing
 - Incentives for solar (specific to landfills – RECs, net metering, ITC, accelerated depreciation)
 - Design considerations for solar on landfills (feasibility, construction considerations, specific landfill issues affecting solar development, post-closure use/maintenance)
 - Ownership structures (development tasks, municipal ownership, land leases, PPA, Credit Purchase Agreements, Hybrid land lease and PPA revenue structure)
 - Development and design considerations (permitting, interconnection, system design)
 - Project cost profile (design/engineering, permitting, interconnection, operations, monitoring, insurance, taxation)
 - Procurement (Solicitation, vendors, procurement)
 - Long term management (operations, equipment warranty, monitoring, end-of-life, buy-out provisions)

- Example projects
- Project checklists
- Permit List and Map <https://www.mass.gov/lists/closed-landfills-with-permits-for-renewable-energy>
 - Lists of tens of projects with permitting information
- Summarized top criteria for evaluating and developing solar on brownfields in Massachusetts are listed as follows. Note, they are not weighted, but all considered important and necessary for evaluation prior to developing these projects.
 - System ownership
 - Experience with solar development on brownfields
 - Experience with brownfields
 - Experience with operations and maintenance
 - Power purchasers
 - Utilities/ electric cooperatives
 - Municipalities
 - Behind-the-meter
 - Hybrid ownership for power purchase
 - Power purchase arrangements and incentives
 - Power purchase agreements (PPAs)
 - Net Metering
 - State incentives
 - Other
 - Proximity to transmission and distribution Lines
 - Environmental factors
 - Cap age and settlement
 - Permitting challenges – political or environmental
 - NIMBYism or project opposition
 - Key natural resources: threatened/endangered species; wetlands; other protected/regulated resources

B3. Gathering Stakeholder Input

B3.1 Minnesota Brightfields Conference

Barr staff attended a Minnesota Brightfields conference on February 20, 2020 and heard from a range of experts from the EPA, State of MN, developers, non-profits, industry representatives, and consultants. That conference assisted in providing some background and context for this study.

B3.2 Virtual Focus Group Meetings

The scope of work required two in-person focus group meetings to gather feedback on stakeholders' concerns, questions, and perceived barriers to solar development on closed landfills. The COVID-19 pandemic required us to modify our approach and provide an on-line venue for these meetings.

Barr invited representatives from solar development companies, general contractors, utilities, transmission system operators (Midcontinent Independent System Operator (MISO)), state governments, local governments, and non-profit organizations who have experience and/or interest in both solar development and landfills. Attendees were identified from lists of people who had previously attended conferences and events focused on solar development on brownfields. Barr reached out to people individually to gauge their interest and obtained additional recommendations for persons to invite. Through this process of identifying potential participants, we heard several names repeated as persons who could contribute to this project. The invitee list was reviewed with the EQB and other project leads. In total, approximately 125 people were invited to the virtual focus group sessions.

Barr held two virtual focus group meetings via WebEx (full audio and video) for approximately 2 hours each on March 27, 2020 and April 1, 2020. Each meeting was attended by approximately 15 to 20 participants, representing a mix of industry categories. The sessions included a project introduction, overview of MN Closed Landfills, an introduction to the draft Web tool (description provided in next paragraph), results from a survey sent to all participants, and small and large group discussions.

The draft Web tool started with the list of 114 land management areas. The tool includes many key site features including facility address, local utility, solid waste permit number, land management area size, waste-footprint size, power transmission lines, power distribution lines, and substations. The tool allows users to query sites by a range of site features. The query function allows users to put in ranges of values. For example, a user can query "sites larger than 5 acres; sites less than 1 mile from transmission; sites more than 1 mile from a substation, etc."

Additional information was gathered from a survey questionnaire included with the invitation to the focus group meetings, which invitees were allowed to complete up to several weeks after the last focus group. There were 11 total respondents: four worked in state government, two were solar developers, two were contractors (not solar), one worked in local government, and two fell into the category of "other." One of those in the "other" category did brownfields work for a nonprofit.

A summary of responses received from stakeholders following the focus group meetings indicated that perceived benefits of placing solar energy on closed landfill sites include:

- trees and vegetation would not need to be removed
- the presence of pollinators/native vegetation could be encouraged
- there may be greater public acceptance of this use
- the site may generate tax revenue to local governments
- local governments may buy power
- states may issue incentives for this type of use

Respondents also documented some perceived negatives for developing solar energy on closed landfills. These include:

- greater costs for constructing solar facilities
- geotechnical challenges inherent at these sites
- public distaste for seeing solar arrays
- access to monitoring wells and vents may be required, which could reduce MWs per acre
- production may be too little to gain utility interest
- sites may be too far from transmission lines to make distribution economical
- there is no one clearing house to aid developers
- access to private funding is difficult

Notes from six small group discussions held during the two focus group meetings were prepared by volunteers in each small group and forwarded to Barr for review. These small group notes and the observations of focus group facilitators and agency committee members provided important input to our identification of barriers and opportunities, which fed into our initial development of the comprehensive list of criteria affecting the feasibility of solar development on CLP sites.

B3.3 One-on-one Discussions

Following the focus group meetings, Barr reached out to individuals regarding specific feedback to obtain more information and to clarify key findings or observations. They included solar developers with much experience developing solar projects on landfills across the U.S., utility representatives, both from investor owned utilities and regional electric cooperatives, solar contractors and vendors with experience constructing solar projects on landfills, and energy experts from government or non-profit organizations. These follow up meetings were critical to analyzing information obtained during the focus group meetings and clarifying key points and feedback.

B3.4 EPA – Brightfields Program

Following the focus group meetings, the EQB set up a meeting with EPA staff, Minnesota's Interagency Solar on Closed Landfills team, and Barr to discuss opportunities and barriers to solar development on CLP sites and the potential for technical assistance from EPA. The meeting was held April 20, 2020 and was led by Laura Strine, EPA's RE-Powering America's Lands Initiative Coordinator. The EPA provided information regarding state policies, incentive programs, and strategic engagement for communities to states such as Massachusetts, New Jersey, New Hampshire, and Colorado who are developing or interested in developing solar on brownfields. The EPA has provided technical assistance regarding streamlining permitting programs, and financial analyses to assist states in determining whether there is

enough added economic benefit to make a solar project at a brownfield site viable. They have expertise in examining brownfield sites and assisting in understanding issues such as liability, clean-up requirements, and financial incentives. The EPA has also developed its own mapping tool to identify a broad range of energy projects on brownfield sites across the United States.

The EPA provided some feedback gleaned from their work across the country looking at solar development on brownfields. First, it appears that state financial incentives have played a key role in the viability of solar development. Second, site characteristics and solar radiance are less important than having sufficient financial support for this development. Third, identifying who will purchase the power and sign a power purchase agreement is critical to successful project development.

The EPA works closely with the National Renewable Energy Laboratory (NREL). NREL has performed detailed analyses of the viability of solar development at specific brownfield sites throughout the United States. The EPA agreed to work with NREL to offer a commitment to reviewing one or more MN CLP sites and their potential for solar development including opportunities and barriers.

B3.5 NREL Assessment

During discussions with contacts in EPA's Repowering Americas Land program, connections were made with staff at NREL who offered to provide an analysis of the techno-economic viability of a standalone solar PV system for one of MN's CLP sites. MPCA staff chose the Becker site as there has been strong local interest. Meetings were held with Barr Engineering, MPCA, and other members of the team of agency staff working on this study to set the parameters of the study and exchange information needed for the analysis. The results of the NREL study of the Becker site are pending and were not available for use in this study report.

B3.6 Interagency Team Meetings

The MN EQB organized bi-weekly meetings throughout the course of this study. Participants included MPCA, Mn EQB, Mn MMB, Mn COMM, Met Council, and Barr. Typical agenda items included: criteria, geospatial analysis results, ranking of sites, barriers and opportunities, recommended actions, and conclusions. The issue of GOB restrictions was the subject of a great deal of discussion as this is a very complicated issue and everyone involved was focused on providing an accurate portrayal of the issue and reasonable recommendations.

B3.7 Criteria Development Focus Group Meeting

Following the development of site criteria and some initial site evaluation and scoring, we held a (full audio) focus group meeting on July 13, 2020 with a subset of participants from the first focus group meetings. We discussed the initial site scoring results. We focused on some key criteria: solar generation potential (nameplate capacity – on the waste footprint, and on the buffer area) and distance to transmission/distribution/substations. We also experimented with weighting the scores.

Appendix C

Ranking of all Minnesota CLP Sites

Appendix C Ranking of all Minnesota CLP Sites

Site Name	City	County	Total Site Area (Acres)	Site Nameplate Capacity (MW)	Site Capacity Score	Buildable Cap Area (acres)	Cap Nameplate Capacity, Buildable Area (MW)	Cap Capacity Score	Buildable Buffer Area (acres)	Buffer Nameplate Capacity Buildable Area (MW)	Buffer Capacity Score	Nearest Substation Distance (miles)	Substation Score	Composite Score	General Obligation Bond Status
Flying Cloud Landfill	Eden Prairie	Hennepin	235.83	43.1	5	60.1	12.5	3	147.2	30.6	5	1.4	10	560	Bonded
Western Lake Superior Sanitary District Landfill	Duluth	St. Louis	471.14	40.3	5	61.8	12.8	3	131.9	27.4	4	2.2	10	540	Bonded
Olmsted County Landfill	Oronoco	Olmsted	294.92	44.8	5	31.9	6.6	2	183.6	38.2	5	3.4	9	520	Not Bonded
Anoka-Ramsey Landfill	Ramsey	Anoka	267.40	27.5	4	4.0	0.8	1	128.1	26.6	4	0.9	10	460	Bonded
Redwood County Landfill	Redwood Falls	Redwood	158.53	31.7	4	22.7	4.7	1	129.7	27.0	4	5.4	9	440	Bonded
Winona County Landfill	Winona	Winona	414.92	30.9	4	5.1	1.1	1	143.7	29.9	4	3.0	9	440	Bonded
Red Rock Landfill	Austin	Mower	159.41	26.6	4	39.8	8.3	2	88.0	18.3	3	3.1	9	440	Bonded
Freeway Landfill	Burnsville	Dakota	148.72	23.6	3	113.7	23.6	5	0.0	0.0	1	1.5	10	440	Not Bonded
Albert Lea Landfill	Albert Lea	Freeborn	173.39	17.6	2	24.5	5.1	2	60.2	12.5	2	0.8	10	360	Bonded
Woodlake Landfill	Medina	Hennepin	194.01	17.3	2	44.7	9.3	2	38.5	8.0	2	2.6	10	360	Bonded
St. Augusta Landfill	St. Cloud	Stearns	117.68	17.1	2	32.7	6.8	2	49.4	10.3	2	0.8	10	360	Bonded
Waste Disposal Engineering Landfill	Andover	Anoka	121.81	17.0	2	49.9	10.4	3	31.8	6.6	1	0.4	10	360	Bonded
Oak Grove Landfill	Oak Grove	Anoka	158.10	15.8	2	30.2	6.3	2	45.8	9.5	2	1.9	10	360	Bonded
Washington County Landfill	Lake Elmo	Washington	129.01	12.9	2	14.1	2.9	1	47.9	10.0	2	2.6	10	340	Bonded
Hibbing Landfill	Hibbing	St. Louis	80.11	12.4	2	25.0	5.2	2	34.7	7.2	1	1.0	10	340	Not Bonded
Grand Rapids Area Landfill	Grand Rapids	Itasca	114.71	11.3	2	13.2	2.7	1	41.3	8.6	2	2.5	10	340	Bonded
Dakhue Landfill	Hampton	Dakota	79.92	11.3	2	16.4	3.4	1	38.1	7.9	2	2.2	10	340	Bonded
Leech Lake Landfill	Cass Lake	Hubbard	82.58	11.1	2	14.9	3.1	1	38.7	8.0	2	0.6	10	340	Bonded
East Mesaba Landfill	Virginia	St. Louis	222.14	15.1	2	8.0	1.7	1	64.7	13.5	2	3.0	9	320	Bonded
Waseca County Landfill	Waseca	Waseca	125.30	14.6	2	6.3	1.3	1	64.2	13.3	2	4.6	9	320	Bonded
Kummer Landfill	Bemidji	Beltrami	53.92	11.1	2	19.5	4.1	1	33.7	7.0	1	1.9	10	320	Not Bonded
Maple Landfill	Pequot Lakes	Cass	80.88	10.6	2	13.3	2.8	1	37.9	7.9	2	4.2	9	320	Not Bonded
Meeker County Landfill	Litchfield	Meeker	76.77	9.0	2	17.9	3.7	1	25.2	5.2	1	1.5	10	320	Bonded
Tellijohn Landfill	Le Sueur	Le Sueur	84.98	15.1	2	14.3	3.0	1	58.3	12.1	2	5.8	8	300	Not Bonded
Roseau County-Salol Landfill	Salol	Roseau	101.53	12.0	1	28.5	5.9	2	29.0	6.0	1	2.1	10	300	Not Bonded
Wadena Landfill	Wadena	Wadena	128.13	11.4	2	9.1	1.9	1	45.6	9.5	2	7.8	8	300	Bonded
Watonwan County Landfill	St. James	Watonwan	71.17	11.4	2	21.6	4.5	1	33.1	6.9	1	4.5	9	300	Bonded
Yellow Medicine County Landfill	Granite Falls	Yellow Medicine	96.52	11.0	2	17.9	3.7	1	34.9	7.3	1	3.5	9	300	Bonded

Site Name	City	County	Total Site Area (Acres)	Site Nameplate Capacity (MW)	Site Capacity Score	Buildable Cap Area (acres)	Cap Nameplate Capacity, Buildable Area (MW)	Cap Capacity Score	Buildable Buffer Area (acres)	Buffer Nameplate Capacity Buildable Area (MW)	Buffer Capacity Score	Nearest Substation Distance (miles)	Substation Score	Composite Score	General Obligation Bond Status
Lake of the Woods County Landfill	Williams	Lake of the Woods	97.55	10.9	2	10.4	2.2	1	42.2	8.8	2	6.4	8	300	Not Bonded
Goodhue Cooperative Landfill	Goodhue	Goodhue	85.16	10.3	1	5.4	1.1	1	44.4	9.2	2	2.2	10	300	Not Bonded
Louisville Landfill	Shakopee	Scott	60.21	6.3	1	28.0	5.8	2	2.5	0.5	1	1.4	10	300	Not Bonded
Ironwood Landfill	Spring Valley	Fillmore	142.69	12.6	1	10.0	2.1	1	50.8	10.6	2	4.4	9	280	Not Bonded
French Lake Landfill	French Lake	Wright	79.68	9.5	1	4.6	0.9	1	41.1	8.6	2	4.2	9	280	Bonded
Walker-Hackensack Landfill	Hackensack	Cass	163.18	8.5	1	8.9	1.8	1	31.9	6.6	1	2.5	10	280	Not Bonded
Johnson Brothers Landfill	Blaine	Anoka	89.14	8.3	1	9.1	1.9	1	30.9	6.4	1	0.8	10	280	Not Bonded
Northwest Angle Inlet Landfill	Angle Inlet	Lake of the Woods	39.97	8.3	1	1.9	0.4	1	37.9	7.9	2	4.5	9	280	Not Bonded
Paynesville Landfill	Paynesville	Stearns	73.83	8.1	1	1.9	0.4	1	36.8	7.7	1	2.2	10	280	Bonded
East Bethel Landfill	East Bethel	Anoka	77.54	7.7	1	6.3	1.3	1	30.9	6.4	1	1.8	10	280	Bonded
Koochiching County Landfill	International Falls	Koochiching	42.78	7.5	1	20.9	4.3	1	15.3	3.2	1	2.3	10	280	Bonded
Becker County Landfill	Detroit Lakes	Becker	47.05	7.0	1	10.6	2.2	1	22.9	4.8	1	2.6	10	280	Bonded
Pine Lane Landfill	Wyoming	Chisago	66.08	6.9	1	19.0	3.9	1	14.1	2.9	1	1.9	10	280	Bonded
Fifty Lakes Landfill	Fifty Lakes	Crow Wing	149.41	6.3	1	4.9	1.0	1	25.6	5.3	1	0.7	10	280	Bonded
Battle Lake Landfill	Battle Lake	Otter Tail	79.08	6.3	1	4.1	0.9	1	26.2	5.5	1	0.8	10	280	Bonded
Hopkins Landfill	Hopkins	Hennepin	33.57	6.1	1	16.3	3.4	1	12.9	2.7	1	2.1	10	280	Bonded
Lincoln County Landfill	Ivanhoe	Lincoln	34.39	6.0	1	0.0	0.0	1	28.9	6.0	1	1.1	10	280	Bonded
Hoyt Lakes Landfill	Hoyt Lakes	St. Louis	79.15	5.9	1	12.9	2.7	1	15.4	3.2	1	1.8	10	280	Not Bonded
Dodge County Landfill	Kasson	Dodge	42.74	5.8	1	4.8	1.0	1	23.2	4.8	1	0.7	10	280	Bonded
Sibley County Landfill	Gaylord	Sibley	39.58	5.7	1	0.8	0.2	1	26.6	5.5	1	0.7	10	280	Not Bonded
Lindala Landfill	Annandale	Wright	69.32	5.7	1	5.2	1.1	1	22.1	4.6	1	0.1	10	280	Bonded
Benson Landfill	Benson	Swift	47.29	5.7	1	4.0	0.8	1	23.4	4.9	1	2.7	10	280	Not Bonded
Cook Area Landfill	Cook	St. Louis	40.58	5.4	1	4.7	1.0	1	21.2	4.4	1	1.9	10	280	Not Bonded
Cotton Area Landfill	Cotton	St. Louis	24.77	5.1	1	2.7	0.6	1	21.7	4.5	1	2.3	10	280	Bonded
Geislers Landfill	Winona	Winona	39.21	4.6	1	0.0	0.0	1	22.0	4.6	1	2.1	10	280	Not Bonded
Eighty Acre Landfill	Bemidji	Beltrami	40.42	4.5	1	6.7	1.4	1	15.0	3.1	1	0.9	10	280	Bonded
Crosby American Properties Landfill	Inver Grove Heights	Dakota	50.98	4.3	1	15.6	3.3	1	5.2	1.1	1	0.5	10	280	Not Bonded
Karlstad Landfill	Karlstad	Kittson	19.84	4.0	1	3.6	0.7	1	15.8	3.3	1	1.9	10	280	Not Bonded
Stevens County Landfill	Morris	Stevens	20.57	3.9	1	12.9	2.7	1	5.7	1.2	1	1.3	10	280	Bonded
Bueckers #1 Landfill	Melrose	Stearns	30.60	3.1	1	9.1	1.9	1	6.0	1.2	1	2.0	10	280	Bonded

Site Name	City	County	Total Site Area (Acres)	Site Nameplate Capacity (MW)	Site Capacity Score	Buildable Cap Area (acres)	Cap Nameplate Capacity, Buildable Area (MW)	Cap Capacity Score	Buildable Buffer Area (acres)	Buffer Nameplate Capacity Buildable Area (MW)	Buffer Capacity Score	Nearest Substation Distance (miles)	Substation Score	Composite Score	General Obligation Bond Status
Iron Range Landfill	Taconite	Itasca	44.84	3.0	1	6.9	1.4	1	7.3	1.5	1	1.4	10	280	Not Bonded
Sauk Centre Landfill	Sauk Centre	Stearns	19.70	2.8	1	2.9	0.6	1	10.7	2.2	1	2.6	10	280	Bonded
Floodwood Landfill	Floodwood	St. Louis	39.36	2.6	1	4.5	0.9	1	8.1	1.7	1	2.3	10	280	Not Bonded
Northeast Otter Tail County Landfill	New York Mills	Otter Tail	21.49	2.5	1	5.7	1.2	1	6.5	1.3	1	1.9	10	280	Not Bonded
Murray County Landfill	Slayton	Murray	16.34	2.5	1	6.8	1.4	1	5.3	1.1	1	1.8	10	280	Bonded
Aitkin Area Landfill	Aitkin	Aitkin	52.47	2.3	1	2.0	0.4	1	9.3	1.9	1	2.2	10	280	Not Bonded
Northome Landfill	Northome	Koochiching	36.26	2.2	1	2.5	0.5	1	8.3	1.7	1	2.3	10	280	Not Bonded
Pickett Landfill	Park Rapids	Hubbard	16.92	2.2	1	5.3	1.1	1	5.3	1.1	1	2.4	10	280	Bonded
Carlton County South Landfill	Moose Lake	Carlton	39.18	2.1	1	2.8	0.6	1	7.1	1.5	1	2.6	10	280	Not Bonded
Adams Landfill	Adams	Mower	12.87	1.7	1	0.0	0.0	1	8.2	1.7	1	0.4	10	280	Not Bonded
Greenbush Landfill	Greenbush	Roseau	8.13	1.6	1	0.0	0.0	1	7.9	1.6	1	1.2	10	280	Not Bonded
Hickory Grove Landfill	McGrath	Aitkin	10.07	1.5	1	5.9	1.2	1	1.4	0.3	1	2.6	10	280	Not Bonded
Bueckers #2 Landfill	Avon	Stearns	89.04	1.5	1	0.4	0.1	1	6.6	1.4	1	2.0	10	280	Not Bonded
La Crescent Landfill	LaCrescent	Houston	15.68	1.3	1	6.2	1.3	1	0.0	0.0	1	0.1	10	280	Not Bonded
Leslie Benson Landfill	Dassel	Meeker	8.24	1.0	1	0.8	0.2	1	4.1	0.8	1	1.6	10	280	Not Bonded
Chippewa County Landfill	Montevideo	Chippewa	46.85	8.5	1	12.5	2.6	1	28.5	5.9	1	4.0	9	260	Not Bonded
Mille Lacs County Landfill	Milaca	Mille Lacs	61.91	8.3	1	2.9	0.6	1	37.0	7.7	1	4.9	9	260	Not Bonded
Rock County Landfill	Luverne	Rock	52.08	7.8	1	13.0	2.7	1	24.8	5.2	1	3.7	9	260	Bonded
Carlton County #2 Landfill	Twin Lakes Township	Carlton	116.03	7.8	1	18.8	3.9	1	18.9	3.9	1	4.8	9	260	Not Bonded
Isanti-Chisago County Landfill	Stanley	Isanti	64.52	7.5	1	16.7	3.5	1	19.5	4.1	1	3.1	9	260	Bonded
Korf Brothers Landfill	Pine City	Pine	78.71	7.1	1	12.1	2.5	1	22.2	4.6	1	4.1	9	260	Not Bonded
La Grand Landfill	Alexandria	Douglas	70.47	6.6	1	1.2	0.3	1	30.3	6.3	1	5.3	9	260	Bonded
Gofer Landfill	Fairmont	Martin	38.82	6.5	1	6.8	1.4	1	24.5	5.1	1	3.0	9	260	Bonded
Hansen Landfill	Mankato	Blue Earth	39.69	6.3	1	7.1	1.5	1	23.0	4.8	1	3.6	9	260	Not Bonded
Sun Prairie Landfill	Le Center	Le Sueur	32.87	5.0	1	10.0	2.1	1	14.2	2.9	1	4.5	9	260	Not Bonded
Hudson Landfill	Aurora	St. Louis	40.56	5.0	1	9.0	1.9	1	15.0	3.1	1	4.5	9	260	Not Bonded
Jackson County Landfill	Lakefield	Jackson	24.44	5.0	1	13.3	2.8	1	10.7	2.2	1	3.6	9	260	Not Bonded
Crosby Landfill	Crosby	Crow Wing	80.75	4.3	1	4.6	1.0	1	16.2	3.4	1	5.2	9	260	Bonded
Long Prairie Landfill	Long Prairie	Todd	128.65	3.6	1	2.7	0.6	1	14.8	3.1	1	3.4	9	260	Not Bonded
Brookston Area Landfill	Brookstone	St. Louis	19.23	3.4	1	5.0	1.0	1	11.3	2.3	1	3.4	9	260	Not Bonded

Site Name	City	County	Total Site Area (Acres)	Site Nameplate Capacity (MW)	Site Capacity Score	Buildable Cap Area (acres)	Cap Nameplate Capacity, Buildable Area (MW)	Cap Capacity Score	Buildable Buffer Area (acres)	Buffer Nameplate Capacity Buildable Area (MW)	Buffer Capacity Score	Nearest Substation Distance (miles)	Substation Score	Composite Score	General Obligation Bond Status
Mankato Landfill	Mankato	Blue Earth	17.68	3.3	1	11.2	2.3	1	4.6	1.0	1	3.6	9	260	Bonded
Longville-Remer Landfill	Remer	Cass	39.81	2.5	1	2.3	0.5	1	9.8	2.0	1	4.8	9	260	Not Bonded
Minnesota Sanitation Services Landfill	Kasota	Le Sueur	17.48	1.9	1	2.4	0.5	1	6.5	1.4	1	3.3	9	260	Not Bonded
Mahnomen County Landfill	Mahnomen	Mahnomen	31.38	1.4	1	3.1	0.6	1	3.9	0.8	1	3.2	9	260	Not Bonded
Land Investors, Inc. Landfill	Sauk Rapids	Benton	8.51	0.8	1	0.0	0.0	1	3.7	0.8	1	3.5	9	260	Bonded
Wabasha County Landfill	Kellogg	Wabasha	25.50	0.7	1	1.2	0.3	1	2.3	0.5	1	3.6	9	260	Bonded
McKinley Landfill	McKinley	St. Louis	5.55	0.6	1	0.0	0.0	1	2.8	0.6	1	4.5	9	260	Not Bonded
Lindenfelser Landfill	St. Michael	Wright	73.92	8.7	1	20.8	4.3	1	20.9	4.4	1	5.8	8	240	Bonded
Cook County Landfill	Grand Marais	Cook	99.27	7.7	1	0.3	0.1	1	37.0	7.7	1	5.6	8	240	Not Bonded
Lake County Landfill	Two Harbors	Lake	40.60	7.6	1	32.3	6.7	2	4.1	0.9	1	9.3	7	240	Not Bonded
Pipestone County Landfill	Pipestone	Pipestone	41.09	6.8	1	10.4	2.2	1	22.3	4.6	1	5.7	8	240	Bonded
Faribault County Landfill	Bricelyn	Faribault	41.23	6.6	1	11.2	2.3	1	20.8	4.3	1	6.8	8	240	Bonded
Killian Landfill	Motley	Todd	79.88	6.3	1	6.5	1.3	1	24.0	5.0	1	5.9	8	240	Not Bonded
Northwoods Landfill	Babbitt	St. Louis	95.55	5.5	1	6.2	1.3	1	20.3	4.2	1	6.2	8	240	Bonded
Kluver Landfill	Alexandria	Douglas	28.79	4.9	1	13.8	2.9	1	9.8	2.0	1	8.1	8	240	Not Bonded
Orr Landfill	Orr	St. Louis	31.90	1.1	1	0.7	0.1	1	4.7	1.0	1	10.8	7	220	Not Bonded
Vermilion Dam Landfill	Cook	St. Louis	41.06	5.4	1	0.0	0.0	1	26.0	5.4	1	13.5	6	200	Not Bonded
Barnesville Landfill	Barnesville	Wilkin	21.22	4.4	1	5.7	1.2	1	15.5	3.2	1	11.3	6	200	Not Bonded
Vermilion Modified Landfill	Tower	St. Louis	44.87	4.0	1	0.8	0.2	1	18.4	3.8	1	13.0	6	200	Bonded
Big Stone County Landfill	Beardsley	Big Stone	20.56	2.8	1	5.2	1.1	1	8.5	1.8	1	12.2	6	200	Bonded
Anderson Landfill	Sebeka	Wadena	27.07	2.0	1	2.0	0.4	1	7.5	1.6	1	13.2	6	200	Bonded
Highway 77 Landfill	Tower	St. Louis	39.29	0.4	1	1.5	0.3	1	0.6	0.1	1	12.9	6	200	Not Bonded
Portage Modified Landfill	Orr	St. Louis	10.95	1.1	1	0.0	0.0	1	5.4	1.1	1	27.7	1	100	Not Bonded

Appendix D

Bonding Status for Closed Landfill Program Sites

Bonding Status for Closed Landfill Program Sites

Landfill	GOB Spent ⁽¹⁾	GOB Expiration Date ⁽²⁾	Area with GOB Restrictions (acres) ⁽³⁾	Area without GOB Restrictions (acres) ⁽⁴⁾
ALBERT LEA	\$6,958,084.58	2048.5	171	2
ANDERSON/SEBEKA	\$482,945.00	2038.5	26	1
ANOKA-RAMSEY	\$2,996,284.81	2042.5	154	113
BATTLE LAKE	\$690,528.30	2035.5	62	17
BECKER CO	\$4,165,375.00	2043.5	46	1
BIG STONE	\$420,429.16	2039.5	21	0
BUECKERS CONSTRUCTION	\$719,845.54	2034.5	28	3
COTTON	\$428,800.53	2040.5	24	0
CROSBY	\$961,300.54	2036.5	78	3
DAKHUE	\$1,118,561.11	2042.5	80	0
DODGE RD/RA	\$81,199.71	2037.5	37	6
EAST BETHEL	\$3,133,145.94	2044.5	77	0
EAST MESABA	\$1,155,950.59	2052.5	222	0
EIGHTY ACRE	\$1,182,676.03	2041.5	40	0
FARIBAULT	\$135,279.70	2041.5	41	1
FIFTY LAKES RD/RA	\$390,104.91	2037.5	107	43
FLYING CLOUD	\$1,819,811.21	2054.5	201	35
FRENCH LAKE	\$613,913.95	2037.5	80	0
GOFER	\$1,750,837.03	2044.5	37	2
GRAND RAPIDS	\$811,660.17	2042.5	66	49
HOPKINS	\$4,692,053.96	2052.5	33	0
ISANTI/CHISAGO RD/RA	\$705,488.79	2034.5	53	11
KOOCHICHING	\$8,141,445.96	2052.5	43	0
LAND INVESTORS	\$234,829.51	2035.5	8	0
LANDFILL BONDS/LAWS OF 1994	\$20,636.14	2038.5	not applicable	not applicable
LEECH LAKE	\$1,361,464.63	2042.5	66	16
LEGRAND	\$717,016.51	2044.5	70	0
LINCOLN/PIPESTONE	\$987,376.20	2035.5	74	2
LINDALA RD/RA	\$1,137,147.73	2038.5	69	0
LINDERFELSER	\$4,369,294.80	2041.5	68	6
MANKATO	\$890,456.84	2036.5	17	1
MEEKER	\$497,300.00	2042.5	75	2
MURRAY CO	\$394,561.22	2039.5	16	0
NORTHWOODS RD/RA	\$1,101,964.02	2037.5	74	21

Landfill	GOB Spent ⁽¹⁾	GOB Expiration Date ⁽²⁾	Area with GOB Restrictions (acres) ⁽³⁾	Area without GOB Restrictions (acres) ⁽⁴⁾
OAK GROVE	\$1,080,576.70	2041.5	149	9
PAYNESVILLE RA	\$993,495.46	2035.5	74	0
PICKETT CONSTRUCTION	\$1,263,636.94	2034.5	16	1
PINE LANE	\$4,868,228.51	2042.5	65	1
RED ROCK	\$3,436,073.90	2041.5	80	79
REDWOOD	\$1,019,665.95	2043.5	37	122
ROCK CO	\$994,678.00	2041.5	52	0
SAUK CENTRE	\$868,059.93	2042.5	19	0
ST AUGUSTA	\$4,332,304.79	2041.5	117	1
STEVENS CO	\$162,202.41	2042.5	20	0
VERMILLION RD/RA	\$735,309.68	2039.5	31	14
WABASHA RD	\$803,882.94	2038.5	25	0
WADENA	\$1,693,206.39	2036.5	127	1
WASECA	\$1,407,761.86	2042.5	73	53
WASHINGTON CO	\$4,294,062.52	2054.5	127	2
WASTE DISPOSAL ENGINEERING	\$2,019,767.83	2056.5	111	11
WATONWAN	\$2,730,766.79	2041.5	71	0
WINONA	\$4,456,303.82	2045.5	86	329
WLSSD	\$9,375,881.33	2051.5	317	154
WOODLAKE	\$5,019,158.88	2046.5	182	12
YELLOW MEDICINE	\$58,086.01	2039.5	50	47
TOTAL	\$106,880,880.76	null	4092	1174

Notes:

55 unique sites

Landfill bonds/Laws of 1994 was expenses for bond sales and not for any particular site

- (1) Sum of General Obligation Bond (GOB) spent per landfill. Some landfills have more than one GOB.
- (2) GOBs expire 37.5 years from last expenditure. Date is approximate as month/day of last expenditure not available for study. Years are fiscal years (July 1 - June 30)
- (3) Area with GOB restrictions provided by MPCA. Values are rounded to the nearest whole acre and should be considered approximate based on data available at time of study.
- (4) Area without GOB restrictions calculated as difference between total land management area and area with GOB restrictions. Values should be considered approximate.



RESOLUTION OF THE

MINNESOTA ENVIRONMENTAL QUALITY BOARD

Executive Order 19-28: Restoring Healthy, Diverse Pollinator Populations that Sustain and Enhance Minnesota's Environment, Economy, and Way of Life directs the Environmental Quality Board (EQB or Board) to:

- 1) Convene agency leadership to implement the executive order;
- 2) Convene the Interagency Pollinator Protection Team to provide operational support, ensure interagency coordination, develop cross-agency policies and programs, and report on progress toward statewide goals in a report to the Board by December 1 of each year; and
- 3) Establish a public engagement process, consistent with the vision for One Minnesota, to ensure public participation in pollinator policy and program development and build cross-sector partnerships.

The 2020-2021 EQB work plan directs interagency pollinator protection and public engagement efforts, with the desired long-term outcomes of increased public awareness and implementation of efforts to address pollinator stressors.

The Board resolves to:

- Approve the 2020 Minnesota State Agency Pollinator Report, to be released by December 1, 2020.
- Support cross-agency collaboration to implement the recommendations in the 2020 Minnesota State Agency Pollinator Report.
- Support cross-agency collaboration to continue developing the Civic Engagement Framework for Pollinator Protection.
- Convene future meetings to monitor progress and invite public input.

The Board approves and adopts the 2020 Minnesota State Agency Pollinator Report and the Civic Engagement Framework for Pollinator Protection on this 18th day of November, 2020.

Laura Bishop, Chair
Minnesota Environmental Quality Board

MINNESOTA STATE AGENCY POLLINATOR REPORT

2020 | Annual Report

DRAFT





Monarch caterpillar
on milkweed at the
Minnesota Zoo.
Photo by Erik Runquist

On the cover:
Dakota Skipper
butterflies in the wild.
Photo by Erik Runquist

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OVERVIEW

Pollinators face multiple threats including habitat loss, diseases, parasites, climate change, pesticides and more. Protecting pollinators requires a multipronged approach to address these stressors. There is no simple “silver bullet,” and collaboration across sectors, regions, and communities is essential for progress.

Despite these challenges, Minnesota is making progress toward three pollinator protection goals:

- Lands throughout Minnesota support healthy, diverse and abundant pollinator populations.
- Minnesotans will use pesticides judiciously and only when necessary.
- Minnesotans understand, value, and actively support pollinators.

The Interagency Pollinator Protection Team (IPPT) works collaboratively across state agencies and with external partners to strategically align resources to achieve measurable outcomes.

Highlights from 2020 include:

- The Minnesota Zoo’s Dakota Skipper breeding program found new Dakota skippers in reintroduction sites, first signs of potential recovery of this endangered species.
- The Lawns to Legumes pilot program is engaging the public across the state to increase pollinator habitat, and promote pollinator protection on private lands.
- Recent pollinator surveys and citizen science projects have begun to address the pollinator information gap.

Limited resources and knowledge of the thousands of pollinator species in Minnesota complicate the development of comprehensive pollinator protection strategies. Key actions to move progress forward include protecting remnant prairie, increasing conservation land holdings, promoting integrated pest management, and increasing funding for pollinator research and conservation.

It takes all of us

Supporting healthy and diverse pollinator populations in the state requires the continued participation of every Minnesotan. Here are a few ways to take action:

- Plant Minnesota-native plants around our homes, neighborhoods, and businesses that provide floral resources through spring, summer and fall.
- Schools, cities and towns can participate in sustainable community commitments that promote pollinator-friendly policies and initiatives.
- Use an integrated pest management approach to limit pollinator exposure to pesticides.
- Participate in citizen science activities to help further research efforts.
- Help spread the message about pollinator protection within your circles of influence.

We can all contribute to create a brighter future for pollinators in Minnesota! Let’s do it!

INTRODUCTION

The 2020 pollinator annual report contains scorecards that help us identify challenges and recommendations to move progress forward toward pollinator protection in Minnesota. In each section, the report highlights key programs and actions that have been instrumental for progress during this year.

Interagency Pollinator Protection Team

Executive Order 19-28 directs the Environmental Quality Board (EQB) to convene the IPPT and coordinate interagency efforts for pollinator

protection, develop cross-agency policies and programs, and report on progress toward pollinator protection goals in a report to the EQB by December 1 of each year. Members of ten State Agencies form the IPPT: Minnesota Department of Administration (ADMIN), Agriculture (MDA), Corrections (DOC), Education (MDE), Health (MDH), Natural Resources (DNR), Transportation (MnDOT), Pollution Control Agency (MPCA), Minnesota Board of Water and Soil Resources (BWSR), and the Minnesota Zoological Garden (MNZOO).



Hummingbird sphinx moth feeding on a wild bergamot flower.

Photo by Erik Runquist

SCORECARD

Key to Status

- GOOD Ahead of goals and expectations
- OKAY Meets goals and expectations
- FAIR Behind goals and expectations
- POOR Well behind goals and expectations
- ? Not enough data or too variable

Key to Trend

- ↗ Getting better
- ↔ About the same
- ↘ Getting worse
- ? Not enough data or too variable

The IPPT chose metrics and indicators based on available and reliable data. Additionally, the IPPT consulted with external subject matter experts to determine status and trends that reflect, as accurately as possible, the progress toward each of the state's pollinator protection goals. The IPPT recognizes that painting an accurate picture of the status of pollinators in Minnesota is challenging, especially considering the limited resources available to understand the complexities of this work. Consequently, each year, the IPPT evaluates the functionality of the scorecards and seeks feedback from key subject matter experts that can help improve this process.



Monitoring for rusty patched bumblebee. Researcher from the University of Minnesota Native Lab processing samples from a rusty patched bumblebee nest found under a house in Red Wing, Minnesota.

Photo by Michelle Boone

DESIRED OUTCOME

Healthy, diverse pollinator populations that sustain and enhance Minnesota's environment, economy, and quality of life

GROUP	INDICATOR	STATUS	TREND	SUMMARY
Imperiled Pollinators	Rusty patched bumble bee	POOR	?	The status of this federally endangered species in Minnesota remains poor. While the U.S. Fish and Wildlife Service (USFWS) reports more sightings, this could be due to more people participating in the surveys.
	Monarch butterfly	POOR	↘	The 2019-2020 overwintering monarch population in Mexico was about half the size of the 2018-2019 population. The population remains at-risk and small relative to 20 years ago.
	Dakota skipper	POOR	↔	The Minnesota Zoo's reintroduction of this endangered butterfly saw early positive evidence of successful re-establishment in 2020. The wild population, monitored by the DNR remains stable.
Common Pollinators	Common bumble bees	FAIR	?	The Bee Atlas bumble bee survey produced the contemporary distribution and abundance data for common bumblebees across the state. Additionally, park surveys in the Twin Cities from 2008-2019 suggest the abundance of common bumblebees in the metro has remained relatively constant over the past decade. It is uncertain how well this trend holds statewide.
	Bumble bee communities	OKAY	?	The Bee Atlas bumble bee survey has produced baseline distribution and species abundance data that could inform a baseline estimate for this metric in the future. Park surveys in the Twin Cities from 2011-2019 suggest the diversity of bumble bees in the metro has remained relatively constant over the past decade. It is uncertain how well this trend holds statewide.
Managed Pollinators	European honey bee	FAIR	↔	Honey produced per colony, a measure of honey bee health, remains steady, but is still ~20% lower than the previous decade.

Status and trend rankings are not related across species or species group.

Progress

Recent investments into pollinator surveys have begun to address the **pollinator information gap**. The Minnesota Environment and Natural Resources Trust Fund (ENRTF) supported statewide baseline bee surveys conducted by the DNR. The project to date has contributed essential data for creating effective monitoring programs.

ENRTF funded the Minnesota Bee Atlas, from 2015-2019 this project built a community science network to survey Minnesota's native bumble bees and cavity nesting solitary bees statewide. Information from state-wide community science and biodiversity atlas projects can provide baseline estimates of the abundances and distributions of common species, as well as estimates of biodiversity.

In 2020, MNZOO biologists recorded new wild adults of the Dakota skipper butterfly at the reintroduction site where they have been **conducting releases since 2017**. Supported by the ENRTF, the MNZOO has established the world's only managed rearing and breeding program for this species. This state endangered and U.S. threatened butterfly was once widespread across our prairies and now, only one historic wild population may remain in the state. These encouraging sightings indicate that efforts to re-establish this and other lost populations in Minnesota are possible, and represent a key step towards successful recovery of this prairie butterfly.

A newly released Dakota skipper butterfly, reared and marked by Minnesota Zoo biologists to differentiate it from wild adults at the reintroduction site.

Photo by Erik Runquist



BEE SURVEY BY THE DEPARTMENT OF NATURAL RESOURCES

The Minnesota Department of Natural Resources (DNR), and specifically the Minnesota Biological Survey (MBS), has taken the crucial first steps to documenting and protecting the diversity of native bees in Minnesota through the Minnesota Native Bee Surveys. The MBS, in conjunction with the University of Minnesota Insect Collection and Bee Lab, and with investments by the ENRTF, are working towards understanding how to protect Minnesota's native bees by investigating: 1) which bee species reside in Minnesota and 2) their

distribution within the state. **The project to date has established a state list of approximately 450 bee species.** These surveys have expanded our understanding of the distributions of many bee species and contributed two new species to the state list. Surveys will continue in the Laurentian Mixed Forest area, completing the initial statewide bee survey in 2022. However, stable funding for ongoing monitoring will be critical to understand which bee species are in decline or at-risk.



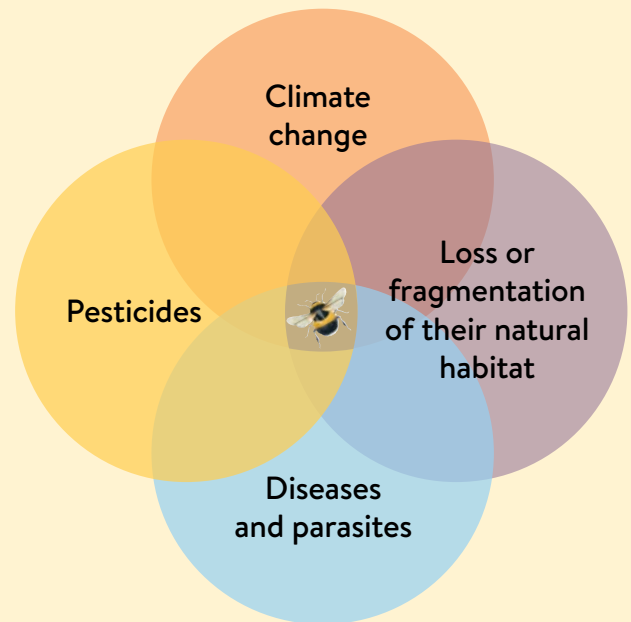
Bee survey netting—
action shot.

Photo by Nicole Gerjets

Challenges

Limited knowledge of the hundreds, if not thousands of pollinator species that call Minnesota home complicate the development of comprehensive pollinator protection strategies. The overwhelming majority of Minnesota's pollinators are insects, the most diverse group of animals on the planet. Native bees, butterflies, moths, flies (including some mosquitoes!), and beetles constitute the major pollinator groups in our state. Each of these groups are composed of hundreds of species that vary in their biology and habitat requirements. This can also lead to species responding differently to stressors. For example, the 23 species of bumble bee native to Minnesota visit a wide variety of flowering plants for pollen and nectar. On the other hand, many species of native bees only feed their larva the pollen of one or a few plant species.

The main stressors affecting pollinators



These four factors can interact and even amplify the effect of the others. For instance, the lack of quality habitat decreases the food available to pollinators, making them more susceptible to diseases, parasites, and the effects of pesticides.

Monarch butterflies mating
on the Minnesota prairie.

Photo by Erik Runquist



Monarch butterflies continue to face challenges.

The overwintering monarch butterfly population in Mexico dropped in 2020 to about half its 2019 size. Although Minnesota is an important breeding ground for the generation of monarchs that migrates to Mexico, progress toward conserving this iconic species needs a sustained and coordinated effort throughout the regions comprising its breeding range.

Balancing the needs of managed and wild pollinator populations. Managed and wild bees have both intersecting and differing habitat needs, which means that they can compete for food resources. Additionally, managed bees have the potential to introduce diseases into wild bee communities that can have catastrophic effects, especially for imperiled pollinators.

Recommendations

- **Investment in long-term monitoring and staff.** Both baseline surveys and long-term monitoring are necessary to understand the abundance and identities of pollinators throughout Minnesota. For this, Minnesota also needs to provide stable funding for well-trained professionals to lead and staff pollinator protection programs.
- **Support grassroots efforts throughout the state to create optimal conditions for the recovery of the Monarch butterfly.**
- **Increase promotion of best practices for managed pollinators.** Creating training opportunities and resources for Minnesota beekeepers to help reduce negative impacts to native pollinators.

Rusty patched bumble bee at the Minnesota Zoo.

Photo by Erik Runquist



GOAL 1

Lands throughout Minnesota support healthy, diverse, and abundant pollinator populations

Key output: more food sources for pollinators

GROUP	INDICATOR	STATUS	TREND	SUMMARY
Public Lands	Restoration on state-managed protected lands	OKAY	↔	Restorations by the DNR have improved substantially in the past decades, and support for creating high quality restorations will continue in the long term.
	Restoration on state-managed highway rights-of-way	OKAY	↗	MnDOT continues to increase use of native seed and prescribed fire along state managed road rights-of-way.
Private Lands	Restoration on state private lands	GOOD	↗	Restoration of pollinator habitat through Conservation Reserve Enhancement Program and other Board of Water and Soil Resources easement programs has remained steady over the past two fiscal years.
	Restoration on federal private lands	FAIR	↔	The number of acres enrolled in the Conservation Reserve Program (CRP) is similar to 2018 and 2019. The 2018 Farm Bill provided only a modest increase in this program over the next five years.
	Restoration on urban and developed lands	FAIR	↗	The BWSR's (L2L) Pilot Program assisted interested residents with establishing pollinator habitat at their homes across the state.

Progress

Public Lands

While restoration acres remain steady, the diversity of plants seeded in these areas continue to increase slowly. The DNR's pollinator best management practices (BMPs) and habitat restoration guidelines instruct managers to use native plant species that bloom across growing seasons, providing floral resources to pollinators through their active foraging seasons.

The DNR also continues to improve conditions for pollinators across the state through partnerships with federal agencies and conservation non-governmental organizations (NGOs). These cross-institutional collaborations benefit pollinator health by overcoming challenges to ecosystem restoration, such as improving seed availability and diversity.

MnDOT continues to implement adjusted mowing practices, prescribed fire, and restoration of roadsides to increase native vegetation for pollinators on state highway rights of way. MnDOT has steadily increased the number of acres managed for pollinators over the past decade through partnerships and internal efforts.

MnDOT has provided funding and staff time to facilitate the development of the Monarch Candidate Conservation Agreement with Assurances (CCAA), the first nationwide CCAA,

and MnDOT representatives currently serve on the CCAA advisory committee. The CCAA promotes habitat management for monarch butterflies and other pollinators in transportation and energy rights-of-ways through an agreement with many state transportation agencies, energy companies, and the USFWS. MnDOT has applied to enroll over 250,000 acres of state highways in the agreement for conservation of monarch habitat.

Private Lands

Enrollment in some state and federal private land conservation easement programs continued to grow in 2019. The BWSR Minnesota Conservation Reserve Easement Program (CREP) continues to make progress towards its goal of restoring and protecting up to 60,000 acres over five years. In addition, BWSR's Pollinator Initiative focuses on strengthening partnerships and incorporating habitat across all conservation programs. Enrollment has also increased for NRCS's Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) pollinator practices. Minnesota currently ranks fifth in the U.S. in terms of Pollinator Habitat Initiative acres (CP-42) enrolled through CRP.

Minnesota continues to lead the way in creating novel pollinator habitat, such as the legislatively created (L2L) Pilot Program, and Habitat-Friendly Solar initiatives. Both programs, now part of Minnesota Statute, play an essential role in aiding at risk pollinators by increasing flowering habitats, while also engaging the public and businesses in conservation efforts. Other long-standing programs, such as Restore Your Shore and Native Prairie Bank, also support pollinator habitat on private land. Programs such as the Minnesota Agricultural Water Quality Certification Program (MAWQCP) also encourage participation in private land easement programs and conservation practices that can benefit pollinators, such as no mowing or haying during peak pollinator activity. These programs can also provide other ecological benefits such as climate adaptation, carbon sequestration, water management, creating areas free from pesticides and fertilizer, as well as building community and the wellbeing of residents.

Challenges

Public Lands

Acquiring ecologically appropriate native seed, high management workloads, and limited funding for pollinator and restoration monitoring are some of the challenges for habitat restoration in public lands. Nevertheless, the overall rate and quality of restoration is greater than a decade ago, and best management practices have been adopted across state-managed lands.

Private Lands

The high cost of native seed, limited capacity for habitat management, and reliance on federal funding impose challenges to restoring habitats and ecosystems for pollinators on private lands. While recent sign-ups for CRP have included new Pollinator Habitat Initiative acres (CP-42), this practice represents a small proportion of total CRP acreage in Minnesota (1.5%). For both CRP and other programs, conservation practices targeting other ecosystem services may provide incidental habitat for pollinators.

Expenses associated with installing diverse seed mixes and maintaining habitats for pollinators may deter landowner participation. Designing cost-effective seed mixes that target and balance multiple ecological benefits is an area of active research.

WHAT IS HABITAT FOR POLLINATORS?

Habitat is any place that provides resources a pollinator needs, plants that provide pollen and nectar, nesting and overwintering habitat. Some pollinators have more specific resource requirements than others, and these can vary across their life cycles. For instance, monarch caterpillars can only develop on milkweeds, but adult monarch butterflies visit a wide variety of flowers for nectar to fuel their flight, so both milkweeds and nectar sources are needed to provide habitat.

How can we help?

One way to increase the number and diversity of plants that provide pollen and nectar across the growing season in an area. For example, BWSR's L2L Pilot Program teaching Minnesota residents across the state how to install pollinator habitat. The DNR's Wildlife Management Areas (WMA) and Scientific and Natural Areas (SNA) programs restore natural ecosystems by recreating pre-settlement native plant communities and natural ecosystem disturbances like fires in prairies.

Pollinator habitat in restored wetland areas in Minnesota.

Photo by BWSR



Recommendations

- **Evaluation of habitat quality is a critical need and top priority.** Support is needed for habitat quality assessments in both public and private lands that evaluate benefits to pollinators. Increasing capacity or funding for follow-up habitat data collection will help inform adaptive management for pollinators, ensuring investments into pollinator conservation are successful in the face of continued climate and land-use change.
- **Support for land, water, and wildlife conservation programs is essential for preserving and restoring pollinator habitats in Minnesota.** Most pollinator habitat in Minnesota exists within the mosaic of public and private conservation lands maintained or created by state and federal programs. Through broadly conserving Minnesota's wildlife and ecosystems, these programs protect and restore pollinator food and nesting resources. Examples of these programs are administered by the DNR, BWSR, USFWS, and NRCS, and supported through partnerships with NGOs such as The Nature Conservancy, Pheasants Forever, and Ducks Unlimited.
- **Solutions to seed limitations can be supported with state-supported seed programs.** Diverse seed mixes are critical to recreating ecosystems that both protect our soil and water, and provide habitat for a diversity of pollinators and other wildlife. Support for a state native seed program where local ecotype native seed is grown on state lands would improve seed mix diversity for public land restoration projects. Incorporating seed mix data into existing state habitat or management relational databases would also improve our ability to analyze restoration outcomes, cost-effectiveness, and pollinator benefits.
- **Grow workforce for maintaining lands for pollinators.** State land managers have a limited capacity and workforce for managing habitats and restorations they administer. Funding or support for additional seasonal staff, roving crews, and contractors to assist in habitat maintenance is needed to ensure state-managed lands continue to provide adequate nectar and pollen resources for pollinators over time.
- **Seek ways to accelerate progress in the creation of pollinator habitat.** For example, by promoting pollinator habitat on any solar developments (meeting Habitat Friendly Solar guidelines) or supporting pollinator habitat plantings on the State's Closed Landfill Program sites.



Habitat Friendly Solar installation.
Photo by the National Renewable Energy Lab

GOAL 2

Minnesotans use pesticides judiciously and only when necessary, to avoid harm to pollinators while retaining economic strength

Key output: Reduced pesticide impacts to pollinators through integrated pest management (IPM)

INDICATOR	STATUS	TREND	SUMMARY
IPM development	OKAY	↔	The number of Minnesota-specific IPM-related grants that were funded has remained relatively consistent for the past four years. For example, LCCMR funded four IPM-related grants in 2019.
IPM promotion	OKAY	↗	Promotion of IPM has increased for a third year in a row. Innovative education and outreach ideas have been implemented.
IPM adoption	?	?	Consistent methodology in reports from state and national agencies about IPM adoption is not available. Additional data is needed to fully understand the level of adoption on state and private lands. The MDA has begun collecting data on adoption of IPM on farm land. State agencies such as the DNR, and MnDOT use IPM on public lands.

Pesticides can harm pollinator populations. Pesticides can be important tools for homeowners, growers, land managers, public health officials, and beekeepers to produce food, protect human health, and to control invasive species. Using an IPM approach can reduce the exposure of bees and other pollinators to pesticides.

State agencies are implementing and promoting IPM to protect pollinators. Minnesota statute 18B.063 requires IPM to be used on all managed public lands. Some examples include prescribed burns, brush management, and conservation grazing for weed management.

Progress

Staff from EQB and MDA participate in a national-level Managed Pollinator Protection Working Group. This group collaborates to develop and implement managed pollinator protection plans. In 2020, the group developed comprehensive and interactive presentations for different audiences including pesticide applicators and growers. These presentations are suited for both in person and remote formats.

The MDA and the University of Minnesota Extension used forward-thinking approaches to promote IPM through education and outreach. With COVID-19 safety in mind, new materials were

developed to provide IPM educational materials, and targeted outreach in areas with endangered and threatened species. Additionally, the MDA promoted FieldWatch to pesticide applicators and beekeepers.

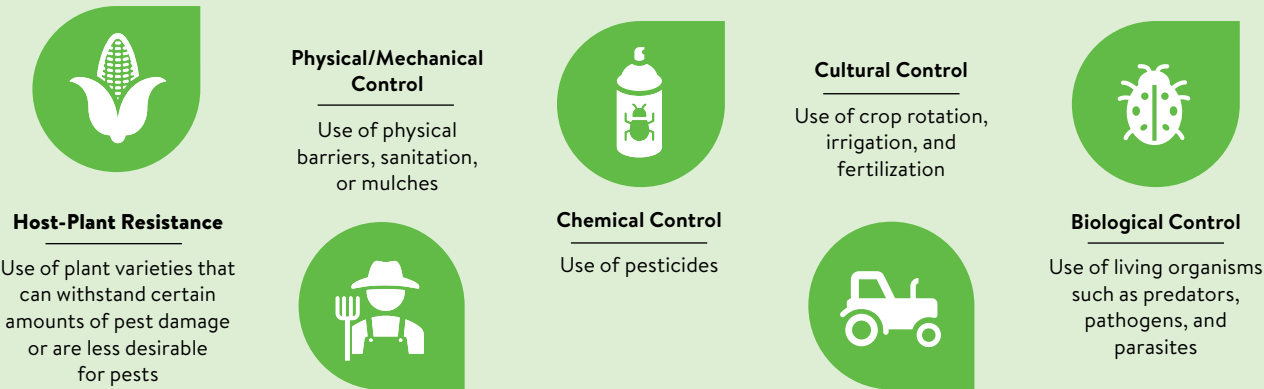
MDA reviewed all recommendations made by the Governor’s Committee on Pollinator Protection (GCPP) published in November 2018. Out of 39 recommendations, 22 were related to pesticides, however, the GCPP did not find consensus on any of the pesticide-related recommendation. The MDA evaluated these recommendations based on the MDA’s statutory authority and availability of resources. Thirteen recommendations required legislative action. Some of these recommendations overlapped with recommendations the MDA’s special registration review of neonicotinoids. The

MDA brought forward two of them which did not get enough support. The MDA acted on five recommendations based on current authority and available resources.

The Office of the Legislative Auditor (OLA) published [a report](#) in 2020, which evaluated pesticide regulation and found that “in response to its own review of neonicotinoids, the MDA has taken a number of actions to mitigate the impact of pesticides on pollinators.” Examples include the development of Minnesota-specific pollinator stewardship material, BMPs for guidance when using neonicotinoids, the proposal of a treated seed program and a dedicated pollinator protection account to the MN legislature, review of top-selling neonicotinoid pesticide products, and increased pesticide use/post-use inspections.

Pest management approaches that can be used in an IPM program

Key components of IPM include preventing pests from becoming a problem, using a variety of non-chemical management tools, counting, and identifying pests, and in specific contexts, using economic thresholds to determine when pesticides are warranted.



Challenges

IPM is a complex approach. Implementation of IPM varies and depends on the pest, location (e.g. farms, gardens, and schools), and individual circumstances. In some situations, research on management tools is limited to chemical control. Additionally, predicting pest pressure is challenging, especially due to climate change.

Adoption of IPM may involve more time and/or effort compared to pesticide applications alone, and benefits may not be apparent initially. However, this approach can save money when managing pests.

Data on the level of adoption of IPM in Minnesota is not available for each crop or use location on a consistent basis across years. Additionally, IPM adoption is measured in many different ways, making it difficult to compare datasets.

Recommendations

- Explore where pest management frameworks that prioritize pollinators (e.g. integrated pest and pollinator management) could be implemented. The IPPT can facilitate an action group of experts to discuss potential ways to incorporate pollinator protection to a greater level in pest management.
- **State agencies and the University of Minnesota Extension expand and continue educational efforts on IPM to diverse groups of stakeholders.** Since educational efforts regarding land and pest management are performed by many groups, collaboration to unify educational messages and reach more stakeholders will potentially increase understanding and adoption of IPM.
- **Increase support for Minnesota-specific research and IPM-based strategies.** Including effective non-chemical methods and pest modeling, supporting development of pest resistant varieties, biological control, and economic thresholds.
- **The Legislature should revisit the recommendations made in recent state reviews of pollinator health.** Echoing the recommendation made by the OLA, the IPPT asks the legislature to consider “taking further legislative action to protect pollinators.”



MDA INVESTIGATES PROPERLY REPORTED PESTICIDE MISUSE, INCLUDING BEE AND MONARCH KILLS

The MDA receives approximately 270 pesticide-related misuse complaints per year. **The MDA's pesticide misuse complaint line is 651-201-6333.**

Beekeeper inspecting a honey bee colony frame. Photo: iStock

GOAL 3

Minnesotans understand, value, and actively support pollinators

Key output: More action through community commitments

INDICATOR	STATUS	TREND	SUMMARY
Pollinator resolutions	OKAY	↗	Resolutions through Pollinate Minnesota have increased consistently each year from 2018 to 2020. The majority of resolutions during the 2018-2019 period were made by municipalities. For 2020, the majority of the new resolutions were made by educational institutions.
Community science	OKAY	↗	The number of participants in the Bumble Bee Watch increased to 147 in 2019. This is the highest participation registered since 2016. The IPPT is exploring additional community science programs that reflect participation more broadly.
Pollinator pledges	OKAY	↗	Pollinator pledges through the Xerces Society have increased from 2015 to 2019.



Creative Lego® display showcasing pollinator habitat and solar panels at the first Habitat Friendly Solar Summit, February 19, 2020.
Photo by Paul Erdmann

Progress

Minnesotans continue to be interested in pollinators and finding new ways to help them. Organizations continue to commit to pollinator resolutions and pollinator pledges around the state. Additionally, Minnesotans have continued to participate in citizen science projects that provide critical information about native pollinators in the state.

Agencies and organizations were able to adapt to online education and outreach, to make information available to Minnesotans despite COVID-19 mitigation strategies. Although several events that promote pollinators statewide were

canceled, organizations adapted their events to be held remotely. In this way, Minnesotans were able to access webinars, workshops, and conferences regardless of their location.

Minnesota had the first Habitat Friendly Solar Summit. The event was a collaboration between BWSR, the DNR, Fresh Energy, the Great Plains Institute and the University of Minnesota Institute on the Environment. The goal was to inform city planning staff, solar developers, Soil and Water Conservation Districts staff and other stakeholders about how the Habitat Friendly Solar Program works.

First Habitat Friendly Solar Summit, February 19, 2020. Photo by Paul Erdmann



The IPPT through the EQB started a collaboration with the Minnesota Lottery to design a pollinator-themed lottery ticket. The ticket will have the rusty patched bumble bee, the official state bee, as the ambassador for imperiled pollinators in Minnesota. This collaboration presents a unique opportunity to reach new audiences with the pollinator protection message. Furthermore, 40% of the proceeds from the ticket sales will go to the Minnesota Environment and Natural Resources Trust Fund. The ticket is scheduled to launch in April 2021.

A new pollinator-themed license plate will be released in 2021! In partnership with Driver and Vehicle Services, MINNCOR Industries (MINNCOR) is presently ramping up its production. DOC's license plate production program is one of a variety of education and employment programs offered by MINNCOR that provide job skills training to support positive inmate behavior and successful re-entry into the community. The pollinator license plate is the 10th design in the DNR's Critical Habitat Series. Sales contribute to the Reinvest in Minnesota Fund, helping enhance habitat across the state.

Challenges

Having to adapt to a new reality with COVID-19 precautions can make engagement activities challenging.

State Agencies have limited resources and personnel for focused engagement work on pollinator protection.

Pollinator resolutions are variable and it is difficult to assess their strength. Additionally, there is no assessments of the effectiveness of the ongoing efforts.

Recommendations

- Develop new strategies to increase public participation with COVID-19 safety in mind.
- Look for opportunities to increase coordination and collaboration with the different organizations working to help pollinators in Minnesota. The IPPT will seek to create opportunities for meaningful engagement with Minnesotans, supporting pollinator friendly initiatives, and community actions to advance pollinator protection in the state.
- Continue support for innovative projects and explore creative ways to promote pollinator protection and conservation throughout the state.



Urban Roots interns collect seeds from Minnesota native plants to support their restoration program in public and private spaces.

Photo by Urban Roots

LAWNS TO LEGUMES PILOT PROGRAM

The statewide Pilot Program started in June 2019 assists residential landowners and renters with establishing pollinator habitat at their homes.

The program has received significant attention in Minnesota and nationally as an effective model for supporting declining pollinator populations on residential landscapes. A combination of the program's three components: demonstration neighborhoods, individual support, and public outreach, helped maximize benefits for pollinators by providing cost share incentives and free technical resources available online. Having this structure and public awareness in place, creates a well-timed opportunity to further engage and assist Minnesota's communities and residents to create pollinator habitat. Due to the high demand and interest in the program, additional funding sources are being pursued.



L2L sign in a newly completed rain garden installed by the City of Brooklyn Park, a Demonstration Neighborhood L2L grantee.

Photo by Metro Blooms

Highlights from the Lawns to Legumes Pilot Program

June 2019 to June 2020

126

articles published about L2L Pilot Program. Including a feature in *Oprah* magazine.

33,000

Over people have accessed the program's website, which offers materials for technical assistance.

7,500

Over people applied for the Individual Support grant.

2,000

Over people attended L2L design workshops.

100

Over volunteer coaches signed up around the state providing one-on-one assistance to new gardeners.

Leafcutter bee
(Family Megachilidae)
on vervain (*Verbena* sp.).

Photo by Laura Marti



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Civic Engagement Framework for Pollinator Protection - DRAFT



Picture by Anna Barker

Interagency Pollinator Protection Team

December 2020



MINNESOTA

ENVIRONMENTAL QUALITY BOARD

Overview

The Environmental Quality Board (EQB or Board) provides coordination and leadership on priority environmental issues that are multi-dimensional, and serves as a public forum for developing long-range strategies to enhance Minnesota's environmental quality. The Board is made up of nine agency leaders and several public members from across the state. Executive Order 19-28 directs the EQB to convene the Interagency Pollinator Protection Team (IPPT) to coordinate actions to restore pollinator health in Minnesota. The IPPT consists of members from the Departments of Administration (ADMIN), Agriculture (MDA), Corrections (DOC), Education (MDE), Health (MDH), Natural Resources (DNR), Transportation (MnDOT), Board of Water and Soil Resources (BWSR), the Minnesota Pollution Control Agency (MPCA), and the Minnesota Zoological Garden (MNZOO).

The IPPT was created in 2016 to provide operational support, develop cross-agency policies and programs, and to report progress toward statewide pollinator protection goals. For four years, the IPPT has increased the level of interagency collaboration around pollinator protection actions throughout the state. The team coordinates action on three overarching goals: lands support diverse pollinators, judicious use of pesticides, and Minnesotans understand, value, and support pollinators.

The Executive Order 19-28 also directs the EQB to develop a civic engagement framework that needs to be "consistent with the vision for One Minnesota, to ensure public participation in pollinator policy and program development, and build cross-sector partnerships. One point of emphasis will be identifying and supporting opportunities for statewide collaboration to conserve imperiled pollinators such as the rusty-patched bumble bee and the monarch butterfly."

EQB understands civic engagement as "the intentional effort of government to facilitate meaningful dialogue with all members of the public in its work and the development of policy. Meaningful engagement means that relationships and conversations are reciprocal, authentic, and intentional to create opportunities for all communities to participate in the process."

Purpose

The Civic Engagement Framework for Pollinator Protection (Framework) represents a coordinated effort to strategically increase engagement efforts to contribute to pollinator protection goals. The approaches described in this document are feasible within the current funding and capacity of the IPPT. It does not include efforts that would require additional resources or recommendations for those resources. The Framework will be evaluated on an annual basis, in concert with the annual report, and updated to reflect progress, lessons learned, and next steps. The Framework will serve as a common touchpoint across IPPT member agencies and with the public as we work together to engage Minnesotans on pollinator protection.



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Project Scope

The IPPT convened to discuss the role that a civic engagement framework would have in advancing the pollinator protection goals set forth by Executive Order 19-28, and move us closer to our desired outcome of healthy and diverse pollinator populations in Minnesota. This exercise included conversations about the status of our pollinator protection actions and how to advance progress. Additionally, the IPPT conducted an inventory of pollinator-related engagement efforts developed by IPPT member agencies. Based on the results from the inventory, an analysis of the strengths, weaknesses, opportunities and threats (SWOT) was conducted to develop strategies and formulate an action plan for civic engagement for pollinator protection.

Focus areas for civic engagement

The IPPT identified focus areas that have the potential to drive positive change toward pollinator protection. Building civic engagement strategies around these areas for each one of the pollinator protection goals will expand state agencies' capacity by involving more Minnesotans in making progress toward our desired outcome of healthy and diverse pollinators in the state.

- Imperiled pollinators.** Imperiled pollinators refers to native bees and butterflies that are listed as endangered under the Endangered Species Act. These pollinators are especially vulnerable to the different stressors that threaten wildlife, like the reduction of suitable habitat, pesticides, diseases and parasites, and the effects of climate change. Managed pollinators, such as honey bees and commercial bumble bees, also face these challenges, but have dedicated caretakers to help mitigate stressors. Imperiled pollinators lack dedicated caretakers and there is a large knowledge gap about their diversity, needs, and how stressors impact their survival. Thus, addressing this knowledge gap will require engagement with scientists, land managers, educators, and the public in general.
- Pesticides.** Pesticides are an important tool for pest management in different scenarios, for example weed control on roadsides, mosquito control in urban areas, and pest control in farmlands. However, pesticides can harm pollinators. It is important that pesticides are used judiciously and only when necessary. Additionally, avoiding the use of pesticides that are particularly toxic to pollinators is an important consideration. Engaging with and educating different individuals and organizations that use pesticides is a key step to increasing judicious use of pesticide use in the state.
- Diversity and Inclusion.** Civic engagement in pollinator protection must have a diversity and inclusion component to ensure the representation of the different Minnesotan communities that are impacted and that can have an impact in this work. Reaching out and involving individuals and organizations that haven't been engaged before can be challenging. Therefore, the IPPT needs to develop an action plan to establish contact, build trust, and create new relationships and partnerships around pollinator protection in Minnesota.



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SWOT analysis

Through the civic engagement inventory, IPPT members shared key engagement efforts led by their agencies and their current audiences. The inventory objectives were to: a) inform the IPPT of the ongoing programs and initiatives around pollinator work that are happening within their agencies; b) identify individuals and organizations that are involved in these efforts, which would also help identify gaps and opportunities for action; and c) identify opportunities to develop strategies for civic engagement.

The inventory recorded agency-led initiatives directly or indirectly connected to pollinators (Appendix I). Using these results and feedback from external stakeholders, the IPPT conducted a SWOT analysis (Table 1). This analysis helped identify the IPPT's key strengths and weaknesses, as well as the main opportunities and threats for effective engagement.

Table 1. IPPT SWOT analysis for civic engagement.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Awareness: IPPT member agencies are aware of the importance of engagement to advance our pollinator protection goals. • Educational resources: the majority of the current pollinator related initiatives in state agencies are focused on education, especially about pesticide use, pollinator identification, and habitat. A wide variety of educational and training resources have been developed to this end. • Existing networks and audiences: IPPT member agencies have ongoing initiatives with interested individuals and organizations who can be allies in advancing pollinator engagement. • Communication: IPPT has a unique opportunity to access different outlets of communication to get the message across to diverse audiences. 	<ul style="list-style-type: none"> • Prevalent form of engagement: IPPT members recognize that providing information to interested individuals and organizations is currently the most prevalent level of engagement. This is an important step, but making progress on pollinator goals requires more than the exchange of information. It also requires deeper engagement and relationship building to involve diverse communities and organizations in pollinator protection actions. • Diversity and Inclusion: the IPPT identified the need to intentionally reach out and involve diverse audiences in the pollinator conversation. The majority of the current engagement activities carried out by IPPT agency members do not emphasize diversity and inclusion. • Capacity: there are limited resources and personnel for focused engagement work. • Feedback on pollinator annual report: there are no mechanisms for interested individuals and organizations to weigh in on the pollinator annual report other than one-on-one conversations with the project coordinator. The report could be strengthened by providing additional spaces for two-way conversations on the report during the development phases. • Authority: state agencies have limited authority to enact some regulations that could benefit pollinators, for example, the regulation of neonicotinoid treated seeds.



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Opportunities	Threats
<ul style="list-style-type: none"> • Deepen engagement with external individuals and organizations: move the level of engagement from “informing” to “involving” and “collaboration” where suitable. (see IAP2 spectrum in Appendix II) • Building new partnerships: capitalize on a high level of public interest in pollinator protection across the state to build new partnerships and collaborations. • Leverage changing public opinion to advance pollinator protection actions: public interest in helping pollinators is high, and there is growing public awareness of the importance of native landscaping and pollinator habitat. This provides opportunities for advancing pollinator protection actions. 	<ul style="list-style-type: none"> • Availability of good information: there are many misunderstandings about pollinators and the actions needed to protect them. For instance, a lot of people know that planting flowers can help feed pollinators, but accurate information on the best species to plant and where to get those resources might be harder to find. • Lack of trust: some communities do not trust initiatives that are led by State Government. • Complex problems: pollinator protection is a complex issue with no easy fixes. Protecting pollinator involves addressing numerous interrelated threats. This can make it challenging to know where to prioritize pollinator engagement efforts for greatest impact. • Divergent viewpoints: Minnesotans have different needs and interests, and they don’t all share the same views on the best pathway for pollinator protection. Finding consensus can be difficult. Subjects such as pesticide management and landscape design can often elicit divergent or opposing viewpoints. Reaching agreements and compromises around these topics is necessary but challenging.

Civic engagement strategies

The IPPT is a reflection of the crucial role interagency coordination plays in the development and promotion of pollinator protection policies and programs in Minnesota. The IPPT reports progress to the EQB on December 1st of each year. As reflected in the last two annual reports, progress toward healthy pollinator populations requires the participation of many different individuals and organizations in Minnesota, in addition to well-coordinated efforts by state agencies.

This Framework seeks to utilize the strengths that state agencies bring to the table through the IPPT, address the weaknesses, take advantage of engagement opportunities, and tackle threats identified in the SWOT analysis. Establishing collaborations with grassroots organizations and different stakeholders around the state will expand state agencies’ capacity, strengthening existing partnerships and building new relationships with interested individuals and organizations that can help move progress forward for pollinators.

This Framework presents two main strategies and an action plan to support them. Each strategy will help the IPPT make progress on the focus areas identified above.



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Strategy 1. Engagement in the development and distribution of the Minnesota State Agency Pollinator Annual Report

The IPPT will partner with external stakeholders involved in pollinator-related work to gather data, expert opinions, and feedback on the report. The Framework will formalize collaborations and provide opportunities for public feedback on the progress, challenges, and recommendations included in the report.

Strategy 2. Engagement to increase public participation in pollinator protection efforts and reach new audiences

To move progress toward healthy and diverse pollinator populations in the state requires the participation of all Minnesotans. While state agencies actively involve many individuals and organizations in pollinator protection efforts, there is considerable room to grow participation and reach new audiences. The IPPT will look for key individuals and organizations to make strategic connections between agency-led and public-led efforts to expand the reach of the pollinator protection message and increase public participation in pollinator policy and program development.

These two strategies will initially emphasize engagement work around the focus areas identified by the IPPT, imperiled pollinators, pesticides, and diversity and inclusion. Figure 1 (page 6) illustrates the role that this Framework will play in the work to restore pollinator health in Minnesota. The IPPT will use this Framework as the foundation to work strategically to engage Minnesotans to advance the three pollinator protection goals and make progress toward our desired outcome.

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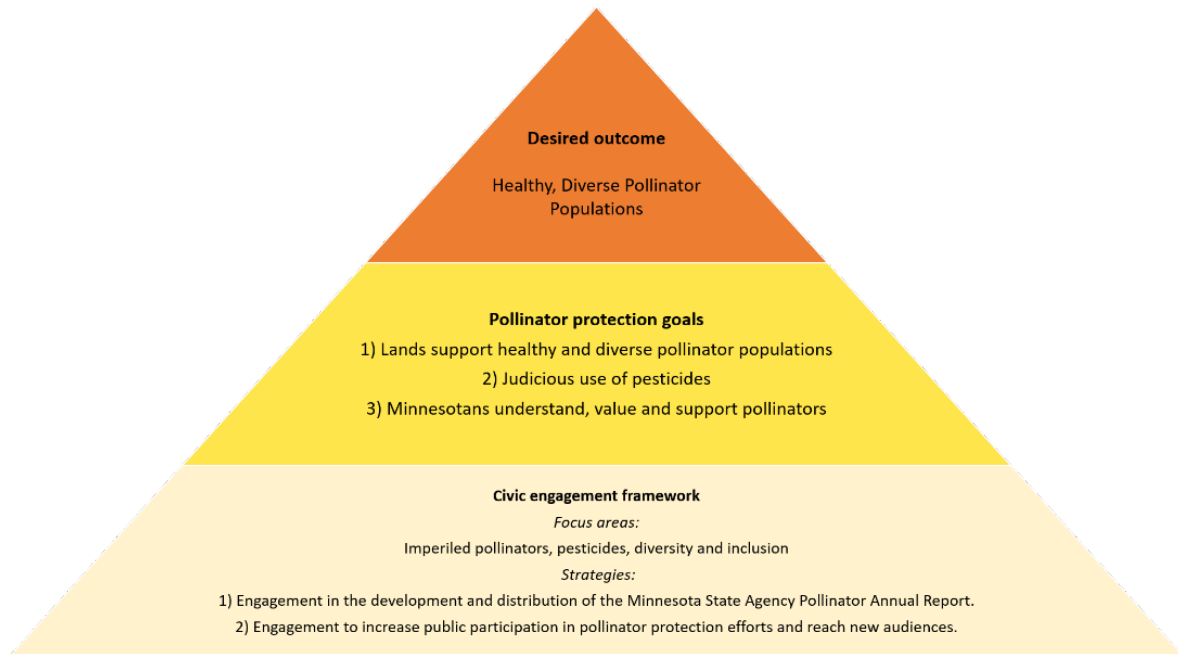


Figure 1. Diagram showing the civic engagement framework as the foundation that will support the work of the IPPT to advance pollinator protection goals to achieve our desired outcome.



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2021 Civic Engagement Action Plan

Strategy 1. Engagement in the development and distribution of the Minnesota State Agency Pollinator Annual Report.

Outcome

Increase subject matter expert participation in the development of the Minnesota State Agency Pollinator Annual Report (Report). Obtain feedback from interested individuals and organizations on the progress, challenges, and recommendations reflected in the Report.

When developing the Report, the IPPT forms sub-teams to work on four main sections: desired outcome, goal 1 (habitat), goal 2 (judicious use of pesticides), and goal 3 (engagement). Each sub-team is responsible for gathering the data required to inform the metrics for the scorecard of their section and work on the narrative to inform on progress toward each goal. Additionally, sub-team leaders coordinate the engagement with subject matter experts and collaborators to provide technical guidance and external perspective on their section of the Report.

Beginning in 2021, IPPT sub-teams will expand their engagement efforts as part of the Report development process. Table 2 provides an overview of the action steps and proposed timeline for this strategy. During the first two months after the publication of the Report, the IPPT will open a comment period for interested individuals and organizations to provide feedback on the contents of the Report. The IPPT will collect and evaluate this feedback and identify key individuals and experts to collaborate in the development of the next Report. These individuals will then meet with the IPPT report sub-teams to provide feedback on the metrics, progress, challenges, and recommendations identified by the IPPT. Report sub-teams will consider the external input to make decisions about trends, feed the metrics with updated data, and inform recommendations.

Report sub-teams will reach out to the external collaborators to inform them on how their participation was considered, and provide further opportunities for feedback. In addition, the IPPT will invite key individuals to the EQB meeting when the Report is considered for approval, to provide technical guidance during EQB discussion. Once the Report is finalized and public, the IPPT will send the a copy with a thank you letter to the collaborators that participated in the production process.

Table 2. 2021 Action plan for engagement in the production of the pollinator annual report.

Action	Product	Timeline
Open a period for public comment on the pollinator annual report	Public feedback on annual report	Jan. – Feb.
IPPT evaluates public feedback on the report	Key feedback for 2021 report	Mar.
Identify subject matter experts, and key individuals that provided comments on the pollinator annual report	List of key individuals to engage in the development of the report	Mar.



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IPPT sub-teams meet with external key individuals and experts to discuss each section of the annual report	Input on strategies and recommendations for the 2021 pollinator annual report	Apr.
IPPT works on report	Data to feed metrics and indicators Narrative that includes the work toward civic engagement.	May. – Aug.
IPPT presents report draft to EQB for feedback and public comment.	Feedback from EQB and public comment	Sep.
IPPT works on EQB feedback and applicable comments from the public.	Final report draft	Sep.
IPPT coordinator works with report graphic designer	Pollinator annual report proofs	Sep. – Nov.
IPPT invites subject matter experts and action group members to November EQB meeting	Technical help with questions during EQB meeting	Nov.
IPPT presents report proof to the EQB for feedback and public comment	Feedback from EQB and public comment	Nov.
IPPT addresses feedback and works with graphic designer on final report	Published annual report	Dec.
Close the loop	EQB-IPPT acknowledges individuals and organizations for their collaboration	Dec.

Strategy 2. Engagement to increase public participation in pollinator protection efforts and reach new audiences.

Outcome

Increase public participation in pollinator policy and program development by building new and strengthening current relationships with interested individuals and organizations.

The IPPT will work to identify new individuals, organizations and communities with a focus on diversity and inclusion to engage in pollinator protection efforts. The IPPT will create a communication plan, including timeline, ad-hoc emails, and key information to start connections with identified individuals and organizations. In addition, the IPPT will create a survey to determine new stakeholder's interest and needs for engaging in pollinator related programs and initiatives. EQB's pollinator project coordinator will reach out to the identified individuals and organizations and determine if they are interested in participating in the survey. Table 3 details the short-term steps for this strategy's action plan, key definitions for diversity and inclusion can be found in Appendix II.

To help gauge the level of interest in pollinator activities, the IPPT will use the International Association for Public Participation (IAP2) framework. The IAP2 developed a public participation spectrum that identifies five levels of engagement: inform, consult, involve, collaborate, and empower (definitions in Appendix II). The IPPT will determine the agency-ideal level of engagement for each stakeholder. As a result of this effort, the IPPT hopes to develop a wide network of connections across the state that will represent the diversity in Minnesota. This network will be comprised of individuals and organizations engaged in pollinator protection actions and different levels of engagement in the IAP2 spectrum. The



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long-term goal is to utilize an expanded network of pollinator-interested groups and individuals across Minnesota to accelerate pollinator action across the state.

In addition, using the results from the civic engagement inventory, engagement survey results and the list of individuals that participated in the comment period for the pollinator report, the IPPT will identify key individuals and organizations to participate in action groups. The IPPT will provide coordination and a safe space for proactive discussions to develop and recommend strategies around the three focus areas described in this Framework, imperiled pollinators, pesticides, and diversity and inclusion.

Table 3. Action plan for engagement to expand participation in pollinator protection programs and actions and reach new audiences.

Action	Product	Timeline
Identify key individuals and organizations with a focus on diversity and inclusion	Engagement matrix with individuals and organizations – IAP2 spectrum table	July – Sep. (2020)
IPPT develops communication plan to reach out to key individuals and organizations	-Communication timeline. -Initial connecting emails. -Identify key information and resources to share	Oct. – Dec. (2020)
IPPT coordinator starts initial contact with identified individuals and organizations	Updated IAP2 matrix	Jan. – Feb. (2021)
Create a survey to identify new stakeholder interest and needs	Electronic survey. To be sent to interested individuals and organizations	Jan. – Feb. (2021)
Action group meetings, focused on engagement focus areas	Strategies to address focus areas. Identify key individuals and organizations to build and expand the IPPT capacity in engagement for each pollinator protection goal	Apr.
One-on-one meetings with interested individuals and organizations	Completing and filling the engagement matrix (IAP2 spectrum table)	Sep. 2020 - long term

Roles and expectations for the Civic Engagement Framework

The work toward engagement through this Framework will require interagency collaboration and the support from the EQB and IPPT member agencies. Here are the key players:

- *Environmental Quality Board (EQB)*
 - Executive sponsor of the Framework.
 - Ultimate decider to the structure, purpose and content.
 - Direct IPPT members to dedicate time to implementing the framework.
- *EQB Executive Director*
 - Managing sponsor, provide guidance during the development and implementation of the Framework.



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- *EQB Project Coordinator*
 - Facilitate discussions and meetings to develop the Framework.
 - Coordinate IPPT engagement strategies specified in the Framework.
 - Facilitate engagement action groups.
 - Lead the efforts to reach out to new individuals and organizations and recruit help from IPPT members as necessary.
 - Present Framework and updates to the EQB.
- *IPPT*
 - Form sub-teams to work on the pollinator annual report.
 - Identify key individuals and organizations to participate in the engagement strategies specified in this Framework.
 - Join pollinator report sub-teams to determine and update metrics to report on progress toward pollinator protection goals.
 - Support EQB project coordinator in engagement action groups and in building cross-sector relationships.
 - Identify new opportunities for engagement to advance pollinator protection goals.
 - Keep their agency's leadership updated in the developments and needs of this Framework.
- *Partners and collaborators*
 - Work with the IPPT to develop strategies to advance pollinator protection in the State.
 - Bring external perspective and experiences to provide feedback on the pollinator annual report and to participate in engagement action groups.



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APPENDIX I. Agency-led initiatives recorded during the 2020 IPPT civic engagement inventory

Agency	Effort	Engagement Status
BWSR	Lawns to Legumes	Active
	Habitat Friendly Solar Program	Active
	The Pollinator Initiative	Active
GOV RESIDENCE	Public Garden Tours	Active
MDA	Protecting Pollinators with IPM – EPA grant	Active
	Promotion of DriftWatch	Active
	The Minnesota Agricultural Water Quality Certification Program – IPM endorsement	Active
	Creation Emerald Ash Borer Insecticides: Label Guidance for Use Limits Guide	Completed
	Creation of Pesticide Safety Guide for Homeowners	Active
	Homeowner and Residential Pesticide Education and Outreach	Active
	Neonicotinoid BMPs	Active
	Neonicotinoid Label Language Guidance	Active
	Presentations	Active
	Endangered Pollinator Guide	Active
	Pollinator-specific inspection and enforcement	Active
	MDA Pollinator Webpage	Active
	State Fair	Active
	Bee Kill Investigations and Compensations	Active
	Special Registration Review of Neonicotinoids	Completed
	Adding Pollinator Content in Applicator Training Manuals	Active
	2016 Pollinator Summit	Completed
	2014 Protect MN Pollinator Campaign	Completed
	Pollinator Listserv	Active
	Labeling and Advertising of Pollinator Friendly Plants	Active



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Agency	Effort	Engagement Status
	MDA-NASS Surveys	Active
	Soybean Aphid Guidance	Active
	Pollinator Report 2015	Completed
MDE	Library Pollinator Exhibit	Active
	Pollinator Citizen Science/Project-based learning training for school day and after school educators	Active
DOT	Monarch CCAA	Active
	Pollinator Social Media Postings	Varies
	Highway Sponsorship Program	Varies
DNR	Outreach & Education Events	Active
	Community Science & Service Learning	Active
	Direct Communication with Concerned Citizens	Active
DOC	Pollinator Related Education	Active
MPCA	Pollinator Habitat on Closed Landfills	Active
MNZOO	Pollinator Social Media Postings	Active
	"Plant for Pollinators" and "Butterfly Neighbors" Pamphlet Distributions	Active
	Demonstration gardens and pollinator-themed signs at the Zoo	Active
	Public Presentations	Varies
	Zoo Camp School and Education Events	Varies
	Multiple National and International Research and Outreach Committees for Poweshiek skipperling, Dakota skipper, and rusty patched bumble bee	Active



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APPENDIX II. Definitions

Definitions according to The Ford Foundation.

Diversity is the representation of all our varied identities and differences (race, ethnicity, gender, disability, sexual orientation, gender identity, national origin, tribe, caste, socio-economic status, thinking and communication styles, etc.), collectively and as individuals.

Diversity in the pollinator civic engagement framework is open to include individuals and organizations that fall within the definition above. Still, it will also include stakeholders representing different regions and locations, for example in rural communities.

Inclusion builds a culture of belonging by actively inviting the contribution and participation of all people.

IAP2 spectrum

Identifies five levels of public participation in planning, decision-making, and actions:

1. **Inform:** To provide interested individuals and organizations with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.
2. **Consult:** To obtain feedback on analysis, alternatives and/or decisions from interested individuals and organizations.
3. **Involve:** To work directly with interested individuals and organizations throughout the process to ensure that their concerns and aspirations are consistently understood and considered.
4. **Collaborate:** To partner with interested individuals and organizations in each aspect of the decision including the development of alternatives and the identification of the preferred solution.
5. **Empower:** To place final decision-making in the hands of other interested individuals or organizations.



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Comments from Johanna Rupprecht to EQB on Minnesota Sands matter, September 9, 2020

Good afternoon, Environmental Quality Board members and staff. My name is Johanna Rupprecht. I live in Winona, Minnesota, and I am an organizer with the Land Stewardship Project, based in our southeastern Minnesota office in Lewiston. I hope you have had a chance to review the written comments submitted yesterday by LSP's Executive Director Jess Anna Glover.

The correct course of action before you is actually much simpler than what has been presented to you. The EQB can not allow any portion of Minnesota Sands' proposal to move forward without the required Environmental Impact Statement being completed on the project. This EIS requirement has never lapsed or been lifted and there is no justification for doing so now. It is absurd to claim this is a new project when *no new details* about Minnesota Sands' proposal have been provided!

As LSP's lead organizer working on the frac sand issue, I first began tracking Minnesota Sands' proposed operations in 2012 and am an expert on this issue. I've repeatedly observed the same pattern of behavior from this company since then – failure to disclose the full nature of its plans, attempts to circumvent the environmental review process, failure to respect public processes and the will of the people in the rural communities in which it seeks to operate. Minnesota Sands is the company that hired the largest law firm in the state of Minnesota to sue Winona County in an attempt to overturn the frac sand ban enacted by the County Board, a lawsuit the company pursued for three years, from 2017 through 2020, all the way to the State Supreme Court level. Court filings in this case made it clear that the company still has plans to pursue large-scale frac sand mining and processing operations in southeastern Minnesota. Minnesota Sands has gone to extreme measures, for years, to be able to carry out this project, while continually attempting to avoid going through the required Environmental Impact Statement process.

The proposed Dablestein Mine in Fillmore County has been and remains one of the sites included in Minnesota Sands' larger plans since 2012. Given this company's history, it would frankly be naïve of EQB members to accept at face value the claim that Minnesota Sands now, suddenly, wishes to pursue only this single mine. It would also be a failure in your duty to protect the health, safety, and well-being of Minnesotans and protect the land and water. The only appropriate action is to continue to require Minnesota Sands to undergo an EIS before any portion of its project may be permitted. Minnesota Sands last attempted the same strategy it is attempting now – seeking to circumvent the EIS requirement and proceed with its project without proper scrutiny – in 2017, an attempt which was rightly rejected by the Board at that time.

The idea that an EIS could be undertaken later on, after several portions of the project have already begun, is completely unacceptable. Environmental review is relevant because it examines the consequences of a project before it is permitted to begin. To say that the possibility of the project meeting an EIS threshold in the future, AFTER the mining has already begun to take place, provides a "safeguard," is insulting to the residents of the communities where this mining is proposed to take place. Relying on the "three-year look-back" concept in this instance is a joke.

Thank you for your time this afternoon, and I would be happy to take any questions.